Quantum

DLT Tape Drive

DLT

6464162-03 A01

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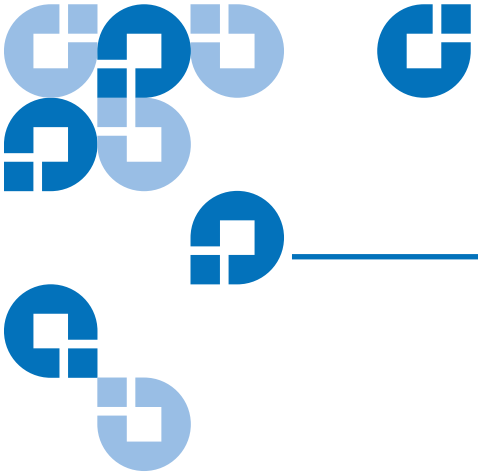

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Preface

This document describes the DLT® tape drive library interface implemented for two-way communication between a library tape drive (referred to as a "tape drive" in the remainder of this document) and a tape library system (referred to as a "library" in the remainder of this document). The tape drive communicates with the library over an RS-422 serial port set to 9600 baud, 8 bits per character, no parity, and 1 stop bits. All data sent through the interface to and from the tape drive consists of bit-wise encoded hex values, unless otherwise noted in the description.

Audience

This document serves firmware engineers and technicians who support DLT tape drives. It also serves firmware engineers and technicians who integrate DLT tape drives into automated systems such as libraries.

Purpose

This document provides information about how DLT tape drives interact in a library system, including:

- Communications
- Commands
- Errors
- Cartridge handling

Products Supported

This document pertains to the following DLT tape drives:

- SDLT 220
- SDLT 320
- SDLT 600
- DLT-S4

Document Organization

This document is organized as follows:

- Chapter 1, Protocol, describes communication between the library and the tape drive.
- Chapter 2, Single Byte Library Commands, describes single byte commands.
- Chapter 3, Multiple Byte Library Commands, describes multiple byte commands.
- Chapter 4, Set and Get Fibre Configuration describes the commands that set the Fibre Channel configuration in the tape drive or get Fibre Channel configuration information from the tape drive. This chapter applies to the DLT-S4 tape drive only.
- Chapter 5, Exceptions, describes tape drive behavior before it has established normal operation or when it detects a hardware error.
- Chapter 6, Tape Load and Unload Guidelines, discusses the primary LOAD and UNLOAD status contained in the Library Interface General Status Packet, and provides examples of LOAD and UNLOAD failures.

The document concludes with a Glossary.

Notational Conventions

This document uses the following conventions:

Note: Notes emphasize important information related to the main topic.

Caution: Cautions indicate potential hazards to equipment and are included to prevent damage to equipment.

Warning: Warnings indicate potential hazards to personal safety and are included to prevent injury.

This document uses the following:

- Tape Drive System — Refers to the complete system including the cartridge.
- Tape Drive — Refers to just the tape drive and does not include the cartridge.
- Right side of the tape drive — Refers to the right side as you face the component being described.
- Left side of the tape drive — Refers to the left side as you face the component being described.
- Power cycle — Means to turn the tape drive or system on, then turn them off (or off, then on).
- Dimensions in figures — All dimensions are shown with no units specified (Inches understood unless otherwise specified).

Related Documents

Document No.	Document Title	Document Description
6464191-xx	Automation Device Interface — Transport Layer Specification	Describes the Automation/Drive Interface – Transport Protocol (ADT) implemented for two-way communication between a tape drive and a library.
6464192-xx	Automation Devices Command Set Specification	Describes the Automation Devices Command (ADC) Set Specification implemented for two-way communication between a tape drive and a library.
81-81281-xx	DLT-S4 Interface Reference Guide	Provides host interface command information specific to the tape drive.

Document No.	Document Title	Document Description
81-81278-xx	DLT-S4 Product Manual	Provides specification and usage instructions for your tape drive
81-81279-xx	DLT-S4 Product Specification	Provides hardware, performance, environment, shock and vibration, and regulatory specifications for the tape drive
81-81283-xx	DLT-S4 Quick Start Guide	Provides “quick” instructions on how to install and run your tape drive
81-85002-xx	SDLT 220 and SDLT 320 Product Manual	Provides specification and usage instructions for your tape drive
81-81110-xx	SDLT 220 and SDLT 320 User Reference Guide	Provides brief specification and usage instructions for your tape drive
81-85001-xx	SDLT 220 and SDLT 320 SCSI Interface Guide	Provides SCSI command information specific to the tape drive.
81-81184-xx	SDLT 600 Product Manual	Provides specification and usage instructions for your tape drive
81-81220-xx	SDLT 600 User Reference Guide	Provides brief specification and usage instructions for your tape drive
81-81202-xx	SDLT 600 Fibre Channel Interface Guide	Provides Fibre Channel command information specific to the tape drive.
81-81200-xx	SDLT 600 SCSI Interface Guide	Provides SCSI command information specific to the tape drive.

SCSI Standards

Copies of the approved version of the SCSI standards may be obtained from:

Global Engineering Documents
15 Inverness Way, East
Englewood, CO 80112
(800) 854-7179 or (303) 397-2740

Contacts

Quantum company contacts are listed below.

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Chapter 1

Protocol

This chapter describes communication between the library and the tape drive.

Tape Drive States

The tape drive interface is in the IDLE state after any reset or power-up, and remains IDLE until it receives a valid **ATTENTION** or data request command from the library.

In response to the **ATTENTION** or data request command, the tape drive returns a command-specific data packet to the library.

The tape drive is now in the COMMAND state. It remains in this state until it receives the next byte.

If the next byte received is a valid command, the tape drive initiates the appropriate action, then returns to IDLE.

If the next byte received is NOT a valid command, the tape drive clears the communication interface and goes to the IDLE state.

General Status Data

When the library requests General Status data, the tape drive returns a General Status Packet. If the General Status Packet contains error information, the library can request an Extended Status Packet. Using the Extended Status Packet, the library reads additional information about the error.

Chapter 2

Single Byte Library Commands

The library uses commands to get information from the tape drive or to initiate tape drive action. The only time the tape drive accepts a command other than the **ATTENTION** or data request command is *after* it receives a valid **ATTENTION** command or data request command. At any other time, it discards any data it does not recognize as an **ATTENTION** or data request command.

This chapter presents single byte commands. For information on multiple byte commands, see chapter 3, Multiple Byte Library Commands.

All undefined and not-yet-implemented commands put the tape drive interface into the IDLE state, causing the tape drive to put an invalid command status in the Command Error Code field of the Extended Status Packet.

[0x00] – ATTENTION

The tape drive returns a General Status Packet, which contains eight bytes of information, and the tape drive interface enters the COMMAND state.

Note:	This command affects only the tape drive interface. It does not stop tape motion.

Table 1 shows the packet structure.

Table 1 General Status Packet Description

Bit Byte	7	6	5	4	3	2	1	0
0	Product Type							
1	Servo Firmware Version							
2	Policy Firmware Version							
3	No ID	In Flux	Cartridge Present	Hardware Error	Cleaning Reques-ted	Com-press Enabled	Write Protect	OK to Eject
4	SCSI ID							
5	Current Tape Format							
6	OK to Load	TapeAlert Capable	Rsv'd (prior use)	Tape Motion Status				
7	Load Complete	Cleaning Cartridge Expired	Cleaning Required	Ex Status Changed	Prevent Removal	Rsv'd	Rsv'd (prior use)	Rsv'd (prior use)

[Byte 0] – Product Type

Contains information that informs the library about what model of tape drive is installed. Table 2 shows the tape drive type.

Table 2 Tape Drive Type

Bit	Tape Drive Type
0x14	SDLT 220
0x15	SDLT 320
0x17	SDLT 600
0x18	DLT-S4

[Byte 1] – Servo Firmware Version

Contains the SDLT servo firmware version as a hexadecimal number.

[Byte 2] – Policy Firmware Version

Contains the SDLT policy firmware version as a hexadecimal number.

[Byte 3] – Status 1

Bit 7 – No ID

No SCSI ID is present from any source.

Bit 6 – In Flux

The tape drive sets this bit when it cannot ensure that returned status values are valid. After initialization, this bit remains set until the tape drive either knows it has no data cartridge present or it has determined the format of the currently loaded data cartridge. Once the **In Flux** bit has cleared, the library interface is ready to accept commands other than **ATTENTION** and the returned data will accurately reflect the state of the system.

The tape drive may set this bit when it sets a **Hardware Error** value. Setting both the **In Flux** bit and the **Hardware Error** bit indicates that one or more power-on self-test (POST) errors have occurred.

Bit 5 – Cartridge Present

A cartridge is loaded in the tape drive.

Bit 4 – Hardware Error

A hardware fault exists in the tape drive. If the tape drive sets both this bit and the **In Flux** bit, it indicates a POST failure occurred.

Bit 3 – Cleaning Requested

Indicates the tape drive has requested a head cleaning.

If the request for cleaning is urgent (for example, normal operation may not complete successfully), the tape drive also sets a second status bit, **Cleaning Required** (refer to Bit 5 – Cleaning Required on page 10).

If normal operation may be affected, but is expected to complete successfully, the tape drive does not set the second status bit.

This bit operates only with the **OK to Eject** bit set or the **Cartridge Present** bit not set. In this way, the cleaning request occurs only when a cleaning is possible; that is, when a data cartridge can be removed or inserted or when a data cartridge is not mounted in the tape drive.

Bit 2 – Compress Enabled

The current compression command for the next write command.

Bit 1 – Write Protect

Prevents the tape drive from writing data.

Bit 0 – OK to Eject

The tape is in the unloaded state and it is okay to send the **EJECT** command (0x22).

[Byte 4] – SCSI ID

Contains the current SCSI bus ID of the tape drive as a hexadecimal number.

[Byte 5] – Current Tape Format

Reports the current format of the loaded tape. Table 3 shows the values and formats.

Table 3 Current Tape Format

Bit	Current Format
0x00	No tape
0x01	Unknown format
0x02	Cleaning cartridge
0x09	20/40 GB on DLTtape IV (for SDLT 320)
0x0A	35/70 GB on DLTtape IV (for SDLT 320)
0x0B	40/80 GB on DLTtape IV (for SDLT 320)
0x0C	40/80 GB on DLTtape IV (for SDLT 320)
0x10	110/220 GB on Super DLTtape I (for SDLT 220)
0x11	160/320 GB on Super DLTtape I (for SDLT 320)
0x12	300/600 GB on Super DLTtape II (for SDLT 600)
0x13	800/1600 GB on DLTtape S4 (for DLT-S4)

Note: The tape drive must set **Load Complete** before the library can read the tape format from the tape drive (refer to [Byte 7] – Status 3 on page 10).

