IBM TS3500
with ALMS

Operator Guide

IBM

Edition notice

This edition applies to the ninth release of the *IBM TS3500 with ALMS Operator Guide* and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

Figures

Tables

Read this first

This is the ninth edition of the *IBM TS3500 with ALMS Operator Guide* (October 2015). This guide is published specifically for the TS3500 tape library with the Advanced Library Management System (ALMS).

What's new in this edition (October 2015)

Revision bars (|) appear next to all of the information that was added or changed since the release of the last edition (GA32–0594–08). Changes include:

- Support for the IBM® TS1070 tape drive F7A (LTO Ultrium 7)
- A new Simple Network Management Protocol (SNMP) Query Configuration capability that facilitates auditing the settings of all of IBM tape libraries by using a common Management Information Base (MIB)
- Support for new enhanced password rules
- The System Summary, Library Status now can display the number of active errors.

Ninth edition (September 2014)

The following information was new or updated in the ninth edition:

- Support for the IBM TS1150 tape drive (3592 Model E08)
- Extended information about IPv6 addresses

Eighth edition (November 2012)

The following information was new or updated in the eighth edition:

- Support for the IBM LTO Ultrium 6 tape drive
- Support for SNMP traps for No Motion Allowed (NMA) state
- Support for up to 80 web user accounts
- Support for the IBM 3592-C07 controller
- Support for an enhanced rack-mount TS3000 system console (TS3000)

Seventh edition (June 2011)

The following information was new or updated in the seventh edition:

- Introduction of shuttle technology and the TS3500 tape libraryshuttle complex
- New procedures for managing a shuttle complex
- Support for automatic eject of expired cleaning cartridges
- Support for the IBM TS1140 tape drive (3592 Model E07)
- Support for an 8 Gb Fibre Channel switch

Sixth edition (June 2010)

The following information was new or updated in the sixth edition:

- Instructions for enabling bar code compatibility so that the TS3500 tape library can read Silo-style bar code labels on 3592 tape cartridges
- Introduction of the TS3500 tape library Command Line Interface (CLI)
- Support for a secure connection to the Storage Authentication Service (SAS) server using Secure Socket Layer (SSL) certificates

Fifth edition (March 2010)

The following information was new or updated in the fifth edition:
- Enhanced node card prerequisite
- Support for the IBM TS1050 tape drive F5A (LTO Ultrium 5)
- Tape Library Specialist Web interface enhancements, including Library Preferences and Web Security
- Support for the Storage Authentication Service
- Support for a floating home cell in non-HD libraries
- Support for mixed media in HD libraries with dual accessors

Fourth edition (September 2009)

The following information was new or updated in the fourth edition:
- Higher cartridge capacity (more than 6 887 storage slots)
- Enhanced node card prerequisite
- Simple Network Management Protocol (SNMP) audit logging
- Encryption key path diagnostics on the Web
- Support for the Tivoli Key Lifecycle Manager (TKLM)
- TS3500 tape library Specialist Web interface enhancements
- Introduction of the rack-mountable TS3000 system console with optional internal modem

Third edition (December 2008)

The following information was new or updated in the third edition:
- Updated power features and power cords
- Introduction of the TS7700 Backend Switches (Models L23 and D23)

Second edition (November 2008)

The following information was new or updated in the second edition:
- Introduction of High Density (HD) Frames (Models S24 and S54)
- New and updated procedures for the operator panel and the Tape Library Specialist Web interface
- Introduction of the IBM Tape System Reporter application

First edition (September 2008)

The following information was new or updated in the first edition:
- Introduction of the IBM TS1130 tape drive (3592 Models E06 and EU6)

- Information specific for the TS3500 tape library with the Advanced Library Management System (ALMS)
- Additional information about remote support security
- Addition of Secure Socket Layer (SSL) for Ethernet network security
- An embedded SMI-S agent which works with the IBM TotalStorage Productivity Center (TPC) 3.3.1 and later
- Addition of Internet Protocol, version 6 (IPv6) functionality, allowing the 3584 library to operate under the following configurations:
  - IPv4 network only
  - IPv6 network only
  - Both IPv4 and IPv6 networks
- Updates to the operator panel and the Tape Library Specialist Web interface
- Updated data storage values for compliance with the International System of Units (SI) measurement

Send us your feedback

Your feedback is important in helping to provide the most accurate and high-quality information. If you have comments or suggestions for improving this publication, you can send us comments by email to starpubs@us.ibm.com or by using the Readers' Comments form at the back of this publication. Be sure to include the following information in your correspondence:

- Exact publication title
- Form number (for example, GA32–0689–00), part number, or EC level (located on the back cover)
- Page numbers to which you are referring

Note: For suggestions on operating enhancements or improvements, please contact your IBM Sales team.

Safety and environmental notices

This section contains information about safety notices that are used in this guide and environmental notices for this product.

Safety notices

Observe the safety notices when using this product. These safety notices contain danger and caution notices. These notices are sometimes accompanied by symbols that represent the severity of the safety condition.

Most danger or caution notices contain a reference number (Dxxx or Cxxx). Use the reference number to check the translation in the *IBM Systems Safety Notices*, G229-9054 manual.

