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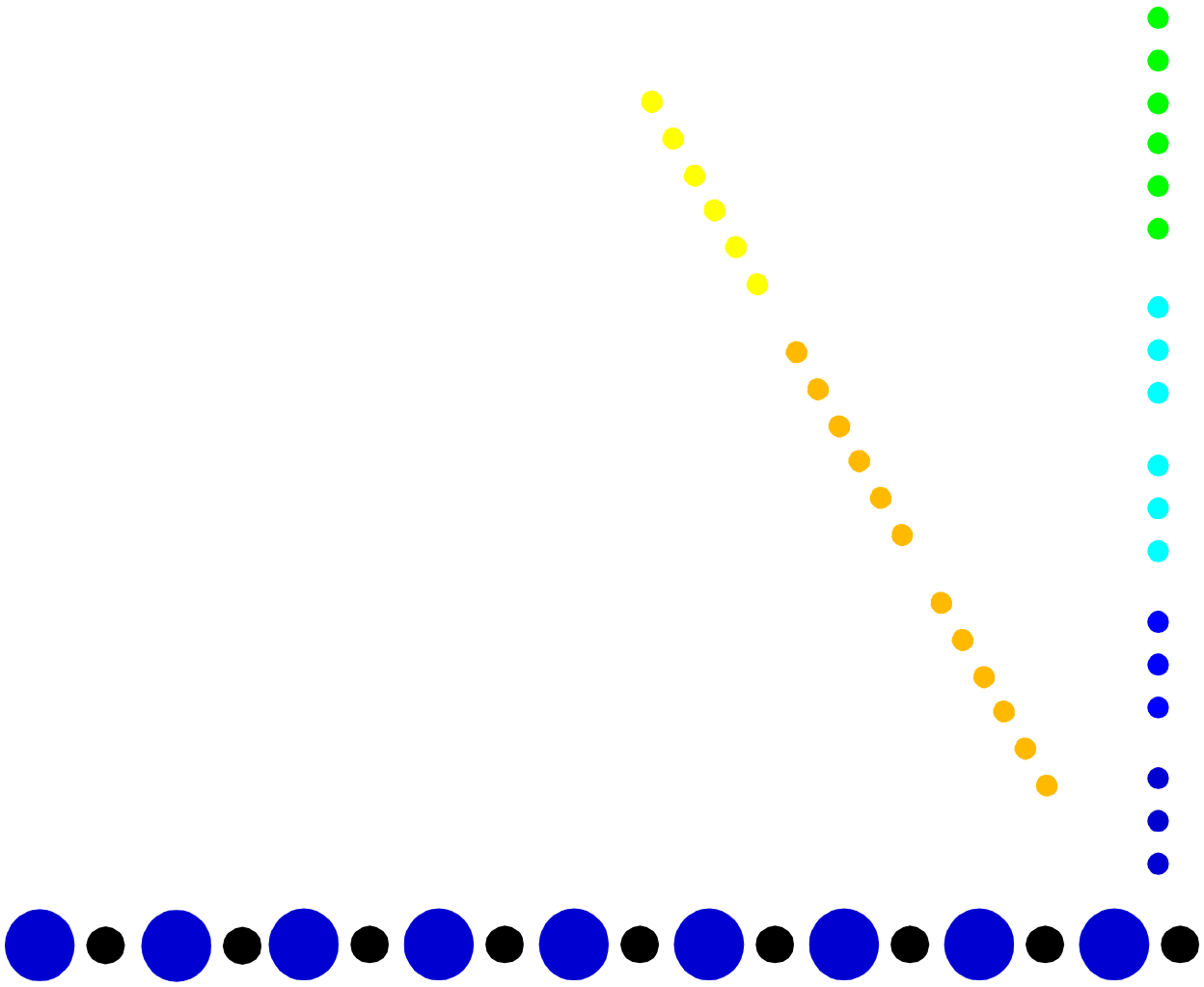
DLT1/VS80 SCSI Interface Guide



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Revision History

The following table lists all revisions made to this document in chronological order.

Document Release	Date	Summary of Changes
Rev 01	10/06/2000	Initial Release
Rev 02	7/27/2001	Cover Sheet Updates
81-81276-01 Rev A01	7/26/2004	Converted to FrameMaker and Quantum Style Guide. Released Per C0O9834.

User Manual Statements for Class A Equipment (Internal Tape System)

This is a Class A product. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference in which case the user will be required to correct the interference at his own expense.

Any modifications to this device—unless expressly approved by the manufacturer—can void the user's authority to operate this equipment under Part 15 of the FCC rules.

German Statement

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Canadian Notice (Avis Canadien)

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Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

French Statement

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User Manual Statements for Class B Equipment (External Tape System)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. Any modifications to this device—unless expressly approved by the manufacturer—can void the user's authority to operate this equipment under part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesirable operation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.

Canadian Notice

This Class B digital apparatus complies with Canadian ICES-003.

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CHAPTER 1

Introduction

1.1 Purpose and Scope

This manual provides a detailed explanation of the Small Computer System Interface (SCSI) Protocol features the Quantum VS80 tape drive implements. This manual does not replace the full ANSI SCSI specification, messages, options, and command code specifications; instead, it describes the commands, messages, and options this tape drive supports. It also describes the tape drive's error recovery procedures.

NOTE: From this point forward, we may refer to the Quantum VS80 tape drive simply as the "tape drive."

1.2 Audience

Quantum provides this document to software and firmware engineers and technicians who support Quantum VS80 tape drives. It also serves software and firmware engineers and technicians who integrate Quantum VS80 tape drives into automated systems such as tape drive libraries.

1.3 Related Documents

- *DLT VS80 Installation and Operations Guide* (001596-01)
- Current standards documents available from www.t10.org
  - *SCSI Architecture Model (SAM)*
  - *SCSI Primary Commands (SPC)*
  - *SCSI Parallel Interface (SPI)*
  - *SCSI Stream Commands (SSC)*

1.4 Structure of this Manual

Chapter 1, "Introduction," is the chapter you are currently reading.

Chapter 2, "General SCSI Bus Operation," describes tape drive responses to a variety of situations that occur on the SCSI bus; for example, power-on, bus phases, data transfer, and so forth.

Chapter 3, "SCSI Messages," describes the SCSI message system and lists the messages supported by the tape drive.

Chapter 4, "SCSI Commands," lists the commands the tape drive supports and defines each command.

Chapter 5, "Supported SCSI-2 Medium Changer Device Commands," lists the commands unique to the medium changer that the tape drive supports. It also defines each supported command.

1.5 Conventions Used In This Manual

This manual uses the following conventions:

NOTE: *Notes* provide supplemental information.

TECH TIP: *Tech Tips* provide information that helps you complete a procedure or avoid additional steps.

CAUTION *Cautions* provide information you must know to avoid damaging the tape drive or losing data.

WARNING! *Warnings* provide information you must know to avoid personal injury.

Table 1-1. Typographical Conventions

Element	Convention	Example
Commands	Uppercase (unless case-sensitive)	TEST UNIT READY
Hexadecimal Notation	Number followed by lowercase h	25h
Binary Notation	Number followed by lowercase b	101b
Decimal Notation	Number without suffix	512
Acronyms	Uppercase	POST
Abbreviations	Lowercase, except where standard usage requires uppercase	Mb (megabits) MB (megabytes)

Notes

CHAPTER 2

General SCSI Bus Operation

2.1 Data Transfer

The tape drive supports both narrow and wide, asynchronous and synchronous data transfers. The product is configured as a Low-Voltage Differential (LVD) or Single-Ended (SE) tape drive. The tape drive generates parity (ODD) during all information transfer phases where the tape drive transfers data onto the SCSI bus. The tape drive also checks parity during all information transfer phases where the tape drive receives data from the SCSI bus.

The tape drive supports even block sizes of 2 bytes to (16 MB – 2) bytes.

Disconnects from the SCSI bus occur at regular intervals during a data transfer. This allows other tape drives to access the bus. The Disconnect–Reconnect Mode Parameters page configures SCSI bus disconnects.

2.2 Initiator/Target Operation

The tape drive does not act as an initiator on the SCSI bus. Therefore, the tape drive does not perform any of the following tasks:

- Generate unsolicited interrupts to the host
- Initiate its own SCSI commands
- Assert a bus reset.

2.3 SCSI IDs and Logical Unit Numbers

The tape drive has one logical unit number (LUN), which is always LUN 0.

The tape drive treats unsupported LUNs as follows: If the LUN specified in the IDENTIFY message is invalid, the tape drive accepts the Command Descriptor Block (CDB). The next action is one of the following three cases:

- If the command is INQUIRY, the target returns the INQUIRY data with the peripheral qualifier set to 011, indicating that the target does not support the LUN in question.
- If the command is REQUEST SENSE, the target returns sense data. The sense key is ILLEGAL REQUEST, with an Additional Sense Code of INVALID Logical Unit Number.
- For any other command, the target terminates the command with CHECK CONDITION status and generates the Sense Data described in item 2.

2.4 UNIT ATTENTION Condition

The tape drive implements Queued Unit Attentions which are maintained separately for each valid LUN for each Initiator. The host computer creates Unit Attentions under the following conditions:

- Power-on Reset
- BUS Reset
- Bus Drive Reset message
- Asynchronous media change
- Mode Parameters changed by another initiator
- Firmware update completed.

Two queued Unit Attentions are not unusual. For example, powering up a tape drive and loading a data cartridge create Power Up and Not-ready to Ready Transition Unit Attentions. Since there are a limited number of Unit Attention buffers, if an initiator does not clear Unit Attentions queued for it, at some point the tape drive stops generating new Unit Attentions for that I–L combination. However, existing Unit Attentions remain queued.

A LOAD command does not generate a Unit Attention for the initiator that issued the command since the transition to Ready is a synchronous event.

2.5 Behavior Around Power-On and SCSI BUS RESET

In the following situations, the tape drive generates these responses:

Table 2-1. Tape Drive Behavior after a Power-On and SCSI BUS RESET

Situation	Tape Drive Response
Tape drive power off	All tape drive SCSI lines go to high impedance.
Tape drive power on	The tape drive does not generate any spurious signals on the SCSI bus
Within 5 seconds of power on and within 250 milliseconds (typically under 4 ms) after a BUS RESET	The tape drive responds to SCSI bus selections and returns appropriate, normal responses. The tape drive returns medium motion commands with CHECK CONDITION status, Sense Key Not Ready, until the media is ready.
	The tape drive implements the Hard BUS RESET option.
	The tape drive rewinds the medium to BOP (Beginning of Partition, i.e. Beginning of Medium).

The tape drive recognizes multiple bus resets in succession and bus resets of arbitrarily long duration. It recovers within the time limits specified above following the last bus reset.

2.6 Data Cache and Medium Write Interaction

The tape drive contains a data cache that buffers blocks (records) until writing them. This section defines specific times that the tape drive writes blocks to medium. A MODE SELECT parameter allows disabling the data cache (unbuffered mode). In this mode, every WRITE command causes the tape drive to write data to the data cartridge before returning the STATUS byte and the COMMAND COMPLETE messages to the host.

NOTE: We do not recommend unbuffered mode because it produces poor performance.

The tape drive writes (flushes) the write data cache to the data cartridge under the following circumstances:

- An initiator issues one or more WRITE FILEMARKS commands without intervening medium motion commands.
- An initiator issues a WRITE 0 FILEMARKS command.
- The tape drive automatically writes data in the cache longer than specified by the value of the Mode Parameter “Write Delay Time” to the data cartridge.
- The tape drive receives a non-write type medium access command; for example, SPACE, READ, UNLOAD, REWIND, and so forth.

2.7 Other SCSI Functionality

The tape drive supports these additional functions:

- Linked commands
- Untagged queuing.

2.8 Bus Phases

The tape drive conforms to the bus state transition table shown in the SCSI-2 standard, “Phase Sequences.” The information in the following sections also applies.

2.8.1 ATTENTION Signal Response

The tape drive responds to an ATN condition at least at every phase transition, as long as the initiator sets the ATN bit before the target abandons the REQ for the last byte of the previous phase. Ordinarily the tape drive immediately recognizes ATN and changes the bus phase to MESSAGE OUT.

2.8.2 STATUS Phase

The tape drive enters the STATUS phase only once per command unless the initiator requests a retry. The sole exception to this behavior is during error cases when the drive goes immediately to BUS FREE, as defined in the SCSI-2 standard.

The tape drive returns the following STATUS bytes:

- GOOD (00h): This status indicates the tape drive successfully completed the command.
- CHECK CONDITION (02h): A contingent allegiance condition occurred. The REQUEST SENSE command should be sent following this status to determine the nature of the event.
- BUSY (08h): The target is busy. The tape drive returns this status whenever the tape drive is unable to accept a command from an otherwise acceptable initiator. The initiator should reissue the command at a later time.
- INTERMEDIATE GOOD (10h): The tape drive returns this status instead of GOOD status for commands issued with the LINK bit set. Following the return of this status, the tape drive proceeds to the COMMAND phase for the transfer of the next linked command.
- RESERVATION CONFLICT (18h): The tape drive returns this status whenever one initiator (a SCSI tape drive) attempts to access the tape drive when another initiator has reserved the tape drive with a RESERVE UNIT command.
- COMMAND TERMINATED (22h): The tape drive returns this status for a command that a TERMINATE I/O PROCESS message has terminated. This status also indicates that a contingent allegiance condition has occurred.

NOTE: In contrast to the BUSY status condition, the tape drive returns the DRIVE NOT READY Sense Key as part of the Sense data following a REQUEST SENSE command. This indicates that an initiator has issued a data cartridge access command and the data cartridge is not ready to be accessed. For example, the data cartridge is not installed, the data cartridge has been unloaded, the tape drive is currently initializing the data cartridge to prepare it for access, and so forth.

When the tape drive is in the “not ready” state, the initiator cannot perform any operation that would cause medium motion, for example, write, read, space, verify, etc. If the initiator attempts any of these commands, the tape drive returns a CHECK CONDITION status with a DRIVE NOT READY sense key. The initiator may, however, execute commands that do not require access to the data cartridge and the tape drive may return a GOOD status.

These commands do not require access to the data cartridge:

- INQUIRY
- LOG SENSE/SELECT
- MODE SELECT
- MODE SENSE
- PREVENT/ALLOW MEDIUM REMOVAL
- READ BLOCK LIMITS
- READ BUFFER
- READ ELEMENT STATUS
- RECEIVE DIAGNOSTIC RESULTS
- REQUEST SENSE
- RESERVE/RELEASE UNIT
- SEND DIAGNOSTIC (non-media access diagnostics)
- WRITE BUFFER.

NOTE: The TEST UNIT READY command determines whether the tape drive would accept a data cartridge access command without returning CHECK CONDITION status.

2.8.3 BUS FREE Phase

Some situations can cause the tape drive to go to BUS FREE unexpectedly, as defined in the SCSI-2 standard (see sections 6.1.1 and 6.31 in the SCSI-2 specification):

- An internal hardware or firmware fault that makes it unsafe for the tape drive to continue operation without a full reset (similar to a power-up reset)
- Bus parity error detected during non-medium data transfers.

2.9 Bus Parity Errors

The occurrences of bus parity errors (that is, single bit errors) are very serious because they imply the possibility of undetected double-bit errors on the bus. These most likely would result in undetected data corruption. On properly configured SCSI buses, parity errors should be extremely rare. If bus parity errors are detected, they should be quickly addressed by improving the electrical and mechanical configuration of the SCSI bus.

A well-configured SCSI system bus in most normal environments should be practically free of bus parity errors.

Bus parity errors cause the tape drive to retry the operation, go to STATUS phase, or go to BUS FREE and prepare Sense Data (see section 6.1.1 in the SCSI-2 specification). Retrying of parity errors during DATA OUT Phase when writing is normally not done, but can be enabled by changing the EnaParErrRetry parameter in the Vendor Unique EEPROM Mode Page. The default value for this feature is parity error disabled.

Notes

CHAPTER 3

SCSI Messages

This chapter provides a detailed description of the SCSI messages DLT1 tape drives support. Specifically, it covers the following topics:

- "SCSI Message System" lists the specific format of SCSI messages.
- "Supported SCSI Messages" contains a description of each message supported by the tape drive.

3.1 SCSI Message System

SCSI messages allow communication between an initiator and a target for the purpose of physical path management.

To support particular SCSI-1 initiators, the tape drive does not require an IDENTIFY message. If the initiator sends a message after the SELECTION phase, it should be an IDENTIFY, ABORT, or BUS DEVICE RESET message. If the tape drive receives any other message in this case, it goes directly to BUS FREE phase.

Table 3-1 lists the supported SCSI messages. It also shows the message code and the direction of the message flow (In = target-to-initiator, Out = initiator-to-target).

Table 3-1. Supported SCSI Messages

Code	In/Out	Description	Section
06h	Out	ABORT	"ABORT (06h)" on page 3-2
0Ch	Out	BUS DEVICE RESET	"BUS DEVICE RESET (0Ch)" on page 3-3
00h	In	COMMAND COMPLETE	"COMMAND COMPLETE (00h)" on page 3-3
04h	In	DISCONNECT	"DISCONNECT (04h)" on page 3-3
01h	Both	EXTENDED MESSAGE	"EXTENDED MESSAGE (01h)" on page 3-4
80h–FFh	Both	IDENTIFY	"IDENTIFY (80h–FFh)" on page 3-5

Table 3-1. Supported SCSI Messages *(Continued)*

Code	In/Out	Description	Section
05h	Out	INITIATOR DETECTED ERROR	"INITIATOR DETECTED ERROR (05h)" on page 3-6
23h	In	IGNORE WIDE RESIDUE	"IGNORE WIDE RESIDUE (23h)" on page 3-5
0Ah	In	LINKED COMMAND COMPLETE	"LINKED COMMAND COMPLETE (0Ah)" on page 3-6
0Bh	In	LINKED COMMAND COMPLETE w/ flag	"LINKED COMMAND COMPLETE, with flag (0Bh)" on page 3-6
09h	Out	MESSAGE PARITY ERROR	"MESSAGE PARITY ERROR (09h)" on page 3-6
07h	Both	MESSAGE REJECT	"MESSAGE REJECT (07h)" on page 3-7
08h	Out	NO–OP	"NO–OPERATION (NO–OP, 08h)" on page 3-7
03h	In	RESTORE POINTERS	"RESTORE POINTERS (03h)" on page 3-7
02h	In	SAVE DATA POINTER	"SAVE DATA POINTER (02h)" on page 3-8

3.2 Supported SCSI Messages

This section describes the messages outlined in Table 3-1.

3.2.1 ABORT (06h)

The initiator sends this message to the target to clear the current I/O process on the selected tape drive. On buffered (cached) write operations, the tape drive attempts to complete the command, if possible. The tape drive goes directly to the BUS FREE phase after it successfully receives this message. The message has no effect on the current settings of the MODE SELECT parameters and reservations. It also has no effect on commands, data, and status for other initiators.

An initiator may send this message to a logical unit that is not currently performing an operation for the initiator. If the initiator does not select a logical unit, the tape drive enters BUS FREE phase and no commands, data, or status on the drive are affected.

3.2.2 BUS DEVICE RESET (0Ch)

This message from an initiator clears all commands, data, and status in the tape drive controller. When the tape drive recognizes this message, it writes cached data to the medium and goes to the BUS FREE phase. The tape drive then executes a hard reset, which leaves it as if a BUS RESET had occurred.

3.2.3 COMMAND COMPLETE (00h)

A target sends this message to an initiator to indicate that it has completed the execution of a command or a series of linked commands and has sent valid status to the initiator. After successfully sending this message, the target goes to the BUS FREE phase by releasing BSY.

If the tape drive receives this message, it handles it as an illegal message. The tape drive returns MESSAGE REJECT and enters the STATUS phase reporting CHECK CONDITION with the Sense Key set to COMMAND ABORTED.

3.2.4 DISCONNECT (04h)

A target sends DISCONNECT to tell an initiator that the target intends to break the present physical path; that is, the target intends to disconnect by releasing BSY. Later, the initiator must reselect the target in order to complete the current operation. This message does not cause the initiator to save the data pointer.

When it receives this message from an initiator, the tape drive can respond in one of two ways.

1. It can take the message as a request by the initiator to disconnect and comply by entering the MESSAGE IN phase and returning the DISCONNECT message to the initiator, possibly preceded by the SAVE DATA POINTERS message. In this case, it delays a minimum of 200 ms before arbitrating for the bus again.

2. It can enter the MESSAGE IN phase and return MESSAGE REJECT EXTENDED MESSAGE (01h).

3.2.5 EXTENDED MESSAGE (01h)

An initiator or target sends this message as the first byte of a multiple-byte message (> 2 bytes). Figure 3-1 shows the EXTENDED MESSAGE format.

Bit / Byte	7	6	5	4	3	2	1	0
0	Extended Message Identifier (01h)							
1	Extended Message Length							
2	Extended Message Code							
3	Extended Message Additional Parameters							

Figure 3-1. EXTENDED MESSAGE (01h) Format

The Extended Message Length specifies the length of the EXTENDED MESSAGE plus the number of additional parameter bytes that are to follow. The length does not include bytes 0 and 1. A value of 0 for the Extended Message Length indicates 256 bytes to follow.

Table 3-2 lists the EXTENDED MESSAGE codes.

Table 3-2. EXTENDED MESSAGE Codes

Code	Description
00h	MODIFY DATA POINTER (not supported)
01h	SYNCHRONOUS DATA TRANSFER REQUEST (see “SYNCHRONOUS DATA TRANSFER REQUEST (SDTR)” on page 3-8)
02h	Reserved
03h	WIDE DATA TRANSFER REQUEST (see “WIDE DATA TRANSFER REQUEST (WDTR)” on page 3-8)
04h – 7Fh	Reserved
80h – FFh	Vendor Unique (see Section 4.4.2, “Vendor Unique Inquiry Data.”)

If the tape drive receives an extended message that it does not support, it switches to MESSAGE IN phase and returns MESSAGE REJECT after transferring all the bytes of the message.

3.2.6 IDENTIFY (80h–FFh)

The initiator or target sends these messages to establish (or reestablish) the physical connection path between an initiator and target for a particular logical unit.

Table 3-3 lists the bits in the message byte.

Table 3-3. Bits in the IDENTIFY Message

Bit	Description
7	Always set to 1.
6	Set by initiator if target is allowed to disconnect/reconnect.
5	Must be 0 (“Target Routines” not supported).
4	Reserved. Must be 0.
3	Reserved. Must be 0.
2 – 0	Logical Unit Number (LUN)

When a target sends the IDENTIFY message to an initiator during reconnection, a RESTORE POINTERS message is implied.

3.2.7 IGNORE WIDE RESIDUE (23h)

The target sends the IGNORE WIDE RESIDUE message to indicate that the number of valid bytes sent during the last REQ/ACK handshake and REQB/ACKB handshake of a DATA IN phase is less than the negotiated transfer width. The ignore field indicates the number of invalid data bytes transferred. The target sends this message immediately following the DATA IN phase and before any other messages.

Figure 3-2 shows the message format.

Bit Byte	7	6	5	4	3	2	1	0
0	Message code (23h)							
1	Ignore (01h)							

Figure 3-2. IGNORE WIDE RESIDUE Format (23h)

3.2.8 INITIATOR DETECTED ERROR (05h)

An initiator sends this message to inform a target that an error, for example, a bus parity error, has occurred that does not prevent the target from attempting the operation again. Upon receiving this message, the tape drive tries to retransfer the last command, data, or status bytes by using the RESTORE POINTERS message.