[Byte 6] – Status 2

Bit 7 – OK to Load

The tape drive has ejected a data cartridge and is ready to accept another data cartridge. After issuing an **EJECT** command, the library must check this bit to verify that the tape drive has fully ejected the previous data cartridge.

> **Note:** This bit does not indicate removal of the data cartridge from the tape drive by the library mechanism.

Bit 6 – TapeAlert Capable

The firmware currently running the tape drive supports the reporting of TapeAlert flags over the library interface.

Bit 5 – Reserved (prior use)

Bits 0 to 4 - Tape Motion Status

Bits 0 through 4 contain these values, which report the current tape drive operation. Table 4 shows tape motion status.

Table 4 Tape Motion Status

Bit Field Value	Definition	Description
0x0	Idle	There is currently no tape motion with the loaded data cartridge.
0x1	Rewinding	The tape drive is currently rewinding the loaded data cartridge.
0x2	Seeking	The tape drive is currently positioning the loaded data cartridge.
0x3	Reading	The tape drive is currently reading data from the loaded data cartridge.
0x4	Writing	The tape drive is currently writing data on the loaded data cartridge.
0x5	Erasing	The tape drive is currently erasing data from the loaded data cartridge.
0x6	Cleaning	The tape drive has a cleaning cartridge loaded that is currently in use.
0x7	Loading	The tape drive is currently loading a data cartridge.
0x8	Unloading	The tape drive is currently unloading a data cartridge, ejecting a data cartridge, or both.
0x9	Ready for code update	The tape drive is waiting for the code update tape to load.
0xA	Updating Code	The tape drive is currently updating its firmware.
0xB	Calibrating	The tape drive is currently calibrating.

[Byte 7] – Status 3

Bit 7 — Load Complete

The tape drive sets this bit to indicate to the library that the data cartridge has completed loading and is ready for use. Unloading the data cartridge clears this bit.

Bit 6 — Cleaning Cartridge Expired

The cleaning cartridge has exceeded its use count and needs to be replaced. This bit is valid only in the following circumstances:

- After attempting a cleaning application
- Until the next cleaning cartridge is inserted
- Until a power cycle

Bit 5 — Cleaning Required

When set in conjunction with the **Cleaning Requested** status (see Bit 3 – Cleaning Requested on page 6), this bit tells the library that it is necessary to cycle a head-cleaning cartridge through the tape drive before attempting any further tape operation. If the tape drive sets the **Cleaning Requested** status but does not set this bit, it tells the library to cycle a head-cleaning cartridge through the tape drive at the next best opportunity.

Bit 4 — Ex Status Changed

Indicates that the Extended Status Packet has changed since it was last read. After the library issues a **SEND EXTENDED STATUS** command, the tape drive clears this bit.

Bit 3 – Prevent Removal

Indicates that at least one initiator, using the **SCSI PREVENT MEDIUM REMOVAL** command, has requested that data cartridge removal be prevented. The bit is clear if no initiator has requested that data cartridge removal be prevented, and only when all initiators have allowed data cartridge removal. Bus reset, internal resets, and power cycles clear this bit.

Bit 2 – Reserved for Future Products

Bit 1 – Reserved (prior use)

Bit 0 – Reserved (prior use)

[0x02] – UNLOAD

The tape drive unloads the currently loaded cartridge. This command takes the tape to the unload position, but does not eject the cartridge. To complete the unload sequence, a separate **EJECT** command (0x22) must follow this **UNLOAD** command.

[0x22] – EJECT

The tape drive ejects the data cartridge from either the loaded or unloaded state. This command functions the same as the **UNLOAD AND EJECT** command (0x32).

[0x29] – DTD STATUS LOG SENSE

The tape drive returns log page data about the Data Transfer Device (DTD) primary port; specifically, it returns only the DTD Primary Port Status log parameter of the DTD Status log page. The information includes port identification and current status; for example, link negotiation process, signal, conflict, speed, topology, and N_Port ID if the tape drive is using Fibre Channel. If the tape drive is using parallel SCSI, the information includes bus mode, SCSI address, and so forth.

Note:	This command is only available on the DLT-S4 tape drive.

For details about the DTD port status data, see the ADC draft standard at www.t10.org.

[0x32] – UNLOAD AND EJECT

The tape drive ejects the data cartridge from either the loaded or unloaded state. This command functions the same as the **EJECT** command (0x22).

[0x33] – SEQUENTIAL-ACCESS DEVICE LOG PAGE

The tape drive returns log page data about the number of bytes read or written and whether cleaning is required.

For details about the Sequential-Access Device log page, see the SSC-2 standard at www.t10.org.

[0x34] – VHF DATA

The tape drive returns the 4-byte Very High Frequency (VHF) Data section of the very high frequency data parameter of the DTD Primary Port Status log page.

> **Note:** To clear bits 0 or 1 of "Byte 3" of the VHF Data, the Single Byte Command 0x14, or 0x29 (respectively), must be executed. These two commands are only available on the DLT-S4 drive.

For details about the contents of the VHF Data, refer to the ADC draft standard at www.t10.org.

[0x38] – SET AUTO LOAD MODE TO FULL LOAD

Enables the drive to automatically perform a full load of the cartridge, and ready it for access. The drive auto-loads the cartridge as soon as the media has reached the point where the tape drive mechanics are able to take control of the cartridge and seat it in the drive.

This parameter takes precedence over the host and default settings. The setting will persist over an internal reset and bus reset. This setting is cleared by the following events:

- The library sends a **SET AUTO LOAD MODE TO NO LOAD** command
- The tape drive cycles power

[0x39] – SET AUTO LOAD MODE TO NO LOAD

Enables the drive to NOT automatically load the cartridge once it reaches the point where the tape drive mechanics are able to take control of the cartridge and seat it in the drive. The cartridge will remain at the unseated point until the library issues a load command to the drive. This

parameter takes precedence over the host and default settings. The setting persists over an internal reset and bus reset.

This is the drive's default setting.

> **Note:** If the library does not issue either of the auto load mode commands, the load mode may be changed by the host using mode page 0x0A, Control Mode page. See SPC-3, mode parameters for Control Mode Page.

The legacy library may opt to use the multiple byte mode commands to change the auto load mode field. See Mode Page Data on page 51 for additional information. The behavior, using this method to change the auto load mode field, is described in ADC specification INCITS 403-2005.

[0x03] – RESET

The tape drive runs its power-on self-test (POST) and restarts its firmware.

Compression

There are several ways to set compression in the tape drive:

- EEPROM
- Library
- Host Interface Mode page

The following is the order of precedence:

1. EEPROM **ForceComp** Parameter – This SCSI changeable EEPROM setting takes precedence over all other methods. Refer to the Interface Reference Guide for your product for detailed information.

2. Library **ENABLE DATA COMPRESSION** and **DISABLE DATA COMPRESSION** commands – The library sends one of these commands through the library port. If the EEPROM setting is NoForce, the tape drive honors the library command and turns compression on or off accordingly.
3. Host Interface Mode Pages – If the EEPROM setting is **NoForce**, and if the library has not sent an **ENABLE DATA COMPRESSION** or **DISABLE DATA COMPRESSION** command, the tape drive uses the mode settings.
4. Default – If the tape drive has received no requests from EEPROM, the library, or the host, it defaults to its optimal setting: **Compression Enabled**.

[0x04] – ENABLE DATA COMPRESSION

The library enables data compression. The tape drive overrides any host setting and enables data compression starting with the next write command issued from the host. This compression setting persists until the next tape load, and then it defaults to the host compression setting.

[0x05] – DISABLE DATA COMPRESSION

The library disables data compression. The tape drive overrides any host setting and disables data compression starting with the next write command issued from the host. This compression setting persists until the next tape load, and then it defaults to the host compression setting.

[0xn6] – SET SCSI ID

The **SET SCSI ID** command applies to the parallel SCSI environment. The **SET SCSI ID** command is the only supported way to use software to set the tape drive SCSI ID.

The following table shows the commands to set the SCSI ID of the tape drive. Table 5 shows the commands to set the SCSI ID of the tape drive.

Table 5 Setting the Tape Drive SCSI ID

Command	Sets SCSI ID to ...
0x06	0
0x16	1
0x26	2
0x36	3
0x46	4
0x56	5
0x66	6
0x76	7
0x86	8
0x96	9
0xA6	A
0xB6	B
0xC6	C
0xD6	D
0xE6	E
0xF6	F

When powered on, the tape drive does not have a SCSI ID set and does not enable the SCSI bus. The **SET SCSI ID** command does not take effect until the library issues a **RESET** command to the tape drive.

After receiving the **SET SCSI ID** command, the tape drive awaits a **RESET** command from the library. After it receives this discrete **RESET** command, the tape drive uses the SCSI ID (defined by the **SET SCSI ID** command) as its bus ID and enables the SCSI bus.

For example, to set the tape drive SCSI ID to 4, the library sends 0x46 to the library tape drive interface. The tape drive awaits a **RESET** command.

On receiving the **RESET** command, the tape drive completes initializing, then begins to respond to commands sent to ID 4 on the SCSI bus.

> **Note:** Any ID set using the **SET SCSI ID** command takes precedence over any previous ID, no matter how the previous ID was set.

The SCSI IDs 8 through F function only on tape drives that support wide SCSI buses. A tape drive that does not support a wide SCSI bus ignores the command or returns an error.

If reset (due to a SCSI bus reset or bug check), the tape drive checks to see if the library has previously issued a valid **SET SCSI ID** command. If a **SET SCSI ID** command has previously set up a valid SCSI ID, the tape drive uses that SCSI ID and enables the SCSI bus. If, however, the library did not issue a valid **SET SCSI ID** command, the tape drive disables the SCSI bus and waits for the library to set a valid SCSI ID.

[0xn7] – SET DENSITY

The following commands set the density in gigabytes (GB) that the tape drive uses when performing a write operation from Beginning Of Tape (BOT).

> **Note:** This command applies only to SDLT 220 and SDLT 320 tape drives. The SDLT 600 and DLT-S4 tape drives write at only one density.

Table 6 Commands to Set Input Density for Write Operations

Command	Sets density to ...
0x07	Automatic selection (on any compatible media)
0x87	110/220 GB on Super DLTtape I media
0x97	160/320 GB on Super DLTtape I media

The tape drive ignores all **SET DENSITY** inputs unless it is writing from BOT. The tape drive uses the recorded density for all read and write append operations (except as noted in the following paragraphs).

On a write from BOT, the following factors can change tape density:

- **SET DENSITY** commands
- A programmable host selection through your OS and the SCSI interface
- Native default density as determined by tape drive type.

In case of multiple selections, the order of precedence is from top to bottom in the list.

