TL81X/TL894 Automated Tape Library for DLT™ Cartridges

Software Interface Guide

EK-TL810-SG

Revision C01

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FCC STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Any changes or modifications made to this equipment may void the user's authority to operate this equipment.

Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

INDUSTRY CANADA (DIGITAL APPARATUS)
Interference-Causing Equipment Standard
ICES-003 Issue 2

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cer apparcil numerique de la classe A respecte toutes les exigences du Reglement sur le materiel brouilleur du Canada.

CISPR-22 WARNING!

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

ACHTUNG!

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

ATTENTION!

Ceci est un produit de classe A. Dans un environment domestique, ce produit peat causer des interférences radio lectriques. Il appartienl alors a l'utilisateur de prendre les mesures appropriées.

NOTICE FOR USA AND CANADA ONLY

If shipped to USA, use the UL LISTED power cord specified below for 100-120 V operation. If shipped to CANADA, use the CSA CERTIFIED power cord specified below for 100-120V operation.

Plug Cap	Parallel blade with ground pin (NEMA 5-15P Configuration)
Cord	Type: SJT, three 16 or 18 AWG wires
Length	Maximum 15 feet
Rating	Minimum 10 A, 125 V

ATTENTION

LIRE LA REMARQUE DANS LE MODE D'EMPLOI

REMARQUE

CETTE REMARQUE NE CONCERNE QUE LES ÉTATS-UNIS ET LE CANADA.

En cas d'envoi aux États-Unis, utiliser le cordon d'alimentation certifié UL et convenant pour 100-120 V.

En cas d'envoi au CANADA, utiliser le cordon d'alimentation CERTIFIÉ CSA et convenant pour 100-120 V.

Fiche	Broches paralléus avec une broche de mise à la terre (configuration NEMA 5-15P)
Cordon	Type: SJT, trifilaire 16 ou 18 AWG
Longeur	Maximum 15 pieds
Capacité	Minimum 10 A, 125 V

ZU IHRER SICHERHEIT

Vorsicht

Um Feuergefahr und die Gefahr eines elektrischen Schlages zu vermeiden. darf das Gerät weder Regen noch Feuchtigkeit ausgesetzt werden.

Um einen elektrischen Schlag zu vormeiden, darf das Gehäuse nicht geöffnet werden. Überlassen Sie Wartungsarbeiten stets nur einem Fachmann.

Achtung

Da der interne Laserstrahl in lhre Augen eindringen und Verletzungen verursachen kann, darf das Gehäuse nicht selbst geöffnet werden. Überlassen Sie Wartungearbeiten stets nur einem Fachmann.

Die Verwendung von Brillen, Kontaktlinsen usw.vergrössert die Gefahr.

Zur besonderen Beachtung

Zur Sicherheit

Sollte ein fester Gegenstand oder Flüssigkeit in das Geräteinnere gelangen, trennen Sie das Gerät von der Wandsteckdose ab und lassen Sie es von einem Fachmann überprufen, bevor Sie es weiter verwenden.

Zum Abziehen des Kabels fassen Sie stets am Stecker und niemals am Kabel selbst an.

Zur Aufstellung

Stellen Sie das Gerät weder auf einer weichen Unterlage (z. B. Decke, Teppich) noch in der Nahe von Vorhangen, Tapeten usw, auf, da hierdurch die Ventilationsöffnungen blockiert werden können.

Zur Reinigung

Verwenden Sie zur Reinigung des Gehäuses, des Bedienungspultes und der Bedienungselemente ein trockenes, weiches Tuch oder ein weiches, leicht mit mildem Haushaltsreiniger angefeuchtetes Tuch. Lösemittel wie Alkohol oder Benzin dürfen nicht verwendet werden, da diese die Gehäuseoberfläche ungreifen.

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Introduction 1

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Purpose

This guide was written for software engineers developing application software for the TL810, TL812, or TL894 automated tape libraries. The term TL81X/TL894 refers to all three models of libraries. This manual describes the Small Computer Systems Interface (SCSI-2), discusses performance issues and error handling, and is divided into the following sections:

- Section 1, “Introduction”, describes the purpose of this manual, provides a list of its contents and a list of related documentation.
- Section 2, “Theory of Operation”, contains detailed discussions of the Medium Changer Elements, Events, Operational Sequences, Configuration and Error Recovery Procedures as well as System Performance and Diagnostic Support issues.
- Section 3, “Software Interfaces”, describes the specific terminology of the Small Computer Systems Interface (SCSI-2).

Conventions Used in this Guide

The following conventions are used in this guide:

All binary numbers are succeeded by “**b**”.

All hexadecimal numbers are succeeded by “**h**”.

Error or attention conditions are represented in parenthesis that translate as follows:

(SK=S ASC=AA ASCQ=QQ)

where:

S= hexadecimal sense key value
AA= hexadecimal additional sense code
QQ= hexadecimal additional sense code qualifier

A definition of these values are located in Appendix A.

Related Documentation

Table 1 is a list of all manuals associated with the TL81X/TL894 automated tape libraries. To obtain further information and/or copies of documentation on this product, contact:

U.S. Software Supply Business
Digital Equipment Corporation
10 Cotton Road
Nashua, New Hampshire 03063-1260

The part number of each document will be required at the time of order.

Table 1: Related Documentation

Document Number	Document Title	Document Description
EK-TL810-IG	TL81X/TL894 Facilities Planning and Installation Guide	This guide describes facility preparation and provides the procedures for first-time installation of the library.
EK-TL810-OG	TL81X/TL894 Operator's Guide	This guide describes the operator accessible components of the library and provides both operating and troubleshooting procedures.
EK-TL810-SV	TL81X/TL894 Field Service Manual	This manual provides fault isolation, removal and replacement, and periodic maintenance procedures.
EK-TL810-UM	TL81X/TL894 Diagnostic Software User's Manual	This manual provides procedures for installing and using the TL81X/TL894 Diagnostic Software.
EK-OTZ87-OM	TZ87 Series Cartridge Tape Subsystem Owner's Manual	This document describes the TZ87 Tape Drive and provides operating instructions and troubleshooting procedures.
EK-TZ88X-OM	TZ88 Series Cartridge Tape Subsystem Owner's Manual	This document describes the TZ88 Tape Drive and provides operating instructions and troubleshooting procedures.
EK-TZ89N-UG	TZ89 DLT™ Series Tape Drive User's Manual	This document describes the TZ89 Tape Drive and provides operating instructions and troubleshooting procedures.

On-Line Documentation

On-line documentation for the TL81X/TL894 libraries is available from the Digital Equipment Corporation, Shrewsbury MA world wide web site, in portable document format (.pdf) at:

http://www.shr.dec.com

SCSI-2 Specification

This Small Computer System Interface-2 (SCSI-2)communications specification is the proposed American National Standard for information systems, dated March 9, 1990. Copies may be obtained from:

Global Engineering Documents
2805 McGaw
Irvine, California 92714
(800) 854-7179 or (714) 261-1455

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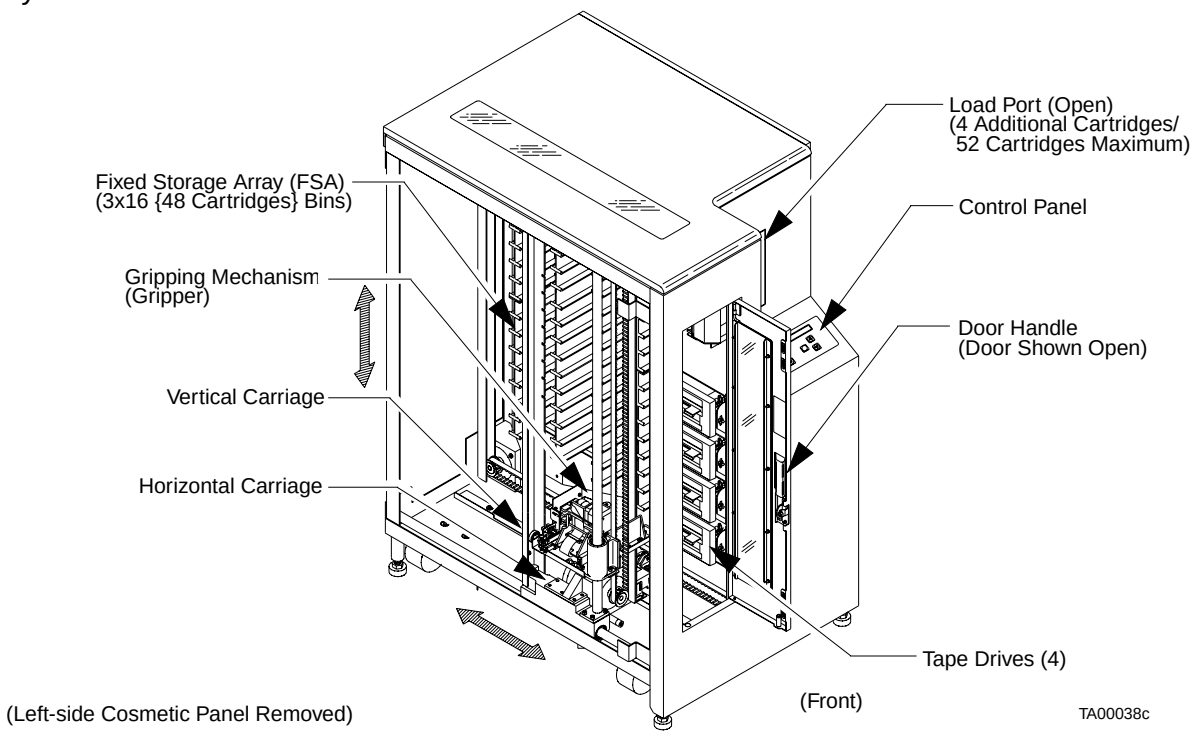
Chapter Overview

This chapter contains detailed discussions of the Medium Changer Elements, Events, Operational Sequences, Configuration and Error Recovery Procedures as well as System Performance and Diagnostic Support issues.

Library Description

Your TL810, TL812, or TL894 library (Figure 1) is the automated storage and retrieval component of an automated tape library system. The TL810 contains four TZ87 tape drives, the TL812 contains four TZ88 tape drives, and the TL894 contains four TZ89 tape drives; otherwise, the three models are exactly the same. All store a maximum of 48 Digital Linear Tape (DLT™) cartridges in a Fixed Storage Array (FSA). An operator-accessible load port at the front of the library can hold an additional four tape cartridges for a total of 52. A host computer communicates with the library through a SCSI interface using the SCSI-2 medium changer command set.

Figure 1: TL81X/TL894 Library



In a typical operation, the host commands the robotics to transfer DLT™ cartridges between storage bins (in the FSA), one of the four (TZ87, TZ88, or TZ89) tape drives or the Load Port. Each time a DLT™ cartridge is transferred, a gripping mechanism is moved to the storage location where it “picks” the tape, then moves to and “places” it in the new location.

The library has fully functional media changer capability as defined by the SCSI-2 specification. The library robotics control is directed by the host computer. The SCSI-2 interface enables the robotics to be driven by the same SCSI bus as the tape drives.

The TL81X / TL894 has a minimal connection to the installed tape drives. The library knows the number of drives installed and the SCSI addresses for each tape drive. The library does not know if the drives are on the same SCSI bus. This information is only relevant to the host computer.

Table 2 describes the different library configurations.

Table 2: Library Models

Library Model #	Number of Drives	DLT™ Drive Type	DLT™ Cartridge Capacity
TL810	4	TZ87	52
TL812	4	TZ88	52
TL894	4	TZ89	52

Table 3 describes the DLT™ tape drive specifications.

Table 3: Tape Drive Specifications

Model Number	Native Mode		With 2:1 Compression	
	Transfer Rate	Capacity	Transfer Rate	Capacity
TZ87	1.25 Mbytes / s	10 Gbytes	2.5 Mbytes / s	20 Gbytes
TZ88	1.5 Mbytes / s	20 Gbytes	3.0 Mbytes / s	40 Gbytes
TZ89	5 Mbytes / s	35 Gbytes	10 Mbytes / s	70 Gbytes

SCSI Implementation Philosophy

Using the SCSI-2 standard, the tape library has been designed so that the host can adapt to changes in the tape library configuration. Changes in the number of tape drives can be detected by the host.

The tape library uses the SCSI-2 medium-changer command set. No attempt is made to add complex commands to the tape library command set. The tape library command set is complete and includes all primitive (elemental) commands required by a host to carry out any required complex operations.

Even though the tape library relies on the host computer to issue a sequence of elemental commands in the correct order to complete complex operations, it has been designed to be forgiving of system integration errors. The tape library monitors the status of all mechanisms and does not execute operations that could result in damage to the library or an installed tape drive.

Medium Changer Elements

The Medium Changer Command Set accesses the address space for the set of physical locations and mechanisms within the library unit. The SCSI-2 term “element” is used throughout this document to refer to one member of the tape library address space. Each “element” is a discrete physical entity that can hold a DLT™ cartridge.

Each element within a library is represented by a unique 16 bit element address. Each library consists of the following medium changer elements:

- Medium Transport Element
- Storage Elements
- Data Transfer Elements
- Import / Export Elements

The Mode Sense Command can be issued to determine each library’s configuration. The first address and number of elements for each type (medium transport, storage, import / export or data transfer) can also be determined using this command.

Medium Transport Element

The library has a transport mechanism. This mechanism consists of the horizontal, vertical and extension axes and a gripper.

The transport mechanism can hold a single cartridge using the gripper and is considered one medium transport element. The transport mechanism is used to move media between elements within the library unit.

Storage Elements

Each library unit contains up to 48 storage elements, which correspond to the bins in the FSA. One storage element exists per bin.

Import/Export (Load Port) Elements

The import / export mechanism consists of a four-bin, rotating Load Port. Each of the four bins in the Load Port has a unique element address.

When the door is open the elements still exist, but are not “accessible” to the Medium Transport.

Data Transfer Elements

A data transfer element is associated with every tape drive installed in a library unit since each tape drive can store a single tape cartridge. The medium transport mechanism is able to load or unload tape cartridges into or from each tape drive.

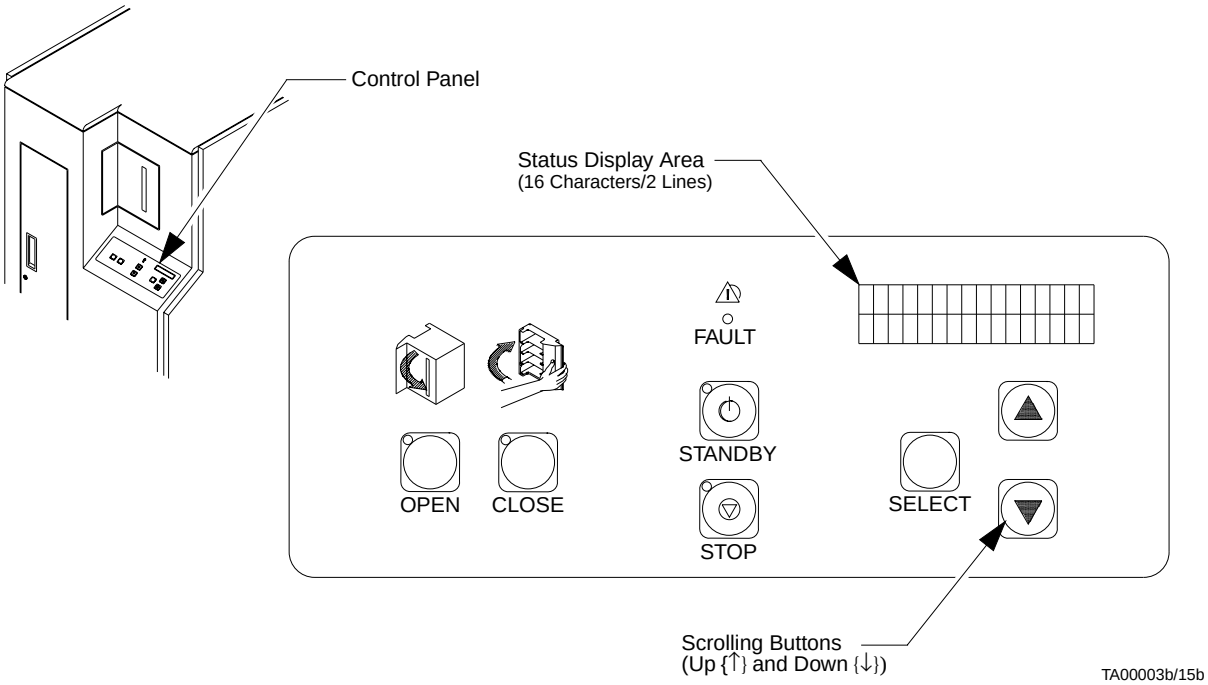
Events

Events are system conditions created by failures or operator actions such as opening the door or pressing the STOP switch.

Some of these events appear as states on the control panel. For a list of event states, see Appendix B. (The control panel does not queue these states.)

Events are recorded in sense data. Depending on the interface, the host can obtain the sense data either in response to a Request Sense Command or as an Unsolicited Message.

Figure 2: Control Panel



The library does not support asynchronous event notification. This simplifies the host/library interface and is acceptable since the events happen infrequently and do not require an immediate host response. The SCSI host can check for library events by issuing the Request Sense command to the library. The event sense data is transmitted in response to a Request Sense command. The library queues event conditions for the library. The host can repeatedly issue the Request Sense command to obtain each queued condition.

The most significant events are described in the sections that follow.

Power Cycle

When the library is powered on it generates a “Power On / Reset Occurred” event (SK=6 ASC=29 ASCQ=00).

Library Unit Offline/Standby

When a library is placed into the offline / standby state, it generates a “Logical Unit Standby Button Was Pressed” event (SK=6 ASC=80 ASCQ=09).

Library Unit Online Initialization Failure

When a library is placed into the online state and the online initialization fails, the library generates an event for the specific error condition that caused the failure. The control panel indicates which state of the initialization failed (see Appendix B for more information).

Library Unit Door Opened

When the front door of a library is opened, the library disables all actuators and generates a “Door Was Opened” event (SK=6 ASC=80 ASCQ=00).

Library Unit Stopped

When the library is stopped by pressing the STOP switch on the control panel, the library disables all actuators and generates a “System Stop Button Was Pressed” event (SK=6 ASC=80 ASCQ=07).

Accessed Load Port

When the Load Port door is closed, the library generates an “Import or Export Element Accessed” event (SK=6 ASC=28 ASCQ=01).

Maximum Temperature Exceeded

The library monitors the ambient temperature within the system. If the temperature exceeds 91.4^{O}F, there is a possibility for potential damage to the medium, the library generates a “Warning Safe Temperature Exceeded” event (SK=6 ASC=88 ASCQ=00) and continues operations. If the temperature exceeds 96.8^{O}F, the library disables all actuators until the temperature decreases and generates a “Maximum Temperature Exceeded” event (SK=4 ASC=88 ASCQ=01).

Operational Sequences

A description of operational sequences follow. They are listed in order of precedence. For example, if the door is opened and the STOP switch was pressed, the door open sequence will override the system stop sequence until it is complete.