3.2.9 LINKED COMMAND COMPLETE (0Ah)

A target sends this message to an initiator to indicate that the execution of a linked command (with the Flag bit set to 0) is complete and that the target has sent status back to the initiator. The initiator then sets the pointers to the initial state for the next command.

When a target receives this message, it handles it as an illegal message. The tape drive enters the MESSAGE IN phase and returns MESSAGE REJECT.

3.2.10 LINKED COMMAND COMPLETE, with flag (0Bh)

A target sends this message to an initiator to indicate that the execution of a linked command (with the Flag bit set to 1) is complete and that the target has sent status back to the initiator.

3.2.11 MESSAGE PARITY ERROR (09h)

An initiator sends this message to the target to indicate that one or more bytes in the last message it received had a parity error.

To indicate that it intends to send the message, the initiator sets the ATN signal before it releases ACK for the REQ/ACK handshake of the message that has the parity error. This provides an interlock so that the target can determine which message has the parity error. If the target receives this message under any other conditions, it proceeds directly to the BUS FREE phase by releasing the BSY signal.

The target's response to this message is to switch to the MESSAGE IN phase and re-send from the beginning all the bytes of the message that generated the original MESSAGE PARITY ERROR message.

3.2.12 MESSAGE REJECT (07h)

The initiator or target sends this message to indicate that the last message received was inappropriate or remains not implemented.

To indicate its intentions of sending this message, the initiator asserts the ATN signal before it releases ACK for the REQ/ACK handshake of the message that is to be rejected.

The tape drive issues MESSAGE REJECT in response to any messages the tape drive considers to be illegal or not supported. When sending to the initiator, the tape drive issues a MESSAGE REJECT before requesting any additional message bytes.

3.2.13 NO–OPERATION (NO–OP, 08h)

If a target requests a message, the initiator sends NO–OP if it does not currently have any other valid message to send. The tape drive accepts the message when acting as a target and can send the message when acting as an initiator. If the tape drive receives NO–OP during a selection operation, the tape drive proceeds to the COMMAND phase, provided ATN does not continue being asserted. The tape drive ignores and discards the NO–OP message.

3.2.14 RESTORE POINTERS (03h)

A target sends this message to direct the initiator to restore the most recently saved pointers for the currently attached logical unit. When it receives the RESTORE POINTERS message, the initiator performs the following tasks:

- Restores pointers to the command, data, and status locations for the logical unit to the active pointers
- Restores Command and Status pointers to the beginning of the present Command and Status areas
- Restores the Data pointer to the value at the beginning of the data area in the absence of a SAVE DATA POINTER message, or to the value at the last SAVE DATA POINTER message that occurred for that logical unit.

When a target receives the RESTORE POINTERS message, the target switches to the MESSAGE IN phase and returns MESSAGE REJECT.

3.2.15 SAVE DATA POINTER (02h)

A target sends this message to the initiator and saves a copy of the present active data pointer for the logical unit currently attached.

As a target, the tape drive sends this message before a disconnect during a data transfer. It does not send a SAVE DATA POINTER message if it intends to move directly to the STATUS phase.

When it receives the SAVE DATA POINTER message, the tape drive switches to the MESSAGE IN phase and returns MESSAGE REJECT.

3.2.16 SYNCHRONOUS DATA TRANSFER REQUEST (SDTR)

This extended message allows the target and initiator to agree on the values of the parameters relevant to synchronous transfers. The tape drive does not initiate the SYNCHRONOUS DATA TRANSFER REQUEST (SDTR) message, but relies on the Initiator to do so. Figure 3-3 shows the format for extended messages.

Bit Byte	7	6	5	4	3	2	1	0
0	Extended Message Identifier (01h)							
1	Extended Message Length (03h)							
2	SYNCHRONOUS DATA TRANSFER REQUEST (01h)							
3	Transfer Period: min = 100ns (19h)							
4	Transfer REQ/ACK Offset: max = 15 (0Fh)							

Figure 3-3. SDTR Extended Message Format

NOTE: The tape drive supports initiating synchronous transfer negotiations with the host, but this feature is disabled by default. To enable it, set the MODE SELECT Vendor Unique EEPROM parameter EnaInitSyncNeg.

3.2.17 WIDE DATA TRANSFER REQUEST (WDTR)

The WDTR message exchange establishes an agreement between two SCSI tape drives on the width of the data path to be used for DATA phase transfer between the two tape drives. All other information transfer phases use an eight-bit data path.

Figure 3-4 shows the format for this extended message.

Bit Byte	7	6	5	4	3	2	1	0
0	Extended Message Identifier (01h)							
1	Extended Message Length (02h)							
2	WIDE DATA TRANSFER REQUEST (03h)							
3	Transfer Width Exponent							

Figure 3-4. WDTR Message Format

A SCSI tape drive initiates a WDTR message exchange whenever a previously arranged transfer width agreement may have become invalid. The agreement becomes invalid after any condition that leaves the data transfer agreement in an indeterminate state:

- After a hard reset condition
- After a BUS DEVICE RESET message
- After a power cycle.

The tape drive implements both the wide and synchronous data transfer options. It negotiates the wide data transfer agreement before negotiating the synchronous data transfer agreement. If a synchronous data transfer agreement is in effect, the tape drive resets the synchronous agreement to asynchronous mode after accepting a WDTR message.

The transfer width is expressed as 2^n where ***n*** is the transfer width in bytes. The established transfer width applies to all logical units. Valid transfer widths for the tape drive are 8 bits (m = 00h) and 16 bits (m = 01h). Values of ***m*** greater than (01h) are reserved.

Notes

CHAPTER 4

SCSI Commands

This chapter describes the supported SCSI commands, options, and error recovery procedures implemented in the Quantum DLT1/VS80 tape drive. This chapter *does not* fully reiterate the entire ANSI SCSI specification; for information of this nature, refer to the SCSI specification itself.

The web sites *http://www.scsita.org* and *http://www.t10.org* are also helpful sources of information.

4.1 Control Byte — Flag and Link Bits

The control byte of the Command Descriptor Block (CDB) contains the Flag and Link bits. Use of these bits depends entirely on the initiator. Setting the Link bit provides an automatic link to the next command, bypassing the usual ARBITRATION, SELECTION, and MESSAGE OUT phases that would normally occur between commands.

All other bits in the Control Byte are reserved.

4.2 Summary of Supported Sequential-Access Tape Drive Commands

The following table shows the SCSI commands/Opcodes the tape drive supports and the page in this manual on which you can find each command.

Table 4-1. Supported SCSI Commands

Command	Opcode	Section
ERASE	19h	Page 4-3
INQUIRY	12h	Page 4-4
LOAD/UNLOAD	1Bh	Page 4-13
LOCATE	2Bh	Page 4-15
LOG SELECT	4Ch	Page 4-16
LOG SENSE	4Dh	Page 4-23
MODE SELECT	15h/55h	Page 4-44
MODE SENSE	1Ah/5Ah	Page 4-68
PREVENT /ALLOW MEDIUM REMOVAL	1Eh	Page 4-85
READ	08h	Page 4-86
READ BLOCK LIMITS	05h	Page 4-88
READ BUFFER	3Ch	Page 4-89
READ POSITION	34h	Page 4-92
RECEIVE DIAGNOSTICS RESULTS	1Ch	Page 4-94
RELEASE UNIT	17h	Page 4-95
REQUEST SENSE	03h	Page 4-96
RESERVE UNIT	16h	Page 4-108
REWIND	01h	Page 4-110
SEND DIAGNOSTIC	1Dh	Page 4-111
SPACE	11h	Page 4-115
TEST UNIT READY	00h	Page 4-116
VERIFY	13h	Page 4-117

Table 4-1. Supported SCSI Commands *(Continued)*

Command	Opcode	Section
WRITE	0Ah	Page 4-118
WRITE BUFFER	3Bh	Page 4-121
WRITE FILEMARK	10h	Page 4-123

4.3 ERASE (19h)

ERASE causes data on the medium to be erased. Before executing the ERASE command, the tape drive flushes to medium any write data currently held in a data cache and not yet written.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operaton Code (19h)							
1	Logical Unit Number			Reserved			Immed	Long
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-1. ERASE (19h) Command Descriptor Block — Data Format

Table 4-2. ERASE (19h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Immed	Immediate. If this bit is 0, the target does not return status until the selected operation has completed. If the bit is 1, the target returns the status as soon as the tape drive has initiated the operation.
Long	The Long bit controls the distance to be erased. If the bit is set, the tape drive writes filler and EOD blocks if needed and then erases the entire rest of the medium. **Note**: This command is a NO-OP on the tape drive unless the Long bit is set. Issuing the ERASE command away from BOT is an ILLEGAL REQUEST.

4.4 INQUIRY (12h)

INQUIRY tells the tape drive to send information regarding its parameters to the initiator.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Logical Unit Number			Reserved				EVPD
2	Page Code							
3	Reserved							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

Figure 4-2. INQUIRY (12h) Command Descriptor Block — Data Format

The INQUIRY command executes normally even if the specified LUN is not supported. INQUIRY returns a CHECK CONDITION status only when the target cannot return the requested INQUIRY data. If a tape drive receives INQUIRY from an initiator with a pending UNIT ATTENTION condition (before the tape drive reports CHECK CONDITION status), the tape drive performs the INQUIRY and does not clear the UNIT ATTENTION condition.

Table 4-3. INQUIRY (12h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
EVPD	Vital Product Data. The tape drive implements the Vital Product Data pages option on LUNs 0 and the optional medium loader LUN.
Page Code or Operation Code	The tape drive implements three Vital Product Data pages: **Code** — **Page Definition** 00h — Supported Vital Product Data pages 80h — Unit Serial Number page C0h — Code Build Information page. If the Page Code field contains a different value, the tape drive generates a CHECK CONDITION with ILLEGAL REQUEST Sense Key.

Table 4-3. INQUIRY (12h) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
Allocation Length	This specifies the maximum number of bytes that the initiator has allocated for returned INQUIRY data. An Allocation Length of zero indicates no INQUIRY data transferred. This condition is not considered an error. The tape drive terminates the DATA IN phase when it has transferred Allocation Length bytes or all available Inquiry data to the initiator, whichever is less.

4.4.1 Tape Drive Inquiry Response

The tape drive returns the following information in response to an INQUIRY command on the tape drive LUN.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB	Device Type Modifier						
2	ISO Version		ECMA Version	ANSI-Approved Version				
3	ANEC	TrmlOP	Reserved	Response Data Format				
4	Additional Length (35h)							
5	Reserved							
6	Reserved	MChngr	Reserved					
7	RelAdr	Wbus32	Wbus16	Sync	Linked	Rsv’d	CmdQu	SftRes
8–15	Vendor ID = “QUANTUM“							
16–31	Product ID = “VS80”							
32–35	Product Revision Level = “xxyy”							
36–55	Vendor Unique Bytes							

Figure 4-3. Standard Inquiry Data Page — Data Format

The following table contains field descriptions for the data that the tape drive returns.

Table 4-4. Standard Inquiry Data Page — Field Descriptions

Field Name	Description	
Peripheral Qualifier	The tape drive returns one of the following values in this field:	
	000b	The indicated Peripheral Device Type is connected to the logical unit.
	001b	The indicated Peripheral Device Type is not connected to the logical unit; however, the tape drive is capable of supporting the indicated Peripheral Device Type at the specified logical unit.
	011b	The target is not capable of supporting a physical device on this logical unit. In this case, the Peripheral Device Type is 1Fh.
Peripheral Device Type	On the tape drive LUN, this field is 01h, indicating a sequential access device. On the Medium Changer LUN, this field is 08h. All other LUNs return 1Fh.	
Other Inquiry Data Fields	The rest of the fields in the Inquiry Response are used as follows:	
	Byte 1	RMB – Removable Medium bit. Set to 1. Device Type Modifier. Set to 0.
	Byte 2	ISO Version. Set to 0 ECMA Version. Set to 0 ANSI Approved Version. Set to 02h, indicating compliance with SCSI-2
	Byte 3	ANEC. Set to 0 (Asynchronous Event Notification not supported) TrmIOP. Set to 0 (TERMINATE I/O PROCESS message not supported) Response Data Format. Set to 2 (Inquiry Data in SCSI-2 format)
	Byte 4	Additional Length. The tape drive sets this field to indicate the number of additional bytes of INQUIRY Response Data available.
	Byte 6	All bits set to 0, except MChngr – Set to 1 if an integrated Media Loader is present and EEPROM parameter EnbIngMedChgr is 1. This SCSI-3 bit indicates that the initiator can issue READ ELEMENT STATUS and MOVE MEDIUM commands to the tape drive LUN (0). By default, this bit is 0.

Table 4-4. Standard Inquiry Data Page — Field Descriptions *(Continued)*

Field Name	Description	
	Byte 7	RelAdr. Set to 0
		WBus32. Set to 0 (The tape drive does not support 32-bit transfer.)
		WBus16. Set to 1 (The tape drive supports 16-bit wide data transfers.)
		Sync. Set to 1 (The tape drive supports Synchronous Data Transfer/
		Linked. Set to 1 (The tape drive supports Linked commands.)
		CmdQu. Set to 0
		SftRes. Set to 0
Vendor Identification	“QUANTUM”	
Product Identification	“VS80 ”	
Product Revision Level	This field contains four bytes of ASCII data that define the product's software Revision Levels. The first two bytes are the version number of servo code. In Quantum products, this firmware is located in an EEPROM and is field updateable. The second two bytes are the version number of the SCSI/read/write code. When a firmware update is performed on the tape drive, this part of the Revision Level field changes appropriately.	
Vendor Specific	See “Vendor Unique Inquiry Bytes” on page 4-9	

4.4.2 Vendor Unique Inquiry Data

Use the following information to identify precisely the revision of subsystem components.

Bit / Byte	7	6	5	4	3	2	1	0
36	Product Family				Released Firmware			
37	Firmware Major Version #							
38	Firmware Minor Version #							
39	EEPROM Format Major Version #							
40	EEPROM Format Minor Version #							
41	Firmware Personality							
42	Firmware Sub-personality							
43	Tape Directory Format Version #							
44	Controller Hardware Version #							
45	Drive EEPROM Version #							
46	Drive Hardware Version #							
47	Media Loader Firmware Version #							
48	Media Loader Hardware Version #							
49	Media Loader Mechanical Version #							
50	Media Loader Present Flag							
51	Library Present Flag							
52–55	Module Revision							

Figure 4-4. INQUIRY Vendor Unique Bytes — Data Format

4.4.3 Vendor Unique Inquiry Bytes

To identify the product and the installed firmware more precisely, additional information is available. Refer to Table 4-5.

Table 4-5. Vendor Unique Inquiry Data — Field Descriptions

Field Name	Description	
Product Family	Use the following table to determine the meaning of the Product Family Bit value:	
	0	Not Specified
	1	40 / 80 GB
	2 – 7	Reserved
Released Firmware	This flag differentiates between released and test versions of firmware. One indicates released code (Vxxx) or field test code (Txxx). Released code has no Minor FW Version number (byte 38 is 0). Field test and engineering versions of code have non-zero Minor FW Version numbers for tracking purposes.	
Various Version Numbers	In binary, not ASCII (see 4.4.1, “SCSI Commands”).	
Firmware Personality	Numeric indicator of firmware personality.	
Firmware Sub-personality	Numeric indicator of firmware sub-personality.	
Loader Present	Non-zero if a media loader is present.	
Library Present	Non-zero if a library is present.	
Module Revisions	A four-byte ASCII string represents the revision of the hardware module.	
Product Revision Level	This field contains four bytes of ASCII data which define the product's software Revision Levels. The first two bytes are the version number of servo code. In Quantum products, this firmware is located in an EEPROM and is field updateable. The second two bytes are the version number of the SCSI/read/write code. When a firmware update is performed on the tape drive, this part of the Revision Level field changes appropriately.	

4.4.4 Vital Product Data Pages

The following tables show the information in the supported Vital Product Data Pages.

Supported Vital Product Data Page (00h)

Figure 4-5 shows the supported vital product data pages.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (00h)							
2	Reserved							
3	Page Length (03h additional bytes)							
4	00h – (this page)							
5	80h – Unit Serial Number Page							
6	83h – Device Identification Page							
7	C0h – Firmware Build Information Page (Vendor Unique)							
8	Subsystem Components Revision Page (C1h – Quantum use only)							

Figure 4-5. Supported Vital Product Data Page — Data Format

Unit Serial Number Page (80h)

The serial number identifies the printed circuit card mounted on the bottom of the tape drive. You can also find it on the bar code label. The tape drive returns the serial number in ASCII.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (80h)							
2	Reserved							
3	Page Length (0Ah)							
4–13	Serial Number							

Figure 4-6. Unit Serial Number Page — Data Format

Firmware Build Information Page (C0h)

The checksums are binary, and provide positive Firmware and EEPROM identification.

Firmware Build Date is an ASCII string in **DD-Mmm-YYYY HH:MM:SS** format.

Bit Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (C0h)							
2	Reserved							
3	Page Length (20h)							
4–7	Servo Firmware Checksum							
8–11	SCSI/Read/Write Firmware Checksum							
12–35	SCSI/Read/Write Firmware Build Date							

Figure 4-7. Firmware Build Information Page — Data Format

Media Loader Inquiry Response

The tape drive controller generates INQUIRY Data on the Medium Changer LUN that is very similar to that of the tape drive LUN. The key difference is that the Peripheral Device Type is “8” for a SCSI-2 Medium Changer.

Subsystem Components Revision Page (C1h)

The following information precisely identifies the revision of tape drive subsystem components.

NOTE: Note: This page is for Quantum use only; page content is subject to change at any time.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (C1h)							
2	Reserved							
3	Page Length (14h)							
4 – 23	Unit Part Number							

Figure 4-8. Subsystem Components Revision Page — Data Format

Table 4-6. Subsystem Components Revision Page — Field Descriptions

Field Name	Description
Peripheral Qualifier	Contains 000b if the command is directed to a valid device. Contains 011b if there is no device at the selected LUN.
Peripheral Device Type	Contains 01h if the LUN is 0h, 8h if the LUN selects an attached library, or 1Fh if there is no device at the selected LUN.
Page Code	A value of C1h identifies this as the Subsystem Components Revision page.
Page Length	Indicates the size of the returned Subsystem Components Revision page.
Unit Part Number	The part number of the tape drive; this number appears on a bar code label on the base of the drive (on the side, at the back of the drive), and is different from the serial number. The drive returns the unit part number in ASCII format. The value is left justified and unused bytes are padded with spaces.

4.5 LOAD/UNLOAD (1Bh)

The LOAD/UNLOAD command tells the target to load or unload the media in the data cartridge. If no cartridge is present in the tape drive, both LOAD and UNLOAD return CHECK CONDITION status with a NOT READY Sense Key set. If the tape drive has received an UNLOAD command with the Immed bit set, and then receives another command involving medium motion or TEST UNIT READY, the tape drive returns a CHECK CONDITION status with a NOT READY Sense Key set.

Operation of the UNLOAD version of this command is different if a media loader is present.

Two modes of operation are possible when a media loader is attached. If the media loader has issued no media loader-specific commands, the tape drive operates in the sequential mode of operation. When a media loader has issued a media loader-specific command and the tape drive has accepted it, the tape drive disables the sequential mode of operation and the UNLOAD command becomes a NO–OP.

If the tape drive is in the default sequential mode of operation and the subsystem receives an UNLOAD command, the tape drive unloads the current data cartridge and the media loader automatically moves it to the magazine slot from which it originated. The media loader automatically moves the data cartridge from the next slot in the magazine, if not empty, from the magazine into the tape drive, which loads it and prepares it for use. If the next magazine slot is empty, no CHECK CONDITION status is created.

When the media loader moves an unloaded data cartridge into the last magazine slot), the subsystem does not cycle back to slot 0. This prevents accidental overwriting of data when using the subsystem in the sequential auto-loading mode. The user must manually select and load the next data cartridge or use a SCSI MOVE MEDIUM command.

You can modify EEPROM parameters ENALDRAUTOLD and DISLDRAUTOLDMC to enable or disable the sequential loading feature (see Section 4.10.10, “EEPROM Vendor Unique Page (3Eh)”).

A media loader does not affect the tape drive's processing of the LOAD flavor of the LOAD/ UNLOAD command.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Bh)							
1	Logical Unit Number			Reserved				Immed
2 - 3	Reserved							
4	Reserved					EOT	Re-Ten	Load
5	Unused		Reserved				Flag	Link

Figure 4-9. LOAD-UNLOAD (1Bh) Command Descriptor Block — Data Format

Table 4-7. LOAD/UNLOAD (1Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Immed	Immediate. If this bit is set, the tape drive returns status as soon as the operation starts. Otherwise, the tape drive returns status after the operation has completed.
Re-Ten	Re-tension. These operations are not needed on the tape drive, so this bit is ignored (that is, GOOD status, if the bit is set).
Load	When a cartridge is inserted, the tape drive automatically loads the media and positions it at BOM. Logically, the tape drive positions the media at the beginning of Partition 0. If the Load bit is set and the media is already loaded, the tape drive takes no action. If the Load bit is 0 and media is loaded, the tape drive writes any buffered data and filemarks to the medium, rewinds the medium to BOM, and unloads the media into the data cartridge. The tape drive partially ejects the cartridge, which you can then remove.
EOT	End of Tape. The tape drive ignores this bit unless both the EOT and Load bits are set; then the tape drive returns CHECK CONDITION, ILLEGAL REQUEST.

4.6 LOCATE (2Bh)

Use the LOCATE command for high-speed positioning to the specified block address.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Logical Unit Number			Reserved		BT	CP	Immed
2	Reserved							
3 - 6	(MSB) Block Address (LSB)							
7	Reserved							
8	Partition							
9	Unused		Reserved				Flag	Link

Figure 4-10. LOCATE (2Bh) Command Descriptor Block — Data Format

When writing, use the READ POSITION command to obtain the block address where particular blocks of data (for example, a data file) are about to be written. Then use the LOCATE command to position back to the same logical position for high performance restore operations of particular blocks of data.

Table 4-8. LOCATE (2Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
BT	Block Type. This bit indicates how the Block Address field is interpreted. The tape drive always returns SCSI Logical Block addresses; that is, setting the BT bit does not affect the values returned. The first recorded object (block or filemark) is at address 0, and Block Addresses count both data blocks and filemarks.
CP	Change Partition. Since the drive does not support multiple partitions, this bit must be 0.
Immed	Immediate. When 1, the drive returns status as soon as the operation starts. When 0, the drive returns status after the operation has completed.

Table 4-8. LOCATE (2Bh) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
Block Address	The Block Address field defines the SCSI Logical Block Address to which the media will be positioned. These addresses start at 0 and include data blocks and filemarks.

