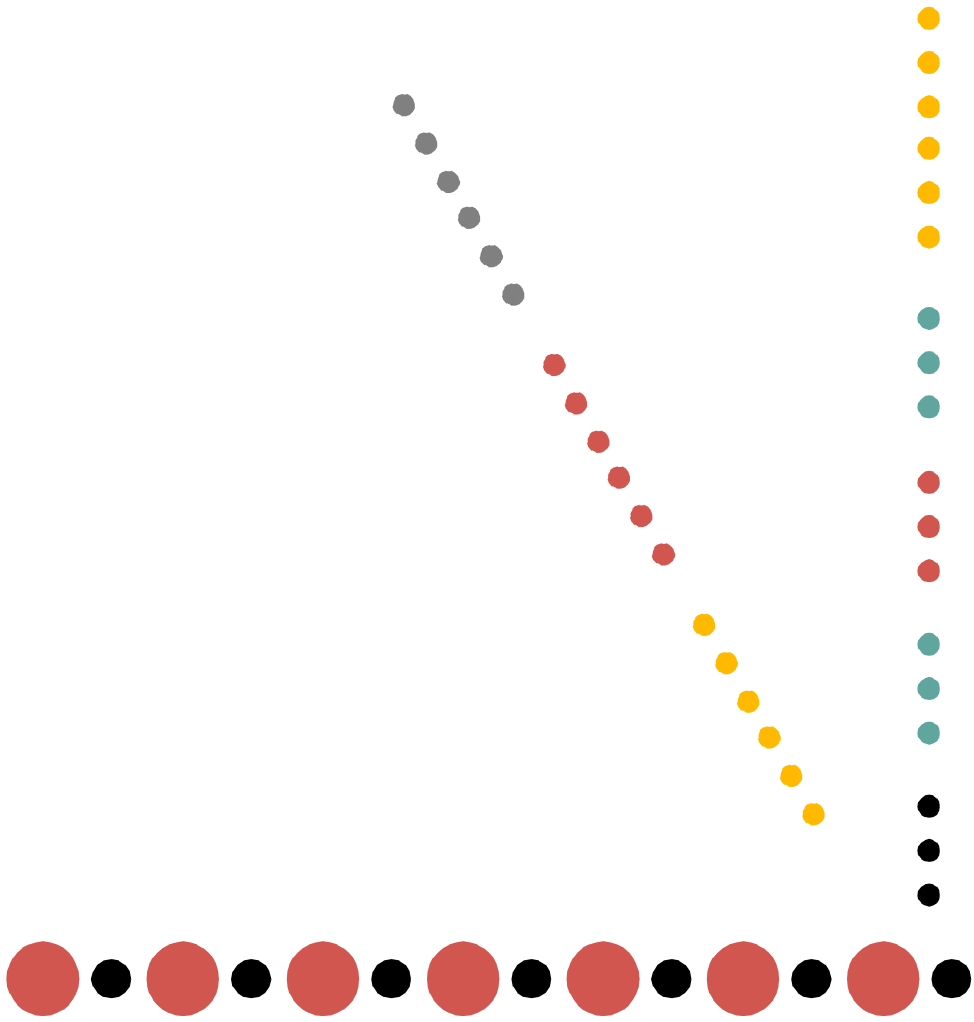
Quantum

DLT VS160
SCSI Interface Guide



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CHAPTER 1

Introduction

1.1 Purpose and Scope

This manual provides a detailed explanation of the SCSI Protocol features that the DLT VS160 tape drive implements. This manual is not intended to replace the full ANSI SCSI specification, messages, options, and command code specifications, but instead 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, the DLT VS160 tape drive is referred to simply as the "tape drive."

1.2 Audience

This document is provided for software and firmware engineers and technicians who support Quantum DLT VS160 tape drives. It also serves software and firmware engineers and technicians who integrate Quantum DLT VS160 tape drives into automated systems such as tape libraries.

1.3 Related Documents

- *DLT VS160 Tape Drive Installation and Operations Guide* (81-81191-01)
- 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," defines general SCSI bus operation, including data transfer, SCSI IDs, power-on and SCSI bus resets, data cache, and other SCSI functionality.

Chapter 3, "SCSI Messages," describes the SCSI message system, which allows communication between an initiator and a target for the purpose of physical path management. This chapter includes the supported SCSI messages, and describes the initiator/target interaction.

Chapter 4, "SCSI Commands," lists all of the supported SCSI commands, defines their use in this tape drive, and identifies their data format and field descriptions.

Chapter 5, "Medium Changer Device Commands," lists all of the supported SCSI-2 medium changer device commands, defines their use in this tape drive, and identifies their data format and field descriptions.

Appendix A, "SCSI Commands Under Reservation," contains tables that list how the SCSI commands supported by the tape drive behave during the various types of reservations that are available to an initiator.

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)

1.6 SCSI Command Descriptions

The SCSI command descriptions contain detailed information about each command the tape drive supports. The SCSI commands are presented in alphabetical order. Fields common to many of the SCSI commands are not repeated for every command; instead they are supported as follows:

Table 1-2. SCSI Command Conventions

Name of Field	How Field is Supported in SCSI Commands
LUN	Logical Unit Number. LUN for the tape drive is 0.
Control	All SCSI commands must have a Control byte, which is implemented as described in *SCSI Architecture Model – 3* (*SAM–3*).
Reserved	Reserved bits, fields, bytes, and code values are set aside for future standardization and must be set to 0. If the tape drive receives a command that contains non-zero bits in a reserved field or a reserved code value, the tape drive terminates the command with a CHECK CONDITION status and the Sense Key is set to ILLEGAL REQUEST.

Throughout this manual, multiple bytes that contain information about specific command parameters are portrayed as shown below in the example from the Parameter List Length field (bytes 7 to 8) of the LOG SELECT command, shown as follows:

Bit / Byte	7	6	5	4	3	2	1	0
	(Bytes 0 – 6)							
7 – 8	(MSB) Parameter List Length (LSB)							

This sample indicates that the most significant bit (MSB) of the field is bit 7 of byte 7; the least significant bit is bit 0 of byte 8. The shorthand version of presentation is used in this manual to save space.

This is an alternate, “shorthand” presentation for:

Bit Byte	7	6	5	4	3	2	1	0
	(Bytes 0 – 6)							
7	(MSB)							
8	Parameter List Length							(LSB)

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) device. Parity (ODD) is generated during all information transfer phases where the device transfers data onto the SCSI bus. Parity is checked during all information transfer phases where data is transferred back 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 devices 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 device does not perform any of the following:

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

2.3 SCSI IDs and Logical Unit Numbers (LUNs)

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

Unsupported LUNs are treated 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:

1. 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.
2. 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.
3. For any other command, the target terminates the command with CHECK CONDITION status and generates the Sense data described in item 2 above.

2.4 Unit Attention Condition

The tape drive implements *queued unit attentions* which are maintained separately for each valid LUN for each Initiator. Unit attentions are created under the following conditions:

- Power-on reset
- Bus reset
- BUS DEVICE RESET message
- When the media may have changed asynchronously
- Another initiator changed the Mode parameters or Log parameters
- A firmware (microcode) update has completed.

Two queued Unit Attentions are not unusual. For example, if a tape drive is powered on and a data cartridge is loaded, Power Up and Not-ready to Ready Transition unit attentions are created. Since there are a limited number of Unit Attention Buffers, if an initiator does not clear the unit attentions queued for it, at some point the tape drive will stop generating new unit attentions for that initiator-LUN combination. Existing unit attentions remain queued, however.

NOTE: 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

You can expect and rely on the following behavior when a power-on or SCSI bus reset event occurs:

- All device SCSI lines go to high impedance when the tape drive is powered off.
- The tape drive does not generate any spurious signals on the SCSI bus at power-on.
- 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. Tape motion commands are returned with CHECK CONDITION status, Sense Key set to NOT READY, until the media is ready.
- The Hard Bus Reset option is implemented.
- The media is rewound to BOP (Beginning of Partition, in other words, Beginning of Tape).

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 Tape Write Interaction

The tape drive contains a data cache that buffers blocks (records) until they are written. This section specifies times when blocks are written to tape. A MODE SELECT parameter allows the data cache to be disabled (unbuffered mode). In this mode, every WRITE command causes the data to be written to the media before the Status byte and the COMMAND COMPLETE messages are returned to the host.

NOTE: Unbuffered Mode is not recommended because it causes poor performance.

The write data cache is written (flushed) to the media under the following circumstances:

- When one or more WRITE FILEMARKS commands are issued without intervening tape motion commands.
- When a WRITE 0 FILEMARKS command is issued.
- If data remains in the cache longer than specified by the value of the MODE SELECT parameter **Write Delay Time**.
- When a non-write-type media access command is received, for example, SPACE, READ, UNLOAD, or REWIND.

2.7 Other SCSI Functionality

The tape drive supports SCSI linked commands.

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 tape 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 device 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 a SCSI device attempts to access the tape drive when it has been reserved by another initiator with a RESERVE command.

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 a media access command has been issued and the media is not ready to be accessed. For example, the media is not installed, the media has been unloaded, the tape drive is currently initializing the media to prepare it for access, etc.

In the “not ready” state, the initiator cannot perform any operation that would cause tape motion, for example, WRITE, READ, SPACE, VERIFY, and so forth. 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 media and the tape drive may return a GOOD status.

These are the commands that do not require media access:

- 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
- SEND DIAGNOSTIC (non-media access diagnostics)
- WRITE BUFFER.

NOTE: The TEST UNIT READY command is used to determine whether the tape drive would accept a media access command without returning CHECK CONDITION status.

2.8.3 BUS FREE Phase

The BUS FREE phase indicates that there is no current I/O process and that the SCSI bus is available for connection.

2.9 Bus Parity Errors

The occurrences of bus parity errors (in other words, 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 bus in most normal environments should be practically free of bus parity errors.

Bus parity errors cause the tape drive to go BUS FREE and prepare Sense data.

CHAPTER 3

SCSI Messages

3.1 SCSI Message System

The tape drive supports the messages listed in Table 3-1. The message code and the direction of the message flow is also included in the following table (In = target-to-initiator, Out = initiator-to-target).

Table 3-1. Supported SCSI Messages

Message and Code	Direction	
ABORT Message (06h)		Out
BUS DEVICE RESET Message (0Ch)		Out
COMMAND COMPLETE Message (00h)	In	
DISCONNECT Message (04h)	In	
Extended Messages (01h)	In	Out
Two-Byte Messages (2xh)	In	Out
IDENTIFY Message (80h–FFh)	In	Out
IGNORE WIDE RESIDUE Message (23h)	In	
INITIATOR DETECTED ERROR Message (05h)		Out
LINKED COMMAND COMPLETE Message (0Ah)	In	
LINKED COMMAND COMPLETE WITH FLAG Message (0Bh)	In	
MESSAGE PARITY ERROR Message (09h)		Out
MESSAGE REJECT Message (07h)	In	Out
NO OPERATION Message (08h)		Out
PARALLEL PROTOCOL REQUEST (Extended Message 04h)	In	
RESTORE POINTERS Message (03h)	In	

Table 3-1. Supported SCSI Messages (Continued)

Message and Code	Direction	
SAVE DATA POINTER Message (02h)	In	
SYNCHRONOUS DATA TRANSFER REQUEST (Extended Message 01h)	In	
WIDE DATA TRANSFER REQUEST (Extended Message 03h)	In	

3.2 Supported SCSI Messages

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

3.2.1 Extended Messages (01h)

An initiator or target sends these messages as the first byte of a multiple-byte message—one that is larger than two bytes. Figure 3-1 shows the extended message data 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 Messages — Data Format

The Extended Message Length specifies the length of the 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.

Possible extended message codes are:

00h – MODIFY DATA POINTER (not supported)
01h – SYNCHRONOUS DATA TRANSFER REQUEST
02h – Reserved
03h – WIDE DATA TRANSFER REQUEST
04h – PARALLEL PROTOCOL REQUEST
(05h – 7Fh) – Reserved
(80h – FFh) – Vendor Unique (not supported)

If the tape drive receives an extended message that it does not support, it switches to MESSAGE-IN phase and returns MESSAGE REJECT after all the bytes of the message have been transferred; then the next appropriate bus phase will be entered.

Table 3-2. Partial Extended Message — Message Behavior

When a partial EXTENDED MESSAGE is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTERS message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.2 Two-Byte Messages (2xh)

The format for two-byte messages are shown in Figure 3-2.

Bit Byte	7	6	5	4	3	2	1	0
0	Two-byte Message Identifier (2xh)							
1	Message Argument							

Figure 3-2. Two-byte Messages — Data Format

Possible two-byte message codes are:
20h – QUEUE SIMPLE (not supported)
21h – QUEUE ORDERED (not supported)
22h – QUEUE HEAD (not supported)
23h – IGNORE WIDE RESIDUE
(24h – 2Fh) — Reserved

Table 3-3. Partial Two-byte Message — Message Behavior

When a partial two-byte message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTERS message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.3 ABORT Message (06h)

The initiator sends this message to the target to clear the current I/O process on the selected device. On buffered (cached) write operations, the tape drive attempts to complete the command, if possible.

Table 3-4. ABORT (06h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE with no reported errors (multi-byte message-out phases will be terminated early with the BUS FREE state)
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase COMMAND COMPLETE message is sent to the initiator	go BUS FREE; all I/O tasks for the present I-T-L nexus are aborted

3.2.4 BUS DEVICE RESET Message (0Ch)

This message from an initiator clears all commands, data, and status in the tape controller. When the tape drive recognizes this message, it writes the data in the cache to the media.

Table 3-5. BUS DEVICE RESET (0Ch) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator DATA-IN or DATA-OUT phase STATUS phase COMMAND COMPLETE message is sent to the initiator	go BUS FREE; perform hard reset and set UNIT ATTENTION for all initiators

3.2.5 COMMAND COMPLETE Message (00h)

A target sends this message to an initiator to indicate that the execution of a command or a series of linked commands has completed and valid status has been sent to the initiator.

Table 3-6. COMMAND COMPLETE (00h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.6 DISCONNECT Message (04h)

A target sends DISCONNECT to tell an initiator that the present physical path is going to be broken (the target intends to disconnect by releasing the BSY signal). Later, reconnect is required in order to complete the current operation. This message does not cause the initiator to save the data pointer.

Table 3-7. DISCONNECT (04h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.7 IDENTIFY Message (80h–FFh)

The initiator or target sends these messages to establish or re-establish the physical connection path between an initiator and target for a particular logical unit. The message byte consists of the following bits:

Bit / Byte	7	6	5	4	3	2	1	0
0	Identify	DiscPriv	Target Routines	Rsv'd (must be 0)		LUN		

Figure 3-3. IDENTIFY (80h–FFh) — Data Format

Table 3-8. IDENTIFY (80h–FFh) — Field Descriptions

Field	Description
Identify	Must be set to 1, indicating that the current message is an IDENTIFY message.
DiscPriv	Disconnect Privilege. May be set to 0 provided that no other I/O process is currently active in the drive. If this bit is not set to 1 and other I/O processes are currently active in the drive, the drive returns BUSY status.
Target Routines	Target Routines are not supported; this bit must be set to 0.
LUN	Logical Unit Number.

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

Table 3-9. IDENTIFY (With Another LUN) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	N/A
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator DATA-IN or DATA-OUT phase STATUS phase COMMAND COMPLETE message is sent to the initiator	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command

Table 3-10. IDENTIFY (Invalid) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection SAVE DATA POINTER message is sent to the initiator DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; finish bus sequence with CHECK CONDITION followed by COMMAND COMPLETE and build Sense data
DISCONNECT message is sent to the initiator	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT

NOTE: An invalid IDENTIFY message is one in which a reserved bit or an unsupported bit is set.

Table 3-11. IDENTIFY (Valid) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase COMMAND COMPLETE message is sent to the initiator	if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator STATUS phase	• if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • Set SCSI disconnection as requested by initiator in IDENTIFY message
DATA-IN or DATA-OUT phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command

3.2.8 IGNORE WIDE RESIDUE Message (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 that DATA-IN phase and prior to any other messages. Figure 3-4 illustrates the data format of an IGNORE WIDE RESIDUE message.

Bit / Byte	7	6	5	4	3	2	1	0
0	Message Code (23h)							
1	IGNORE (01h)							

Figure 3-4. IGNORE WIDE RESIDUE (23h) — Data Format

Table 3-12. IGNORE WIDE RESIDUE (23h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.9 INITIATOR DETECTED ERROR Message (05h)

An initiator sends this message to inform a target that an error has occurred (for example, a bus parity error) that does not prevent the target from attempting the operation again.

Table 3-13. INITIATOR DETECTED ERROR (05h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase IDENTIFY message is sent to the target target re-selection	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
COMMAND phase MESSAGE-IN phase SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator DATA-IN or DATA-OUT phase STATUS phase	finish bus sequence with check condition followed by COMMAND COMPLETE; build Sense data
COMMAND COMPLETE message is sent to the initiator	retry previous MESSAGE-IN phase once; • if successfully retried, then the bus sequence completed successfully • if unsuccessfully retried, then go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command

3.2.10 LINKED COMMAND COMPLETE Message (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 status has been sent back to the initiator. The initiator then sets the pointers to the initial state for the next command.

Table 3-14. LINKED COMMAND COMPLETE (0Ah) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.11 LINKED COMMAND COMPLETE WITH FLAG Message (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 status has been sent back to the initiator.

Table 3-15. LINKED COMMAND COMPLETE WITH FLAG (0Bh) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.12 MESSAGE PARITY ERROR Message (09h)

The initiator sends this message to the tape drive to indicate that one or more bytes in the last message the tape drive passed on to the initiator contained 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 (the tape drive) can determine which message has the parity error.

Table 3-16. MESSAGE PARITY ERROR (09h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase IDENTIFY message is sent to the target COMMAND phase DATA-IN or DATA-OUT phase STATUS phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
MESSAGE-IN phase SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator	retry previous phase once; • if successfully retried, then continue to the next appropriate bus phase • if unsuccessfully retried, then finish bus sequence with check condition followed by COMMAND COMPLETE and build Sense data
target re-selection COMMAND COMPLETE message is sent to the initiator	retry previous phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command

3.2.13 MESSAGE REJECT Message (07h)

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

MESSAGE REJECT is issued 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.

Table 3-17. MESSAGE REJECT (07h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase target re-selection	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
MESSAGE-IN phase	See the following NOTE.
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator	Continue without disconnection to the next appropriate bus phase.
DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; finish bus sequence with CHECK CONDITION followed by COMMAND COMPLETE and build Sense data
COMMAND COMPLETE message is sent to the initiator	if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase

NOTE: This SCSI bus phase is un-reproducible without using a WIDE DATA TRANSFER REQUEST, SYNCHRONOUS DATA TRANSFER REQUEST, or PARALLEL PROTOCOL REQUEST message; it is illegal for an initiator to reject these mandatory messages.

3.2.14 NO OPERATION Message (08h)

If a target requests a message, the initiator sends NO OPERATION if it does not currently have any other valid message to send. The tape drive accepts the message when the tape drive is acting as a target and can send the message when it is an initiator.

Table 3-18. NO OPERATION (08h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase COMMAND COMPLETE message is sent to the initiator	if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator	retry previous MESSAGE-IN phase once; • if successfully retried, then the bus sequence completed successfully • if unsuccessfully retried, then go BUS FREE, and build Sense data

3.2.15 PARALLEL PROTOCOL REQUEST (Extended Message 04h)

The PARALLEL PROTOCOL REQUEST (PPR) message allows the host and target devices to negotiate operating conditions of the SCSI bus. The tape drive responds to a PPR message with a reciprocal PPR message containing acceptable parameters for the interface. The tape drive does *not* initiate the SYNCHRONOUS DATA TRANSFER REQUEST message, but relies on the initiator to do so.

Details about how to configure the PPR message are shown in Table 3-19 on page 3-20.

This extended message allows the target and initiator to agree on the values of the parameters relevant to synchronous and width transfers. Figure 3-5 shows the PARALLEL PROTOCOL REQUEST data format.

Bit / Byte	7	6	5	4	3	2	1	0
0	Extended Message Identifier (01h)							
1	Extended Message Length (06h)							
2	PARALLEL PROTOCOL REQUEST (04h)							
3	Transfer Period Factor							
4	Reserved							
5	REQ/ACK Offset							
6	Transfer Exponent							
7	Reserved					QAS	DT	IU

Figure 3-5. PARALLEL PROTOCOL REQUEST (Ext. Message 04h) — Data Format

Table 3-19. Features of the PARALLEL PROTOCOL REQUEST Message

Field	Description
Transfer Period Factor	09h = 12.5 nsec Transfer Period, 80 MHz 0Ah = 25 nsec Transfer Period, 40 MHz 0Ch = 50 nsec Transfer Period, 20 MHz 19h = 100 nsec Transfer Period, 10 MHz 32h = 200 nsec Transfer Period, 5 MHz
REQ/ACK	Request/Acknowledge Offset. The supported values are: • 00h – 0Fh for DT = 0 • 00h – 7Eh for DT = 1, with only even values being allowed.
Transfer Exponent	Valid transfer widths for the tape drive are 8 bits (transfer width = 00h) and 16 bits (transfer width = 01h). Other transfer widths are reserved.
QAS	Not supported; must be set to 0.
DT	Double Transition. This bit indicates a request for double transition clocking, which means that two units of data are transferred for each clock cycle. Support for the PPR message is indicated by the Clocking field in the Standard Inquiry page.
IU	Not supported; must be set to 0.

Table 3-20. PARALLEL PROTOCOL REQUEST (Ext. Message 04h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command

Table 3-20. PARALLEL PROTOCOL REQUEST (Ext. Message 04h) — Message Behavior

When this message is sent to a target after…	The target will…
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	issue PARALLEL PROTOCOL REQUEST response
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	issue PARALLEL PROTOCOL REQUEST response; retry previous MESSAGE-IN phase once • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE, build Sense data

3.2.16 RESTORE POINTERS Message (03h)

A target sends this message to direct the initiator to restore the most recently saved pointers for the currently attached logical unit. The initiator restores pointers to the command, data, and status locations for the logical unit to their active (present) values. The initiator restores command and status pointers to the beginning of the present command and status areas. The initiator 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.

Table 3-21. RESTORE POINTERS (03h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.17 SAVE DATA POINTER Message (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 disconnect during a data transfer. It does not send a SAVE DATA POINTER message if it intends to move directly to STATUS phase.

Table 3-22. SAVE DATA POINTER (02h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	send MESSAGE REJECT; if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	send MESSAGE REJECT and retry previous MESSAGE-IN phase once; • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE and build Sense data

3.2.18 SYNCHRONOUS DATA TRANSFER REQUEST (Extended Message 01h)

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 message, but relies on the initiator to do so. Figure 3-6 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 (03h)							
2	SYNCHRONOUS DATA TRANSFER REQUEST (01h)							
3	Transfer Period: min. = 100 nsec (19h)							
4	Transfer REQ/ACK Offset: max. = 15 nsec (0Fh)							

Figure 3-6. SYNCHRONOUS DATA TRANSFER REQUEST (Ext. Message 01h) — Data Format

Table 3-23. SYNCHRONOUS DATA TRANSFER REQUEST (Ext. Message 01h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command

Table 3-23. SYNCHRONOUS DATA TRANSFER REQUEST (Ext. Message 01h) — Message Behavior (Continued)

When this message is sent to a target after…	The target will…
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target re-selection DATA-IN or DATA-OUT phase STATUS phase	issue SYNCHRONOUS DATA TRANSFER REQUEST response
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	issue SYNCHRONOUS DATA TRANSFER REQUEST response; retry previous MESSAGE-IN phase once • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE, build Sense data

3.2.19 WIDE DATA TRANSFER REQUEST (Extended Message 03h)

The WIDE DATA TRANSFER REQUEST message exchange establishes an agreement between two SCSI devices on the width of the data path to be used for DATA phase transfer between the two devices. All other information transfer phases use an eight-bit data path. Figure 3-7 shows the format for this extended message.

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

Figure 3-7. WIDE DATA TRANSFER REQUEST (Ext. Message 03h) — Data Format

A SCSI device initiates a WIDE DATA TRANSFER REQUEST 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, including:

- 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 WIDE DATA TRANSFER REQUEST 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.

Table 3-24. WIDE DATA TRANSFER REQUEST (Ext. Message 03h) — Message Behavior

When this message is sent to a target after…	The target will…
SELECTION phase	go BUS FREE, build Sense data, and does not force a CHECK CONDITION on the next command
IDENTIFY message is sent to the target COMMAND phase MESSAGE-IN phase target reselection DATA-IN or DATA-OUT phase STATUS phase	issue WIDE DATA TRANSFER REQUEST response and reset to asynchronous transfer mode
SAVE DATA POINTER message is sent to the initiator DISCONNECT message is sent to the initiator COMMAND COMPLETE message is sent to the initiator	issue WIDE DATA TRANSFER REQUEST response and reset to asynchronous transfer mode; retry previous MESSAGE-IN phase once • if successfully retried, then if ATN is asserted, continue to the MESSAGE-OUT phase, or else continue to the next appropriate bus phase • if unsuccessfully retried, then go BUS FREE, build Sense data

CHAPTER 4

SCSI Commands

This chapter describes the supported SCSI commands, options, and error recovery procedures implemented in the Quantum DLT VS160 tape drive system. However, this chapter *does not* fully reiterate every ANSI SCSI message, option, and command code 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 is entirely at the discretion of 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 or unused.

4.2 Summary of Supported Sequential-access Device Commands

The Quantum DLT VS160 tape drive supports the SCSI commands listed in Table 4-1. The table lists each command, its operation code, and the section in this manual that describes each command.