> **Note:** When powered on, the tape drive uses its native default density setting for any write operations from BOT until either **SET DENSITY** commands or a programmable host selection changes the tape drive's write density.

The **SET DENSITY** command remains in effect until the current data cartridge is unloaded, and then the density reverts to the native setting.

If the currently loaded tape or the tape drive does not support the selected density, the tape drive retains its current density setting. The tape drive sends no notification of this to the library. However, when responding to a library **ATTENTION** command, the tape drive returns its current density setting.

[0x08] – SEND TAPE DATA 1

The tape drive returns Tape Data Packet 1, which contains eight bytes of tape data. The packet contains the following information:

- Tape Remaining (number of 4-kilobyte (KB) blocks remaining)
- Read Compression Ratio * 100
- Write Compression Ratio * 100

If no tape is loaded, the value of the Tape Remaining field is "0." The data is invalid if the library sends the **SEND TAPE DATA 1** command before the

calibration and directory read is complete. The library uses the **ATTENTION** command to check the status of the tape drive to ensure that the initialization is complete and that the tape drive knows the format of the currently loaded data cartridge.

Table 7 shows the packet structure.

Table 7 Tape Data Packet 1 Description

Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Tape Remaining (LSB)							
4 - 5	(MSB) Read Compression Ratio (LSB)							
6 - 7	(MSB) Write Compression Ratio (LSB)							

[Bytes 0 to 3] – Tape Remaining

Represents the number of 4-kilobyte blocks remaining on the tape.

[Bytes 4 to 5] – Read Compression Ratio

Represents the read compression ratio * 100 (shown in this field as a hexadecimal number). To calculate the ratio, convert the number to decimal, then multiply it by 100.

read compression ratio = [read compression (base 10) * 100]: 1

[Bytes 6 to 7] – Write Compression Ratio

Represents the write compression ratio * 100 (shown in this field as a hexadecimal number). To calculate the ratio, convert the number to decimal, then multiply it by 100.

write compression ratio = [write compression (base 10) * 100]: 1

[0x09] – LOAD

The tape drive loads a data cartridge.

[0x0A] – CODE UPDATE REQUEST

The library enables updating the policy and servo firmware via tape update.

Caution: During the code update, while reprogramming the new image into the flash EEPROM is actually in progress, a power failure or power cycle (but not a bus reset) renders the controller module unusable. When doing a code update, take reasonable precautions to prevent a power failure.

To perform a Code Update (CUP) from the library, follow these steps:

1. Make certain the tape drive contains no data cartridge.
2. Send the library **ATTENTION** command.
3. Send the library **CODE UPDATE REQUEST** command.
4. Send the library **ATTENTION** command.
5. Check the Tape Motion Status field of the returned General Status Packet to verify the tape drive is in the Ready for Code Update (0x09) state.

6 Insert the data cartridge containing the new firmware into the tape drive.

> **Note:** If the drive is currently in the default NO LOAD auto load mode, issue the Library VHF data command. Verify that the cartridge is at the point where the VHF data reflects acknowledgement of media control by the drive. Send a library **LOAD** command to the drive.

7 Send the library **ATTENTION** command.

8 Check the Tape Motion Status field of the returned General Status Packet to verify the data cartridge is loading (0x7). It takes about a minute to get into the Updating Code (0xA) state.

9 Send the library **ATTENTION** command.

10 Check the Tape Motion Status field of the returned General Status Packet to verify the update is in progress (Updating Code [0xA] state).

11 Send the library **ATTENTION** command.

12 Check the Policy Firmware Version field to verify that the update completed successfully.

13 Unload the data cartridge and remove it from the tape drive.

Some update circumstances cause the update to fail:

- Data cartridge contains an incompatible update image.
- Data cartridge does not contain an update image.
- No data cartridge in the tape drive.

If the update fails due to any of these circumstances, the tape drive aborts the command, logs the failure, and returns to normal operation.

[0x0B] – REPORT SERIAL NUMBER (deprecated)

The tape drive returns the Serial Number Packet, which contains 10 bytes of information. This command is provided only for backward

compatibility and does not contain the full serial number. The tape drive shifts the full serial number right to eliminate any spaces. If the serial number is larger than 10 bytes, the tape drive shifts it left to reduce the size to 10 bytes.

> **Note:** You can use the **SEND DEVICE ID NUMBERS** command (0x90) to get the full 12 bytes.

Table 8 shows the packet structure.

Table 8 Serial Number Packet Description

Bit / Byte	7	6	5	4	3	2	1	0
0	Serial Number Byte 0							
1	Serial Number Byte 1							
2	Serial Number Byte 2							
3	Serial Number Byte 3							
4	Serial Number Byte 4							
5	Serial Number Byte 5							
6	Serial Number Byte 6							
7	Serial Number Byte 7							
8	Serial Number Byte 8							
9	Serial Number Byte 9							

[0x0C] – SEND TAPE DATA 2

The tape drive returns Tape Data Packet 2, which contains 18 bytes of information. Table 9 shows the packet structure.

Table 9 Tape Data Packet 2 Description

Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Data Cartridge Load Counter (LSB)							
4 - 5	(MSB) Cleaning Cartridge Load Counter (LSB)							
6 - 9	(MSB) Power-on Hours Since Last Cleaning Application (LSB)							
10 - 13	(MSB) Cumulative Power-on Hours (LSB)							
14	Count of Cleaning Applications for Cleaning Cartridge							
15 - 17	(MSB) Tape Motion Hours Since Last Cleaning Application (LSB)							

[Bytes 0 to 3] – Data Cartridge Load Counter

Represents the number of times a data cartridge has been loaded into the tape drive.

[Bytes 4 to 5] – Cleaning Cartridge Load Counter

Represents the number of times a cleaning cartridge has been loaded into the tape drive.

[Bytes 6 to 9] – Power-on Hours Since Last Cleaning Application

The total number of power-on hours for the tape drive since the last cleaning cartridge use.

[Bytes 10 to 13] – Cumulative Power-on Hours

Represents the number of power-on hours for the tape drive. This field actually consists of power-on hours (bytes 10 and 11) and a power cycle count (bytes 12 and 13) for a total of 32 bits. The field is in the following format:

- Power-on hours are in bits 0 through 15.
- Power cycle count is in bits 16 through 31.

[Byte 14] – Count of Cleaning Applications for Cleaning Cartridge

The Count of Cleaning Applications for Cleaning Cartridge field is valid only after a cleaning cartridge has expired.

[Bytes 15 to 17] – Tape Motion Hours Since Last Cleaning Application

The total number of hours the tape has been in motion since the last cleaning cartridge use.

[0xnD] – SET TAPE DRIVE SPEED

Not supported. The DLT tape drive has only one speed.

[0x13] – SEND TAPE DATA 3

The tape drive returns Tape Data Packet 3, which contains eight bytes of information. Table 10 shows the packet structure.

Table 10 Tape Data Packet 3 Description

Bit / Byte	7	6	5	4	3	2	1	0
0	Rsv'd (prior use)				Media Type			
1	BHC Test Status							
2	Tape Drive Temperature							
3	SFP	Rsv'd						
4	Maximum Temperature							
5	Firmware Personality Major Code							
6	Firmware Personality Minor Code							
7	Rsv'd							

[Byte 0] – Status 1

Bits 4 to 7 - Reserved

Reserved (prior use).

Bits 0 to 3 (Media Type)

Reports the type of data cartridge currently in the tape drive. The tape drive sets the media type during calibration and then clears it (0x00 – No Tape) during the unload process.

Table 11 Media Type

Bit	Type
0x00	No Tape or Unknown Tape
0x01	Cleaning Cartridge
0x05	DLTtape IV
0x06	Super DLTtape I
0x07	Super DLTtape II
0x08	DLTtape VS1
0x09	Reserved (prior use)
0x0A	Rsv'd
0x0B	DLTtape S4

[Byte 1] – BHC Test Status (Implementation in Progress)

Represents the current status of the Basic Health Check (BHC) Test. The tape drive reports this status only when the library invokes the BHC Test via the library port; otherwise it remains set to "BHC test not run."

[Byte 2] – Tape Drive Temperature

Represents the tape drive temperature in degrees Celsius. A signed 8-bit hexadecimal number represents the value. The tape drive refreshes this value approximately every 20 seconds while tape drive power is on.

[Byte 3] – Set Software File Protect

Bit 7 – SFP

Indicates the status of the Software File Protect (SFP) feature. Sending the **SET SOFTWARE FILE PROTECT** command through the library port sets this bit. The bit remains set through any form of tape drive reset. Unloading the tape or power cycling the tape drive clears the bit.

Bits 0 to 6 – Reserved

[Byte 4] – Maximum Temperature

Contains the maximum operating temperature, in degrees Celsius. An 8-bit hexadecimal number represents the value.

[Byte 5] – Firmware Personality Major Code

Contains the numeric indicator of the major code of the firmware personality. An 8-bit hexadecimal number represents the value.

[Byte 6] – Firmware Personality Minor Code

Contains the numeric indicator of the minor code of the firmware personality. An 8-bit hexadecimal number represents the value.

[Byte 7] – Reserved

Reserved

[0x14] – SEND CURRENT TAPEALERT DATA

The tape drive returns the TapeAlert Data Packet, which contains nine bytes of data consisting of the major/minor version of TapeAlert supported in the tape drive and the 64 TapeAlert flags.

Note: This command is only available on the DLT-S4 tape drive.

Note: The tape drive maintains a separate set of TapeAlert flags so that this command does not affect the SCSI TapeAlert Data.

A status bit (bit 6 of byte 6) in the General Status Packet (see table 1 on page 4) indicates that the firmware running in the tape drive is capable of reporting TapeAlert Status. Table 12 shows the packet structure.

Table 12 TapeAlert Data Packet Description

Bit / Byte	7	6	5	4	3	2	1	0
0	TapeAlert Major Version				TapeAlert Minor Version			
1	Flag 8	Flag 7	Flag 6	Flag 5	Flag 4	Flag 3	Flag 2	Flag 1
2	Flag 16	Flag 15	Flag 14	Flag 13	Flag 12	Flag 11	Flag 10	Flag 9
3	Flag 24	Flag 23	Flag 22	Flag 21	Flag 20	Flag 19	Flag 18	Flag 17
4	Flag 32	Flag 31	Flag 30	Flag 29	Flag 28	Flag 27	Flag 26	Flag 25
5	Flag 40	Flag 39	Flag 38	Flag 37	Flag 36	Flag 35	Flag 34	Flag 33
6	Flag 48	Flag 47	Flag 46	Flag 45	Flag 44	Flag 43	Flag 42	Flag 41
7	Flag 56	Flag 55	Flag 54	Flag 53	Flag 52	Flag 51	Flag 50	Flag 49
8	Flag 64	Flag 63	Flag 62	Flag 61	Flag 60	Flag 59	Flag 58	Flag 57

[Byte 0] – TapeAlert Major or Minor Version

Indicates the major and minor version of TapeAlert supported by the tape drive. Bits 0 through 3 indicate the minor version and bits 4 through 7 indicate the major version.