4.7 LOG SELECT (4Ch)

The LOG SELECT command allows the host to manage statistical information the tape drive maintains about its own hardware parameters and about the installed media. All types of parameter values are changeable through LOG SELECT. Read the description of the LOG SENSE (4Dh) command on Page 4-23; it provides information about log page format, parameters, and supported pages.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (4Ch)							
1	Logical Unit Number			Reserved			PCR	SP
2	PC		Reserved					
3 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-11. LOG SELECT (4Ch) Command Descriptor Block — Data Format

Table 4-9. LOG SELECT (4Ch) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
PCR	Parameter Code Reset. If this bit is 1 and the Parameter List Length field is 0, all accumulated values of page codes 2, 3, and 32 are 0 and all threshold values are default. If PCR is 1 and the Parameter List Length field is a non-zero value, the tape drive terminates the command with CHECK CONDITION status, Sense Key set to ILLEGAL REQUEST, and Additional Sense Code (ASC) set to INVALID FIELD IN CDB.
SP	Save Page. The tape drive does not support this bit and sets it to 0. If the SP bit is 1, the tape drive terminates the command with CHECK CONDITION status, Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB.
PC	Page Control. This field defines the type of parameter values to be selected. **Code** — **Type of Parameter Values** 00b — Threshold Values 01b — Cumulative Values 10b — Default Threshold Values 11b — Default Cumulative Values When the PC field is 00b or 01b and the Parameter List Length field is 0, the tape drive terminates the command with a CHECK CONDITION status, with Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB. This is because modification of current Threshold Values and current Cumulative Values is not supported. When the PC field is 10b and the Parameter List Length field is 0, then all current Threshold Values are reset to the Default Threshold Values. This is equivalent to no change, since Threshold Values cannot be modified. When the PC field is 11b and the Parameter List Length field is 0, then all current Cumulative Values are reset to the Default Cumulative Values. This is equivalent to clearing all log pages that can be cleared.
Parameter List Length	This field specifies the length in bytes of the LOG SELECT parameter list to be transferred from the initiator to the target during the DATA OUT phase. A parameter list length of 0 indicates that no data is to be transferred. This condition is not considered an error (see the description of Parameter Code Reset and Page Control fields elsewhere in this section).

4.7.1 Error Detection Summary in LOG SELECT CDB

The following conditions constitute errors that the tape drive detects in relation to the CDB. The REQUEST SENSE data is set to ILLEGAL REQUEST, INVALID FIELD IN CDB.

- PCR bit is 1 and parameter list length is not 0.
- SP bit is 1.
- A parameter list length would cause a parameter within a valid page to be truncated or otherwise incompletely initialized.

4.7.2 Operation of LOG SELECT

The LOG SELECT command allows the initiator to modify and initialize parameters within the logs supported by the tape drive.

There are two ways to initialize the log parameters:

1. Set the PCR bit in the LOG SELECT CDB, clearing all parameters.
2. Specify the log page and the parameter value as the log parameters to clear individual pages. You can clear the following pages in this manner.

Table 4-10. LOG SELECT DATA OUT — Phase Codes

Page Code	Page Description
02h	Write Error Counter Page
03h	Read Error Counter Page
32h	Compression Ratio Page

If sending multiple pages during this DATA OUT phase, the initiator must send them in ascending order according to Page Code. Otherwise the command terminates with a CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN PARAMETER LIST. The tape drive returns the same status if an unsupported Page Code appears in any header or if it cannot clear the specified page.

4.7.3 LOG SELECT Page Format

Each Log page begins with a 4-byte header followed by ***n*** number of log parameter blocks, one block for each parameter code. Each block, except for parameter code 05h, is 8 bytes. The parameter block for code 05h is 12 bytes.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserved							
2 - 3	(MSB) Page Length (LSB)							

Figure 4-12. LOG SELECT Log Page Header — Data Format

Table 4-11. LOG SELECT Log Page Header — Field Descriptions

Field Name	Description
Page Code	The Page Code specifies which Log Page this LOG SELECT command affects.
Page Length	The Page Length specifies the total number of bytes contained in this Log Page, not including the four bytes of the header.

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Parameter Code (LSB)							
2	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	Parameter Length (n – 3)							
4 - n	(MSB) Parameter Value (LSB)							

Figure 4-13. LOG SELECT Log Page Parameters — Data Format

Table 4-12. LOG SELECT Log Page Parameters — Field Descriptions

Field Name	Description
Parameter Code	Refer to the LOG SENSE command for an explanation of the Parameter Codes supported for the requested log page.
Parameter Control Byte	Byte 2 of Log parameter block in Figure 4-13 is referred to as the Parameter Control Byte.

Table 4-12. LOG SELECT Log Page Parameters — Field Descriptions *(Continued)*

Field Name	Description	
	DU	Disable Update. This bit is not defined for LOG SELECT; the drive ignores any value in DU.
	DS	Disable Save. Saving parameters is not supported. Set both DS and TSD to 1. If the DS and/or TSD are 0, the command is terminated with CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, with the Additional Sense Code set to INVALID FIELD IN PARAMETER LIST.
	TSD	Target Save Disable. Saving parameters is not supported. Set both DS and TSD to 1. If the DS and/or TSD are 0, the command is terminated with CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, with the Additional Sense Code set to INVALID FIELD IN PARAMETER LIST.
	ETC	Enable Threshold Comparison. When set to 1, the tape drive performs a comparison with threshold values after updating the cumulative value. Comparison criteria are defined in TMC. If the comparison is met and the RLEC bit of MODE SELECT/SENSE Control Page is 1, then a UNIT ATTENTION **is** generated for all initiators. The Additional Sense Code is set to LOG EXCEPTION and the Additional Sense Code Qualifier is THRESHOLD CONDITION MET. If the RLEC bit is 0 and the comparison is met, then UNIT ATTENTION **is not** generated.
	TMC	Threshold Met Criteria. See Table 4-16 on page 4-28 for the list of criteria. After the specified criteria in this field is met, the ETC bit is 1, and the RLEC bit in MODE SENSE/SELECT Control Page is 1, then the UNIT ATTENTION message is generated for all initiators.
	LP	List Parameter. This bit should always be 0 to indicate that parameter codes are treated as data counters.
Parameter Length	This field specifies the number of bytes of the parameter value.	
Parameter Value	This field is the actual value of this log parameter.	

Table 4-13. Supported Parameter Codes

Parameter Code	Parameter Length	Description
00h	04h	Errors corrected with substantial delays
01h	04h	Errors corrected with possible delays
02h	04h	Total rewrites or rereads
03h	04h	Total errors corrected
04h	04h	Total times correction algorithm processed
05h	04h	Total bytes processed
06h	04h	Total uncorrected errors
8000h	04h	Vendor Unique

Parameter codes 00h, 01h, and 04h always return a value of 0.

NOTE: The parameter value for code 05h is 8 bytes; the parameter length is set to 8.

4.7.4 Error Detection Summary in LOG SELECT Pages

The host issues a LOG SELECT command to initialize host-resident software, which allows the host to determine the following pages or codes:

- The pages the tape drive uses.
- The parameter codes and length of each parameter.

The following conditions constitute errors in the parameter block; they cause the tape drive to return CHECK CONDITION, with the Sense Key set to ILLEGAL REQUEST, and Additional Sense Code INVALID FIELD IN PARAMETER LIST:

- The tape drive receives a page header containing unsupported page codes.
- The page header includes an incorrect log page length.
- A valid page code contains an illegal parameter code.
- The initiator did not send parameter codes for a supported page in ascending order.
- LP bit is 1 in the parameter control byte.
- DS bit is 0 in the parameter control byte.
- TSD bit is 0 in the parameter control byte.

4.8 LOG SENSE (4Dh)

The LOG SENSE command allows the host to retrieve statistical information the tape drive maintains about its own hardware or the installed media. This command complements LOG SELECT.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (4Dh)							
1	Logical Unit Number			Reserved			PPC	SP(0)
2	PC		Page Code					
3 - 4	Reserved							
5 - 6	(MSB) Parameter Pointer (LSB)							
7 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-14. LOG SENSE (4Dh) Command Descriptor Block — Data Format

Table 4-14. LOG SENSE (4Dh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.

Table 4-14. LOG SENSE (4Dh) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
PPC	Parameter Pointer Control. This bit must be 0. A Parameter Pointer Control bit of 0 indicates that the parameter data requested from the tape drive starts with the parameter code specified in the Parameter Pointer field. It also returns the number of bytes specified in the Allocation Length field in ascending order of parameter codes from the specified log page. A PPC bit of 0 and a Parameter Point field of 0 cause all available parameter data for that page code to be returned to the initiator. **Note:** The current implementation of the Read/Write Compression Page does not support a parameter pointer other than 0. If the PPC bit is set or the Parameter Pointer is larger than the highest numbered parameter on the page, the target terminates the command with CHECK CONDITION status. It sets the Sense Key to ILLEGAL REQUEST and the Additional Sense Code to INVALID FIELD IN CDB. If the target does not support a parameter code within this page, it does not return any data associated with this parameter.
SP	Saving Log Parameters. Not supported, this bit is always 0. If the SP bit is set, the command is terminated with CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN CDB.
PC	Page Control. This field defines the type of parameter values to be returned: **PC** — **Type of Parameter Values** 00b — Threshold Values 01b — Cumulative Values 10b — Default Threshold Values 11b — Default Cumulative Values The Default Threshold Values are the maximum values that each parameter can attain. The current Cumulative Values are the values computed since the last reset of the tape drive (either by power cycling, BUS DEVICE RESET, or SCSI BUS RESET). The Default Cumulative Values are the values to which each parameter is initialized on a reset condition, as described previously. By default, current Threshold Values = Default Threshold Values. **Note:** All types of parameter values are changeable through LOG SELECT.

Table 4-14. LOG SENSE (4Dh) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
Page Code	Page Code. This field identifies which log page the initiator is requesting. If the page is not supported, the command terminates with a CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, and an Additional Sense Code of INVALID FIELD IN CDB. Supported pages follow: **Page Code** — **Page Description** 00h — List of Supported Pages Page 02h — Write Error Counter Page 03h — Read Error Counter Page 07h — Last *n* Errors Events Page 2Eh — TapeAlert Log Page 32h — Compression Ratio Page 33h — Device Wellness Log Page 3Eh — Device Status Log Page
Parameter Pointer	Parameter Pointer. This field allows the host to specify at which parameter within a log page the requested data should begin. For example, if a page supports parameters 0 through 5, and the Parameter Pointer field contains 3, the target returns only parameters 3, 4, and 5 to the initiator. Similarly, if a page supports parameters 1, 3, and 6, and the Parameter Pointer field contains 2, the target returns only parameters 3 and 6 to the initiator. If Parameter Pointer is larger than the highest numbered parameter on the page, the target terminates the command with CHECK CONDITION status. The Sense Key is ILLEGAL REQUEST and the Additional Sense Code is INVALID FIELD IN CDB. **Note:** The target always returns parameters within a page in ascending order according to parameter code.
Allocation Length	Allocation Length. This field informs the target how much space the initiator has allocated for data. There must be sufficient space allocated for all the requested data, otherwise the command terminates with a CHECK CONDITION status, with Sense Key of ILLEGAL REQUEST, and Additional Sense Code (ASC) of INVALID FIELD IN CDB.

4.8.1 Error Detection Summary in LOG SENSE CDB

The following conditions constitute errors that the tape drive detects in relation to the CDB. It sets the request sense data to ILLEGAL REQUEST, INVALID FIELD IN CDB.

- A page is unsupported.
- A Parameter Pointer is larger than the highest numbered parameter on the page.
- An SP bit is 1.
- An Allocation Length is smaller than the data being returned by the target.

4.8.2 Supported Pages Log Page (Page 00h)

When the host requests the page that contains the list of supported pages (Page Code 00h), the tape drive returns the 4-byte page header followed by the page code for each supported page, displaying the codes in ascending order, one byte for each.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (00h)					
1	Reserved							
2 - 3	(MSB) Page Length (08h) (LSB)							
4	00h							
5	02h							
6	03h							
7	07h							
8	2Eh							
9	32h							
10	33h							
11	3Eh							

Figure 4-15. Supported Pages Log Page 0 — Data Format

4.8.3 Read/Write Error LOG SENSE Page (Pages 02h and 03h)

Each log page begins with a 4-byte header followed by *n* number of log parameter blocks, with each block containing 8 bytes, except for parameter code 05h. The log parameter block for the parameter total bytes processed (05h) is 12 bytes, since the parameter value is 8 bytes long.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code					
1	Reserved							
2 -3	(MSB) Page Length (LSB)							

Figure 4-16. Read / Write Error LOG SENSE (Page 2 and 3) Header — Data Format

Table 4-15. Read / Write Error LOG SENSE (Page 2 and 3) — Field Descriptions

Field Name	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE CDB.
Page Length	The Page Length specifies the total number of bytes contained in this log page, not including the four bytes of the header. For example, if the PPC bit is 0 and Parameter Pointer is 0, the target returns 4 bytes of page header, with page length of 3Ch, followed by 8 bytes of log parameter data for each parameter code, except for parameter code 05h. For code 05h, it returns 12 bytes. Parameter codes may be 8 or 12 bytes long. Refer to the following table for the length of each Parameter Code. **Parameter Code** — **Length in Bytes** 0h, 01h, 02h, 03h, 04h, and 06h — 8 05h — 12

Bit Byte	7	6	5	4	3	2	1	0
0 –1	(MSB) Parameter Code (LSB)							
2[1]	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	Parameter Length							
4 – *n*	(MSB) Parameter Value (LSB)							

1. The byte 2 fields are collectively referred to as the Parameter Control byte.

Figure 4-17. Read / Write Error LOG SENSE Parameters (Pages 02h and 03h) — Data Format

Table 4-16. Read / Write Error LOG SENSE Parameters (Pages 02h and 03h) — Field Descriptions

Field Name	Description
Parameter Code	The following parameter codes are supported for the Read / Write error counter pages:

Parameter Code	Description
00h	Errors corrected with substantial delays
01h	Errors corrected with possible delays
02h	Total rewrites or rereads
03h	Total errors corrected
04h	Total times correction algorithm processed
05h	Total bytes processed
06h	Total uncorrected errors
8000h	Vendor unique

Parameter codes 00h, 01h, and 04h always return a value of 0.

Table 4-16. Read / Write Error LOG SENSE Parameters (Pages 02h and 03h) — Field Descriptions *(Continued)*

Field Name	Description	
Parameter Control Byte	DU, DS, TSD, ETC, TMC, LBIN, and LP are collectively referred to as the Parameter Control Byte.	
	DU	Disable Update. A value of 0 indicates that target updates all log parameter values. A value of 1 indicates that target does not update the log parameter values except in response to LOG SELECT. The tape drive sets this bit when accumulated values reach maximum. The host also returns this bit set if the host set the bit in the last LOG SELECT command. The default is 0. **Note**: For parameter types other than threshold and cumulative values, the DU bit is always 0.
	DS	Disable Save. Since the tape drive does not support saving parameters, this bit is always 1.
	TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always 1.
	ETC	Enable Threshold Comparison. ETC of 1 indicates that comparison to threshold is performed. ETC of 0 indicates that this comparison is not performed. This bit is 1 by LOG SELECT command. Default is 0.

Table 4-16. Read / Write Error LOG SENSE Parameters (Pages 02h and 03h) — Field Descriptions *(Continued)*

Field Name	Description	
	TMC	Threshold Met Criteria. This field is valid only if the host sets the ETC bit to 1. This field determines the basis for comparison. The host specifies this field using the LOG SELECT command. If the result of comparison is true (cumulative = threshold) and the MODE SELECT / SENSE Control Mode Page RLEC bit is 1, the drive generates a UNIT ATTENTION for all initiators. In that case, the drive sets the Sense Key to UNIT ATTENTION, the Additional Sense Code to LOG EXCEPTION, and the Additional Sense Code Qualifier to THRESHOLD CONDITION MET. If the RLEC bit in Control Mode Page is 0, the drive does not generate a UNIT ATTENTION. This comparison is performed in real time. A LOG SENSE command need not be issued to get the CHECK CONDITION status. Once ETC is selected and the RLEC bit in the Control Mode Page is 1, the drive issues a CHECK CONDITION status based on the criteria defined in the TMC bits—if the criteria is met in real time. The CHECK CONDITION status does not identify the parameter code for which the criteria is met. To make this determination, the host must issue a LOG SENSE command to read the counters. **Code** — **Basis of Comparison** 00b — Every update of the cumulative value 01b — Cumulative value equal to threshold value 10b — Cumulative value not equal to threshold value 11b — Cumulative value greater than threshold value
	LP	List Parameter. This bit is always 0, since the tape drive treats the parameter codes as data counter. When the data counter reaches its defined maximum value, it does not increment and the DU bit is 1. If the data counter is at or reaches its maximum value during the execution of a command, the tape drive completes the command. If the RLEC bit of the Control Mode page is 1, the tape drive then issues the status of CHECK CONDITION and sets the Sense Key to RECOVERED ERROR with Additional Sense Code set to LOG COUNTER AT MAXIMUM.
Parameter Length	This field specifies the number of bytes of the parameter value.	
Parameter Value	This field is the actual value of this log parameter.	

4.8.4 Last n Error Events Page (07h)

The log error events page returns zero or more log parameters using the list format of the log page which consist of ASCII text in the parameter value. The EEPROM stores a maximum of 15 log events at a given time. Each log event stored may require more than 0XFF of ASCII text; therefore, two parameter codes are assigned for each log event stored in EEPROM. The parameter pointer field in the CDB specifies which parameter code the requested data should begin with.

Bit / Byte	7	6	5	4	3	2	1	0
4 – 5	(MSB) Parameter Code (LSB)							
6[1]	DU	DS	TSD	ETC	TMC		Rsv'd	LP
7	Parameter Length							
8 – *n*	(MSB) Hex ASCII String for Event *n* (LSB)							

1. The byte 6 fields are collectively referred to as the Parameter Control byte.

Figure 4-18. Log Parameters for Last *n* Error Events LOG SENSE Page — Data Format

Table 4-17. Log Parameters for Last *n* Error Events (07h) LOG SENSE Page — Field Descriptions

Field Name	Description
Parameter Code	Parameter code values are assigned from 0 to 29(two per log event), where 0 is the oldest event stored and the highest parameter code returned is the most recent event. Two parameter codes are assigned for each log entry. A parameter pointer of 0 in the CDB returns all the log events stored in the EEPROM. For example, if only 10 log events are stored, then the parameter codes for the 10th event are parameter codes 18 and 19. If the parameter pointer field in CDB contains 0, the target returns parameter codes 0 to 19 to initiator. If the parameter pointer in CDB contains 20, the target returns zero data to initiator.

Table 4-17. Log Parameters for Last *n* Error Events (07h) LOG SENSE Page — Field Descriptions

Field Name	Description	
Parameter Control Byte	DU, DS, TSD, ETC, TMC, LBIN, and LP are collectively referred to as the Parameter Control Byte.	
	DU	Disable Update. For a list parameter this field is always 0.
	DS	Disable Save. Since the tape device does not support saving parameters, this bit is always 1.
	TSD	Target Save Disable. Since the tape device does not support saving parameters, this bit is always 1.
	ETC	Enable Threshold Comparison. For a list parameter this field is always 0.
	TMC	Threshold Met Criteria. For a list parameter this field is always 0.
	LP	List Parameter. This bit is always set to 1 since the tape drive treats the parameter codes as list parameters.
Parameter Length	This field specifies the number of bytes of the parameter value.	
Parameter Value (Hex ASCII String for Event n)	The content of the parameter value is an ASCII string which describes the error event. The text of the parameter includes a “Packet #,” which is a value from 0 to 255. This internal number is assigned when the packet is written into EEPROM. Zero is normally the oldest packet, but packet numbers can wrap around from 255 to 0.	

4.8.5 TapeAlert Parameters Page (2Eh)

This page reports all TapeAlert status flags. Each parameter is a one-byte flag indicating the state of all TapeAlert events. Each flag is 1 when the corresponding event occurs. It is the responsibility of the host software to examine all TapeAlert flags when this page is read as each flag is only set once per occurrence and all flags are cleared when this page is read. There are a total of 64 one-byte flags, some of which are reserved or not supported by the tape drive.**1**

Table 4-18. TapeAlert LOG SENSE Parameters — Field Descriptions

Parameter Code	Description	Length in Bytes	Default Threshold
0001h	Not Supported.	1	01
0002h	Not supported	1	01
0003h	Hard Error. A write or read hard error has occurred.	1	01
0004h	Media. The number of read or write errors being encountered indicates that the media should be replaced.	1	01
0005h	Read Failure. A hard read error has occurred.	1	01
0006h	Write Failure. A hard write error has occurred.	1	01
0007h	Not supported	1	01
0008h	Not supported	1	01
0009h	Write Protect. An attempt was made to write to a write-protected medium.	1	01
000Ah	Not supported	1	01
000Bh	Not supported	1	01
000Ch	Unsupported Format. The tape drive is unable to detect the format on the inserted medium.	1	01
000Dh	Not supported	1	01
000Eh	Not supported	1	01
000Fh	Not supported	1	01
0010h	Not supported	1	01
0011h	Not supported	1	01
0012h	Not supported	1	01
0013h	Not supported	1	01

Table 4-18. TapeAlert LOG SENSE Parameters — Field Descriptions *(Continued)*

Parameter Code	Description	Length in Bytes	Default Threshold
0014h	Clean Now. Excessive read or write errors due to a dirty medium path; the cleaning LED is on.	1	01
0015h	Cleaning Periodic. A periodic cleaning is due; the cleaning LED is on.	1	01
0016h	Not supported	1	01
0017h	Not supported	1	01
0018h – 001Ch	Reserved	1 Byte Each	01
001Dh	Not supported	1	01
001Eh	Hardware A. A major hardware failure has occurred.	1	01
001Fh	Hardware B. A major hardware failure has occurred.	1	01
0020h	Interface. SCSI interface parity error detected.	1	01
0021h	Eject Media. A load failure occurred; eject the media and try again.	1	01
0022h	Download Fail. The microcode update failed.	1	01
0023h	Not supported	1	01
0024h	Not supported	1	01
0025h	Not supported	1	01
0026h	Not supported	1	01
0027h	Not supported	1	01
0028h – 002Eh	Not supported	1 Byte Each	01
002Fh – 0040h	Reserved	1 Byte Each	01

The tape drive sets each TapeAlert flag to 0 in the following circumstances:

- At tape drive power on
- When the host reads the TapeAlert LOG SENSE page
- When the host takes the specified corrective action
- On SCSI bus reset or device reset messages.

4.8.6 Read/Write Compression Ratio Page (32h)

The Read / Write Compression Ratio page begins with a 4-byte header followed by the log parameter blocks of 6 or 8 bytes, depending on the parameter code selected.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (32h)					
1	Reserved							
2 - 3	(MSB) Additional Length (LSB)							

Figure 4-19. Read / Write Compression Ratio (32h) Page Header — Data Format

Table 4-19. Read / Write Compression Ratio (32h) Page Header — Field Descriptions

Field Name	Description
Page Code	The Page Code echoes the page code specified in the LOG SENSE CDB.
Additional Length	The Additional Length field specifies the number of bytes available and depends on the parameters requested.

Parameter Codes

The tape drive supports the following parameter codes for the Read / Write Compression Ratio page.

Table 4-20. Supported Parameter Codes for the Read / Write Compression Ratio Page

Parameter Code	Description
00h	Read Compression Ratio x 100
01h	Write Compression Ratio x 100
02h	Mbytes Transferred to Host
03h	Bytes Transferred to Host
04h	Mbytes Read from Medium
05h	Bytes Read from Medium
06h	Mbytes Transferred from Host
07h	Bytes Transferred from Host
08h	Mbytes Written to Medium
09h	Bytes Written to Medium

Parameter Block: Codes 00h and 01h

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Parameter Code (LSB)							
2	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	02h							
4 - 5	(MSB) Compression Ratio x 100 (LSB)							

Figure 4-20. Read / Write Compression Ratio Log Page — Data Format

Table 4-21. Read / Write Compression Ratio Log Page — Field Descriptions

Field Name	Description	
Parameter Control Byte	DU, DS, TSD, ETC, TMC, and LP are collectively referred to as the Parameter Control Byte.	
	DU	Disable Update. This bit is always 0.
	DS	Disable Save. Since the tape drive does not support saving parameters, this bit is always 1.
	TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always 1.
	ETC	Enable Threshold Comparison. The tape drive does not support threshold checking on this page. This bit is always 0.
	TMC	Threshold Met Criteria. This bit is always 0.
	LP	List Parameter. This bit is always 0 since the tape drive treats the parameter codes as data counters.
Compression Ratio	The compression ratio is reported as the actual compression ratio multiplied by 100.	