Table 4-1. Supported SCSI Commands

Command	Operation Code	Subsection
ERASE	19h	Page 4-4
INQUIRY	12h	Page 4-5
LOAD/UNLOAD	1Bh	Page 4-21
LOCATE	2Bh	Page 4-23
LOG SELECT	4Ch	Page 4-25
LOG SENSE	4Dh	Page 4-32
MODE SELECT	15h/55h	Page 4-57
MODE SENSE	1Ah/5Ah	Page 4-82
PERSISTENT RESERVE IN (SCSI-3)	5Eh	Page 4-103
PERSISTENT RESERVE OUT (SCSI-3)	5Fh	Page 4-111
PREVENT/ALLOW MEDIUM REMOVAL	1Eh	Page 4-125
READ	08h	Page 4-126
READ BLOCK LIMITS	05h	Page 4-129
READ BUFFER	3Ch	Page 4-131
READ POSITION	34h	Page 4-136
RECEIVE DIAGNOSTICS RESULTS	1Ch	Page 4-141
RELEASE (6)	17h	Page 4-143
RELEASE (10) (SCSI-3)	57h	Page 4-145
REPORT DENSITY SUPPORT (SCSI-3)	44h	Page 4-147
REPORT DEVICE IDENTIFIER (SCSI-3)	A3h	Page 4-152
REPORT LUNS (SCSI-3)	A0h	Page 4-154
REQUEST SENSE	03h	Page 4-156

Table 4-1. Supported SCSI Commands (Continued)

Command	Operation Code	Subsection
RESERVE (6)	16h	Page 4-164
RESERVE (10) (SCSI-3)	56h	Page 4-167
REWIND	01h	Page 4-170
SEND DIAGNOSTIC	1Dh	Page 4-171
SET DEVICE IDENTIFIER (SCSI-3)	A4h	Page 4-173
SPACE	11h	Page 4-175
TEST READY	00h	Page 4-177
WRITE	0Ah	Page 4-178
WRITE BUFFER	3Bh	Page 4-180
WRITE FILEMARKS	10h	Page 4-183

4.3 ERASE Command (19h)

The ERASE command erases data on the media. Any write data currently held in buffer memory and not yet written to the media is flushed to the media before the ERASE command executes.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (19h)							
1	LUN			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. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Immed	Immediate. If Immed is set to 0, the target does not return status until the selected operation has completed. If Immed is set to 1, the target returns the status as soon as the operation has been initiated.
Long	The Long bit controls the distance to be erased. If the bit is set, filler and End of Data (EOD) blocks are written if needed, and then the entire rest of the media is erased. **Note**: This command is a NO OPERATION on the tape drive unless the Long bit is set. Issuing the ERASE command when the media is not at the Beginning of Tape (BOT) is an ILLEGAL REQUEST.

4.4 INQUIRY Command (12h)

The INQUIRY command requests that information regarding tape drive parameters be sent to the initiator.

The tape drive does not need to access its media to respond to the inquiry. The tape drive can provide three categories of data in response to an INQUIRY command:

- Standard Inquiry Data — Standard Inquiry Data contains basic data about the tape drive.
- Vital Product Data — Vital Product Data comprises several pages of additional data. Each Vital Product Data page requires a separate INQUIRY command from the initiator.
- Command Support Data — Command Support Data indicates the fields in the command descriptor block that are supported by each operation code.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	LUN			Reserved			CmdDt	EVPD
2	Page Code or Operation 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 INQUIRY is received from an initiator with a pending ATTENTION condition (before the tape drive reports CHECK CONDITION status), the target performs the INQUIRY and does not clear the ATTENTION condition.

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

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed using an IDENTIFY message.

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

Field Name	Description
CmdDt	Command Support Data. A CmdDt bit of 1 and EVPD bit of 0 specifies that the tape drive returns the command data specified by operation code field. A CmdDt bit of 0 and EVPD bit of 0 specifies that the tape drive returns the standard inquiry data. A CmdDt bit of 1 and EVPD bit of 1 causes the tape return CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN CDB.
EVPD	Enable Vital Product Data. The tape drive implements the Vital Product Data pages option on LUN 0 and the optional medium loader LUN. An EVPD bit of 1 and CmdDt bit of 0 specifies that the tape drive returns the optional vital product data specified by the page code field. An EVPD bit of 0 and CmdDt bit of 0 specifies that the tape drive returns the standard INQUIRY data. An EVPD bit of 1 and CmdDt bit of 1 causes the tape return CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST and an additional sense code of INVALID FIELD IN CDB.
Page Code or Operation Code	When the EVPD bit is set to 1 and the CmdDt bit is 0, the Page/Operation Code field specifies which page of vital product data information the tape drive returns. The following vital product data pages are implemented: **Code** — **Page Definition** 00h — Supported Vital Product Data Page (00h) 80h — Unit Serial Number Page (80h) 83h — Device Identification Page (83h) C0h — Firmware Build Information Page (C0h) C1h — Subsystem Components Revision Page (C1h) If the Page Code field contains an unsupported value, the tape drive returns a CHECK CONDITION with ILLEGAL REQUEST Sense Key and an additional sense code of INVALID FIELD IN CDB. When the CmdDt bit is set to 1 and the EVPD bit is 0, the Operation Code field specifies the command support data information specified by the operation code field.
Allocation Length	This specifies the maximum number of bytes that the initiator has allocated for returned INQUIRY data. An Allocation Length of 0 indicates that no INQUIRY data is transferred. This condition is not considered an error. The tape drive terminates the DATA-IN phase when Allocation Length bytes have been transferred or when all available INQUIRY data has been transferred to the initiator, whichever is less.

4.4.1 Standard INQUIRY Data

The tape drive passes back the following information in response to an INQUIRY command on the tape drive's 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							
16 – 31	Product ID							
32 – 35	Product Revision Level							
36 – 55	Vendor Unique Bytes							
56	Reserved				Clocking		QAS	IUS
57	Reserved							

Figure 4-3. INQUIRY (12h) Standard Data — Data Format

Table 4-4 describes the fields for the data that the tape drive returns.

Table 4-4. INQUIRY (12h) Standard 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 set to 1Fh.
Peripheral Device Type	On the tape drive LUN, this field is set to 01h, indicating a sequential access device. On the medium changer LUN, this field is set to 08h. All other LUNs return 1Fh.	
RMB	Removable Medium Bit. Always set to 1.	
Device Type Modifier	Always set to 0.	
ISO Version	Always set to 0.	
ECMA Version	Always set to 0.	
ANSI-approved Version	This field is set to 2, indicating ANSI SCSI-2 support.	
ANEC	Asynchronous Event Notification. Always set to 0, indicating asynchronous event notification is not supported.	
TrmIOP	Terminate I/O Process. Always set to 0; the TERMINATE I/O PROCESS message is not supported.	
Response Data Format	Set to 2, indicating INQUIRY Data is in SCSI-2 format.	
Additional Length	The tape drive sets this field to indicate the number of additional bytes of INQUIRY Response data available.	
MChngr	Media Changer. Always set to 0, meaning no medium changer commands will be accepted at LUN=0.	
RelAdr	Relative Addressing. Always set to 0.	
WBus32	Wide Bus 32. Always set to 0, indicating the tape drive does not support 32-bit wide data transfers.	
WBus16	Wide Bus 16. Always set to 1, indicating the tape drive supports 16-bit wide data transfers.	

Table 4-4. INQUIRY (12h) Standard Data Page — Field Descriptions (Continued)

Field Name	Description
Sync	Synchronous Data Transfer. Always set to 1, indicating synchronous data transfer is supported.
Linked	Linked Command Support. Always set to 1, indicating linked commands are supported.
CmdQu	Command Queuing. Always set to 0.
SftRes	Soft Reset. Always set to 0.
Vendor Identification	“QUANTUM ”
Product Identification	“DLT VS160 ”
Product Revision Level	This field contains four bytes of ASCII data, which define the product’s software revision levels. In Quantum products, the firmware is located in EEPROM and can be updated in the field. The Product Revision Level field changes appropriately when a firmware update is performed on the tape drive.
Clocking	These bits indicate the level of data clocking. They are set to 11b indicating double-and single-edge transfers are supported (Ultra 160).
QAS	Quick Arbitrate Supported. Quick Arbitration is not supported and thus this bit is always 0.
IUS	Information Units Supported. Information Units are not supported and thus this bit is always 0.

Vendor Unique Bytes

The following information precisely identifies the revision of the DLT VS160 tape drive 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 Subpersonality							
43	Tape Directory Format Version #							
44 - 46	Reserved							
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	(MSB) Hardware Revision (LSB)							

Figure 4-4. INQUIRY (12h) Vendor Unique Bytes — Data Format

Table 4-5. INQUIRY (12h) Vendor Unique Data Page — Field Descriptions

Field Name	Description
Product Family	Use to determine the meaning of the Product Family bit value. **Value** **Drive Density** 3 80/160 GB (VS160)
Released Flag	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 Firmware Version number (byte 2 is 0). For tracking purposes, field test and engineering versions of code have nonzero Minor Firmware Version numbers.
Various Version Numbers	These fields are in binary, not ASCII (see Figure 4-4, Bytes 37-40, 43, 47-49).
Firmware Personality	This field is the numeric indicator of the firmware personality.
Firmware Subpersonality	This indicates the variant of the firmware personality.
Loader Present	When set to 0, indicates that no loader is present.
Library Present	When set to 0, indicates that no library is present.
Hardware Revision	A four byte value that represents the revision of the hardware module.

4.4.2 Vital Product Data Pages

The following sections show the information in the Vital Product Data Pages. The supported vital product data pages are shown in Figure 4-5.

Supported Vital Product Data Page (00h)

The supported pages are:

- Supported Vital Product Data Page (00h)
- Unit Serial Number Page (80h)
- Device Identification Page (83h)
- Firmware Build Information Page (C0h)
- Subsystem Components Revision Page (C1h) (Quantum use only).

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 (05h)							
4	Supported Vital Product Data Page (00h)							
5	Unit Serial Number Page (80h)							
6	Device Identification Page (83h)							
7	Firmware Build Information Page (C0h – Vendor Specific)							
8	Subsystem Components Revision Page (C1h – Quantum use only)							

Figure 4-5. INQUIRY (12h) Supported Vital Product Data Page — Data Format

Unit Serial Number Page (80h)

Figure 4-6 shows the format of the Unit Serial Number page that the tape drive returns.

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. INQUIRY (12h) Unit Serial Number Page — Data Format

Table 4-6. INQUIRY (12h) Unit Serial Number 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 80h identifies this as the Unit Serial Number page.
Page Length	Indicates the size of the returned Unit Serial Number page.
Serial Number	The serial number of the printed circuit card mounted on the bottom of the tape drive. It can be found on the bar code label. The drive returns the serial number in ASCII format.

Device Identification Page (83h)

Figure 4-7 shows the format of the Device Identification page that the tape drive returns.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Page Code (83h)							
2	Reserved							
3	Page Length (*n*-3)							
4 – *n*	Identification Descriptors							

Figure 4-7. INQUIRY (12h) Device Identification Page — Data Format

Table 4-7. INQUIRY (12h) Device Identification 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 83h identifies this as the Device Identification page.
Page Length	Indicates the size of the returned Device Identification page.
Identification Descriptors	Refer to Figure 4-8 on page 4-15.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved				Code Set			
1	Reserved		Association		Identifier Type			
2	Reserved							
3	Identifier Length (*n*-3)							
4 – *n*	Identifier							

Figure 4-8. Identifier Descriptors — Data Format

Table 4-8. Identifier Descriptors — Field Descriptions

Field Name	Description
Code Set	Indicates the type of data found in the Identifier field. A value of 1 indicates binary data. A value of 2 indicates ASCII data.
Association	This field indicates whether the Identifier is associated with the logical unit or the port. It is always set to 0, indicating that the Identifier is associated with the logical unit.
Identifier Type	Type of identifier. (See Table 4-9 on page 4-16 for more detailed information.) **Value** **Description** 01h Concatenation of the Vendor Name, Product ID, and Unit Serial Number. 03h FC-PH Name_Identifier
Identifier Length	Specifies the length in bytes of the Identifier field. If the Allocation Length field of the CDB is too small to transfer the entire identifier, the Identifier Length value is not adjusted to reflect the truncation.
Identifier	The Identifier field contains the identifier as described by the Identifier Type, Code Set, and Identifier Length fields. Refer to Table 4-9 on page 4-16 for details.

The following table describes the identifiers supported by the tape device.

Table 4-9. Device Identification — Supported Identifiers

Identifier Type	Code Set	Identifier Length	Identifier
1	2	34	QUANTUM DLT VS 160, 7 ASCII space characters (20h), followed by the 10 ASCII character unit serial number.
3	1	8	8 bytes of binary data indicating the 64-bit, type 5, FC-PH Name_Identifier assigned to the tape drive.

Firmware Build Information Page (C0h)

Figure 4-9 shows the format of the Firmware Build Information page that the tape drive returns.

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	Controller Firmware Build Date							

Figure 4-9. INQUIRY (12h) Firmware Build Information Page — Data Format

Table 4-10. INQUIRY (12h) Firmware Build Information 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 C0h identifies this as the Firmware Build Information page.
Page Length	Indicates the size of the returned Firmware Build Information page.
Servo Firmware Checksum	The Servo Firmware Checksum is a binary number used for positive firmware identification.
SCSI/Read/ Write Firmware Checksum	The Servo SCSI/READ/WRITE Firmware Checksums are binary numbers used for positive firmware identification.
Controller Firmware Build Date	Firmware Build Date. An ASCII string in DD-MM-YYYY HH:MM:SS format.

Subsystem Components Revision Page (C1h)

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

4.4.3 Command Support Data

The command support data information is sent to the intiator by setting the CmdDt bit of the INQUIRY command to 1 and specifying the SCSI operation code of the command descriptor block (CDB) for which it wants information in the Operation Code field.

Figure 4-10 shows the format of the Command Support Data.

Bit / Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	Reserved					Support		
2	ISO Version		ECMA Version			ANSI-approved Version		
3 – 4	Reserved							
5	CDB Size (*n* – 5)							
6 – *n*	CDB Usage Data							

Figure 4-10. INQUIRY (12h) Command Support Data — Data Format

Table 4-11. INQUIRY (12h) Command Support Data 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.	
Support	The value in this field describes the type of support the drive provides for Command Support Data:	
	Value	**Description**
	000b	Data about the requested SCSI operation code is not currently available. In this case, all data after Byte 1 is undefined.
	001b	The drive does not support the SCSI operation code requested. In this case, all data after Byte 1 is undefined.
	010b	Reserved.
	011b	The drive supports the SCSI operation code in conformance with the SCSI standard.
	100b	Vendor-specific.
	101b	The drive supports the SCSI operation code, but in a vendor-specific manner.
	110b	Vendor-specific.
	111b	Reserved.
ISO Version	Always set to 0.	
ECMA Version	Always set to 0.	
ANSI-approved Version	This field is set to 2, indicating ANSI SCSI-2 support.	
CDB Size	Contains the number of bytes in the CDB for the requested OpCode and the size of the CDB Usage Data in the data that the drive returns in response to the INQUIRY command.	

Table 4-11. INQUIRY (12h) Command Support Data Page — Field Descriptions (Continued)

Field Name	Description
CDB Usage Data	Contains information about the CDB for the OpCode being queried. Note that the first byte of the CDB Usage Data contains the OpCode for the specified operation. All of the other bytes of the CDB Usage Data contain a map for bits in the CDB of the specified OpCode. The bits in the map have a one-to-one correspondence to the CDB for the OpCode being queried. This means that if the drive senses a bit as the entire field or as part of the field of the operation, the map in the CDB Usage Data contains a 1 in the corresponding bit position. If the drive ignores a bit or declares a bit as “reserved” in the CDB for the OpCode being queried, the map has a 0 in the corresponding bit position.

4.5 LOAD/UNLOAD Command (1Bh)

The LOAD/UNLOAD command informs the target to load or unload the data cartridge from the tape drive. If a data cartridge is not 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 tape motion or TEST READY, the tape drive returns a CHECK CONDITION status with a NOT READY Sense Key set.

Operation of this command differs if a medium changer device is present. Two modes of operation are possible, sequential mode and random mode, when a medium changer device is present. The medium changer device is under the default sequential mode after a power-on reset or SCSI bus reset. If a medium changer specific command (INITIALIZE ELEMENT STATUS, MOVE MEDIUM, or READ ELEMENT STATUS commands) is issued to the medium changer device then the device operates in random mode and remains there until the next power-on reset or SCSI bus reset.

- In random mode, the UNLOAD portion of this command is a NO-OP when a data cartridge is present in the tape drive. If a cartridge is not present in the tape drive the UNLOAD command returns CHECK CONDITION status with a NOT READY Sense Key set.
- In sequential mode, the command unloads the current data cartridge into the slot from which it came. The next slot's cartridge will be automatically loaded into the tape drive only if the slot is populated.

When a data cartridge is unloaded into the last slot and circular mode is disabled, then the command exits with GOOD status and the tape drive remains empty. However, if circular mode is enabled, then the data cartridge from the next populated slot is loaded into the tape drive by wrapping from the last slot back to the first.

A medium changer device does not affect how the tape drive processes the LOAD portion of this command.

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

Figure 4-11. LOAD/UNLOAD (1Bh) Command Descriptor Block — Data Format

Table 4-12. LOAD/UNLOAD (1Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Immed	Immediate. If this bit is set to 1, status is returned as soon as the operation is started. Otherwise, the status is returned after the operation has completed.
EOT	End of Tape. The tape drive ignores this bit unless both the EOT and Load bits are set, then the tape drive returns returns a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key set.
Re-Ten	Re-tension. Re-tension operations are not needed on the tape drive, so this bit is ignored (that is, status is GOOD, even if the bit is set).
Load	When a data cartridge is inserted, the media is automatically loaded and positioned by the tape drive at BOM. Logically, the tape drive is positioned at the beginning of Partition 0. If the Load bit is set to 1 and the media is already loaded, no action is taken. If the Load bit is set to 0 and the media is loaded, the tape drive writes any buffered data and filemarks to the tape, rewinds the tape to BOM, and unloads the media into the cartridge. The tape drive partially ejects the data cartridge, which can then be removed the rest of the way.

4.6 LOCATE Command (2Bh)

The LOCATE command is used for high-speed positioning to the specified block address.

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.

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

Figure 4-12. LOCATE (2Bh) Command Descriptor Block — Data Format

Table 4-13. LOCATE (2Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
BT	Block Type. This bit indicates how the Block Address field is interpreted. However, SCSI Logical Block addresses are always returned, 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	Current Partition. Since multiple partitions are not supported this bit must be set to 0.
Immed	Immediate. If this bit is set to 1, status is returned as soon as the operation is started. Otherwise, the status is returned after the operation has completed.
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.
Partition	Not supported. Always set to 0.

4.7 LOG SELECT Command (4Ch)

LOG SELECT allows the host to manage statistical information maintained by the device about its own hardware or the installed media. All types of parameter values are changeable through LOG SELECT. Read the description of the LOG SENSE command on page 4-32; 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	LUN			Reserved			PCR	SP(0)
2	PC		Reserved					
3 – 6	Reserved							
7	(MSB)							
8	Parameter List Length							(LSB)
9	Unused		Reserved				Flag	Link

Figure 4-13. LOG SELECT (4Ch) Command Descriptor Block — Data Format

Table 4-14. LOG SELECT (4Ch) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
PCR	Parameter Code Reset. If this bit is set to 1 and Parameter List Length is 0, all cummulative values of page code 02h and 03h are set to default values, and page 32h values are reset to 0. All threshold values of page code 02h and 03h are also set to defaults. If the PCR is set to 1 and the Parameter List Length Field is not 0, the command is terminated with a CHECK CONDITION status, with Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB.
SP	Save Page. This bit is not supported and must be set to 0. If the SP bit is set to 1, the command is terminated with CHECK CONDITION status, with Sense Key of ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB.

Table 4-14. LOG SELECT (4Ch) Command Descriptor Block — Field Descriptions (Continued)

Field Name	Description
PC	Page Control. This field defines the type of parameter values to be selected. **Note:** All types of parameter values are changeable through LOG SELECT. **Code** — **Type of Parameter Values** 00b — Threshold Values 01b — Cumulative Values 10b — Default Threshold Values 11b — Default Cumulative Values When the PC field is set to 00b or 01b and the Parameter List Length is 0, the command is terminated 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 set to 10b and the Parameter List Length field is 0, then all Current Threshold Values of page code 02h and 03h are reset to their Default Threshold Values. This is equivalent to no change, since Threshold Values cannot be modified. When the PC field is set to 11b and the Parameter List Length field is 0, then all Current Cumulative Values of page code 02h and 03h are reset to their Default Cumulative Values, and those of page 32h are reset to 0.
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). If a parameter list length results in the truncation of any log parameter, the tape drive terminates the command with CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, and ASC of INVALID FIELD IN CDB.

4.7.1 Error Detection Summary in LOG SELECT CDB

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

- PCR bit is set to 1 and parameter list length is not 0.
- SP bit is set to 1.
- A parameter list length that would cause a parameter within a valid page to be truncated or otherwise incompletely initialized.
- A PC value of 00b or 01b and Parameter List Length is 0.

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 device.

The two ways to initialize the log parameters are:

1. By setting the PCR bit in the LOG SELECT CDB, you can immediately clear all parameters of page codes 02h, 03h, and 32h.

2. Specify the log page and the parameter value as the log parameters can change individual pages. The following pages can be changed using this method.

Table 4-15. LOG SELECT (4Ch) DATA-OUT Phase Codes

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

NOTE: The Page Control value is ignored for page code 32h. When specifying log parameters it is assumed that the cumulative values are changed. Furthermore, the setting of parameters 0 and 1 for page code 32h will be ignored. You can set all parameters but 0 and 1.

If multiple pages are sent during this DATA-OUT phase, they must be sent 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 ASC of INVALID FIELD IN PARAMETER LIST.

The same status is returned if an unsupported Page Code appears in any header or if the specified page cannot be changed.

If any log parameters are changed that affect other initiators, then the target generates a unit attention condition for all initiators except the one that issued the LOG SELECT command. This unit attention condition is returned with an ASC of LOG PARAMETERS CHANGED.

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.

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

Figure 4-14. LOG SELECT Log Page Header — Header Format

Table 4-16. LOG SELECT Log Page Header — Field Descriptions

Field Name	Description
Page Code	The Page Code specifies which Log Page this LOG SELECT command is for.
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	(MSB)							
1	Parameter Code							(LSB)
2	DU	DS	TSD	ETC	TMC		Rsv'd	LP
3	Parameter Length (n – 3)							
4	(MSB)							
…	Parameter Value							
…								
n								(LSB)

Figure 4-15. LOG SELECT Log Page Parameters — Data Format

NOTE: Byte 2 of the log parameter block in Figure 4-15 is commonly referred to as the Parameter Control Byte.

Table 4-17. LOG SELECT Log Parameters — Field Descriptions

Field Name	Description
Parameter Code	Refer to the LOG SENSE command on page 4-32 for an explanation of the parameter codes supported for the requested log page.
DU	Disable Update. If set to 1, this bit disables parameter counter updates.
DS	Disable Save. Saving parameters is not supported. Set both DS and TSD to 1. If either the DS or TSD bits are set to 0, the command is terminated with CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, and an ASC of INVALID FIELD IN PARAMETER LIST.
TSD	Target Save Disable. Saving parameters is not supported. Set both to 1. If the DS and/or TSD are set to 0, the command is terminated with CHECK CONDITION status, with the Sense Key set to ILLEGAL REQUEST, and an ASC of INVALID FIELD IN PARAMETER LIST.
ETC	Enable Threshold Comparison. When set to 1, the tape drive performs a comparison with threshold values after the cumulative value is updated. Comparison criteria are defined in TMC. If the comparison is met and the RLEC bit of MODE SELECT/SENSE Control Page is set to 1, then a ATTENTION ***is*** generated for all initiators. The ASC is set to LOG EXCEPTION and the ASCQ is set to THRESHOLD CONDITION MET. If the RLEC bit is 0 and the comparison is met, then the ATTENTION ***is not*** generated.
TMC	Threshold Met Criteria. See Table 4-20 on page 4-37 for the list of criteria. After the specified criteria in this field is met, the ETC bit is set to 1, the RLEC bit in the MODE SENSE/SELECT Control Page is set to 1, and ATTENTION is generated for all initiators. If the RLEC bit is 0 and the comparison is met, then the ATTENTION ***is not*** generated.
LP	List Parameter. This bit should always be set to 0, indicating 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.

4.7.4 Error Detection Summary in LOG SELECT Pages

The host should issue a LOG SENSE command to initialize host-resident software, which allows:

- Correct determination of the pages the tape drive uses.
- Determination of 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 data set to ILLEGAL REQUEST, and the ASC set to INVALID FIELD IN PARAMETER LIST:

- If a page header is received containing unsupported page codes.
- If a reserved field is set.
- Incorrect Log Page length is specified in the page header.
- An illegal parameter code within a valid page code.
- Parameter codes for a supported page are not sent in ascending order.
- Page codes are not sent in ascending order.
- LP bit is set to 1 in the parameter control byte.
- DS bit is set to 0 in the parameter control byte.
- TSD bit is set to 0 in the parameter control byte.
- Parameter length that results in the truncation of parameter value.

4.8 LOG SENSE Command (4Dh)

The LOG SENSE command allows the host to retrieve statistical information the device 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	LUN			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 4-16. LOG SENSE (4Dh) Command Descriptor Block — Data Format

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

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
PPC	Parameter Pointer Control. This bit must be set to 0. A PPC bit of 0 indicates that the parameter data requested from the device 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 Pointer field of 0 cause all available parameter data for that page code to be returned to the initiator.

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

Field Name	Description
PPC, *cont.*	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. The Sense Key is set to ILLEGAL REQUEST, with an ASC of INVALID FIELD IN CDB. **Note:** If the target does not support a parameter code within this page, it does not return any data associated with this parameter.
SP	Parameters Savable (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 ASC of INVALID FIELD IN CDB.
PC	Page Control. The PC field defines the type of parameter values to be returned. These parameter types are only relevant for page codes 02h and 03h. For all other page codes the page control field is ignored within the CDB. **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 device (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.
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 ASC of INVALID FIELD IN CDB. Supported pages are as follows: **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

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

Field Name	Description
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 set to ILLEGAL REQUEST and the ASC is set to INVALID FIELD IN CDB. **Note:** Parameters within a page are always returned in ascending order according to parameter code.
Allocation Length	Allocation Length. This field is used to inform the target how much space the initiator has allocated for data. An Allocation Length of 0 means that the tape drive returns no Log Sense data. This is not considered an error and GOOD status is returned.

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. The Sense data is set to ILLEGAL REQUEST, INVALID FIELD IN CDB.

- If a page is not supported.
- If the parameter pointer is larger than the highest numbered parameter on the page.
- If the SP bit is set to 1.

4.8.2 Supported Pages LOG SENSE Page (00h)

When the host requests Page 00h, the tape drive returns the 4-byte page header followed by the pages supported 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 4-17. Supported Pages LOG SENSE Page — 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.