[Bytes 1 to 8] – Library TapeAlert Flags

These eight bytes contain the 64 TapeAlert flags defined by the TapeAlert specification. The tape drive firmware implements the flags shown in table 13:

Table 13 TapeAlert Flags, Severity Levels, and Meanings

	Flag	Severity Level	Description
1	Read Warning	W	The tape drive is having problems reading data. No data has been lost, but there has been a reduction in the performance of the tape.
2	Write Warning	W	The tape drive is having problems writing data. No data has been lost, but there has been a reduction in the capacity of the tape.
3	Hard Error	W	The operation has stopped because an error has occurred while reading or writing data which the drive cannot correct.
4	Media	C	Your data is at risk: 1. Copy any data you require from this tape. 2. Do not use this tape again. 3. Restart the operation with a different tape.
5	Read Failure	C	The tape is damaged or the drive is faulty. Call the tape drive supplier technical support.
6	Write Failure	C	The tape is from a faulty batch or the tape drive is faulty: 1. Use a good tape to test the drive. 2. If the problem persists, call the tape drive supplier technical support.

	Flag	Severity Level	Description
7	Media Life	W	The tape cartridge has reached the end of its calculated useful life: 1. Copy any data you need to another tape . 2. Discard the old tape.
9	Write Protect	C	You are trying to write to a write-protected cartridge. Remove the write-protection or use another tape.
10	No Removal	I	You cannot eject the cartridge because the tape drive is in use. Wait until the operation is complete before ejecting the cartridge.
11	Cleaning Media	I	The tape in the drive is a cleaning cartridge.
17	Read Only Format	W	You have loaded a cartridge of a type that is read-only in this drive. The cartridge will appear as write-protected in sense data.
19	Nearing Media Life	I	The tape cartridge is nearing the end of its calculated life. It is recommended that you: 1. Use another tape cartridge for your next backup. 2. Store this tape cartridge in a safe place in case you need to restore data from it.
20	Clean Now	C	The tape drive needs cleaning: 1. If the operation has stopped, eject the tape and clean the drive. 2. If the operation has not stopped, wait for it to finish and then eject the tape and clean the drive. Check the tape drive product manual or users guide for device-specific cleaning instructions.

	Flag	Severity Level	Description
21	Clean Periodic	W	The tape drive is due for routine cleaning: 1. Wait for the current operation to finish. 2. Eject the tape and clean the drive using a cleaning cartridge. Check the tape drive product manual or users guide for device specific cleaning instructions.
22	Expired Cleaning Media	C	The last cleaning cartridge used in the tape drive has worn out: 1. Discard the worn out cleaning cartridge. 2. Wait for the current operation to finish. 3. Then use a new cleaning cartridge.
31	Hardware B	C	The tape drive has a hardware fault: 1. Turn the tape drive off and then on again. 2. Restart the operation. 3. If the problem persists, call the tape drive supplier technical support. Check the tape drive product manual or users guide for device-specific instructions on turning the device power on and off.
32	Interface	W	The tape drive has a problem with the host interface: 1. Check the cables and cable connections. 2. Restart the operation.
34	Download Fail	W	The firmware download has failed because you have tried to use the incorrect firmware for this tape drive. Obtain the correct firmware and try again.
36	Drive Temperature	W	Environmental conditions inside the tape drive are outside the specified temperature range.
38	Predictive Failure	C	A hardware failure of the tape drive is predicted. Call the tape drive supplier technical support.

	Flag	Severity Level	Description
40	Loader Hardware A	C	The changer mechanism is having difficulty communicating with the tape drive: 1. Turn the autoloader off and then on again. 2. Restart the operation. 3. If problem persists, call the tape drive supplier technical support.
42	Loader Hardware B	W	There is a problem with the autoloader mechanism.
51	Tape directory invalid at unload	W	The tape directory on the tape cartridge just unloaded has been corrupted. File search performance will be degraded. The tape directory can be rebuilt by reading all the data.
55	Loading Failure	C	The operation has failed because the media cannot be loaded and threaded. 1) Remove the cartridge, inspect it as specified in the tape drive product manual, and retry the operation. 2) If the problem persists, call the tape drive supplier technical support.
59	WORM Medium Integrity Check Failed	W	The tape drive has detected an inconsistency during write-once read-many (WORM) medium integrity checks. Someone may have tampered with the cartridge.

	Flag	Severity Level	Description
60	WORM Medium Overwrite Attempted	W	An attempt has been made to overwrite user data on a WORM medium: 1. If a WORM medium was used inadvertently, replace it with a normal data medium. 2. If a WORM medium was used intentionally, check that the software application is compatible with the WORM medium format you are using.

Note: W = Warning
C = Critical
X = Informational

[0x15] – RUN BHC TEST (Implementation in Progress)

The tape drive invokes the BHC Test. This test does not run if there is a diagnostic test in progress (from the **SCSI SEND DIAGNOSTIC** command) or if the BHC Test is already running. Tape Data Packet 3 (see [0x13] – SEND TAPE DATA 3 on page 25) reports the test results.

[0x18] – SET SOFTWARE FILE PROTECT

The tape drive sets SFP in bit 7 of Tape Data Packet 3, byte 3. This command functions only when the tape drive does not contain a data cartridge. At other times, the tape drive ignores this command.

This command prohibits the tape drive from performing a write or erase command on the tape and the tape's directory. Unloading the data cartridge from the drive clears this bit, resulting in the data cartridge not being write protected. The write protection remains in effect across all resets, regardless of source.

[0x20] – DISABLE EJECT ON SCSI UNLOAD

Prevents the tape drive from ejecting the data cartridge upon receipt of a **SCSI UNLOAD** command. The tape drive continues to process **EJECT** commands sent from the library. This is the tape drive's default state.

[0x30] – ENABLE EJECT ON SCSI UNLOAD

Enables the tape drive to eject the data cartridge as part of a **SCSI UNLOAD**. The library can send this command with a data cartridge loaded or unloaded. If set, the EEPROM Vendor Specific Page parameter **NoSCSIEject** (see the SCSI Interface Guide for your product) overrides this command. An internal reset or power cycle resets this command to its default value, but a bus reset does not. Regardless of this command setting, the tape drive does not eject an expired cleaning cartridge.

[0x40] – DISABLE AUTO TAPE THREAD

Disables the automatic tape thread after a data cartridge unload. The command allows you to load and unload a data cartridge without waiting for the tape drive to thread the tape in the data cartridge automatically. Use this command only during library load/unload testing, *not* during normal operations. The setting persists across an internal reset and bus reset. This setting is cleared by the following events:

- The library sends the **ENABLE AUTO TAPE THREAD** command.
- The tape drive cycles power.

With automatic tape threading disabled, the library can issue either a **LOAD** (0x09) or **EJECT** (0x22) command. The tape drive accepts no other commands.

[0x50] – ENABLE AUTO TAPE THREAD

Enables automatic tape threading after data cartridge insertion. This is the tape drive's default state.

[0x60] – DISABLE SHORT TAPE MODE

Disables the short tape mode and allows the tape drive to use all tracks on the tape. This is the tape drive's default state.

Issue this command only when the tape drive does not contain a data cartridge.

[0x70] – ENABLE SHORT TAPE MODE

Enables the short tape mode. In this mode, the tape drive views the tape as two logical tracks, which allows quicker End of Media (EOM) testing. Use this command only during library testing, *not* during normal operations. The setting persists across an internal reset and bus reset. This setting is cleared by the following events:

- The library sends the **ENABLE AUTO TAPE THREAD** command.
- The library sends the **DISABLE SHORT TAPE MODE** command.
- The tape drive cycles power.

Issue this command only when the tape drive does not contain a data cartridge.

[0x80] – SEND EXTENDED STATUS

The tape drive returns an Extended Status Packet, which contains eight bytes that contain additional status information for the tape drive. Table 14 shows the packet structure.

Table 14 Extended Status Packet Description

Bit / Byte	7	6	5	4	3	2	1	0
0	Bytes to Follow							
1	Command Code							
2	Reset	Rsv'd			Command Error Code			
3	Rsv'd				Interface Type			
4	Rsv'd	Com-mand Active	Max. Safe Temp. Exceed-ed	Back-ward Com-patible Capable	Short Tape Mode Enabled	Auto Tape Thread Disabled	SCSI Eject Enabled	Buckle Error
5	SK Valid	Rsv'd			Sense Key (SK)			
6	Additional Sense Code (ASC)							
7	Additional Sense Code Qualifier (ASCQ)							

[Byte 0] – Bytes to Follow Indicates the number of subsequent bytes in the Extended Status Packet.

[Byte 1] – Command Code (Implementation in Progress) Represents the command that the extended status information refers to.

[Byte 2] – Status 1

Contains status bits that clear to zero after the host reads them.

Bit 7 — Reset (Clear on Read)

The tape drive sets this bit after a reset or power-on; the library clears it after reading it.

Bits 4 to 6 – Reserved

Bits 0 to 3 — Command Error Code (Clear on Read)

These four bits contain the error status of the command indicated by the command code. On sending this value, the drive resets it to No Error. Table 15 shows the possible error codes.

Table 15 Command Error Codes

Code	Description
0x00	No Error
0x01	Wrong State
0x02	Invalid Command
0x03	Command Not Completed
0x04	Overlapped Command

0x00 — No Error The tape drive has not detected a command error since returning the last Extended Status Packet.

0x01 — Wrong State The tape drive is not ready to accept a command. Either a) the library issued a command without previously sending an **ATTENTION** or data request command; or b) when it issued the command, the tape drive was in the process of sending data to the library.

0x02 — Invalid Command The tape drive did not recognize the last command, or it was not a supported command.

0x03 — Command Not Completed The library issued a command after reading the latest Extended Status Packet. The tape drive could not complete the command.

0x04 — Overlapped Command The library has a command outstanding to the tape drive, and the tape drive ignores the current command.

[Byte 3] – Status 2

Bits 4 to 7 – Reserved

Bits 0 to 3 – Interface Type

Indicates the type of interface in use by the tape drive. Table 16 shows the interface types and values.

Table 16 Tape Drive Interface Types

Value	Interface Type
0x00	SCSI Single Ended Low Voltage Differential (SE/LVD) interface board
0x01	SCSI High Voltage Differential (HVD) interface board
0x02	SCSI Ultra 160 interface board
0x03	Fibre Channel (FC) interface board
0x04	SCSI Ultra 320 interface board
0x05	4, 2, 1 Gig Fibre channel interface board
0x06	3 Gig SAS interface board

[Byte 4] – Status 3

Bit 7 – Reserved

Bit 6 — Command Active (Implementation in Progress)

A "1" indicates that the tape drive is currently processing the command indicated by the Command Code in Byte 1, but has not yet completed it.