Power-On Sequence

The following actions occur when the library is powered-on:

- The local controller for the library resets and initializes all hardware.
- The control panel is blank.
- During this time, the library responds to the Inquiry, Request Sense, Log Sense, and Mode Sense commands. Check Condition is set for all other commands and the “Logical Unit is Not Ready” condition (SK=2 ASC=04 ASCQ=00) is set in the sense data.
- When the power-on initialization is complete, the library generates a “Power On / Reset Occurred” event (SK=6 ASC=29 ASCQ=00).
- The library sets the tape drive SCSI IDs and then resets the tape drives

The system then moves into one of the following sequences depending on the condition of the system.

Door Opened Sequence

Before entering the library, take the unit offline. After the offline sequence is complete, it is recommended that you press the STOP switch before opening the doors. When the door is opened, the library is no longer operational (as viewed by the host). The following actions occur when the door is opened:

- The control panel indicates that the door is opened.
- The library generates a “Door Was Opened” event (SK=6 ASC=80 ASCQ=00).
- If the door is opened without performing the offline sequence, the system halts all library motion. Any motion command currently in progress is aborted and Check Condition is returned to the host. The “Door is Opened” condition (SK=2 ASC=80 ASCQ=00) is set in the sense data.

- While the door is opened, the library responds to the Inquiry, Request Sense, Log Sense, and Mode Sense commands. Check Condition is set for all other commands issued during this time and the “Door is Opened” condition (SK=2 ASC=80 ASCQ=00) is set in the sense data.

System Stopped Sequence

The STOP switch allows the operator to stop all power to the actuators. The following actions occur when the system is stopped:

- The control panel indicates that the system is stopped.
- The library generates a “System Stop Button Was Pressed” event (SK=6 ASC=80 ASCQ=07).
- The system halts all library motion. Any motion command currently in progress is aborted and Check Condition status is returned to host. The “System is Stopped” condition (SK=2 ASC=80 ASCQ=07) is set in the sense data.
- While the system is stopped, the library responds to the Inquiry, Request Sense, Log Sense, and Mode Sense commands. Check Condition status is set for all other commands issued during this time, and the “System is Stopped” condition (SK=2 ASC=80 ASCQ=07) is set in the sense data.

Online Initialization Sequence

The STANDBY switch allows the library to be placed online. The online initialization sequence occurs only after the door is shut, the system is not stopped and the library does not have the standby button pressed. The following actions occur during the online initialization sequence:

- The control panel indicates that the library is performing the online initialization sequence.
- The local controller for the library performs a test to check the operation of the library unit mechanisms.
- The mechanisms are then homed.
- During this time, the library responds to the Inquiry, Request Sense, Log Sense, and Mode Sense commands. Check Condition status is set for all other commands, and the “Logical Unit in Process of Becoming Ready” condition (SK=2 ASC=04 ASCQ=01) is set in the sense data.

- When the mechanisms are successfully tested and homed, the library performs an inventory of its elements. (See Library Unit Inventory Sequence).
- When initialization successfully completes, the control panel changes to “System Online” and the library is fully operational.

Load Port Opened Sequence

The OPEN button allows the operator to open the load port door. If the load port door is closed and media removal is not prevented (see Prevent / Allow Media Removal Command), then the following actions occur when the OPEN button is released:

- The local controller for the library will complete any currently active processing command. The OPEN LED will flash during this time.
- If the robotic mechanisms are in the area of the load port, then the library will move them to a position which is safe from interference with the load port. The OPEN LED will remain flashing during this time.
- When any processing command is complete and the robotic mechanisms are clear from the load port, the load port door will unlock. The door will rotate automatically into the open position. The OPEN LED will be solid while the door is opening.
- When the door is locked into the open position, the OPEN LED will go off.

The load port door will remain open until the CLOSE button is pressed (See the Load Port Closed Sequence).

Load Port Closed Sequence

The CLOSE button allows the operator to close the load port door. If the load port door is opened, then the following actions occur when the CLOSE button is released.

- The local controller for the library will complete any currently active processing command. The CLOSE LED will flash during this time.
- If the robotic mechanisms are in the area of the load port, then the library will move them to a position which is safe from interference with the load port. The CLOSE LED will remain flashing during this time.

- When any processing command is complete and the robotic mechanisms are clear from the load port, the load port door will unlock. The door must be rotated closed by the operator. The CLOSE LED will be solid until the door is closed (or the close is timed out by the library).
- When the door is locked into the closed position the CLOSE LED will go off and the library generates and "Accessed Load Port" event (SL=6 ASC=28 ASCQ=01).
- If the system is online when the door is closed, then the library will automatically inventory the contents of the load port.

The load port door will remain closed until the OPEN button is pressed. (See the Open Load Port Sequence).

Library Unit Inventory Sequence

The library inventories its storage elements after power-up (if online), upon receipt of an Initialize Element Status Command or after the door is closed and the library is placed online.

- The local controller for the library checks the state of the medium transport element (gripper). The inventory cannot be performed if there is a cartridge in the medium transport element. In this case, if the inventory is host commanded, then Check Condition is set, and the "Transfer Full" condition (SK=5 ASC=80 ASCQ=01) is set in the sense data. Otherwise, the library generates a "Transfer Full" (SK=5 ASC=80 ASCQ=01) online initialization failure event.
- If a tape drive handle is not closed, the gripper is extended to sense the presence of a cartridge with the Cartridge-in-Gripper (CIG) Sensor. If a cartridge is found, the gripper is used to push the cartridge into the tape drive and the handle is closed. If no cartridge is found, the tape drive handle is closed.
- If this is the first inventory since power-on, an inventory was commanded using Initialize Element Status or an inventory was initiated by opening and closing the front door, each element of the FSA will be inventoried. Otherwise if an inventory was previously commanded, only those elements who's status is unknown will be inventoried.
- First, the FSA is scanned for barcodes. If the library determines that a bin contains an invalid barcode (or no barcode), it uses the gripper to sense whether or not there is a cartridge present.
- After the FSA is scanned, Load Port bins are scanned in the same manner.

- An inventory is attempted for each tape drive present. If the interface reports that a cartridge is present, the controller scans for a valid barcode.
- The inventory time varies depending on the number of cartridges with valid barcodes. A fully populated FSA with valid barcodes takes much less time than a partially populated FSA.
- Results of the inventory are returned with the Read Element Status Command.

Offline Sequence

The STANDBY switch allows the library to be taken offline. The offline sequence can only occur when the door is shut, the system is not stopped and the standby button is pressed. When a library is placed offline, the following sequence is performed:

- The local controller for the library completes any currently processing command. The standby LED will flash during this time.
- When all commands are complete, the control panel changes to “System Offline” and the standby LED will become solid to indicate that the unit is offline.
- The library generates a “Unit Standby Button Was Pressed” event (SK=6 ASC=80 ASCQ=09).
- When the library is offline, it responds to the Inquiry, Request Sense, Log Sense, and Mode Sense commands. Check Condition is set for all other commands issued during this time, and the “Unit Is Turned Offline” (SK=2 ASC=80 ASCQ=09) condition is set in the sense data.
- Field Service Engineer (FSE) level diagnostic commands can be executed via the diagnostic port or control panel.

The library remains offline until one of the other operational sequences occur.

Automatic Drive Cleaning Sequence

The default state of automatic drive cleaning is “disabled.” For a detailed discussion of the automatic drive cleaning features, see Appendix C.

Configuration Procedures

The library can be configured using either the EIA / TIA-574 (DIAG) interface (refer to Document EK-TL810-UM, *TL81X/TL894 Diagnostic Software User's Manual*) or through the Control Panel Menu Mode (refer to Document EK-TL810-OG, *TL81X/TL894 Operator's Guide*).

"DIAG" Interface

The following configuration functions are available using the Diagnostic Software Program via the "DIAG" Port:

- Horizontal, vertical and extension positions of the data transfer elements of the: FSA, Load Port and Tape Drives.
- Set SCSI Address of the: Library and Tape Drives.
- Set Power-Up State (Online / Offline).
- Enable / Disable the Auto Clean Option.
- Enable / Disable the Auto Load Option.
- Select the language to be displayed in the Status Display Area (English / Francais / Deutsch / Espanol / Italiano).
- SCSI Address of the: Library and Tape Drives.
- Initialize Inventory.
- Initialize Non-Volatile RAM.
- Enable / Disable Recovery.
- Report Recovery Status.
- Enable / Disable the Tape Drive Cleaning Feature.
- Initialize Auto-Cleaning Default Values.
- Report the Tape Drive Cleaning Status.
- Download Firmware Revisions.

Control Panel Menu Mode

The following configuration functions are available using the Control Panel Menu Mode:

- Horizontal, vertical and extension positions of the data transfer elements of the: FSA, Load Port and Tape Drives.
- Set SCSI Address of the: Library and Tape Drives.
- Set Power-Up State (Online / Offline).
- Enable / Disable the Auto Clean Option.
- Enable / Disable Recovery.
- Enable / Disable the Auto Load Option.
- Select the language to be displayed in the Status Display Area (English / Francais / Deutsch / Espanol / Italiano).
- Operate System Test.
- Enable / Disable temperature Sensor.

Error Recovery Procedures

Internal Error Recovery

If a failure occurs during a movement command, the software attempts to recover. The following are types of retries and recovery efforts:

- If an actuator is not in a valid starting position at the start of any movement command, the software attempts to home the actuator before starting the command. If the home is successful, the command is continued. (SK=B ASC=81 ASCQ=10, SK=B ASC=83 ASCQ=10, SK=B ASC=84 ASCQ=10, SK=B ASC=86 ASCQ=10)
- If an actuator movement fails because of a current feedback, actuator timeout or mechanical position error, the actuator move is retried. If the retry is successful, the command is continued. (SK=B ASC=81 ASCQ=00-05, SK=B ASC=83 ASCQ=01-03, SK=B ASC=84 ASCQ=01, SK=B ASC=84 ASCQ=03, SK=B ASC=86 ASCQ=01, SK=B ASC=86 ASCQ=03, SK=B ASC=86 ASCQ=07)
- If a drive does not eject a cartridge far enough for it to be fully gripped, the software will make several attempts to pull the cartridge out of the drive. It closes the gripper on the cartridge, pulls it out slightly and then attempts again to pull it out of the drive. (SK=B ASC=81 ASCQ=51)
- If the pick portion of a move command fails and the cartridge appears to be in the gripper, the command is continued and the place completed if possible. If the place fails as well, only the original pick error code is returned.
- If a place into a drive fails because of an extension axis current feedback error, the extension axis is retracted and the “place” is attempted one additional time before the error is reported. (SK=B ASC=83 ASCQ=02)

Operator Recovery

Refer to Document EK-TL810-OG, *TL81X/TL894 Operator’s Guide*, for suggested operator recovery procedures.

System Performance

Key Performance Items

The actuator move times are the key performance items. The internal software attempts to maximize the library's performance by allowing multiple actuators to move simultaneously. For example, the vertical and horizontal axes are moved to the appropriate position at the same time when moving toward a storage element, i.e., diagonally. Also, the extension and gripper actuators are moved to a ready position after the completion of a move, to prepare for the next move.

The host can increase performance by minimizing the distance of the actuator moves. It can do this by using the time when the tape drives are busy (or when no commands are being issued) to sort the storage elements to better suit the application.

Typical Application Enhancements

The host should check for any attention or error conditions that the tape library may have buffered by issuing Request Sense Commands until no conditions exist.

The SCSI interface allows the host to enable the "disconnect from bus" option. This allows the target to disconnect from the bus while processing a command from the host application and reconnect when the command is complete. Disconnecting allows access to the drives or other logical units while the command is being performed.

The internal software does not support command queueing. It is up to the host application to queue commands to the unit. It may also be advantageous for the application to group queued commands to require the least amount of actuator motion.

The Position To Element command allows the application to move the robotics to a more advantageous position while the tape drives are busy. For example, if a cartridge is about to be ejected from the drive, the robotics can be positioned in front of a drive to pick up the cartridge when ejected. (The host should verify that a tape is present before attempting a "pick" operation. If the tape drive is not unloaded, the error "MEDIUM NOT PRESENT {SK=5 ASC=3A ASCQ=00} is returned and the host should attempt to retry.)

System Diagnostic Support

The library unit has a layered self diagnostic capability. Each layer addresses a specific type of diagnostic need. The layers provide a basic go / no-go capability as-well-as complete fault isolation capability.

Host Interface Diagnostic Error Codes

This lowest layer consists of the tests that are performed when the library unit is placed online. These tests are designed to catch all major system failures and give the host computer a high degree of confidence that the library is operational. This layer has been kept as simple as possible to minimize the amount of support software required at the host.

The next layer allows isolation of faults that occur during operation. Error definitions and recovery procedures, provided in Appendix A, are designed to be descriptive enough to quickly test failed operations and correct any conditions that would have resulted in an unnecessary service call.

Offline Diagnostics via the “DIAG” Port

The top level of diagnostic commands are available through the use of the Diagnostic Software Program (DSP) interfacing to the library over the “DIAG” Port on the rear of the library. The commands are designed for use by an authorized Field Service Engineer and are intended for use with the fault isolation procedures described in Document EK-TL810-SV, *TL81X/TL894 Field Service Manual*. Use of the DSP is described in Document EK-TL810-UM, *TL81X/TL894 Diagnostic Software User’s Manual*.

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Chapter Overview

This chapter describes the specific terminology of the Small Computer Systems Interface-2 (SCSI-2) in relation to the TL81X / TL894 libraries.

SCSI Interface

Note ***SCSI -2 terminology is listed below with it's TL81X/TL894 equivalent:***

- ***Logical Unit is the Library.***
- ***Initiator is the Host Computer.***
- ***Data Transfer Element is the Tape Drive.***
- ***Medium Transport Element is the Gripper Mechanism.***
- ***Storage Element is a Bin in the Fixed Storage Array.***
- ***Import Export Element is a Bin in the Load Port.***

The TL81X / TL894 libraries are SCSI-2 medium change devices. The host computer serves as the SCSI initiator and issues commands to the library and tape drives which act as SCSI targets.

The TL81X / TL894 provides only SCSI target support. It does not perform any of the initiator functions. The library has its own SCSI address separate from any other SCSI devices including the tape drives.

The library does not support SCSI queuing or linked commands. All element addresses must be specified absolutely, no relative addressing is permitted.

The amount of data transferred between the host and the library is minimal. For this reason, the library does not support either synchronous or wide data transfers.

The library is intended for use with SCSI-2 initiators. It cannot be used with a SCSI-I initiator.

The library does not support the Change Definition Command, Asynchronous Event Notification or extended contingent allegiance.

Note ***The message and command sections of this chapter assume that you have significant knowledge of the SCSI Specification.***

Reset Sequence

The TL81X / TL894 libraries support the SCSI-2 soft reset option. When a SCSI bus reset occurs, the library clears the SCSI bus as described in the SCSI-2 Standard.

Supported Messages

This section describes the required messages and supported optional messages and their use in coordinating the host and library. The messages that the host (a SCSI initiator) can send to the library (a SCSI target) are described along with the library response when the message is received. The messages sent by the library to the host are described along with why they are sent.

These descriptions are not meant as a supplement to the information provided in the SCSI-2 standard. These descriptions are intended to document how these messages have been adapted for use with the library.

The library supports all messages indicated as mandatory for target support by the SCSI-2 specification. The mandatory messages are:

- Abort
- Bus Device Reset
- Command Complete
- Identify (initiator to target)
- Initiator Detected Error
- Message Parity Error
- Message Reject
- No Operation

The library also supports several messages indicated as optional for SCSI targets by the SCSI-2 specification. Most of the library operations are slow in relation to the other operations being controlled using the SCSI bus. By using these optional messages, the library can make the bus available for other operations while completing a library operation. These messages are:

- Disconnect (Direction is from target to initiator)
- Identify
- Save Data Pointer

Abort

The Abort message allows the host to clear the present operation on the library. Abort can be used as follows with the library:

- The initiator of an operation can abort that process by sending this message to the library. This stops the operation of the library at its next “safe” position. Since only one operation is supported per library at a time, this message effectively stops all processing.
- If any other initiators send this message, the library accepts the message but does not abort any of the operations.

Bus Device Reset

The Bus Device Reset message from a host to the library causes the library to clear all I/O processes. The Unit Attention condition is set to indicate that the device has been reset.

Command Complete

The library sends this message to the host after the library has completed the command operation and sent valid status information to the host. This message does not indicate that the operation was completed successfully. Successful completion must be determined by examining the status information. After sending this message, the library is ready to accept another command.

Disconnect (from Target to Initiator)

The Identify message from the host indicates whether or not the library can disconnect during the execution of an operation. Whenever the library receives a command which cannot be immediately completed and a disconnect has been allowed, then the library disconnects from the host while performing the operation. This frees the SCSI bus for other uses while the operation is in progress.

The library disconnects from the host by sending the host the Save Data Pointer message (if necessary) just before the Disconnect message.

Given the nature of the host and library interface it is not expected that a data pointer will be used by the host. Only data transfers which are broken into multiple connections will end each successful connection with a Save Data Pointer and Disconnect message sequence. This conforms to SCSI-2 standard section 5.6.6.

The SCSI-2 standard also allows an optional host-to-target disconnect message. The library does not support this option and responds with a Message Reject if a Disconnect message is received.

Identify (Initiator to Target)

The host sends this message to the library to identify the library to which the command is being sent. This message also indicates whether the library may disconnect during the command.

The Identify message from the host overrides the unit number in the command descriptor block. If the library receives an Identify message from the host, the library ignores the unit number in the command descriptor block. If an Identify message is not received, the library uses the unit number in the command descriptor block. The library **does not** disconnect during an operation under these circumstances.

Identify (Target to Initiator)

When the library uses the Disconnect message to disconnect from the host, the library sends an Identify message to the host after completing the operation and reselecting the host. The library number in this Identify message is the same as the library number in the Identify message the host sent to the library at the start of the operation.

The library does not support any target routines.

The host does an implied Resume Pointers when the Identify message is received from the library.

Save Data Pointer

The library sends this message to the host, when data transfers are broken into multiple connections, before disconnection using the Disconnect message.