Figure 4-18 shows the header format of the Read/Write Error LOG SENSE page (02h or 03h).

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (02h or 03h)					
1	Reserved							
2 - 3	(MSB) Page Length (LSB)							

Figure 4-18. Read/Write Error LOG SENSE Page Header — Header Format

Table 4-19. Read/Write Error LOG SENSE 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 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 03Ch, followed by 8 bytes of log parameter data for each parameter code, except for parameter code 05h. For code 05h, it returns 12 bytes. For parameter codes 00h, 01h, 02h, 03h, 04h, and 06h, each log parameter is 8 bytes. For log parameter code 05h, each log parameter is 12 bytes.

Figure 4-19 shows the parameter format of the Read/Write Error LOG SENSE Page (02h or 03h).

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							
4 - 7	(MSB) Parameter Value (LSB)							

Figure 4-19. Read/Write Error LOG SENSE Page — Data Format

Table 4-20. Read/Write Error LOG SENSE Page Parameters — Field Descriptions

Field Name	Description
Parameter Code	The following parameter codes are supported for the Read/Write Error log 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
DU	Disable Update. A value of 0 indicates that the target updates all log parameter values. A value of 1 indicates that the 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 set to 1.
TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always set to 1.

Table 4-20. Read/Write Error LOG SENSE Page Parameters — Field Descriptions (Continued)

Field Name	Description
ETC	Enable Threshold Comparison. ETC of 1 indicates that a comparison to threshold is performed. ETC of 0 indicates that this comparison is not performed. This bit is set to 1 by the LOG SELECT command. Default is 0.
TMC	Threshold Met Criteria. This field is valid only if the host sets ETC to 1. It determines the basis for comparison and the host specifies it by LOG SELECT. If the result of comparison is true (cumulative = threshold) and the MODE SELECT/ SENSE Control Mode page RLEC bit is set 1, a UNIT ATTENTION is generated for all initiators. The Sense Key is set to UNIT ATTENTION, ASC is set to LOG EXCEPTION, and ASCQ is set to THRESHOLD CONDITION MET. If the RLEC bit in the Control Mode page is 0, the UNIT ATTENTION is not generated. **Note**: This comparison is performed in real time. You do not need to issue a LOG SENSE command to get the check condition. Once ETC is selected and the RLEC bit in the Control Mode page is set to 1, the drive issues a CHECK CONDITION based on the criteria defined in the TMC bits—if the criteria is met in real time. The check condition does not identify the parameter code for which the criteria is met. The host must issue a LOG SENSE command to read the counters to see the parameter code for which criteria has been met. **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 set to 0; 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 set to 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 set to 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 LOG SENSE Page (07h)

This page returns one parameter at a time that consists of the ASCII text for the specified event log. A maximum of 30 log events are stored at a given time in the EEPROM. The Parameter Pointer field in the command descriptor block specifies with which parameter code the requested data should begin.

Figure 4-20 shows the header format of the Last n Error Events LOG SENSE Page (07h).

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (07h)					
1	Reserved							
2 - 3	(MSB) Page Length (LSB)							

Figure 4-20. Last n Error Events LOG SENSE Page Header — Header Format

Table 4-21. Last n Error Events LOG SENSE Page Header — Field Descriptions

Field Name	Description
Page Code	The page code echoes the page code that was specified in the LOG SENSE command descriptor block.
Page Length	The page length specifies the total number of bytes contained in this log page, not including the four bytes of the header.

Figure 4-21 shows the parameter format of the Last n Error Events LOG SENSE Page (07h).

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							
4 - n	(MSB) Parameter Code (LSB)							

Figure 4-21. Last n Error Events LOG SENSE Page Parameters — Data Format

Table 4-22. Log Parameters for Last n Error Events LOG SENSE Page — Field Descriptions

Field Name	Description
Parameter Code	Parameter code values are assigned from 0 to 29, where 0 is the oldest event stored and the highest parameter code returned represents the most recent event. One parameter code is 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 code for the 10^{th} event is parameter code 9. If the parameter pointer field in the CDB contains 0, the target returns parameter codes 0 to 9 to the initiator. If the parameter pointer in the CDB contains 20, the target returns the log page header with page length of 0.
DU	Disable Update. For a list parameter, this field is always 0.
DS	Disable Save. Since the tape drive does not support saving parameters, this bit is always set to 1.
TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always set to 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; the tape drive treats the parameter codes as list parameters.
Parameter Length	This field specifies the number of bytes of the parameter value. This field is always set to 0xFC.

Table 4-22. Log Parameters for Last n Error Events LOG SENSE Page — Field Descriptions

Field Name	Description
Parameter Code	The content of the parameter is an ASCII string that 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 LOG SENSE 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 set to 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. There are a total of 64 one-byte flags, some of which are reserved or not supported by the tape drive.

Figure 4-22 shows the header format of the TapeAlert LOG SENSE Page (2Eh) .

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		Page Code (2Eh)					
1	Reserved							
2 - 3	(MSB) Page Length (140h) (LSB)							

Figure 4-22. TapeAlert Log Page LOG SENSE Page Header — Header Format

Table 4-23. TapeAlert LOG SENSE 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 specifies the total number of bytes contained in this log page, not including the four bytes of the header.

Figure 4-23 shows the parameter format of the TapeAlert LOG SENSE Page (2Eh).

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 (01h)							
4	Parameter Code (Value of Flag)							

Figure 4-23. TapeAlert LOG SENSE Page Parameters — Data Format

Table 4-24. TapeAlert LOG SENSE Page Parameters — Field Descriptions

Field Name	Description	
Parameter Code	The Parameter Code field contains the TapeAlert flag number. All 64 flags are reported when the TapeAlert LOG SENSE page is requested.	
	Code	**Description**
	0001h	Not supported.
	0002h	Not supported.
	0003h	Hard Error. A write or read hard error has occurred.
	0004h	Media. The number of read or write errors being encountered indicates that the media should be replaced.
	0005h	Read Failure. A hard read error has occurred.
	0006h	Write Failure. A hard write error has occurred.
	0007h	Not supported.
	0008h	Not supported.
	0009h	Write Protect. An attempt was made to write to a write-protected tape.
	000Ah	Not supported.
	000Bh	Not supported.

Table 4-24. TapeAlert LOG SENSE Page Parameters — Field Descriptions (Continued)

Field Name	Description	
	000Ch	Unsupported Format. The tape drive is unable to detect the tape format on the inserted tape.
	000Dh	Not supported.
	000Eh	Not supported.
	000Fh	Not supported.
	0010h	Not supported.
	0011h	Read Only Format. The cartridge loaded in this tape drive is of a type that is read-only.
	0012h	Tape Directory Corrupted. The directory on the tape cartridge has been corrupted.
	0013h	Not supported.
	0014h	Clean Now. Excessive read or write errors due to a dirty tape path; the cleaning LED is on.
	0015h	Cleaning Periodic. A periodic cleaning is due; the cleaning LED is on.
	0016h	Not supported.
	0017h	Not supported.
	0018h – 001Ch	Reserved.
	001Dh	Not supported.
	001Eh	Hardware A. Major hardware failure.
	001Fh	Hardware B. Major hardware failure.
	0020h	Interface. SCSI interface parity error detected.
	0021h	Eject Media. A load failure occurred; eject the media and try again.
	0022h	Download Fail. Microcode update failed.
	0023h	Not supported.
	0024h	Not supported.
	0025h	Not supported.
	0026h	Not supported.
	0027h	Not supported.

Table 4-24. TapeAlert LOG SENSE Page Parameters — Field Descriptions (Continued)

Field Name	Description	
	0028h	Loader Hardware A. The medium changer mechanism is having difficulty communicating with the tape drive.
	0029h	Not supported.
	002Ah	Loader Hardware B. The medium changer mechanism is having a problem.
	002Bh	Loader Door. Operation failed because medium changer door is open.
	002Ch – 002Eh	Not supported.
	002Fh – 0040h	Reserved.
DU	Disable Update. For a list parameter, this field is always 0.	
DS	Disable Save. Since the tape drive does not support saving parameters, this bit is always set to 1.	
TSD	Target Save Disable. Since the tape drive does not support saving parameters, this bit is always set to 1.	
ETC	Enable Threshold Comparison. For a list parameter this field is always 0.	
TMC	Threshold Met Criteria. This bit is always set to 0.	
LP	List Parameter. This bit is always set to 0.	
Parameter Length	This field specifies the number of bytes of the parameter value. This field is always set to 0x01.	
Parameter Value	This field indicates whether the TapeAlert flag is set or cleared. A value of 1 indicates that the TapeAlert flag is set.	

Each TapeAlert flag is set to 0 in the following circumstances:

- At tape drive power-on.
- When the TapeAlert Log Sense page is read.
- When the specified corrective action has been taken.
- On SCSI bus reset or device reset messages.

NOTE: When a flag is cleared by reading the TapeAlert LOG SENSE Page, a flag can not be set again until the error condition is removed (the specific corrective action has been taken). Any other method of clearing allows the TapeAlert flag to be set.

4.8.6 Read/Write Compression Ratio LOG SENSE Page (32h)

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

Figure 4-24 shows the header format of the Read/Write Compression Ratio LOG SENSE Page (32h).

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

Figure 4-24. Read/Write Compression Ratio LOG SENSE Page Header — Header Format

Table 4-25. Read/Write Compression Ratio LOG SENSE 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 specifies the total number of bytes contained in this log page, not including the four bytes of the header.

Figure 4-25 shows the format of the Read/Write Compression Ratio LOG SENSE Page (32h).

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							
4 - n	(MSB) Parameter Value (LSB)							

Figure 4-25. Read/Write Compression Ratio LOG SENSE Page — Data Format

Table 4-26. Read/Write Compression Ratio LOG SENSE Page — Field Descriptions

Field Name	Description
Parameter Codes	The following parameter codes are supported for the Read/Write Compression Ratio page: **Code** — **Description** 00h — Read Compression Ratio x 100 01h — Write Compression Ratio x 100 02h — MB Transferred to Host 03h — Bytes Transferred to Host 04h — MB Read from Tape 05h — Bytes Read from Tape 06h — MB Transferred from Host 07h — Bytes Transferred from Host 08h — MB Written to Tape 09h — Bytes Written to Tape
DU	Disable Update. This bit is always 0.
DS	Disable Save. Saving parameters is not supported. This bit is always set to 1.
TSD	Target Save Disable. Saving parameters is not supported. This bit is always set to 1.
ETC	Enable Threshold Comparison. Threshold checking is not supported on this page. This bit is always set to 0.
TMC	Threshold Met Criteria. Always set to 0.

Table 4-26. Read/Write Compression Ratio LOG SENSE Page — Field Descriptions (Continued)

Field Name	Description
LP	List Parameter. This bit is always set to 0; the tape drive treats the parameter codes as data counters.
Parameter Length	This field specifies the number of bytes of the parameter value. This field is set to 0x02 for parameter code 00h and 01h, otherwise this field is set to 0x04 for parameter codes 02h through 09h.
Parameter Value	See Figure 4-26 and Figure 4-27 for specific information.

Parameter Value: Codes 0000h and 0001h

The value of this parameter contains the compression ratio. The compression ratio is reported as the actual compression ratio multiplied by 100.

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 4-26. Read/Write Compression Ratio LOG SENSE Page Parameter Codes (00h and 01h) — Data Format

Parameter Value: Codes 0002h through 0009h

This block contains a counter value, whose value is explained in Table 4-27.

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 - 5	(MSB) Counter Value (LSB)							

Figure 4-27. Read/Write Bytes Transferred LOG SENSE Page Parameter Codes (02h through 09h) — Data Format

Table 4-27. Log Parameters for Read/Write Bytes Transferred LOG SENSE Page — Field Descriptions (Parameter Codes 02h through 09h)

Field Name	Description
Parameter Length	This field specifies the number of bytes of the parameter value. This field is set to 0x02 for parameter code 00h and 01h, otherwise this field is set to 0x04 for parameter codes 02h through 09h.
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 02h and 03h — Reports the counts of bytes transferred from the tape drive to the initiator. Parameter code 02h reports the number of full megabytes transferred. Parameter code 03h reports the number of bytes less than a full megabyte that have been transferred. Multiplying the counter returned for parameter 02h by 1,048,576 and then adding the counter value returned for parameter 03h gives the actual total bytes transferred to the initiator. Parameter codes 04h and 05h — Reports the counts of bytes transferred from the media to the buffer. Parameter code 04h reports the number of full megabytes transferred. Parameter code 05h reports the number of bytes less than a full megabyte that have been transferred. Multiplying the counter returned for parameter 04h by 1,048,576 and then adding the counter value returned for parameter 05h gives the actual total bytes transferred from tape to buffer.

Table 4-27. Log Parameters for Read/Write Bytes Transferred LOG SENSE Page — Field Descriptions (Parameter Codes 02h through 09h) (Continued)

Field Name	Description
Counter Value	Parameter codes 06h and 07h — Reports the counts of bytes transferred from the initiator to the buffer. Parameter code 06h reports the number of full megabytes transferred. Parameter code 07h reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 06h by 1,048,576 and then adding the counter value returned for parameter 07h will give the actual total bytes transferred from the initiator to the buffer. Parameter codes 08h and 09h — Reports the counts of bytes written to the tape. Parameter code 08h reports the number of full megabytes transferred. Parameter code 09h reports the number of bytes less than a full megabyte that has been transferred. Multiplying the counter returned for parameter 08h by 1,048,576 and then adding the counter value returned for parameter 09h will give the actual total bytes written to the tape.

4.8.7 Device Wellness LOG SENSE Page (33h)

This LOG SENSE page returns the data useful for determining the device 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. On the other hand, it captures *all* error events associated with a Sense Key 3 or 4.

Figure 4-28 shows the header format of the Device Wellness LOG SENSE Page (33h).

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

Figure 4-28. Device Wellness LOG SENSE Page Header — Header Format

Table 4-28. Device Wellness LOG SENSE 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 specifies the total number of bytes contained in this log page, not including the four bytes of the header.

Figure 4-29 shows the parameter format of the Device Wellness LOG SENSE Page (33h).

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)							
8 - 11	(MSB) Media ID (LSB)							
12	Sense Key							
13	Additional Sense Key							
14	Additional Sense Code Qualifier							
15	Additional Error Information							

Figure 4-29. Device Wellness LOG SENSE Page Parameters — Data Format

Table 4-29. Device Wellness LOG SENSE Page Parameters — Field Descriptions

Field Name	Description
Parameter Codes	Parameter codes 0000h to 000Fh are supported by the Device Wellness LOG SENSE log page.
DU	Disable Update. This bit is always set to 0.
DS	Disable Save. Saving parameters is not supported on the tape drive. This bit is always set to 1.
TSD	Target Save Disable. Saving parameters is not supported. This bit is always set to 1.
ETC	Enable Threshold Comparison. Threshold checking is not supported on this page. This bit is always set to 0.
TMC	Threshold Met Criteria. This bit is always set to 0.
LP	List Parameter. This bit is always set to 0.
Parameter Length	This field specifies the number of bytes of the parameter value. This field is always set to 0x0C.
Time Stamp	Power-on hours when error event occurred.
Media ID	Identity of the media being used when the error event occurred. Set to 0 if no media or media unknown.
Sense Key/Code Information	Sense information from when the error event occurred.

4.8.8 Device Status LOG SENSE Page (3Eh)

The Device Status LOG SENSE page describes the current status of the device. There are three 4-byte log parameters defined in this page.

Figure 4-30 shows the header format of the Device Status LOG SENSE Page (3Eh).

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

Figure 4-30. Device Status LOG SENSE Page Header — Header Format

Table 4-30. Device Status LOG SENSE Page Header — Field Descriptions

Field Name	Description
Page Code	The Page Code echoes the page code that was specific 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.

Figure 4-31 shows the parameter format of the Device Status LOG SENSE Page (3Eh).

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 4-31. Device Status LOG SENSE Page Parameters — Data Format

Table 4-31. Device Status LOG SENSE Page Parameters — Field Descriptions

Field Name	Description
Parameter Codes	Parameter codes 0000h to 0002h are supported by the Device Status LOG SENSE page.
DU	Disable Update. This bit is always set to 0.
DS	Disable Save. Saving parameters is not supported on the tape drive. This bit always set to 1.
TSD	Target Save Disable. Saving parameters is not supported. This bit is always set to 1.
ETC	Enable Threshold Comparison. Threshold checking is not supported on this page. This bit is always set to 0.
TMC	Threshold Met Criteria. This bit is always set to 0.
LP	List Parameter. This bit is always set to 0.
Parameter Length	This field specifies the number of bytes of the parameter value. This field is always set to 0x04.
Parameter Value	This field may contain any of the following values:

Table 4-31. Device Status LOG SENSE Page Parameters — Field Descriptions (Continued)

Field Name	Description	
	Parameter Code	**Description**
	0000h	This parameter specifies the device type. For sequential type devices, the parameter value is always 00 01 00 00h.
	0001h	This parameter specifies the device-cleaning-related status. There are three bits currently defined for this parameter. For details, see Table 4-32.
	0002h	The value of this parameter contains the number of loads over the life of the device.

Figure 4-32 shows the Device Status LOG SENSE Page parameter code (0001h) description:

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

Figure 4-32. Device Status LOG SENSE Page Parameter Code (0001h)

Table 4-32. Parameter Values for Device Status LOG SENSE Page (Cleaning Related) — 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 tape is completely used up.

4.9 MODE SELECT (6) / (10) Command (15h / 55h)

The MODE SELECT command enables the host to configure the device. 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 command to get the current configuration and determine what parameters are configurable. The host interprets this information and can then issue a MODE SELECT command 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	LUN			PF	Reserved			SP(0)
2 - 3	Reserved							
4	Parameter List Length							
5	Unused		Reserved				Flag	Link

Figure 4-33. MODE SELECT (6) (15h) Command Descriptor Block — Data Format

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

Figure 4-34. MODE SELECT (10) (55h) Command Descriptor Block — Data Format

The tape drive always powers on 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.

If an initiator sends a MODE SELECT command that changes any parameters applying to other initiators, the target generates a unit attention condition for all initiators except the one that issued the MODE SELECT command. The target sets the ASC to MODE PARAMETERS CHANGED.

Table 4-33. MODE SELECT (15h / 55h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
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 with ASQ of INVALID FIELD IN CDB to have page parameters while the PF bit is set to 0.
SP	Parameters Savable (saving log parameters). Not supported, this bit is always 0.
Parameter List Length	Parameter List Length. This field specifies the length (in bytes) of the MODE SELECT parameter list that is transferred during the DATA-OUT phase. A Parameter List Length set to 0 indicates that no data is transferred. The tape drive terminates the command with CHECK CONDITION status, with Sense Key of ILLEGAL REQUEST, and ASC of PARAMETER LIST ERROR, if the parameter list length results in the truncation of any mode parameter header, mode parameter block descriptor(s), or mode page.

4.9.1 MODE SELECT Pages

Following the Command Block Descriptor come the MODE SELECT pages, which set the device parameters. Each page has a 2-byte header that identifies the page code and indicates the number of bytes in that page. The following table lists the MODE SELECT pages supported and the location of the sections in this manual detailing each page:

Page Code	Description	Refer to
01h	Read/Write Error Recovery Page	Page 4-64
02h	Disconnect/Reconnect Page	Page 4-65
0Ah	Control Mode Page	Page 4-67
0Fh	Data Compression Page	Page 4-69
10h	Device Configuration Page	Page 4-71
11h	Medium Partition Page	Page 4-73
1Ch	TapeAlert Page	Page 4-74
3Eh	EEPROM Vendor Specific Page	Page 4-78

4.9.2 MODE SELECT Parameter List

The MODE SELECT (6) parameter list shown in Figure 4-35, Figure 4-36, and Figure 4-37 contains a 4-byte header, followed by one 8-byte block descriptor if the block descriptor length is set to 8.

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

Figure 4-35. MODE SELECT (6) Mode Page Parameter Header — Header 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 4-36. MODE SELECT (6) Mode Page Parameter Block Descriptor — Data Format

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

Figure 4-37. MODE SELECT (6) Mode Page Parameter Descriptors — Data Format

The MODE SELECT (10) parameter list shown in Figure 4-38, Figure 4-39, and Figure 4-40 contains an 8-byte header, followed by one 8-byte block descriptor (if the block descriptor length is set to 8).

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

Figure 4-38. MODE SELECT (10) Mode Page Parameter Header — Header 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 4-39. MODE SELECT (10) Mode Page Parameter Block Descriptor — Data Format

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

Figure 4-40. MODE SELECT (10) Mode Page Parameter Descriptors — Data Format

Table 4-34. MODE SELECT Mode 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 Buffered Mode field is set to 0, the tape drive does not report a GOOD status on WRITE commands until the data blocks are actually written to tape. If the Buffered Mode field is set to 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 disabled, the tape drive suffers a degradation in performance and possibly capacity as well, depending on tape format, block size, and compression. If the tape drive is writing in block sizes that are a multiple of 8 Kbytes, 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. This field must be set to 0. Any other value causes a CHECK CONDITION status with an ILLEGAL REQUEST Sense Key.
Block Descriptor Length	This field specifies the length, in bytes, of all the block descriptors. Because the tape drive only allows one block descriptor, this value must be set to 8 or 0.
Density Code	This field should match the current density of the media. If this value is set to 0, the default density is used. **Density Code** — **Description** 00h — Use default density 40h — DLT1 format 50h — VS160 format – 80 GB 98h — VS160 format – 80 GB without compression 99h — VS160 format – 160 GB with compression 7Fh — No changes from previous density (No operation) **Notes:** **1** Setting density code = 50h does not implicitly change the state of compression. **2** Setting density code = 98h implicitly changes the compression to off. **3** Setting density code = 99h implicitly changes the compression to on. **4** Setting density code = 00h, when present density code = 98h will change the density code = 99h. The state of compression changes to on. **5** Setting density code = 00h, when present density code = 99h will not change the density code. The state of compression remains on. **6** Setting density code = 00h, when present density code = 50h will not change the density code. The state of compression is not changed.

Table 4-34. MODE SELECT Mode Parameter List — Field Descriptions (Continued)

Field Name	Description
Number of Blocks	This MODE SENSE field is sent as 0, indicating that all of the remaining logical blocks on the tape 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- and WRITE-type commands that specify a “Fixed” bit of 1 (for example, Fixed Block Mode) which also causes the transfer length in the CDB to be defined as a block count. Odd Block Length values are not accepted.
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, the supported parameters cannot be saved. The tape drive does not support Savable pages. Byte 0, bit 6 must be 0.
Additional Page Length	This field indicates the number of bytes in that page. However, the value does not include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set 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 a 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	ERR	PER	DTE	DCR
3	Read Retry Count							
4 - 7	Reserved							
8	Write Retry Count							
9 - 11	Reserved							

Figure 4-41. Read/Write Error Recovery MODE SELECT Page — Data Format

In this page, only the Post Error (PER) flag parameter is changeable. If PER is set, Check Conditions are created, with Sense Key of RECOVERED ERROR, and vendor-unique Sense data detailing the cause. These events should be rare and they only occur if the recovered write or read retry rates reach excessive levels.

Table 4-35. Read/Write Error Recovery MODE SELECT Page — Field Descriptions

Field Name	Description
TB	The Transfer 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 feature is not supported, so this bit must be 0.
Read Retry Count	This field specifies the maximum number of times the tape drive tries to reread before declaring an unrecoverable error.
Write Retry Count	This field specifies 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 format shown in Figure 4-42.
Note: In this page, only the Maximum Burst Size and the DTDC parameters are changeable.

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 4-42. Disconnect/Reconnect MODE SELECT Page — Data Format

Table 4-36. Disconnect/Reconnect MODE SELECT Page — Field Descriptions

Field Name	Description
Buffer Full Ratio	Not supported, this bit is always 0.
Buffer Empty Ratio	Not supported, this bit is always 0.
Bus Inactivity Limit	Not supported, this bit is always 0.
Disconnect Time Limit	Not supported, this bit is always 0.
Connect Time Limit	Not supported, this bit is always 0.
Maximum Burst Size	This value specifies the maximum amount of data that can be transferred without disconnecting. This value is in multiples of 512 bytes. For example, a value of 8 means 4K bytes. The maximum allowed value is 128, a value of 0 is equivalent to a value of 128. All other values report CHECK CONDITION, RECOVERED ERROR, and ROUNDED PARAMETERS.
DTDC	Data Transfer Disconnect Control. The DTDC field defines further aspects of 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 ASC set to ILLEGAL FIELD IN PARAMETER LIST.

4.9.5 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. **Note:** In this page, you can only change the RLEC bit.

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		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)							
8 - 9	(MSB) Busy Timeout Period (LSB)							
10 - 11	(MSB) Extended Self-test Completion Time (LSB)							

Figure 4-43. Control Mode MODE SELECT Page — Data Format

Table 4-37. Control Mode MODE SELECT Page — Field Descriptions

Field Name	Description
RLEC	Report Log Exception Condition. An 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. The RLEC bit works with the Read/Write Error LOG SENSE Page. Refer to Section 4.9.3, "Read / Write Error Recovery Page (01h)" on page 4-64 for information about the TMC bit. The RLEC bit indicates whether the tape drive will 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 Command (4Ch)" on page 4-25 for information about how to change the threshold.
Queue Algorithm Modifier	The tape drive does not support this feature; this field must be set to 0.
QErr	Queue Error. The tape drive does not support this feature; this field must be set to 0.
DQue	Disable Queuing. The tape drive does not support this feature; this field must be set to 0.
EECA	Enable Extended Contingent Allegiance. The tape drive does not support Extended Contingent Allegiance, so this bit must be set to 0.
RAENP	Ready AEN Permission. The tape drive does not support Asynchronous Event Notification (AEN). This bit must be set to 0.
UAAENP	Unit Attention AEN Permission. The tape drive does not support Asynchronous Event Notification. This bit must be set to 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 set to 0.
Busy Timeout Period	The tape drive does not support this feature; this field must be set to 0.
Extended Self-test Completion Time	The tape drive does not support this feature; this field must be set to 0.

4.9.6 Data Compression Page (0Fh)

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

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved		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 4-44. Data Compression MODE SELECT Page — Data Format

Table 4-38. Data Compression MODE SELECT Page — Field Descriptions

Field Name	Description
DCE	Data Compression Enable. The Data Compression Enable bit specifies whether the tape drive should enable or disable data compression. When DCE is set to 1, the tape drive starts in compressed format.
DCC	Data Compression Capable. The DCC bit is used by the MODE SENSE command to indicate that the tape drive supports hardware data compression.
DDE	Data Decompression Enable. When the tape drive reads compressed data from tape, it automatically decompresses the data before sending it to the initiator. Data decompression/compression is always enabled, so this bit must be set to 1 (enable data decompression).