Parameter Block: Parameter Codes 02h through 09h

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Parameter Code (LSB)							
2	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	04h							
4 - 7	(MSB) Counter Value (LSB)							

Figure 4-21. Read / Write Bytes Transferred Log Page — Data Format

Table 4-22. Read / Write Bytes Transferred LOG SENSE Page — Field Descriptions

Field Name	Description	
Parameter Control Byte – DU, DS, TSD, ETC, TMC, and LP are collectively referred to as the Parameter Control Byte.		
	DU	Disable Update. This bit is always 0.
	DS	Disable Save. Since the tape drive does not support saving parameters, this bit is always 1.
	TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always 1.
	ETC	Enable Threshold Comparison. The tape drive does not support Threshold Checking on this page. This bit is always 0.
	TMC	Threshold Met Criteria. This bit is always 0.
	LP	List Parameter. This bit is always 0 since the tape drive treats the parameter codes as data counters.

Table 4-22. Read / Write Bytes Transferred LOG SENSE Page — Field Descriptions *(Continued)*

Field Name	Description
Counter Value	These parameter codes provide a count of the number of bytes transferred since the current data cartridge was inserted or since the last time the counters were reset with a MODE SELECT command. Parameter codes 02 and 03 report the counts of bytes transferred from the tape drive to the initiator. Parameter code 02 reports the number of full megabytes transferred. Parameter code 03 reports the number of bytes less than a full megabyte that have been transferred. Multiplying the counter returned for parameter 02 by 1,048,576 and then adding the counter value returned for parameter 03 gives the actual total bytes transferred to the initiator. Parameter codes 04 and 05 report the counts of bytes transferred from the medium to the buffer. Parameter code 04 reports the number of full megabytes transferred. Parameter code 05 reports the number of bytes less than a full megabyte that have been transferred. Multiplying the counter returned for parameter 04 by 1,048,576 and then adding the counter value returned for parameter 05 gives the actual total bytes transferred from medium to buffer. Parameter codes 06 and 07 report the counts of bytes transferred from the initiator to the buffer. Parameter code 06 reports the number of full megabytes transferred. Parameter code 07 reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 06 by 1,048,576 and then adding the counter value returned for parameter 07 will give the actual total bytes transferred from the initiator to the buffer. Parameter codes 08 and 09 report the counts of bytes written to the medium. Parameter code 08 reports the number of full megabytes transferred. Parameter code 09 reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 08 by 1,048,576 and then adding the counter value returned for parameter 09 will give the actual total bytes written to the medium.

4.8.7 Device Wellness LOG SENSE Page (33h)

This LOG SENSE page returns the data useful for determining the tape drive wellness. The page contains up to 16 log entries (parameter code 0000h to 000Fh). Each entry records an error event classified as recovered error (Sense Key is 1), medium error (Sense Key is 3), or hardware error (Sense Key is 4). Parameter code (0000h) contains the oldest log information, while parameter code (000Fh) contains the newest information.

NOTE: The tape drive records only head cleaning recovered related errors—that is, the more serious recovered errors—on the first category when Sense Key is 1: It captures all error events associated with the Sense Key 3 or 4.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (33h)					
1	Reserved							
2 - 3	(MSB) Page Length (LSB)							

Figure 4-22. Device Wellness (33h) Log Page Header — Data Format

Table 4-23. Device Wellness (33h) Log Page Header — Field Descriptions

Field Name	Description
Page Code	The Page Code echoes the page code that was specified in the LOG SENSE CDB.
Page Length	The Page Length field specifies the number of bytes available and depends on the parameters requested.

Device Wellness (33h) Log Page parameters (0000h through 000Fh) are as follows:

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Parameter Code (LSB)							
2	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	Parameter Length (0Ch)							
4 - 7	(MSB) Time Stamp (LSB)							

Bit Byte	7	6	5	4	3	2	1	0
8 - 11	(MSB) Media ID (LSB)							
12	Sense Key							
13	Additional Sense Code							
14	Additional Sense Code Qualifier							
15	Additional Error Information							

Figure 4-23. Device Wellness (33h) Log Page Parameters (0000h through 000Fh) — Data Format

Table 4-24. Device Wellness (33h) Log Page Parameters — Field Descriptions

Field Name	Description	
Parameter Control Byte – DU, DS, TSD, ETC, TMC, and LP are collectively referred to as the Parameter Control Byte.		
	DU	Disable Update. This bit is always 0.
	DS	Disable Save. Since the tape drive does not support saving parameters, this bit is always 1.
	TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always 1.
	ETC	Enable Threshold Comparison. The tape drive does not support Threshold Checking on this page. This bit is always 0.
	TMC	Threshold Met Criteria. This bit is always 0.
	LP	List Parameter. This bit is always 0 since the tape drive treats the parameter codes as data counters.
Time Stamp (Bytes 4 through 7)	Power-on hours when error event occurred	
Media ID (Bytes 8 through 11)	Identity of media in use when error event occurred. The bytes are 0 if no media or media unknown.	

4.8.8 Device Status Log Page (3Eh)

This LOG SENSE page describes the current status of the tape drive. The page defines three, 4-Byte log parameters.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (3Eh)					
1	Reserved							
2 - 3	(MSB) Page Length (LSB)							

Figure 4-24. Device Status (3Eh) Log Page Header — Data Format

Device Status (3Eh) Log Page parameters (0000h through 0002h) are as follows:

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Parameter Code (LSB)							
2	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	Parameter Length (04h)							
4 - 7	(MSB) Parameter Value (LSB)							

Figure 4-25. Device Status (3Eh) Log Page Parameters (0000h through 0002h) — Data Format

Table 4-25. Device Status (3Eh) Log Page Parameter — Field Descriptions

Field Name	Description	
Parameter Control Byte – DU, DS, TSD, ETC, TMC, and LP are collectively referred to as the Parameter Control Byte.		
	DU	Disable Update. This bit is always 0.
	DS	Disable Save. Since the tape drive does not support saving parameters, this bit is always 1.
	TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always 1.
	ETC	Enable Threshold Comparison. The tape drive does not support Threshold Checking on this page. This bit is always 0.
	TMC	Threshold Met Criteria. This bit is always 0.
	LP	List Parameter. This bit is always 0 since the tape drive treats the parameter codes as data counters.
Parameter Code (0000h)	This parameter specifies the device type. For sequential type devices, the parameter value is always (00 01 00 00h).	
Parameter Code (0001h)	This parameter specifies the tape drive cleaning related status. There are three bits currently defined in this parameter.	

The Device Status (3Eh) Log Page parameter code (0001h) description follows:

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved					ClnQ	ClnR	ClnEx
1 - 3	(MSB) Reserved (LSB)							

Figure 4-26. Device Status (3Eh) Log Page Parameter Code (0001h) — Data Format

Table 4-26. Device Status (3Eh) Log Page Parameter Code (0001h) — Field Descriptions

Field Name	Description
ClnQ	Set to 1 if a Cleaning Required condition exists. This is a recovered error status.
ClnR	Set to 1 if a Cleaning Requested condition exists. This is a hard error status.
ClnEx	Set to 1 if the cleaning medium is used up.
Parameter Code (0002h)	The value of this parameter contains the number of loads over the life of the tape drive.

4.9 MODE SELECT (15h/55h)

The MODE SELECT command enables the host to configure the tape drive. Implementing MODE SELECT and MODE SENSE requires a certain amount of handshaking between the host and the tape drive. Before configuring the tape drive, the host should issue a MODE SENSE to get the current configuration and determine what parameters are configurable. The host interprets this information and can then issue MODE SELECT to set the tape drive to the host's preferred configuration.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	Logical Unit Number			PF	Reserved			SP(0)
2 - 3	Reserved							
4	Parameter List Length							
5	Unused		Reserved				Flag	Link

Figure 4-27. MODE SELECT (15h) 6-Byte Command Descriptor Block — Data Format

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (55h)							
1	Logical Unit Number			PF	Reserved			SP(0)
2 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-28. MODE SELECT (55h) 10-Byte Command Descriptor Block — Data Format

The tape drive always powers up with its default configurations set. This is also true if the tape drive receives a BUS DEVICE RESET message or a hard reset through the RST line on the SCSI bus.

Table 4-27. MODE SELECT (15h/55h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
PF	Page Format. This bit indicates that the data the host sent after the MODE SELECT header and block descriptors complies with the definition of pages in the SCSI-2 specification. The SCSI-1 format is not implemented, so this bit must be set. It is an ILLEGAL REQUEST to have page parameters while the PF bit is 0.
SP	Save Parameters. Not supported. This bit must be 0. The Save Parameters bit instructs the tape drive to save all savable pages.
Parameter List Length	Specifies the length in bytes of the MODE SELECT parameter list that the initiator transfers during the DATA OUT phase. A Parameter List Length of 0 indicates no data is transferred.

4.9.1 MODE SELECT Parameter List

The MODE SELECT parameter list shown in Figure 4-29, Figure 4-30, and Figure 4-31 contains a 4-byte header, followed by one 8-byte block descriptor.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	Media Type							
2	Ignored	Buffered Mode			Speed			
3	Block Descriptor Length (08h)							

Figure 4-29. MODE SELECT (6) Parameter List Header — Data Format

Bit / Byte	7	6	5	4	3	2	1	0
0	Density Code							
1 - 3	(MSB) Number of Blocks (000000h) (LSB)							
4	Reserved							
5 - 7	(MSB) Block Length (LSB)							

Figure 4-30. MODE SELECT (6) Parameter List Block Descriptor — Data Format

Table 4-28. MODE SELECT (6) Parameter List — Field Descriptions

Field Name	Description
Media Type	The MODE SELECT command ignores this field.
Buffered Mode	The tape drive implements Immediate Reporting on WRITE commands through Buffered mode. If the field is 0, the tape drive does not report a GOOD status on WRITE commands until the data blocks are actually written to medium. If the Buffered Mode field is 1, the default configuration, the tape drive reports GOOD status on WRITE commands as soon as the data block has been transferred to the buffer. When Buffered Mode is not used, the tape drive suffers a degradation in performance and possibly capacity as well, depending on medium format, block size, and compression. When writing and the block size is a multiple of 8 KB, there should be no capacity loss. Turning off Buffered Mode essentially disables the block packing feature. If this field is greater than 1, the command is rejected with a CHECK CONDITION, with a Sense Key of ILLEGAL REQUEST.
Speed	The tape drive supports only one speed, the default speed.
Block Descriptor Length	Specifies the length, in bytes, of all the block descriptors. Since the tape drive only allows one block descriptor, this value must be 8 or 0. Any other value causes a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key to be returned.
Density Code	This field should match the current density of the media. If this value is 0, the tape drive uses default density. **Density Code** — **Description** 00h — Use default density 40h — DLT1 format, DLTtapeIV – 40 GB 7Fh — No changes from previous density (No operation) 86h — DLT1 format, DLTtapeIV – 40 GB without compression 87h — DLT1 format, DLTtapeIV – 80 GB with compression
Number of Blocks	This MODE SENSE field is sent as 0, indicating that all of the remaining logical blocks on the medium have the medium characteristics specified by the block descriptor.
Block Length	This specifies the length, in bytes, of each logical block transferred over the SCSI bus. A block length of 0 indicates that the length is variable (specified in the I/O command). Any other value indicates the number of bytes per block to use for READ, WRITE, and VERIFY type commands that specify a “Fixed” bit of 1 (i.e., fixed block mode) which also causes the transfer length in the CDB to be defined as a block count.

4.9.2 MODE SELECT Pages

Following the Command Block Descriptor are the MODE SELECT pages, which set the tape drive parameters. Each page has a 2-byte header that identifies the page code and indicates the number of bytes in that page.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code					
1	Additional Page Length							

Figure 4-31. MODE SELECT Pages — Data Format

Table 4-29. MODE SELECT Pages — Field Descriptions

Field Name	Description
PS	Parameters Savable. For the MODE SELECT command, this bit is reserved. For the MODE SENSE command, a PS bit of 1 indicates that the tape drive can save the page in nonvolatile memory. If the PS bit is 0, it cannot save the supported parameters. The tape drive does not support Savable pages. Byte 0, bit 6 must be 0.
Page Code	These six bits identify the page that follows. **Page Code** — **Description** 01h — Read / Write Error Recovery (Page 4-49) 02h — Disconnect / Reconnect (Page 4-51) 0Ah — Control Mode (Page 4-51) 0Fh — Data Compression (Page 4-56) 11h — Medium Partition (Page 4-58) 1Ch — TapeAlert (Page 4-60) 3Eh — EEPROM Vendor Specific (Page 4-61)
Additional Page Length	This bit indicates the number of bytes in that page. However, the value does not include bytes 0 and 1. The tape drive returns the length on MODE SENSE; the initiator must subsequently set it to the same value when performing a MODE SELECT command. If the page length does not match the length the tape drive expects, the tape drive returns a CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST. The tape drive returns a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key if it receives an unsupported Page Code or any Page field with values not supported or changeable. In this case, the command changes no parameters.

4.9.3 Read/Write Error Recovery Page (01h)

The tape drive supports the Error Recovery Page, which has the following format:

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code (01h)					
1	Additional Page Length (0Ah)							
2	Rsv'd	Rsv'd	TB	Rsv'd	EER	PER	DTE	DCR
3	Read Retry Count							
4 - 7	Reserved							
8	Write Retry Count							
9 - 11	Reserved							

Figure 4-32. Read / Write Error Recovery Page — Data Format

In this page, only the Post Error (PER) flag parameter is changeable. With PER set, the tape drive creates CHECK CONDITIONS, with Sense Key of RECOVERED ERROR, and Vendor Unique Sense Data detailing the cause. These events should be rare and only occur if the recovered write or read retry rates reach excessive levels.

Table 4-30. Read / Write Error Recovery Page (01h) — Field Descriptions

Field Name	Description
TB	Transfer Block. This block (when not fully recovered) function is not supported.
EER	Enable Early Recovery. This function is always enabled.
PER	Post Error. This bit turns on reporting of CHECK CONDITIONS to report recovered Read / Write errors. The default value of this bit is 0.
DTE	Disable Transfer on Error. This feature is not supported, so this bit must be 0.
DCR	Disable ECC Correction. This bit feature is not supported, so this bit must be 0.
Read Retry Count	This field reports the maximum number of times the tape drive tries to reread before declaring an unrecoverable error.
Write Retry Count	This field reports the maximum number of times the tape drive tries to overwrite before declaring an unrecoverable error.

4.9.4 Disconnect/Reconnect Page (02h)

The tape drive supports the Disconnect/Reconnect Page, which has the following format:

Bit Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code (02h)					
1	Additional Page Length (0Eh)							
2	Buffer Full Ratio							
3	Buffer Empty Ratio							
4 - 5	(MSB) Bus Inactivity Limit (LSB)							
6 - 7	(MSB) Disconnect Time Limit (LSB)							
8 - 9	(MSB) Connect Time Limit (LSB)							
10 - 11	(MSB) Maximum Burst Size (LSB)							
12	Reserved							DTDC
13 - 15	Reserved							

Figure 4-33. Disconnect / Reconnect Page — Data Format

In this page, only the Maximum Burst Size parameter is changeable. Table 4-31 lists the supported parameters in this page.

Table 4-31. Disconnect / Reconnect Page (02h) — Field Descriptions

Field Name	Description
Maximum Burst Size	This value specifies the maximum amount of data that can be transferred without disconnecting. A value of 0 sets no limit. This value is in multiples of 512 bytes. For example, a value of 8 means 4K bytes. The Maximum Burst Size must be a multiple of 8. If it is not, the tape drive returns CHECK CONDITION, RECOVERED ERROR, ROUNDED PARAMETERS.

Table 4-31. Disconnect / Reconnect Page (02h) — Field Descriptions *(Continued)*

Field Name	Description
DTDC	Data Transfer Disconnect Control. The DTDC field defines further restrictions when disconnect is permitted. **DTDC** — **Description** 00b — Data Transfer Disconnect Control is not used. Disconnect is controlled by the other fields in this page. 01b — A target does not attempt to disconnect once the data transfer of a command has started until all data the command is to transfer has been transferred. 10b — Reserved 11b — A target does not attempt to disconnect after the data transfer of a command has started until the command is complete. If DTDC is non-zero and the maximum burst size is non-zero, the tape drive returns CHECK CONDITION status. The Sense Key is set to ILLEGAL REQUEST and the Additional Sense Code set to ILLEGAL FIELD IN PARAMETER LIST.

4.9.5 Device Configuration Page (10h)

The tape drive supports the Device Configuration Page, which has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code (10h)					
1	Additional Page Length (0Eh)							
2	Rsv'd	CAP	CAF	Active Format				
3	Active Partition							
4	Write Buffer Full Ratio							
5	Read Buffer Empty Ratio							
6 - 7	(MSB) Write Delay Time (LSB)							
8	DBR	BIS	RSmk	AVC	SOCF		RBO	REW
9	Gap Size							
10	EOD Defined			EEG	SEW	Reserved		
11 - 13	(MSB) Buffer Size at Early Warning (Optional) (LSB)							
14	Select Data Compression Algorithm							
15	Reserved							

Figure 4-34. Device Configuration Page — Data Format

In this page, only the Write Delay Time and Select Data Compression Algorithm parameters are changeable.

Table 4-32. Device Configuration Page — Field Descriptions

Field Name	Description
CAP	This field is not supported and must be 0.
CAF	This field is not supported and must be 0.
Active Format	This field is not supported and must be 0.

Table 4-32. Device Configuration Page — Field Descriptions *(Continued)*

Field Name	Description	
Active Partition	Only partition 0 is supported. The tape drive rejects any other value for this field with a CHECK CONDITION status and the ILLEGAL REQUEST Sense Key set.	
Write Buffer Full Ratio and Read Buffer Empty Ratio	The tape drive sets these fields to 0 (unused). The tape drive uses an automatic, adaptive mechanism to adjust its Full/Empty Buffer ratios dynamically according to the average data rates over the SCSI bus.	
Write Delay Time	This field indicates the maximum time that the tape drive waits with a partially full buffer before forcing the data to medium (in 100 ms increments). The buffer Full/ Empty ratio, which is dynamic, can cause data to be written sooner than the Write Delay time would indicate. The Write Delay Time defaults to 200 (C8h), causing the buffer to be flushed in 20 seconds. The maximum value is 6500 (1964h), the minimum value is 15 (0Fh), representing delays from almost 11 minutes down to 1.5 seconds. Values between 0 and 15 are rounded down to 0. This causes the data to go straight to the media without delay.	
Byte 8	**Code**	**Description**
	DBR	Must be 0 (Data Buffer Recovery not supported).
	BIS	Must be 1 (Block Identifiers Supported in media format).
	RSmk	Must be 0 (Setmarks not supported).
	AVC	Must be 0.
	SOCF	Must be 0.
	RBO	Must be 0.
	REW	Must be 0 (Do not report Early Warning EOM on reads).
Gap Size	This field is not used and is 0.	
EOD Defined	End of Data Defined. This field must be 00h. The tape drive rejects any other value.	
EEG	Enable EOD Generation. This bit indicates that the tape drive generates an EOD. The tape drive generates an EOD mark before any change of direction following a write type operation. This bit must be 1.	
SEW and Buffer Size At Early Warning	Synchronize at Early Warning. This bit is 1. Buffer Size at EW is not supported and must be 0.	
Select Data Compression Algorithm	Setting this field to 1 enables hardware data compression. Setting it to 0 disables hardware data compression.	

4.9.6 Control Mode Page (0Ah)

The Control Mode Page provides controls for several features such as tagged queuing, extended contingent allegiance, asynchronous event notification, and error logging.

Bit / Byte	7	6	5	4	3	2	1	0
0	Rsv'd		Page Code (0Ah)					
1	Additional Page Length (0Ah)							
2	Reserved							RLEC
3	Queue Algorithm Modifier				Reserved		QErr	DQue
4	EECA	Reserved				RAENP	UAAENP	EAENP
5	Reserved							
6 - 7	(MSB) Ready AEN Holdoff Period (LSB)							

Figure 4-35. Control Mode Page — Data Format

Table 4-33. Control Mode Page — Field Descriptions

Field Name	Description
RLEC	Report Log Exception Condition. The RLEC bit works with the Read / Write Error Log Page. A Report Log Exception Condition (RLEC) bit of 1 specifies that the target reports log exception conditions. An RLEC bit of 0 specifies the target does not report log exception conditions. Refer to the TMC bit description in Table 4-16 on page 4-28. The RLEC bit indicates whether the tape drive should return CHECK CONDITION status with the Sense Key set to UNIT ATTENTION (06h) when one of the write and read error counters of the log pages reach 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. **Note:** See "LOG SELECT Page Format" on page 4-19 for information on how to change the threshold.
Queue Algorithm Modifier	This field must be 0.

Table 4-33. Control Mode Page — Field Descriptions *(Continued)*

Field Name	Description
QErr	Queue Error. This bit must be 0.
DQue	Disable Queuing. This bit must be 0.
EECA	Enable Extended Contingent Allegiance. The tape drive does not support extended contingent allegiance. This bit must be 0.
RAENP	Ready AEN Permission. The tape drive does not support asynchronous event notification (AEN). This bit must be 0.
UAAENP	Unit Attention AEN Permission. The tape drive does not support asynchronous event notification. This bit must be 0.
EAENP	Enable AEN Permission. The tape drive does not support asynchronous event notification. This bit must be 0.
Ready AEN Holdoff Period	The tape drive does not support asynchronous event notification. This field must be 0.

4.9.7 Data Compression Page (0Fh)

The Data Compression Page specifies parameters that control data compression. This page allows the user to turn the tape drive’s compressed format on and off independently of the medium's position. Additionally, it allows the user to enable or disable decompression of the tape drive’s compressed data during write operations. In this page you can only change the DCE bit.

Bit Byte	7	6	5	4	3	2	1	0
0	Rsv'd		Page Code (0Fh)					
1	Page Length (0Eh)							
2	DCE	DCC	Reserved					
3	DDE	RED	Reserved					
4 - 7	(MSB) Compression Algorithm (LSB)							
8 - 11	(MSB) Decompression Algorithm (LSB)							
12 - 15	Reserved							

Figure 4-36. Data Compression Page — Data Format

Table 4-34. Data Compression Page — Field Descriptions

Field Name	Description
DCE	Data Compression Enable. This bit specifies whether the tape drive should enable or disable data compression. When the DCE bit is 1, the tape drive starts in compressed format.
DCC	Data Compression Capable. The MODE SENSE command uses this bit to indicate that the tape drive supports hardware data compression.
DDE	Data Decompression Enable. When the tape drive reads compressed data from medium, it automatically decompresses the data before sending it to the initiator. Data decompression/compression is always enabled, so this bit must be 1 (enable data decompression).
RED	Report Exception on Decompression. The tape drive does not report exceptions on decompression (boundaries between compressed and uncompressed data). The RED field must be 0.