Supported Operational Commands

The library supports all commands that the SCSI-2 Specification indicates are required by all devices:

- Inquiry (12h)
- Request Sense (03h)
- Send Disagnostic (1Dh)
- Test Unit Ready (00h)

The library also supports all of the commands which the SCSI-2 Specification indicates are required by media change devices:

- Move Medium (A5h)

In addition, the library supports the following optional commands:

- Initialize Element Status (07h)
- Log Sense (4Dh)
- Mode Select (15h)
- Mode Sense (1Ah)
- Position to Element (2Bh)
- Read Element Status (B8h)
- Request Volume Element Address (B5h)
- Rezero Unit (01h)
- Prevent / Allow Medium Removal (1Eh)
- Release (17h)
- Reserve (16h)
- Send Volume Tag (B6h)

The library supports the following vendor specific commands:

- Initialize Element Status with Range(E7h)
- Ready Import (DEh)

Note ***This section describes the commands, command format and data format. For the most part, these formats are taken directly from the SCSI-2 Specification. Only the fields and values supported by the TL81X/TL894 are described in this guide. The commands, their operation code and type are shown in Table 4.***

Table 4: Supported Operational Commands

Command Name	Operation Code	Type
Initialize Element Status	07h	Optional
Initialize Element Status with Range	E7h	Vendor
Inquiry	12h	Mandatory
Log Sense	4Dh	Optional
Mode Select	15h	Optional
Mode Sense	1Ah	Optional
Move Medium	A5h	Mandatory
Position to Element	2Bh	Optional
Prevent/Allow Medium Removal	1Eh	Optional
Read Element Status	B8h	Optional
Ready Inport	DEh	Vendor
Release	17h	Optional
Request Sense	03h	Mandatory
Request Volume Element Address	B5h	Optional
Reserve	16h	Optional
Rezero Unit	01h	Optional
Send Diagnostic	1Dh	Mandatory
Send Volume Tag	B6h	Optional
Test Unit Ready	00h	Mandatory

Initialize Element Status (07h)

The Initialize Element Status Command allows the host to request an inventory of the tape cartridges held in a library. The library conducts an inventory and determines whether each element contains a tape cartridge. The inventory will read the bar code of each tape (unless commanded not to). If no bar code is read, the library will use sensors to determine whether each element contains a tape.

Inventory information is returned to the host only if requested using the Read Element Status command.

The library does not accept any other commands from the host during the inventory process.

The host can issue an Abort of the inventory for the library. If another Initialize Element Status command is then issued, the inventory process is restarted from the beginning.

If the gripper contains a tape cartridge, the inventory procedure cannot be conducted. In this case a Transfer Full error (SK=5 ASC=80 ASCQ=01) is returned. The cartridge should be moved to an available bin, and the command retried.

The format for this command data block is shown in Table 5.

Table 5: Initialize Element Status Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (07h)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (00h)							
3	Reserved (00h)							
4	Reserved (00h)							
5	NBL	Reserved (00h)						

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

NBL A No Bar-code Labels field of 1 specifies the inventory to not scan the bar codes of the elements and set the corresponding primary volume tags to empty. A value of 0 specifies element bar code labels are to be scanned and placed in the primary volume tags.

Initialize Element Status with Range (E7h)

The Initialize Element Status with Range Command allows the host to request an inventory of a specified range of elements in the library. The library conducts the inventory and determines whether each element within the specified range contains a tape cartridge. The inventory will read the bar code of each tape (unless commanded not to). If no bar code is read, the library will use sensors to determine whether each element contains a tape.

Inventory information is returned to the host only if requested using the Read Element Status command.

The library does not accept any other commands from the host during the inventory process.

The host can issue an Abort of the inventory for the library. If another Initialize Element Status command is then issued, the inventory process is restarted from the beginning.

If the gripper contains a tape cartridge, the inventory procedure cannot be conducted. In this case a Transfer Full error (SK=5 ASC=80 ASCQ=01) is returned. The cartridge should be moved to an available bin, and the command retried.

The format for this command data block is shown in Table 6.

Table 6: Initialize Element Status with Range Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (E7h)							
1	Logical Unit Number			Reserved (00h)				Range
2	(MSB) Starting Element Address							
3								(LSB)
4	Reserved (00h)							
5	Reserved (00h)							
6	(MSB) Number of Elements							
7								(LSB)
8	Reserved (00h)							
9	NBL	Reserved (00h)						

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

Range A Range field of 1 specifies performing the inventory over the range specified by the Starting Element Address and Number of Elements fields. A value of 0 specifies performing the inventory on all elements in the library, ignoring the Starting Element Address and Number of Elements fields.

Starting Element Address and Number of Elements

These fields are used to select the range of elements to be inventoried and are only valid when the Range field is 1. The ranged inventory begins with the first element with an address greater than or equal to the Starting Element Address, and includes all defined elements until the indicated number of elements have been inventoried or the last element is reached.

NBL A No bar code Labels field of 1 specifies the inventory to not scan the bar codes of the elements and set the corresponding primary volume tags to empty. A value of 0 specifies element bar code labels are to be scanned and placed in the primary volume tags.

Inquiry (12h)

The host uses the Inquiry Command to determine the devices attached to the SCSI bus. Using this command, the host can request a description from each device. The description provided by the library identifies the type of device, manufacturer, and the nature of the supported SCSI interface.

Only the standard Inquiry data format is supported.

The format for this command data block is shown in Table 7.

Table 7: Inquiry Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (12h)							
1	Logical Unit Number			Reserved (0h)				EVPD (0)
2	Page Code (00h)							
3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

EVPD The Enable Vital Product Data (EVPD) bit should always be zero. An EVPD bit of zero specifies that the target returns the Standard Inquiry Data.

Allocation Length This field contains the maximum amount of data that may be returned. Anything greater than 36 returns the full 36 bytes of data.

Page Code Vital Product Data Page Code. The TL81X/TL894 library returns only the Standard Inquiry Data. This field is not used and must be set to 0.

The format for the Standard Inquiry Data block returned by the library to the initiator is shown in Table 8.

Table 8: Standard Inquiry Data

Bit/Byte	7	6	5	4	3	2	1	0
0	Peripheral Qualifier			Peripheral Device Type				
1	RMB (1)	Device-Type Modifier (00h)						
2	ISO Version (0)		ECMA Version (0)			ANSI-Approved Version (2)		
3	AENC (0)	TrmIOP (0)	Reserved (0)		Response Data Format (02h)			
4	Additional Length (1Fh)							
5	Reserved (0000h)							
6								
7	RelAdr (0)	WBus32 (0)	WBus16 (0)	Sync (0)	Linked (0)	Reserved (0)	CmdQue (0)	SftRes (0)
8-15	(MSB) Vendor ID (LSB)							
16-31	(MSB) Product ID (LSB)							
32-35	(MSB) Product Revision Level (LSB)							

Peripheral Qualifier

0 indicates the specified library is currently connected.
3 indicates the specified library cannot be supported.

Peripheral Device Type

08h indicates medium changer device.
1Fh indicates unknown or no device type used in conjunction with Peripheral Qualifier 3.

RMB A Removable Medium Bit (RMB) of one indicates that the medium is removable.

Device-Type Modifier This field is not supported and should return a value of zero.

ISO and ECMA Version A zero code value in this field indicates that the target does not claim compliance to the ISO version of SCSI (ISO IS 9316) or the ECMA version of SCSI (ECMA-111).

ANSI-Approved Version A return of two indicates the device complies with the SCSI-2 Standard.

AENC The asynchronous event notification capability bit of 0 indicates that the device does not support the asynchronous event notification capability.

TrmIOP A terminate I/O process value of zero indicates that the device does not support the TERMINATE I/O PROCESS message.

Response Data Format A value of two indicates that the data must be in the format specified in the SCSI-2 standard.

Additional Length This field indicates the length (in bytes) of additional inquiry data available.

RelAdr A Relative Address of zero indicates the device does not support relative addressing for this library.

WBus32 and WBus16 A bit of zero in these two fields indicates that the device supports 8-bit wide data transfers.

Sync A synchronous transfer value of zero indicates the device does not support synchronous data transfer.

Linked A linked command value of zero indicates the device does not support linked commands for this library.

CMDQue A command queuing value of zero indicates the device does not support tagged command queuing for this library.

SftRes A soft reset bit of zero indicates that the device responds to the RESET with a hard reset. A soft reset bit of one indicates that the device responds to the RESET condition with a soft reset.

Vendor ID This field contains the string "**DEC$_{bbbbb}$**".

Product ID This field contains the following ASCII character strings:
for the TL810: TL810$_{bbbb}$(C)$_{b}$DEC.
for the TL812: TL810$_{bbbb}$(C)$_{b}$DEC.
for the TL894: TL810$_{bbbb}$(C)$_{b}$DEC.

Product Revision Level This field contains the library firmware revision level in the format X.XX.

Log Sense Command (4Dh)

The Log Sense Command (Table 9) provides a means to retrieve statistical information maintained by the logical unit. Data is returned from the logical unit in the Medium Changer Statistics Page (Table 11).

Table 9: Log Sense Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (4Dh)							
1	Logical Unit Number			Reserved (0)			PPC(0)	SP(0)
2	PC (1)		Page Code					
3	Reserved (0000h)							
4								
5	(MSB) Parameter Pointer							
6								(LSB)
7	(MSB) Allocation Length							
8								(LSB)
9	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

PPC The parameter pointer control field is not supported and must be set to zero.

SP The save parameters field is not supported and must be set to zero.

PC The page control field defines the type of parameter values to be selected. Only cumulative values are supported, therefore this field must be set to one.

Page Codes

Currently, there are only 3 supported page codes:

00h Supported Log Page (see Table 10).
30h Medium Changer Statistic Page (see Table 11).
3Fh Return all supported pages. This is a composite of all pages, returned sequetially. Order of composition is Supported Log Page (00h) followed by Medium Changer Statistic Page (30h).

Parameter Pointer

This field allows the host to request parameter data beginning from a specific parameter code to the maximum allocation length or the maximum parameter code supported by the target, whichever is less. See Table 13 for supported parameter codes.

Allocation Length:

This field specifies how much memory the host has set aside to store the log sense information returned by the library.

Supported Log Page

The supported log page (Table 10) returns the list of log pages supported.

Table 10: Supported Log Pages

Bit/Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (00h)					
1	Reserved (00h)							
2	(MSB)							
3	Page Length (0002h)							(LSB)
SUPPORTED PAGE LIST								
4	(00h)							
5	(30h)							

Page Length

This field specifies the length in bytes of the following supported page list.

Supported Page List

The supported page list field contains a list of all log page codes supported. Currently, there are only 2 pages supported. This one (00h), and the Medium Changer Statistics Page (30h) all log pages.

Medium Changer Statistics Page

This page provides a means for returning medium changer statistical data.

Table 11: Medium Changer Statistics Page

Bit/Byte	7	6	5	4	3	2	1	0
0	Reserved (0)		Page Code (30h)					
1	Reserved (00h)							
2	(MSB)							
3	Page Length							(LSB)
LOG PARAMETER LIST								
4 - 11	Log Parameter (First)							
	. .							
x-7 - x	Log Parameter (Last)							

Page Length This field specifies the length in bytes of the following list of log parameters.

Log Parameter Each Log parameter begins with a four-byte parameter header followed by four bytes of parameter value data. See Table 12 for Log Parameter format.

Table 12: Log Parameter

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

Parameter Code The parameter code field identifies which log parameter is being transferred for that log page. See Table 13 for parameter codes supported.

DU, DS, TSD, ETC, TMC and LP

These parameters are not supported and must be set to zero.

Parameter Length All log parameter values supported in the Medium Changer Statistics page have a length of 4 bytes.

Parameter Value The cumulative count of parameter as described in Table 13.

Table 13: Supported Log Parameter Codes

Parameter Code	Description	Size (bytes)
8000	Number of seconds system has been powered on	4
8001	Number of seconds spent processing commands	4
8010	Number of attempted moves from a bin	4
8011	Number of attempted moves to a bin	4
8012	Number of attempted moves from a drive	4
8013	Number of attempted moves to a drive	4
8014	Number of attempted moves from the Load Port	4
8015	Number of attempted moves to the Load Port	4
8020	Number of individual horizontal moves	4
8021	Number of individual vertical moves	4
8022	Number of individual extension moves	4
8023	Number of individual gripper moves	4
8024	Number of individual extension force moves	4
8030	Number of horizontal retries	4
8031	Number of vertical retries	4
8032	Number of extension retries	4
8033	Number of gripper retries	4
8040	Number of place into drive retries	4
8041	Number of pick from drive retries	4
8042	Number of partially gripped cartridge retries	4
8043	Number of drive load retries	4

Mode Select Command (15h)

The Mode Select command provides a means for the host to specify parameters to the library. The library supports Clement Address Assignment Page, Vendor Unique Page 20h, and Vendor Unique Page 00h.

Table 14: Mode Select Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (15h)							
1	Logical Unit Number			PF (1)	Reserved (0)			SP
2	Reserved (0000h)							
3								
4	Parameter List Length							
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to zero. This field indicates which logical unit the command should be sent to.

SP - Save Page When set to zero indicates perform mode select without saving. When set to one performs mode select and saves it in nonvolatile memory.

PF When set to one, the page format field indicates that the Mode Select Parameters are formatted as specified in the SCSI-2 Standard.

Parameter List Length Indicates the length of the following parameter list. The list length should reflect the combined length of all Mode Select Data pages being sent with the Mode Select command. Mode Select Data pages are shown in Table 15 through Table 18.

The format for the Mode Select Header Block is shown in Table 15.

Table 15: Mode Select Data Header

Bit/Byte	7	6	5	4	3	2	1	0
0	Mode Select Data Length							
1	Medium Type (00h)							
2	Device-Specific Parameter (00h)							
3	Block Descriptor Length (00h)							

Mode Data Length This field is set to the amount of data following the Data Length field in bytes. This includes the last three bytes in the Header Block as well as all bytes in the parameter page or pages.

Medium Type Code This field is reserved for medium changer devices.

Device-Specific Parameter This field is reserved for medium changer devices.

Block Descriptor Length This field is reserved for medium changer devices.

The format for Mode Select Vendor Unique Page 20h is shown in Table 16.

Table 16: Mode Select Data - Vendor Unique Page 20h

Bit/Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (20h)					
1	Page Length (02h)							
2	Reserved (00h)						AC	DLR
3	Reserved (00h)							EXB

PS - Parameters Savable This bit is only used with the Mode Sense command (See Table 25 on page 3-36). This bit is reserved for Mode Select command and should be set to zero.

DLR-Drive Load Retry This bit is ignored. It can be set to one or zero for compatibility with existing hosts.

AC-Auto Clean When this bit is set to one, the automatic drive cleaning feature is enabled. When it is set to zero, the automatic drive cleaning feature is disabled.

Note ***The normal state of automatic drive cleaning is "disabled". For a detailed discussion of the automatic drive cleaning feature, see "Appendix C."***

EXB-Exabyte Emulation When this bit is set to one the library emulates an Exabyte EXB-120. This setting changes the behavior of the SCSI command set. The differences in the interface when in Exabyte Emulation mode are described in Appendix D. When set to zero the library SCSI interface operates in the default manner as described in this document.

The format for Mode Select Vendor Unique Page 00h is shown in Table 17.

Table 17: Mode Select Data - Vendor Unique Page 00h

Bit/Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (00h)					
1	Page Length (3Eh)							
2	AInit	UInit (0)	Parity (0)	NBL	Rsrvd (0)	NRDC (0)	MDC (0)	
3	Maximum Parity Retries (00h)							
4-63	Display Messages (00h)							

PS - Parameters Savable This bit is only used with the Mode Sense command (See Table 21 on page 3-30). This bit is reserved for Mode Select command and should be set to zero.

AInit When this value is set to one the library insures that all elements have been inventoried before entering the On-line state. If set to zero, the library only inventories itself when commanded to by the Init Element Status or Init Element Status with Range command.

UInit Not supported.

Parity Not supported.

NBL - No barcode Labels Valid only if the AInit field value is one. When the library performs an inventory due to going On-line, if the value of the NBL field is one bar codes are not scanned and the primary volume tags are set to empty. If the NBL field is set to zero, when the library performs an inventory due to going On-line, bar codes are scanned and their value placed in the corresponding primary volume tag.

NRDC - Not Ready Display Control

Not supported.

MDC - Message Display Control

Not supported.

Maximum Parity Retries Not supported.

Display Message Not supported.

The format for the Element Address Assignment Page is shown in Table 18.

Table 18: Mode Select Data - Element Address Assignment Page

Bit/Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (1Dh)					
1	Parameter Length (12h)							
2	(MSB) First Medium Transport Element Address							
3	(LSB)							
4	(MSB) Number of Medium Transport Elements (0001h)							
5	(LSB)							
6	(MSB) First Storage Element Address							
7	(LSB)							
8	(MSB) Number of Storage Elements							
9	(LSB)							
10	(MSB) First Import Export Element Address							
11	(LSB)							
12	(MSB) Number of Import Export Elements							
13	(LSB)							
14	(MSB) First Data Transport Element Address							
15	(LSB)							
16	(MSB) Number of Data Transport Elements							
17	(LSB)							
18	Reserved (0000h)							
19								

PS - Parameters Savable This bit is only used with the Mode Sense command (See Table 22 on page 3-32). This bit is reserved for Mode Select command and should be set to zero.

First Medium Transport Element Address

This field specifies the first medium transport element contained in the medium changer (other than the default medium transport address of zero).

Number of Medium Transport Elements

This field defines the total number of medium transport elements contained in the medium changer.

First Storage Element Address

This field specifies the first storage element contained in the medium changer.

Number of Storage Elements

This field defines the total number of storage elements contained in the medium changer.

First Import/Export Element Address

This field specifies the first import / export element contained in the medium changer.

Number of Import/Export Elements

This field defines the total number of import / export elements contained in the medium changer.

First Data Transport Element Address

The first data transfer element address field specifies the first data transfer element contained in the medium changer.

Number of Data Transport Elements

This field defines the total number of data transfer elements contained within the medium changer and accessible to the medium transport elements.

Mode Sense (1Ah)

The SCSI Mode Sense Command provides a general method for a host to obtain the current parameter settings of a target device. The host selects the set parameters to be returned by setting the Page Code field in the command block. This code selects the page of parameter information to be returned by the target.

The TL81X / TL894 libraries support the three medium changer device parameter pages defined in the SCSI-2 standard and two vendor unique pages:

- Element Address Assignment Page
- Transport Geometry Parameters Page
- Device Capabilities Page
- Vendor Unique Page 20h
- Vendor Unique Page 00h

The host can request all pages with a single command using the Return All Pages page code as described in the standard.

The format for the Mode Sense Command block is shown in Table 19.

Table 19: Mode Sense Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Ah)							
1	Logical Unit Number			Reserved (0)	DBD	Reserved (00)		
2	PC		Page Code					
3	Reserved (00h)							
4	Allocation Length							
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

DBD

The disable block descriptors (DBD) field can be one or zero. A bit of zero indicates that the target may return zero or more block descriptors in the returned Mode Sense data at the target's discretion. A DBD bit of one specifies that the target does not return any block descriptors in the returned Mode Sense data.

PC

The Page Control (PC) field defines the type of parameter values to be returned:

0 requests the current parameter values for the specified page code for the library. The current values returned are the default values.

1 requests the target to return the changeable parameter mask for the page code specified. The page requested is returned containing information that indicates which parameters are changeable.

2 requests the target return the default values for the page code specified.

3 requests the target return saved values for the page code specified. Only the Vendor Unique Page has changeable / savable parameters. Otherwise, the current setting for each parameter is always the same as the setting that parameter had when the library was turned on.