Table 4-38. Data Compression MODE SELECT Page — Field Descriptions (Continued)

Field Name	Description
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 set to 00h.
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 set to 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.
Decompression Algorithm	The Decompression Algorithm field indicates which decompression algorithm the tape drive uses when decompressing data encountered on the tape. 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.

4.9.7 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)	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 4-45. Device Configuration MODE SELECT Page — Data Format

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

Table 4-39. Device Configuration MODE SELECT Page — Field Descriptions

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

Table 4-39. Device Configuration MODE SELECT 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 writing the data to tape (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.
DBR	Must be set to 0 (Data Buffer Recovery not supported).
BIS	Must be set to 1 (Block Identifiers Supported in media format).
RSmk	Must be set to 0 (Setmarks not supported).
AVC	Automatic Velocity Control. This feature is not supported, so this bit must be 0.
SOCF	Stop on Consecutive Filemarks. This feature is not supported, so this bit must be 0.
RBO	Recover Buffer Order. This feature is not supported, so this bit must be 0.
REW	Report Early Warning. Must be set to 0 (do not report Early Warning EOM on reads).
Gap Size	This field is not used and is set to 0.
EOD Defined	End-of-Data Defined. This field must be set to 00h. The tape drive rejects any other value.
EEG	Enable EOD Generation. This bit is set to indicate 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 set to 1.
SEW	Synchronize at Early Warning. This bit is set to 1.
Buffer Size at Early Warning	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.

4.9.8 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)	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 4-46. Medium Partition MODE SELECT Page — Data Format

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Table 4-40. Medium Partition MODE SELECT Page — Field Descriptions

Field Name	Description
Maximum Additional Partitions	No additional partitions are supported. This field must be 0.
Additional Partitions Defined	The field specifies the number of additional partitions to be defined for the tape based on the value 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.
FDP	Fixed Data Partitions. This field must be 0.
SDP	Select Data Partitions. This field must be 0.
IDP	Initiator Defined Partitions. This field must be 0.
PSUM	Partition Size Unit of Measure. This field must be 0.
Medium Format Recognition	This field is only valid with a MODE SENSE command and is set to 01h, indicating that Automatic Format Recognition is supported.

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 4-47. TapeAlert MODE SELECT Page — Data Format

In this page, the DExcpt, Test, MRIE, and the Test Flag Number fields are changeable.

Table 4-41. TapeAlert MODE SELECT Page — Field Descriptions

Field Name	Description
Perf	This bit is not supported and always returns 0.
DExcpt	Disable Informational Exceptions. The default value for this bit is set to 1 by the tape drive. When this bit is set to 0, the reporting method indicated by the MRIE field is used. When this bit is set to 1, the target disables all information exception conditions, ignoring the MRIE field (in this mode the software must poll the TapeAlert Log page).

Table 4-41. TapeAlert MODE SELECT Page — Field Descriptions (Continued)

Field Name	Description
Test	The TapeAlert Flag Test field's default value is 0, and is set to that value by the tape drive. When this bit is set to 0, this indicates that the target does not generate any false informational exception conditions. When this bit is set to 1 and Test Flag Number is set to 0, the target will generate a FALSE INFORMATIONAL EXCEPTION condition based on the MRIE field. When a false information exception condition is posted, the TapeAlert flags in the Log page are not modified when the Test Flag Number field is 0. Real informational exception conditions have priority over false informational exception conditions. The false information exception condition is posted on the first command (excluding INQUIRY and REQUEST SENSE) that is received with no real information exception condition pending. The false informational exception condition will then be reported in the method specified by the MRIE value, except with the additional sense code set to 0x5DFF. If the Test and DExcpt bits are set to 1 and Test Flag Number is set to 0, then the MODE SELECT command will return CHECK CONDITION, with ASC set to ILLEGAL REQUEST and ASCQ set to INVALID FIELD IN PARAMETER LIST. When the Test bit is set to 1 and the Test Flag Number is set to a valid non-zero value, the target will generate FALSE INFORMATION EXCEPTION condition or CLEAR INFORMATIONAL EXCEPTION condition. The Test bit action is based on the value of Test Flag Number (described later): **Test Flag Number Value** — **Description** 0 — This just reports False Information Exception condition based on the MRIE value. No TapeAlert flags are set. 1 to 64 — This sets the TapeAlert flag indicated by the Test Flag Number. Once the TapeAlert flag is set, it is processed normally based on the MRIE value. -1 to -64 — This clears the TapeAlert flag indicated by the absolute value of the Test Flag Number. Clearing the flag in this way is equivalent to performing the specified corrective action for that flag. 32767 (0x7FFF) — This sets all of the TapeAlert flags that are supported by the target. Once the supported TapeAlert flags are set, they are processed normally based on the MRIE value. **Note**: The values returned by MODE SENSE command for the Test bit and the Test Flag Number are always 0.
LogErr	This bit is not supported and must be 0.

Table 4-41. TapeAlert MODE SELECT Page — Field Descriptions (Continued)

Field Name	Description
MRIE	Method of Reporting Information Exception. The MRIE field's default value is 03h, and is set to that value by the tape drive. This field indicates the method used by the tape drive to report informational exception conditions. The values defined below are supported by the tape drive: **MRIE Value** — **Description** 0x0 — **No reporting of informational exception conditions**. This method instructs the tape drive to not report information exception conditions. 0x3 — **Conditionally generate Recovered Error.** This method instructs the tape drive to report information exception conditions, if reporting of recovered errors is allowed, by returning a CHECK CONDITION status on the next SCSI command (excluding INQUIRY and REQUEST SENSE) after an informational exception condition was detected. The Sense Key is set to RECOVERED ERROR and the additional sense code shall indicate the cause of the information exception condition (which is 5D 00 for a TapeAlert event). The command that has the CHECK CONDITION shall complete without error before any exception condition may be reported (and thus does NOT need to be repeated). 0x4 — **Unconditionally generate Recovered Error.** This method instructs the tape drive to report information exception conditions, regardless of the value of the PER bit of the Read/Write Error Recovery Mode Page, by returning a CHECK CONDITION status on the next SCSI command (excluding INQUIRY and REQUEST SENSE) after an informational exception condition was detected. The Sense Key is set to RECOVERED ERROR and the additional sense code shall indicate the cause of the information exception condition (which is 5D 00 for a TapeAlert event). The command that has the CHECK CONDITION shall complete without error before any exception condition may be reported (and thus does NOT need to be repeated).

Table 4-41. TapeAlert MODE SELECT Page — Field Descriptions (Continued)

Field Name	Description	
	0x6	**Only report informational exception condition on request**. This method instructs the tape drive to preserve information about informational exception(s). To find out about information exception conditions, the application client polls the tape drive by issuing an unsolicited REQUEST SENSE command. The Sense Key is set to NO SENSE and the additional sense code indicates the cause of the informational exception condition (which is 5D 00 for a TapeAlert event).
Interval Timer	This field is not supported and must be 0.	
Report Count/Test Flag Number	The Report Count/Test Flag Number field default value is set to 0 by the tape drive. This field has a dual purpose. When the Test bit is set to 0, the value of this field in the MODE SELECT data represents the Report Count, which is what is always returned in response to a MODE SENSE command. The Report Count field is not supported, and must be 0 (when the Test bit is 0). When a MODE SELECT command is sent with the Test bit set to 1, then the value of this field in the MODE SELECT data represents the Test Flag Number, which is never returned in response to a Mode Sense command. Valid values of the Test Flag Number are -64 to 64 and 32677 (0x7FFF). Negative numbers are represented using the 2's complement method. If the Test Flag Number is set to an invalid value, then the MODE SELECT command will return CHECK CONDITION, with the ASC set to ILLEGAL REQUEST and the ASCQ set to INVALID FIELD IN PARAMETER LIST. If the tape drive does not support Test Flag Number, then when the Test bit is set to 1 and the Test Flag Number is set to non-zero, the MODE SELECT command will return CHECK CONDITION, with the ASC set to ILLEGAL REQUEST and the ASCQ set to INVALID FIELD IN PARAMETER LIST.	

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	Page Length (n)							
2	ASCII String of parameter name and value							

Figure 4-48. EEPROM Vendor Unique MODE SELECT 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 Table 4-42. The parameter name can be in uppercase or lowercase.

Table 4-42. EEPROM Vendor Unique MODE SELECT Page — Parameter Descriptions

Name	Value Rep	Default	Length (Bytes)	Usage
VendorID	ASCII	QUANTUM	8	Vendor ID in INQUIRY data.
ProductID	ASCII Decimal	DLT VS160	16	Product ID field in INQUIRY data.
ClnTimeLmtHrs	ASCII Decimal	250	4	Number of hours from the time the drive is cleaned until the Cleaning Required LED comes on.
DefaultCompOn	ASCII Binary	1	1	When set to 0, indicates that compression is defaulted OFF at power-on/reset. When set to 1, indicates that compression is defaulted ON at power-on/reset.
DefFixedBlkLen	ASCII Decimal	0	4	Default fixed block size.
EnaInitSyncNeg	ASCII Binary	0	1	When set to 1, enables target initiated synchronous negotiation.
ForceEERebuild	ASCII Binary	0	1	When set to 1, forces the drive to reset all of the parameters to default values at the next power cycle.

Table 4-42. EEPROM Vendor Unique MODE SELECT Page — Parameter Descriptions

Name	Value Rep	Default	Length (Bytes)	Usage
LoaderLUN	ASCII Decimal	1	1	Specifies the LUN on which to report media loader device. Valid values are in the range 1 through 7.
RewindOnReset	ASCII Binary	1	1	When set to 1, the drive rewinds the tape to BOT on reset. When set to 0, the drive does *not* rewind the tape on reset. **Caution:** Partial block data may be written to tape if reset occurs during WRITE.
SCSIRdyEarly	ASCII Binary	0	1	When set to 1, the tape drive reports READY status earlier.

Figure 4-49 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	"i" (69h)							
9	"d" (64h)							
10	" " (20h)							
11	"X" (58h)							
12	"X" (58h)							
13	"X" (58h)							
14	"Y" (59h)							

Bit / Byte	7	6	5	4	3	2	1	0
15	“Y” (59h)							
16	<LF> (0Ah) or (00h)							

Figure 4-49. EEPROM Vendor Unique Page — Example 1

Figure 4-50 shows an example of an EEPROM Vendor Unique page that modifies the SCSIRdyEarly parameter to 1.

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

Figure 4-50. EEPROM Vendor Unique Page — Example 2

4.9.11 Changeable Parameters Within MODE SELECT

Table 4-43 lists the changeable mode parameters and their minimum and maximum allowed values. See individual parameter descriptions for the units that are used. Parameter rounding is supported for all parameters except the Block Descriptor Length.

Table 4-43. Changeable Parameters Within MODE SELECT

Page: Parameter	Default	Minimum	Maximum
Header: Buffered Mode, Device Specific Byte	1	0	1
Header: Block Descriptor Length	08h	00h	08h
Block Descriptor: Density Code	50h	00h	FFh
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): Select Data Compression Algorithm	1	0	1
TapeAlert (1Ch): DExcpt bit	1	0	1
TapeAlert (1Ch): Test bit	0	0	1
TapeAlert (1Ch): MRIE	3h	0h	6h
TapeAlert (1Ch): Test Flag Number	0	0	0x7FFF

4.10 MODE SENSE (6) / (10) Command (1Ah / 5Ah)

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

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

Figure 4-51. MODE SENSE (6) (1Ah) Command Descriptor Block — Data Format

The tape drive also supports the 10-byte MODE SENSE command, which is required 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 be used to retrieve the other pages as well. Note that MODE SENSE (10) returns a different format of Descriptor data, as shown in Figure 4-52.

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

Figure 4-52. MODE SENSE (10) (5Ah) Command Descriptor Block — Data Format

Table 4-44. MODE SENSE (1Ah/5Ah) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
DBD	Disable Block Descriptors. If this bit is set to 0, the device returns the Block Descriptor Data. If the DBD bit is set to 1, the device 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** 0 0 Report Current Values 0 1 Report Changeable Values 1 0 Report Default Values 1 1 Report Saved Values The Additional Page Length field of each page that 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.

Table 4-44. MODE SENSE (1Ah/5Ah) Command Descriptor Block — Field Descriptions

Field Name	Description
Allocation Length	This 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 4-53. MODE SENSE (6) Mode Page Parameter Header — Header 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. The MODE SENSE (10) data header format is as follows:

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 4-54. MODE SENSE (10) Mode Page Parameter Header — Header Format

Table 4-45. MODE SENSE (6/10) Command Header — Field Descriptions

Field Name	Description
Data Length	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 media type as determined by the tape drive is listed below: **Type** — **Description** 00h — Unknown or media not present 81h — Cleaning tape 85h — DLTtape IV 90h — DLTtape VS1
WP	Write Protect. If this bit is set to 0, indicates that the tape is write-enabled. When set to 1, indicates that the tape is write-protected.
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 tape. If the Buffered Mode field is 1, the tape drive reports GOOD status on WRITE commands as soon as the data block has been transferred to the buffer. This is the default configuration for the tape drive. If Buffered Mode is not used, the tape drive suffers a degradation in performance, but not capacity.
Speed	The tape drive supports only the default speed, so this value is always 0.
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 8 or 0.

The MODE SENSE (6/10) Block Descriptor has the following 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 4-55. MODE SENSE (6/10) Block Descriptor — Data Format

Table 4-46. 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 40h — DLT1 format 50h — VS160 format – 80 GB 7Fh — No change from previous density (No operation) 98h — VS160 format – 80 GB without compression 99h — VS160 format – 160 GB with compression
Number of Blocks	This field is set to 0, indicating that all of the remaining logical blocks on the tape 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- and WRITE-type commands that specify a “Fixed” bit of 1 (Fixed Block Mode).

4.10.2 MODE SENSE Pages

Following the block descriptor are the various MODE SENSE pages. Each page has a 2-byte header that identifies the page code and indicates the number of bytes in that page. The supported page codes are:

Table 4-47. Supported MODE SENSE Block Pages and Page Codes

Page Code	Description	Sense/Select
00h	No Requested Page	Sense
01h	Read/Write 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

4.10.3 Read / Write Error Recovery Page (01h)

The tape drive supports the Read/Write 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 4-56. Read/Write Error Recovery MODE SENSE Page — Data Format

Table 4-48. Read/Write Error Recovery MODE SENSE 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 01h (Error Recovery Page).
Page Length	The Page Length indicates the number of bytes in the Error Recovery Page that follow this byte. The value returned for this byte is 0Ah.
TB	Transfer Block. Transferring blocks (when not fully recovered) function is not supported.
EER	Enable Early Recovery. This function is always enabled.
PER	Post Error. This bit enables 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 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.

4.10.4 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)							
12	Reserved							DTDC
13 - 15	Reserved							

Figure 4-57. Disconnect / Reconnect MODE SENSE Page — Data Format

Table 4-49. Disconnect / Reconnect MODE SENSE 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 02h (Disconnect / Reconnect Page).
Page Length	The Page Length indicates the number of bytes in the Disconnect / Reconnect Page that follow this byte. The value returned for this byte is 0Eh.
Buffer Full Ratio	Not supported. Always set to 0.
Buffer Empty Ratio	Not supported. Always set to 0.
Bus Inactivity Limit	Not supported. Always set to 0.
Disconnect Time Limit	Not supported. Always set to 0.
Connect Time Limit	Not supported. Always set to 0.
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	PS (0)	0	Page Code (0Ah)					
1	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)							
8 - 9	(MSB) Busy Timeout Period (LSB)							
10 - 11	(MSB) Extended Self-Test Completion Time (LSB)							

Figure 4-58. Control Mode MODE SENSE Page — Data Format

Table 4-50. Control Mode MODE SENSE 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 0Ah.

Table 4-50. Control Mode MODE SENSE Page — Field Descriptions (Continued)

Field Name	Description
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.
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	Ready AEN Holdoff Period. The value returned for this field is 0.
Busy Timeout Period	The value returned for this field is 0.
Extended Self-Test Completion Time	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 (0)	Rsv'd	Page Code					
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 4-59. Data Compression MODE SENSE Page — Data Format

Table 4-51. Data Compression MODE SENSE Page — Field Descriptions

Field Name	Description
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.

Table 4-51. Data Compression MODE SENSE Page — Field Descriptions (Continued)

Field Name	Description
DCC	Data Compression Capable. The DCC bit indicates whether the device supports data compression as follows: 0 The device does not support data compression. 1 The device 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 EnaRepDCcomp 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)	0	Page Code (10h)					
1	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 4-60. Device Configuration MODE SENSE Page — Data Format

Table 4-52. Device Configuration MODE SENSE Page — Field Descriptions

Field Name	Description
Page Code	The Page Code identifies the type of MODE SENSE data being transferred. The value returned for this field is 10h (Device Configuration Page).
Page Length	The Page Length indicates the number of Device Configuration Page bytes that follow this byte. The value returned for this byte is 0Eh.
CAP	Change Active Partition. This field is not supported and must be 0.

Table 4-52. Device Configuration MODE SENSE Page — Field Descriptions (Continued)

Field Name	Description
CAF	Change Active Format. This field is not supported and must be 0.
Active Format	This field is not supported and must be 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 writing the data to tape (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 set to 0.
EOD Defined	End-of-Data Defined. This field is set to 00h.
EEG	Enable EOD Generation. The EEG bit is set to indicate 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. This bit is set to 1.
Buffer Size at Early Warning	Buffer Size at EW is not supported and must be 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)	0	Page Code (11h)					
1	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 4-61. Medium Partition MODE SENSE Page — Data Format

Table 4-53. Medium Partition MODE SENSE 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 11h (Medium Partition Page).
Page Length	The Page Length indicates the number of bytes in the Medium Partition Page that follow this byte. The value returned for this byte is 06h.
Maximum Additional Partitions	The tape drive does not support additional partitions. This field is set to 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 not supported and must be 0.
SDP	Select Data Partitions. This field is not supported and must be 0.
IDP	Initiator Defined Partitions. This field is not supported and must be 0.
PSUM	The Partition Size Unit of Measure field is 0.
Medium Format Recognition	This field is set to 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)	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 4-62. TapeAlert MODE SENSE Page — Data Format

Table 4-54. TapeAlert MODE SENSE 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 1Ch (TapeAlert Page).
Page Length	The Page Length indicates the number of bytes in the TapeAlert Page that follow this byte. The value returned for this byte is 0Ah.
Perf	Performance. This field always returns 0.
DExcpt	Disable Information Exception Operations. When this bit is set to 0, the reporting method indicated by the MRIE field is used. When this bit is set to 1, the target disables all information exception conditions, ignoring the MRIE field (in this mode the software must poll the TapeAlert Log page).
Test	This field always returns 0, even though this field can be changed in Mode Select command.
LogErr	Error Log. This field always returns 0.

Table 4-54. TapeAlert MODE SENSE Page — Field Descriptions (Continued)

Field Name	Description	
MRIE	Method of Reporting Informational Exception. This field indicates the method used by the tape drive to report informational exception conditions. The tape drive returns any of the values defined below:	
	Value	**Method**
	0x0	**No reporting of informational exception conditions.** This method instructs the tape drive to not report information exception conditions.
	0x3	**Conditionally generate Recovered Error.** This method instructs the tape drive to report information exception conditions, if reporting of recovered errors is allowed, by returning a CHECK CONDITION status on the next SCSI command (excluding INQUIRY and REQUEST SENSE) after an informational exception condition was detected. The Sense Key is set to RECOVERED ERROR and the ASC indicates the cause of the informational exception condition (which is 5D 00 for a TapeAlert event). The command that has the Check Condition completes without error before any exception condition is reported (and thus does NOT need to be repeated).
	0x4	**Unconditionally generate Recovered Error.** This method instructs the tape drive to report information exception conditions, regardless of the value of the PER bit of the Read/Write Error Recovery Mode page, by returning a CHECK CONDITION status on the next SCSI command (excluding INQUIRY and REQUEST SENSE) after an informational exception condition was detected. The Sense Key is set to RECOVERED ERROR and the ASC indicates the cause of the informational exception condition (which is 5D 00 for a TapeAlert event). The command that has the Check Condition completes without error before any exception condition is reported (and thus does NOT need to be repeated).
	0x6	**Only report informational exception condition on request.** This method instructs the tape drive to preserve information exception(s) information. To find out about information exception conditions the application client polls the tape drive by issuing an unsolicited REQUEST SENSE command. The Sense Key is set to NO SENSE and the ASC indicates the cause of the informational exception condition (which is 5D 00 for a TapeAlert event).

Table 4-54. TapeAlert MODE SENSE Page — Field Descriptions (Continued)

Field Name	Description
Interval Timer	This field always returns 0.
Report Count/Test Flag Number	This field always returns 0, even though this field can be changed with a MODE SELECT command.

4.10.10 EEPROM Vendor Unique Page (3Eh)

The tape drive supports the EEPROM Vendor Unique Page (3Eh). All the EEPROM parameters that can be set through MODE SELECT EEPROM Vendor Unique Page are returned.

NOTE: As a result of the long list of parameters, use MODE SENSE (10) instead of MODE SENSE (6) to retrieve EEPROM parameters. Also use the MODE SENSE (10) Data Length in the Data Header to determine the length of page 0x3E instead of the Page Length of the page descriptor.