Table 4-34. Data Compression Page — Field Descriptions *(Continued)*

Field Name	Description
Compression Algorithm	The Compression Algorithm field indicates which compression algorithm the tape drive uses to process data from the initiator when the DCE bit is 1. Specifying a value other than 10h for this field causes the tape drive to return CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST (05h). However, if EEPROM parameter EnaRepDecomp is set, the parameter in this field is ignored and the tape drive returns no CHECK CONDITION status.
Decompression Algorithm	The Decompression Algorithm field indicates which decompression algorithm the tape drive uses when decompressing data encountered on the medium. Specifying a value other than 10h for this field causes the tape drive to return CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST (05h).

4.9.8 Medium Partition Page (11h)

The tape drive supports the Medium Partition Parameter Page, which has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code (11h)					
1	Additional Page Length (06h)							
2	Maximum Additional Partitions							
3	Additional Partitions Defined							
4	FDP	SDP	IDP	PSUM	Reserved			
5	Medium Format Recognition (01h)							
6 -7	Reserved							

Figure 4-37. Medium Partition Page — Data Format

Table 4-35. Medium Partition Page — Field Descriptions

Field Name	Description	
Maximum Additional Partitions	No additional partitions are supported. This field must be 0.	
Additional Partitions Defined	This field specifies the number of additional partitions to be defined for the medium based on the settings of the SDP and IDP bits. The maximum allowed is the value returned in the Maximum Additional Partitions field. Since only one partition is supported, this field must be 0.	
Option Flags		
	FDP	Fixed Data Partitions bit must be 0.
	SDP	Select Data Partitions bit must be 0.
	IDP	Initiator Defined Partitions bit must be 0.
	PSUM	Partition Size Unit of Measure field must be 0.
Medium Format Recognition	This field is only valid with a MODE SENSE command and is 01h, indicating that the tape drive supports automatic Format Recognition.	

4.9.9 TapeAlert Page (1Ch)

The TapeAlert Page specifies parameters that control the TapeAlert MODE SELECT configuration.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (1Ch)					
1	Page Length (0Ah)							
2	Perf	Reserved			DExcpt	Test	Rsv'd	LogErr
3	Reserved				MRIE			
4 - 7	Interval Timer							
8 - 11	Report Count / Test Flag Number							

Figure 4-38. TapeAlert Page — Data Format

Table 4-36. TapeAlert Page — Field Descriptions

Field Name	Description
Perf	Performance. This bit must be 0, which indicates that the tape drive may incur higher command overhead when processing some TapeAlert information exception conditions.
DExcpt	Disable Exceptions. This bit must be 1: The tape drive generates no TapeAlert exception conditions. This is polled mode for TapeAlert.
Test	TapeAlert Flag Test. This bit must be 0: The tape drive does not generate any false/test informational exception conditions. **Note:** The value returned in MODE SENSE is always 0.
LogErr	Log Errors. This bit must be 0, which indicates that the logging of informational exception conditions is specific. The tape drive reports the informational exception condition when processing of such information is convenient for the tape drive. Depending on resource availability within the tape drive, processing of informational exceptions may be delayed until more processing time and memory are available.
MRIE	Method of Reporting Informational Exception. This bit must be 03h. This field is ignored since the DExcpt bit is always 1, which is the polled mode for TapeAlert. The value in MODE SENSE is always 03h.
Interval Timer	This field is not supported and must be 0.
Report Count/Test Flag Number	This field is not supported and must be 0.

4.9.10 EEPROM Vendor Unique Page (3Eh)

The tape drive supports a Vendor Unique Page, which you can use to modify savable parameters. Only one savable parameter can be changed per MODE SELECT command. The page has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (3Eh)					
1	Additional Page Length							
2	ASCII String of Parameter Name and Value							

Figure 4-39. MODE SELECT EEPROM Vendor Unique Page — Data Format

The ASCII string has a parameter name, followed by one or more space characters, a parameter value, and an ASCII *line-feed* or *null* character. When the string is parsed, the parameter value is interpreted as indicated in the following table. The parameter name can be in uppercase or lowercase.

Table 4-37. MODE SELECT EEPROM Vendor Unique Page — Parameter Descriptions

Name	Value Rep	Default	Length (Bytes)	Usage
VendorID	ASCll	QUANTUM	8	Vendor ID in INQUIRY Data (see Table 4-4, “Standard Inquiry Data Page — Field Descriptions” on page 4-6)
ProductID	ASCll Decimal	VS80	16	Product ID in INQUIRY Data (see Table 4-4, “Standard Inquiry Data Page — Field Descriptions” on page 4-6)
CacheTMS	ASCll Decimal	0	1	0, 1 = Do not cache filemarks unless IMMED bit is 1. 2 = Cache if not two in a row unless IMMED bit is 1. 3 = Always cache filemarks.
DefaultCompON	ASCll Binary	1	1	When set to 0, defaults compression off upon power-up/reset. When set to 1, defaults compression to on upon powerup/ reset.
DefFixedBlkLen	ASCll Decimal	0	8	Sets the default fixed block size.
DefSEW	ASCll Binary	0	1	Sets the default SEW parameter.

Table 4-37. MODE SELECT EEPROM Vendor Unique Page — Parameter Descriptions

Name	Value Rep	Default	Length (Bytes)	Usage
DisDRAutoLDMC	ASCll Binary	1	1	When set, partially disables sequential loading with loader if any media loader command has been received.
DisUnbufMode	ASCll Binary	0	1	When set, the tape drive disables unbuffered mode; that is, the tape drive ignores the MODE SELECT “buffered mode” selection to turn off buffered mode.
EnaClngLTRPT	ASCll Binary	1	1	When set, reports error status (if cleaning indicator is on).
EnaInitSyncNeg	ASCll Binary	0	1	When set, enables target initiated synchronous negotiation.
EnaLdrAutold	ASCll Binary	1	1	When set, turns on/off sequential loading with loader.
EnaModePg22	ASCll Binary	0	1	When set, enables vendor unique data compression (Status Mode Page).
EnaParErRetry	ASCll Binary	0	1	When set, turns on/off parity error retry feature.
EnaRepDecomp	ASCll binary	0	1	If set and the tape drive is in Read mode, the decompression algorithm field in Data Compression Mode page will reset if the last block requested by the host was decompressed, otherwise it is cleared.
EnaThirdPtyDens	ASCll Binary	1	1	When set, makes non-DLT density code act as the default density (same as density code).
EnbInqMedChgr	ASCll Binary	0	1	When set to 0, disables media changer bit. When set to 1, enables media changer bit in byte 6 of INQUIRY data.
ForceComp	ASCll Binary	0	1	0=Automatic 1=Always compress
ForceDensity	ASCII Decimal	1	1	0=Automatic 1=DLT
ForceEERebuild	ASCll Binary	0	1	When set, forces all the EEPROM parameters reset to default.
ForceReadSILI	ASCll Binary	0	1	When set, handles variable READ command as if the SILI bit is set.

Table 4-37. MODE SELECT EEPROM Vendor Unique Page — Parameter Descriptions

Name	Value Rep	Default	Length (Bytes)	Usage
LdrCycleReset	ASCll Binary	0	1	When set, causes the first cartridge to be loaded if unloading the last cartridge when the loader product is operated in sequential mode.
LoaderLUN	ASCll Decimal	1	1	LUN to report media loader device on. Valid values are 1 - 7.
LongXportPage	ASCll Binary	1	1	When set, reports medium transport element status descriptor (6 bytes or 18 bytes) .
NoDeferRcvdErr	ASCll Binary	0	1	When set, the tape drive reports a deferred recovered error as current recovered error.
NoDisconFxdBlk	ASCll Binary	1	1	When set to 0, turn off feature of not to disconnect on every fixed block data transfer. When set to 1, turns on this feature.
NoRdyUAOnUnld	ASCll Binary	0	1	When set, removes Not Ready to Ready Unit Attention from the Unit Attention queue upon a successful unload.
PerfMode	ASCll Binary	1	1	When set to 0, the tape drive is tuned for capacity. When set to 1, the tape drive is tuned for performance.
ProtectDirOnWp	ASCll Binary	0	1	When set, protects tape directory if the cartridge write-protect switch is in write protect position.
RedundancyMode	ASCll Decimal	1	1	Sets the value of the allowed maximum marginal channel (0-3 allowed).
RepBusyInProg	ASCll Binary	0	1	When set to 1, reports BUSY status if the tape drive is in the process of becoming ready.
ReportRcvdPErrs	ASCll Binary	1	1	When set, reports recovered error if parity error has been retried successfully.
ReportRcvRdErr	ASCll Binary	0	1	Sets the default value of PER bit of Read / Write Error Recovery Mode page (01h).

Table 4-37. MODE SELECT EEPROM Vendor Unique Page — Parameter Descriptions

Name	Value Rep	Default	Length (Bytes)	Usage
RewindOnReset	ASCll Binary	1	1	When set to 0, the tape drive does not rewind on BUS RESET or BDR msg (Caution: May have partial block data written to the medium, if reset happens during writing), When set to 1, the tape drive rewinds the media to BOT upon reset.
SCSIBusDMATimer	ASCll Decimal	2	1	Sets the number of seconds the tape drive times out waiting for ACK once DMA transfer starts. When set to 0, the timer is set to infinite.
SCSIInqVS	ASCll Binary	0	1	When set, returns vendor unique INQUIRY string.
SCSIRdyEarly	ASCll Binary	0	1	When set, the tape drive reports READY status earlier.
SCSIReselRetries	ASCll Decimal	10	1	The number of reselection retries the tape drive makes before giving up. Each reselection retry occurs every 1 second. When set to 0, the tape drive performs infinite reselection retries.
SCSIResRelNOP	ASCll Binary	0	1	When set, SCSI RESERVE/RELEASE UNIT commands are NOP.

Figure 4-40 shows an example of an EEPROM vendor unique page that modifies the VendorID parameter to “XXXYY.”.

Bit Byte	7	6	5	4	3	2	1	0
0	0	0	Page Code (3Eh)					
1	Page Length (0Fh)							
2	“v” (76h)							
3	“e” (65h)							
4	“n” (6Eh)							
5	“d” (64h)							
6	“o” (6Fh)							
7	“r” (72h)							
8	“l” (69h)							
9	“d” (64h)							
10	“ ” (20h)							
11	“X” (58h)							
12	“X” (58h)							
13	“X” (58h)							
14	“Y” (59h)							
15	“Y” (59h)							
16	<LF> (0Ah) or (00h)							

Figure 4-40. EEPROM Vendor Unique Page — Example 1

Figure 4-41 shows an example of an EEPROM vendor unique page that modifies the Force Density parameter to 1.

Bit / Byte	7	6	5	4	3	2	1	0
0	0	0	Page Code (3Eh)					
1	Page Length (0Fh)							
2	“F” (53h)							
3	“O” (43h)							
4	“R” (72h)							
5	“C” (49h)							
6	“E” (52h)							
7	“D” (44h)							
8	“E” (59h)							
9	“N” (45h)							
10	“S” (41h)							
11	“I” (52h)							
12	“T” (4Ch)							
13	“Y” (59h)							
14	“ ” (20h)							
15	“1” (31h)							
16	<LF> (0Ah) or (00h)							

Figure 4-41. EEPROM Vendor Unique Page — Example 2

4.9.11 MODE SELECT Changeable Parameters

Table 4-38 lists the changeable mode parameters and their minimum and maximum allowed values. See the individual parameter descriptions for the units that are used. Parameter rounding is supported for all parameters except the Block Descriptor Length.

Table 4-38. Changeable Mode Parameters

Page: Parameter	Default	Minimum	Maximum
Header: Buffered Mode, Device Specific Byte	1	0	1
Block Descriptor Length	08h	00h	08h
Block Descriptor: Block Length	0	0	FFFFFFh
Read-Write Error Recovery (01h): PER Bit	0	0	1
Control Mode (0Ah): RLEC	0	0	1
Data Compression (0Fh): DCE	1	0	1
Disconnect-Reconnect (02H): Maximum Burst Size	0080h	0000h	FFFFh
Disconnect-Reconnect (02h): DTDC	0	0	3
Device Configuration (10h): Write Delay Time	C8h	Fh	1964h
Device Configuration (10h): SEW	1	0	1
Device Configuration (10h): Select Data Compression Algorithm	1	0	1

4.10 MODE SENSE (1Ah/5Ah)

The MODE SENSE command allows the tape drive to report its media and current or changeable configuration parameters to the host. It complements the MODE SELECT command.

The VS80 tape drive supports both the 6-byte and 10-byte MODE SENSE commands.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Logical Unit Number			Rsv'd	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

Figure 4-42. MODE SENSE (1Ah) 6-Byte Command Descriptor Block — Data Format

The VS80 tape drive requires the 10-byte MODE SENSE command to request the Vendor Unique EEPROM Parameter Page as a result of the large amount of data that the Vendor Unique EEPROM Parameter Page contains. MODE SENSE (10) can retrieve the other pages as well. Note that MODE SENSE (10) returns a different format of Descriptor data.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Ah)							
1	Logical Unit Number			Rsv'd	DBD	Reserved		
2	PC		Page Code					
3 - 6	Reserved							
7 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-43. MODE SENSE (5Ah) 10-Byte Command Descriptor Block — Data Format

Table 4-39. MODE SENSE (1Ah/5Ah) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
DBD	Disable Block Descriptors. If this bit is 0, the tape drive returns the Block Descriptor Data. If the Disable Block Descriptors bit is 1, the tape drive does not return Block Descriptor information.
PC	Page Control. This field indicates the type of page parameter values to be returned to the host as shown in the following table: **Code** — **Description** 00 — Report Current Values 01 — Report Changeable Values 10 — Report Default Values 11 — Report Saved Values The Additional Page Length field of each page the tape drive returns indicates the number of bytes supported for that page.
Page Code	Allows the host to select any specific page or all of the pages the tape drive supports.
Allocation Length	The Allocation Length field specifies the number of bytes that the host has allocated for returned MODE SENSE data. An Allocation Length of 0 means that the tape drive returns no MODE SENSE data. This is not considered an error and GOOD status is returned.

4.10.1 MODE SENSE Parameter List

The MODE SENSE (6) data contains a 4-byte header followed by one 8-byte block descriptor, which is in turn followed by zero or more variable length pages, depending on the Page Code and the Allocation Length.

Bit / Byte	7	6	5	4	3	2	1	0
0	Mode Sense Data Length							
1	Media Type							
2	WP	Buffered Mode			Speed (0)			
3	Block Descriptor Length (08h)							

Figure 4-44. MODE SENSE (6) Data Header — Data Format

The MODE SENSE (10) data contains an 8-byte header followed by one 8-byte block descriptor, followed by zero or more variable length pages.

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Mode Sense Data Length (LSB)							
2	Media Type							
3	WP	Buffered Mode			Speed (0)			
4 - 5	Reserved							
6 - 7	(MSB) Block Descriptor Length (8) (LSB)							

Figure 4-45. MODE SENSE (10) Data Header — Data Format

Table 4-40. MODE SENSE (6/10) Data Header— Field Descriptions

Field Name	Description
Mode Sense Data Length	This field specifies the length, in bytes, of the following MODE SENSE data that is available to be transferred during the DATA IN phase. Mode Sense Data Length does not include itself.
Media Type	The following list shows the media type as determined by the tape drive: **Type** — **Description** 00h — Unknown or media not present 81h — Cleaning Medium 85h — DLTtape IV
WP	Write-Protected. When set to 0, this bit indicates that the medium is write-enabled. When set to 1, this bit indicates that the medium is write-protected.
Buffered Mode	The tape drive implements Immediate Reporting on WRITE commands through Buffered Mode. When set to 0, the tape drive does not report a GOOD status on WRITE commands until the data blocks are actually written to medium. When set to 1, the tape drive reports GOOD status on WRITE commands as soon as the tape drive has transferred the data block to the buffer. This is the default configuration for the tape drive. If not using Buffered Mode, the tape drive suffers a degradation in performance, but not capacity.

Table 4-40. MODE SENSE (6/10) Data Header— Field Descriptions *(Continued)*

Field Name	Description
Speed	The tape drive supports only the default speed.
Block Descriptor Length	This field specifies the length, in bytes, of all the block descriptors. Since the tape drive only allows one block descriptor, this value must be 0 or 8.

Figure 4-46 shows the MODE SENSE (6/10) Block Descriptor.

Bit / Byte	7	6	5	4	3	2	1	0
0	Density Code							
1 - 3	(MSB) Number of Blocks (000000h) (LSB)							
4	Reserved							
5 - 7	(MSB) Block Length (LSB)							

Figure 4-46. MODE SENSE (6/10) Block Descriptor — Data Format

Table 4-41. MODE SENSE (6/10) Block Descriptor — Field Descriptions

Field Name	Description
Density Code	This field matches the current density of the media, or 0 if the density is unknown.

Density Code	Description
00h	Use default density
1Ah	DLT 4000 format, 20 GB (READ-ONLY)
40h	DLT1 format, DLTtape IV – 40 GB
82h	DLT 4000 format, 20 GB without compression (READ-ONLY)
83h	DLT 4000 format, 40 GB with compression (READ-ONLY)
86h	DLT1 format, DLTtape IV – 40 GB without compression
87h	DLT1 format, DLTtape IV – 80 GB with compression

Number of Blocks	This field is sent as 0, indicating that all of the remaining logical blocks on the medium have the medium characteristics specified by the block descriptor.
Block Length	This specifies the length, in bytes, of each logical block transferred over the SCSI bus. A block length of 0 indicates that the length is variable (as specified in the I/O command). Any other value indicates the number of bytes per block used for READ, WRITE, and VERIFY type commands that specify a “Fixed” bit of 1 (Fixed Block Mode).

4.10.2 MODE SENSE Pages

Following the block descriptor are the MODE SENSE pages, which set the tape drive parameters.

Table 4-42. Supported MODE SENSE Block Pages and Page Codes

Page Code	Description	Sense/Select
00h	No Requested Page	Sense
01h	Error Recovery Page	Both
02h	Disconnect/Reconnect	Both
0Ah	Control Mode Page	Both
0Fh	Data Compression Page	Both
10h	Device Configuration	Both
11h	Medium Partition	Both
1Ch	TapeAlert Page	Both
3Eh	EEPROM Vendor Unique	Both
3Fh	All Pages (Except EEPROM)	Sense

Each page has a 2-byte header that identifies the page code and indicates the number of bytes in that page.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code					
1	Additional Page Length							
2 - n	Page Defined or Vendor Unique Parameter Bytes							

Figure 4-47. MODE SENSE Page Descriptor — Data Format

Table 4-43. MODE SENSE Page — Field Descriptions

Field Name	Description
PS	Parameters Savable. A bit of 1 indicates that the tape drive can save the page in nonvolatile memory. If the PS bit is 0, the tape drive cannot save the supported parameters. (The tape drive does not support Savable pages.)
Additional Page Length	This field indicates the number of bytes in that page. However, the value does not include bytes 0 and 1. The tape drive returns the length on MODE SENSE and must subsequently set it to the same value when performing MODE SELECT.

4.10.3 Read/Write Error Recovery Page (01h)

The tape drive supports the Error Recovery Page, which has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code (01h)					
1	Additional Page Length (0Ah)							
2	Rsv'd	Rsv'd	TB	Rsv'd	ERR	PER	DTE	DCR
3	Read Retry Count							
4 - 7	Reserved							
8	Write Retry Count							
9 - 11	Reserved							

Figure 4-48. Read / Write Error Recovery Page — Data Format

Table 4-44. Read / Write Error Recovery Page — Field Descriptions

Field Name	Description
Page Code	The Page Code identifies the type of MODE SENSE page being transferred. The value returned for the Page Code is 0Ah (Control Mode Page).
Additional Page Length	The Additional Page Length indicates the number of bytes that follow this byte. The value returned for this byte is 0Ah.
TB	Transfer Block. This function (when not fully recovered) is not supported; this bit is always 0.

Table 4-44. Read / Write Error Recovery Page — Field Descriptions *(Continued)*

Field Name	Description
EER	Enable Early Recovery. Always enabled, this bit is always 1.
PER	Post Error. This bit turns on reporting of CHECK CONDITION to report recovered Read / Write errors. The default value of this bit is 0.
DTE	Disable Transfer on Error. Not supported, this bit is 0.
DCR	Disable ECC Correction. Not supported, this bit is 0.
Read Retry Count	This field reports the maximum number of times the tape drive tries to reread before declaring an unrecoverable error.
Write Retry Count	This field reports the maximum number of times the tape drive tries to overwrite before declaring an unrecoverable error.

4.10.4 Disconnect/Reconnect Page (02h)

The tape drive supports the Disconnect/Reconnect Page, which has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS (0)	0	Page Code (02h)					
1	Additional Page Length (0Eh)							
2	Buffer Full Ratio							
3	Buffer Empty Ratio							
4 - 5	(MSB) Bus Inactivity Limit (LSB)							
6 - 7	(MSB) Disconnect Time Limit (LSB)							
8 - 9	(MSB) Connect Time Limit (LSB)							
10 - 11	(MSB) Maximum Burst Size (LSB)							

Bit Byte	7	6	5	4	3	2	1	0
12	Reserved						DTDC	
13 - 15	Reserved							

Figure 4-49. Disconnect / Reconnect Page — Data Format

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Table 4-45. Disconnect / Reconnect Page — Field Descriptions

Field Name	Description	
Maximum Burst Size	This field specifies the maximum amount of data that can be transferred without disconnecting. A value of 0 sets no limit. This value is in multiples of 512 bytes. For example, a value of 8 means 4K bytes. Values that are not multiples of 8 are rounded up to the nearest multiple of 8.	
DTDC	Data Transfer Disconnect Control. This value specifies the restriction when disconnect is permitted.	
	Page Code	**Description**
	00b	Data transfer disconnect control is not used. Disconnect is controlled by the other fields in this page.
	01b	A Target does not attempt to disconnect once the data transfer of a command has started until all data the command is to transfer has been transferred.
	10b	Reserved.
	11b	A Target does not attempt to disconnect after the data transfer of a command has started until the command is complete.

4.10.5 Control Mode Page (0Ah)

The Control Mode Page allows the user to determine whether the tape drive returns CHECK CONDITION status when one of the write and read error counters has reached a specified threshold.

Bit / Byte	7	6	5	4	3	2	1	0
0	Rsv'd		Page Code (0Ah)					
1	Page Length							
2	Reserved							RLEC
3	Queue Algorithm Modifier				Reserved		QErr	DQue
4	EECA	Reserved				RAENP	UAAENP	EAENP
5	Reserved							
6 - 7	(MSB) Ready AEN Holdoff Period (LSB)							

Figure 4-50. Control Mode Page — Data Format

Table 4-46. Control Mode Page — Field Descriptions

Field Name	Description
Page Code	The Page Code identifies the type of MODE SENSE page being transferred. The value returned for the Page Code is 0Ah (Control Mode Page).
Page Length	The Page Length indicates the number of bytes in the Control Mode Page that follow this byte. The value returned for this byte is 06h.
RLEC	Report Log Exception Condition. The RLEC bit indicates whether the tape drive should return CHECK CONDITION status with the Sense Key set to Unit Attention (06h) when one of its write and 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.
Queue Algorithm Modifier	The value returned for this field is 0.

Table 4-46. Control Mode Page — Field Descriptions *(Continued)*

Field Name	Description
QErr	Queue Error. The value returned for this field is 0.
DQue	Disable Queuing. The value returned for this field is 0.
EECA	Enable Extended Contingent Allegiance. The value returned for this field is 0.
RAENP	Ready AEN Permission. The value returned for this field is 0.
UAAENP	Unit Attention AEN Permission. The value returned for this field is 0.
EAENP	Enable AEN Permission. The value returned for this field is 0.
Ready AEN Holdoff Period	The value returned for this field is 0.