The sections that follow define each type of safety notice and give examples.

Danger notice

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. A lightning bolt symbol always accompanies a danger notice to represent a dangerous electrical condition. A sample danger notice follows:

If the symbol is...	It means...
	DANGER: An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. *(D004)*

Caution notice

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition, or to a potentially dangerous situation that might develop because of some unsafe practice. A caution notice can be accompanied by one of several symbols:

If the symbol is...	It means...
	A generally hazardous condition not represented by other safety symbols.
Class II	This product contains a Class II laser. Do not stare into the beam. (*C029*) Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).
	A hazardous condition due to mechanical movement in or around the product.

If the symbol is...	It means...
> 18 kg (40 lb)	This part or unit is heavy but has a weight smaller than 18 kg (39.7 lb). Use care when lifting, removing, or installing this part or unit. (*C008*)

Sample caution notices follow:

Caution

The battery is lithium ion. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (*C007*)

Caution

The system contains circuit cards, assemblies, or both that contain lead solder. To avoid the release of lead (Pb) into the environment, do not burn. Discard the circuit card as instructed by local regulations. (*C014*)

Caution

When removing the Modular Refrigeration Unit (MRU), immediately remove any oil residue from the MRU support shelf, floor, and any other area to prevent injuries because of slips or falls. Do not use refrigerant lines or connectors to lift, move, or remove the MRU. Use handholds as instructed by service procedures. (*C016*)

Caution

Do not connect an IBM control unit directly to a public optical network. The customer must use an additional connectivity device between an IBM control unit optical adapter (that is, fibre, ESCON, FICON®) and an external public network. Use a device such as a patch panel, router, or switch. You do not need an additional connectivity device for optical fibre connectivity that does not pass through a public network.

Environmental notices

The environmental notices that apply to this product are provided in the*Environmental Notices and User Guide*, Z125-5823-xx manual. A copy of this manual is located on the publications CD.

Laser safety and compliance

Before using the TS3500 tape library, review the following laser safety information.

Class II laser product

The TS3500 tape library is a Class II laser product. It is important for you to be aware of the laser caution label. See Figure 1 on page xvii for an example of the label.

LASER RADIATION –
DO NOT STARE INTO BEAM

CLASS II LASER PRODUCT

P/N 50G0321

a06c0068
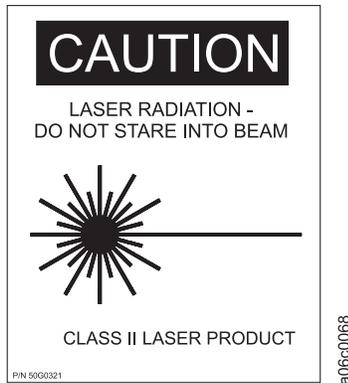
Figure 1. Laser safety caution label

This product complies with the performance standards set by the U.S. Food and Drug Administration for a Class II Laser product. This product belongs to a class of laser products that requires precautions be taken to avoid prolonged viewing of the laser beam. Under normal working conditions, you must not come in direct contact with the laser beam. This classification was accomplished by providing the necessary protective housings and scanning safeguards to ensure that laser radiation is inaccessible during operation or is within Class II limits. These products have been reviewed by external safety agencies and have obtained approvals to the latest standards as they apply to this product type.

Class I laser product

The TS3500 tape library contains a laser assembly that complies with the performance standards set by the U.S. Food and Drug Administration for a Class I laser product. Class I laser products do not emit hazardous laser radiation. Protective housing and scanning safeguards ensure that laser radiation is inaccessible during operation or is within Class I limits. External safety agencies have reviewed the library and have obtained approvals to the latest standards as they apply.

About this publication

This guide contains information about how to operate the IBM TS3500, also known as the 3584 tape library.

This publication provides an introduction to the TS3500 tape library with the Advanced Library Management System (ALMS) and explains how it interacts in both mainframe and Open Systems environments. While reading this publication, you learn about the library's primary components and how the library processes both Linear Tape-Open (LTO) Ultrium Tape Cartridges and 3592 Enterprise Tape Cartridges. A significant portion of this publication presents operating procedures, including how to power the library on or off, insert or remove cartridges, clean a drive, change a configuration, determine the status of components, perform an inventory, move a cartridge, configure logical libraries, and so forth. Instructions are given for operating the library from the operator panel or by using the IBM Tape Library Specialist Web interface. Additional chapters provide details about supported tape drives and media, problem determination procedures, TapeAlert messages, tape library frame capacities, and the locations and addresses of SCSI Elements. The appendix provides information about the electronic emission regulations that pertain to the TS3500 tape library in the United States and other countries or regions. It also contains information about the trademarks in this book. Overall, this book serves as a guide for operating the TS3500 tape library.

Who should read this book

This book is intended for operators and administrators of the IBM TS3500. It is recommended that you also read the *IBM TS3500 with ALMS Introduction and Planning Guide*.

Terminology used in this book

See the "Glossary" on page 399 for definitions of terms, abbreviations, and acronyms in this publication.

Related information

Refer to the following publications and sources for more information about the TS3500 tape library and its associated products.