Page Codes

The valid page codes are:

00h Vendor Unique Page 00h
1Dh Element Address Assignment Page
1Eh Transport Geometry Parameters Page
1Fh Device Capabilities Page
20h Vendor Unique Page 20h
3Fh Return All Pages

Allocation Length

This should be set according to the number of bytes in the page that has been requested:

44h Vendor Unique Page 00h
18h Element Address Assignment Page
08h Transport Geometry Parameters Page
18h Device Capabilities Page
08h Vendor Unique Page 20h
84h Return All Pages

The parameter data returned for each Mode Sense command is preceded by a Mode Parameter Header Block. The header block is then followed by either the requested parameter page or all pages if the Return All Pages page code was used.

The format for the Mode Sense Header Block is shown in Table 20.

Table 20: Mode Sense Data Header

Bit/Byte	7	6	5	4	3	2	1	0
0	Mode Sense Data Length							
1	Medium Type (00h)							
2	Device-Specific Parameter (00h)							
3	Block Descriptor Length (00h)							

Mode Data Length This field is set to the amount of data following the Data Length field in bytes. This includes the last three bytes in the Header Block as well as all bytes in the parameter page or pages.

Medium Type Code This field is reserved for medium changer devices.

Device-Specific Parameter This field is reserved for medium changer devices.

Block Descriptor Length This field is reserved for medium changer devices.

The format for Mode Select Vendor Unique Page 00h is shown in Table 21.

Table 21: Mode Sense Data - Vendor Unique Page 00h

Bit/Byte	7	6	5	4	3	2	1	0
0	PS (1)	Reserved (0)	Page Code (00h)					
1	Page Length (3Eh)							
2	AInit	UInit (0)	Parity (0)	NBL	Rsrvd (0)	NRDC (1)	MDC (1)	
3	Maximum Parity Retries (00h)							
4-63	Display Messages (00h)							

PS-Parameters Savable This bit is always set to one indicating that this page can be saved to nonvolatile memory.

AInit When this value is set to one the library insures that all elements have been inventoried before entering the On-line state. If set to zero, the library only inventories itself when commanded to by the Init Element Status or Init Element Status with Range command.

UInit Not supported.

Parity Not supported.

NBL - No barcode Labels Valid only if the AInit field value is one. When the library performs an inventory due to going On-line, if the value of the NBL field is one bar codes are not scanned and the primary volume tags are set to empty. If the NBL field is set to zero, when the library performs an inventory due to going On-line, bar codes are scanned and their value placed in the corresponding primary volume tag.

NRDC - Not Ready Display Control

Not supported.

MDC - Message Display Control

Not supported.

Maximum Parity Retries Not supported.

Display Message Not supported.

The format for the Element Address Assignment Page is shown in Table 22.

Table 22: Mode Sense Data - Element Address Assignment Page

Bit/Byte	7	6	5	4	3	2	1	0
0	PS (1)	Reserved (0)	Page Code (1Dh)					
1	Parameter Length (12h)							
2	(MSB) First Medium Transport Element Address							
3	(LSB)							
4	(MSB) Number of Medium Transport Elements (0001h)							
5	(LSB)							
6	(MSB) First Storage Element Address							
7	(LSB)							
8	(MSB) Number of Storage Elements							
9	(LSB)							
10	(MSB) First Import Export Element Address							
11	(LSB)							
12	(MSB) Number of Import Export Elements							
13	(LSB)							
14	(MSB) First Data Transport Element Address							
15	(LSB)							
16	(MSB) Number of Data Transport Elements							
17	(LSB)							
18	Reserved (0000h)							
19								

PS-Parameters Savable This bit is always set to one indicating that this page can be saved to nonvolatile memory.

First Medium Transport Element Address

This field identifies the first medium transport element contained in the medium changer (other than the default medium transport address of zero).

Number of Medium Transport Elements

This field defines the total number of medium transport elements contained in the medium changer.

First Storage Element Address

This field identifies the first storage element contained in the medium changer.

Number of Storage Elements

This field defines the total number of storage elements contained in the medium changer.

First Import/Export Element Address

This field identifies the first import / export element contained in the medium changer.

Number of Import/Export Elements

This field defines the total number of import / export elements contained in the medium changer.

First Data Transport Element Address

The first data transfer element address field identifies the first data transfer element contained in the medium changer.

Number of Data Transport Elements

This field defines the total number of data transfer elements contained within the medium changer and accessible to the medium transport elements.

The format for the Transport Geometry Parameters Page is shown in Table 23.

Table 23: Mode Sense Data - Transport Geometry Parameters Page

Bit/Byte	7	6	5	4	3	2	1	0
0	PS (0)	Reserved (0)	Page Code (1Eh)					
1	Parameter Length (02h)							
TRANSPORT GEOMETRY DESCRIPTOR								
2	Reserved (00h)							Rotate (0)
3	Member Number In Transport Element Set (00h)							

PS The parameters savable bit of zero indicates the target is not capable of saving the page in a nonvolatile vendor-specific location.

Parameter Length There are two bytes of parameter information.

Transport Geometry Descriptor

A rotate bit of zero indicates that the medium transport element does not support media rotation.

Member Number In Transport Element Set

The first element in a set has a member number of zero.

The format for the Device Capabilities Page is shown in Table 24.

Table 24: Mode Sense Data - Device Capabilities Data

Bit/Byte	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	PS (0)	Reserved (0)	Page Code (1Fh)					
1	Parameter Length (12h)							
2	Reserved (0h)				StorDT (1)	StorI/E (1)	StorST (1)	StorMT (1)
3	Reserved (0h)							
4	Reserved (0h)				MT->DT (1)	MT->I/E (1)	MT->ST (1)	MT->MT (0)
5	Reserved (0h)				ST->DT (1)	ST->I/E (1)	ST->ST (1)	ST->MT (1)
6	Reserved (0h)				I/E->DT (1)	I/E->I/E (1)	I/E->ST (1)	I/E->MT (1)
7	Reserved (0h)				DT->DT (1)	DT->I/E (1)	DT->ST (1)	DT->MT (1)
8 - 11	Reserved (00000000h)							
12	Reserved (0h)				MT<->DT (0)	MT<->I/E (0)	MT<->ST (0)	MT<->MT (0)
13	Reserved (0h)				ST<->DT (0)	ST<->I/E (0)	ST<->ST (0)	ST<->MT (0)
14	Reserved (0h)				I/E<->DT (0)	I/E<->I/E (0)	I/E<->ST (0)	I/E<->MT (0)
15	Reserved (0h)				DT<->DT (0)	DT<->I/E (0)	DT<->ST (0)	DT<->MT (0)
16 - 19	Reserved (00000000h)							
	DT = Data Transfer Element (Tape Drive) IE = Import/Export Element (Load Port) MT = Medium Transport Element (Gripper Mechanism) ST = Storage Element (Fixed Storage Array Bin)							

The StorDT, StorIE, StorST, and StorMT fields indicate whether an element of the indicated type (DT, IE, ST, or MT) is capable of storing a tape cartridge.

The XX->YY fields indicate whether a transfer from an element of type XX is possible to an element of type YY. A one in any of these fields indicates that all Move Medium commands where the source element is type XX and destination element is type YY are supported. A zero in these fields indicates the move may or may not be valid depending on the particular element requested.

The library does not support the Exchange Medium command. Bytes 12 through 15 in this parameter page contain the individual fields specifying the library exchange capabilities. Since the library has no exchange capability, all of these fields are zero.

The format of the Vendor Unique Page 20h is shown in Table 25.

Table 25: Mode Sense Data - Vendor Unique Page 20h

Bit/Byte	7	6	5	4	3	2	1	0
0	PS (1)	Reserved	Page Code (20h)					
1	Page Length (02h)							
2	Reserved						AC	DLR
3	Reserved							EXB

PS-Parameters Savable This bit is always set to one indicating that this page can be saved to nonvolatile memory.

Page Code The page code value of 20h is used to indicate a vendor unique page, in page format.

Page Length The page length is fixed at a value of 2 bytes.

DLR-Drive Load Retry This bit is ignored and will be set to 0.

AC-Auto Clean If this bit is set to one, the current state of the automatic drive cleaning feature is “enabled.” When it is set to zero, the feature is “disabled.”

EXB-Exabyte Emulation When this bit is set to one the library emulates an Exabyte EXB-120. This setting changes the behavior of the SCSI command set. The differences in the interface when in Exabyte Emulation mode are described in "Appendix D, Exabyte EXB-120 Emulation Discussion." When set to zero the library SCSI interface operates in the default manner as described in this document.

Move Medium (A5h)

The host uses the Move Medium Command to move a tape cartridge from one element to another within a library. The host specifies the source element and the destination element in the command block. The library then moves the tape cartridge contained in the source element to the empty destination element.

The source and destination elements can be of any type: storage, medium transport, import / export or data transport element. The valid combinations of source element type and destination element type are summarized in the Mode Sense Device Capabilities Parameter Page.

If a valid source element type and destination element type are specified, the command is valid but the operation may still not be possible. In this case the library returns Check Condition status and sets the sense key to Illegal Request.

The Additional Sense Code and Additional Sense Code Qualifier is set to indicate why the operation cannot be carried out. For example, this might occur if a source element or destination element is specified which does not contain a tape cartridge. See Appendix A, Table A1, “Sense Data Values (Hexadecimal),” for a summary of the conditions, sense key, and additional sense encoding.

The format for the Move Medium Command block is shown in Table 26.

Table 26: Move Medium Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (A5h)							
1	Logical Unit Number			Reserved (00h)				
2	(MSB) Transport Element Address (0000h)							
3	(LSB)							
4	(MSB) Source Element Address							
5	(LSB)							
6	(MSB) Destination Element Address							
7	(LSB)							
8	Reserved (0000h)							
9								
10	Reserved (00h)							Invert (0)
11	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

Transport Element Address The default medium transport element address of zero or the medium transport element address specified by the Mode Sense Data can be used.

Source Element Address The source element address specifies the location from which the medium is taken.

Destination Element Address
The destination address specifies the location to which the medium is moved.

Invert The medium changer does not support medium rotation for handling double sided media. The invert bit must be set to zero.

Position To Element (2Bh)

The Position To Element command is used by the host to position the medium transport element in front of another element within a library. The host specifies the destination element in the command block. The library then moves the transport element in front of the destination element.

The destination element can be one of the following types: storage, import/export or data transfer. If the address is in error, the library returns Check Condition status and sets the sense key to Illegal Request.

The format of the Position To Element Command block is shown Table 27.

Table 27: Position To Element Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (2Bh)							
1	Logical Unit Number			Reserved (00h)				
2	(MSB) Transport Element Address (0000h)							
3	(LSB)							
4	(MSB) Destination Element Address							
5	(LSB)							
6	Reserved (00h)							
7								
8	Reserved (00h)							Invert (0)
9	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

Transport Element Address

The default medium transport element address of zero or the medium transport element address specified by the mode sense data can be used.

Destination Element Address

The destination address specifies the location to which the medium transport element is moved.

Invert

The medium changer does not support medium rotation for handling double-sided media. The invert bit must be set to zero.

Prevent/Allow Medium Removal (1Eh)

The Prevent / Allow Medium Removal Command requests the target to disable or enable, respectively, the removal of medium by not allowing the user to open the load port door.

This does not allow medium removal if any initiator currently has medium removal prevented. However, if the door is already opened the user can still close the door.

The prevention of medium removal begins when the initiator issues a Prevent / Allow Medium Removal Command with a prevent bit of one (medium removal prevented). The prevention of medium removal for the logical unit terminates:

- after the initiator (that has medium removal prevented) issues a Prevent / Allow Medium Removal Command with a prevent bit of zero and the target has successfully performed a synchronize cache operation.
- upon the receipt of a Bus Device Reset message from the initiator,

or

- after a Hard Reset

While a prevention of medium removal condition exists, the target inhibits mechanisms that normally allow removal of the medium by an operator.

The format of the Prevent / Allow Medium Removal Command block is shown in Table 28.

Table 28: Prevent/Allow Medium Removal Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Eh)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (00h)							
3	Reserved (00h)							
4	Reserved (00h)							Prevent
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

Prevent When this bit is set to one, medium removal is (prevented) disabled. When set to zero (default), removal is (allowed) enabled.

Read Element Status (B8h)

The host can determine the status of any of the library's elements by issuing a Read Element Status Command. The type of element (medium transfer, storage, import/export or data transfer) can be specified in the command as well as the starting address and number of elements for which status information is to be returned.

The library automatically updates its internal element status every time the status changes. The library inventory initializes the information and it is updated with each move. Because the information is updated with each move, no action is required by the library other than returning the information it has stored.

The format for the Read Element Status Command block is shown in Table 29.

Table 29: Read Element Status Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (B8h)							
1	Logical Unit Number			VolTag	Element Type Code			
2	(MSB) Starting Element Address							
3	(LSB)							
4	(MSB) Number of Elements							
5	(LSB)							
6	Reserved (00h)							
7	(MSB) Allocation Length							
8								
9	(LSB)							
10	Reserved (00h)							
11	Reserved (00h)							

Logical Unit Number The Logical Unit Number is 0.

VolTag

The Volume Tag field (VolTag) indicates whether or not the volume tag information associated with each tape cartridge should be returned as part of the status information. The volume tag (or bar code) is updated for each tape cartridge whenever it is moved with a Move Medium Command. The volume tag information for all tape cartridges can also be updated using the Initialize Element Status Command. Since tape cartridges are a single-sided media, only a single volume tag is supported per tape cartridge.

Element Type Code

This field is used to indicate which type of element (medium transport, storage, import / export, data transfer, or all) is to be reported by this command:

0 indicates all element types reported.

1 indicates medium transport element.

2 indicates storage element.

3 indicates import / export element.

4 indicates data transfer elements.

Starting Element Address and Number of Elements

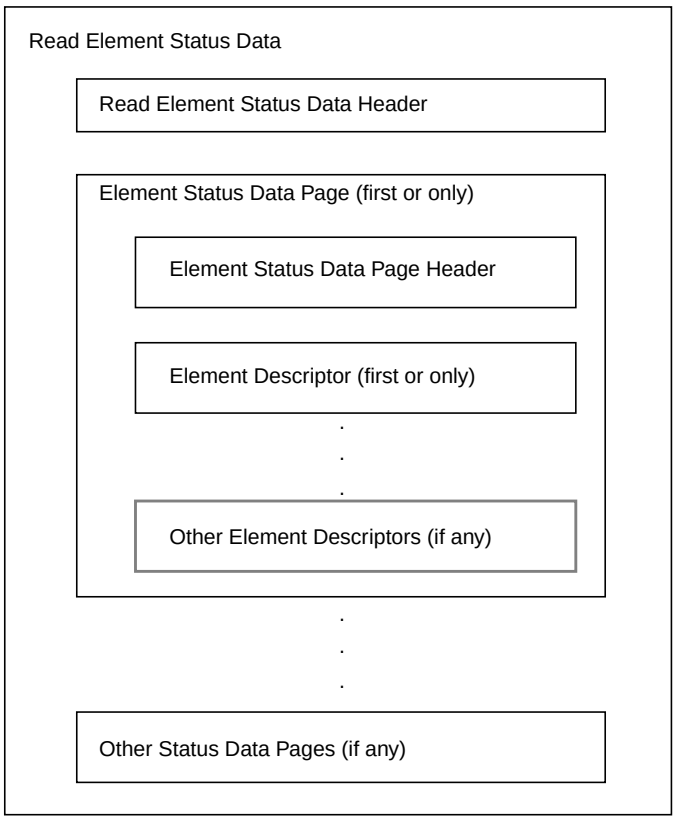
These fields are used to select the range of elements to be reported. Within this range no status information will be reported for an undefined element address. Only elements matching the indicated type will be returned. No elements with an address smaller than the Starting Element Address will be reported. Beginning with the first defined element with an address greater than or equal to the Starting Element Address, all defined, type matching elements will be reported until reports for the indicated number of elements have been returned.

Allocation Length

This field specifies how much memory the host has set aside to store the status information returned by the library. This field should be set to a number which is large enough to store the status information for the requested number of elements. If it is not, the library only reports the status information for the number of elements whose status information fits within the allocated space.

The returned Read Element Status Data has the general structure as depicted in Figure 3.

Figure 3: Read Element Status Data General Structure



A single Read Element Status Data Header is returned along with one or more element status pages. The Read Element Status Data Header indicates the address of the first element reported, the number of elements reported, and the size of the report for all requested data.

The size of the report is given in bytes. The size is the total number of bytes that would be contained in the report for all requested data less seven. The Read Element Status command can be given with an Allocation Length of eight to determine how much space must be allocated to transfer all of the status data requested by the command.

The format for the Read Element Status Data is shown in Table 30.

Table 30: Element Status Data

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) First Element Address Reported							
1								(LSB)
2	(MSB) Number of Elements Reported							
3								(LSB)
4	Reserved (00h)							
5	(MSB) Byte Count of Report Available							
6								
7								(LSB)
8 - X	One or More Element Status Page(s)							

First Element Address Reported

This field indicates the element address of the element with the smallest element address found to meet the command description block request.

Number of Elements Reported

This field indicates the number of elements meeting the request in the command descriptor block. The status for these elements is returned if sufficient allocation length was specified.

Byte Count of Report Available

This field indicates the number of bytes of element status page data available for all elements meeting the request in the command descriptor block.

From one to four Element Status Pages can be returned. One page is returned for each type of element with status information. Each page contains a header and one or more element descriptors. Each element descriptor reports the status for a single library element.

The page header (bytes 0-7) contains information that defines the contents of the element descriptors for the elements of that type. The format of a status page is shown in Table 31.

Table 31: Element Status Page

Bit/Byte	7	6	5	4	3	2	1	0
0	Element Type Code							
1	PVolTag	AVolTag (0)	Reserved (00h)					
2	(MSB) Element Descriptor Length							
3								(LSB)
4	Reserved (00h)							
5	(MSB) Byte Count of Descriptor Data Available							
6								
7								(LSB)
8 - X	One or More Element Descriptors							

PVolTag A primary volume tag field value of one indicates that the primary volume tag information field is present in each of the following element descriptor blocks. A value of zero indicates that these bytes are omitted from the element descriptors that follow.

AVolTag The Alternate Volume Tag is not supported. This field is set to zero.

Element Descriptor Length This field indicates the number of bytes in each element descriptor.

Byte Count of Descriptor Data Available

The Byte Count of Descriptor Data Available indicates the number of bytes (minus seven) of descriptor data (excluding this header) that would be returned for the descriptors of the specified type if an adequate allocation length had been specified.

There are four different types of element descriptor blocks, one for each type of element. There are several fields which are found in more than one type of element descriptor as well as fields which are unique to an element descriptor.

The fields found in more than one type of element descriptor have been indicated by the same name in the illustrations and descriptions that follow.

The format of an element descriptor for an element of the medium transport element type is shown in Table 32.

Table 32: Medium Transport Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (00h)					Except	Rsvd (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (000000h)							
7								
8								
9	SValid (0)	Invert (0)	Reserved (00h)					
10	Source Storage Element Address (0000h)							
11								
12 - 47	Primary Volume Tag Information (if present)							
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Element Address This field indicates the address of the element being reported by that element descriptor.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state is available in the Additional Sense Code and Additional Sense Code Qualifier fields.

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero otherwise.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one.