Bit 5 — Max. Safe Temp. Exceeded

A "1" indicates that the tape drive has exceeded its safe maximum prescribed temperature.

Bit 4 — Backward Compatible Capable

A "1" indicates that the tape drive can run in backward compatible mode.

Bit 3 — Short Tape Mode Enabled

A "1" indicates that the tape drive is in Short Tape Mode. Short Tape Mode means the tape drive views the tape as two logical tracks, which allows quicker End of Media (EOM) testing.

Bit 2 — Auto Tape Thread Disabled

A "1" indicates that the tape drive does not automatically thread the tape after loading a data cartridge. The library can issue a **LOAD** command (0x09) to force the tape drive to thread the tape.

Bit 1 — SCSI Eject Enabled on SCSI Unload Command

A "1" indicates that the library has issued an **ENABLE EJECT ON SCSI UNLOAD** command (0x30), which allows a **SCSI UNLOAD** command to both unload and eject the data cartridge. By default, this bit is "0," which indicates that a **SCSI UNLOAD** command unloads the data cartridge but

does not eject the data cartridge. In either state, the tape still processes all **EJECT** commands received from the library.

Bit 0 — Buckle Error

A "1" indicates that the tape drive has failed to buckle the inserted tape properly. Upon receiving this status, the library issues an **EJECT** command, and then attempts to reload the data cartridge.

[Byte 5] – Sense Key (Implementation in Progress)

This byte contains the SCSI Sense Key and other related SCSI information.

Bit 7 — Sense Key Valid (Implementation in Progress)

A "1" indicates that the Sense Key, Additional Sense Code, and Additional Sense Code Qualifier fields are valid.

Bits 4 to 6 – Reserved

Bits 0 to 3 — Sense Key (Implementation in Progress)

This is the standard SCSI Sense Key. It corresponds to the last Sense Key information assembled in response to a **REQUEST SENSE** command received from the SCSI bus. Refer to the SCSI interface guide for your product for details. This command functions only if Sense Key Valid (0x80) is set.

[Byte 6] – Additional Sense Code (ASC) (Implementation in Progress)

This byte contains the standard SCSI Additional Sense Code. The ASC is only valid if the Sense Key Valid (0x80) bit is set. Refer to the *S*CSI interface guide for your product for details and a complete list of ASC codes.

[Byte 7] – Additional Sense Code Qualifier (ASCQ) (Implementation in Progress)

This byte contains the standard SCSI Additional Sense Code Qualifier. The ASCQ is only valid if the Sense Key Valid bit is set. Refer to the SCSI interface guide for your product for details and a complete list of ASCQ codes.

[0x90] – SEND DEVICE ID NUMBERS

The tape drive returns a Device ID Numbers Packet, which contains 48 bytes. Table 17 shows the packet structure.

Table 17 Device ID Numbers Packet Description

Bit Byte	7	6	5	4	3	2	1	0
0	Bytes to Follow							
1 - 8	Vendor ID							
9 - 24	Product ID							
25 - 40	Tape Drive Serial Number							
41 - 48	*FC-PH* NAA Type 5 ID							

[Byte 0] – Bytes to Follow

Contains the number of subsequent bytes in the packet.

[Bytes 1 to 8] – Vendor ID

These eight bytes contain the Vendor ID in ASCII format.

[Bytes 9 to 24] – Product ID

These 16 bytes contain the Product ID in ASCII format.

[Bytes 25 to 40] – Tape Drive Serial Number

These 16 bytes contain the Tape Drive Serial Number in ASCII format. Currently, only the first 12 bytes contain a valid serial number, and the remaining 4 bytes contain spaces (0x20). If the serial number is invalid, the tape drive returns question marks (????????????).

[Byte 41 to 48] – *FC-PH* NAA Type 5 ID

These eight bytes contain the Type 5 ID (as defined in the Fibre Channel specification, *FC-PH* NAA) in binary format.

[0x23] – SEND TAPE DATA 4

The tape drive returns a Tape Data 4 Data Packet, which contains eight bytes of information. Table 18 shows the packet structure.

Table 18 Tape Data 4 Data Packet Description

Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Media ID (LSB)							
4 - 7	Rsv'd							

[Bytes 0 to 3] – Media ID

These four bytes contain the data cartridge unique Media ID in ASCII format. The tape drive reports the Media ID as all zeroes if no tape is loaded or if the Media ID is unknown.

[Bytes 4 to 7] – Reserved

Reserved.

[0x24] – SEND WRITE ERRORS

The tape drive returns the Write Error Data Packet, which contains 20 bytes of information. The packet contains the scaled write information. The data resulting from this command are the same as the data you receive from the **SCSI LOG SENSE** Page 02h command, with parameter codes 02, 03, 05, and 06.

Table 19 shows the packet structure

Table 19 Write Error Data Packet Description

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Bit / Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Total Rewrites (LSB)							
4 - 7	(MSB) Total Errors Corrected (LSB)							
8 - 15	(MSB) Total Bytes Processed (LSB)							
16 - 19	(MSB) Total Uncorrected Errors (LSB)							

The following conditions reset the data:

- Tape load
- SCSI bus reset or one of the following Fibre Channel task management functions:
  - Target reset
  - Logical unit reset
- Internal reset
- Power-on
- **LOG SELECT** command (sent through SCSI) to clear the parameters.

[0x25] – SEND READ ERRORS

The tape drive returns the Read Error Data Packet, which contains 20 bytes of information. The packet contains the scaled read information. The data resulting from this command are the same as the data you receive from the **SCSI LOG SENSE** Page 03h command, using parameter codes 02, 03, 05, and 06.

Table 20 shows the packet structure.

Table 20 Read Error Data Packet Description

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Total Rereads (LSB)							
4 - 7	(MSB) Total Errors Corrected (LSB)							
8 - 15	(MSB) Total Bytes Processed (LSB)							
16 - 19	(MSB) Total Uncorrected Errors (LSB)							

The following conditions reset the data:

- Tape load
- SCSI bus reset or one of the following Fibre Channel task management functions:
  - Target reset
  - Logical unit reset
- Internal reset
- Power-on
- **LOG SELECT** command (sent through SCSI) to clear the parameters.

[0x28] – SEND TSERVO ERRORS

The tape drive returns the current number of Tservo errors in the Tservo Error Packet, which contains 24 bytes of information. The packet contains the Tservo Read and Write error counts and the number of Read and Write bytes processed. The data resulting from this command are the same as the data you receive from the **SCSI LOG SENSE** Page 03h or 02h commands, using parameter codes 05h and 8003h.

Table 20 shows the packet structure.

Table 21 Tservo Error Packet Description

Bit Byte	7	6	5	4	3	2	1	0
0 - 3	(MSB) Total Tservo Read Errors (LSB)							
4 - 11	(MSB) Total Read Bytes Processed (LSB)							
12 - 15	(MSB) Total Tservo Write Errors (LSB)							
16 - 23	(MSB) Total Write Bytes Processed (LSB)							

This command is modeled after the **SCSI LOG SENSE** command. Data returned in response to the **SEND TSERVO ERRORS** command follow the same validity rules as data returned in response to the **LOG SENSE** command. The following conditions reset the data:

- Tape load
- SCSI bus reset or one of the following Fibre Channel task management functions:
  - Target reset
  - Logical unit reset
- Internal reset
- Power-on
- **LOG SELECT** command (sent through SCSI) to clear the parameters.

[0x5B] – ENABLE AUTOMATION/DEVICE INTERFACE — TRANSPORT PROTOCOL MODE

Note: This command is not supported by the SDLT 220 and SDLT 320. This command is only supported by the SDLT 600 running V30 (or higher) code.

This is the start-of-frame character for an ADT frame. When the tape drive receives this character, it switches into ADT mode and enters the P0:Initial state, as specified by the ADT draft standard. If the ADT port does not enter the P2:Logged In state within 10 seconds, the port will disable ADT mode and revert to operations per this specification.

For more information on the behavior in this mode, refer to the ADT draft standard at www.t10.org.

[0xFD] – FORCE CLEANING REQUESTED ON

Forces the library's General Status Packet to report a cleaning requested status regardless of the actual tape drive state. Use this command for debug purposes only.

[0xFE] – FORCE CLEANING REQUIRED ON

Forces the library's General Status Packet to report a cleaning required status regardless of the actual tape drive state. Use this command for debug purposes only.

[0xFF] – FORCE CLEANING OFF

Returns the tape drive to normal reporting of the cleaning state. Use this command for debug purposes only.

Chapter 3

Multiple Byte Library Commands

Some commands require more information than is feasible to transfer with a single byte. This chapter describes multiple byte commands and their method of delivery.

All undefined and not-yet-implemented commands put the tape drive interface into the IDLE state, causing the tape drive to put an **INVALID** command status in the Command Error Code field (0x0F) of the Extended Status Packet.

[0x55] – MODE SELECT

To initiate this command, the library sends a 55h command byte.

When it receives either a **MODE SELECT** or **MODE SENSE** command, the tape drive sends one of the following responses:

- 06h, Acknowledgement (ACK), acknowledges receipt of the command byte.
- 15h, Negative Acknowledgement (NAK), indicates that an error occurred.

Note:	For a normal **MODE SELECT** command, the length field is reserved. For this interface, the length field *must* contain the length of the **MODE SELECT** data.

The tape drive acknowledges every byte sent with a 06h byte, indicating successful reception; or with a 15h byte, indicating that an error occurred. The library does not send more than one byte of the **MODE SELECT** command or its associated data without receiving a 06h byte. If the library receives a 15h byte, it considers the command aborted due to an error.

While receiving data, the tape drive waits a maximum of two seconds between characters. If the time between two consecutive characters exceeds two seconds, the tape drive aborts the sequence, discards the command, and sends a 15h byte.

During this time, the library also implements a two-second timeout between sending a character and receiving a 06h byte. If the library does not see a 06h byte, it does not send the next character, so the tape drive times out. When this occurs, the library aborts the sequence.

After receiving the last byte of data, the tape drive validates and executes the **MODE SELECT** command before acknowledging the data byte.

- If the tape drive returns 06h after the last byte of the **MODE SELECT** data, then the command was valid and has completed execution.
- If the tape drive returns 15h, the tape drive detected an error in execution of the command and aborted the operation.

If the tape drive receives any characters after the last byte of **MODE SELECT** data but before returning the acknowledgement byte, it ignores them.

[0x5A] – MODE SENSE

To initiate this command, the library sends a 5Ah command byte. In response, the tape drive sends one of the following responses:

- 06h, Acknowledged (ACK), acknowledges receipt of the command byte.
- 15h, Not Acknowledged (NAK), indicates that an error occurred.