4.10.6 Data Compression Page (0Fh)

The Data Compression Page specifies parameters that control the data compression feature.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	Rsv'd	Page Code					
1	Page Length (0Fh)							
2	DCE	DCC	Reserved					
3	DDE	RED		Reserved				
4 - 7	(MSB) Compression Algorithm (LSB)							
8 - 11	(MSB) Decompression Algorithm (LSB)							
12 - 15	Reserved							

Figure 4-51. Data Compression Page — Data Format

Table 4-47. Data Compression Page — Field Descriptions

Field Name	Description
PS	Parameters Savable. The value returned for this bit is 0.
Page Code	The Page Code identifies the type of MODE SENSE data being transferred. The value returned for this field is 0Fh (Data Compression Page).
Page Length	The Page Length indicates the number of Data Compression Page bytes that follow this byte. The value returned for this byte is 0Eh.
DCE	Data Compression Enable. The DCE bit indicates whether data compression is enabled. The value returned for this bit depends on the current write density of the tape drive as follows: 0 Data compression is disabled. 1 Data compression is enabled.
DCC	Data Compression Capable. The DCC bit indicates whether the tape drive supports data compression as follows: 0 The tape drive does not support data compression. 1 The tape drive supports data compression and processes any data the initiator sends to it according to the setting of the DCE bit. The tape drive supports data compression in its native mode. The value returned for this bit is 1.
DDE	Data Decompression Enable. The DDE bit indicates whether data decompression is enabled or disabled as follows: 0 Data decompression is disabled. 1 Data decompression is enabled. When the tape drive reads compressed data from tape, it automatically decompresses the data before sending it to the initiator. The value returned for this bit is always 1 (data decompression enabled).
RED	Report Exception on Decompression. The tape drive does not report exceptions on decompression (boundaries between compressed and uncompressed data). The value returned for the RED field is 00h.
Compression Algorithm	The value returned for the Compression Algorithm field is 10h. This indicates Lempel-Ziv (DLZ) high efficiency data compression algorithm.
Decompression Algorithm	The value returned for the Decompression Algorithm field is 10h. This indicates Lempel-Ziv (DLZ) high efficiency data decompression algorithm. If EEPROM parameter EnaRepDecomp is set, a 0 value is reported if the last block read is not decompressed.

4.10.7 Device Configuration Page (10h)

The tape drive supports the Device Configuration Page, which has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (10h)					
1	Additional Page Length (0Eh)							
2	Rsv'd	CAP	CAF	Active Format				
3	Active Partition							
4	Write Buffer Full Ratio							
5	Read Buffer Empty Ratio							
6 - 7	(MSB) Write Delay Time (LSB)							
8	DBR	BIS	RSMK	AVC	SOCF		RBO	REW
9	Gap Size							
10	EOD Defined			EEG	SEW	Reserved		
11 - 13	(MSB) Buffer Size at Early Warning (Optional) (LSB)							
14	Select Data Compression Algorithm							
15	Reserved							

Figure 4-52. Device Configuration Page — Data Format

Table 4-48. Device Configuration Page — Field Descriptions

Field Name	Description
PS	Parameters Savable. The value returned for this bit is 0.
Page Code	The Page Code identifies the type of MODE SENSE page being transferred. The value returned for the Page Code is 10h (Device Configuration Page).
Additional Page Length	The Additional Page Length indicates the number of bytes that follow this byte. The value returned for this byte is 0Eh.

Table 4-48. Device Configuration Page — Field Descriptions *(Continued)*

Field Name	Description
CAP, CAF, Active Format	These fields are not supported and are 0.
Active Partition	Only partition 0 is supported.
Write Buffer Full Ratio and Read Buffer Empty Ratio	The tape drive sets these fields to 0 (unused). The tape drive uses an automatic, adaptive mechanism to adjust its full/empty ratios dynamically according to the average data rates over the SCSI bus.
Write Delay Time	This field indicates the maximum time that the tape drive waits with a partially full buffer before forcing the data to medium (in 100 ms increments). Note that the buffer full/empty ratio, which is dynamic, can cause data to be written sooner than the Write Delay time would indicate. The Write Delay Time defaults to 200 (C8h), causing the buffer to be flushed in 20 seconds. The maximum value is 6500 (1964h), while the minimum is 15 (0Fh) representing delays from almost 11 minutes down to 1.5 seconds.
DBR	Data Buffer Recovery. Set to 0 (Data buffer recovery not supported)
BIS	Block Identifiers Supported. Set to 1 (Block Identifiers Supported in media format).
RSmk	Report Setmark. Set to 0 (Setmarks are not supported).
AVC	Automatic Velocity Control. Set to 0.
SOCF	Stop on Consecutive Filemarks. Set to 0.
RBO	Recover Buffer Order. Set to 0.
REW	Report Early Warning. Set to 0 (Do not report Early Warning EOM on reads).
Gap Size	This field is not used and is always 0.
EOD Defined	End of Data. This field is 0.
EEG	Enable EOD Generation. When set, the Enable EOD Generation bit indicates that the tape drive generates an EOD. The tape drive generates an EOD mark before any change of direction following a write type operation.
SEW	Synchronize at Early Warning. The Synchronize at Early Warning bit is 1.
Buffer Size at Early Warning	Buffer Size at EW fields are not supported and are 0.
Select Data Compression Algorithm	A setting of 1 enables data compression, 0 disables it.

4.10.8 Medium Partition Page (11h)

The tape drive supports the Medium Partition Page, which has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (11h)					
1	Additional Page Length (06h)							
2	Maximum Additional Partitions							
3	Additional Partitions Defined							
4	FDP	SDP	IDP	PSUM	Reserved			
5	Medium Format Recognition (01)							
6 - 7	Reserved							

Figure 4-53. Medium Partition Page — Data Format

Table 4-49. Medium Partition Page — Field Descriptions

Field Name	Description
Maximum Additional Partitions	The tape drive does not support additional partitions. This field is 0.
Additional Partitions Defined	The field specifies the number of additional partitions to be defined for the tape based on the settings of the SDP and IDP bits. The maximum allowed is the value returned in the Maximum Additional Partitions field. Since only one partition is supported, this field is 0.
FDP	Fixed Data Partitions. This field is always 0.
SDP	Select Data Partitions. This field is always 0.
IDP	Initiator Defined Partitions. This field is always 0.
PSUM	Partition Size Unit of Measure. This field is always 0.
Medium Format Recognition	This field is 01h, indicating that Automatic Format Recognition is supported.

4.10.9 TapeAlert Page (1Ch)

The TapeAlert Page specifies parameters that control the TapeAlert mode select configuration.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (1Ch)					
1	Page Length (0Ah)							
2	Perf	Reserved			DExcpt	Test	Rsv'd	LogErr
3	Reserved				MRIE			
4 - 7	Interval Timer							
8 - 11	Report Count / Text Flag Number							

Figure 4-54. TapeAlert Page — Data Format

Table 4-50. TapeAlert Page — Field Descriptions

Field Name	Description
PS	Parameters Savable. Saving parameters is not supported and is 0.
Perf	Performance. This field always returns 0. 0– Indicates that the tape drive may incur higher command overhead when processing some TapeAlert information exception conditions.
DExcpt	Disable Exception Operations. Disable Exceptions bit returns 1 which indicates no TapeAlert exception conditions are generated. This is polled mode for TapeAlert.
Test	TapeAlert Flag Test. This field always returns 0, even though the MODE SELECT command can change it.
LogErr	Log Errors. This bit always returns 0, which indicates that the logging of informational exception conditions is specific. The tape drive reports the informational exception condition when processing of such information is convenient for the tape drive. Depending on resource availability within the tape drive, processing of informational exceptions may be delayed until more processing time and memory are available.
MRIE	Method of Reporting Informational Exception. This field is ignored in MODE SELECT since the DExcpt bit is always 1. This is the polled mode for TapeAlert. The value in MODE SENSE is always 03h.
Interval Timer	Not supported, this field always returns 0.

Table 4-50. TapeAlert Page — Field Descriptions *(Continued)*

Field Name	Description
Report Count/Test Flag Number	This field always returns 0.

4.10.10 EEPROM Vendor Unique Page (3Eh)

The tape drive supports the EEPROM vendor unique page (3Eh), and returns all EEPROM parameters that can be set through MODE SELECT EEPROM Vendor Unique Page.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (3Eh)					
1	Additional Page Length							
2	ASCII String of Parameter Name and Value							

Figure 4-55. MODE SENSE EEPROM Vendor Unique Page — Data Format

NOTE: As a result of the long list of parameters, use MODE SENSE (10) instead of MODE SENSE (6) to retrieve EEPROM parameters.

Because of the length of the EEPROM parameter, you must use a 10-byte MODE SENSE command to retrieve the parameters. If you use a 6-byte MODE SENSE command to retrieve the EEPROM parameter page, the tape drive returns this message:

“Send a 10-byte MODE SENSE command to get the Parameter List.”

The data returned by the 10-byte MODE SENSE command for the EEPROM page is in the form of a MODE SENSE (10) data header followed by block and page descriptors.

The data in the page descriptor is organized in the form of a parameter header followed by the actual parameter value. The parameter header is as follows:

```
EeromRevMajor
Cur:   0x01   Def: 0x01   Min: 0x00 Max: 0xFF <CR> <LF>
```

Name refers to the parameter name, for example, ProductID or DefaultCompOn.

'T' designates data type: 'b' specifies binary type, 'A' specifies string type, decimal data type if no value is specified.

4.11 PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

This command enables or disables the unloading of the data cartridge.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Eh)							
1	Logical Unit Number			Reserved				
2 - 3	Reserved							
4	Reserved							Prevent
5	Unused		Reserved				Flag	Link

Figure 4-56. PREVENT/ALLOW MEDIUM REMOVAL (1Eh) Command Descriptor Block — Data Format

Table 4-51. PREVENT/ALLOW MEDIUM REMOVAL (1Eh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Prevent	When this bit is 1, the Unload button on the tape drive's front panel is effectively disabled and the UNLOAD command does not unload the media or the data cartridge. The PREVENT/ALLOW status in the tape drive is maintained separately for each initiator. When the Prevent bit is 0, the Prevent state corresponding to that initiator is cleared. When all initiators have cleared their Prevent state, the Unload button and UNLOAD commands are enabled. By default, after power up, a hard reset, or a BUS DEVICE RESET message, the Prevent Medium Removal function is cleared. If a Media Loader is present, the MOVE MEDIUM command is not allowed to remove a cartridge if PREVENT has been selected. For more details, refer to Section 5.3, "MOVE MEDIUM (A5h)" on page 5-4

4.12 READ (08h)

The READ command transfers one or more data blocks to the initiator starting with the next block on the tape drive.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (08h)							
1	Logical Unit Number			Reserved			SILI	Fixed
2 - 4	(MSB) Transfer Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-57. READ (08h) Command Descriptor Block — Data Format

Table 4-52. READ (08h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
SILI	Suppress Incorrect Length Indicator. If the SILI bit is 1 and the fixed bit is 1, the target terminates the command with CHECK CONDITION status and the Sense Key set to ILLEGAL REQUEST with an Additional Sense Code of INVALID FIELD in CDB. If the SILI bit is not set and the actual block length is different from the specified transfer length, the tape drive returns a CHECK CONDITION status. Within the Sense data, the Incorrect Length Indicator (ILI) bit and Valid bit are 1. The Sense Key field is NO SENSE. The Information Bytes are set to the difference (residue) between the requested transfer length and the actual block length, or in Fixed Blocked Mode, the difference (residue) between the requested number of blocks and the actual number of blocks read. No more than Transfer Length bytes are transferred to the initiator and the medium is logically positioned after the block (EOM side).

Table 4-52. READ (08h) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
Fixed	This bit specifies the meaning of the Transfer Length field and whether fixed-length or variable-length blocks are to be transferred. When the Fixed bit is 0, the host is requesting a Variable Block mode. The tape drive transfers a single block with the Transfer Length specifying the maximum number of bytes the initiator has allocated for the returned data. When the Fixed bit is 1, the Transfer Length specifies the number of blocks to be transferred to the initiator. This is valid only if the logical unit is currently operating in Fixed Block mode. When the Transfer Length is 0, the tape drive transfers no data and does not change the current position on the logical unit. A successful READ with the Fixed bit set to 1 transfers (current block length) × (Transfer Length) bytes of data to the host. Upon termination of READ, the media is logically positioned after the last block transferred (EOM side).

4.12.1 Filemark and End-of-Data Handling

If the tape drive reads a Filemark, it returns a CHECK CONDITION status. Within the Sense data, the Filemark and Valid bits are set and the Sense Key field is NO SENSE. The information fields contain the residue count. The Additional Sense Code and Additional Sense Code Qualifier fields are set to Filemark Detected. Upon termination, the drive logically positions the media after the Filemark (EOM side).

If the tape drive detects EOD during the READ, the tape drive returns a CHECK CONDITION status. Within the Sense data, the Valid bit is set and the Sense Key field is BLANK CHECK. The EOM bit may be set if the tape drive determines that the medium is positioned past the PSEN marker. The information fields contain the residue count. The Additional Sense Code and Additional Sense Code Qualifier fields are set. Upon termination, the media is physically positioned before EOD and after the last block on medium.

4.12.2 End-of-Medium/Partition Handling

The meaning of EOM is different for a read than for a write type of command. EOM is only reported when the physical EOM/P is encountered. The tape drive returns a CHECK CONDITION status. The EOM and Valid bits are set and the Sense Key is MEDIUM ERROR. The information fields contain the residue count and the Additional Sense Code and Additional Sense Code Qualifier fields are EOM/P Detected. The medium is physically positioned at EOM/P.

If any READ command cannot be completed successfully, the tape drive returns a CHECK CONDITION status. Further commands should attempt to move past the error and complete successfully.

4.13 READ BLOCK LIMITS (05h)

The READ BLOCK LIMITS command tells the tape drive to return its limits for block length. The tape drive sends this information during the DATA IN phase of the command. The command does not reflect the currently selected block size, only the available limits; MODE SENSE returns the current block size.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (05h)							
1	Logical Unit Number			Reserved				
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-58. READ BLOCK LIMITS (05h) Command Descriptor Block — Data Format

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved			Granularity				
1 - 3	(MSB) Maximum Block Length (LSB)							
4 - 5	(MSB) Minimum Block Length (LSB)							

Figure 4-59. READ BLOCK LIMITS (05h) — Data Format

Table 4-53. READ BLOCK LIMITS (05h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Granularity	This field indicates the reported block size granularity. The tape drive supports a granularity of 1.
Maximum Block Length	This field indicates the maximum block size. The tape drive supports a maximum block length of 16,777,214 bytes (16MB – 2 Bytes).
Minimum Block Size	This field indicates the minimum block size. The tape drive supports a minimum block length of 2 bytes.

4.14 READ BUFFER (3Ch)

The READ BUFFER command, used in conjunction with WRITE BUFFER, serves as a diagnostic function for testing the tape drive's data buffer and the SCSI bus integrity.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (3Ch)							
1	Logical Unit Number			Reserved		Mode		
2	Buffer ID							
3 - 5	(MSB) Buffer Offset (LSB)							
6 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-60. READ BUFFER (3Ch) Command Descriptor Block — Data Format

Table 4-54. READ BUFFER (3Ch) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Mode	The tape drive supports the following values within the field. If any unsupported value is set, the tape drive terminates the command with a CHECK CONDITION status and an ILLEGAL REQUEST Sense Key set. **Mode** — **Description** 000b — Combined Header and Data 010b — Data 011b — Descriptor
Buffer ID	The tape drive supports only a single Buffer ID field of 0. If this field is nonzero, the tape drive returns a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key set.
Offset	The tape drive does not support offsetting of data. If this field is nonzero, the tape drive returns a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key set.
Allocation Length	This field specifies the maximum number of bytes that the initiator has allocated for returned data.

4.14.1 Combined Header and Data Mode

In this mode, the tape drive returns a 4-byte header followed by the data bytes. The tape drive terminates the DATA IN phase when it has transferred Allocation Length bytes of header and data or when it has transferred all available data to the initiator, whichever is less. Data bytes from the target data buffer follow the 4-byte READ BUFFER header. The header has the following format:

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1 - 3	(MSB) Available Length (LSB)							

Figure 4-61. READ BUFFER Header for Combined Header and Data Mode — Data Format

Available Length

The Available Length field specifies the total number of data bytes available in the target's buffer. This number is not reduced to reflect the allocation length, nor is it reduced to reflect the actual number of bytes written using the WRITE BUFFER command. Following the READ BUFFER header, the target transfers data from its data buffer.

4.14.2 Data Mode

In this mode, the DATA IN phase only contains buffer data.

4.14.3 Descriptor Mode

In this mode, the tape drive returns a maximum of 4 bytes of READ BUFFER descriptor information. The tape drive returns the descriptor information for the buffer specified by the Buffer ID. The tape drive does not reject the valid Buffer IDs with a CHECK CONDITION status, but returns all zeros in the READ BUFFER descriptor.

The Offset Boundary is 12 (0Ch), indicating buffer offsets should be integral multiples of 4K.

Bit Byte	7	6	5	4	3	2	1	0
0	Offset Boundary (02h)							
1 - 3	(MSB) Buffer Capacity (LSB)							

Figure 4-62. READ BUFFER Descriptor — Data Format

4.15 READ POSITION (34h)

The READ POSITION command reads a position identifier or SCSI Logical Block Address. The LOCATE command uses this identifier to position the medium to this same logical position in a high-performance fashion.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (34h)							
1	Logical Unit Number			Reserved				BT
2 - 8	Reserved							
9	Unused		Reserved				Flag	Link

Figure 4-63. READ POSITION (34h) Command Descriptor Block — Data Format

Table 4-55. READ POSITION (34h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
BT	Block Type. This bit indicates how the position is interpreted. Since the tape drive uses the same logical block address whether this bit is set or not, it ignores setting BT. The logical block address values include all recorded objects: blocks and filemarks.

NOTE: The tape drive returns CHECK CONDITION with the UNIT NOT READY Sense Key with the READ POSITION command if the media is not ready to be accessed.

4.15.1 READ POSITION Data Short Format

Bit / Byte	7	6	5	4	3	2	1	0
0	BOP	EOP	Reserved			BPU	Reserved	
1	Partition Number							
2 - 3	Reserved							
4 - 7	(MSB) First Block Location (LSB)							
8 - 11	(MSB) Last Block Location (LSB)							
12	Reserved							
13 - 15	(MSB) Number of Blocks in Buffer (LSB)							
16 - 19	(MSB) Number of Bytes in Buffer (LSB)							

Figure 4-64. READ POSITION (Short Format) — Data Format

Table 4-56. READ POSITION (Short Format) — Field Descriptions

Field Name	Description
BOP	Beginning of Partition. The BOP bit is set as appropriate.
EOP	End of Partition. The EOP bit is set as appropriate.
BPU	Block Position Unknown. The Block Position Unknown (BPU) bit is never set since setting the BT bit in the READ POSITION CDB does not affect the block address values returned.

Table 4-56. READ POSITION (Short Format) — Field Descriptions *(Continued)*

Field Name	Description
First Block Location	The block address associated with the current logical position; the next block to be transferred between the target and initiator if a READ or WRITE command is issued.
Last Block Location	The block address associated with the current physical position; the next block to be transferred to the media and from the target's buffer. If the buffer is empty, or has only a partial block, the tape drive reports the same value as First Block Location. The first block or filemark written onto the media is at address 0.
Number of Blocks in Buffer	The number of data blocks in the target's buffer.
Number of Bytes in Buffer	The number of data bytes in the buffer that have not been written to the medium.

4.16 RECEIVE DIAGNOSTICS RESULTS (1Ch)

The RECEIVE DIAGNOSTIC RESULTS command tells the tape drive to send analysis data to the initiator after completing a SEND DIAGNOSTIC command. The tape drive returns the following data as a result of this command. A REQUEST SENSE command should be issued to obtain more detailed information following a CHECK CONDITION on a SEND DIAGNOSTIC command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ch)							
1	Logical Unit Number			Reserved				
2	Reserved							
3 - 4	(MSB) Allocation Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-65. RECEIVE DIAGNOSTICS RESULTS (1Ch) Command Descriptor Block — Data Format

4.16.1 RECEIVE DIAGNOSTIC RESULTS Data

This information indicates which of the main components of the subsystem failed testing.

Bit / Byte	7	6	5	4	3	2	1	0
0	Controller Present Flag							
1	Controller Error Flag							
2	Drive Present Flag							
3	Drive Error Flag							
4	Media Loader Present Flag							
5	Media Loader Error Flag							

Figure 4-66. RECEIVE DIAGNOSTICS RESULTS (1Ch) — Data Format

4.17 RELEASE UNIT (17h)

The RELEASE UNIT command releases the tape drive if it is currently reserved by the requesting initiator. It is not an error to attempt to release the tape drive if it is not currently reserved by the requesting initiator. However, if reserved by another initiator, the tape drive is not released.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	Logical Unit Number			3rd Pty	Third Party Device ID			Rsv'd
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-67. RELEASE UNIT (17h) Command Descriptor Block — Data Format

Table 4-57. RELEASE UNIT (17h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
3rdPty	The third-party release option for RELEASE UNIT allows an initiator to release a logical unit that was previously reserved using the third-party reservation option. If the third-party (3rdPty) bit is 0, the third-party release option is not requested. If the 3rdPty bit is 1, the tape drive is released if it was originally reserved by the same initiator using the third-party reservation option and if the tape drive is the same SCSI device that was specified in the Third-party Device ID field.
Medium Changer Considerations	The optional Element Reservation feature defined for Medium Changer devices in SCSI-2 is not supported. The RELEASE command is defined the same as for the tape drive. The entire loader can be released. RESERVE/RELEASE of the Loader and Drive LUNs are handled independently.

4.18 REQUEST SENSE (03h)

The REQUEST SENSE command tells the target to transfer sense data to the initiator.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (03h)							
1	Logical Unit Number			Reserved				
2 - 3	Reserved							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

Figure 4-68. REQUEST SENSE (03h) Command Descriptor Block — Data Format

The Sense Data is valid for a CHECK CONDITION or RESERVATION CONFLICT status returned on the previous command. The target preserves the Sense Data bytes until they are retrieved by the REQUEST SENSE command or until receipt of any other command from the same initiator.

If the tape drive receives an unsolicited REQUEST SENSE, it returns Sense Data with the appropriate values in the EOM, Sense Key, Additional Sense Code, and Additional Sense Code Qualifier. The positional information provided reflects the logical position of the tape drive. The tape drive returns

information based on the (non-diagnostic) data in its buffer as well as the data on medium. Additionally, bytes 25 through 28 will contain the amount of medium to be written in 4 KB blocks.

REQUEST SENSE does not cause the tape drive to flush its buffered data to medium. Therefore, if the host requires the exact physical positioning of the media, it should precede the REQUEST SENSE with a WRITE FILEMARKS command with length 0 (Immed =0), which forces the tape drive to flush any currently buffered data to medium. A subsequent REQUEST SENSE returns to the initiator the actual physical (and logical) position of the tape drive.

Table 4-58. REQUEST SENSE Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Allocation Length	The Allocation Length specifies the maximum number of sense bytes to be returned. The tape drive terminates the transfer when it has transferred Allocation Length bytes or when it has transferred all available Sense Data to the host, whichever is less.