The most recent publications are available on the web. To ensure that you have the latest publications, visit the web at http://www.ibm.com/support/us/en/.

The most up-to-date information is available on the web in IBM Knowledge Center. Go tohttp://www.ibm.com/support/knowledgecenter/STCMML8/ to see the TS3500 customer online documentation. Or, follow the instructions on the Knowledge Center welcome page to create your own information collection:http://www-01.ibm.com/support/knowledgecenter/.

Publications about the TS3500 tape library

Note: There are two versions of the TS3500 tape library Introduction and Planning Guide, as well as two versions of the TS3500 tape library Operator Guide. One

version of each document is specific to the TS3500 tape library with the Advanced Library Management System (ALMS) and provides details about features and functions that are only available for libraries with ALMS installed and enabled. Refer to the titles of each guide in order to determine which version you need.

- *IBM TS3500 Introduction and Planning Guide*, GA32-0559
- *IBM TS3500 Operator Guide*, GA32-0560
- *IBM TS3500 SCSI Reference*, GA32-0561
- *IBM TS3500 with ALMS Tape System Reporter User's Guide*, GA32-0589
- *IBM TS3500 with ALMS Introduction and Planning Guide*, GA32-0593
- *IBM TS3500 with ALMS Operator Guide*, GA32-0594 (This guide)
- *IBM TS3500 Maintenance Information* (provided with the TS3500 tape library)

IBM i, System i, and i5/OS source

For information about IBM i, System i, and i5/OS, visit the information center on the web at http://publib.boulder.ibm.com/iseries/.

IBM Power Systems and System p source

For information about the IBM Power Systems and System p, visit the information center on the web at http://www.ibm.com/servers/eserver/pseries.

IBM System z source

For information about the IBM System z server, visit the web at http://ibm.com/servers/eserver/zseries.

Other sources

- For a list of compatible software, operating systems, and servers for Ultrium tape drives, visit the web at http://ibm.com/storage/lto. Under**TS3500 Library**, select Product details. Under **Learn more**, select Interoperability matrix or select Independent Software Vendor (ISV) matrix for LTO.
- For a list of compatible software, operating systems, and servers for 3592 tape drives, visit the web at http://www.ibm.com/servers/storage/tape/drives. Under the tape drive model, select Product details. Under **Learn more**, select Interoperability matrix or Independent Software Vendor (ISV) matrix.
- *IBM Encryption Key Manager component for the Java™ platform Introduction, Planning, and User's Guide*, GA76-0418
- *IBM Tivoli Key Lifecycle Manager Quick Start Guide*, GI11-8744
- For more information about the Tivoli® Key Lifecycle Manager, visit the web: http://www-01.ibm.com/software/tivoli/products/key-lifecycle-mgr/
- To search the IBM Tivoli Key Lifecycle Manager Information Center, visit the web: http://publib.boulder.ibm.com/infocenter/tivihelp/v2r1/index.jsp?topic=/com.ibm.tklm.doc/welcome.htm
- *IBM 3953 Tape System Introduction and Planning Guide*, GA32-0557
- *IBM 3953 Library Manager Model L05 Operator Guide*, GA32-0558
- *IBM 3953 Tape Frame Model F05 Maintenance Information* (provided with the 3953 Tape System)
- *IBM TotalStorage Enterprise Silo Compatible Tape Frame 3592 Introduction, Planning, and User's Guide* Model C20, GA32-0463
- To search the *IBM 3592-C07 Customer Information Center*, visit the web at: http://publib.boulder.ibm.com/infocenter/etc/cust/index.jsp.

- *IBM 3592 Tape Drives and TS1120 Controller Operator Guide*, GA32-0556
- *IBM 3592 Tape Drives and TS1120 Controller Introduction and Planning Guide*, GA32-0555
- *IBM 3592 Tape Drive SCSI Reference*, GA32-0562
- *IBM TS3000 and TS4500 System Console Maintenance Information*
- *IBM TS7700 Series Introduction and Planning Guide IBM TS7700, TS7700 Cache Controller, and TS7700 Cache Drawer*, GA32-0567
- To search the IBM TS7700 Information Center, visit the web: http://publib.boulder.ibm.com/infocenter/ts7700/cust/index.jsp
- *IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference*, GA32-0450
- *Systems Safety Notices*, G229-9054. This publication is available at http://www.ibm.com/servers/resourcelink. To access, register for a userid and password, then select Library in the navigation area.
- *IBM Tape Device Drivers Installation and User's Guide*, GC27-2130. This user's guide is available for download from the IBM Support portal:
    1. Open the following URL in your web browser: http://www.ibm.com/support/us/en/.
    2. Enter the publication title within double quotation marks in the **Search support** text box and then click the blue button.
    3. Click **IBM Tape Device Drivers Installation and User's Guide**.
    4. Click the PDF file to download the user's guide.
- *IBM Tape Device Drivers Programming Reference*, GA32-0566
- *Implementing IBM Tape in Linux and Windows*, SG24-6268. This book is available on the Web at http://www.redbooks.ibm.com/redpieces/pdfs/sg246268.pdf.
- *Implementing IBM Tape in Unix Systems*, SG24-6502. This book is available on the Web at http://www.redbooks.ibm.com/redbooks/pdfs/sg246502.pdf.
- *The IBM TotalStorage Tape Libraries Guide for Open Systems*, SG24-5946
- *The LTO Ultrium Primer for IBM eServer iSeries Customers*, REDP-3580. This book is available on the Web at http://www.redbooks.ibm.com/. Search on REDP-3580.
- *IBM TS3500 Tape Library Data Gathering - Introduction to Library Statistics*, a white paper that is available from your IBM Representative
- *IBM TotalStorage 3584 Tape Library Performance*, a white paper that is available from your IBM Representative
- To access installation instructions for customer-setup units (CSUs) from the web, go to http://www-03.ibm.com/servers/storage/tape/resourcelibrary.html#publications. Under **Technical support**, select 3584 Tape Library. Then, under **Support and downloads**, select Documentation.
- *IBM LTO Ultrium Cartridge Label Specification (Revision 2)*. This document is available on the Web at http://www.ibm.com/servers/storage/support/lto/3584/. Under **Additional resources**, select LTO Ultrium media. Under **Learn more**, select LTO label specifications. Under **Abstract**, select the PDF file to access the document.
- *Label Specification for IBM 3592 Cartridges when used in IBM Libraries*. This document is available on the web at http://www-03.ibm.com/systems/storage/media/3592/index.html. Under **Learn more**, select Barcode Label Specification for use with 3592 Tape Media. You can also contact your IBM Marketing Representative for this specification.