Once the tape drive has acknowledged the command, the library sends the second byte, which contains the data that would be in byte 2 of a **MODE SENSE** (10) command and contains the Page Control (PC) and Page Code fields.

The tape drive responds to the **MODE SENSE** command by sending a Mode (10) Parameter Header as defined in *SCSI Primary Commands - 2* (SPC-2). The Block Descriptor Length field is 0 and the returned data includes no Block descriptor. If the PC or Page Code values are invalid, or if the Page Code value is 0, the tape drive sets the Mode Data Length field to 6, indicating it is returning only the header.

If the PC and Page Code fields are valid and non-zero, the tape drive sends the requested page(s) of **MODE SENSE** data following the Mode (10) Page Header. The library uses the value in the Mode Data Length field to determine the amount of data being sent so that it can detect the end of the transmission. Following a **MODE SENSE** command, the library may send any other command.

> **Note:** During the transmission of **MODE SENSE** data, the library may abort the transmission at any time by sending any character to the tape drive. The library can use this technique to recover from errors detected during the transmission; for example, the return data is too large for its allocated buffer.

Mode Page Data

The library sends this data to the tape drive immediately after sending a **MODE SELECT** command.

The tape drive supports the Automation/Drive Interface – Commands (ADC) Mode Page as described in the ADC draft standard.

The tape drive supports changing the following fields in the ADC Mode Page:

- From the Node sub-page: Modify Node Name (MNN) and Node_Name.
- From the Service Delivery Port descriptor sub-page:
  - From the parallel SCSI descriptor: Port Enable (PE), Minimum Transfer Period Factor, and SCSI Bus Address.
  - From the FC descriptor: Port Enable (PE), Modify Port Name (MPN), Loop ID Valid (LIV), Require Hard Address (RHA), Point-to-point (P2P), Speed, FC-AL Loop ID, and Port_Name.

- From the Logical Unit descriptor sub-page, only the RMC Logical Unit descriptor is available.
    - From the RMC Logical Unit descriptor: ENABLE, SCSI Unload Hold Override (SUHO), Autoload Mode Override (AMO), AUTOLOAD MODE, and Write Protect (WP).

Chapter 4

Set and Get Fibre Configuration

This chapter applies to the DLT-S4 drive only.

This chapter presents commands that set the Fibre Channel configuration in the tape drive or get Fibre Channel configuration information from the tape drive. Everything supported by these commands can also be accomplished using the Multiple Byte Library Commands. It is suggested that the Multiple Byte Library Commands be used instead of the Get and Set Fibre Configuration commands because the multiple byte commands use the same data structures as Automation/Drive Interface Commands (ADC) which will help transition to the standardized Automation Drive Interface.

Set Fibre Configuration Command Packet

Table 22 shows the packet structure.

Table 22 Set Fibre Configuration Command Packet Description

Bit / Byte	7	6	5	4	3	2	1	0
0	STX (0x99)							
1	Sequence Number							
2 - 3	Command Packet Length							
4	Set Fibre Config Command OP-Code (0x20)							
5	Port A Enable	Rsv'd (Future Port B Enable)	Rsv'd	Rsv'd	Force Point to Point Port A	Rsv'd (Future Force Point to Point Port B)	Rsv'd	Rsv'd
6 - 13	World Wide Node Name (8 bytes)							
14	Port A Loop ID (Not AL_PA) (Range: 1-125)							
15 - 22	Port A World Wide Name (WWN) (8 bytes)							
23	Rsv'd Future Port B Loop ID							
24 - 31	Rsv'd Future Port B World Wide Name							
32 - 33	CHKSUM							
34	ETX (0x03)							

[Byte 0] – STX (0x99)

Start of text character, 0x99. Wait for ACK byte 0x06 before continuing to send the packet.

[Byte 1] – Sequence Number

The tape drive does not validate the sequence number; instead, it returns the number in the response packet.

[Bytes 2 to 3] – Command Packet Length

Sets the total packet size to 35. The value in the length field includes all bytes in the packet including ETX and STX.

[Byte 4] – Set Fibre Config Command OP-Code (0x20)

Sets the OP-Code, 0x20, for the Fibre Channel configuration command.

[Byte 5]

Bit 7 – Port A Enable

When set to 1, this bit enables Fibre ChannelFibre Channel port A. When set to 0, this bit disables the port.

Bit 6 – Reserved

Future Port B Enable.

Bit 5– Reserved

Bit 4– Reserved

Bit 3 – Force Point to Point Port A

Bit 2 – Reserved (Future Force Point to Point Port B)

Bit 1 – Reserved

Bit 0 – Reserved

[Bytes 6 to 13] – World Wide Node Name

This 8-byte field sets the tape drive's World Wide Node Name. This allows the library to own the tape drive's World Wide Node Name while the tape drive is in the library. A value of 0 instructs the tape drive to use its own World Wide Node Name.

[Byte 14] – Port A Loop ID (Not AL_PA)

This field tells the tape drive what Loop ID (not an AL_PA address) to acquire in hard address mode. Valid addresses are 1 through 125 (0x01 through 0x7D). If the given Loop ID is not valid, the tape drive takes an address during soft addressing. If the given Loop ID is valid but not available, the tape drive takes an address during soft addressing.

[Bytes 15 to 22] – Port A World Wide Name (WWN)

This 8-byte field sets the tape drive's World Wide Name. This allows the library to own the tape drive's World Wide Name while the tape drive is in the library. A value of 0 instructs the tape drive to use its own World Wide Name.

[Byte 23] – Reserved

Future Port B Loop ID – not supported. The tape drive ignores this value.

[Bytes 24 to 31] – Reserved Future Port B World Wide Name – not supported. The tape drive ignores this value.

[Bytes 32 to 33] – CHKSUM This is the sum of the Command OP-Code (byte 4) and Command Data (bytes 5 through 31) modulo 65536.

[Byte 34] – ETX (0x03) End of text character.

Set Fibre Configuration Response Packet

Table 23 shows the packet structure.

Table 23 Set Fibre Configuration Response Packet Description

Bit Byte	7	6	5	4	3	2	1	0
0	STX							
1	Sequence Number							
2 - 3	Response Packet Length							
4	Command Status							
5 - 6	CHKSUM							
7	ETX							

[Byte 0] – STX

Start of text character, 0x99. Wait for ACK byte 0x06 before continuing to send the packet.

[Byte 1] – Sequence Number

The tape drive does not validate the sequence number; instead, it returns the number in the response packet.

[Bytes 2 to 3] – Response Packet Length

Sets the total packet size to 8.

[Byte 4] – Command Status

This byte shows one of the following status settings (see table 24):

Table 24 Command Status Settings

Setting	Description
0x01	Success
0x02	Check Condition

[Bytes 5 to 6] – CHKSUM

Sum of Command OP-Code (byte 4) and Command Data (byte 5) modulo 65536.

[Byte 7] – ETX

End of text character.

Get Fibre Configuration Command Packet

Table 25 shows the packet structure.

Table 25 Get Fibre Configuration Command Packet Description

Bit / Byte	7	6	5	4	3	2	1	0
0	STX							
1	Sequence Number							
2 - 3	Command Packet Length							
4	Get Fibre Config Command OP-Code (0x21)							
5	Rsv'd	Rsv'd	Rsv'd	Rsv'd	Rsv'd	Rsv'd	Rsv'd	Actual Loop ID
6	CHKSUM							
7	ETX							

[Byte 0] – STX

Start of text character, 0x99. Wait for ACK byte 0x06 before continuing to send the packet.

[Byte 1] – Sequence Number

The tape drive does not validate the sequence number; instead, it returns the number in the response packet.

[Bytes 2 to 3] – Command Packet Length

Sets the total packet size to 8.

[Byte 4] – Get Fibre Config Command OP-Code (0x21)

The operation code for the **GET FIBRE CONFIG** command is 0x21.

[Byte 5]

Bits 1 to 7 – Reserved

Bit 0 – Actual Loop ID

When set to 1 (enabled), this bit causes the tape drive to report the actual Loop ID. When set to 0 (disabled), this bit causes the tape drive to report the requested Loop ID.

[Byte 6] – CHKSUM

Sum of Command OP-Code (byte 4) and Command Data (byte 5) modulo 65536.

[Byte 7] – ETX

End of text character.

Get Fibre Configuration Response Packet

Table 26 shows the packet structure.

Table 26 Get Fibre Configuration Response Packet Description

Bit / Byte	7	6	5	4	3	2	1	0
0	STX							
1	Sequence Number							
2 - 3	Response Packet Length							
4	Port A Enable	Rsv'd (Future Port B Enable)	Rsv'd	Rsv'd	Force Point to Point Port A	Rsv'd (Future Force Point to Point Port B)	Rsv'd	Tape Drive Is Dual Port
5	Rsv'd	Port A Topology			Port A Speed			
6	Rsv'd	Rsv'd Future Port B Topology			Rsv'd Future Port B Speed			
7 - 14	World Wide Node Name (8 bytes)							
15	Port A Loop ID (Not AL_PA) (Range: 0-125)							
16 - 23	Port A World Wide Name (WWN) (8 bytes)							
24	Rsv'd Future Port B Loop ID							
25 - 32	Rsv'd Future Port B World Wide Name (8 bytes)							
33	Command Status							
34 - 35	CHKSUM							
36	ETX							

[Byte 0] – STX

Start of text character, 0x99. Wait for ACK byte 0x06 before continuing to send the packet.

[Byte 1] – Sequence Number

The tape drive does not validate the sequence number; instead, it returns the number in the response packet.

[Bytes 2 to 3] – Response Packet Length

Sets the total packet size to 37. The value in the length field includes all bytes in the packet including ETX and STX.

[Byte 4]

Bit 7 – Port A Enabled

When set to 1, the tape drive reports that the specified port is currently enabled. When set to 0, the tape drive reports that the specified port is currently disabled.

Bit 6 – Reserved

Future Port B Enabled.

Bits 5 to 4 – Reserved

Bit 3 – Force Point to Point Port A

Bit 2 – Reserved (Future Force Point to Point Port B)

Bit 1 – Reserved

Bit 0 – Tape Drive Is Dual Port

When set to 1, this bit indicates that the tape drive is dual port; when set to 0, single port.

[Byte 5]

Bit 7 – Reserved

Bits 4 to 6 – Port A Topology

These bits indicate the Port A topology shown in table 27

Table 27 Port A Topology Settings

Setting	Description
0x00	Not Acquired
0x01	Private Loop
0x02	Public Loop
0x03	Point to Point
0x04	Fabric Attached
0x05 through 0x07	Reserved

Bits 0 to 3 – Port A Speed

These bits indicate the Fibre Channel speed settings shown in table 28.