4.18.1 Sense Information Format

Bit / Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code						
1	Segment Number							
2	Filemark	EOM	ILI	Rsv'd	Sense Key			
3 - 6	(MSB) Information Bytes (LSB)							
7	Additional Sense Length							
8 - 11	(MSB) Command Specific Information Bytes (LSB)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Sub-Assembly Code							
15	SKSV	C/D	Reserved		BPV	Bit Counter		
16 - 17	(MSB) Field Pointer (LSB)							
18	Internal Status Code (VU)							
19 - 20	(MSB) Tape Motion Hours (LSB)							
21 - 24	(MSB) Power On Hours (LSB)							
25 - 28	(MSB) Tape Remaining (LSB)							
29	Reserved							

Figure 4-69. REQUEST SENSE — Data Format

Table 4-59. REQUEST SENSE Data — Field Descriptions

Field Name	Description
Valid	When set to 1, this field indicates that the information bytes contain valid information as defined in the SCSI specification.
Error Code	A value of 70h indicates a current error; the report is associated with the most recently received command. A value of 71h indicates a deferred error; the report is associated with a previous command and is not a result of the current command. No other values are returned.
Segment Number	This field is always 0.
Filemark	This bit indicates that the current command has read a Filemark.
EOM	End of Medium. This bit indicates that an End of Medium condition (End of Partition or Beginning of Partition) exists. The warning is also given by setting the Sense Key to NO SENSE and the Additional Sense Code Qualifier to END OF PARTITION or BEGINNING OF PARTITION. For WRITE operations, the tape drive returns a CHECK CONDITION on any operation which occurs after detection of the Early Warning EOP marker. The EOM and Additional Sense Code fields are set. For READ operations, the tape drive does not return a CHECK CONDITION until the tape drive encounters the physical EOM.
ILI	Incorrect Length Indicator. This bit indicates that the requested logical block length did not match the logical block length of the data on the medium. Only Read or Verify can set this bit.
Sense Key	In most cases, Additional Sense Code and/or Qualifier information is available. See Table 4-66 on page 4-114.
Information Bytes	These bytes contain the differences (residue) of the requested length minus the actual length in bytes, blocks, or Filemarks, as determined by the command. Negative values are indicated by two's complement notation.
Additional Sense Length	Specifies the number of additional sense bytes to follow. If the Allocation Length of the CDB is too small to transfer all of the additional sense bytes, the Additional Sense Length is not adjusted to reflect the truncation.
Command Specific Information Bytes	Command Specific Information Bytes are handled as device specific and can be logged by the operating system on error conditions. On media errors, these bytes usually contain the current SCSI Logical Block Address.
Additional Sense Code (ASC) and ASC Qualifier (ASCQ)	These two bytes provide additional information about the Sense Key and the cause of the CHECK CONDITION status. See Table 4-67 on page 4-114.
Sub-Assembly Code	Unsupported, always returns 0.

Table 4-59. REQUEST SENSE Data — Field Descriptions *(Continued)*

Field Name	Description
SKSV	Sense-Key Specific Valid. When set to1, this bit indicates that the Sense Key specific fields are valid. The Sense Key specific fields are bytes 15, 16, and 17 of the Request Sense data.
C/D	When set to1, this bit indicates that the illegal parameter is in the CDB. When set to 0, this bit indicates that the illegal parameter is in the Parameter List from the initiator.
BPV	Bit Pointer Valid. When set to1, this bit indicates that the Bit Pointer field is valid and designates which bit of the byte designated by the field pointer is in error. For a multi-bit field, it points to the most significant bit of the field.
Field Pointer	Indicates which byte of the CDB or Parameter List was in error. For a multi-byte field, the most significant byte is indicated.
Internal Status Code	The Internal Status Code is located at byte offset 18 of the request sense data and may be available after certain types of failures.
Tape Motion Hours	Report the number of medium motion hours, that is, the head wear hours. Format is represented in a hexadecimal word (2 bytes).
Power On Hours	Report the total hours the tape drive power has been on. Format is represented in a hexadecimal longword (4 bytes).
Tape Remaining	Report the amount of medium remaining in 8 Kb (8192 bytes) blocks.

4.18.2 Sense Keys

Table 4-60 describes the Sense Keys that accompany SENSE REQUEST data.

Table 4-60. Supported Sense Keys That Accompany REQUEST SENSE Data

Sense Key	Description
00h	No Sense. Check the Filemark/EOM/ILI bits and the ASC/Q bytes
01h	Recovered Error. Reports rounding of Mode Parameters on a MODE SELECT, or R/W error rates reaching subsystem specification limits for optimal operation. However, the tape drive may still be able to continue to function without any unrecovered errors for a long time.
02h	Not Ready. The medium is not ready for tape drive operation commands. Media might not be present in the tape drive, or may be in process of loading or calibrating.
03h	Medium Error. An unrecoverable write, read, or positioning error occurred. Detailed tape drive-specific information may be available.
04h	Hardware Error. The Additional Sense Code/Qualifier fields may provide more specific information.

Table 4-60. Supported Sense Keys That Accompany REQUEST SENSE Data *(Continued)*

Sense Key	Description
05h	Illegal Request. The CDB or supplied parameter data had an unsupported or illegal operation specified.
06h	Unit Attention. Unit Attentions are created after a tape drive reset, if the media asynchronously becomes ready to this initiator, if another initiator changes Mode Parameters, and if the firmware is updated.
07h	Data Protected. The current media is write-protected. Results from the Write Protect switch on the cartridge, or if the media is not DLTtape III, DLTtape IIIxt. or DLTtape IV.
08h	Blank Check. An EOD or LongGap has been encountered.
09h	Vendor Unique. Code update event occurred.
0Ah	Error Log.
0Bh	Command Aborted. Generated when the tape drive aborts a command. Check the Asc/Q bytes
0Dh	Volume Overflow. Physical end of media has been reached during writing. The initiator ignored the EOM condition and continued writing.
0Eh	Miscompare. A compare error occurred during reading by the self tests invoked during execution of SEND DIAGNOSTIC.

Table 4-61 describes Sense Keys (SK), Additional Sense Codes (ASC), and Additional Sense Code Qualifiers (ASCQ) that the tape drive reports in response to a REQUEST SENSE command.

Table 4-61. Supported SK, ASC, and ASCQ (Hex) in Response to the REQUEST SENSE Command

SK	ASC	ASCQ	Description
00h - NO SENSE	00	00	No Additional Sense Code
	00	01	Unexpected FM Encountered
	00	02	End of Medium (EOM) Encountered
	00	03	SetMark Encountered
	00	04	Beginning of Medium (BOM) Encountered
	00	05	EOD Encountered
	5D	00	TapeAlert Failure Prediction Threshold Exceeded
	5D	FF	False Exception Condition

Table 4-61. Supported SK, ASC, and ASCQ (Hex) in Response to the REQUEST SENSE Command *(Continued)*

SK	ASC	ASCQ	Description
01h RECOVERED ERROR	00	17	Clean Requested (Non-Vendor Unique)
	0A	00	Error Log Overflow
	0A	80	Error Log Generated
	37	00	Rounded Parameter
	3B	08	Repositioning Error
	44	C1	EEPROM Copy 1 Area Bad
	44	C2	EEPROM Copy 2 Area Bad
	47	00	SCSI Parity Error
	48	00	IDE Message Received
	51	00	ERASE Failure
	53	01	Unload Medium Failure
	5B	02	Log Counter at Maximum
	80	02	Cleaning Requested (use cleaning tape)
	80	03	Soft Error Exceeds Threshold
02h NOT READY	04	00	Unit Not Ready, Cause Nonreportable
	04	01	Unit Not Ready, Calibration in Process
	04	02	Unit Not Ready, LOAD Command Needed
	04	03	Unit Not Ready, Manual Intervention Needed
	30	02	Incompatible Format
	30	03	Unit Not Ready, Incompatible Media (Cleaning Cartridge) Installed
	3A	00	Media Not Present
	3A	80	Media Not Present, VU Cartridge Missing
	5A	01	Operator Media Removal Request

Table 4-61. Supported SK, ASC, and ASCQ (Hex) in Response to the REQUEST SENSE Command *(Continued)*

SK	ASC	ASCQ	Description
03h MEDIUM ERROR	00	00	Medium Error
	04	02	Unit Not Ready, LOAD Command Needed
	0C	00	WRITE Error (possible medium problem, cleaning medium needed)
	11	00	Unrecovered Read Error
	11	08	Unrecovered READ Error, Incomplete Block Read
	14	00	Recorded Entity Not Found (logical DLT block not found)
	15	02	Position Error Detected by Read of Medium
	30	00	Incompatible Medium Installed
	30	01	Unknown Format
	3B	00	Sequential Positioning Error
	3B	08	Repositioning Error
	51	00	ERASE Failure
	80	00	Calibration Error (use cleaning cartridge)
	80	01	Cleaning Required (use cleaning cartridge)
	81	00	Directory Read Error (use cleaning cartridge)
04h HARDWARE ERROR	08	00	LUN Communication Failure
	08	01	LUN Communication Timeout Failure
	0C	80	Write SCSI FIFO CRC Error
	11	80	Read SCSI FIFO CRC Error
	11	81	Block Port Detected EDC Error
	11	82	Block Port Detected Record CRC Error
	15	01	Random Mechanical Positioning Error
	21	01	Invalid Element Address
	3B	08	Repositioning Error
	3B	0D	Media Destination Element Full[a]

Table 4-61. Supported SK, ASC, and ASCQ (Hex) in Response to the REQUEST SENSE Command *(Continued)*

SK	ASC	ASCQ	Description
04h HARDWARE ERROR (continued)	3B	0E	Media Source Element Empty[a]
	40	80	Diagnostic/POST Failure, ROM EDC Error[b]
	40	81	Diagnostic/POST Failure, RAM Failure[b]
	40	82	Diagnostic/POST Failure, Bad Drive Status[b]
	40	83	Diagnostic/POST Failure, Loader Diagnostics Failure[b]
	40	84	Diagnostic/POST Failure, POST Soft Failure[b]
	44	00	Internal Target Failure
	44	83	SCSI Chip Gross Error/ Illegal – Command Status
	44	84	Unexpected/Unexplained Residue Count in Transfer Register
	44	85	Immediate Data Transfer Timeout
	44	86	Insufficient CDB Bytes
	44	87	Disconnect/SDP Sequence Failed
	44	88	Bus DMA Transfer Timeout
	44	8A	Over Temperature Condition
	44	C1	EEPROM Copy 1 Area Bad
	44	C2	EEPROM Copy 2 Area Bad
	44	C3	Both EEPROM Copy Areas Bad
	47	00	SCSI Parity Error
	48	00	IDE Message Received
	51	00	Erase Failure
	53	00	Media Load/Eject Failure
	53	01	Unload Tape Failure

Table 4-61. Supported SK, ASC, and ASCQ (Hex) in Response to the REQUEST SENSE Command *(Continued)*

SK	ASC	ASCQ	Description
05h ILLEGAL REQUEST	1A	00	Parameter List Length Error
	20	00	Illegal Opcode
	20	81	Illegal Command While In Recovery Mode
	21	01	Invalid Element Address (Media Changer)
	24	00	Invalid CDB Field (may occur if odd block counts are attempted in fixed mode)
	24	81	Invalid Mode on WRITE Buffer
	24	82	Media in Drive
	24	84	Insufficient Resources
	24	86	Invalid Offset
	24	87	Invalid Size
	24	89	Image Data Over Limit[c]
	24	8B	Image/Personality is Bad[c]
	24	8C	Not Immediate Command
	24	8D	Bad Drive/Server Image EDC[c]
	24	8E	Invalid Personality for Code Update (CUP)[c]
	24	8F	Bad Controller Image EDC[c]
	25	00	Illegal LUN
	26	00	Parameter List Error, Invalid Field
	26	01	Parameter List Error, Parameter Not Supported
	26	02	Parameter List Error, Parameter Value Invalid
	30	00	Incompatible medium (cannot read medium)
	39	00	Saving Parameters Not Supported
	3B	0D	Media Destination Element Full[a]
	3B	0E	Media Source Element Empty[a]

Table 4-61. Supported SK, ASC, and ASCQ (Hex) in Response to the REQUEST SENSE Command *(Continued)*

SK	ASC	ASCQ	Description
05h ILLEGAL REQUEST (continued)	3D	00	Invalid Bits in ID Message
	53	02	Media Removal Prevented
	82	00	Not Allowed if not at BOT
06h UNIT ATTENTION	28	00	Not Ready To Ready Transition
	29	00	Reset Occurred
	2A	01	Mode Parameters Changed
	2A	02	Log Parameters Changed
	3F	01	Microcode has been Changed
	5B	01	Log Threshold Condition Met
07h DATA PROTECTED	27	80	Hardware WRITE Protect
	27	82	Data Safety WRITE Protect (if Use Cleaning Tape LED is lit, use a cleaning cartridge)
08h BLANK CHECK	00	05	EOD Encountered
	08	00	LUN Communications Failure
	08	01	LUN Communications Time-out
09h VENDOR UNIQUE	XX	YY	Code Update Event (where XX = Drive revision code; YY = Controller revision code)
0Ah	0A	00	Error Log Overflow
		80	Error Log Generated

Table 4-61. Supported SK, ASC, and ASCQ (Hex) in Response to the REQUEST SENSE Command *(Continued)*

SK	ASC	ASCQ	Description
0Bh ABORTED COMMAND	2F	00	Commands Cleared by Another Initiator
	43	00	Message Error
	44	80	Unexpected Selection Interrupt
	44	82	Command Complete Sequence Failure
	44	83	SCSI Chip, Gross Error/ Illegal – Command Status
	44	84	Unexpected/Unexplained Residue Count in Transfer Register
	44	87	Disconnect Sequence Failed
	44	89	Command Cleared from Queue Without Other
	45	00	Select/Reselect Failure
	47	00	SCSI Parity Error (check SCSI bus configuration and connections)
	48	00	IDE Message Error
	49	00	Invalid Message Error
	4B	00	Data Phase Error
	4E	00	Overlapped Commands Attempted (queue tag is not unique, CDB sent with abort tag message, or untagged, or untagged CDBs are outstanding)
	83	00	Can not Retry Read / Write Data Transfer (a Read / Write Data Transfer was aborted due to a bus parity error or unexpected ATN.
0Dh VOLUME OVERFLOW			(No Additional Sense Code or Sense Code Qualifier)
0Eh MISCOMPARE			(No Additional Sense Code or Sense Code Qualifier)

a. Command is specific to medium changers.
b. Contact a service representative.
c. Bad firmware image or code download possible.

4.19 RESERVE UNIT (16h)

The RESERVE UNIT command reserves the specified tape drive for the exclusive use of the requesting initiator or for another specified SCSI device. The reservation remains in effect until one of the following conditions occurs:

- The initiator that made the reservation sends another RESERVE UNIT command.
- The same initiator releases the tape drive with the RELEASE UNIT command.
- The tape drive receives a BUS DEVICE RESET message from any initiator.
- A hard reset occurs.

The occurrence of the last two conditions is indicated by the tape drive returning a CHECK CONDITION status with a Sense Key of UNIT ATTENTION on the next command following the condition. It is not an error to issue a RESERVE UNIT command to a tape drive that is currently reserved by the requesting initiator.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	Logical Unit Number			3rd Pty	Third Party Device ID			Rsv'd
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-70. RESERVE UNIT (16h) Command Descriptor Block — Data Format

If another initiator has previously reserved the logical unit, the target returns a RESERVATION CONFLICT status.

If, after the tape drive has honored the reservation, any other initiator attempts to perform any command except INQUIRY, REQUEST SENSE, or RELEASE UNIT, the tape drive rejects the command with a RESERVATION CONFLICT status. A reserved logical unit ignores a RELEASE UNIT command issued by another initiator.

Table 4-62. RESERVE UNIT (16h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
3rd Pty	Third Party. The third-party reservation option for RESERVE UNIT allows an initiator to reserve a logical unit for another SCSI device. This tape drive implements this option, which is intended for systems that perform copy operations. When set to 0, the 3rdPty bit does not request the third-party reservation option. When set to 1, RESERVE UNIT reserves the logical unit for the SCSI device specified in the Third-Party Device ID field. The tape drive preserves the reservation until any one of four conditions occurs (see the first paragraph of "RESERVE UNIT (16h)" on page 4-108). The tape drive ignores any attempt made by any other initiator to release the reservation and returns a GOOD status. An initiator that holds a current reservation can modify that reservation (for example, to switch third-parties) by issuing another RESERVE UNIT to the tape drive.
Third Party Device ID	This field identifies the SCSI device to be reserved.

4.19.1 Medium Changer Considerations

The optional Element Reservation feature defined for Medium Changer tape drives in SCSI-2 is not supported. The RESERVE command is defined the same as for the tape drive. The entire loader device can be reserved. This is distinct from a reservation of the tape drive.

The RESERVE/RELEASE commands operate on a LUN basis. The medium changer and tape drive are generally handled as different devices. In the case of a reserved tape drive LUN, a MOVE MEDIUM command issued to the loader LUN cannot insert/remove a data cartridge in the tape drive unless the same initiator has reserved the tape drive.

4.20 REWIND (01h)

The REWIND command tells the tape drive to position the medium at its beginning. Before rewinding, the tape drive writes any write buffered data to the medium and appends an EOD marker.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (01h)							
1	Logical Unit Number			Reserved				Immed
2 – 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-71. REWIND (01h) Command Descriptor Block — Data Format

Table 4-63. REWIND (01h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Immed	Immediate. When the Immediate bit is set to 1, the tape drive first writes any remaining buffered data to medium followed by an EOD marker. It then returns status to the host before beginning the actual rewind operation. If the Immed bit is set to 0, the tape drive returns status after completing the rewind.

4.21 SEND DIAGNOSTIC (1Dh)

The SEND DIAGNOSTIC command tells the tape drive to perform diagnostic tests on itself.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	Logical Unit Number			PF	Rsv'd	SelfTst	DevOfl	UnitOFl
2	Reserved							
3 - 4	(MSB) Parameter List Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-72. SEND DIAGNOSTIC (1Dh) Command Descriptor Block — Data Format

The tape drive does not support the Page Format field; it must remain 0.

Two separate types of unit resident tests can be accessed:

- Electronics Self-Test (Level 1 test) – To invoke the diagnostic, a good portion of the controller hardware and software must be functioning properly. The premise this test is based on is that full power-on testing is not necessary. Therefore, this test performs an extension of the power-on self tests. The code ROM EDC is verified and two queues used by much of the controller software are checked by dequeuing and enqueuing items.

  If there is a loader attached, a software reset is performed on it. This test does not attempt to write data to or read data from media. When complete, the test posts any errors in the extended Sense Data bytes. This test has an execution time of approximately 5 seconds.

  This test is specified by setting just the Self-Test bit (DevOfl, and UnitOfl both remain 0).
- Write/Read Functionality Test (Level 2 test) – The default version of this test does the following:
  - Writes 500 32 KB records on track 0.
  - Rewinds the medium.
  - Reads the records.
  - Positions to the beginning of track 1.
  - Writes 500 32 KB records on track 1.
  - Repositions to the beginning of track 1.

- Reads the records.
- Rewinds the medium. The execution time for the test is 6 minutes if calibration is not required. Specify this test by setting the Self-Test and UnitOfL bits and zeroing the DevOfL bit. This test can accept a parameter list specifying test variables.

If a parameter list is specified, all parameters must be filled in and the parameter list length must be 12. If these requirements are not met, the tape drive returns an ILLEGAL REQUEST. The Self-Test bit must be 0.

Table 4-64. Parameters for SEND DIAGNOSTIC

Selftest	DevOfl	UnitOfl	Selftest Action
0	0	0	Illegal combination
0	0	1	Self-Test 2 with default parameters
0	1	0	Illegal combination
0	1	1	Self-Test 2 with default parameters
1	0	0	Self-Test 1 with default parameters
1	0	1	Self-Test 2 with default parameters
1	1	0	Self-Test 1 with default parameters
1	1	1	Self-Test 2 with default parameters

Bit / Byte	7	6	5	4	3	2	1	0
0 – 1	(MSB) Pattern Number (LSB)							
2 – 3	(MSB) Maximum Number of Test Passes (LSB)							
4 – 7	(MSB) Block Size (LSB)							
8 – 11	(MSB) Block Count (LSB)							

Figure 4-73. SEND DIAGNOSTIC (1Dh) Parameter List — Data Format

Table 4-65. Definition of Pattern Numbers for the SEND DIAGNOSTIC Command

Pattern	Name	Data in Hex
0	Rotate	(Rotate through the other 9 patterns, change for each file)
1	All 0's	00 00 00 00 00
2	2F	FF FF FF FF FF
3	Alternating 1's and 0's	55 5A AA A5 55 5A AA A5
4	Marching 1	01 02 04 08 10 20 40 80
5	Marching 0	FE FD FB F7 EF DF BF 7F
6	MW	0E 0E 0E 0E 0E 0E 0E 0E
7	MFM	DE AD DE AD DE AD DE AD
8	1F	AA AA AA AA AA AA AA AA
9	Random Data	Random

If the Maximum Number of Test Passes is 0, causes testing to loop forever. A BUS RESET or a selection from the host sending an ABORT or a BUS DEVICE RESET message terminates testing.

If the Block Size field is 0, the tape drive uses random block sizes.

The Block Count field specifies how many blocks to write/read starting first on track 0, then again on track 1. So if the Block Size and Count fields result in 3 tracks worth of data, the test performs these actions:

- Write tracks 0, 1, 2
- Rewind, read, and verify tracks 0, 1, 2
- Write 3 tracks starting with 1: 1, 2, 3 and then rewind to the beginning of track 1 and do the read/verify pass. If Block Count is 0, the tape drive writes data until it reaches EOT each time, which yields almost 4 complete passes over the medium.

NOTE: As a result of data generation and verification, this test only streams the medium for short periods of time. Therefore, if Block Count is very high, this test can take many minutes or even hours to complete.

If the specified test passes, the tape drive returns a GOOD status. Otherwise, it generates a CHECK CONDITION and the Sense Data contains information about the failure.

Table 4-66. Sense Keys Used with SEND DIAGNOSTIC (1Dh)

Sense Key	Description
3h	Medium Error – A positioning error has occurred where the returned position does not match the expected.
4h	Hardware Error – The Additional Sense Code/Qualifier fields provide more specific information.
5h	ILLEGAL REQUEST – Illegal bit settings in the SEND DIAGNOSTIC command.
Eh	Miscompare – A compare error occurred during a read.

Table 4-67. Additional Sense Codes for Reporting Test Results

Additional Sense Code	Additional Sense Code Qualifier	Description
15h	2h	A positioning error has occurred where the returned position does not match the expected.
40h	80h	Level 1 ROM test failed.
40h	81h	Level 1 RAM test failed.
40h	82h	Level 1 test failed. Bad Drive status.
40h	83h	Level 1 test failed. Loader Reset failed.

4.22 SPACE (11h)

The SPACE command provides a variety of positioning functions that are determined by the Code and Count fields in the CDB. The command provides both forward (toward EOM/P) and reverse (toward BOM/P) positioning.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (11h)							
1	Logical Unit Number			Reserved		Code		
2 - 4	(MSB) Count (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-74. SPACE (11h) Command Descriptor Block — Data Format

Table 4-68. SPACE (11h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Code	The code have any of the following values. All other values are reserved.