Because of the length of the EEPROM parameter, a 10-byte MODE SENSE command is required to retrieve the parameters. If you use a 10-byte MODE SENSE command to retrieve the EEPROM parameter page, the data returned is as follows:

```
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 name followed by the current, default, Minimum, and Maximum parameter values. For example:

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

The parameter list is as follows:

Bit / Byte	7	6	5	4	3	2	1	0
0	PS	0	Page Code (3Eh)					
1	Page Length (n)							
2 - n	All Changeable EEPROM Parameters							

Figure 4-63. EEPROM Vendor Unique MODE SENSE Page — Data Format

4.11 PERSISTENT RESERVE IN Command (5Eh)

The PERSISTENT RESERVE IN command is a 10-byte command used to obtain information about persistent reservations and registrations that are active within the tape drive. It is used in conjunction with the PERSISTENT RESERVE OUT command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Eh)							
1	Reserved			Service Action				
2 - 6	Reserved							
7 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-64. PERSISTENT RESERVE IN (5Eh) Command Descriptor Block — Data Format

If the logical unit has previously been reserved by any initiator with RESERVE (6) or RESERVE (10) then PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands will be rejected with RESERVATION CONFLICT status.

If the logical unit has previously been registered by any initiator with PERSISTENT RESERVE OUT then RESERVE (6), RESERVE (10), RELEASE (6), and RELEASE (10) commands will be rejected with RESERVATION CONFLICT status.

Table 4-55. PERSISTENT RESERVE IN (5Eh) Command — Field Descriptions

Field Name	Description		
Service Action	The Service Action codes for the PERSISTENT RESERVE IN command are defined below.		
	Code	**Name**	**Description**
	00h	Read Keys	Reads all registered reservation keys
	01h	Read Reservations	Reads all current persistent reservations
	02-1Fh	Reserved	Reserved

Table 4-55. PERSISTENT RESERVE IN (5Eh) Command — Field Descriptions (Continued)

Field Name	Description
Allocation Length	This field indicates how much space has been reserved for the returned parameter list (Read Keys or Read Reservations parameters). The actual length of the parameter data is indicated in the parameter data field for those parameters. If the Allocation Length is not sufficient to contain the entire list of parameters, the first portion of the list that does fit is returned. If it is determined that the remainder of the list is required, the initiator should send a new PERSISTENT RESERVE IN command with an Allocation Length field large enough to contain the entire list of parameters.

4.11.1 Read Keys Service Action

A Read Keys Service Action requests that the tape drive return a parameter list that includes a header and a complete list of all of the reservation keys currently registered with the tape drive. If multiple initiators have registered with the same key, then the key is listed multiple times, once for each registration. The following table describes the Read Keys parameter data.

Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Generation (LSB)							
4 - 7	(MSB) Additional Length (n-7) (LSB)							
	Reservation Key List							
8 - 15	(MSB) First Reservation Key (LSB)							
n **- 7 to n**	(MSB) Last Reservation Key (LSB)							

Figure 4-65. PERSISTENT RESERVE IN Read Keys Parameters — Data Format

Table 4-56. PERSISTENT RESERVE IN Read Keys Parameter List — Field Descriptions

Field Name	Description
Generation	The value in this field is a 32-bit counter in the tape drive that is incremented each time a PERSISTENT RESERVE OUT command requests a Register, Clear, Pre-empt, or Pre-empt and Abort operation. Note that PERSISTENT RESERVE IN commands do not increment the counter, nor do PERSISTENT RESERVE OUT commands that perform a Reserve or Release service action, or a PERSISTENT RESERVE OUT command that is not done due to an error or a reservation conflict. The value in the Generation field is set to 0 as part of the power-on or reset processes. The value in the Generation field allows the host that examines the value to verify that the configuration of the initiators attached to a logical unit has not been modified by another host without the knowledge of the examining host.
Additional Length	This field contains the count of the number of bytes that are in the Reservation Key list (bytes 8 – *n*). Note that this field contains the number of bytes in the Reservation Key list regardless of the value prescribed by the Allocation Length field in the command's CDB.
Reservation Keys	Each of the Reservation Keys appears as items in a list as bytes 8 through *n*. Each entry reflects an 8-byte Reservation Key registered with the tape drive via the PERSISTENT RESERVE OUT, Register or Register and Ignore Existing Key service actions. Each key can be examined by the host for correlation with a set of initiators and SCSI ports.

4.11.2 Read Reservation Service Action

A Read Reservation Service Action requests that the tape drive return a parameter list that contains a header and a complete list of all persistent reservations that are presently active in the tape drive.

Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Generation (LSB)							
4 - 7	(MSB) Additional Length (n-7) (LSB)							
8 - *n*	(MSB) Reservation Descriptors (LSB)							

Figure 4-66. PERSISTENT RESERVE IN Read Reservations Parameters — Data Format

Table 4-57. PERSISTENT RESERVE IN Read Reservations Parameter List — Field Descriptions

Field Name	Description
Generation	The value in this field is a 32-bit counter in the tape drive that is incremented each time a PERSISTENT RESERVE OUT command requests a Register, Clear, Pre-empt, or Pre-empt and Abort operation. Note that PERSISTENT RESERVE IN commands do not increment the counter, nor do PERSISTENT RESERVE OUT commands that perform a Reserve or Release service action, or by a PERSISTENT RESERVE OUT command that is not done due to an error or a reservation conflict. The value in the Generation field is set to 0 as part of the power-on or reset processes. The value in the Generation field allows the host that examines the value to verify that the configuration of the initiators attached to a logical unit has not been modified by another host without the knowledge of the examining host.
Additional Length	This field contains the count of the number of bytes that are in the Reservation Descriptors list (bytes 8 – *n*). Note that this field contains the number of bytes in the Reservation Descriptor list regardless of the value prescribed by the Allocation Length field in the command's CDB.
Reservation Descriptors	One Reservation Descriptor is reported for each unique persistent reservation on the logical unit when the PERSISTENT RESERVE IN command has indicated a Read Reservations action. The following table describes the contents of each Reservation Descriptors field.

Figure 4-67 and Table 4-58 illustrate and describe the data fields of each Read Reservations Descriptor's data fields.

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	Reservation Key							
8 - 11	Scope-specific Address (0)							
12	Reserved							
13	Scope				Type			
14 - 15	Obsolete (0)							

Figure 4-67. PERSISTENT RESERVE IN Read Reservations Descriptor — Data Format

Table 4-58. PERSISTENT RESERVE IN Read Reservations Descriptor — Field Descriptions

Field Name	Description		
Reservation Key	The Reservation Key field contains an 8-byte value that identifies the reservation key under which the persistent reservation is held.		
Scope-specific Address	This field is always 0.		
Scope	The value in this field indicates whether a persistent reservation applies to an entire logical unit, to a part of the logical unit (defined as an extent), or to an element. The values for the Scope field are:		
	Code	**Name**	**Description**
	0h	LU	Logical Unit. Persistent reservation applies to the full logical unit. The LU scope is therefore implemented by all tape drives that implement PERSISTENT RESERVE OUT. The tape drive always reports this value.
	1h	Obsolete	
	2h	Element	Tape drive does not support the reservation of elements.
	3h-Fh	Reserved	Reserved.
Type	The value of the Type field specifies the characteristics of the persistent reservation being established for all data blocks within the logical unit. Refer to the following list for the applicable Type codes and their meanings.		
	Code	**Name**	**Description**
	0h	Obsolete	
	1h	Exclusive	READS: Shared; any host on any initiator may execute commands that perform transfers from the target to the initiator. WRITES: Exclusive; any command from any initiator other than the initiator that holds the persistent reservation that attempts a transfer to the target results in a reservation conflict. ADDITIONAL RESERVATIONS: Allowed; any initiator may reserve the logical unit, extents, or elements as long as the persistent reservations do not conflict with any reservations already known to the tape drive.

Table 4-58. PERSISTENT RESERVE IN Read Reservations Descriptor — Field Descriptions

Field Name	Description		
	2h	Obsolete	
	3h	Exclusive Access	READS: Exclusive; any command from any initiator other than the initiator holding the persistent reservation that attempts a transfer from the target results in a reservation conflict. WRITES: Exclusive; any command from any initiator other than the initiator holding the persistent reservation that attempts a transfer to the target results in a reservation conflict. ADDITIONAL RESERVATIONS: Restricted; any PERSISTENT RESERVE OUT command with the Reserve service action from any initiator other than the initiator holding the persistent reservation results in a reservation conflict. The initiator that holds the persistent reservation can reserve the logical unit as long as the persistent reservations do not conflict with any reservations already known to the tape drive.
	4h	Obsolete	
	5h	Write Exclusive, Registrants Only	READS: Shared; any host on any initiator may execute commands that perform transfers from the target to the initiator. WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the tape drive that attempts a transfer to the target results in a reservation conflict. ADDITIONAL RESERVATIONS: Allowed; any initiator may reserve the logical unit as long as the persistent reservations do not conflict with any reservations already known to the tape drive.

Table 4-58. PERSISTENT RESERVE IN Read Reservations Descriptor — Field Descriptions

Field Name	Description		
	6h	Exclusive Access, Registrants Only	READS: Exclusive; any command from an initiator that has not previously performed a Register service action with the tape drive that attempts a transfer from the target results in a reservation conflict. WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the tape drive that attempts a transfer to the target results in a reservation conflict. ADDITIONAL RESERVATIONS: Allowed; any initiator may reserve the logical unit as long as the persistent reservations do not conflict with any reservations already known to the tape drive.
	7h – Fh	Reserved	Reserved.
Obsolete	This field is always 0.		

4.11.3 SCSI Commands Under Reservations

The behavior of some SCSI commands when under reservation varies slightly. Refer to Appendix A, “SCSI Commands Under Reservation” for details.

4.12 PERSISTENT RESERVE OUT Command (5Fh)

The PERSISTENT RESERVE OUT command is a 10-byte command used to reserve a logical unit for the exclusive or shared use by an initiator or initiators. The command is used in conjunction with the PERSISTENT RESERVE IN command and not used with the RESERVE and RELEASE commands.

Initiators that perform PERSISTENT RESERVE OUT actions are identified by a reservation key assigned by the host. The host may use the PERSISTENT RESERVE IN command to identify which other initiators within a system hold persistent reservations and use the PERSISTENT RESERVE OUT command to pre-empt those reservations.

Note that since persistent reservations can be configured to not be reset by the TARGET RESET task management functions or other global actions, they can be used to enact device sharing among multiple initiators. The PERSISTENT RESERVE OUT and PERSISTENT RESERVE IN commands provide the means for resolving conflicts in multiple-initiator systems with multiple port targets. By using the Reservation Key to identify persistent reservations, it is possible to determine which ports hold persistent reservations and to take over such reservations.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (5Fh)							
1	Reserved				Service Action			
2	Scope				Type			
3 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-68. PERSISTENT RESERVE OUT (5Fh) Command Descriptor Block — Data Format

If a PERSISTENT RESERVE OUT command is attempted, but there are insufficient device resources to complete the operation, the device returns a CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST, and an ASC of INSUFFICIENT REGISTRATION RESOURCES.

If the logical unit has previously been reserved by any initiator with RESERVE (6) or RESERVE (10) then PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands will be rejected with RESERVATION CONFLICT status.

If the logical unit has previously been registered by any initiator with PERSISTENT RESERVE OUT then RESERVE (6), RESERVE (10), RELEASE (6), and RELEASE (10) commands are rejected with RESERVATION CONFLICT status.

Table 4-59. PERSISTENT RESERVE OUT (5Fh) Command — Field Descriptions

Field Name	Description		
Service Action	The service action codes used with the PERSISTENT RESERVE OUT command are listed below; for more thorough information, refer to Table 4-60 on page 4-115:		
	Code	**Name**	**Description**
	00h	Register	Register a reservation key with the tape drive.
	01h	Reserve	Create a persistent reservation using a reservation key.
	02h	Release	Release a persistent reservation.
	03h	Clear	Clear all reservation keys and all persistent reservations.
	04h	Pre-empt	Pre-empt persistent reservations from another initiator.
	05h	Pre-empt and Abort	Pre-empt persistent reservations from another initiator and Abort the task set for the pre-empted initiator.
	06h	Register and Ignore Existing Key	Register a reservation key with the tape drive. Existing reservation key is ignored.
	07h – 1Fh	Reserved	Reserved.

Table 4-59. PERSISTENT RESERVE OUT (5Fh) Command — Field Descriptions (Continued)

Field Name	Description		
Scope	The value in this field indicates whether a persistent reservation applies to an entire logical unit, to a part of the logical unit (defined as an extent), or to an element. The values for the Scope field are:		
	Code	**Name**	**Description**
	0h	LU	Logical Unit. Persistent reservation applies to the full logical unit. The LU scope is therefore implemented by all tape drives that implement PERSISTENT RESERVE OUT. The tape drive always reports this value.
	1h	Obsolete	
	2h	Element	The tape drive does not support reservation of elements.
	3h-Fh	Reserved	Reserved.
Type	The value of the Type field specifies the characteristics of the persistent reservation being established for all data blocks within the logical unit. Refer to the table below for the applicable Type codes and their meanings.		
	Code	**Name**	**Description**
	0h	Obsolete	
	1h	Write Exclusive	READS: Shared; any host on any initiator may execute commands that perform transfers from the target to the initiator. WRITES: Exclusive; any command from any initiator—other than the initiator that holds the persistent reservation—that attempts a transfer to the target results in a reservation conflict.
	2h	Obsolete	

Table 4-59. PERSISTENT RESERVE OUT (5Fh) Command — Field Descriptions (Continued)

Field Name	Description		
	3h	Exclusive Access	READS: Exclusive; any command from any initiator—other than the initiator—holding the persistent reservation that attempts a transfer from the target results in a reservation conflict. WRITES: Exclusive; any command from any initiator other than the initiator holding the persistent reservation that attempts a transfer to the target results in a reservation conflict.
	4h	Obsolete	
	5h	Write Exclusive, Registrants Only	READS: Shared; any host on any initiator may execute commands that perform transfers from the target to the initiator. WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the tape drive that attempts a transfer to the target results in a reservation conflict.
	6h	Exclusive Access, Registrants Only	READS: Exclusive; any command from an initiator that has not previously performed a Register service action with the tape drive that attempts a transfer from the target results in a reservation conflict. WRITES: Exclusive; any command from an initiator that has not previously performed a Register service action with the tape drive that attempts a transfer to the target results in a reservation conflict.
	7h-Fh	Reserved	Reserved.
Parameter List Length	Fields contained in the PERSISTENT RESERVE OUT parameter list specify the reservation key, service action reservation key, and ATPTL bit state to perform a Persistent Reservation service action. The parameter list is 24 bytes in length. If the Parameter list length is not 24, the tape drive returns a CHECK CONDITION with ILLEGAL REQUEST with the ASC set to PARAMETER LIST LENGTH ERROR.		

4.12.1 PERSISTENT RESERVE OUT Command Service Actions

The service action codes used with the PERSISTENT RESERVE OUT command are listed and defined in Table 4-60.

NOTE: Service actions that require information about persistent reservation and registrations may require enabling of nonvolatile memory within the logical unit.

Table 4-60. PERSISTENT RESERVE OUT Command — Service Action Descriptions

Service Action	Description
Register or Register and Ignore Existing Key	To establish a persistent reservation the initiator first registers with a logical unit. An initiator registers with a logical unit by issuing a PERSISTENT RESERVE OUT command with service action of Register or Register and Ignore Existing Key. If the initiator has not yet established a reservation key or the reservation key has been removed, the registration is accomplished by issuing a PERSISTENT RESERVE OUT command with service action of Register with the following parameters: • APTPL bit optionally set to 1; • Reservation key set to 0; and • Service action reservation key set to a non-zero value. If the initiator has an established registration it may change its reservation key. This is accomplished by issuing a PERSISTENT RESERVE OUT command with service action of Register with the following parameters: • APTPL bit optionally set to 1; • Reservation key set to the value of the previously established reservation key; and • Service action reservation key set to a non-zero value. Alternatively, an initiator may establish a reservation key—without regard for whether one has previously been established—by issuing a PERSISTENT RESERVE OUT command with a service action of Register and Ignore Existing Key and the following parameters: • APTPL bit optionally set to 1; and • Service action reservation key set to a non-zero value.

Table 4-60. PERSISTENT RESERVE OUT Command — Service Action Descriptions (Continued)

Service Action	Description
	If a PERSISTENT RESERVE OUT command with a Register and Ignore Existing Key service action is sent when an established Registration Key exists, the registration is superseded with the specified service action reservation key. If a PERSISTENT RESERVE OUT with a Register and Ignore Existing Key service action is sent when there is no established Registration Key, a new registration is established. If a PERSISTENT RESERVE OUT command with a Register or a Register and Ignore Existing Key service action is attempted, but there are insufficient tape drive resources to complete the operation, the tape drive shall return a CHECK CONDITION status. The Sense Key is set to ILLEGAL REQUEST and the additional Sense data is set to INSUFFICIENT REGISTRATION RESOURCES. After the registration request has been processed, the tape drive allows other PERSISTENT RESERVE OUT commands from the registered initiator to execute. For each initiator that performs a PERSISTENT RESERVE OUT with a Register or a Register and Ignore Existing Key service action service action, the tape drive retains the reservation key until the key is changed by a new PERSISTENT RESERVE OUT command with the Register or the Register and Ignore Existing Key service action from the same initiator or until the initiator registration is removed by: • Powering down the logical unit, if the last Activate Persist Through Power Loss (APTPL) received by the tape drive was 0; • Performing a Clear service action; • Performing a Pre-empt service action; • Performing a Pre-empt and Abort service action; or • Performing a Register service action from the same initiator with the value of the service action reservation key set to 0. When the reservation has been removed, no information is reported for the initiator in the Read Keys service action of the resulting PERSISTENT RESERVE IN command. Any PERSISTENT RESERVE OUT command service action received from an unregistered initiator, other than the Register or the Register and Ignore Existing Key service action is rejected with a RESERVATION CONFLICT status.

Table 4-60. PERSISTENT RESERVE OUT Command — Service Action Descriptions (Continued)

Service Action	Description
Reserve	A PERSISTENT RESERVE OUT command with Reserve service action creates a persistent reservation with a specified Scope and Type through a registered initiator with the following parameters: • Reservation Key set to the value of the initiator/logical unit pair's established reservation key; and • Type and Scope set to the reservation being created. Only one persistent reservation is allowed at a time per logical unit. If the target receives a PERSISTENT RESERVE OUT command that attempts to create a persistent reservation when a persistent reservation already exists for the logical unit from an initiator other than the initiator that created the reservation, then the command is rejected with a RESERVATION CONFLICT status. If the initiator that created the persistent reservation attempts to modify the Type or Scope of an existing reservation, then the command is rejected with a RESERVATION CONFLICT status. If the tape drive receives a PERSISTENT RESERVE OUT command with a service action of Reserve where the Type and Scope are the same as the existing Type and Scope from the initiator that created the persistent reservation, it does not make any change to the existing reservation and returns a GOOD status. Persistent reservations are not superseded by a new persistent reservation from any initiator except by the execution of a PERSISTENT RESERVE OUT command that specifies a Release, Clear, Pre-empt, or Pre-empt and Abort service action.
Release	A PERSISTENT RESERVE OUT command with Release service action removes a persistent reservation held by the same initiator. Only the initiator that creates the persistent reservation is allowed to release that persistent reservation. A host releases the persistent reservation it holds by issuing a PERSISTENT RESERVE OUT command with a service action of Release through the registered initiator that holds the persistent reservation with the following parameters: • Reservation Key set to the value of the initiator/logical unit pair's established reservation key; and • Type and Scope set to match the persistent reservation being released. If the released persistent reservation has a type of Write Exclusive – Registrants Only or Exclusive Access – Registrants Only, the tape drive generates a UNIT ATTENTION condition for all registered initiators other than the initiator that issued the PERSISTENT RESERVE OUT command with Release service action. The Sense Key is set to UNIT ATTENTION and the additional Sense data is set to RESERVATIONS RELEASED. If the persistent reservation is of any other type the tape drive does not generate a UNIT ATTENTION condition.

Table 4-60. PERSISTENT RESERVE OUT Command — Service Action Descriptions (Continued)

Service Action	Description
	The tape drive returns a CHECK CONDITION status for any PERSISTENT RESERVE OUT command that specifies the release of a persistent reservation held by the requesting initiator that does not match the Scope and Type. The Sense Key is set to ILLEGAL REQUEST and additional Sense data is set to INVALID RELEASE OF ACTIVE PERSISTENT RESERVATION. Sending of a PERSISTENT RESERVE OUT command that specifies a Release service action, when no persistent reservation exists from that initiator does not result in an error. Instead, the tape drive returns a GOOD status without altering any other reservation: the Reservation Key is not changed by the Release service action. An active persistent reservation may also be released by: • Powering off, when the most recent APTPL value received by the tape drive is 0, performs a hard reset, clears all persistent reservations, and removes all registered reservation keys. • Executing a PERSISTENT RESERVE OUT command from another initiator with a persistent reserve service action of Clear, Pre-empt, or Pre-empt and Abort. Note that a Release service action should not be performed if any operations interlocked by the persistent reservation have not yet completed.
Clear	A PERSISTENT RESERVE OUT command with a successful Clear service action removes all persistent reservations for all initiators. All Reservation Keys are also removed. Any commands from any initiator that have been accepted by the tape drive as non-conflicting continue their normal executions. A UNIT ATTENTION condition is established for all registered initiators for the logical unit. The Sense Key is set to UNIT ATTENTION; the additional Sense data is set to Reservations Pre-empted. Note that applications should not use the Clear service action except during recoveries associated with initiator or system reconfiguration, since data integrity may be compromised.

Table 4-60. PERSISTENT RESERVE OUT Command — Service Action Descriptions (Continued)

Service Action	Description
Pre-empt	A PERSISTENT RESERVE OUT command with a Pre-empt service action is used to pre-empt a persistent reservation and/or registration. The determination of whether the Pre-empt service action is related to a persistent reservation or a registration is made by the tape drive by examining the value in the Service Action Reservation Key field of the Pre-empt service action. If the value in the Service Action Reservation Key field is associated with the reservation being pre-empted, then the reservation is preempted and any matching registration(s) removed. If the value in the Service Action Reservation Key field is not associated with the reservation being pre-empted, then the reservation is not pre-empted and any matching registration(s) are removed. Refer to the following for a description of how the tape drive interprets the Pre-empt service action to determine its action: Pre-empting reservations: Any registered initiator may pre-empt any persistent reservation with another persistent reservation by issuing a PERSISTENT RESERVE OUT command with a Pre-empt service action through a registered initiator with the following parameters: • Reservation Key set to the value of the initiator/logical unit pair's established reservation key; • Service Action Reservation Key set to match the reservation key of the persistent reservation being Pre-empted; and • Type and Scope set to define a new persistent reservation. The Scope and Type of the persistent reservation created by the Pre-empting initiator may be different than the persistent reservation being pre-empted. If the Service Action Reservation Key is associated with a reservation, the tape drive performs the pre-empt by doing the following: • Releasing the persistent reservation for the initiator identified by the Service Action Reservation Key specified in the PERSISTENT RESERVE OUT parameter list; • Removing the registration for the initiator or initiators identified by the Service Action Reservation Key specified in the PERSISTENT RESERVE OUT parameter list; • Establishing a persistent reservation for the pre-empting initiator; and • Establishing a UNIT ATTENTION condition for any initiator that lost its reservation and/or registration. The Sense Key is set to UNIT ATTENTION and the additional Sense data is set to REGISTRATIONS PRE-EMPTED.

Table 4-60. PERSISTENT RESERVE OUT Command — Service Action Descriptions (Continued)

Service Action	Description
	A PERSISTENT RESERVE OUT command specifying a Pre-empt service action with the Service Action Reservation Key value equal to the reservation key is not an error. In that case, the tape drive establishs the new reservation. Pre-empting registrations: When a registered Reservation Key is not associated with a persistent reservation, a host may remove the registration(s) without affecting any persistent reservations by issuing a PERSISTENT RESERVE OUT command with a Pre-empt service action through a registered initiator with the following parameters: • Reservation Key set to the value of the initiator/logical unit pair's established reservation key; and • Service Action Reservation Key set to match the reservation key of the registration being removed. If the Service Action Reservation Key field is not associated with a reservation, the device performs the pre-empt by doing the following series of actions: • Removing the registration for the initiator or initiators identified by the Service Action Reservation Key field specified in the PERSISTENT RESERVE OUT parameter list; • Ignoring the contents of the Scope and Type fields; and • Establishing a UNIT ATTENTION condition for any other initiator that lost its registration. The Sense Key is set to UNIT ATTENTION and the additional Sense data is set to REGISTRATIONS PRE-EMPTED. If a PERSISTENT RESERVE OUT command specifying a Pre-empt service action sets the Service Action Reservation Key field to a value that does not match any registered reservation key, the device server returns a RESERVATION CONFLICT status. Note that persistent reservations are not superseded by a new persistent reservation from any initiator except by the execution of a PERSISTENT RESERVE OUT command that specifies either the Pre-empt or the Pre-empt and Abort service actions. New persistent reservations that do not conflict with an existing persistent reservation execute normally.
Pre-empt and Abort	This service action operates exactly like Pre-empt.

4.12.2 PERSISTENT RESERVE OUT Command Descriptor Block Behavior

Invalid or unsupported service actions return a CHECK CONDITION with ILLEGAL REQUEST with the ASCs set to INVALID FIELD IN CDB.

Table 4-61. Command Descriptor Block Field Relevance

Service Actions	Scope	Type
Register	Ignored	Ignored
Reserve	Valid	Valid
Release	Valid	Valid
Clear	Ignored	Ignored
Pre-empt	Valid	Valid
Pre-empt and Abort	Valid	Valid
Register and Ignore Existing Key	Ignored	Ignored

When a Scope or Type field becomes valid and the supplied value is unsupported, then the command returns a CHECK CONDITION with ILLEGAL REQUEST with the ASC set to INVALID FIELD IN CDB.

4.12.3 PERSISTENT RESERVE OUT Parameter List