SValid, Invert, and Source Storage Element Address

The source valid, source storage element address field and the invert bit information value of zero indicates these fields are not valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field will be included in the element descriptor. This field contains the information read from the bar code affixed to each tape cartridge; its format is shown in Table 33.

Table 33: Primary Volume Tag Information

Bit/Byte	7	6	5	4	3	2	1	0
12 - 43	Volume Identification Field							
44	Reserved (0000h)							
45								
46	Volume Sequence Number (0000h)							
47								

Volume Identification Field

This is a left justified sequence of ASCII characters representing the bar code scanned from the cartridge followed by blanks 20h.

Volume Sequence Number This field is reserved and set to zero.

The format of an element descriptor for an element of the storage element type is shown in Table 34.

Table 34: Storage Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (0h)				Access	Except	Reserved (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (000000h)							
7								
8								
9	SValid	Invert (0)	Reserved (00h)					
10	Source Storage Element Address							
11								
12 - 47	Primary Volume Tag Information (if present)							
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Element Address This field indicates the address of the element being reported by that element descriptor.

Access An access bit value of one indicates that access to the element by a medium transport element is allowed.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state will be available in the Additional Sense Code and Additional Sense Code Qualifier fields in that element descriptor. See the Request Sense Command for the meaning of the codes contained in the two Sense Code fields.

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero otherwise.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one. Currently, the only valid values for these fields indicate either the Element Contents Unknown condition (ASC=80 ASCQ=22), Cleaning Cartridge Installed (ASC=30 ASCQ=03) or Operation Medium Removal Requested (ASC=5A ASCQ=01).

SValid The SValid bit is set to one if the information in the Source Storage Element Address field is valid. If the information is unknown (due to a door open or power on condition) the SValid bit is set to zero.

Invert The invert field is not supported and is set to zero.

Source Storage Element Address

The Source Storage Element Address represents the address of the last storage element which held the cartridge. The SValid field indicates whether or not this information is valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field will be included in the element descriptor. See Table 33 for format.

The layout of an element descriptor for an element of the import / export element type is illustrated in Table 35.

Table 35: Import/Export Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (0)		Import Enable	Export Enable	Access	Except	Import Export	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (000000h)							
7								
8								
9	SValid	Invert (0)	Reserved (00h)					
10	Source Storage Element Address							
11								
12 - 47	Primary Volume Tag Information (if present)							
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Import Element The Import Enable field indicates whether the element can import a tape cartridge into the library. It is set to one if imports are possible through that element and zero otherwise. This field is always set to one.

Import Enable The Import Enable field indicates whether the element can export a tape cartridge from the library. It is set to one.

Export Enable The Export Enable field indicates whether the element can export a tape cartridge from the library. It is set to one.

Access An access bit value of one indicates access to the element by a medium transport element is allowed. This is set to zero if the load port door is open.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state will be available in the Additional Sense Code and Additional Sense Code Qualifier fields in that element descriptor. See Appendix A for the meaning of the codes contained in the two Sense Code fields.

Import Export The Import/Export field is set to zero if the tape cartridge contained in the element was placed there by the transfer mechanism. It is set to one if the tape was placed there by an operator or if its source is unknown (e.g., after power cycle).

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero when the element contains no tape or the Load Port door is open.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one. Currently the only valid values for these fields indicate the Element Contents Unknown condition (ASC=80 ASCQ=22), Cleaning Cartridge Installed (ASC=30 ASCQ=03) and Operator Medium Removal Request (ASC=5A ASCQ=01).

SValid The SValid bit is set to one if the information in the Source Storage Element Address field is valid. If the information is unknown the SValid bit is set to zero.

Invert The invert field is not supported and is set to zero.

Source Storage Element Address

The Source Storage Element Address represents the address of the last storage element which held the cartridge. The SValid field indicates whether or not this information is valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field will be included in the element descriptor. See Table 33 for format.

The format of an element descriptor for an element of the data transfer element type is shown in Table 36.

Table 36: Data Transfer Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (0h)				Access	Except	Rsvd (0)	Full
3	Reserved (00)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Not Bus	Rsvd	ID Valid	LU Valid	Rsvd	Logical Unit Number		
7	SCSI Bus Address							
8	Reserved (00h)							
9	SValid	Invert (0)	Reserved (00h)					
10	Source Storage Element Address							
11								
12 - 47	Primary Volume Tag Information (if present)							
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Element Address This field indicates the address of the element being reported by that element descriptor.

Access An access bit value of one indicates access to the element by a medium transport element is allowed.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state will be available in the Additional Sense Code and Additional Sense Code Qualifier fields in that element descriptor. See the Request Sense Command for the meaning of the codes contained in the two Sense Code fields.

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero otherwise.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one. Currently the only valid values for these fields indicate the Element Contents Unknown condition (ASC=80 ASCQ=22), Cleaning Cartridge Installed (ASC=30 ASCQ=03) or any DLT™ drive error (ASC=8D or ASC=F3).

SValid The SValid bit is set to one if the information in the Source Storage Element Address field is valid. If the information is unknown (due to a door open or power on condition) the SValid bit is set to zero.

Invert The invert field is not supported and is set to zero.

Source Storage Element Address

The Source Storage Element Address represents the address of the last storage element which held the cartridge. The SValid field indicates whether or not this information is valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field is included in the element descriptor. See Table 33 for format.

Ready Inport (DEh)

Note ***This is only provided on this unit for compatibility with existing libraries and provides no function on this library.***

Table 37: Ready Inport Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (DEh)							
1	Logical Unit Number			Reserved (00h)				
2	(MSB) Element Address							
3								(LSB)
4	Reserved (00h)							
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the command should be sent to.

Element Address Address of import to ready.

Release (17h)

The Release Command releases the library or elements that match the specified release parameters.

Note ***It is not an error to attempt to release the library if it is not currently reserved by the requesting initiator. However, if the library is reserved by another initiator, the library is not released***

Table 38: Release Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (17h)							
1	Logical Unit Number			3rdPty	3rd Party ID			Element
2	Reservation ID							
3	Reserved (00h)							
4	Reserved (00h)							
5	Unused		Reserved (00h)				Flag	Link

Logical Unit Number The Logical Unit Number is 0. This field indicates which logical unit the command should be sent to.

3rdPty and 3rd Party ID The third-party release option for Release allows an initiator to release a logical unit or elements that were previously reserved using the third-party reservation option. If the third-party (3rdPty) bit is zero, then the third-party release option is not requested and the command will only release a unit or elements that were reserved without third-party reservation. If the third-party (3rdPty) bit is one, the unit or elements are released were originally reserved by the same initiator using the third-party reservation option, and if the device is the same SCSI device that was specified in the third-party device ID (3rd Party ID) field.

Element and Reservation ID The Element field specifies whether this command is an Element or Unit Release. If the value is one, the command will Release all elements reserved by the requesting initiator, that were reserved with the same Reservation ID value as this release attempt and that meet 3rd party release requirements, if applicable. If the value is zero, the command will Release a reservation placed on this unit by the requesting initiator that meets 3rd party release requirements, if applicable.

Reserve (16h)

Reserve reserves the specified library or elements for exclusive use by the requesting initiator or the another specified SCSI device. The reservation remains in effect until one of the following conditions is met:

The initiator that made the reservation sends a valid Reserve command capable of overriding the reservation. Element reservations will replace all previous element reservations with the same Reservation ID from the same initiator, and can not override Unit reservations. Unit reservation can override any previous reservation from the same initiator, regardless of Reservation ID.

The library or element is released by a valid Release command from the same initiator.

A Bus Device Reset message is received from any initiator.

A hard reset occurs.

The occurrence of the last two conditions is indicated by the library 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 Unit to a library that is currently reserved to the requesting initiator.

If a Unit Reserve is attempted on a unit that has previously been reserved by another initiator or contains any element previously reserved by another initiator, the target returns a Reservation Conflict status. If an Element Reserve is attempted on an element previously reserved from another initiator or contained by a unit previously reserved by any initiator or previously element reserved with a different Reservation ID, the target returns a Reservation Conflict status.

If, after honoring a Unit 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. If, after honoring an Element Reservation, any other initiator issues a command other than Release to that element, the command is rejected with a Reservation Conflict status. A Release command issued by another initiator is ignored by the reserved element.

Table 39: Reserve Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (16h)							
1	Logical Unit Number			3rdPty	3rd Party ID			Element
2	Reservation ID							
3	(MSB) Element List Length							
4								(LSB)
5	Unused		Reserved (00h)				Flag	Link

Logical Unit Number The Logical Unit Number must always be 0. This field indicates which logical unit the command should be sent to.

3rdPty and 3rd Party ID The third-party reservation option for RESERVE UNIT allows an initiator to reserve a logical unit for another SCSI device. This option is intended for systems that use COPY, and is implemented by the library.

If the third-party (3rdPty) bit is zero, then the third-party reservation option is not requested. If the 3rdPty bit is one, Reserve Unit reserves the logical unit for the SCSI device specified in the Third-Party Device ID (Third Party ID) field. The library preserves the reservation until any one of the four conditions mentioned above occurs. The library ignores any attempt made by any other initiator to release the reservation and returns a Good status.

An initiator that holds a current reservation may modify that reservation (for example, to switch third-parties) by issuing another Reserve Unit to the library.

Element and Reservation ID The Element field specifies whether this command is an Element or Unit Release. If the value is one, the command will Release all elements reserved by the requesting initiator, that were reserved with the same Reservation ID value as this release attempt and that meet 3rd party release requirements, if applicable. If the value is zero, the command will Release a reservation placed on this unit by the requesting initiator that meets 3rd party release requirements, if applicable.

Element List Length Only valid if Element is 1, otherwise this field is reserved and must contain zeroes. This field specifies the Length of Element List Descriptors that follow. This value must be a whole multiple of the length of a single Element List Descriptor (6).

Table 40: Element List Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	Reserved (0000h)							
1								
2	(MSB) Number of Elements							
3								(LSB)
4	(MSB) Starting Element Address							
5								(LSB)

Starting Element Address and Number of Elements
These fields are used to select the range of elements to be reserved. The reservation begins with the first element with an address greater than or equal to the Starting Element Address, and includes all defined elements until the indicated number of elements have been reserved or the last element is reached. All the specified elements must be able to be reserved or no reservations take place at all.

Request Sense (03h)

The Request Sense Command allows the host to receive sense data from the library.

The library supports the reporting of current errors only. A current error (error code 70h) is returned when the error was generated during the execution of the command indicating the Check Condition.

The library supports unit attention condition queuing as described in the SCSI-2 standard. Other details of processing for this command are consistent with those described in the SCSI-2 standard.

The format of the Request Sense command is shown in Table 41.

Table 41: Request Sense Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (03h)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (0000h)							
3								
4	Allocation Length							
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number is 0. This field indicates which logical unit the command should be sent to.

Allocation Length This field contains the maximum amount of data which may be returned to the host. Anything greater than 21 returns the full 21 bytes of data.

The format of the Request Sense data is shown in Table 42.

Table 42: Request Sense Data

Bit/Byte	7	6	5	4	3	2	1	0
0	Valid (0)	Error Code (70h)						
1	Segment Number (00h)							
2	Filemark (0)	EOM (0)	ILI (0)	Reserved (0)	Sense Key			
3	(MSB) Information Bytes (00000000h)							
4								
5								
6								(LSB)
7	Additional Sense Length (0Dh)							
8	(MSB)							
9	Command Specific Information Bytes (0h)							
10								
11								(LSB)
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Field Replaceable Unit Code (00h)							
15	SKSV (0)							
16	Reserved							
17								
18	Vendor Unique ASC							
19	Vendor Unique ASCQ							
20	Vendor Specific							

Valid This field is set to zero indicating that the information field is not being used.

Segment Number, Filemark, EOM, and ILI

These fields are not supported and are set to zero.

Error Code The following error value is supported:

70h current error

Sense Key The following Sense Key values are supported:

0h NO SENSE
1h RECOVERED ERROR
2h NOT READY
4h HARDWARE ERROR
5h ILLEGAL REQUEST
6h UNIT ATTENTION
9h VENDOR SPECIFIC
Bh ABORTED COMMAND

Information This field is not supported and is set to zero.

SKSV The Sense Key Specific fields are not supported, therefore this field is always set to zero.

Additional Sense Length, Additional Sense Code, Additional Sense Code Qualifier, Vendor Unique ASC and Vendor Unique ASCQ

See Appendix A, “Sense Data Values,” for a list of possible sense information returned from the library.

Command-Specific Information and Field Replaceable Unit Code

These fields are not supported and are set to zero.

Request Volume Element Address (B5h)

The Request Volume Element Address command reports the element descriptors found by a Send Volume Tag command. The type of element (medium transfer, storage, import/export or data transfer) can be specified in the command as well as the starting address and number of elements for which status information is to be returned.

The format of the Request Volume Element Address command is shown in Table 43.

Table 43: Request Volume Element Address Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (B5h)							
1	Logical Unit Number			VolTag	Element Type Code			
2	(MSB) Starting Element Address							
3	(LSB)							
4	(MSB) Number of Elements							
5	(LSB)							
6	Reserved (00h)							
7	(MSB) Allocation Length							
8	(LSB)							
9								
10	Reserved (00h)							
11	Reserved (00h)							

Logical Unit Number The Logical Unit Number is 0.

VolTag The Volume Tag field (VolTag) indicates whether or not the volume tag information associated with each tape cartridge should be returned as part of the status information. The volume tag (or bar code) is updated for each tape cartridge whenever it is moved with a Move Medium Command. The volume tag information for all tape cartridges can also be updated using the Initialize Element Status Command. Since tape cartridges are a single-sided media, only a single volume tag is supported per tape cartridge.

Element Type Code

This field is used to indicate which type of element (medium transport, storage, import/export, data transfer, or all) is to be reported by this command.

0 indicates all element types reported.

1 indicates medium transport element.

2 indicates storage element.

3 indicates import/export element.

4 indicates data transfer elements.

Starting Element Address and Number of Elements

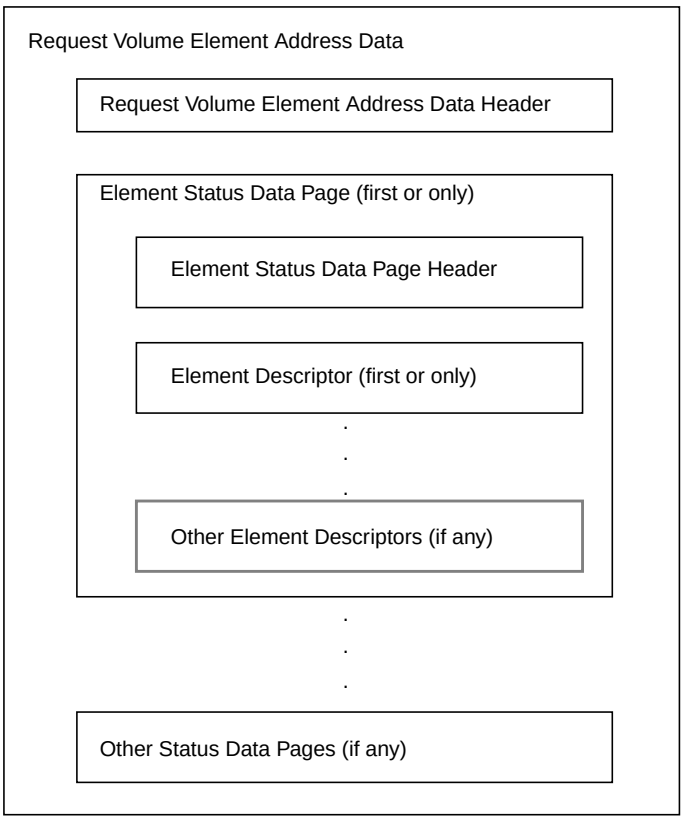
These fields are used to select the range of elements to be reported. Within this range no status information will be reported for an undefined element address. Only elements matching the indicated type will be returned. No elements with an address smaller than the Starting Element Address will be reported. Beginning with the first defined element with an address greater than or equal to the Starting Element Address, all defined, type matching elements will be reported until reports for the indicated number of elements have been returned.

Allocation Length

This field specifies how much memory the host has set aside to store the status information returned by the library. This field should be set to a number which is large enough to store the status information for the requested number of elements. If it is not, the library only reports the status information for the number of elements whose status information fits within the allocated space.

The returned Request Volume Element Address Data has the general structure as depicted in Figure 4.

Figure 4: Request Volume Element Address Data General Structure



A single Volume Element Address Header is returned along with one or more element status pages. The Volume Element Address indicates the address of the first element reported, the number of elements reported, the action code of the reported Send Volume Tag command and the size of the report for all requested data.

The size of the report is given in bytes. The size is the total number of bytes that would be contained in the report for all requested data less seven. The Request Volume Element Address command can be given with an Allocation Length of eight to determine how much space must be allocated to transfer all of the status data requested by the command.

The format for the Volume Element Address Header is shown in Table 44.

Table 44: Volume Element Address Header

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) First Element Address Reported							
1								(LSB)
2	(MSB) Number of Elements Reported							
3								(LSB)
4	Reserved (00h)			Send Action Code (05h)				
5	(MSB) Byte Count of Report Available							
6								
7								(LSB)
8 - X	One or More Element Status Page(s)							

First Element Address Reported

This field indicates the element address of the element with the smallest element address found to meet the command description block request.

Number of Elements Reported

This field indicates the number of elements meeting the request in the command descriptor block. The status for these elements is returned if sufficient allocation length was specified.

Send Action Code Send Action Code from the Send Volume Tag that issued the command. The library only supports Action code 05h.

Byte Count of Report Available

This field indicates the number of bytes of element status page data available for all elements meeting the request in the command descriptor block.

From zero to four Element Status Pages can be returned. One page is returned for each type of element with status information. Each page

contains a header and one or more element descriptors. Each element descriptor reports the status for a single library element.

The page header (bytes 0-7) contains information that defines the contents of the element descriptors for the elements of that type. The format of a status page is shown in Table 45.

Table 45: Element Status Page

Bit/Byte	7	6	5	4	3	2	1	0
0	Element Type Code							
1	PVolTag	AVolTag (0)	Reserved (00h)					
2	(MSB) Element Descriptor Length							
3								(LSB)
4	Reserved (00h)							
5	(MSB) Byte Count of Descriptor Data Available							
6								
7								(LSB)
8 - X	One or More Element Descriptors							

PVolTag A primary volume tag field value of one indicates that the primary volume tag information field is present in each of the following element descriptor blocks. A value of zero indicates that these bytes are omitted from the element descriptors that follow.

AVolTag The Alternate Volume Tag is not supported. This field is set to zero.

Element Descriptor Length This field indicates the number of bytes in each element descriptor.

Byte Count of Descriptor Data Available

The Byte Count of Descriptor Data Available indicates the number of bytes (minus seven) of descriptor data (excluding this header) that would be returned for the descriptors of the specified type if an adequate allocation length had been specified.

There are four different types of element descriptor blocks, one for each type of element. There are several fields which are found in more than one type of element descriptor as well as fields which are unique to an element descriptor.