Authorized suppliers of bar code labels

You can order bar code labels directly from the authorized label suppliers listed in the table below.

Attention: The IBM TS3500 is designed to work with bar code labels that meet the specifications and requirements set forth in the *IBM LTO Ultrium Cartridge Label Specification (Revision 2)* and the *Label Specification for IBM 3592 Cartridges when used in IBM Libraries*. The following label providers have demonstrated the ability to produce finished bar code labels that meet the foregoing specifications and requirements. This information is provided for the convenience of TS3500 tape library users only, and is not an endorsement or recommendation of such providers. IBM is not responsible for the quality of bar code labels procured from sources other than IBM. This information is applicable to bar code labels actually printed by the listed companies. IBM has not reviewed the quality of any labels produced by software or services offered by such companies which allow end users to print labels on their own printing equipment.

Table 1. Authorized suppliers of custom bar code labels

In the Americas	In Europe and Asia
Dataware PO Box 740947 Houston, TX 77274 U.S.A. Telephone: 800-426-4844 or 713-432-1023 Fax: 713-432-1385 http://www.datawarelabels.com/	Not applicable
Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U.S.A. Telephone: 888-438-8362 or 303-464-3508 Fax: 888-438-8363 or 303-666-2166 http://www.tri-optic.com	EDP Europe Limited 43 Redhills Road South Woodham Ferrers Chelmsford, Essex CM3 5UL U.K. Telephone: 44 (0) 1245 322380 Fax: 44 (0) 1245 323484 http://www.edpeurope.com/media-labels.html
Netc, L.L.C.[1] 100 Corporate Drive Trumbull, CT 06611 U.S.A. Telephone: 203-372-6382 Fax: 203-372-0676 http://www.NetcLabels.com	Netc Europe Ltd[1] The Old Surgery 5a The Pavement North Curry TA3 6LX Somerset U.K. Telephone: 44 (0) 1823 491439 Fax: 44 (0)1823 491373 http://www.NetcLabels.co.uk
	Netc Asia Pacific Pty Ltd[1] PO Box 872 Cooroy QLD 4563 Australia Telephone: 61 (0) 7 5442 6263 Fax: 61 (0) 7 5442 6522 http://www.NetcLabels.com.au
Note: 1. This is an authorized supplier for radio frequency identification (RFID) labels.	

Data storage values

TS3500 tape library documentation displays data storage values using both decimal (base-10) prefixes and binary (base-2) units of measurement.

Decimal units such as K, MB, GB, and TB have commonly been used to express data storage values, though these values are more accurately expressed using binary units such as KiB, MiB, GiB, and TiB. At the kilobyte level, the difference between decimal and binary units of measurement is relatively small (2.4%). This difference grows as data storage values increase, and when values reach terabyte levels the difference between decimal and binary units approaches 10%.

To reduce the possibility of confusion, the TS3500 tape library documentation represents data storage using both decimal and binary units. Data storage values are displayed using the following format:

```
#### decimal unit (binary unit)
```

By this example, the value 512 terabytes is displayed as:

```
512 TB (465.6 TiB)
```

Table 2 compares the names, symbols, and values of the binary and decimal units. Table 3 shows the increasing percentage of difference between binary and decimal units.