Table 28 Port A Speed Settings

Setting	Description
0x00	Not Negotiated
0x01	1 Gigabit Negotiated
0x02	2 Gigabit Negotiated
0x03	4 Gigabit Negotiated
0x04 through 0x0F	Reserved

[Byte 6] – Future Port B Topology and Speed

Bit 7 – Reserved

Bits 4 to 6 – Reserved

Future Port B topology.

Bits 0 to 3 – Reserved

Future Port B speed.

[Bytes 7 to 14] – World Wide Node Name

This 8-byte field reports the library's World Wide Node Name.

[Byte 15] – Port A Loop ID (Not AL_PA)

This field reports the tape drive's actual or requested Loop ID (not an AL_PA address) for the specified Fibre Channel port. The setting of the Actual Loop ID bit in the **GET FIBRE CONFIGURATION** command determines whether this reported value is actual or requested. The valid range for this response is 1 to 125 (0x00 to 0x7D).

[Bytes 16 to 23] – Port A World Wide Name (WWN)

This 8-byte field reports the current World Wide Name for the specified port.

[Byte 24] – Reserved

Future Port B Loop ID – not supported. The tape drive ignores this value.

[Bytes 25 to 32] – Reserved

Future Port B World Wide Name – not supported. The tape drive ignores this value.

[Byte 33] – Command Status

This byte shows one of the status settings shown in table 24 on page 58.

[Bytes 34 to 35] – CHKSUM

This is the sum of Return Data (bytes 4 through 33) and Command Status (Byte 4) modulo 65536.

[Byte 36] – ETX

End of text character.

Packet Use

Packet Checking

When the tape drive receives a command packet or the library receives a response packet, they shall verify the CHKSUM before examining the packet contents. If the CHKSUM is valid, the recipient sends an ACK character (0x06) to notify the sender. If the CHKSUM is invalid, the recipient sends an NAK character (0x15). The sender re-sends the packet without changing the sequence number.

Reserved Fields

No part of the system uses or checks reserved bits or fields in these packets; therefore, they may be any value.

Tape Drive Behavior

When a tape drive is in a library, the tape drive waits with its transmitter turned off until the library enables the port.

Once the library has enabled the port, subsequent set commands must disable the port by setting the Port A Enable bit to 0. When the tape drive receives such a set command, it turns its transmitter off and waits for the library to enable the port again. *If the subsequent set command does not have the port disabled, the tape drive ignores the set command*. If the library has enabled the port, and then disabled the port with a subsequent set command, the tape drive does not take its Loop ID in the LIPA phase; instead, the tape drive takes its Loop ID in the LISA phase because the library may have changed the Loop ID.

If the library has requested the tape drive to take a hard Loop ID, and if that Loop ID is not available in the LIHA phase, then the tape drive will take a soft Loop ID in the LISA phase.

Chapter 5

Exceptions

This chapter describes tape drive behavior before it has established normal operation or when it detects a hardware error.

Immediately following a tape drive power cycle or reset, until POST has completed, the tape drive does not respond to any library requests. This takes approximately 10 to 15 seconds, depending on the tape drive type.

Once the tape drive completes POST, it is ready to accept commands from the library. It does, however, respond with the In Flux bit (see Bit 6 – In Flux on page 5) set to indicate that some tape drive subsystems are still initializing and cannot give reliable status. This can take an average of 90 seconds with a data cartridge loaded, or an average of 10 seconds with no data cartridge loaded. The tape drive handles other commands sent to it in the normal manner.

When the tape drive completes initialization, it clears the In Flux bit and returns normal status information.

The tape drive does not enable the transmitter on the Fibre Channel interface until it receives a **MODE SELECT** command and **MODE SELECT** data with the Port Enable bit set (see [0x55] – MODE SELECT on page 49).

The tape drive does not respond across the SCSI bus until the library has set a SCSI ID. This can happen as soon as the tape drive starts responding after a reset.

If the tape drive fails to complete POST, but it is able to communicate with the library, it sets the Hardware Error bit in the General Status Packet indicating that one or more POST tests have failed.

The tape drive sets the Hardware Error bit anytime it detects a Hardware Error after POST has completed.

Chapter 6

Tape Load and Unload Guidelines

This chapter discusses the primary **LOAD** and **UNLOAD** status contained in the Library Interface General Status Packet, and provides examples of **LOAD** and **UNLOAD** failures.

A DLT tape drive responds to an **ATTENTION** command (0x00) from a library controller with a General Status Packet. General Status contains several bits that reflect the tape drive's loader status and its ability to accept new commands.

- **OK to Load** is the primary indicator that a data cartridge can be inserted into the tape drive
- **OK to Eject** is the primary indicator that the tape drive has a data cartridge waiting to be ejected.
- **Load Complete** indicates that the media is loaded and the read/write hardware is functional.

However, the tape drive is not ready on the SCSI bus until it completes calibration and read directory operations. Table 29 lists the status bits for Tape Load and Tape Unload.

Table 29 Status Bits for Tape Load and Unload

Tape Load		Tape Unload	
Status	**Value**	**Status**	**Value**
OK to Load	0	OK to Load	0
Cartridge Present	1	Cartridge Present	1
Load Complete	1	Load Complete	0
OK to Eject	0	OK to Eject	1
Hardware Error	0	Hardware Error	0

Tape Load Sample Scenarios

The following examples of exception conditions show typical states of status bits.

A failure to complete the load cycle was simulated by physically restraining the take-up reel during a load cycle. This produced status for a “generic load cycle failure” that illustrates possible statuses during an exception event. All the bytes in the first packet were examined to create a baseline status for this discussion.

Tape Load Baseline Status Packet

Table 30 represents this baseline status packet.

Table 30 ATTENTION Command Received by Tape Drive (Baseline Status Packet Returned)

General Status	Description	
00 **15 1E 23 84 FF 00 40 00**	15	Status Byte 0: Product Type SDLT 320
	1E	Status Byte 1: Drive Servo Firmware Revision
	23	Status Byte 2: Drive Policy Firmware Revision
	84	Status Byte 3: No SCSI ID / No Cartridge / Compression Enabled
	FF	Status Byte 4: SCSI ID (invalid ID reported)
	00	Status Byte 5: Tape Format (no tape)
	40	Status Byte 6: Tape Alert Capable / Tape Motion - Idle
	00	Status Byte 7: Load not complete

Tape Load General Status Packets

The following sample General Status Packets discussion includes only bits and bytes that have changed.

Table 31 Data Cartridge Inserted into Tape Drive

General Status	Description	
00 15 1E 23 **A4** FF **01 47** 00	A4	Status Byte 3: Cartridge Present
	01	Status Byte 5: Tape Format (unknown format)
	47	Status Byte 6: Tape Motion - Loading
Data cartridge was allowed to buckle. Tape drive starts to load tape onto the take-up reel.		

Table 32 Purposely Restrained Take-up Reel To Create Hardware Error

General Status	Description	
00 15 1E 23 **B4** FF 01 47 **10**	B4	Status Byte 3: Hardware Error
	10	Status Byte 7: Extended Status Changed is set (Extended Status records buckle errors)
Take-up reel motion was purposely stopped. Tape drive tries three times to engage the tape, and then posts Hardware Error. Note that bits for OK to Eject, OK to Load, and Load Complete remain 0.		

Table 33 Tape Drive Now Recovered from Hardware Error

General Status	Description	
00 15 1E 23 **A4** FF 01 **40 90**	A4	Status Byte 3: Hardware Error is cleared
	40	Status Byte 6: Tape Motion - Idle
	90	Status Byte 7: Load Complete; Extended Status Changed
Approximately 45 seconds after the initial event, the take-up reel was allowed free motion again so that the tape drive recovered from the Hardware Error. Servo posts Idle status while it verifies its position and other status. Note that Load Complete is set. Extended Status Changed remains set until Extend Status Packet is sent.		

Table 34 Tape Drive Calibrating on Tape

General Status	Description	
00 15 1E 23 A4 FF **10 4B** 90	10	Status Byte 5: Tape Format (110/220 GB on Super DLTtape I)
	4B	Status Byte 6: Tape Motion - Calibrating
Load Complete is defined as “the data cartridge has completed loading.” However, the tape drive is still in the process of coming ready and performs calibration after loading the data cartridge.		

Table 35 Tape Drive Reading Data (Directory Read)

General Status	Description	
00 15 1E 23 A4 FF 10 **43** 90	43	Status Byte 6: Tape Motion - Reading
The tape drive reads the directory after calibration completes.		

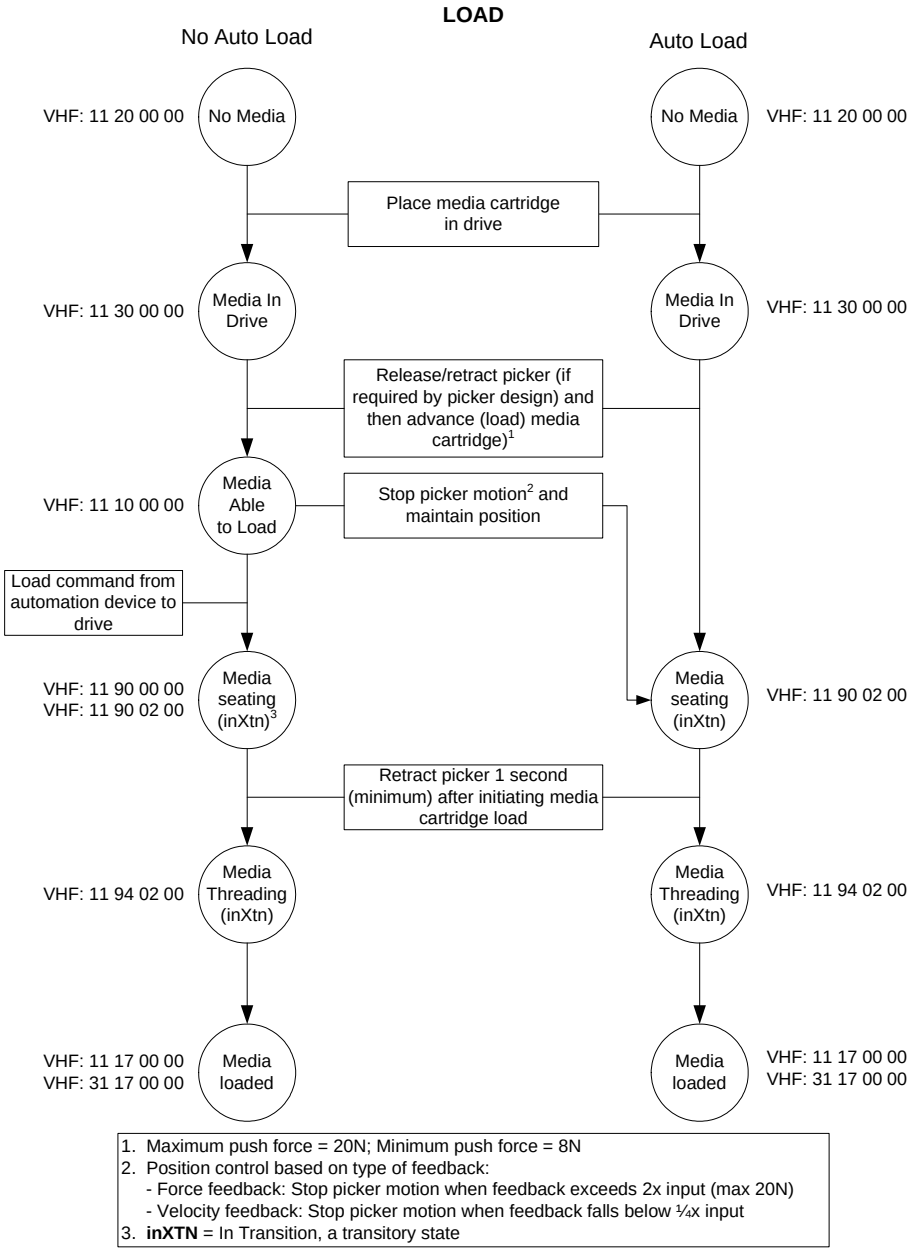
Table 36 Tape Drive Has Recovered from a Load Error and Is Ready