The fields found in more than one type of element descriptor have been indicated by the same name in the illustrations and descriptions that follow.

The format of an element descriptor for an element of the medium transport element type is shown in Table 46.

Table 46: Medium Transport Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (00h)					Except	Rsvd (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (000000h)							
7								
8								
9	SValid (0)	Invert (0)	Reserved (00h)					
10	Source Storage Element Address (0000h)							
11								
12 - 47	Primary Volume Tag Information (if present)							

Bit/Byte	7	6	5	4	3	2	1	0
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Element Address This field indicates the address of the element being reported by that element descriptor.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state is available in the Additional Sense Code and Additional Sense Code Qualifier fields.

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero otherwise.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one.

SValid, Invert, and Source Storage Element Address

The source valid, source storage element address field and the invert bit information value of zero indicates these fields are not valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field will be included in the element descriptor. This field contains the information read from the bar code affixed to each tape cartridge; its format is shown in Table 47.

Table 47: Primary Volume Tag Information

Bit/Byte	7	6	5	4	3	2	1	0
12 - 43	Volume Identification Field							
44	Reserved (0000h)							
45								
46	Volume Sequence Number (0000h)							
47								

Volume Identification Field

This is a left justified sequence of ASCII characters representing the bar code scanned from the cartridge followed by 20h (blanks).

Volume Sequence Number This field is reserved and set to zero.

The format of an element descriptor for an element of the storage element type is shown in Table 48.

Table 48: Storage Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (0h)				Access	Except	Reserved (0)	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (000000h)							
7								
8								
9	SValid	Invert (0)	Reserved (00h)					
10	Source Storage Element Address							
11								
12 - 47	Primary Volume Tag Information (if present)							
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Element Address This field indicates the address of the element being reported by that element descriptor.

Access An access bit value of one indicates that access to the element by a medium transport element is allowed.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state will be available in the Additional Sense Code and Additional Sense Code Qualifier fields in that element descriptor. See the Request Sense Command for the meaning of the codes contained in the two Sense Code fields.

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero otherwise.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one. Currently, the only valid values for these fields indicate either the Element Contents Unknown condition (ASC=80 ASCQ=22), Cleaning Cartridge Installed (ASC=30 ASCQ=03) or Operation Medium Removal Requested (ASC=5A ASCQ=01).

SValid The SValid bit is set to one if the information in the Source Storage Element Address field is valid. If the information is unknown (due to a door open or power on condition) the SValid bit is set to zero.

Invert The invert field is not supported and is set to zero.

Source Storage Element Address

The Source Storage Element Address represents the address of the last storage element which held the cartridge. The SValid field indicates whether or not this information is valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field will be included in the element descriptor. See Table 47 for format.

The layout of an element descriptor for an element of the Import/Export element type is illustrated in Table 49.

Table 49: Import/Export Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (0)		Import Enable	Export Enable	Access	Except	Import Export	Full
3	Reserved (00h)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Reserved (000000h)							
7								
8								
9	SValid	Invert (0)	Reserved (00h)					
10	Source Storage Element Address							
11								
12 - 47	Primary Volume Tag Information (if present)							
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Import Element The Import Enable field indicates whether the element can import a tape cartridge into the library. It is set to one if imports are possible through that element and zero otherwise. This field is always set to one.

Export Enable The Export Enable field indicates whether the element can export a tape cartridge from the library. It is set to one (01h).

Access An access bit value of one indicates access to the element by a medium transport element is allowed. This is set to zero (0h) if the load port door is open.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state will be available in the Additional Sense Code and Additional Sense Code Qualifier fields in that element descriptor. See Appendix A for the meaning of the codes contained in the two Sense Code fields.

Import Export The Import/Export field is set to zero if the tape cartridge contained in the element was placed there by the transfer mechanism. It is set to one if the tape was placed there by an operator or if its source is unknown (e.g., after power cycle).

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero when the element contains no tape or the Load Port door is open.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one. Currently the only valid values for these fields indicate the Element Contents Unknown condition (ASC=80 ASCQ=22), Cleaning Cartridge Installed (ASC=30 ASCQ=03) and Operator Medium Removal Request (ASC=5A ASCQ=01).

SValid The SValid bit is set to one if the information in the Source Storage Element Address field is valid. If the information is unknown the SValid bit is set to zero.

Invert The invert field is not supported and is set to zero.

Source Storage Element Address

The Source Storage Element Address represents the address of the last storage element which held the cartridge. The SValid field indicates whether or not this information is valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field will be included in the element descriptor. See Table 33 for format.

The format of an element descriptor for an element of the data transfer element type is shown in Table 50.

Table 50: Data Transfer Element Descriptor

Bit/Byte	7	6	5	4	3	2	1	0
0	(MSB) Element Address							
1								(LSB)
2	Reserved (0h)				Access	Except	Rsvd (0)	Full
3	Reserved (00)							
4	Additional Sense Code							
5	Additional Sense Code Qualifier							
6	Not Bus	Rsvd	ID Valid	LU Valid	Rsvd	Logical Unit Number		
7	SCSI Bus Address							
8	Reserved (00h)							
9	SValid	Invert (0)	Reserved (00h)					
10	Source Storage Element Address							
11								
12 - 47	Primary Volume Tag Information (if present)							
48 - 51	Reserved (00000000h)							
52	Vendor Unique (0000h)							
53								

Element Address This field indicates the address of the element being reported by that element descriptor.

Access An access bit value of one indicates access to the element by a medium transport element is allowed.

Except The Exception field is set to one when that element is in an abnormal state. When the element is in a normal state, it is set to zero. Further information on the abnormal state will be available in the Additional Sense Code and Additional Sense Code Qualifier fields in that element descriptor. See the Request Sense Command for the meaning of the codes contained in the two Sense Code fields.

Full The Full field is set to one whenever the element contains a tape cartridge. It is set to zero otherwise.

Additional Sense Code and Additional Sense Code Qualifier

These fields are only valid if the Exception field is set to one. Currently the only valid values for these fields indicate the Element Contents Unknown condition (ASC=80 ASCQ=22), Cleaning Cartridge Installed (ASC=30 ASCQ=03) or any DLT™ drive error (ASC=8D or ASC=F3).

SValid The SValid bit is set to one if the information in the Source Storage Element Address field is valid. If the information is unknown (due to a door open or power on condition) the SValid bit is set to zero.

Invert The invert field is not supported and is set to zero.

Source Storage Element Address

The Source Storage Element Address represents the address of the last storage element which held the cartridge. The SValid field indicates whether or not this information is valid.

Primary Volume Tag Information

If the Volume Tag information was requested in the command block, the Primary Volume Tag Information field is included in the element descriptor. See Table 47 for format.

Rezero Unit (01h)

The Rezero Unit Command allows the host to home all library mechanisms.

The format of the Rezero Unit command is shown in Table 51.

Table 51: Rezero Unit Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (01h)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (000000h)							
3								
4								
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number is 0. This field indicates which logical unit the command is sent to.

Send Diagnostic (1Dh)

The library includes a built-in self test. This test is automatically performed when the library is turned on. It can also be performed by issuing the Send Diagnostic Command to the library. If the self-test passes, a Good status is returned. If the self-test fails, a Check Condition status is returned and the sense key is set to Hardware Error. The Additional Sense fields identify the type of failure. The description of the Request Sense command tells how to get the Sense data from the library and how to interpret the Sense data fields. The format of the Send Diagnostic command is shown in Table 52.

Table 52: Send Diagnostic Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (1Dh)							
1	Logical Unit Number			PF (1)	Reserved (0)	Self Test	Dev-OfL	Unit-OfL
2	Reserved (00h)							
3	(MSB) Parameter List Length (00)							
4	Parameter List Length (00) (LSB)							
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number must always be set to 0. This field indicates which logical unit the command is sent to.

PF A page format bit of one specifies that the Send Diagnostic parameters conform to the page structure as specified in the SCSI-2 standard. This bit must be set to one.

Self Test, DevOfL and UnitOfL

Figure 53 illustrates how the “Seltst”, “DevOfl” and “UnitOfl” bits determine which test will be performed. These tests verify that all major library subsystems are working as follows:

- Electronics Self-Test (Selftest 1)

This performs tests such as CPU Functionality, Buffer RAM Integrity and ROM Check sum as well as others. This test does not move any mechanical components.

- Functionality Test (Selftest 2)

This test checks the robotic systems.

Table 53: Selftest Bit Definitions

Selftst	DevOfl	UnitOfl	Selftest Action
0	0	0	Illegal Combination
0	0	1	No-Op
0	1	0	Illegal Combination
0	1	1	No-Op
1	0	0	Selftest 1
1	0	1	Selftest 2
1	1	0	Selftest 1
1	1	1	Selftest 2

Parameter List Length A parameter length of zero indicates that no data is transferred.

Send Volume Tag (B6h)

The Send Volume Tag command evaluates the element descriptors found by a Send Volume Tag command. The type of element (medium transfer, storage, import / export or data transfer) can be specified in the command as well as the starting address for evaluation.

The format of the Send Volume Tag command is shown in Table 54.

Table 54: Send Volume Tag Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (B6h)							
1	Logical Unit Number			Rsvd	Element Type Code			
2	(MSB) Starting Element Address							
3	(LSB)							
4	Reserved (00h)							
5	Reserved (0h)			Send Action Code (05h)				
6	Reserved (0000h)							
7								
8	(MSB) Parameter List Length (0028h)							
9	(LSB)							
10	Reserved (00h)							
11	Reserved (00h)							

Logical Unit Number The Logical Unit Number is 0.

Element Type Code This field is used to indicate which type of element (medium transport, storage, import / export, data transfer, or all) is to be acted on by this command.

0 indicates all element types reported.

1 indicates medium transport element.

2 indicates storage element.

3 indicates import / export element.

4 indicates data transfer elements.

Starting Element Address The Starting Element Address field specifies the starting point of the Volume Tag evaluation. Beginning with the first defined element with an address greater than or equal to the Starting Element Address, all defined, type matching elements will be tagged until the last element of the specified type.

Send Action Code The Send Action Code field specifies the test to be evaluated. The library only implements the “Translate - search primary tags - ignore sequence numbers” (05h) action.

Parameter List Length This field specifies the number of bytes in the Send Volume Tag Parameters. This value should always be 28h.

The format of the Send Volume Tag Parameters is shown in Table 55.

Table 55: Send Volume Tag Parameters

Bit/Byte	7	6	5	4	3	2	1	0
0-	(MSB) Volume Identification Template Field							
31								(LSB)
32	Reserved (0000h)							
33								
34	(MSB) Minimum Volume Sequence Number (0000h)							
35								(LSB)
36	Reserved (0000h)							
37								
38	(MSB) Maximum Volume Sequence Number (0000h)							
39								(LSB)

Volume Identification Template Field

The search template to be evaluated by the translate function. This may contain the '?' and '*' wildcards, where '?' will match any single character and '*' will match any number of characters. Any characters that follow the '*' wildcard are ignored.

Minimum Volume Sequence Number

Sequence numbers are not supported. This must be set to zero.

Maximum Volume Sequence Number

Sequence numbers are not supported. This must be set to zero.

Test Unit Ready (00h)

The host uses the Test Unit Ready Command to determine if a library is ready.

The library responds in one of the following ways, depending upon the state of the library:

- Returns a Good status.

Whenever the library is ready to accept a medium access command without returning a Check Condition status it returns this status in response to a Test Unit Ready command.

- Returns a Check Condition status.

When the library receives a Test Unit Ready command but is not ready to accept a medium access command, it sets the Additional Sense fields and returns this status. The meaning of the values in the Additional Sense fields are described along with the Request Sense command.

The format for the Test Unit Ready Command Descriptor Block is shown in Table 56.

Table 56: Test Unit Ready Command

Bit/Byte	7	6	5	4	3	2	1	0
0	Operation Code (00h)							
1	Logical Unit Number			Reserved (00h)				
2	Reserved (000000h)							
3								
4								
5	Reserved (00h)							

Logical Unit Number The Logical Unit Number must be set to 0. This field indicates which logical unit the message is sent to.

Appendix A
Sense Data Values

Introduction

Table A-1 lists message information that can be sent from the TL81X / TL894 library to the host computer. The table lists the following information:

- Sense Key
- Additional Sense Code (ASC)
- Additional Sense Code Qualifier (ASCQ)
- Message Name / Description and (potential) recovery action
- Valid Interfaces

  SCSI (Host Computer)

  Diag (Diagnostic Port / Computer)

  Both = SCSI and Diag

Note ***The Message Name / Description field may contain abbreviations as follows:***

LU	***Logical Unit***
REQ'D	***Required***
DEV	***Device***
Diag	***Diagnostics***
NVRAM	***Non-Volatile RAM***
A/D	***Analog-to-Digital***

Table is sorted by the data in the ASC column.

Table A1: Sense Data Values (Hexadecimal)

Sense Key	ASC	ASCQ	Message Name/Description	Interface
0	00	00	NO ADDITIONAL SENSE INFORMATION No recovery necessary.	Both
B	00	00	SCSI ABORT Command aborted because host sent SCSI Abort Message.	SCSI
2	04	00	LU IS NOT READY, CAUSE NOT REPORTABLE Check library unit power. Retry command.	Both
2	04	01	LOGICAL UNIT IN PROCESS OF BECOMING READY Wait for library unit to complete initialization.	Both
2	04	02	LOGICAL UNIT INITIALIZATION REQUIRED The status of some element(s) required by the specified operation is unknown. Issue and initialize the Element Status command to recover.	
2	04	03	LU IS NOT READY, MANUAL INTERVENTION REQ'D Initialization failed. Determine failure type by checking any previous error code returned to host. Correct the cause of the failure and toggle **STANDBY** switch.	Both
5	1A	00	PARAMETER LIST LENGTH ERROR Invalid parameter list length field specified by command.	SCSI
5	20	00	INVALID COMMAND OPERATION CODE Verify host command format using the *TL81X/TL894 Software Interface Guide.*	SCSI
5	21	01	INVALID ELEMENT ADDRESS Check Mode Sense data for correct element addresses.	SCSI
5	24	00	INVALID FIELD IN COMMAND DATA BLOCK Ensure all reserve fields are set to zero.	SCSI

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
5	25	00	LOGICAL UNIT IS NOT SUPPORTED Verify the logical unit field specified in the command contains a legitimate logical unit number. Check cabling to logical unit.	SCSI
5	26	00	INVALID FIELD IN PARAMETER LIST Verify Mode Select page fields.Verify that fields comply with the command format described in the *TL81X/TL894 Software Interface Guide.*	SCSI
5	26	02	PARAMETER VALUE INVALID Verify Mode Select page fields. Verify that fields comply with the command format described in the *TL81X/TL894 Software Interface Guide.* This response will also be returned for commands issued to the “Diagnostic” interface of the library if an invalid parameter is sent.	Both
6	28	01	IMPORT OR EXPORT ELEMENT ACCESSED Load Port door has been closed.	Both
6	29	00	POWER-ON, RESET OR BUS DEV. RESET OCCURRED Informational message. If power on occurs, the host user should assume the inventory may have been corrupted, and should ask the library for that information again.	Both
6	2A	01	MODE PARAMETERS CHANGED Mode parameters may have changed due to another host issuing a Mode Select command.	SCSI

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
-none- OR 5	30 30	03 03	CLEANING CARTRIDGE INSTALLED Indicates that the element contains a cleaning cartridge that is not “used-up”. This is returned with the element status data, which has no sense key. OR CLEANING CARTRIDGE INSTALLED • A cleaning cartridge cannot be removed from a drive because it is being used in a cleaning operation. • A cartridge cannot be placed into the drive because the drive is being cleaned. • A cartridge cannot be placed into an empty storage element because it is reserved for a cleaning cartridge that is currently in use in a drive cleaning operation.	SCSI Both
5	39	00	SAVING PARAMETERS NOT SUPPORTED Verify Save Parameter field in the Mode Sense command complies with the command format described in the *TL81X/TL894 Software Interface Guide.*	SCSI
5	3A	00	MEDIUM NOT PRESENT The inventory indicated that a cartridge was in this bin but no cartridge was sensed by the gripper when it attempted to pick it. Retry the command. Check for proper seating of the cartridge. It may also indicate that the tape is not ready to be picked from the drive because the tape is not fully unloaded. Retry the command. If the problem persists, check the function of the tape drive handle assembly. Manually unload the tape.	Both
5	3B	0D	MEDIUM DESTINATION ELEMENT FULL Destination element address already contains a cartridge. Issue a Read Element Status command and retry move command. If the problem repeats, issue an Initialize Element Status command followed by a Read Element Status command and retry move command.	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
5	3B	0E	MEDIUM SOURCE ELEMENT EMPTY Source element address does not contain a cartridge. Issue a Read Element Status command and retry move command. If problem repeats, issue an Initialize Element Status command followed by a Read Element Status command and retry the move command.	Both
B	43	00	SCSI MESSAGE ERROR Detected message error in message processing on the SCSI BUS.	SCSI
B	45	00	SELECT OR RE-SELECT FAILURE The TL81X / TL894 timed out trying to reselect host. Make sure host is running.	SCSI
B	47	00	SCSI PARITY ERROR Check cable connections and cable lengths.	SCSI
B	48	00	INITIATOR DETECTED ERROR Initiator Detected Error Message was received from the host.	SCSI
5	4E	00	OVERLAPPED COMMANDS ATTEMPTED Second command was sent when previous had not completed. This may also occur when executing off-line commands via the Control Panel and Diagnostic Port simultaneously.	Both
5	53	02	MEDIUM REMOVAL PREVENTED Prevent Medium Removal command was executed and command was received to export cartridge. Execute Allow Medium Removal command and retry move medium command.	SCSI
6	54	00	SCSI TO HOST SYSTEM INTERFACE FAILURE Possible SCSI bus time-out or premature disconnect. Check cable connections and cable length.	SCSI