Table 2. Comparison of binary and decimal units and values

Decimal			Binary		
Name	**Symbol**	**Value (base-10)**	**Name**	**Symbol**	**Value (base-2)**
kilo	K	10^3	kibi	Ki	2^{10}
mega	M	10^6	mebi	Mi	2^{20}
giga	G	10^9	gibi	Gi	2^{30}
tera	T	10^{12}	tebi	Ti	2^{40}
peta	P	10^{15}	pebi	Pi	2^{50}
exa	E	10^{18}	exbi	Ei	2^{60}

Table 3. Percentage difference between binary and decimal units

Decimal Value	Binary Value	Percentage Difference
100 kilobytes (KB)	97.65 kibibytes (KiB)	2.35%
100 megabytes (MB)	95.36 mebibytes (MiB)	4.64%
100 gigabytes (GB)	93.13 gibibytes (GiB)	6.87%
100 terabytes (TB)	90.94 tebibytes (TiB)	9.06%
100 petabytes (PB)	88.81 pebibytes (PiB)	11.19%
100 exabytes (EB)	86.73 exbibytes (EiB)	13.27%

Chapter 1. Introduction

This chapter introduces the IBM TS3500 (TS3500 tape library), machine type 3584, formerly referred to as the 3584 tape library. This information is specific to the TS3500 tape library with the Advanced Library Management System (ALMS).

Overview

The IBM TS3500 tape library is a highly scalable, stand-alone device that provides reliable, automated tape handling and storage for both mainframe and Open Systems environments.

Figure 2 on page 2 shows a 6-frame version of the TS3500 tape library. An individual library, or *library string*, consists of one base frame and up to 15 expansion frames and can include up to 192 tape drives and more than 20 000 tape cartridges. The flexibility to connect multiple library strings to create a *shuttle complex* greatly increases opportunities for growth, as well as the maximum cartridge capacity. In addition to scalability, the TS3500 tape library offers the following enhancements:

- Enhanced data accessibility through dual accessors that increase speed and provide failover protection
- Enhanced data security through support for tape drive encryption and write-once-read-many (WORM) cartridges
- Increased storage capacity with high-density (HD) frames that greatly increase capacity without requiring more floor space
- Increased growth flexibility with shuttle technology, even in physically constrained environments
- Greatly increased cartridge capacity in a shuttle complex without the need for additional tape drives

These features are explained in greater detail in the *IBM TS3500 tape library with ALMS Introduction and Planning Guide*.
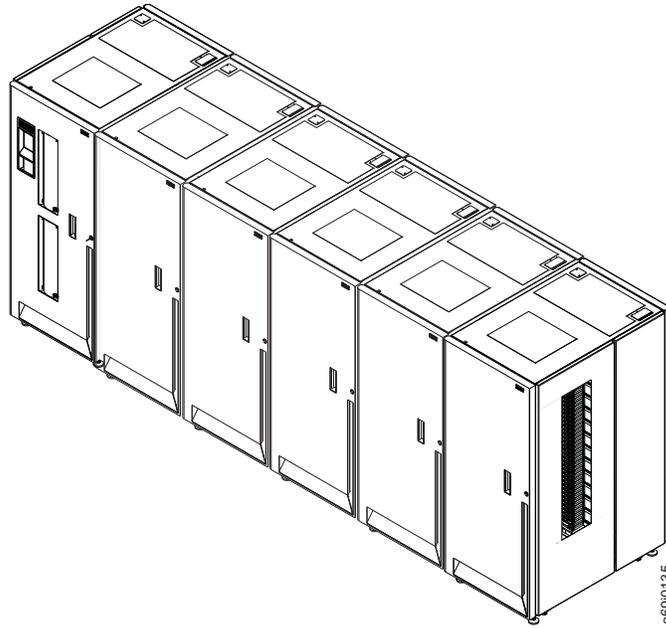
Figure 2. The TS3500 tape library

The TS3500 tape library comes with several tape drive, frame model, and feature options to meet your specific needs. Some additional features of the TS3500 tape library are listed here:

- Ability to attach multiple simultaneous heterogeneous servers
- Remote management using a web browser or the TS3500 Command Line Interface program
- Remote monitoring using Simple Network Management Protocol (SNMP)
- Multipath architecture
- Drive/media exception reporting
- In-depth reporting using the Tape System Reporter
- Host-based path failover
- Up to 224 I/O slots (16 I/O slots standard)

Table 4 on page 3 gives potential library capacity based on supported frames and configurations.

Table 4. TS3500 tape library configurations

Supported configurations			
A library including these models	**With these drives**	**Can contain this many cartridges[1, 2]**	**And has this maximum native capacity[3]**
L5x, D5x, and S54	Ultrium tape drives	> 20 000	150 PB (133.23 PiB)
L32, D32, and S54[4, 5]	Ultrium tape drives	> 20 000	50 PB (44.41 PiB)
L2x, D2x, and S24	3592 tape drives	> 15 000	150 PB (133.23 PiB)
L5x, D5x, S54, and SC1	Ultrium tape drives	> 300 000	1 800 PB (1 598.72 PiB)
L32, D32, S54, and SC1[4, 5]	Ultrium tape drives	> 300 000	750 PB (666.1 PiB)
L2x, D2x, S24, and SC1	3592 tape drives	> 225 000	2.25 EB (1.95 EiB)

Notes:

1. In order to support code level 9500 or higher, all node cards in the library must be xx3-equivalent node cards. For xx2 models, this requires a xx3 model conversion OR the enhanced node card(s) feature (FC 1700 or 1701).