General Status	Description	
00 15 1E 23 A4 FF 10 **40** 90	40	Status Byte 6: Tape Motion - Idle
The tape drive is ready and idle.		

VHF Data During Load

Figure 1 illustrates the VHF data returned and the states of the load sequence.

Figure 1 General Soft Load Sequence in Automation



Tape Unload Sample Scenarios

The following examples of exception conditions show typical states of status bits.

A failure to complete the unload cycle was simulated by physically blocking the buckle during an unload cycle. This produced status for a "generic unload cycle failure" that illustrates possible statuses during an exception event. All the bytes in the first packet were examined to create a baseline status for this discussion.

Tape Unload Baseline Status Packet

Table 37 shows this baseline status packet.

Table 37 ATTENTION Command Received by Tape Drive (Baseline Status Packet Returned)

General Status	Description	
00 **15 1E 23 A6 FF 10 40 90**	15	Status Byte 0: Product Type SDLT
	1E	Status Byte 1: Drive Servo Firmware Revision
	23	Status Byte 2: Drive Policy Firmware Revision
	A6	Status Byte 3: No SCSI ID / No Cartridge / Compression Enabled / Write Protected
	FF	Status Byte 4: SCSI ID (invalid ID reported)
	10	Status Byte 5: Tape Format (SDLTtape I format)
	40	Status Byte 6: TapeAlert Capable / Tape Motion - Idle
	90	Status Byte 7: Load Complete / External Status Changed

Tape Unload General Status Packets

The following sample General Status Packets discussion includes only bits and bytes that have changed.

Table 38 Unload Command Issued to Tape Drive

General Status	Description	
00 15 1E 23 A6 FF 10 **41** 90	41	Status Byte 6: Tape Motion - Rewinding
Tape drive responds to an UNLOAD command by rewinding tape into the data cartridge.		

Table 39 Tape Drive Attempts To Unload Tape to the Buckle Point

General Status	Description	
00 15 1E 23 A6 FF 10 **48** 90	48	Status Byte 6: Tape Motion - Unloading
Tape drive starts to move tape to the buckle point.		

Table 40 Tape Path Is Purposely Blocked To Force a Hardware Error

General Status	Description	
00 15 1E 23 **B6** FF 10 **40** 10	B6	Status Byte 3: Hardware Error
	40	Status Byte 6: Tape Motion - Idle
The tape drive retries move to buckle point three times before giving up.		

Table 41 Servo Tries To Clear the Hardware Error

General Status	Description	
00 15 1E 23 B6 FF 10 **47** 10	47	Status Byte 6: Tape Motion - Loading
After posting Hardware Error, servo tries to clear the error by loading and unloading tape. (There may be more than one Load / Unload cycle during recovery.)		

Table 42 Servo Has Returned to a Determinant State

General Status	Description	
00 15 1E 23 **A6** FF 10 **40** 10	A6	Status Byte 3: Hardware Error is cleared
	40	Status Byte 6: Tape Motion - Idle

Table 43 Tape is Ready To Unload

General Status	Description	
00 15 1E 23 **A7** FF 10 40 10	A7	Status Byte 3: Set OK to Eject
Tape drive has recovered from the error and it is okay to eject the data cartridge.		

Table 44 Eject Command Issued to Tape Drive

General Status	Description	
00 15 1E 23 A7 FF 00 **48** 10	48	Status Byte 6: Tape Motion - Unloading
EJECT command is issued after OK to Eject status was posted. Tape drive attempts to unload again, tape path is now clear.		

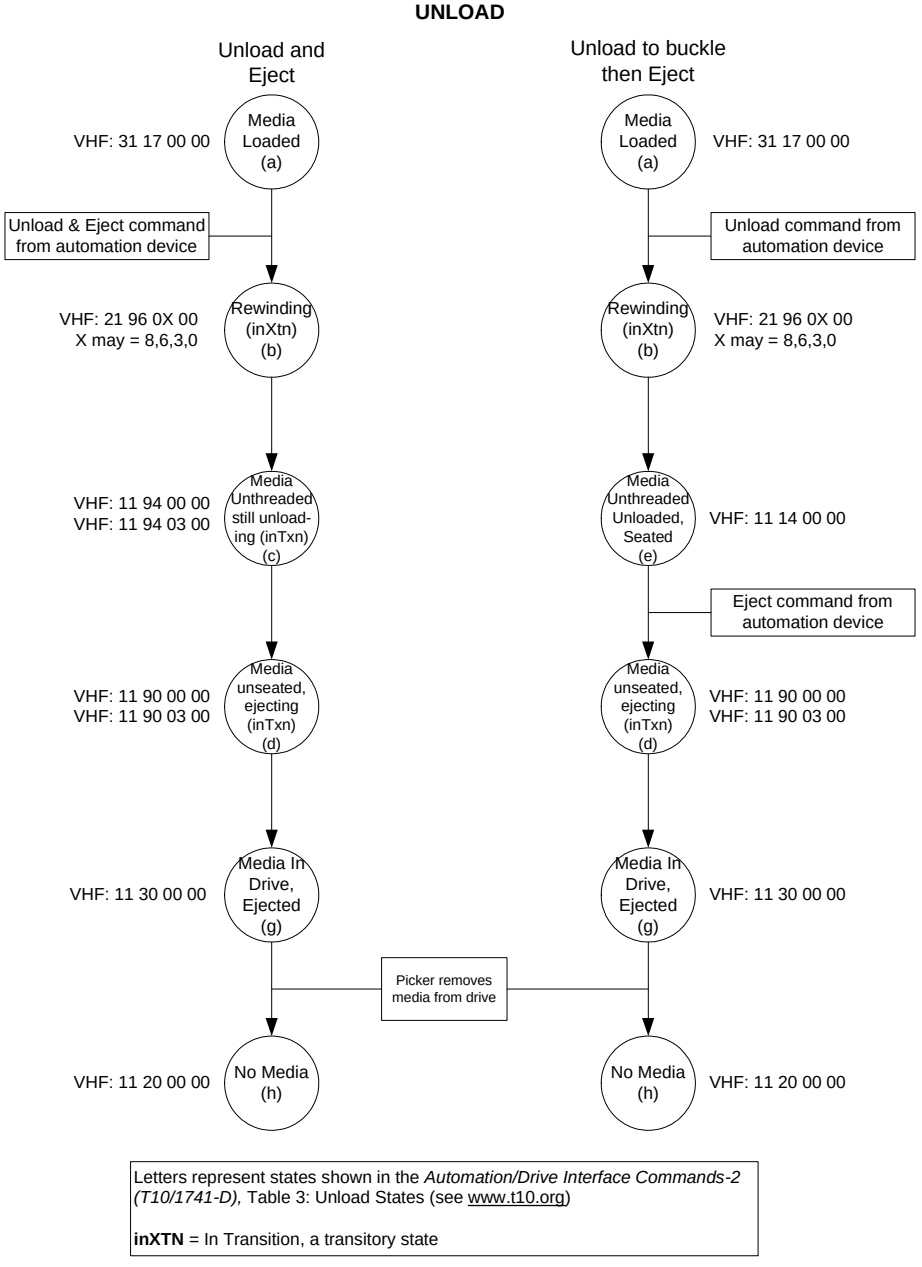
Table 45 Tape Path Was Clear, and Eject Was Successful

General Status	Description	
00 15 1E 23 **84** FF 00 **C0** 10	84	Status Byte 3: Hardware Error is cleared
	C0	Status Byte 6: OK to Load is set

VHF Data During Unload

Figure 2 illustrates VHF data returned and the states of the unload sequence.

Figure 2 General Soft Unload Sequence in Automation



General Notes

Since there is no ACK protocol for single byte commands on the library serial port, it is okay to re-issue a command to the tape drive if status does not change in response to a previous command or if unexpected status occurs. You could implement this strategy in your library error recovery algorithms when serial communications problems are possible, or to check if a tape drive is not responding during recovery from an exception condition. The library port can queue one new command in addition to the command currently being processed.

SDLT tape drives use multiple algorithms to recover from error states. They are capable of attempting heroic recoveries that—in extreme cases—can take more than 20 minutes. However, a tape drive that has not recovered from an exception condition after several seconds should be flagged for manual intervention.

Glossary

A

ACK Acknowledgement (06h). A transmission control character used to indicate that a transmitted message was received uncorrupted or without errors or that the receiving station is ready to accept transmissions. The receiver sends the code to the sender to indicate that the transmission has been accepted.

ADC Automation/Drive Interface Commands.

ASC Additional Sense Code.

ASCQ Additional Sense Code Qualifier.

B

BHC Basic Health Check

BOT Beginning Of Tape. The physical beginning of the media.

D

DLT Digital Linear Tape.

DTD Data Transfer Device.

C

CUP Code Update (a firmware update).

E

EOM End of media.

N

NAK Negative Acknowledgement (15h). A transmission control character used to indicate that a transmitted message was received with errors or corrupted or that the receiving station is not ready to accept transmissions. The receiver sends the code to the sender to indicate that the transmission must be resent.

O

OP Operation.

P

POST Power-On Self-Test — The test the tape drive performs at power-on to confirm it is working correctly.

S

SFP Software File Protect.

V

VHF Very High Frequency.

W

WORM Write Once Read Many. A functionality that enables secure storage of data on a medium.