The PERSISTENT RESERVE OUT command requires a parameter list. Each of the fields of the parameter list is sent for every PERSISTENT RESERVE OUT command, even if the field is not required for the specific Service Action and/or Scope values.

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	Reservation Key							
8 - 15	Service Action Reservation Key							
16 - 19	Scope-specific Addresses							

Bit Byte	7	6	5	4	3	2	1	0
20	Reserved							APTPL
21	Reserved							
22 - 23	Obsolete							

Figure 4-69. PERSISTENT RESERVE OUT Parameter List — Data Format

Table 4-62. PERSISTENT RESERVE OUT Parameters — Field Descriptions

Field Name	Description
Reservation Key	This field contains an 8-byte token that is provided by the host to the tape drive to identify which initiator is the source of the PERSISTENT RESERVE OUT command. For all service actions except Register and Ignore Existing Key, the tape drive verifies that the Reservation Key in the PERSISTENT RESERVE OUT command matches the Reservation Key that is registered for the initiator from which the command is received. If there is no match, the tape drive returns a RESERVATION CONFLICT status. The Reservation Key of the initiator is valid for all Service Action and Scope values.
Service Action Reservation Key	This field contains information needed for three service actions: the Register service action, the Pre-empt service action, and the Pre-empt and Abort service action. The Service Action Reservation Key is ignored for all other service actions. For the Register service action, the Service Action Reservation Key field contains the new Reservation Key to be registered. For the Pre-empt and the Pre-empt and Abort service actions, the Service Action Reservation Key contains the reservation key of the persistent reservations that are being pre-empted. For the Pre-empt and the Pre-empt and Abort actions, any failure of the Service Action Reservation Key to match any registered keys results in the tape drive returning a RESERVATION CONFLICT status.
APTPL	Activate Persist Through Power Loss. This bit is valid only for the Register and Register and Ignore Existing Key service actions; it is ignored for all other types of service actions. If the last valid APTPL bit value received by the tape drive is 0, any reset in the target releases any persistent reservations and removes all Reservation Keys. If the last valid APTPL bit value is 1, the logical unit retains all persistent reservations and all reservation keys for all initiators even if a reset occurs.

Table 4-62. PERSISTENT RESERVE OUT Parameters — Field Descriptions (Continued)

Field Name	Description
APTPL, *cont.*	The most recently received valid APTPL value from any initiator governs the logical unit's behavior in the event of a reset. The power-on reset (POR) is considered just like any type of reset, and thus the APTPL bit applies to power losses as well as bus resets.

4.12.4 PERSISTENT RESERVE OUT Parameter List Behavior

The following table explains which parameter list fields are ignored based on the service action field received in the command descriptor block.

Table 4-63. PERSISTENT RESERVE OUT Parameter List Field Relevance

	Parameter List Fields					
Service Action Fields	**Reservation Key**	**Service Action Reservation Key**	**Scope-Specific Address**	**Reserved**	**APTPL Bit**	**Obsolete**
Register	Note[1]	Note[3]	Ignored	Note[5]	Valid	Ignored
Reserve	Note[2]	Ignored	Ignored	Note[5]	Ignored	Ignored
Release	Note[2]	Ignored	Ignored	Note[5]	Ignored	Ignored
Clear	Note[2]	Ignored	Ignored	Note[5]	Ignored	Ignored
Pre-empt	Note[2]	Note[4]	Ignored	Note[5]	Ignored	Ignored
Pre-empt and Abort	Note[2]	Note[4]	Ignored	Note[5]	Ignored	Ignored
Register and Ignore Key	Ignored	Note[3]	Ignored	Note[5]	Valid	Ignored

NOTES: **1** The target verifies that this value matches the Registration Key already present for this initiator. If the verification fails, then the command returns a RESERVATION CONFLICT status. Otherwise, execution of the command proceeds in the specified manner.

2 The target verifies that this value matches the Registration Key already present for this initiator. If the verification fails, then the command returns a status of RESERVATION CONFLICT.

3 The target verifies that the service action Reservation Key is a non-zero value. If the verification fails, then the command returns a CHECK CONDITION status with Sense data of ILLEGAL REQUEST

and ASC set to INSUFFICIENT RESOURCES. Otherwise, execution of the command proceeds in the specified manner.

4 Any value is possible.

5 Must be 0.

4.12.5 SCSI Commands Under Reservations

The behavior of some SCSI commands when under reservation varies slightly. Refer to Appendix A, “SCSI Commands Under Reservation” for details.

4.13 PREVENT / ALLOW MEDIUM REMOVAL Command (1Eh)

The PREVENT/ALLOW MEDIUM REMOVAL 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	LUN			Reserved				
2 - 3	Reserved							
4	Reserved							Prevent
5	Unused		Reserved				Flag	Link

Figure 4-70. PREVENT/ALLOW MEDIUM REMOVAL (1Eh) Command Descriptor Block — Data Format

Table 4-64. PREVENT/ALLOW MEDIUM REMOVAL (1Eh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Prevent	When this bit is set to 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 device is maintained separately for each initiator. When the Prevent bit is set to 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-on, 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 data cartridge if Prevent is set to 1. For more details, refer to Section 5.6, "MOVE MEDIUM Command (A5h)" on page 5-18.

4.14 READ Command (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	LUN			Reserved			SILI	Fixed
2 - 4	(MSB) Transfer Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-71. READ (08h) Command Descriptor Block — Data Format

Table 4-65. READ (08h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Suppress Incorrect Length Indicator (SILI)	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 ASC of INVALID FIELD IN CDB. If the SILI bit is not set and the actual block length is different from the specified transfer length, a CHECK CONDITION status is returned. Within the Sense data, the Incorrect Length Indicator (ILI) bit and Valid bit are set to 1. The Sense Key is set to 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 media is logically positioned after the block (EOM side).

Table 4-65. 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 set to 0, a Variable Block mode is requested. A single block is transferred with the Transfer Length specifying the maximum number of bytes the initiator has allocated for the returned data. When the Fixed bit is set to 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 set to 0, no data is transferred and the current position on the logical unit is not changed. 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).
Transfer Length	A Transfer Length set to 0 specifies no data will be transferred. This condition is not considered an error.

4.14.1 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 to 1 and the Sense Key is set to NO SENSE. The information fields contain the residue count. The ASC/Qs are set to FILEMARK DETECTED. Upon termination, the drive logically positions the media after the Filemark (EOM side).

If the tape drive detects End-of-Data (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 is set to BLANK CHECK. The EOM bit may be set if the tape drive determines that the media is positioned past EOT. The information fields contain the residue count. Upon termination, the media is physically positioned before EOD and after the last block on the media.

4.14.2 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 set to MEDIUM ERROR. The information fields contain the residue count and the ASC/Qs are set to EOM/P DETECTED. The media is physically positioned at EOM/P.

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

4.15 READ BLOCK LIMITS Command (05h)

The READ BLOCK LIMITS command tells the tape drive to return its limits for block length; the information is sent 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	LUN			Reserved				
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-72. 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 4-73. READ BLOCK LIMITS Data — Data Format

Table 4-66. READ BLOCK LIMITS (05h) Command Descriptor Block and Data — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
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 (16 MB – 2 bytes).
Minimum Block Length	This field indicates the minimum block size. The tape drive supports a minimum block length of 2 bytes.

4.16 READ BUFFER Command (3Ch)

The READ BUFFER command is used in conjunction with WRITE BUFFER 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	LUN			Rsv'd	Mode			
2	Buffer ID							
3 - 5	(MSB) Buffer Offset (LSB)							
6 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-74. READ BUFFER (3Ch) Command Descriptor Block — Data Format

Table 4-67. READ BUFFER (3Ch) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
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
0000b	Combined Header and Data
0010b	Data
0011b	Descriptor
1010b	Echo Buffer
1011b	Echo Buffer Descriptor

Table 4-67. READ BUFFER (3Ch) Command Descriptor Block — Field Descriptions (Continued)

Field Name	Description
Buffer ID	The tape drive only supports a single Buffer ID field of 0.
Buffer Offset	Buffer offsets are allowed to be non-zero. However, only certain integral multiples are valid. The offset boundary in the descriptor mode page of the READ BUFFER command reports the allowed integral multiple for the buffer offset values.
Allocation Length	This field specifies the maximum number of bytes that the initiator has allocated for returned data.

4.16.1 Combined Header and Data Mode (0000b)

The buffer offset and buffer ID are reserved in the command's CDB for this 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 Allocation Length bytes of header and data have been transferred or when all available data has been transferred to the initiator, whichever is less. The 4-byte READ BUFFER header is followed by data bytes from the target data buffer. The header has the format shown in Figure 4-75.

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

Figure 4-75. READ BUFFER Header — Header Format

Table 4-68. READ BUFFER Header — Field Descriptions

Field Name	Description
Buffer Capacity	The Buffer Capacity 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.

4.16.2 Data Mode (0010b)

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

4.16.3 Descriptor Mode (0011b)

The buffer offset is reserved in the command's CDB for this mode. In this mode, a maximum of 4 bytes of READ BUFFER descriptor information are returned. The tape device returns the descriptor information for the buffer specified by the Buffer ID. The tape device does not reject the invalid Buffer IDs with a CHECK CONDITION status, but returns all zeroes in the READ BUFFER descriptor.

The Offset Boundary is 2 (02h), indicating buffer offsets should be integral multiples of 4 bytes, as shown in Figure 4-76.

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

Figure 4-76. READ BUFFER Descriptor — Data Format

Table 4-69. READ BUFFER Descriptor — Field Descriptions

Field Name	Description
Offset Boundary	The Offset Boundary is 2 (02h), indicating buffer offsets should be integral multiples of 4 bytes.
Buffer Capacity	This 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.

4.16.4 Echo Buffer Mode (1010b)

In this mode, the tape device transfers data to the host from the echo buffer. The echo buffer transfers the same data as when the WRITE BUFFER command with the Mode field set to echo buffer was issued.

The Buffer ID and Buffer Offset fields are ignored in this mode.

The READ BUFFER command returns as many bytes of data as were received in the previous echo buffer mode WRITE BUFFER command from the same initiator, if possible. If the Allocation Length is insufficient to accommodate the number of bytes of data as received in the previous echo buffer mode WRITE BUFFER command, the data returned is truncated—this is not considered an error. If a previous echo buffer mode WRITE BUFFER command was not successfully completed, the echo buffer mode READ BUFFER command terminates with a CHECK CONDITION status, the Sense Key is set to ILLEGAL REQUEST and the ASC is set to COMMAND SEQUENCE ERROR. Each initiator has its own echo buffer, which prevents other initiators from overwriting that initiator echo buffer.

The initiator may send a READ BUFFER command requesting the echo buffer descriptor prior to a WRITE BUFFER command.

If an echo buffer mode WRITE BUFFER command is successful, then the initiator may send multiple echo buffer mode READ BUFFER commands to read the echo buffer data multiple times.

4.16.5 Echo Buffer Descriptor Mode (1011b)

In this mode, a maximum of 4 bytes of Read Echo Buffer descriptor information is returned. The tape drive returns the descriptor information for the echo buffer.

The Buffer Offset field is reserved in this mode.

Set the Allocation Length to 4 or greater. The tape drive transfers the Allocation Length, or 4 bytes of Read Buffer descriptor, whichever is lesser. The Read Echo Buffer descriptor is shown in Figure 4-77.

Bit Byte	7	6	5	4	3	2	1	0
0	Reserved							EBOS
1	Reserved							
2	Reserved			(MSB)				
3	Buffer Capacity (LSB)							

Figure 4-77. READ BUFFER Read Echo Buffer Descriptor — Data Format

Table 4-70. READ BUFFER Read Echo Buffer Descriptor — Field Descriptions

Field Name	Description
EBOS	Echo Buffer Overwritten Supported. If set to 1, indicates that the tape drive ensures echo buffer data from each initiator is the same as that previously written by the same initiator. If set to 0, specifies that the echo buffer may be overwritten by other initiators or intervening commands.
Buffer Capacity	This 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.

4.17 READ POSITION Command (34h)

The READ POSITION command is used to read a position identifier or a SCSI Logical Block Address. The LOCATE command uses this identifier to return to this same logical position in a high-performance manner.

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

Figure 4-78. READ POSITION (34h) Command Descriptor Block — Data Format

Table 4-71. READ POSITION (34h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
TCLP	Total Current Logical Position. When this field is set to 1, the data returned includes block and filemark position and fits the format described in "READ POSITION Data — Long Format" on page 4-139. When set to 0, the data returned takes the SCSI-2 format described in "READ POSITION Data — Short Format" on page 4-137. This bit indicates the tape drive returns data specifying the partition, file, and set number with the current logical position (Long Form). A TCLP bit of 0 indicates the tape drive returns data specifying the first and last block location with the number of bytes and blocks in the buffer (Short Form).
Long	When the Long field is set to 1, it indicates the tape drive returns 32 bytes of data. A Long bit of 0 indicates the tape drive returns 20 bytes of data. The Long bit and the TCLP bit must both be 1 or both be 0. If Long and TCLP have different values, the tape drive returns CHECK CONDITION with a Sense Key of ILLEGAL REQUEST.
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, the setting of BT is ignored. The logical block address values include all recorded objects: blocks and filemarks.

NOTE: If the media is not ready to be accessed, the tape drive returns CHECK CONDITION with a Sense Key of UNIT NOT READY.

4.17.1 READ POSITION Data — Short Format

The BOP and EOP bits are set as appropriate; refer to their descriptions in Table 4-72 on page 4-138. Figure 4-79 lists the READ POSITION data returned when the TCLP and the Long bits are both set to 0.

Bit / Byte	7	6	5	4	3	2	1	0
0	BOP	EOP	BCU	BYCU	Rsv'd	BPU (0)	PERR	Rsv'd
1	Partition Number (0)							
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 4-79. READ POSITION Data (Short Format) — Data Format

Table 4-72. READ POSITION Data (Short Format) — Field Descriptions

Field Name	Description
BOP	Beginning of Partition. When set to 1, indicates that the logical unit is at the beginning of partition in the current partition. When set to 0, indicates that the current logical position is not at the beginning of partition. Since the tape drive does not support more than one partition, the value of this field will be 1 when at BOT.
EOP	End of Partition. When set to 1, indicates that the logical unit is positioned between Early Warning and EOP in the current partition. When set to 0, it indicates that the current logical position is not between Early Warning and EOP.
BCU	Block Count Unknown. A BCU bit of 1 indicates that the Number of Blocks in Buffer field does not represent the actual number of blocks in the buffer. A BCU bit of 0 indicates that the Number of Blocks in Buffer field is valid.
BYCU	Byte Count Unknown. A BYCU bit of 1 indicates that the Number of Bytes in Buffer field does not represent the actual number of bytes in the buffer. A BYCU bit of 0 indicates that the Number of Bytes in Buffer field is valid.
BPU	Block Position Unknown. The BPU bit is never set, since the setting of the BT bit in the READ POSITION CDB does not affect the block address values returned.
PERR	Position Error. A PERR bit of 1 indicates that the logical unit is unable to report the correct position due to an overflow of any of the returned position data. A PERR bit of 0 indicates that an overflow has not occurred in any of the returned position data fields.
Partition Number	This field reports the partition number for the current logical position. If the logical unit only supports one partition for the medium, this field is set to 0.
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 same value as First Block Location is reported. 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.

4.17.2 READ POSITION Data — Long Format

The BOP and EOP bits are set as appropriate; refer to their descriptions in Table 4-73 on page 4-139. The following table indicates the READ POSITION data returned when the TCLP and the LONG bits are both set to 1.

Bit Byte	7	6	5	4	3	2	1	0
0	BOP	EOP	Reserved		MPU	BPU (0)	Reserved	
1 - 3	Reserved							
4 - 7	(MSB) Partition Number (LSB)							
8 - 15	(MSB) Block Number (LSB)							
16 - 23	(MSB) File Number (LSB)							
24 - 31	(MSB) Set Number (LSB)							

Figure 4-80. READ POSITION Data (Long Format) — Data Format

Table 4-73. READ POSITION Data (Long Format) — Field Descriptions

Field Name	Description
BOP	Beginning of Partition. When set to 1, indicates that the logical unit is at the beginning of partition in the current partition. When set to 0, indicates that the current logical position is not at the beginning of partition. Since the tape drive does not support more than one partition, the value of this field will be 1 when at BOT.
EOP	End of Partition. When set to 1, indicates that the logical unit is positioned between Early Warning and EOP in the current partition. When set to 0, it indicates that the current logical position is not between Early Warning and EOP.

Table 4-73. READ POSITION Data (Long Format) — Field Descriptions (Continued)

Field Name	Description
MPU	Mark Position Unknown. An MPU bit set to 1 indicates the file number and set number are not known, or accurate reporting is not currently available. A MPU bit set to 0 indicates the File Number and Set Number fields contain valid position information.
BPU	Block Position Unknown. The BPU bit is never set, since the setting of the BT bit in the READ POSITION CDB does not affect the block address values returned.
Partition Number	The tape drive supports only partition 0 on the medium, so this field is always set to 0.
Block Number	This field is the number of logical blocks between the beginning of partition and the current logical position. Filemarks and Setmarks count as one logical block each.
File Number	This field is the number of Filemarks between the beginning of partition and the current logical position.
Set Number	This field is the number of Setmarks between the beginning of partition and the current logical position.

4.18 RECEIVE DIAGNOSTIC RESULTS Command (1Ch)

The RECEIVE DIAGNOSTIC RESULTS command tells the tape drive to send analysis data to the initiator after completing a SEND DIAGNOSTIC command. The data that is returned by this command is shown in Figure 4-82 on page 4-142. 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	LUN			Reserved				
2	Reserved							
3 - 5	(MSB) Allocation Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-81. RECEIVE DIAGNOSTICS RESULTS (1Ch) Command Descriptor Block — Data Format

Table 4-74. RECEIVE DIAGNOSTICS RESULTS (1Ch) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Allocation Length	The Allocation Length specifies the maximum number of bytes that the host has allocated for returned data.

4.18.1 Diagnostics Results Returned

A four byte error code is returned to the initiator.

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	Error Code							

Figure 4-82. RECEIVE DIAGNOSTICS RESULTS — Data Format

The information in the returned results indicates which of the main components of the subsystem failed testing.

4.19 RELEASE (6) Command (17h)

The RELEASE and the RESERVE commands are used for conflict resolution in multiple-initiator systems. The RELEASE (6) command is used to release a previously reserved logical unit. The tape drive does not return an error if the initiator attempts to release a reservation that is not currently valid.

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

Figure 4-83. RELEASE (6) (17h) Command Descriptor Block — Data Format

If the logical unit has previously been reserved by any initiator with RESERVE (6) or RESERVE (10), then PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands will be rejected with RESERVATION CONFLICT status.

If the logical unit has previously been registered by any initiator with PERSISTENT RESERVE OUT, then RESERVE (6), RESERVE (10), RELEASE (6), and RELEASE (10) commands will be rejected with RESERVATION CONFLICT status.

Table 4-75. RELEASE (6) (17h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
3rdPty	Third Party Release. This bit allows an initiator to release a logical unit that was previously reserved. If the value in this field is 0, third party release is not requested. If 3rdPty is set to 1, then the tape drive releases the specified logical unit, but only if the initiator ID, 3rdPty bit, and Third Party Device ID are identical when compared to the RESERVE command that established the reservation.
Third Party Device ID	If the 3rdPty bit is set to 1, then this field specifies the SCSI ID of the initiator whose third party reservation is being released. This field must be set if the initiator of the original third party RESERVE is the source of the RELEASE.

4.19.1 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 the drive LUNs are handled independently.

4.19.2 SCSI Commands Under Reservations

The behavior of some SCSI commands when under reservation varies slightly. Refer to Appendix A, “SCSI Commands Under Reservation” for details.

4.20 RELEASE (10) Command (57h)

The RELEASE and the RESERVE commands are used for conflict resolution in multiple-initiator systems. The RELEASE (10) command is used to release a previously reserved logical unit. The tape drive does not return an error if the initiator attempts to release a reservation that is not currently valid.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (57h)							
1	Reserved			3rdPty	Reserved		LongID (0)	Extent (0)
2	Reservation Identification							
3	Third Party Device ID							
4 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-84. RELEASE (10) (57h) Command Descriptor Block — Data Format

If the logical unit has previously been reserved by any initiator with RESERVE (6) or RESERVE (10), then PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands will be rejected with RESERVATION CONFLICT status.

If the logical unit has previously been registered by any initiator with PERSISTENT RESERVE OUT, then RESERVE (6), RESERVE (10), RELEASE (6), and RELEASE (10) commands will be rejected with RESERVATION CONFLICT status.

Table 4-76. RELEASE (10) (57h) Command Descriptor Block — Field Descriptions

Field Name	Description
3rdPty	Third Party Release. This bit allows an initiator to release a logical unit that was previously reserved. If the value in this field is 0, third party release is not requested. If 3rdPty bit is set to 1, then the tape drive releases the specified logical unit, but only if the initiator ID, 3rdPty bit, and third party device ID are identical when compared to the RESERVE command that established the reservation.
LongID	This field is not supported and must be 0.

Table 4-76. RELEASE (10) (57h) Command Descriptor Block — Field Descriptions (Continued)

Field Name	Description
Extent	This field is not supported and must be set to 0.
Reservation Identification	This field is ignored by the tape drive.
Third Party Device ID	If the 3rdPty bit is 1, then this field specifies the SCSI ID of the initiator whose third party reservation is being released. This field must be set if the initiator of the original third party RESERVE is the source of the RELEASE.
Parameter List Length	This field must be 0.

4.20.1 SCSI Commands Under Reservations

The behavior of some SCSI commands when under reservation varies slightly. Refer to Appendix A, “SCSI Commands Under Reservation” for details.

4.21 REPORT DENSITY SUPPORT Command (44h)

The REPORT DENSITY SUPPORT command is used to request that information about the densities supported by the logical unit be sent to the initiator. Note that a reservation conflict will occur when a REPORT DENSITY SUPPORT command is received from any initiator other than the one holding a logical unit reservation.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (44h)							
1	Reserved							Media
2 - 6	Reserved							
7 - 8	(MSB) Allocation Length (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-85. REPORT DENSITY SUPPORT (44h) Command Descriptor Block — Data Format

Table 4-77. REPORT DENSITY SUPPORT (44h) Command Descriptor Block — Field Descriptions

Field Name	Description
Media	When the Media bit is set to 0, it indicates that the tape drive returns density support data blocks for densities supported by the logical unit for any supported media. When the Media bit is set to 1, it indicates that the tape drive returns density support data blocks for densities supported by the mounted media.
Allocation Length	The value in this field specifies the maximum number of bytes that the tape drive may return.

4.21.1 Density Support Header

The REPORT DENSITY SUPPORT command returns the DENSITY SUPPORT header followed by one or more density support data block descriptors.

Bit / Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Available Density Support Length (LSB)							
2 - 3	Reserved							
4 - n	Density Support Data Block Descriptors							

Figure 4-86. REPORT DENSITY SUPPORT Header — Header Format

Table 4-78. REPORT DENSITY SUPPORT Header — Field Descriptions

Field Name	Description
Available Density Support Length	The Available Density Support Length field specifies the number of bytes in the following data that is available to be transferred. The available density support length does not include itself. This field must be equal to 2 more than an integer multiple of 52 (the length in bytes of a density support data block descriptor).
Density Support Data Block Descriptors	Refer to Section 4.21.2, “Density Support Data Block Descriptor” on page 4-149 for details about this field.

4.21.2 Density Support Data Block Descriptor

The density support data block descriptors follow the density support header. The density support data block descriptors are in numerical ascending order, based on the Primary Density Code value.

Bit / Byte	7	6	5	4	3	2	1	0
0	Primary Density Code							
1	Secondary Density Code							
2	WrtOK	DUP	Deflt	Reserved				
3 - 4	Reserved							
5 - 7	(MSB) Bits per MM (LSB)							
8 - 9	(MSB) Media Width (LSB)							
10 - 11	(MSB) Tracks (LSB)							
12 - 15	(MSB) Capacity (LSB)							
16 - 23	(MSB) Assigning Organization (LSB)							
24 - 31	(MSB) Density Name (LSB)							
32 - 51	(MSB) Description (LSB)							

Figure 4-87. REPORT DENSITY SUPPORT Data Block Descriptor — Data Format

Table 4-79. REPORT DENSITY SUPPORT Data Block Descriptor — Field Descriptions

Field Name	Description
Primary Density Code	This field contains the value returned by a MODE SENSE command for the density described in the remainder of the Density Support Data Block Descriptor.
Secondary Density Code	When multiple density code values are assigned to the same recording technology, this field lists the equivalent density code value. The tape drive returns the Primary Device Code value in this field.
WrtOK	Write OK. When this bit is set to 0, it indicates that the tape drive does not support writing to the media with this density. When this bit is set to 1, it indicates that the tape drive is capable of writing this density to either the currently mounted medium (if the Media bit in the command block descriptor = 1), or for some media (if the Media bit in the command block descriptor = 0). **Note:** All density code values returned by the Report Density Support command are supported for READ operations.
DUP	Duplicated. When this bit is set to 0, it indicates that this Primary Density Code has exactly one density support data block. When this bit is set to 1, it indicates that this Primary Density Code is specified in more than one density support data block.
Deflt	Default. When this bit is set to 0, it indicates that this is not the default density of the tape drive. If either the Primary Density Code or the Secondary Density Code is 0, the Deflt bit will be 1. If neither of the Primary or Secondary Density Code is 0 and the Deflt is 1, the logical unit will accept a MODE SELECT header with a density code of 00h as equivalent to the Primary and Secondary Density Codes. **Note:** The default density of the logical unit may vary depending on the currently mounted media. Multiple codes may return a Deflt bit of 1 when the Media bit is 0 since more than one default may be possible.
Bits per MM	Bits per Millimeter. The value in this field indicates the number of bits per millimeter per track as recorded on the tape medium. The value is rounded up, if the fractional value of the actual value is greater than or equal to 0.5. A value of 00h indicates that the number of bits per millimeter does not apply to this logical unit.
Media Width	The value in this field indicates the width of the tape medium supported by this density. This field has units in tenths of millimeters. A value of 00h indicates that the width of the medium does not apply to this logical unit.
Tracks	The value in this field indicates the number of data tracks supported on the medium by this density.

Table 4-79. REPORT DENSITY SUPPORT Data Block Descriptor — Field Descriptions

Field Name	Description