2. In order to increase the maximum number of cartridges to more than 6 887, or to support a shuttle complex, logical libraries must use LTO Ultrium 4, 3592 E05, or later tape drives as control path drives. In order to support more than 6 887 cartridges, Ultrium 4 control path drives require a minimum code level of 97F0. For logical libraries with shuttle stations assigned, Ultrium 4 control path drives require a minimum code level of A480 and Ultrium 5 control path drives require a minimum code level of B170.

3. The maximum native capacity figures are based on library configurations with high density (HD) frames and these drives:

   For library configurations with no x32 frames, all Ultrium 7 or 3592 E08 tape drives.

   For library configurations with x32 frames, all Ultrium 6 or 3592 E08 tape drives.

   In addition, the figures for libraries with Model SC1 (shuttle connection) are based on the maximum shuttle complex configuration.

4. Ultrium 7 tape drives are not supported in model x32 frames.

5. In order to support Ultrium 6 tape drives, libraries with an L32 frame require enhanced grippers (FC 2205 or 2304).

For detailed information regarding tape drives supported by the TS3500 tape library, and the data rate and capacity for these drives, see "Supported tape drives" on page 14. For information regarding supported tape media, refer to "Supported tape cartridges" on page 23. For details regarding frame models and frame capacity, see "Structure of the library" on page 4. For information about the shuttle complex and Model SC1, refer to "Structure of the shuttle complex" on page 11.

For additional information regarding supported tape drives, supported tape cartridges, attachment interfaces, and the structure of the library, refer to the appropriate sections in the *IBM TS3500 tape library with ALMS Introduction and Planning Guide*.

Structure of the library

A description of base and expansion frames, and the models of the TS3500 tape library.

The basic TS3500 tape library is a single storage unit known as the *base frame* (Models L32, L52, or L53 for LTO Ultrium tape drives, or Models L22 or L23 for 3592 tape drives). The library's scalability allows you to increase capacity by adding up to 15 additional storage units, called *expansion frames* (Models D32, D52, D53, and S54 for LTO Ultrium tape drives or Models D22, D23, and S24 for 3592 tape drives). The frames join side by side, with the base frame on the left and the expansion frame on the right. The additional expansion frames are supported by a common cartridge accessor that requires no pass-through mechanism. Frame Models D22, D23, D32, D52, and D53 can contain up to 12 Ultrium tape drives or 3592 tape drives, but cannot contain a mix of both.

High-density frames, referred to hereafter as HD frames, greatly increase library capacity. HD frame Model S54 can contain up to 1 320 Ultrium tape cartridges and HD frame Model S24 can contain up to 1 000 IBM 3592 tape cartridges. The HD frames offer increased capacity without increasing frame size or required floor space by using high density storage slots for tape cartridges, referred to hereafter as HD slots. For more information, see "High-density technology" on page 9. In addition, HD frames can support shuttle stations that enable connections between multiple TS3500 tape library strings. For more information, see "Structure of the shuttle complex" on page 11.

Note: Base frame models L22, L23, L52, L53, and L32 are referred to hereafter as *base frames*, unless model-specific information is discussed. Expansion frame models D22, D23, D52, D53, D32, S24, and S54 are referred to hereafter as *expansion frames*, unless model-specific information is discussed.

The TS3500 tape library features an optional second cartridge accessor. If you order dual accessors, two frames that are used as *servicebays* are required. Service bay A is known as Model HA1 and service bay B is a Model D23, D22, D52, D53, S24, or S54 frame.

Note: In order to support mixed media in an HD library with dual accessors, service bay B must be a model Dxx frame. This configuration requires feature code 1697, which ensures that the service bays provide both LTO and 3592 HD test slots.

For bulk media handling, the TS3500 tape library supports four I/O stations in newly purchased Models D23 and D53 frames. The D-frame with I/O installed is comprised of four independently accessible I/O station doors with a total of 64 slots (16 in each I/O station door). Additionally, two LED indicators are provided for each I/O station in a D-frame in order to indicate if the I/O station is empty or full and if the I/O station door is locked or unlocked. This plant feature reduces the frame storage slot capacity by 160 for a Model D23 and by 176 for a Model D53. The I/O stations increase the maximum library I/O slot capacity from 32 to 224. The multiple I/O stations can double the maximum insert and eject throughput since both accessors can be used. The D23 and D53 models remain compatible with existing Models L22, L32, L52, D22, D32, and D52.

The models of the TS3500 tape library vary depending on the type of media they contain and whether the frame is a service bay, a base frame, or an expansion frame. Table 5 on page 5 lists each frame and its characteristics.