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
2	5A	01	OPERATOR MEDIUM REMOVAL REQUEST • Indicates that the element contains a cleaning cartridge that is "used-up" and the system is unable to export the cleaning cartridge. Manually unload the tape. • The load port door is open, so import/export elements can not be accessed.	Both
2	80	00	DOOR IS OPENED INVENTORY MAY HAVE BEEN CORRUPTED Close door and retry command. If the system is ONLINE, it executes its initialization procedure.	Both
	80	01	DLT™ DRIVE REQUIRES CLEANING DLT™ tape drive indicates that drive needs cleaning. Clean the DLT™ tape drive. This is returned with element status data, which has no sense key.	SCSI
6	80	00	DOOR WAS OPENED INVENTORY MAY HAVE BEEN CORRUPTED Close door and retry command.	Both
5	80	01	TRANSFER FULL - COMMAND CAN NOT BE EXECUTED Gripper has cartridge in it. Move cartridge to empty storage element using Move Medium command. Retry command.	Both
B	80	01	TRANSFER FULL - AT END OF PLACE Gripper has cartridge in it at end of a place operation (Move Medium with a target other than the Transfer). Move cartridge to empty storage element using Move Medium command. Retry command.	Both
B	80	06	TRANSFER EMPTY - COMMAND ABORTED Gripper does not contain cartridge at end of pick portion of Move Medium command.	Both
2	80	07	SYSTEM IS STOPPED (BUTTON IS CURRENTLY PUSHED) The Control Panel **STOP** button was pressed. Press the **STOP** button.	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
6	80	07	SYSTEM STOP BUTTON WAS PRESSED (MAY CURRENTLY BE PRESSED) The Control Panel **STOP** button was pressed. Press the **STOP** button. Retry command.	Both
6	80	08	LOGICAL UNIT TURNED ONLINE The library is ready to communicate with the host computer. Press the Control Panel **STANDBY** switch to take the library offline.	Diag
2	80	09	LOGICAL UNIT IS TURNED OFFLINE The library is ready to communicate with the diagnostic PC. Press the Control Panel **STANDBY** switch to place the library online.	SCSI
6	80	09	LOGICAL UNIT STANDBY BUTTON WAS PRESSED Retry command.	SCSI
B	80	10	LOAD RETRY FAILED TL81X/TL894 was unable to successfully load the drive, even after retries. Check drive alignment. If problem continues, drive may need servicing.	Both
4	80	0A	NVRAM CHECKSUM FAILURE Nonvolatile RAM contents are corrupted. Ensure nonvolatile RAM ICs are seated correctly. Use the Diagnostic Software to initialize nonvolatile RAM and calibrate system.	Both
B	80	0B	COMMAND ABORTED BY USER Informational message. No action is necessary.	Both
B	80	0D	CARTRIDGE IS ONLY PARTIALLY GRIPPED (ONLY SEEN IN THE FRONT SENSOR). Issue a Move Medium command to move the cartridge from the transfer element to an empty storage element.	Both
4	80	0F	LOW POWER ERROR Check power connections.	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
4	80	11	MOTOR POWER FAILURE Indicates motor power turned off for a reason not otherwise reported. Toggle of the Stop button should clear.	Both
5	80	22	ELEMENT CONTENTS UNKNOWN The contents of an element address are unknown. Issue a Read Element Status for the element address. If contents are still unknown issue an Initialize Element Status command.	Both
4	80	23	BARCODE DECODER COMMUNICATION FAILURE Unable to initialize decoder. Verify that the decoder is powered on. Cycle power and / or check cable connections.	Both
B	81	01	GRIPPER TIMEOUT Gripper did not reach desired position. Issue a Rezero Unit command.	Both
B	81	04	GRIPPER OPEN FAILURE Gripper did not reach open position. Issue a Rezero Unit command. Check open sensor and cable connection.	Both
B	81	05	GRIPPER CLOSE FAILURE Gripper did not reach close position. Issue a Rezero Unit command. Check closed sensor and cable connection.	Both
4	81	50	REAR CASSETTE IN GRIPPER SENSOR IS BLOCKED, BUT FRONT SENSOR IS CLEAR Issue a Rezero Unit command. If condition repeats, check for a cartridge in the gripper and issue a Move Medium to an empty storage element.	Both
B	81	51	UNABLE TO PICK CARTRIDGE Cartridge was sensed in front gripper sensor, but was unable to seat cartridge in the rear gripper sensor. Check that gripper sensors are working and / or that tape was ejected far enough.	Both
4	81	53	GRIPPER CURRENT FAIL Gripper motor driver failed or operating out of specifications. Replace Actuator Driver Board.	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
4	81	54	GRIPPER TPU REGISTER FAILURE Replace Robotic Controller Board.	Both
4	81	55	GRIPPER TPU RAM FAILURE Replace Robotic Controller Board.	Both
B	83	01	EXTENSION TIMEOUT Extension axis did not reach desired position. Retry command. If failure repeats, use Diagnostic Software to run extension self-test.	Both
4	83	02	EXTENSION CURRENT FEEDBACK FAILURE Extension axis collided with obstruction. Determine cause of obstruction. Calibrate the system. Lubricate the rail.	Both
4	83	03	EXTENSION MECHANICAL POSITION ERROR Extension axis was unable to move to commanded position. Retry command. If failure repeats, run extension self-test.	Both
B	83	10	EXTENSION INVALID ACTUATOR START POSITION Extension axis position is unknown. Issue a Rezero Unit command.	Both
5	83	11	EXTENSION ACTUATOR CURRENT FEEDBACK TEST FAILURE Unable to detect current feedback during self-test. Check motor cable connection.	Both
4	83	21	EXTENSION ACTUATOR CURRENT FEEDBACK TEST FAILURE Unable to detect current feedback during self-test. Check motor cable connection.	Both
4	83	22	EXTENSION ACTUATOR ENCODER (OR MOTOR) TEST FAILURE The value of the extension encoder did not change during self-test. Check motor / encoder connector.	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
4	83	23	EXTENSION FLAG MISSING Extension axis home sensor or electronics failure. Check for obstacles in extension path. Check cable connectors.	Both
4	83	40	EXTENSION FORCE NOT REACHED During calibration or pushing into a drive, the extension never reached its intended force. If failure repeats, run extension self-test.	Both
4	83	41	EXTENSION FORCE OBJECT MISSING During calibration or pushing into a drive, the extension never made contact with any object.	Both
B	84	01	VERTICAL TIMEOUT Vertical axis did not reach desired position within the time limits. Retry command. If failure repeats, run vertical self-test.	Both
4	84	03	VERTICAL MECHANICAL POSITION ERROR Vertical axis did not reach desired position. Retry command. If failure repeats, run vertical self-test.	Both
4	84	08	VERTICAL HOME NOT FOUND Vertical axis did not reach the home position. Issue Rezero Unit and retry command. If failure repeats, run vertical self-test.	Both
B	84	10	VERTICAL INVALID ACTUATOR START POSITION Position of vertical axis is unknown. Issue a Rezero Unit command.	Both
5	84	11	VERTICAL INVALID COMMAND Vertical axis commanded to position out of system mechanical limits. Issue a Rezero Unit command. If problem persists, calibrate the library.	Both
4	84	20	VERTICAL TEST FAILURE The axis crossed no confirmation flags at expected velocities during self-test. Check flag sensor and cable connection. Check for obstacles in path. Check motor cable connection.	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
4	84	21	VERTICAL CURRENT TEST FAILURE Unable to detect current feedback during self-test. Check motor cable connection.	Both
4	84	23	VERTICAL POSITION OVERFLOW The position step counter overflowed. Issue a Rezero Unit command.	Both
4	84	24	VERTICAL HARDWARE ERROR Vertical actuator or sensor has failed.	Both
4	84	30	VERTICAL MAPPING FAILURE Scanner was unable to detect vertical target during calibration.	Both
4	84	31	VERTICAL CONFIRMATION FAILURE Unable to locate all confirmation flags. Check flag sensor and cable connections. Check for obstructions on vertical rail. If failure repeats, run vertical self-test.	Both
B	85	01	HORIZONTAL TIMEOUT Horizontal axis did not reach desired position within the time limits. Retry command. If failure repeats, use the Diagnostic Software to run horizontal self-test.	Both
4	85	03	HORIZONTAL MECHANICAL POSITION ERROR Horizontal axis did not reach desired position. Retry command. If failure repeats, use the Diagnostic Software to run horizontal self-test.	Both
4	85	08	HORIZONTAL HOME NOT FOUND Horizontal axis did not reach the home position. Issue Rezero Unit and retry command. If failure repeats, run horizontal self-test.	Both
B	85	10	HORIZONTAL INVALID ACTUATOR START POSITION Position of horizontal axis is unknown. Issue a Rezero Unit command.	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
5	85	11	HORIZONTAL INVALID COMMAND Horizontal axis commanded to position out of system mechanical limits. Issue a Rezero Unit command. If problem persists, calibrate the library.	Both
4	85	20	HORIZONTAL TEST FAILURE The axis crossed no confirmation flags at expected velocities during self-test. Check flag sensor and cable connection. Check for obstacles in path. Check motor cable connection.	Both
4	85	21	HORIZONTAL CURRENT TEST FAILURE Unable to detect current feedback during self-test. Check motor cable connection.	Both
4	85	23	HORIZONTAL POSITION OVERFLOW The position step counter overflowed. Issue a Rezero Unit command.	Both
4	85	24	HORIZONTAL HARDWARE ERROR Horizontal actuator or sensor has failed.	Both
4	85	30	HORIZONTAL MAPPING FAILURE Scanner was unable to detect horizontal target during calibration.	Both
4	85	31	HORIZONTAL CONFIRMATION FAILURE Unable to locate all confirmation flags. Check flag sensor and cable connections. Check for obstructions on horizontal rail. If failure repeats, run horizontal self-test.	Both
6	88	00	WARNING SAFE TEMPERATURE EXCEEDED This is only a warning that the temperature in the library exceeds the normal operational temperature (90^{o}F).	Both
4	88	01	MAXIMUM TEMPERATURE EXCEEDED Library turns off and remains off until the temperature returns to an acceptable level (59-90^{o}F).	Both

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
5	8A	02	UNCALIBRATED POSITION System requires calibration.	Both
B	8C	01	LOAD PORT TIMEOUT The door was unlocked but did not leave its current position before time-out (30 seconds). This may be due to the door being stuck, or in the case of a close operation, the operator not moving the door.	Both
4	8C	06	LOAD PORT DOOR OPEN The door is stuck in an intermediate position (not opened and not closed.) Operation intervention is required.	Both
B	8D	01	DLT™ DRIVE HANDLE MOTOR TPU TIMEOUT Replace Robotics Controller Board.	Both
B	8D	02	DLT™ DRIVE HANDLE MOTOR MOVE TIMEOUT Retry command. If failure repeats, power cycle unit. If failure repeats, run DLT™ Drive Handle self-test.	Both
4	8D	03	DLT™ DRIVE HANDLE MOTOR CPU RAM ERROR Replace Robotic Controller Board.	Both
4	8D	04	DLT™ DRIVE HANDLE MOTOR CPU REGISTER ERROR Replace Robotic Controller Board.	Both
4	8D	05	DLT™ DRIVE HANDLE MOTOR HARDWARE ERROR Stepper was unable to reach destination (open or close). Retry command. If failure repeats, run DLT™ Drive Handle self-test.	Both
4	8D	06	DLT™ DRIVE HANDLE MOTOR CURRENT FEEDBACK TEST FAILURE Unable to sense current feedback from stepper motor controller during self-test. Check motor cable connections.	Both
4	8E	01	FLASH MEMORY UNABLE TO IDENTIFY Flash is soldered onto the board. Replace the Robotic Controller.	Diag

Table is sorted by the data in the ASC column.

Sense Key	ASC	ASCQ	Message Name/Description	Interface
4	8E	02	FLASH MEMORY UNABLE TO ERASE Flash is soldered onto the board. Replace the Robotic Controller.	Diag
4	8E	03	FLASH MEMORY UNABLE TO PROGRAM Flash is soldered onto the board. Replace the Robotic Controller.	Diag
B	8F	00	LIBRARY UNIT COMMAND TIMED OUT Verify that communications to library still exists by issuing another command	SCSI
4	F3	02	DLT™ DRIVE COMMUNICATION TIMEOUT The library is unable to communicate with a drive.	Both
4	F3	11	DLT™ DRIVE HANDLE NOT OK The tape drive is reporting that the handle cannot open. (This may indicate that a DLT™ cartridge is present that has not been unloaded.)	Both

Appendix B

Control Panel Messages

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Introduction

The following tables provide a complete listing of the messages that can be displayed in the Control Panel Status Display Area (SDA). Each table provides a list of messages based on the "type" of message displayed in the SDA, as follows:

- System States
- Operator Messages
- Menu Mode Messages

Note ***In each of the following tables, Column #1, "Message", shows the two lines of the SDA. (If there is only one line of text in the message, it is displayed on Line #1.) Column #2, the "Description" column, provides a brief explanation of the message.***

System States

The system state describes the overall condition of the system including the status of the stop button, Load port and front door. It also monitors the activities that place the system in an 'online' condition.

Table B1: System States

Message	Description
Going Offline... Please Wait.	The library is transitioning from online to offline but must complete a command that is (currently) executing. When finished, "System Offline" is displayed in the SDA.
Going Online... Please Wait.	The library is transitioning from offline to online but must complete a command that is (currently) executing. When finished, "System Online" is displayed in the SDA.
Initializing... Wait for Online.	The library is performing actions to bring the unit to the online condition. (When the library *successfully* completes initialization, "System Online" is displayed in the SDA.)
LoadPort Active Please Wait.	The library is in the process of parking the carriage before the load port unlock operation is executed.
LoadPort Moving Please Wait.	The Load port is currently in neither the closed or opened position. This message is usually covered by the "Load Port Opening" or "Load Port Closing" operator messages, and will not be seen.
LoadPortRequest Please Wait.	The library is transitioning from offline or online to Load port Active, but must complete a command that is (currently) executing. When finished, "Load Port Active" is displayed in the SDA.
Off-line Failure	An operator action (such as operating the Load port while online, or commanding the unit to Offline while in the Initializing, Load Port Active or Going On of Offline States), has failed. After the error has been resolved, toggling the 'Stop Button' will command the library to enter 'Offline' States.
On-line Failure.	An operator action (such as commanding the unit to Online, or operating the Load port while online) has failed. After the error has been resolved, toggling the 'Stop Button' will command the library to attempt initialization again.

Message	Description
SystemDoorOpen.	The library front door is open.
System Offline.	The library is ready to accept commands from the Diagnostic PC (“DIAG” Port) or enter the Control Panel Menu Mode.
System Online.	The library is online and ready to communicate with the host computer.
System Power-Up.	This is the first message displayed in the SDA when the library power is cycled from “off” to “on”.
System Stopped.	The Control Panel STOP switch was pressed.

Operator Messages

Operator Messages assist on operator interacting with the library. These messages will obscure most other messages, but are temporary and will only last until the condition they are describing has past or they have been displayed too long (generally 80 sec).

Table B2: Operator Messages

Message	Description
LoadPort Closing Please Operate.	Informs the operator the Load port has unlocked and the operator must move the door to the closed position. This message will time-out after 30 seconds and the Load port will be locked again.
LoadPort Opening Keep Clear.	Informs the operator the Load port has unlocked and the door is swinging to the open position. It warns the operator to keep clear of the port while it is in motion.
Media Removal Not Allowed.	Informs the operator that the 'Media Removal' flag has been set to false, and the Load port cannot be opened. This message will go away after 30 seconds.

Menu Mode Messages

Refer to the *TL81X/TL894 Operator's Guidel* (Document EK-TL810-OG) for a detailed description of the "Menu Mode Messages."

Appendix C
Automatic Drive Cleaning Discussion

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Purpose and Scope

This appendix presents a detailed discussion of the Automatic Drive Cleaning feature for the TL81X / TL894 library.

Drive Cleaning Modes

Two modes of drive cleaning support are provided: Host Initiated Cleaning Mode and Fully Automatic Cleaning Mode.

Host Initiated Cleaning Mode

Drive cleaning in Host Initiated Cleaning Mode is initiated by the host. Although the library internally tracks cleaning cartridge movement and use, the library itself provides no cleaning support in this mode. The host is responsible for all cleaning functions such as detecting when a drive requires cleaning, tracking and selecting cleaning cartridges, initiating media movement of the cleaning cartridge to the drive and determining when a cleaning cartridge has been “used up”.

Fully Automatic Cleaning Mode

Drive cleaning in Fully Automatic Cleaning Mode is initiated by the library when it determines that a drive requires cleaning. The library monitors each drive’s status to determine when a drive requires cleaning. When the library determines that cleaning for a drive is required, it selects an available cleaning cartridge, handles media movement of the cleaning cartridge to and from the drive and supervises the cleaning operation in the drive. The library tracks cleaning cartridges, monitors cleaning cartridge use and determines when a cleaning cartridge has been “used up”. It will move “used up” cleaning cartridges to the loadport so that they can be manually unloaded.

Selection of Cleaning Mode

The cleaning mode is selectable by using either the diagnostic software, control panel, or through a host initiated Mode Select command. A host initiated Mode Select command is the only way to permanently change the cleaning mode in the library's NVRAM. The default cleaning mode is Host Initiated Cleaning Mode, which disables all library support for drive cleaning. The cleaning mode, if saved in the library's NVRAM, is retained when the library power is cycled.

Diagnostic Software

To enable Fully Automatic Cleaning Mode, select "Enable Clean Tape" from the "Config" Menu of the Diagnostic Software.

Control Panel

To enable Fully Automatic Cleaning Mode, select "Enable" from the "AutoClean" submenu of the "Configuration" menu from the control panel.

Note ***When the cleaning mode is selected using the diagnostic software or control panel, it is retained only until the library power is cycled. The diagnostic software and the control panel cannot permanently change the cleaning mode in the library's NVRAM.***

Mode Select Command (Host Initiated)

The cleaning mode may be set in the Vendor Unique Page 00h (which can be permanently saved to the library NVRAM) by the host using the Save Page bit. A host initiated Mode Select command is the only method that can permanently change the cleaning mode in the library's NVRAM.

Note ***A SCSI bus reset will not change the cleaning mode.***

To enable Fully Automatic Cleaning Mode, the host must set bit number 1 in the first parameter byte (following the Page Length byte in the vendor unique page).

To enable Host Initiated Cleaning Mode, the host must clear bit number 1 in the first parameter byte (following the Page Length byte in the vendor unique page). The cleaning mode can be permanently saved to the library's NVRAM by using the Save Page bit.

Reporting of Cleaning Mode

Reporting of the current cleaning mode may be obtained by using either the diagnostic software or through a host initiated Mode Sense command.

Diagnostic Software

To obtain a report of the current cleaning mode using the diagnostic software, select “Report Clean Tape” from the “Config” Menu. In response, the current cleaning mode is displayed as well as the bar code label, the number of uses of the cleaning cartridges, and the “home and current” storage element location for each of the cleaning cartridges in the library.

Mode Sense Command (Host Initiated)

A host initiated Mode Sense command can be used to obtain a report of the current cleaning mode. The type of report requested is determined by the Page Control field of the Mode Sense command and the data is located in bit number 1 in the first parameter byte (following the Page Length byte in the vendor unique page). A bit value of 1 indicates that Fully Automatic Cleaning Mode is enabled or that the mode is changeable, as appropriate. A bit value of 0 indicates that Host Initiated Cleaning Mode is enabled or that the mode is not changeable, as appropriate.

Cleaning Cartridges

In Host Initiated Cleaning Mode, the host is fully responsible for identifying, tracking and monitoring cleaning cartridges. Although the library internally tracks cleaning cartridge locations and use, this information is not available to the host.

In Fully Automatic Cleaning Mode, the library tracks cleaning cartridge locations, monitors cleaning cartridge use to determine when a cleaning cartridge has been “used up” and exports used cleaning cartridges from the library.

Capacity

A maximum of ten cleaning cartridges may be present in the library at any given time. If more than ten cleaning cartridges are present in the library, the library moves the additional cartridges to the loadport for manual unloading.

Identification

Cleaning cartridges are identified with a uniquely identifiable bar code. A bar code for a cleaning cartridge begins with the prefix “CLN”, for example “CLN001.”