Capacity	If the Media bit is set to 0, the Capacity field indicates the approximate capacity of the longest supported medium. If the Media bit is set to 1, the Capacity field indicates the approximate capacity of the current medium. The capacity assumes that compression is disabled. If this density does not support an uncompressed format, the capacity assumes that compression is enabled using “average” data. The capacity also assumes that the media is in good condition and that normal data and block sizes are used. The value is given in units of megabytes. Note that the logical unit does not guarantee that this space is actually available in all cases. The Capacity field is intended to be used by the host to determine that the correct density is being used, especially when a lower density format is required.
Assigning Organization	This field contains 8 bytes of ASCII data identifying the organization responsible for the specifications that define the values in the density support data block. The data in this field is left aligned. Use the ASCII value for a space (20h) if padding is required.
Density Name	This field contains 8 bytes of ASCII data identifying the document that is associated with this density support data block. The data in this field is left aligned. Use the ASCII value for a space (20h) if padding is required.
Description	The DESCRIPTION field contains twenty bytes of ASCII data describing the density. The data in this field is left aligned. Use the ASCII value for a space (20h) if padding is required. The density information is reported by the tape drive in the following manner:

Field	DLT1/VS80	VS160
Primary Density Code	40h	50h
Secondary Density Code	40h	50h
Bits per MM	4843d	7283d
Media Width	127d	127d
Tracks	84d	60d
Capacity	40000d	80000d
Assigning Organization	BNCHMARK	QUANTUM
Density Name	DLT	DLT
Description	DLT-VS80	DLT-VS160

4.22 REPORT DEVICE IDENTIFIER Command (A3h)

The REPORT DEVICE IDENTIFIER command requests that the tape drive send device identification information to the initiator. The REPORT DEVICE IDENTIFIER parameter list format is shown below.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A3h)							
1	Reserved			Service Action (05h)				
2 - 5	Reserved							
6 - 9	(MSB) Allocation Length (LSB)							
10	Reserved							
11	Unused		Reserved				Flag	Link

Figure 4-88. REPORT DEVICE IDENTIFIER (A3h) Command Descriptor Block — Data Format

Table 4-80. REPORT DEVICE IDENTIFIER (A3h) Command Descriptor Block — Field Descriptions

Field Name	Description
Service Action	This field must be set to 05h. Set to any other value, the target terminates the command with CHECK CONDITION status and the Sense Key set to ILLEGAL REQUEST with an ASC of INVALID FIELD IN CDB.
Allocation Length	This field specifies the number of bytes of Report Device Identifier information the tape drive is allowed to return. If the allocation length is not sufficient to contain all the information, the requested Allocation Length is returned; this is not considered an error. The actual length of the parameter data is available in the Identifier Length field in the parameter data. If the remainder of the parameter data is required, the initiator sends a new REPORT DEVICE IDENTIFIER command with an Allocation Length field large enough to contain all the data.

4.22.1 REPORT DEVICE IDENTIFIER Command Parameter List

The REPORT DEVICE IDENTIFIER parameter list contains a 4-byte field that contains the length in bytes of the parameter list and the logical unit's identifier.

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

Figure 4-89. REPORT DEVICE IDENTIFIER Parameter List Format — Data Format

Table 4-81. REPORT DEVICE IDENTIFIER (A3h) Parameter List Format — Field Descriptions

Field Name	Description
Identifier Length	This field specifies the length in bytes of the Identifier field. If the Allocation Length field in the CDB is too small to transfer all of the identifier, the length is not adjusted to reflect the truncation. The identifier length is initially equal to 0, and is changed only by a successful SET DEVICE IDENTIFIER command.
Identifier	The value reported in this field is the last value written by a successful SET DEVICE IDENTIFIER command. The value of the identifier is changed only by a successful SET DEVICE IDENTIFIER command. The identifier value persists through resets, power cycles, media write operations, and media replacement.

4.23 REPORT LUNS Command (A0h)

The initiator uses this command to retrieve information about which logical units the tape drive supports. The REPORT LUNS command is not affected by reservations or persistent reservations.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (A0h)							
1 - 5	Reserved							
6 - 9	(MSB) Allocation Length (LSB)							
10	Reserved							
11	Unused		Reserved				Flag	Link

Figure 4-90. REPORT LUNS (A0h) Command Descriptor Block — Data Format

Table 4-82. REPORT LUNS (A0h) Command Descriptor Block — Field Descriptions

Field Name	Description
Allocation Length	The Allocation Length is at least 16 bytes. If the Allocation Length is less than 16 bytes, the tape drive returns CHECK CONDITION status. The Sense Key will be set to ILLEGAL REQUEST with an ASC of INVALID FIELD IN CDB. If the Allocation Length is not sufficient to contain the logical unit number values for all configured logical units, the tape drive will report as many logical unit number values as will fit in the specified Allocation Length; this is not considered an error. The tape drive will report the logical unit numbers of configured logical units using the format shown in Figure 4-91 on page 4-155.

4.23.1 REPORT LUNS Command Parameter List

The tape drive reports the logical unit numbers of configured logical units using the format shown in Figure 4-91.

Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) LUN List Length (n-7) (LSB)							
4 - 7	(MSB) Reserved (LSB)							
	LUN List							
8 - 15	(MSB) LUN (First LUN) (LSB)							
…								
(n-7) - n	(MSB) LUN (Last LUN) (LSB)							

Figure 4-91. REPORT LUNS Parameter List — Data Format

Table 4-83. REPORT LUNS (A0h) Parameter List — Field Descriptions

Field Name	Description
LUN List Length	The LUN List Length field contains the length (in bytes) of the LUN list that is available to be transferred. The LUN List Length is the number of logical unit numbers reported multiplied by eight. If the allocation length in the command descriptor block is too small to transfer information about all configured logical units, the LUN List Length value is not adjusted to reflect the truncation.
First LUN	The first configured LUN. See the description for LUN List Length field, above.
Last LUN	The last configured LUN. See the description for LUN List Length field, above.

4.24 REQUEST SENSE Command (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	LUN			Reserved				
2 - 3	Reserved							
4	Allocation Length							
5	Unused		Reserved				Flag	Link

Figure 4-92. 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 tape. Additionally, bytes 25 through 28 will contain the amount of data to be written in 8 KB blocks.

REQUEST SENSE does not cause the tape drive to flush its buffered data to tape. 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, which forces the tape drive to flush any currently buffered data to the medium. A subsequent REQUEST SENSE returns to the initiator the actual physical (and logical) position of the tape drive.

Table 4-84. REQUEST SENSE (03h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Allocation Length	The Allocation Length specifies the maximum number of sense bytes to be returned. The tape drive terminates the transfer when Allocation Length bytes have been transferred or when all available Sense data has been transferred to the host, whichever is less.

4.24.1 REQUEST SENSE Information Data

The Sense data returned by the REQUEST SENSE command has the format shown in Figure 4-93.

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	Tape Motion Hours							
21 - 24	Power-on Hours							
25 - 28	Tape Remaining							
29	Reserved							

Figure 4-93. REQUEST SENSE Data — Data Format

Table 4-85. REQUEST SENSE (03h) Data — Field Descriptions

Field Name	Description	
Valid	When Valid is set to 1, indicates that the information bytes contain valid information, as defined by the SCSI specification.	
Error Code	These values may be returned for Error Code:	
	Value	**Description**
	70h	Indicates a current error; the report is associated with the most recently received command.
	71h	Indicates a deferred error; the report is associated with a previous command and not as a result of the current command.
	Note: 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-type 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-type 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 tape. Only READ can set this bit.	
Sense Key	In most cases, Additional Sense Code and Qualifier information is available. See Table 4-86 on page 4-159 for more information.	
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 command descriptor block 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.	

Table 4-85. REQUEST SENSE (03h) Data — Field Descriptions (Continued)

Field Name	Description
Additional Sense Code (ASC) and ASC Qualifier	These two bytes provide additional information about the Sense Key and the cause of the CHECK CONDITION status. See Table 4-87 on page 4-160 for more information.
Sub-Assembly Code	Not supported. Always set to 0.
SKSV	Sense-Key Specific Valid. When this bit is set to 1, indicates that the Sense Key specific fields are valid. The Sense-Key-specific fields are bytes 15, 16, and 17 of the Sense data.
C/D	Command/Data. When set to 1, indicates that the illegal parameter is in the CDB. When set to 0, indicates that the illegal parameter is in the Parameter List from the initiator.
BPV	Bit Pointer Valid. When BPV is set to 1, 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.
Bit Counter	Bit Counter. Indicates which bit of the byte was 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 Sense data and may be available after certain types of failures.
Tape Motion Hours	Reports the number of tape motion hours, that is, the head wear hours. Format is represented in a hexadecimal word (2 bytes).
Power-on Hours	Reports the total hours the tape drive power has been on. Format is represented in a hexadecimal longword (4 bytes).
Tape Remaining	Reports the amount of tape remaining in 8 KB (8192 bytes) blocks.

Table 4-86 lists and describes the Sense Keys supported by the tape drive.

Table 4-86. Supported Sense Keys for REQUEST SENSE (03h) Command

Sense Key	Description
0h	No Sense. Check the Filemark/EOM/ILI bits and the ASC/Q bytes.
1h	Recovered Error. Can be caused by rounding of Mode Parameters on a MODE SELECT, or to report that R/W error rates are 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 period of time.

Table 4-86. Supported Sense Keys for REQUEST SENSE (03h) Command (Continued)

Sense Key	Description
2h	Not Ready. The media is not ready for tape operation commands. Media might not be present in the tape drive, or may be in process of loading or calibrating.
3h	Medium Error. An unrecoverable write, read, or positioning error has occurred. Detailed device-specific information may be available.
4h	Hardware Error. The ASC/Q fields may provide more specific information.
5h	Illegal Request. The CDB or supplied parameter data had an unsupported or illegal operation specified.
6h	Unit Attention. Unit Attentions are created after a device reset, if the media asynchronously becomes ready to this initiator, if another initiator changes Mode Parameters, and if the firmware is updated.
7h	Data Protected. The current media is write-protected. This Sense Key results from the write-protect switch on the data cartridge, or if the media is not DLTtape III, DLTtape IIIxt, or DLTtape IV.
8h	Blank Check. An EOD has been encountered.
Bh	Command Aborted. Generated when the tape drive aborts a command. Check the ASC/Q bytes.
Dh	Volume Overflow. Physical End of Media (EOM) has been reached during writing. The initiator ignored the EOM condition and continued writing.

Table 4-87 lists and describes all the Sense Keys and ASC/ASCQ combinations that are reported by the tape drive.

Table 4-87. Supported ASC / ASCQ (Hex) for REQUEST SENSE (03h) Command

Sense Key	ASC	ASCQ	Description
00h NO SENSE	00	00	No Additional Sense Code
	00	01	Unexpected Filemark (FM) Encountered
	00	02	End of Medium (EOM) Encountered
	00	04	Beginning of Medium (BOM) Encountered
01h RECOVERED ERROR	37	00	Rounded Parameter
	5B	02	Log Counter at Maximum
	5D	00	TapeAlert Failure Prediction Threshold Exceeded
	5D	FF	False Exception Condition

Table 4-87. Supported ASC / ASCQ (Hex) for REQUEST SENSE (03h) Command (Continued)

Sense Key	ASC	ASCQ	Description
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	07	Unit Not Ready, Operation in Progress
	30	00	Unit Not Ready, Incompatible Medium
	30	01	Unit Not Ready, Unknown Format
	30	02	Unit Not Ready, Incompatible Format
	30	03	Unit Not Ready, Cleaning Cartridge Installed
	3A	00	Unit Not Ready, Media Not Present
	80	00	Unit Not Ready, Calibration Error
03h MEDIUM ERROR	0C	00	WRITE Error (possible tape medium problem, cleaning tape needed)
	11	01	Unrecovered Read Error, Read Retries Exhausted
	80	00	Calibration Error (use Cleaning Tape)
04h HARDWARE ERROR	15	01	Random Mechanical Positioning Error
	30	02	Incompatible Format
	40	84	Diagnostic Media Present Error
	44	00	Internal Target Failure
05h ILLEGAL REQUEST	1A	00	Parameter List Length Error
	20	00	Illegal Opcode
	21	01	Invalid Element Address (Media Changer)
	24	00	Invalid CDB Field (may occur if odd block counts are attempted in Fixed Mode)
	24	89	Image Data Over Limit
	24	8B	Image/Personality is Bad
	24	8D	Bad Drive/Server Image EDC
	24	90	Image not for this Product Family
	24	91	Incompatible Hardware Features

Table 4-87. Supported ASC / ASCQ (Hex) for REQUEST SENSE (03h) Command (Continued)

Sense Key	ASC	ASCQ	Description
	25	00	Illegal LUN
	26	00	Parameter List Error, Invalid Field
	26	02	Parameter List Error, Parameter Value Invalid
	26	04	Invalid Release of Persistent Reservations
	2C	00	Command Sequence Error
	39	00	Saving Parameters Not Supported
	3B	0D	Media Destination Element Full 1
	3B	0E	Media Source Element Empty 1
	3D	00	Invalid Bits in ID Message
	53	02	Media Removal Prevented
	55	04	Insufficient Resources
	82	00	Not Allowed if Not at BOT
06h UNIT ATTENTION	28	00	Not Ready to Ready Transition
	29	00	Power-on Reset Occurred
	29	02	SCSI Bus Reset Occurred
	29	03	BUS DEVICE RESET Message Occured
	29	05	Transceiver Mode Changed to Single-ended
	29	06	Transceiver Mode Changed to LVD
	2A	01	Mode Parameters Changed
	2A	02	Log Parameters Changed
	2A	03	Persistent Reservation Pre-empted
	2A	04	Persistent Reservation Released
	2A	05	Persistent Registrations Pre-empted
	3F	01	Microcode has been Changed
	3F	05	Device Identifier Changed
	5B	01	Log Threshold Condition Met
07h DATA PROTECTED	27	00	WRITE Protected
	27	80	Hardware WRITE Protected

Table 4-87. Supported ASC / ASCQ (Hex) for REQUEST SENSE (03h) Command (Continued)

Sense Key	ASC	ASCQ	Description
08h BLANK CHECK	00	05	EOD Encountered
0Bh ABORTED COMMAND	43	00	Message Error
	44	86	Insufficient CDB Bytes
	44	88	Bus DMA Transfer Timeout
	47	00	SCSI Parity Error (check SCSI bus configuration and connections)
	48	00	IDE Message Error
	4E	00	Overlapped Commands Attempted (queue tag is not unique, CDB sent with abort tag message, or untagged, or untagged CDBs are outstanding)
0Dh VOLUME OVERFLOW	00	02	End of Medium (EOM) Encountered

4.25 RESERVE (6) Command (16h)

The RESERVE (6) command reserves the specified tape drive for the exclusive use of the requesting initiator or for another specified SCSI device.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	LUN			3rdPty	Third-Party Device ID			Rsv'd
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-94. RESERVE (6) (16h) Command Descriptor Block — Data Format

If the logical unit has previously been reserved by any initiator with RESERVE (6) or RESERVE (10) then PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands will be rejected with RESERVATION CONFLICT status.

If the logical unit has previously been registered by any initiator with PERSISTENT RESERVE OUT then RESERVE (6), RESERVE (10), RELEASE (6), and RELEASE (10) commands will be rejected with RESERVATION CONFLICT status.

The reservation remains in effect until one of the following conditions is met:

- The initiator that made the reservation sends another RESERVE command.
- The same initiator releases the tape drive with the RELEASE 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 RESERVE to a tape drive that is currently reserved by the requesting initiator.

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

If, after honoring the reservation, any other initiator attempts to perform any command except INQUIRY, REQUEST SENSE, or RELEASE, the command is rejected with a RESERVATION

CONFLICT status. A RELEASE command issued by another initiator is ignored by that reserved logical unit.

Table 4-88. RESERVE (6) (16h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
3rdPty	Third Party. The third-party reservation option for RESERVE (6) 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. If the third-party (3rdPty) bit is set to 0, the third-party reservation option is not requested. If the 3rdPty bit is set to 1, RESERVE (6) 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 the four conditions mentioned earlier occurs. 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 to the tape drive.
Third Party Device ID	The Third Party Device ID is used only when the 3rdPty bit is set, in which case this field specifies the SCSI ID of the initiator to be granted the reservation of the logical unit. The drive ignores any attempt to release the reservation made by any other initiator. For example, if ID7 sends ID2 a Third Party reservation on behalf of ID6 (the target at ID2 gets reserved for the initiator ID6), then only ID7 can release the target at ID2 (using a Third Party release). ID6 cannot release the reservation, even though the reservation was made on its behalf.

4.25.1 Medium Changer Considerations

The optional Element Reservation feature defined for Medium Changer devices in SCSI-2 is not supported. The RESERVE command is defined the same as for the tape drive. The entire loader 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 cartridge in the tape drive unless the same initiator has reserved the tape drive.

4.25.2 SCSI Commands Under Reservations

The behavior of some SCSI commands when under reservation varies slightly. Refer to Appendix A, “SCSI Commands Under Reservation” for details.

4.26 RESERVE (10) Command (56h)

The RELEASE (10) and the RESERVE (10) commands are used for conflict resolution in multiple-initiator systems. The RESERVE (10) command is used to reserve a logical unit.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (56h)							
1	Reserved			3rdPty	Reserved		LongID (0)	Extent (0)
2	Reservation Identification							
3	Third Party Device ID							
4 - 6	Reserved							
7 - 8	(MSB) Parameter List Length (0) (LSB)							
9	Unused		Reserved				Flag	Link

Figure 4-95. RESERVE (10) (56h) Command Descriptor Block — Data Format

If the logical unit has previously been reserved by any initiator with RESERVE (6) or RESERVE (10) then PERSISTENT RESERVE IN and PERSISTENT RESERVE OUT commands will be rejected with RESERVATION CONFLICT status.

If the logical unit has previously been registered by any initiator with PERSISTENT RESERVE OUT then RESERVE (6), RESERVE (10), RELEASE (6), and RELEASE (10) commands will be rejected with RESERVATION CONFLICT status.

RESERVE (10) 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 is met:

- The initiator that made the reservation sends another RESERVE command.
- The same initiator releases the tape drive with the RELEASE 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 RESERVE to a tape drive that is currently reserved by the requesting initiator.

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

If, after honoring the reservation, any other initiator attempts to perform any command except INQUIRY, REQUEST SENSE, or RELEASE , the command is rejected with a RESERVATION CONFLICT status. A RELEASE command issued by another initiator is ignored by that reserved logical unit.

Table 4-89. RESERVE (10) (56h) Command Descriptor Block — Field Descriptions

Field Name	Description
3rdPty	The third-party reservation option for RESERVE (10) allows an initiator to reserve a logical unit for another SCSI device. This tape drive implements this option, which is intended for systems that use COPY. If the third-party (3rdPty) bit is 0, the third-party reservation option is not requested. If the 3rdPty bit is 1, RESERVE (10) 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 the four conditions mentioned above occurs. 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 to the tape drive.
LongID	This field is not used and must be set to 0.
Extent	This field must be set to 0.
Reservation Identification	This field is ignored by the tape drive.
Third Party Device ID	The Third Party Device ID is used only when the 3rdPty bit is set, in which case this field specifies the SCSI ID of the initiator to be granted the reservation of the logical unit. The drive ignores any attempt to release the reservation made by any other initiator. For example, if ID7 sends ID2 a Third Party reservation on behalf of ID6 (the target at ID2 gets reserved for the initiator ID6), then only ID7 can release the target at ID2 (using a Third Party release). ID6 cannot release the reservation even though the reservation was made on its behalf.
Parameter List Length	This field must be 0.

4.26.1 SCSI Commands Under Reservations

The behavior of some SCSI commands when under reservation varies slightly. Refer to Appendix A, “SCSI Commands Under Reservation” for details.

4.27 REWIND Command (01h)

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

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (01h)							
1	LUN			Reserved				Immed
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-96. REWIND (01h) Command Descriptor Block — Data Format

Table 4-90. REWIND (01h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Immed	Immediate. If this bit is set to 1, the tape drive first writes any remaining buffered data to tape 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, status is returned after the rewind has completed.

4.28 SEND DIAGNOSTIC Command (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	LUN			PF	Rsv'd	SelfTst	DevOfl	UnitOfl
2	Reserved							
3 - 4	(MSB) Parameter List Length (LSB)							
5	Unused		Reserved				Flag	Link

Figure 4-97. SEND DIAGNOSTIC (1Dh) Command Descriptor Block — Data Format

Table 4-91. SEND DIAGNOSTIC (1Dh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
PF	Page Format. Not supported. Must be set to 0.
SelfTst	Self Test. If set to 1, a Level 1 self-test is performed. If set to 0, no self-test is performed.
DevOfl	Device Offline. Not supported. Must be set to 0.
UnitOfl	Unit Offline. Not supported. Must be set to 0.
Parameter List Length	This field specifies the length in bytes of the SEND DIAGNOSTIC parameter list to be transferred from the initiator to the target during the DATA-OUT phase.

4.28.1 Unit Resident Tests

The Electronics Self-Test – (Level 1 test) is the only self-test supported by the tape drive. 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-up testing is not necessary. Therefore, this test performs an extension of the power-up self tests.

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 takes approximately 5 seconds to execute.

4.29 SET DEVICE IDENTIFIER Command (A4h)

The SET DEVICE IDENTIFIER command requests that the device identifier information in the logical unit be set to the value received in the SET DEVICE IDENTIFIER parameter list.

On successful completion of a SET DEVICE IDENTIFIER command that changes the device identifier saved by the tape drive, a UNIT ATTENTION is generated for all initiators except the one that issued the service action. When reporting the unit attention condition, the ASC is set to DEVICE IDENTIFIER CHANGED.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (A4h)							
1	Reserved			Service Action (06h)				
2 - 5	Reserved							
6 - 9	(MSB) Parameter List Length (LSB)							
10	Reserved							
11	Unused		Reserved				Flag	Link

Figure 4-98. SET DEVICE IDENTIFIER (A4h) Command Descriptor Block — Data Format

Table 4-92. SET DEVICE IDENTIFIER (A4) Command Descriptor Block — Field Descriptions

Field Name	Description
Service Action	This field must be set to 06h. Set to any other value, the target terminates the command with CHECK CONDITION status and the Sense Key set to ILLEGAL REQUEST with an ASC of INVALID FIELD IN CDB.
Parameter List Length	This field specifies the length in bytes of the Identifier that is transferred from the initiator to the tape drive. For more information about Identifier, refer to "SET DEVICE IDENTIFIER Command Parameter List" on page 4-174. The maximum value for this field is 64 bytes. A Parameter List Length of 0 indicates that no data is transferred, and that subsequent REPORT DEVICE IDENTIFIER commands return an Identifier length of 0. If Parameter List Length exceeds 64 bytes, then the tape drive returns CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST and an ASC of INVALID FIELD IN CDB.

4.29.1 SET DEVICE IDENTIFIER Command Parameter List

The SET DEVICE IDENTIFIER parameter list contains the identifier to be set by the addressed logical unit.

Bit / Byte	7	6	5	4	3	2	1	0
0 - n	(MSB) Identifier (LSB)							

Figure 4-99. SET DEVICE IDENTIFIER Parameter List— Data Format

Table 4-93. SET DEVICE IDENTIFIER (A4) Parameter List — Field Descriptions

Field Name	Description
Identifier	Data to be returned by all subsequent REPORT DEVICE IDENTIFIER commands, until replaced by another valid SET DEVICE IDENTIFIER command.

4.30 SPACE Command (11h)

The SPACE command provides a variety of positioning functions that are determined by the Code and Count fields in the CDB, as shown in Figure 4-100. Both forward (toward EOM/P) and reverse (toward BOM/P) positioning are provided.

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

Figure 4-100. SPACE Command (11h) Command Descriptor Block — Data Format

Table 4-94. SPACE Command (11h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Code	The code can 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 4-94. SPACE Command (11h) Command Descriptor Block — Field Descriptions

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 tape 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 tape on the BOM/P side of the Nth block or mark. • When spacing to End of Data (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 tape before EOD.

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

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

Therefore, a command to 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. A SPACE N Filemarks halts on the Nth Filemark or on any occurrence of EOD, BOM/P, or EOM/P, and so on.

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

4.31 TEST UNIT READY Command (00h)

The TEST UNIT READY command checks if the tape drive is ready for commands involving tape 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	LUN			Reserved				
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

Figure 4-101. TEST UNIT READY (00h) Command Descriptor Block — Data Format

Table 4-95. TEST UNIT READY (00h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.

4.32 WRITE Command (0Ah)

WRITE transfers one or more blocks from the host to the current logical position. When in Buffered Mode (see Section 4.9, “MODE SELECT (6) / (10) Command (15h / 55h)” on page 4-57), the tape drive reports a GOOD status on WRITE commands as soon as this data block has been transferred to the data buffer.

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

Figure 4-102. WRITE (0Ah) Command Descriptor Block — Data Format

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

- The write hold-off time limit is exceeded. (See “MODE SELECT (6) / (10) Command (15h / 55h)” on page 4-57.)
- 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 Immed bit cleared.
- A SCSI reset or BUS DEVICE RESET reset message is received.

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

Table 4-96. WRITE (0Ah) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
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 tape position. Upon successful termination, the tape 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 cause the Transfer Length field to specify the number of blocks to be transferred to the host beginning at the current tape 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 tape 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 set to 0, no data is transferred and the current position on the logical unit is not changed.

4.32.1 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 is set to NO SENSE, and the ASC/Qs are set to 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 is set to VOLUME OVERFLOW. The Information fields contain the residue count and the ASC/Qs are set to EOM/P DETECTED. The tape is physically positioned at EOM/P.

4.33 WRITE BUFFER Command (3Bh)

The WRITE BUFFER command is used with the READ BUFFER command as a diagnostic function for testing the device data buffer, direct memory access (DMA) engine, SCSI bus interface hardware, and SCSI bus integrity. It is also used for downloading and updating microcode (firmware).

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

Figure 4-103. WRITE BUFFER (3Bh) Command Descriptor Block — Data Format

Table 4-97. WRITE BUFFER (3Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.

Table 4-97. WRITE BUFFER (3Bh) Command Descriptor Block — Field Descriptions

Field Name	Description
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 set. **Mode** — **Description** 0000b — Write Combined Header and Data 0010b — Write Data 0100b — Download Microcode 0101b — Download Microcode and Save 1010b — Echo Buffer
Buffer ID	The tape drive only supports a single Buffer ID field of 0.
Buffer Offset	Buffer offsets area 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.
Parameter List Length	This field specifies the maximum number of bytes that will be transferred from the data out buffer to be stored in the echo buffer. The application client should attempt to ensure that the parameter list length does not exceed the capacity of the echo buffer. The capacity of the echo buffer may be determined by the Buffer Capacity field in the READ BUFFER echo buffer descriptor. If the Parameter List Length field specifies a transfer in excess of the buffer capacity, the device server will return CHECK CONDITION status and will set the Sense Key to ILLEGAL REQUEST with an ASC of INVALID FIELD IN CDB.

4.33.1 Header and Data Mode

The data to be transferred is preceded by a 4-byte header consisting entirely of reserved bytes. This header is discarded (not stored into the buffer). The Buffer Offset and Buffer ID within the command's CDB are reserved in this mode.

4.33.2 Write Data Mode

Similar to Mode 0000b (Write Combined Header and Data), except there is no header in the data passed to the target, and buffer offsets and buffer ID are not reserved for this mode. The target detects potential buffer overruns and rejects the command.

4.33.3 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; if this is the desired result, a Download and Save mode WRITE BUFFER command must be issued.