Table 5. TS3500 tape library frame models

Frame model	Type	Depth	Media type and capacity		Other
HA1	Service Bay A	Short	N/A	N/A	• Required when an optional second accessor is ordered • Contains slots for diagnostic cartridges only
L22	Base frame	Short	3592	Up to 12 drives and up to 260 cartridges	• Might require L23 model conversion OR installation of FC 1700[1]
L23	Base frame	Short	3592	Up to 12 drives and up to 260 cartridges	• Equipped with the enhanced frame control assembly • Optionally equipped with backend Fibre Channel switches
D22	Expansion frame	Short	3592	Up to 12 drives and up to 400 cartridges	• Optionally configured as service bay B • Might require D23 model conversion OR installation of FC 1701[1]
D23	Expansion frame	Short	3592	Up to 12 drives and up to 400 cartridges	• Optionally equipped with the enhanced frame control assembly • Optionally equipped with backend Fibre Channel switches • Optionally equipped with four I/O stations • Optionally configured as service bay B, if not equipped with four I/O stations
S24	Expansion frame	Short	3592	Up to 1 000 cartridges	• Optionally configured as service bay B • Optionally equipped with a shuttle station
L32[2]	Base frame	Long	LTO Ultrium	Up to 12 drives and up to 281 cartridges	• Might require installation of FC 1700[1] • Might require installation of FC 2205 or 2304[3]
D32[2]	Expansion frame	Long	LTO Ultrium	Up to 12 drives and up to 440 cartridges	• Might require installation of FC 1701[1]
L52	Base frame	Short	LTO Ultrium	Up to 12 drives and up to 287 cartridges	• Might require L53 model conversion OR installation of FC 1700[1]
L53	Base frame	Short	LTO Ultrium	Up to 12 drives and up to 287 cartridges	• Equipped with the enhanced frame control assembly

Table 5. TS3500 tape library frame models (continued)

Frame model	Type	Depth	Media type and capacity		Other
D52	Expansion frame	Short	LTO Ultrium	Up to 12 drives and up to 440 cartridges	• Optionally configured as service bay B • Might require D53 model conversion OR installation of FC 1701[1]
D53	Expansion frame	Short	LTO Ultrium	Up to 12 drives and up to 440 cartridges	• Optionally equipped with the enhanced frame control assembly • Optionally equipped with four I/O stations • Optionally configured as service bay B, if not equipped with four I/O stations
S54	Expansion frame	Short	LTO Ultrium	Up to 1 320 cartridges	• Optionally configured as service bay B • Optionally equipped with a shuttle station

Note:

1. Prerequisite for any frame with a node card installed in a library string with code level 9500 or higher.
2. Ultrium 7 tape drives are not supported in model x32 frames.
3. In order to support Ultrium 6 tape drives, libraries with an L32 frame require enhanced grippers (FC 2205 or 2304).

Models L22, D22, L23, D23, L52, D52, L53, D53, S24, and S54 are compatible with Models L32 and D32, but require additional features because they use different side and rear covers. If you change from a Model L32 or D32 to a Model D22, D23, D52, D53, S24, or S54 (or from a Model D22, D23, D52, D53, S24, or S54 to a Model D32) within the same library you may also need the appropriate side covers.

When expanding an installed library, an expansion frame is installed at the end of the library string (*end of the library string* refers to the very last frame or, if requested by the customer, the last frame before service bay B). In order to have the expansion frame installed somewhere other than the end of the library string, the IBM service representative must obtain a service contract to uninstall additional frames as necessary to accommodate the customer's request.

The IBM Tape Library Specialist Web interface and 10/100 Ethernet support are included with Models L22, L23, L52, and L53. For Model L32, they are available as feature codes 1662 and 1660, respectively.

Figure 3 on page 7 shows an example of a base frame and an expansion frame. A Model L23 or L53 (base frame) is on the left. A Model D23 or D53 (expansion frame) is on the right and attaches to the base frame.
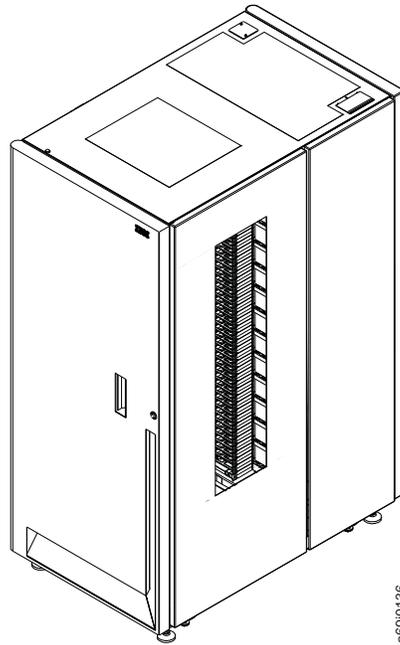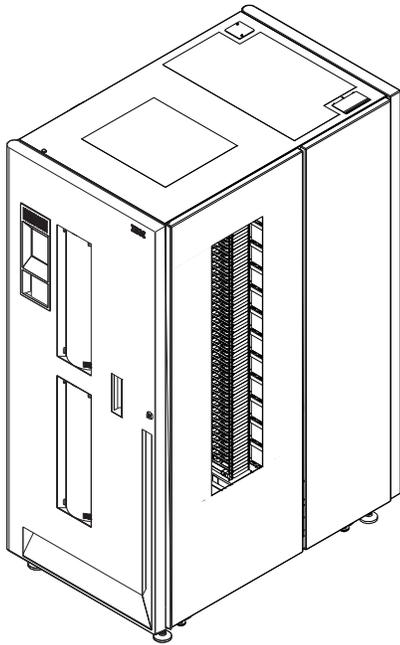
Figure 3. Frames in the IBM TS3500

Dual accessors and service bays

A description of dual accessors and service bays and how they can enhance library performance.