Space Code	Space By
000b	Blocks
001b	Filemarks
010b	Sequential Filemarks
011b	End-of-Data

Table 4-68. SPACE (11h) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
Count	When spacing over blocks or marks, the Count field is interpreted as follows: • A positive value N causes forward movement over N blocks or marks. The tape drive logically positions the medium after the Nth block or mark on the EOM/P side. • A 0 value causes no change in the logical position. • A negative value -N (two's complement notation) causes reverse movement over N blocks or marks. The tape drive logically positions the medium on the BOM/P side of the Nth block or mark. • When spacing to EOD, the Count field is ignored. Forward movement occurs until the tape drive encounters EOD. The position is such that a subsequent WRITE command would append data after the last object that has been written to medium before EOD.

When executing SPACE, the tape drive implements the following hierarchy:

- Blocks – lowest
- Filemarks
- EOD
- BOM/P or EOM/P – highest.

Therefore, SPACE N Blocks halts with GOOD status after the Nth block or with CHECK CONDITION status on any occurrence of Filemark, EOD, BOM/P, or EOM/P. SPACE N Filemarks halts on the Nth Filemark or on any occurrence of EOD, BOM/P, or EOM/P, etc.

Depending on the size of blocks, read-ahead data in the buffer allows some spacing requests to be satisfied without medium movement.

4.23 TEST UNIT READY (00h)

The TEST UNIT READY command checks if the tape drive is ready for commands involving medium movement. If the tape drive has a data cartridge loaded, the command returns a GOOD status. Otherwise, it reports CHECK CONDITION.

Due to power cycle, code update, and data cartridge loaded conditions, it is possible to get multiple check conditions on a TEST UNIT READY command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (00h)							
1	Logical Unit Number			Reserved				
2 – 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-75. TEST UNIT READY (00h) Command Descriptor Block — Data Format

4.24 VERIFY (13h)

The VERIFY command tells the tape drive to verify one or more blocks beginning with the next block on the medium. VERIFY validates both CRC and ECCs.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (13h)							
1	Logical Unit Number			Reserved		Immed	BC	Fixed
2 – 4	(MSB) Verification Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-76. VERIFY (13h) Command Descriptor Block — Data Format

Table 4-69. VERIFY (13h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Immed	Immediate. When set, the VERIFY command completes before any media movement takes place, that is, when processing has been initiated.

Table 4-69. VERIFY (13h) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
BC	Byte Compare. This bit selects a CRC/ECC verification or a byte-by-byte compare. When set to 0, the tape drive performs an internal CRC/ECC check of the data. When set to 1, the tape drive rejects the command.
Fixed	This bit specifies the meaning of the Transfer Length field and whether fixed-length or variable-length blocks are to be transferred. When the Fixed bit is 0, the host is requesting a Variable Block mode. The tape drive transfers a single block with the Transfer Length specifying the maximum number of bytes the initiator has allocated for the returned data. When the Fixed bit is 1, the Transfer Length specifies the number of blocks to be transferred to the initiator. This is valid only if the logical unit is currently operating in Fixed Block mode. When the Transfer Length is 0, the tape drive transfers no data and does not change the current position on the logical unit. A successful READ with the Fixed bit set to 1 transfers (current block length) × (Transfer Length) bytes of data to the host. Upon termination of READ, the media is logically positioned after the last block transferred (EOM side).
Verification Length	This field specifies how many blocks to verify.

4.25 WRITE (0Ah)

The WRITE command transfers one or more blocks from the host to the current logical position. When in Buffered Mode (see “MODE SELECT (15h/55h)” on page 4-44), the tape drive reports a GOOD status on WRITE commands as soon as this data block has transferred to the data buffer.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (0Ah)							
1	Logical Unit Number			Reserved				Fixed
2 - 4	(MSB) Transfer Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-77. WRITE (0Ah) Command Descriptor Block — Data Format

The tape drive flushes the write buffer to medium under the following conditions:

- The write hold-off time limit is exceeded. (See "MODE SELECT (15h/55h)" on page 4-44)
- Receipt of the following non-write commands:
  - LOAD / UNLOAD
  - REWIND
  - ERASE
  - LOCATE
  - MOVE MEDIUM
  - PREVENT/ALLOW MEDIUM REMOVAL that clears a prevent state.
- A WRITE FILEMARKS command with the Immediate bit cleared
- A SCSI Reset or BUS DEVICE RESET message is received.

If Buffered Mode is not selected, the buffer flushes after every write-type command. This causes significant degradation in performance to the transfer rate.

Table 4-70. WRITE (0Ah) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.

Table 4-70. WRITE (0Ah) Command Descriptor Block — Field Descriptions *(Continued)*

Field Name	Description
Fixed	The fixed bit specifies both the meaning of the Transfer Length field and whether fixed-length or variable-length blocks are to be transferred. Setting the Fixed bit to 0 selects Variable Block mode. A single block is transferred from the initiator and is written to the logical unit beginning at the current logical medium position. Upon successful termination, the medium is logically positioned after this block (EOM/P side). The Transfer Length specifies the number of bytes that the tape drive handshakes out from the initiator. Setting the Fixed bit to 1 causes the Transfer Length field to specify the number of blocks to be transferred to the host beginning at the current medium position. This form of WRITE is valid only if the logical unit is currently operating in Fixed Block mode, in other words, when it has been instructed to use fixed-length blocks with MODE SELECT. The current block length is the block length defined in the MODE SELECT command. Upon termination, the medium is logically positioned after these blocks.
Transfer Length	This field contains the length of the data transfer in bytes or blocks, depending on whether Fixed or Variable block mode is selected. When the Transfer Length is 0, no data is transferred and the current position on the logical unit is not changed.
Exception Conditions	If EOT is detected while writing, the tape drive finishes writing any buffered data. The command terminates with CHECK CONDITION status. Within the Sense data, the EOM bit is set, the Sense Key field is NO SENSE, and the Additional Sense Code and Additional Sense Code Qualifier fields are EOM/P Detected. The tape drive attempts to complete any subsequent writes, returning a CHECK CONDITION status in each case. If the tape drive encounters the physical EOM when attempting to write, it returns CHECK CONDITION status. Within the Sense data, the EOM and Valid bits are set and the Sense Key field is Volume Overflow. The Information fields contain the residue count and the Additional Sense Code and Additional Sense Code Qualifier fields are EOM/P Detected. The medium is physically positioned at EOM/P.

4.26 WRITE BUFFER (3Bh)

The WRITE BUFFER command, used with READ BUFFER, is a diagnostic function for testing the tape drive data buffer, DMA engine, SCSI bus interface hardware, and SCSI bus integrity. It also enables downloading and updating firmware.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (3Bh)							
1	Logical Unit Number			Reserved		Mode		
2	Buffer ID (00h)							
3 - 5	(MSB) Buffer Offset (000000h) (LSB)							
6 - 8	(MSB) Parameter List / Data Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-78. WRITE BUFFER (3Bh) Command Descriptor Block — Data Format

Table 4-71. WRITE BUFFER (3Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
Mode	The tape drive supports the following values within the field. If any other value is set, the tape drive terminates the command with a CHECK CONDITION status and an ILLEGAL REQUEST Sense Key.

Mode	Description
000b	Write combined header and data
010b	Write Data
100b	Download Microcode
101b	Download Microcde and Save

Table 4-71. WRITE BUFFER (3Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
Buffer ID	For all modes, only a Buffer ID of 0 is supported. If the Buffer ID field is non-zero, the target rejects the command. The target detects and rejects commands that would overrun the buffer.
Buffer Offset	Buffer offsets are allowed to be non-zero. However, only integral multiples are valid. The offset boundary in the descriptor mode page of the READ BUFFER command reports the allowed integral multiple for buffer offset values.

4.26.1 Header and Data Mode

A 4-byte header consisting entirely of reserved bytes precedes the data to be transferred. The tape drive discards this header (does not store it into the buffer). The buffer offset field must be 0 for this mode.

4.26.2 Write Data Mode

Similar to mode 000b, except no header is in the data passed to the target. The Buffer Offset must be 0. The target detects potential buffer overruns and rejects the command.

4.26.3 Download Microcode Mode

Using buffer offsets, the host can download the firmware image into the target's buffer in pieces. These commands do not cause the new image to become active; a Download and Save mode WRITE BUFFER command must be issued.

The tape drive must be empty to allow downloading an image. This is to safeguard against accidentally starting a firmware update. If a data cartridge is loaded when all or part of a firmware image has been downloaded, the tape drive rejects any other WRITE BUFFER with Download Microcode mode. Overlapping or nonconsecutive downloading of the image data is not supported. The firmware image must be downloaded in integral multiples of 8KB.

Any error on a WRITE BUFFER command causes the tape drive to discard any downloaded image data and requires restarting the download from the beginning.

4.26.4 Download Microcode and Save Mode

This mode causes one of the following actions:

- Download and save the entire image at once.
- Download the image data and save it.
- Start a save operation after all the image data has been downloaded using the Download-only mode.

This mode of the command causes the image data to be verified and the EEPROM firmware area to be updated. During the reprogramming, the Write Protect and Drive Activity LEDs on the tape drive's front panel blink.

> **CAUTION** During the actual reprogramming of the EEPROM, if any type or power failure occurs or if the reprogramming fails part way through, the subsystem may be unusable.

When the Save operation successfully completes, the firmware restarts itself, reruns POST, and generates two Unit Attention conditions: POWER-UP RESET, and OPERATING CODE HAS CHANGED.

4.27 WRITE FILEMARKS (10h)

The WRITE FILEMARKS command causes the tape drive to write the specified number of Filemarks beginning at the current logical position on medium. If the Immed bit is not set, the tape drive writes any data or Filemarks in the write cache buffer to medium.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (10h)							
1	Logical Unit Number			Reserved			WSmrk	Immed
2 - 4	(MSB) Number of Filemarks (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-79. WRITE FILEMARKS (10h) Command Descriptor Block — Data Format

Table 4-72. WRITE FILEMARKS (10h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. The target ignores this field. Only an IDENTIFY message can change the LUN.
WSmrk	Not supported. This field must be 0.
Immed	When this bit is 1, the tape drive returns status as soon as the CDB has been validated unless the Filemark count is 0 or greater than 1 (since both cause the write buffer to be flushed to media). An Immed bit of 0 indicates that the status will not be returned until the operation is complete.
Number of Filemarks	This is the number of consecutive marks to be written to medium. A value of 0 is not considered an error and GOOD status is returned. Use this command to force the tape drive to write any buffered WRITE data to the medium. If the tape drive is in Buffered Mode and the WRITE FILEMARKS command is received, the tape drive appends the requested Filemarks to the data and flushes the write buffer to medium. A 0 value in the Number of Filemarks field indicates that the tape drive does not write Filemarks to the medium, but still flushes any WRITE data to medium. If EOT is detected while writing Filemarks, the tape drive finishes writing any buffered data and terminates with CHECK CONDITION status. Within the Sense data, the EOM bit is set, the Sense Key field is set to NO SENSE, and the Additional Sense Code and Additional Sense Code Qualifier fields are EOM/P detected. The tape drive attempts to complete any subsequent WRITE FILEMARKS commands, returning a CHECK CONDITION status in each case. If the tape drive encounters the physical EOM when attempting a WRITE FILEMARKS command, it returns CHECK CONDITION status.

Supported SCSI-2 Medium Changer Device Commands

On the Medium Changer LUN, only commands defined for this device type are allowed. Table 5-1 lists the supported Opcodes/SCSI commands and the section in this manual that describes each command.

Table 5-1. SCSI-2 Medium Changer Commands

Opcode	Command	Section
07[a]	INITIALIZE ELEMENT STATUS	"INITIALIZE ELEMENT STATUS (07h)" on page 5-2
12	INQUIRY	"INQUIRY (12h)" on page 4-4
15[b]	MODE SELECT	"MODE SENSE/SELECT (1Ah/15h)" on page 5-2
1A[b]	MODE SENSE	"MODE SENSE/SELECT (1Ah/15h)" on page 5-2
A5[a]	MOVE MEDUIM	"MOVE MEDIUM (A5h)" on page 5-4
3C	READ BUFFER	"READ BUFFER (3Ch)" on page 4-89
B8[a]	READ ELEMENT STATUS	"READ ELEMENT STATUS (B8h)" on page 5-4
1C	RECEIVE DIAGNOSTIC RESULTS	"RECEIVE DIAGNOSTICS RESULTS (1Ch)" on page 4-94
17	RELEASE	"RELEASE UNIT (17h)" on page 4-95
03	REQUEST SENSE	"REQUEST SENSE (03h)" on page 4-96
16	RESERVE	"RESERVE UNIT (16h)" on page 4-108
1D	SEND DIAGNOSTIC	"SEND DIAGNOSTIC (1Dh)" on page 4-111
00	TEST UNIT READY	"TEST UNIT READY (00h)" on page 4-116
3B	WRITE BUFFER	"WRITE BUFFER (3Bh)" on page 4-121

a. Medium Changer specific commands
b. Commands with specific Medium Changer specific content

Previous sections document the INQUIRY, SEND DIAGNOSTIC, RECEIVE DIAGNOSTIC RESULTS, Read / Write BUFFER, and REQUEST SENSE commands.

The rest of this chapter discusses commands that are unique to medium changers.

5.1 INITIALIZE ELEMENT STATUS (07h)

The INITIALIZE ELEMENT STATUS command causes the medium changer to initialize the element status. Figure 5-1 shows the data format for the command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (07h)							
1	Logical Unit Number			Reserved				
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 5-1. INITIALIZE ELEMENT STATUS (07h) — Data Format

5.2 MODE SENSE/SELECT (1Ah/15h)

The tape drive supports all three pages that are specific to Medium Changers.

5.2.1 Device Capabilities Page (1Fh)

The tape drive supports the Device Capabilities Page. Figure 5-2 shows the data format for the page.

Bit Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (1Fh)					
1	Additional Page Length (0Eh)							
2	Reserved				StorDT	StorI/E	StorST	StorMT
3	Reserved							
4	Reserved				MT-DT	MT_1/E	MT-ST	MT-MT
5	Reserved				ST-DT	ST-I/E	ST-ST	ST-MT
6	Reserved				IE-DT	IE-I/E	IE-ST	IE-MT
7	Reserved				DT-DT	DT-I/E	DT-ST	DT-MT
8 – 11	Reserved							
12	Reserved				MT<>DT	MT<>I/E	MT<>ST	MT<>MT
13	Reserved				ST<>DT	ST<>I/E	ST<>ST	ST<>MT
14	Reserved				IE<>DT	IE<>I/E	IE<>ST	IE<>MT
15	Reserved				DT<>DT	DT<>I/E	DT<>ST	DT<>MT

Figure 5-2. Device Capabilities Page — Data Format

Bit Field Values

- Elements that can store media: StorDT, StorST
- Valid Source-Destination pairs: ST-DT, DT-ST

All the “MT-XX” and the “XX-MT” entries are 0, since the loader does not accept a Medium Transport element address as a source or destination.

All the “IE-XX” and the “XX-IE” entries are 0 since there is no Import/Export element.

Bytes 12 through 15 are all 0 as the medium changer does not support the exchange medium command. The medium changer does not support “ST-ST” or “DT-DT”.

5.3 MOVE MEDIUM (A5h)

The MOVE MEDIUM command moves data cartridges from the tape drive to the magazine slot it came from or from any magazine slot to the tape drive.

The Transport Element Address field must be 0 or 1. Figure 5-3 shows the data format for the command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	Logical Unit Number			Reserved				
2 – 3	(MSB) Transport Element Address (LSB)							
4 – 5	(MSB) Source Address (LSB)							
6 – 7	(MSB) Destination Address (LSB)							
8 – 10	Reserved							
11	Unused		Reserved				Flag	Link

Figure 5-3. MOVE MEDIUM (A5h) — Data Format

5.4 READ ELEMENT STATUS (B8h)

The SCSI-2 specification defines the format of Element Status data. The following sections show the information returned for the medium changer. The Element Status data consists of a header and one or more Status Pages for each element type. The Status Pages consist of a header and one or more element descriptors, one for each element address. The data shown assumes the CDB was specified in such a way that all descriptors for a given element type would be returned.

The Primary and Alternate Volume Tag functions are not supported. The flags indicating these functions in the Element Status Pages are always 0. Figure 5-4 shows the data format for the command header.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Logical Unit Number			VolTag	Element Type Code			
2 – 3	(MSB) Starting Elements Address (LSB)							
4 – 5	(MSB) Number of Elements (LSB)							
6	Reserved							
7 – 9	(MSB) Allocation Length (LSB)							
10	Reserved							
11	Unused		Reserved				Flag	Link

Figure 5-4. READ ELEMENT STATUS (B8h) Command Descriptor Block— Header Format

Table 5-2 shows the element type codes and their definitions.

Table 5-2. Element Type Code Definitions

Code	Description
0h	All element types reported (valid in CDB only)
1h	Medium Transport Element
2h	Storage Element (magazine slot)
3h	Import Export Element (not supported)
4h	Data Transfer Element (tape drive)
5h-Fh	Reserved

5.4.1 Element Status Header

Figure 5-5 shows the data format for the Element Status header.

Bit / Byte	7	6	5	4	3	2	1	0
0 – 1	(MSB) First Element Address Reported (LSB)							
2 – 3	(MSB) Number of Elements Reported (LSB)							
4	Reserved							
5 – 7	(MSB) Byte Count of Report Available (LSB)							

Figure 5-5. Element Status Header — Data Format

5.4.2 Medium Transport Element Status Page

Figure 5-6 shows the format for the Medium Transport Element Status header; Figure 5-7, the descriptor.

Bit Byte	7	6	5	4	3	2	1	0
0	Element Type Code (1h = Medium Transport)							
1	PVolTag	AVolTag	Reserved					
2 – 3	(MSB) Transport Element Descriptor Length (LSB)							
4	Reserved							
5 – 7	(MSB) Byte Count of Descriptor Data Available (LSB)							

Figure 5-6. Medium Transport Element Status Header — Data Format

Bit Byte	7	6	5	4	3	2	1	0
8 – 9	(MSB) Transport Element Address (01h) (LSB)							
10	Reserved					Except	Rsv'd	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14 – 16	Reserved							
17	Svalid	Invert	Reserved					
18 – 19	(MSB) Source Element Address (LSB)							
20 – 23	Reserved							
24	Density Code of Media (=0 if empty) VU							
25	Unused (VU)							

Figure 5-7. Medium Transport Element Status Descriptor — Data Format

There is only one Medium Transport element. It can be addressed explicitly as element address 1, or implicitly as address 0. PvolTag and AVolTag are always 0.

5.4.3 Storage Element Status Page

Figure 5-8 shows the format for the Storage Element Status header; Figure 5-9, the descriptor.

Bit / Byte	7	6	5	4	3	2	1	0
0	Element Type Code (2h = Storage Transport)							
1	PVolTag	AVolTag	Reserved					
2 – 3	(MSB) Storage Element Descriptor Length (LSB)							
4	Reserved							
5 – 7	(MSB) Byte Count of Descriptor Data Available (LSB)							

Figure 5-8. Storage Element Status Header — Data Format

Bit Byte	7	6	5	4	3	2	1	0
8 – 9	(MSB) First Storage Element Address Reported (LSB)							
10	Reserved				Access	Except	Rsv'd	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14 – 16	Reserved							
17	Svalid	Invert	Reserved					
18 – 19	(MSB) Source Element Address (LSB)							
20 – 23	Reserved							
24	Density Code of Media (=0 if empty) VU							
25	Unused (VU)							
26 – n	Descriptors for other Storage Elements							

Figure 5-9. Storage Element Status Descriptor — Data Format

There are up to 14 Storage Elements, the number corresponding to the number of slots in a magazine. PvolTag and AVolTag are always 0. Access is always 1. Full is set to 1 if a data cartridge is in the corresponding magazine slot. Exception is 1 if the magazine slot indicates that a cartridge has been removed, but is not in the Medium Transport or Data Transfer elements. The Source Element Address is always set to this element's address.

5.4.4 Data Transfer Element Status Page

Figure 5-10 shows the format for the Data Transfer Element Status header; Figure 5-11, the descriptor.

Bit Byte	7	6	5	4	3	2	1	0
0	Element Type Code (4h = Data Transport)							
1	PVolTag	AVolTag	Reserved					
2 – 3	(MSB) Data Transfer Element Descriptor Length (LSB)							
4	Reserved							
5 – 7	(MSB) Byte Count of Descriptor Data Available (LSB)							

Figure 5-10. Data Transfer Element Status Header — Data Format

Bit Byte	7	6	5	4	3	2	1	0
8 – 9	(MSB) Data Transfer Element Descriptor (LSB)							
10	Reserved				Access	Except	Rsv'd	Full
11	Reserved							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	NotBus	Rsv'd	IDVAlid	LUValid	Rsv'd	Logical Unit Number		
15	SCSI Bus Address (same as tape drive's)							
16	Reserved							
17	SValid	Invert	Reserved					
18 – 19	(MSB) Source Element Address (LSB)							
20 – 23	Reserved							
24	Density Code of Media (=0 if Empty) VU							
25	Unused (VU)							

Figure 5-11. Data Transfer Element Status Descriptor — Data Format

Table 5-3. Data Transfer Element Status Header and Descriptor — Field Descriptions

Field Name	Description
PvolTag	Always 0.
AvolTag	Always 0.
Access	Always set.
Full	Set if a data cartridge is in the tape drive.
IDValid	Always set.
LUValid	Always set.

Table 5-3. Data Transfer Element Status Header and Descriptor — Field Descriptions *(Continued)*

Field Name	Description
LUN	Logical Unit Number – The tape drive number is 0.
SCSI Bus Address	The SCSI Bus Address is the same as the tape drive's controller.
SValid	Set if a data cartridge is in the tape drive.
Source Element Address	Indicates which magazine slot the data cartridge came from.

5.4.5 Element Address Assignment Page (1Dh)

The tape drive supports the Element Address Assignment Page. Figure 5-12 shows the data format for the page.

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (1Dh)					
1	Length (12h)							
2 – 3	(MSB) 1st Medium Transport Element Address (01h) (LSB)							
4 – 5	(MSB) Number of Medium Transport Elements (1) (LSB)							
6 – 7	(MSB) 1st Storage Element Address (100h) (LSB)							
8 – 9	(MSB) Number of Storage Elements (08h) (LSB)							
10 – 11	(MSB) Import/Export Element Address (00h) (LSB)							

Bit Byte	7	6	5	4	3	2	1	0
12 – 13	(MSB) Number of Import/Export Elements (00h) (LSB)							
14 – 15	(MSB) 1st Data Transfer Element Address (10h) (LSB)							
16 – 17	Number of Data Transfer Elements (01h)							
18 – 19	Reserved							

Figure 5-12. Element Address Assignment Page — Data Format

Table 5-4 lists the Medium Changer Element Address assignments.

Table 5-4. Medium Changer Element Addresses

Address	Comments
00h	Default Medium Transport Element
01h	Medium Transport Element
02-0Fh	Reserved
10h	Data Transfer Element (tape drive)
11h-0FFh	Reserved
100h	Medium Storage Element (Magazine slot 0)
101h	Medium Storage Element (Magazine slot 1)
102h	Medium Storage Element (Magazine slot 2)
103h	Medium Storage Element (Magazine slot 3)
104h	Medium Storage Element (Magazine slot 4)
105h	Medium Storage Element (Magazine slot 5)
106h	Medium Storage Element (Magazine slot 6)
107h-0FFFFh	Medium Storage Element (Magazine slot 7)
108h-0FFFFh	Reserved

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