Storage and Tracking

A cleaning cartridge is tracked by the library from the time that it is loaded into the library until the time that it is unloaded from the library. Once a cleaning cartridge with a particular bar code is unloaded from the library, the library no longer retains information concerning that cleaning cartridge (bar code). If a cleaning cartridge with the same bar code is subsequently imported into the library, it will be considered a different cleaning cartridge for all tracking and monitoring purposes.

Each cleaning cartridge must have a unique bar code. If a cleaning cartridge with a bar code is identical to one currently stored in the library, it is loaded, and the library moves the last recognized cleaning cartridge to the loadport.

As the library determines that drives require cleaning and cleaning cartridges are used to clean the drives, the library tracks the movement of the cleaning cartridges.

When a cleaning cartridge has been “used up”, it is moved to the loadport. The library tracks cleaning cartridges that are moved by a host initiated Move Medium command and by a movement command initiated by the diagnostic software.

The library attempts to adjust for cleaning cartridges that are manually moved within the library while the library is offline. When an inventory is performed after power-up, or after the library transitions from offline to online, all cartridges are scanned and identified. For each cleaning cartridge, the library first checks if the previous inventory shows that a cleaning cartridge with the same bar code was in the same location. If so, the library assumes that it is the same cleaning cartridge and retains all cleaning cartridge information.

If previous records do not show a cleaning cartridge with the same bar code at that location, the library checks if a cleaning cartridge with the same bar code label was previously located at another location (and is not currently at that other location). If so, the library assumes that it is the same cleaning cartridge that was manually moved and retains all cleaning cartridge information. If the library cannot locate a previous record for the cleaning cartridge, it assumes the cleaning cartridge is new and creates a new record for it.

Monitoring Usage

The library maintains a usage history for each cleaning cartridge currently contained within the library. The usage history consists of a count of the number of times that the cleaning cartridge was used to clean a drive.

When a cleaning cartridge has been successfully identified and imported into the library, the usage history for that cleaning cartridge is initialized so that the use count is zero (0).

Each time a cleaning cartridge is removed from a drive via the robotics (which is to assume that a drive cleaning operation has completed, either successfully or unsuccessfully), the "use count" for the cleaning cartridge used in the drive cleaning operation is incremented one count. If the "use count" has reached the maximum allowable number of 20 uses, (in Fully Automatic Cleaning Mode) the cleaning cartridge is moved to the loadport.

Note ***A library updates "use counts" for cleaning cartridges that are used in host initiated cleaning operations (regardless of the cleaning mode) as well as those used in library initiated cleaning operations.***

A cleaning cartridge that appears defective will have its number of uses set to the maximum allowable number to prevent further use. The library will then move the cartridge to the loadport.

When a cleaning cartridge has been exported from the library, all record of that cleaning cartridge is deleted and all monitoring of that cleaning cartridge ceases.

Element Status Information

The presence of cleaning cartridges results in the reporting of additional status information in response to host initiated Read Element Status commands. This additional information is only present in Fully Automatic Cleaning Mode and will be suppressed in Host Initiated Cleaning Mode. The additional information may consist of the Except bit being set and the Additional Sense Code and Additional Sense Code Qualifier values being filled-in as well as possible changes to the Access bit (describe below).

A storage element that contains a cleaning cartridge that *is not* used up has the Access bit set to 1, the Except bit set to 1 and the status set to Cleaning Cartridge Installed (ASC=30 ASCQ=03).

A storage element that contains a cleaning cartridge that *is* used up has the Access bit set to 1, the Except bit set to 1 and the status set to Operator Medium Removal Request (ASC=5A ASCQ=01).

A storage element that is empty but is the home location for a cleaning cartridge that is currently being used in a cleaning operation has the

Access bit set to 0, the Except bit set to 1 and the status set to Cleaning Cartridge Installed (ASC=30 ASCQ=03).

A data transfer element that is currently being cleaned as part of a fully automatic cleaning operation has the Access bit set to 0, the Except bit set to 1 and the status set to Cleaning Cartridge Installed (ASC=30 ASCQ=03).

Monitoring Drives

In Host Initiated Cleaning Mode, the host is fully responsible for monitoring the drives to determine when a drive indicates that cleaning is required.

In Fully Automatic Cleaning Mode, the library monitors the drives to determine when a drive indicates that cleaning is required.

Drive Interface

The library examines the drive flag “CLEANING_ REQUIRED.” When this flag is set, it indicates that the drive requires cleaning.

Drive Monitoring

All installed drives are checked following the completion of a system inventory and all drives meeting the conditions detailed in section “Drive Interface”, are noted as requiring cleaning. On the completion of a Move Medium command from any drive, only that drive is checked and if it meets the conditions detailed in section “Drive Interface,” it is noted as requiring cleaning.

Initiating Drive Cleaning Operations

In Host Initiated Cleaning Mode, the host is fully responsible for initiating and controlling drive cleaning operations. The host may choose to initiate a drive cleaning operation while in Fully Automatic Cleaning Mode. In these cases, the library updates the cleaning cartridge’s “use count,” but does not perform any other support functions for the cleaning operation.

In Fully Automatic Cleaning Mode, the library initiates drive cleaning operations for a drive after it has been determined that it requires cleaning. If two or more drives require cleaning, the drives are cleaned one at a time.

Selection of Cleaning Cartridges

When a drive cleaning operation is initiated, the library selects an available cleaning cartridge to use. Cleaning cartridges which have been “used up” will not be used.

If no usable cleaning cartridge can be found, the drive cleaning operation will not proceed. A cleaning cartridge must be loaded into the library before the drive can be cleared.

Media Movement to the Drive

When a cleaning cartridge has been successfully selected, the library attempts to move the cleaning cartridge to the drive requiring cleaning. If the movement operation cannot be successfully completed due to unrecoverable errors, the drive cleaning operation will not proceed. Wherever possible, the library attempts to return the cleaning cartridge to its original storage element. If an unrecoverable error occurs during the movement of a cleaning cartridge that prevents a subsequent host initiated command from successfully completing, the subsequent host initiated command will fail, Check Condition will be set in the returned status byte and a subsequent Request Sense returns the appropriate error (such as Transfer Element Full). Since the drive still indicates that it needs cleaning, a new drive cleaning operation is attempted if possible.

If a library initiated cleaning cartridge movement is in progress and the host issues a command that requires the use of the transport, the host initiated command is held until the library initiated movement command is complete. If an error occurs with the library initiated movement command, the host initiated command is processed following the error (but will likely encounter an error condition resulting from the previous library initiated command). If a subsequent error occurs, the host initiated command will fail, Check Condition will be set in the returned status byte and a subsequent Request Sense will return the appropriate error.

If the host attempts to move a cartridge to a cleaning cartridge’s home location while the cleaning cartridge is being used in a cleaning operation, the attempted Move Medium command will fail, Check Condition will be set in the returned status byte and a subsequent Request Sense will return a Cleaning Cartridge Installed status (SK=5 ASC=30 ASCQ=03). The cleaning cartridge’s original location is not available until either the library determines that the cleaning cartridge’s location has been emptied (with an Initialize Element Status), the library moves the cleaning cartridge to a different storage element.

Supervising the Drive Cleaning Operation

When a cleaning cartridge is successfully placed into the drive requiring cleaning, the drive automatically loads the cartridge and initiate the cleaning operation. The library is still available to service host initiated commands during the drive cleaning operation.

If the host attempts to move a cartridge into the drive that is being cleaned, the command will fail, Check Condition will be set in the returned status byte and a subsequent Request Sense will return a Cleaning Cartridge Installed status (SK=5 ASC=30 ASCQ=03).

Upon successful completion of the cleaning operation, the drive automatically rewinds the cleaning cartridge and unloads the cartridge.

Note ***Unsuccessful drive cleaning operations may not rewind and export the cartridge, especially if it is a regular data cartridge incorrectly labeled as a cleaning cartridge.***

If a drive does not complete the cleaning operation and the cleaning cartridge is automatically unloaded within five minutes, then the library classifies the cartridge as defective, marking it as unusable.

The library monitors the drive flag “HANDLE_OK” to determine when the cleaning cartridge has been unloaded by the drive.

When a cleaning cartridge is unloaded, the cleaning operation is considered complete. The library only attempts to clean the drive once each time that it is checked. If a cleaning operation is not successful, the drive will not be serviced again until the next time that the drive is checked.

Media Movement from the Drive

Whether a cleaning operation is successfully or unsuccessfully completed, the library increments the cleaning cartridge’s “use count” and attempts to move the cleaning cartridge back to its home location.

If an export or movement operation cannot be successfully completed due to unrecoverable errors, the library, wherever possible, attempts to return the cleaning cartridge to its original storage element so as to clear the transport element. If an unrecoverable error occurs during the movement of a cleaning cartridge that prevents a subsequent host initiated command from successfully completing, the subsequent host initiated command fails, Check Condition is set in the returned status byte and a subsequent Request Sense returns the appropriate error.

Unloading Cleaning Cartridges

Each time a cleaning operation is successfully or unsuccessfully completed, the library attempts to move all cleaning cartridges that have been marked as “used up” to the loadport.

If a or movement operation cannot be successfully completed due to unrecoverable errors, the library, wherever possible, attempts to return the cleaning cartridge back to its original storage element so as to clear the transport element.

If an unrecoverable error occurs during the movement of a cleaning cartridge that prevents a subsequent host initiated command from successfully completing, the subsequent host initiated command fails, Check Condition is set in the returned status byte and a subsequent Request Sense returns the appropriate error.

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Exabyte EXB-120 Emulation Discussion

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Purpose and Scope

This appendix presents a detailed discussion of the Exabyte EXB-120 Emulation Mode for the TL81X/TL894 library. It is intended to document the differences between the TL81X/TL894 Standard Interface Mode and the Exabyte Emulation Mode.

Host Interface Modes

Two Host Interface modes are provided on the TL81X/TL894 library: Standard Interface Mode and Exabyte EXB-120 Emulation Mode.

Standard Interface Mode

Standard Interface Mode is the default interface used while communicating with a host. This manual (except this appendix) describes the operations in Standard Interface Mode.

Exabyte EXB-120 Interface Mode

An optional Host Interface Mode that emulates an Exabyte EXB-120 is provided to allow use of host software that already integrates the Exabyte library.

Selection of Host Interface Mode

The Host Interface mode is selectable by using either the diagnostic software, control panel, or through a host initiated Mode Select command. The default Host Interface mode is Standard Interface Mode, as documented in the preceding sections of this manual. The Host Interface mode, if saved in the library's NVRAM, is retained when the library power is cycled.

Diagnostic Software

Setting the Host Interface mode using the Diagnostic Software (version 3.03 or later) requires the user to select a command from the "Exabyte" Option of the "Config" Menu. The mode is permanently saved to the library NVRAM.

To enable Exabyte Emulation Mode, select "ENABLE."

To enable Standard Interface Mode, select "DISABLE."

Control Panel

To set the Host Interface using the Control Panel select "Emulate Exabyte" from the "Configuration" Menu, then issue an "Enable" or "Disable" as appropriate. The mode will be permanently saved to the library NVRAM.

To enable Exabyte Emulation Mode, select "Enable."

To enable Standard Interface Mode, select "Disable."

Mode Select Command (Host Initiated)

The Host Interface mode may be set in Vendor Unique Page 00h. The mode can be permanently saved in library NVRAM by setting the Save Page bit.

Note ***A SCSI bus reset will not change the Exabyte Emulation mode.***

To enable Exabyte Emulation Mode, the host must set bit number 0 in the second parameter byte (byte 3 of the Vendor Unique Page 00h).

To enable Standard Interface Mode, the host must clear bit number 0 in the second parameter byte (byte 3 of the Vendor Unique Page 00h).

Reporting of Host Interface Mode

Reporting of the current Host Interface mode may be obtained by using either the diagnostic software or through a host initiated Mode Sense command.

Diagnostic Software

To obtain a report of the current Host Interface mode using the diagnostic software (version 3.03 or later), select “REPORT” from the “Exabyte” Option of the “Config” Menu. In response, the current Host Interface mode is displayed.

Mode Sense Command (Host Initiated)

A host initiated Mode Sense command can be used to obtain a report of the current Host Interface mode. The type of report requested is determined by the Page Control field of the Mode Sense command and the data is located in bit number 0 in the second parameter byte (byte 3 of Vendor Unique Page 00h). A bit value of 1 indicates that Exabyte Emulation Mode is enabled or that the mode is changeable, as appropriate. A bit value of 0 indicates that the Standard Interface Mode is enabled or that the mode is not changeable, as appropriate.

SCSI Command Differences

This section describes the operational differences of commands act in the Exabyte Emulation Mode, compared to the Standard Host Interface described in the other sections of this manual.

Inquiry (12h)

In Exabyte Emulation, the Inquiry command reports the Vendor ID field as "EXABYTE$_b$".and the Product ID field as "EXB-120$_{bbbbbbbbb}$," where "$_b$" is a blank character (20h). There is also a vender specific field, 20 bytes long filled with NULLs (00h), following the standard inquiry data (bytes 36-55).

Move Medium (A5h)

In Exabyte Emulation mode, the Move Medium command supports the vendor specific Entry / Exit Position field. The field is in bits 7-6 of byte 11 of the Move Medium command. Normally this field is unused, and set to 00b.

To command the TL81X / TL894 Load Port both the source and target elements must both be set to an element in the Load Port (40h - 43h in the standard configuration). The command will complete when the axis finishes the commanded motion.

To command the Load Port to Open, place a 01b in the EEPos field. The door will swing open automatically and completes when the door is locked open.

To command the Load Port to Close, place a 10b in the EEPos field. The door can not close automatically, so an operator message is sent to the Control Panel instructing the operator to close the Load Port. If the operator does not close the door within 30 seconds, the library generates an IOD Timeout Error (8 8C 01). The command completes when the door is locked closed and the Load Port is inventoried (if the library is configured to Auto-Inventory), or when the Load Port times out (if not closed after 30 seconds).

Unlike the Exabyte EXB-120 that is being emulated, the TL81X / TL894 is capable of operating when the Load Port is open. The TL81X / TL894 will perform any command it normally would, except of course a Move Medium to or from the Load Port.

Read Element Status (B8h)

In Exabyte Emulation Mode the Read Element Status command's Element Descriptor returns 52 bytes, omitting the vender unique bytes (bytes 52-53). Also, the Volume Identification field will only have valid data in the first 8 bytes (as opposed to 10 valid bytes in a TL81X/TL894) with the remainder being blanks (20h).

Receive Diagnostic Results (1Ch)

This command returns the Allocation Length of 0.

Request Sense (03h)

When in Exabyte Emulation Mode the Request Sense command's Data In phase only returns 18 bytes, omitting the TL81X/TL894 vender specific Additional Sense Bytes (bytes 18-20). No attempt is made to map reporting of TL81X/TL894 vender specific sense codes to Exabyte vender specific sense codes.

Send Diagnostic (1Dh)

When in Exabyte Emulation Mode the Send Diagnostic command will accept the Exabyte vender specific additional tests. No test is actually performed and OK Status is returned.

Write Firmware (C1h)

This vendor unique command is not implemented in the TL81X/TL894 in any host interface mode. Issuing this command returns Check Condition with sense data Invalid Command Operation Code (5 20 00).

Unsolicited Message Differences

Closing the load port does not generate the unsolicited message "Import/Export Accessed."

Exabyte Emulation Design Philosophy

The Exabyte Emulation is designed to accept as many commands as possible from a host designed to operate an Exabyte EXB-120 library. Where the operations of the TL81X / TL894 are a superset of Exabyte EXB-120 behavior, the extended behavior is retained. Where Exabyte EXB-120 behavior cannot actually be performed by the TL81X / TL894 efforts are made to responsibly mimic the interface interactions.

There are physical differences between the libraries that preclude some Exabyte EXB-120 commands from operating on a TL81X / TL894. Most of these commands, such as Receive Diagnostics, use a fixed response to mimic a successful call. The Write Firmware command should not act successful if not executed, so a Check Condition is returned.

There are capabilities of the TL81X / TL894 library that allows it to perform actions that an EXB-120 can not. This includes a move to the Transport Element, a move with the same source and target, or a third party reservation. Though an Exabyte EXB-120 would reject these commands, the TL81X / TL894 in Exabyte Emulation Mode will accept any commands that would operate in Standard Interface Mode. This super-set behavior will not cause problems for an Exabyte host as it only affects commands that would be an error to an Exabyte EXB-120.

Glossary

actuators	Robotic components that move inside the library to manipulate cartridges. These include the gripper, extension axis, vertical and horizontal axes.
automated tape library	A robotic storage and retrieval system for DLT™ cartridges.
bar code label	The identification label on DLT™ cartridges.
bar code scanner	A device that is mounted on the extension axis that reads the cartridge bar code labels.
calibration	The software measurements and configuration required for successful operation of the library.
control panel	The panel on the front of the library that contains the Status Display Area, as well as indicators and control switches.
DLT™	Digital Linear Tape (cartridge)
extension axis assembly	Mounted onto the vertical axis, the extension axis assembly consists of the gripper assembly and the horizontal axis on which the gripper assembly is mounted.
extension axis belt	The drive belt connecting the extension motor / gearbox to the gripper.
FCC Class A	Standard established by the U.S. Federal Communications Commission governing electromagnetic emissions.
FSE	Field Service Engineer
gripper assembly	The assembly that mounts on the extension axis and grips cartridges; referred to as the gripper.
horizontal belt	The drive belt connecting the horizontal motor to the horizontal axis assembly.
host	Host Computer
host computer	The computer that issues SCSI commands to control the library robotics.
LCD	Liquid Crystal Display
Load Port	The component of the library that allows cartridges to be imported and exported.

MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
NVRAM	Non-Volatile RAM
on-line	Ready for communications with a host.
PC	Personal Computer
pick	The act of removing a cartridge from one location in preparation for placing it in another location.
place	The act of placing a cartridge in a location after it has been picked from another location.
PROM	Programmable Read-Only Memory
RAM	Random Access Memory
rear panel	The rear cosmetic panel of the library that contains the power switch and connectors for attaching external cabling to the library.
RS-232	A serial communications cabling and protocol standard for nine-pin connectors.
SCSI	Small Computer System Interface communications standard for attaching peripheral equipment to small computers.
tape drive	The mechanism that reads and writes data from and to a tape.
TL810 library	The automated storage and retrieval component of an automated tape library system used for storing and handling DLT™ cartridges. The TL810 library uses TZ87 tape cartridges.
TL812 library	The automated storage and retrieval component of an automated tape library system used for storing and handling DLT™ cartridges. The TL812 library uses TZ88 tape cartridges.
TL894 library	The automated storage and retrieval component of an automated tape library system used for storing and handling DLT™ cartridges. The TL894 library uses TZ89 tape cartridges.
UL	Underwriters Laboratories
vertical belt	The drive belt connecting the vertical motor to the vertical axis assembly.
vertical carriage assembly	The crossbar and linear bearings mounted on the vertical rails and all components mounted on the crossbar.

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