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

Any error on a WRITE BUFFER command causes any downloaded image data to be discarded and the download must be restarted from the beginning.

4.33.4 Download Microcode and Save Mode

This mode can be used to download and save the entire image at once, to download the image data and save it, or to force 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 of power failure occurs or if the reprogramming fails part way through, the subsystem may be unusable.

When the Save operation is successfully completed, the firmware restarts itself, reruns POST, and two UNIT ATTENTION conditions are generated: POWER-UP RESET and OPERATING CODE HAS CHANGED.

4.33.5 Echo Buffer Mode

In this mode the tape device transfers data from the host and stores it in an echo buffer. The Buffer ID and Buffer Offset fields are ignored in this mode. Each initiator has its own echo buffer.

4.34 WRITE FILEMARKS Command (10h)

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

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

Figure 4-104. WRITE FILEMARKS (10h) Command Descriptor Block — Data Format

Table 4-98. WRITE FILEMARKS (10h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
WSmk	Not supported. This field must be 0.
Immed	Immediate. When this bit is set to 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.

Table 4-98. WRITE FILEMARKS (10h) Command Descriptor Block — Field Descriptions

Field Name	Description
Number of Filemarks	This is the number of consecutive marks to be written to tape. 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 tape. 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 tape. A 0 value in the Number of Filemarks field indicates that the tape drive does not write Filemarks to the tape, but still flushes any write data to tape. 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 is set to NO SENSE, and the ASC/Qs are set to 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, CHECK CONDITION status is returned.

CHAPTER 5

Medium Changer Device Commands

On the Medium Changer LUN, only commands defined for this device type are allowed. Table 5-1 shows the commands that are implemented for this LUN.

Table 5-1. SCSI-2 Medium Changer Commands

Opcode	Command	Refer to
07h[a]	INITIALIZE ELEMENT STATUS	Page 5-3
12h[b]	INQUIRY	Page 5-3
4Dh[b]	LOG SENSE	Page 5-4
15h[b] / 55h[b]	MODE SELECT	Page 5-6
1Ah[b] / 5Ah[b]	MODE SENSE	Page 5-11
A5h[a]	MOVE MEDUIM	Page 5-18
5Eh	PERSISTENT RESERVE IN	Page 4-103
5Fh	PERSISTENT RESERVE OUT	Page 4-111
1Eh	PREVENT/ALLOW MEDUIM REMOVAL	Page 4-125
3Ch	READ BUFFER	Page 4-131
B8h[a]	READ ELEMENT STATUS	Page 5-20
1Ch	RECEIVE DIAGNOSTIC RESULTS	Page 4-141
17h	RELEASE (6)	Page 4-143
57h	RELEASE (10)	Page 4-145
A3h	REPORT DEVICE IDENTIFIER	Page 4-152
A0h	REPORT LUNS	Page 4-154
03h	REQUEST SENSE	Page 4-156
16h	RESERVE (6)	Page 4-164

Table 5-1. SCSI-2 Medium Changer Commands (Continued)

Opcode	Command	Refer to
56h	RESERVE (10)	Page 4-167
1Dh	SEND DIAGNOSTIC	Page 4-171
A4h	SET DEVICE IDENTIFIER	Page 4-173
00h	TEST UNIT READY	Page 4-177
3Bh	WRITE BUFFER	Page 4-180

a. Medium Changer specific commands. These commands cause the LOAD/UNLOAD command to change from sequential mode to the random mode of operation. Refer to Section 4.5, "LOAD/UNLOAD Command (1Bh)" for additional information about these different modes of operation.
b. Commands with significant Medium Changer specific content.

The rest of this chapter provides information about medium changer unique commands.

5.1 INITIALIZE ELEMENT STATUS Command (07h)

This command causes the medium changer to check all assigned element addresses for volume presence and status. This command enables an initiator to get a quick response from a subsequent command.

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation Code (07h)							
1	LUN			Reserved				
2 - 4	Reserved							
5	Unused		Reserved				Flag	Link

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

Table 5-2. INITIALIZE ELEMENT STATUS (07h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.

5.2 INQUIRY Command (12h)

Refer to “INQUIRY Command (12h)” on page 4-5 for information relating to the operation of the inquiry command. The only key differences in command operation are as follows:

- The Peripheral Device Type changes to “8” for SCSI-2 Medium Changer.
- The Product Identifier changes to “VS1280” in the Standard INQUIRY data.
- The media-loader present flag in the Standard INQUIRY data is set to TRUE.
- The firmware sub-personality will change to the appropriate new value in the Standard INQUIRY data.

5.3 LOG SENSE Command (4Dh)

Refer to "LOG SENSE Command (4Dh)" on page 4-32 for information relating to the operation of the LOG SENSE command.

5.3.1 LOG SENSE Pages

The medium changer supports the pages listed in Table 5-3.

Table 5-3. LOG SENSE (4Dh) — Supported Pages

Page Code	Page Description
00h	List of Supported Pages Page
07h	Last n Errors Events Page
2Eh	TapeAlert Log Page
33h	Device Wellness Log Page

5.3.2 Supported Pages LOG SENSE Page (Page 00h)

When Page 00h is requested, the 4-byte page header is returned followed by the pages supported 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 (04h) (LSB)							
4	00h							
5	07h							
6	2Eh							
7	33h							

Figure 5-2. Supported Pages LOG SENSE Page — Data Format

5.3.3 Last n Error Events LOG SENSE Page (07h)

Refer to "Last n Error Events LOG SENSE Page (07h)" on page 4-39 for information relating to this page.

5.3.4 TapeAlert LOG SENSE Page (2Eh)

Refer to "TapeAlert LOG SENSE Page (2Eh)" on page 4-42 for information relating to this page.

5.3.5 Device Wellness LOG SENSE Page (33h)

Refer to "Device Wellness LOG SENSE Page (33h)" on page 4-51 for information relating to this page.

5.4 MODE SELECT Command (15h/55h)

Refer to "MODE SELECT (6) / (10) Command (15h / 55h)" on page 4-57 for information relating to the operation of the MODE SELECT command.

5.4.1 MODE SELECT Pages

The medium changer supports the pages listed in Table 5-4.

Table 5-4. MODE SELECT (15h/55h) — Supported Pages

Page Code	Page Description
1Ch	TapeAlert Page
1Dh	Element Address Assignment Page
1Fh	Device Capabilities Pag

5.4.2 MODE SELECT Parameter List

The MODE SELECT (6) parameter list shown below contains a 4-byte header, followed by the page descriptors.

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

Figure 5-3. MODE SELECT (6) Mode Parameter Header — Header Format

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

Figure 5-4. MODE SELECT (6) Mode Parameter Block Descriptor — Data Format

The MODE SELECT (10) parameter list shown below contains an 8-byte header, followed by the page descriptors.

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

Figure 5-5. MODE SELECT (10) Mode Parameter Header — Header Format

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

Figure 5-6. MODE SELECT (10) Mode Parameter Block Descriptor — Data Format

Table 5-5. MODE SELECT Parameter List — Field Descriptions

Field Name	Description
Media Type	This field is not applicable to a medium changer device. This field is ignored.
Buffered Mode	This field is not applicable to a medium changer device. This field is ignored.
Speed	This field is not applicable to a medium changer device. This field is ignored.
Block Descriptor Length	The medium changer device does not support Block Descriptor. This field must be set to 0.
PS	Parameters Savable. The medium changer device does not support Savable pages. Byte 0, bit 6 must be 0.
Additional Page Length	This field indicates the number of bytes in that page. However, the value does not include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set to the same value when performing a MODE SELECT command. If the page length does not match the length the medium changer device expects, the medium changer device returns a CHECK CONDITION status with the Sense Key set to ILLEGAL REQUEST. The medium changer device 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.

5.4.3 TapeAlert Page (1Ch)

The medium changer device supports the TapeAlert page. Refer to "TapeAlert Page (1Ch)" on page 4-74 for information relating to this page.

5.4.4 Element Address Assignment Page (1Dh)

The medium changer device supports the Element Address Assignment page. Refer to "Element Address Assignment Page (1Dh)" on page 5-10 for information relating to this page.

None of the fields are changeable for this page.

5.4.5 Device Capabilities Page (1Fh)

The medium changer device supports the Device Capabilities page. Refer to "Device Capabilities Page (1Fh)" on page 5-17 for information relating to this page.

None of the fields are changeable for this page.

5.4.6 MODE SELECT Changeable Parameters

The following table lists the changeable MODE SELECT parameters and their minimum and maximum allowed values.

Table 5-6. MODE SELECT Changeable Parameters

Page: Parameter	Default	Minimum	Maximum
TapeAlert (1Ch): DExcpt bit	1	0	1
TapeAlert (1Ch): Test bit	0	0	1
TapeAlert (1Ch): Test Flag Number	0	0	0x7FFF

5.5 MODE SENSE Command (1Ah/5Ah)

Refer to "MODE SENSE (6) / (10) Command (1Ah / 5Ah)" on page 4-82 for information relating to the operation of the MODE SENSE command. The only difference in command operation being that the command's DBD bit is ignored and as a result the block descriptor is never sent to a host.

5.5.1 MODE SENSE Pages

The medium changer supports the pages listed in Table 5-7.

Table 5-7. MODE SENSE (1Ah/5Ah) — Supported Pages

Page Code	Page Description
00h	No Requested Page
1Ch	TapeAlert Page
1Dh	Element Address Assignment Page
1Fh	Device Capabilities Page
3Fh	All Pages

5.5.2 MODE SENSE Parameter List

The MODE SENSE (6) parameter list shown below contains a 4-byte header, followed by the page descriptors.

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

Figure 5-7. MODE SENSE (6) Mode Parameter Header — Header Format

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

Figure 5-8. MODE SENSE (6) Mode Parameter Block Descriptor — Data Format

The MODE SENSE (10) parameter list shown below contains an 8-byte header, followed by the page descriptors.

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

Figure 5-9. MODE SENSE (10) Mode Parameter Header — Header Format

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

Figure 5-10. MODE SENSE (10) Mode Parameter Block Descriptor — Data Format

Table 5-8. MODE SENSE Parameter List — Field Descriptions

Field Name	Description
Data Length	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	This field is not applicable to a medium changer device. This field is set to 0.
WP	Write Protect. This field is not applicable to a medium changer device. This field is set to 0.
Buffered Mode	This field is not applicable to a medium changer device. This field is set to 0.
Speed	This field is not applicable to a medium changer device. This field is set to 0.
Block Descriptor Length	The medium changer device does not support Block Descriptor. This field is set to 0.
PS	Savable Pages. The medium changer device does not support savable pages. This field is set to 0.
Additional Page Length	This field indicates the number of bytes in that page. However, the value does not include bytes 0 and 1. The length is returned on MODE SENSE and must subsequently be set to the same value when performing a MODE SELECT command.

5.5.3 TapeAlert Page (1Ch)

The medium changer device supports the TapeAlert page. Refer to "TapeAlert Page (1Ch)" on page 4-99 for information relating to this page.

5.5.4 Element Address Assignment Page (1Dh)

The Element Address Assignment page is used to assign and report addresses to the elements of the medium changer. Figure 5-11 shows the data format of this 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 (00h) (LSB)							
4 - 5	(MSB) Number of Medium Transport Elements (00h) (LSB)							
6 - 7	(MSB) 1st Storage Element Address (100h) (LSB)							
8 - 9	(MSB) Number of Storage Elements (08h) (LSB)							
10 - 11	(MSB) 1st Import/Export Element Address (00h) (LSB)							
12 - 13	(MSB) Number of Import/Export Elements (00h) (LSB)							
14 - 15	(MSB) 1st Data Transfer Element Address (10h) (LSB)							
16 - 17	(MSB) Number of Data Transfer Elements (01h) (LSB)							
18 - 19	Reserved							

Figure 5-11. Element Address Assignment MODE SENSE Page (1Dh) — Data Format

Table 5-9. Element Address Assignment MODE SENSE Page (1Dh) — Field Descriptions

Field Name	Description
Length	Indicates the size of the returned Element Address Assignment page, which is always 12h for this command.
1st Medium Transport Element Address	The medium transport element is not supported. This field is set to 0.
Number of Medium Transport Elements	The medium transport element is not supported. This field is set to 0.
1st Storage Element Address	This field identifies the address of the first medium storage element; refer to Table 5-10 for details.
Number of Storage Elements	This field identifies the number of medium storage elements.
1st Import/Export Element Address	The import/export element is not supported. This field is set to 0.
Number of Import/ Export Elements	The import/export element is not supported. This field is set to 0.
1st Data Transfer Element Address	This field identifies the address of the first data transfer element.
Number of Data Transfer Elements	This field identifies the number of data transfer elements.

Medium Changer Element Addresses

Table 5-10 lists the addresses you can use for specifying the address of various medium changer elements.

Table 5-10. Medium Changer Element Addresses

Address	Comments
0h	Default Medium Transport Element
2h-Fh	Reserved
10h	Data Transfer Element (tape drive)
11h-FFh	Reserved
100h	Medium Storage Element (magazine slot 0)
101h	Medium Storage Element (magazine slot 1)

Table 5-10. Medium Changer Element Addresses (Continued)

Address	Comments
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	Medium Storage Element (magazine slot 7)
108h-FFFFh	Reserved

5.5.5 Device Capabilities Page (1Fh)

The Device Capabilities page defines attributes of the element types. Figure 5-12 shows the data format of this 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-I/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<>IE	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

Note: Bytes 12 through 15 are all 0. The medium changer does not support the EXCHANGE MEDIUM command.

Figure 5-12. Device Capabilities MODE SENSE Page (1Fh) — Data Format

Table 5-11. Device Capabilities MODE SENSE Page (1Fh) — Field Descriptions

Bit Field Values	Description
StorDT	This element can store media.
StorST	This element can store media.
ST-DT	This is a valid source-destination pair.
DT-ST	This is a valid source-destination pair.

Table 5-11. Device Capabilities MODE SENSE Page (1Fh) — Field Descriptions (Continued)

Bit Field Values	Description
MT-XX	This field is 0. The loader does not accept a Medium Transport element address as a source or destination.
XX-MT	This field is 0. The loader does not accept a Medium Transport element address as a source or destination.
IE-XX	This field is 0 since there is no Import/Export element.
XX-IE	This field is 0 since there is no Import/Export element.
ST-ST	The medium changer does not support this field.
DT-DT	The medium changer does not support this field.

5.6 MOVE MEDIUM Command (A5h)

The MOVE MEDIUM command is used to move data cartridges from the tape drive to the cartridge slot from which it came or from any cartridge slot to the tape drive. This command does not support moving data cartridges from one cartridge slot to a different cartridge slot.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	LUN			Reserved				
2 - 3	(MSB) Transport Element Address (0000h) (LSB)							
4 - 5	(MSB) Source Address (LSB)							
6 - 7	(MSB) Destination Address (LSB)							
8 - 9	Reserved							

Bit Byte	7	6	5	4	3	2	1	0
10	Reserved							Inv(0)
11	Unused		Reserved				Flag	Link

Figure 5-13. MOVE MEDIUM (A5h) Command Descriptor Block — Data Format

Table 5-12. MOVE MEDIUM (A5h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
Transport Element Address	This field must be set to 0.
Source Address	This field may contain any defined source address consisting of a storage element address or the data transfer element address. If the source address element is empty, the device will return ILLEGAL REQUEST with additional sense code MEDIUM SOURCE ELEMENT EMPTY. Any illegal address will cause the device to return ILLEGAL REQUEST with ASC set to INVALID ELEMENT ADDRESS.
Destination Address	This field may contain any defined source address consisting of a storage element address or the data transfer element address. If the destination address element is full and different from the source address, the device will return ILLEGAL REQUEST with additional sense code MEDIUM DESTINATION ELEMENT FULL. Any illegal address will cause the device to return ILLEGAL REQUEST with ASC set to INVALID ELEMENT ADDRESS.
Inv	Inv is not supported and therefore must be 0.

5.7 READ ELEMENT STATUS Command (B8h)

This command requests that the target report the status of its internal elements to the initiator. The element status data consists of a header and one or more element status pages for each element type. The element status pages consist of a header and one or more element descriptors, one for each element address requested.

Bit Byte	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	LUN			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 5-14. READ ELEMENT STATUS (B8h) Command Descriptor Block — Data Format

Table 5-13. READ ELEMENT STATUS (B8h) Command Descriptor Block — Field Descriptions

Field Name	Description
LUN	Logical Unit Number. This field is ignored by the target, the LUN must be changed within an IDENTIFY message.
VolTag	Volume Tag. A volume tag bit of 1 indicates that the target will report volume tag information. Primary volume tag information is supported and alternate volume tag information is not supported. A value of 0 indicates that no volume tag information is reported.

Table 5-13. READ ELEMENT STATUS (B8h) Command Descriptor Block — Field Descriptions

Field Name	Description	
Element Type Code	This field specifies the particular element type(s) that the device should report appropriate status.	
	Code	**Description**
	0h	All element types reported (valid in CDB only)
	1h	Medium Transport Element (not supported)
	2h	Storage Element (data cartridge slot)
	3h	Import Export Element (not supported)
	4h	Data Transfer Element (tape drive)
	5h-Fh	Reserved
Starting Element Address	This field specifies the minimum element address to report. Only elements with an element type code permitted by the Element Type Code field, and an element address greater than or equal to the Starting Element Address, are reported.	
Number of Elements	This field specifies the maximum number of element descriptors to be returned.	
Allocation Length	The target will send back partial block descriptors and partial headers if the allocation length is not of sufficient size to hold complete decriptors or headers.	

5.7.1 Element Status Data

The data returned by the READ ELEMENT STATUS command is defined in the following table.

Bit Byte	7	6	5	4	3	2	1	0
0 - 7	Element Status Data Header							
8 - n	Element Status Data Pages							

Figure 5-15. READ ELEMENT STATUS Data — Data Format

5.7.2 Element Status Data Header

Provided the allocation length is of sufficient size, the Element Status data header is returned preceding all Element Status pages. The host can issue the READ ELEMENT STATUS command with Allocation Length set to 8 in order to determine the entire allocation length required to contain all data satisfying the request of the CDB.

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

Figure 5-16. READ ELEMENT STATUS Data Header — Header Format

Table 5-14. READ ELEMENT STATUS Data Header — Field Descriptions

Field Name	Description
First Element Address Reported	This field indicates the element address of the element with the smallest element address found to meet the CDB request.
Number of Elements Available	This field indicates the number of elements meeting the request in the CDB.
Byte Count of Report Available	This field indicates the number of bytes of element status page data available for all elements meeting the request of the CDB. This value is not adjusted to match the allocation length.

5.7.3 Element Status Page Header

Every Element Status page consists of a single page header and one or more element descriptors.

Bit / Byte	7	6	5	4	3	2	1	0
0	Element Type Code							
1	PvolTag	AvolTag	Reserved					
2 - 3	(MSB) Element Descriptor Length (LSB)							
4	Reserved							
5 - 7	(MSB) Byte Count of Descriptor Data Available (LSB)							

Figure 5-17. READ ELEMENT STATUS Page Header — Header Format

Table 5-15. READ ELEMENT STATUS Page Header — Field Descriptions

Field Name	Description
Element Type Code	This field indicates the element type reported by this page.
PvolTag	Primary Volume Tag. When set, it indicates that the primary volume tag information fields are included in the following element descriptors.
AvolTag	Alternate Volume Tag. The alternate volume tag information is not supported; therefore this field is always 0.
Element Descriptor Length	This field indicates the number of bytes in each element descriptor that follows.
Byte Count of Descriptor Data Available	This field indicates the number of bytes of element descriptor data available for elements of this element type meeting the request of the CDB. This value is not adjusted to match the allocation length.

Storage Element Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Element Address (LSB)							
2	Reserved				Access	Except	Rsv'd	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6 - 8	Reserved							
9	Svalid	Invert	Reserved					
10 - 11	(MSB) Source Element Address (LSB)							
	Primary Volume Tag Information (Field Omited if PvolTag = 0)							
12	Bar Code Label Information							
13	Bar Code Label Information							
14	Bar Code Label Information							
15	Bar Code Label Information							
16	Bar Code Label Information							
17	Bar Code Label Information							
18 - 47	Reserved							
48 - 53	Reserved							

Figure 5-18. Storage Element Descriptor — Data Format

Table 5-16. Storage Element Descriptor — Field Descriptions

Field Name	Description
Element Address	This field indicates the address of the medium changer element whose status is reported by this descriptor block.
Access	This value is always 1, indicating that access to the element by a medium transport element is allowed.
Except	Exception. An exception bit set to 0 indicates the element is in a normal state. If this bit is set to 1, information on the abnormal state may be available in the Additional Sense Code and Additional Sense Code Qualifier fields.
Full	This bit will be set to 1 when a data cartridge is populating this element.
Additional Sense Code	This field provides more detailed information on an abnormal element state.
Additional Sense Code Qualifier	This field provides more detailed information on an abnormal element state.
Svalid	Source Element Valid. This bit is always 0, indicating that the source storage element address and the invert bit are invalid.
Invert	This bit is not supported and is always 0.
Source Element Address	This field is not supported and is always 0.
Primary Volume Tag Information	These bytes contain the bar code label information from the storage media assigned to this element. This volume tag information will only be sent when the VolTag bit in the CDB is set; otherwise, no volume tag information is sent.

Data Transfer Descriptor

Bit Byte	7	6	5	4	3	2	1	0
0 - 1	(MSB) Element Address (LSB)							
2	Reserved				Access	Except	Rsv'd	Full
3	Reserved							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	NotBus	Rsv'd	IDValid	LUValid	Rsv'd	Logical Unit Number		
7	SCSI Bus Address (same as tape drive's)							
8	Reserved							
9	Svalid	Invert	Reserved					
10 - 11	(MSB) Source Element Address (LSB)							
	Primary Volume Tag Information (Field Omitted if PvolTag = 0)							
12	Bar Code Label Information							
13	Bar Code Label Information							
14	Bar Code Label Information							
15	Bar Code Label Information							
16	Bar Code Label Information							
17	Bar Code Label Information							
18 - 47	Reserved							
48 - 53	Reserved							

Figure 5-19. Data Transfer Descriptor — Data Format

Table 5-17. Data Transfer Descriptor — Field Descriptions

Field Name	Description
Element Address	This field indicates the address of the medium changer element whose status is reported by this descriptor block.
Access	This value is always 1, indicating that access to the element by a medium transport element is allowed.
Except	An exception bit of 0 indicates the element is in a normal state. If this bit is 1, information on the abnormal state may be available in the Additional Sense Code and Additional Sense Code Qualifier fields.
Full	This bit will be set to 1 when a data cartridge is populating this element.
Additional Sense Code	This field provides more detailed information on an abnormal element state.
Additional Sense Code Qualifier	This field provides more detailed information on an abnormal element state.
NotBus	This bit is always 0, indicating that the SCSI bus address and the LUN for this element are on the same bus as the medium changer device.
IDValid	ID Valid. This bit is always set to 1, indicating that the SCSI Bus Address field contains valid data.
LUValid	LUN Valid. This bit is always set to 1, indicating that the Logical Unit Number field contains valid data.
Logical Unit Number	This field specifies the LUN value for the primary device served by the medium changer.
SCSI Bus Address	This field specifies the SCSI bus address for the primary device served by the medium changer, which is the same as the tape drive.
Svalid	Source Element Valid. This bit is set to 1 when a data cartridge is populating the tape drive, otherwise it is set to 0.
Invert	This bit is not supported and is always 0.
Source Element Address	This field contains valid data when the Svalid bit is set. When available, this field provides the address of the last storage element this unit of media occupied.
Primary Volume Tag Information	These bytes contain the bar code label information from the storage media assigned to this element. This volume tag information will only be sent when the VolTag bit in the CDB is set, otherwise no volume tag information will be sent.

APPENDIX A

SCSI Commands Under Reservation

The tables in this appendix detail the target's behavior during various types of reservations available to an initiator.

Table A-1. SCSI Command Behavior During RESERVE (6) or RESERVE (10)

SCSI Command	Addressed LUN is RESERVed (6) or RESERVed (10)	
	Command issued from initiator other than the one holding the reservation	**Command issued from initiator holding the reservation**
ERASE	Conflict	Allow
INITIALIZE ELEMENT STATUS	Conflict	Allow
INQUIRY	Allow	Allow
LOAD/UNLOAD	Conflict	Allow
LOCATE	Conflict	Allow
LOG SELECT	Conflict	Allow
LOG SENSE	Allow	Allow
MODE SELECT (6) or MODE SELECT (10)	Conflict	Allow
MODE SENSE (6) or MODE SENSE (10)	Conflict	Allow
MOVE MEDIUM	Conflict	Allow
PERSISTENT RESERVE IN	Conflict	Conflict
PERSISTENT RESERVE OUT	Conflict	Conflict
PREVENT/ALLOW MEDIA REMOVAL; PREVENT=0	Allow	Allow

Table A-1. SCSI Command Behavior During RESERVE (6) or RESERVE (10) (Continued)

PREVENT/ALLOW MEDIA REMOVAL; PREVENT=1	Conflict	Allow
READ	Conflict	Allow
READ ELEMENT STATUS	Conflict	Allow
READ BLOCK LIMITS	Allow	Allow
READ BUFFER	Conflict	Allow
READ POSITION	Conflict	Allow
RECEIVE DIAGNOSTIC RESULTS	Conflict	Allow
RELEASE (6) or RELEASE (10)	Allow	Allow
REPORT DENSITY SUPPORT	Allow	Allow
REPORT DEVICE ID	Allow	Allow
REPORT LUNS	Allow	Allow
REQUEST SENSE	Allow	Allow
RESERVE (6) or RESERVE (10)	Conflict	Allow
REWIND	Conflict	Allow
SEND DIAGNOSTICS	Conflict	Allow
SET DEVICE ID	Conflict	Allow
SPACE	Conflict	Allow
TEST UNIT READY	Conflict	Allow
WRITE	Conflict	Allow
WRITE BUFFER	Conflict	Allow
WRITE FILEMARK	Conflict	Allow

Notes: **1** Conflict – The command is terminated with RESERVATION CONFLICT status.

2 Allowed – The command is processed normally.

Table A-2. SCSI Command Behavior During Persistent Reservations

SCSI Command	Addressed LUN has this type of persistent reservation held by another initiator					
	Initiator not holding reservation					Initiator holding the reservation
	From any initiator		From any			
			Unregistered initiator		Registered initiator	
	Type (01h)	Type (03h)	Type (05h)	Type (06h)	Type (05h or 06h)	All Types
ERASE	Conflict	Conflict	Conflict	Conflict	Allow	Allow
INITIALIZE ELEMENT STATUS	Conflict	Conflict	Conflict	Conflict	Allow	Allow
INQUIRY	Allow	Allow	Allow	Allow	Allow	Allow
LOAD/UNLOAD	Conflict	Conflict	Conflict	Conflict	Allow	Allow
LOCATE	Allow	Conflict	Allow	Conflict	Allow	Allow
LOG SELECT	Conflict	Conflict	Conflict	Conflict	Allow	Allow
LOG SENSE	Allow	Allow	Allow	Allow	Allow	Allow
MODE SELECT (6) or MODE SELECT (10)	Conflict	Conflict	Conflict	Conflict	Allow	Allow
MODE SENSE (6) or MODE SENSE (10)	Conflict	Conflict	Conflict	Conflict	Allow	Allow
MOVE MEDIUM	Conflict	Conflict	Conflict	Conflict	Allow	Allow
PERSISTENT RESERVE IN	Allow	Allow	Allow	Allow	Allow	Allow
PERSISTENT RESERVE OUT	Cond	Cond	Cond	Cond	Cond	Allow
PREVENT/ALLOW MEDIA REMOVAL; PREVENT=0	Allow	Allow	Allow	Allow	Allow	Allow
PREVENT/ALLOW MEDIA REMOVAL; PREVENT=1	Conflict	Conflict	Conflict	Conflict	Allow	Allow
READ	Allow	Conflict	Allow	Conflict	Allow	Allow

Table A-2. SCSI Command Behavior During Persistent Reservations (Continued)

READ ELEMENT STATUS	Conflict	Conflict	Conflict	Conflict	Allow	Allow
READ BLOCK LIMITS	Allow	Allow	Allow	Allow	Allow	Allow
READ BUFFER	Conflict	Conflict	Conflict	Conflict	Allow	Allow
READ POSITION	Allow	Conflict	Allow	Conflict	Allow	Allow
RECEIVE DIAGNOSTIC RESULTS	Conflict	Conflict	Conflict	Conflict	Allow	Allow
RELEASE (6) or RELEASE (10)	Conflict	Conflict	Conflict	Conflict	Conflict	Conflict
REPORT DENSITY SUPPORT	Allow	Allow	Allow	Allow	Allow	Allow
REPORT DEVICE ID	Allow	Allow	Allow	Allow	Allow	Allow
REPORT LUNS	Allow	Allow	Allow	Allow	Allow	Allow
REQUEST SENSE	Allow	Allow	Allow	Allow	Allow	Allow
RESERVE (6) or RESERVE (10)	Conflict	Conflict	Conflict	Conflict	Conflict	Conflict
REWIND	Allow	Conflict	Allow	Conflict	Allow	Allow
SEND DIAGNOSTICS	Conflict	Conflict	Conflict	Conflict	Allow	Allow
SET DEVICE ID	Conflict	Conflict	Conflict	Conflict	Allow	Allow
SPACE	Allow	Conflict	Allow	Conflict	Allow	Allow
TEST UNIT READY	Conflict	Conflict	Conflict	Conflict	Allow	Allow
WRITE	Conflict	Conflict	Conflict	Conflict	Allow	Allow
WRITE BUFFER	Conflict	Conflict	Conflict	Conflict	Allow	Allow
WRITE FILEMARK	Conflict	Conflict	Conflict	Conflict	Allow	Allow

Notes: **1** Conflict – The command is terminated with RESERVATION CONFLICT status.
2 Allowed – The command is processed normally.
3 Cond – Conditionally depends upon the command's service action. Refer to Table A-3 on page A-5.

Table A-3. Conditional Reaction Based Upon Service Action

Service Action	Issued From a Registered Initiator	Issued From an Unregistered Initiator
Clear	Allow	Conflict
Pre-empt	Allow	Conflict
Pre-empt and Abort	Allow	Conflict
Register	Allow	Allow
Register and Ignore Key	Allow	Allow
Release	Allow	Conflict
Reserve	Conflict	Conflict

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