When an optional second accessor is installed, the TS3500 tape library features enhanced availability by using an extra accessor. The extra accessor enables the library to operate without disruption if any component of the working accessor fails.

If the library is installed with the optional second accessor, cartridge mount performance is also optimized. (A *mount* occurs when the accessor removes a cartridge from a drive, returns it to its storage slot, collects another cartridge from a random storage slot, moves it, and loads it into the drive.) The second accessor is part of feature code 1440 (Service Bay B Configuration), which can be ordered with expansion frames used as service bay B. If you order a second accessor you must also order a 3584 high availability (HA1) frame, which is also known as service bay A.

As you view the library from the front, service bay A (the HA1 frame) is on the far left and service bay B is on the far right. Figure 4 shows the location of service bays in the TS3500 tape library.
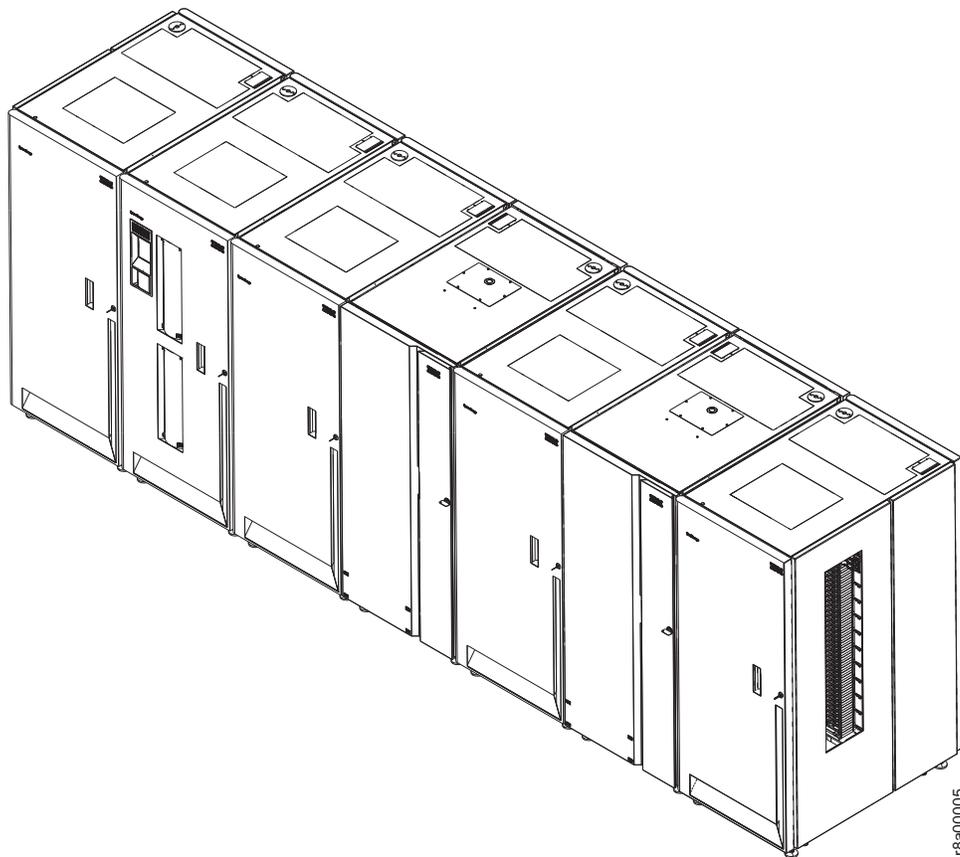
Figure 4. Location of service bays in the TS3500 tape library

When dual accessors are installed and an attached host issues a command for cartridge movement, the library automatically determines which accessor can

perform the mount in the most timely manner. If the library's primary accessor fails, the second accessor assumes control and eliminates system outage or the need for operator intervention.

Although the library uses defaults to specify the zones (areas) in which the accessors operate, you can specify particular zones by using the Tape Library Specialist Web interface. This process is called setting the preferred zone. For details, see "Using the Web to set or change the preferred zone of an accessor" on page 166.

For information about library availability and performance, go to the section about library performance in the *IBM TS3500 with ALMS Introduction and Planning Guide*.

High-density technology

The TS3500 tape library offers high-density, storage-only frame models (HD frames) designed to greatly increase storage capacity without increasing frame size or required floor space. The new HD frames (Model S24 for 3592 tape cartridges and Model S54 for LTO tape cartridges) contain HD storage slots.

HD slots contain tape cartridges in a tiered architecture. The cartridge immediately accessible in the HD slot is a Tier 1 cartridge. Behind that is Tier 2, and so on. The maximum tier in an LTO (Model S54) HD slot is Tier 5. The maximum tier in a 3592 (Model S24) HD slot is Tier 4 because the 3592 tape cartridge is slightly longer than the LTO cartridge. The single-deep slots on the door side of HD frames are referred to as Tier 0 slots. On the left, Figure 5 on page 10 shows the inside of an HD frame from the side. On the right, Figure 5 on page 10 shows a top-down view of one row of an HD frame with cartridges in Tiers 0 (door side), 1, 2, and 3.
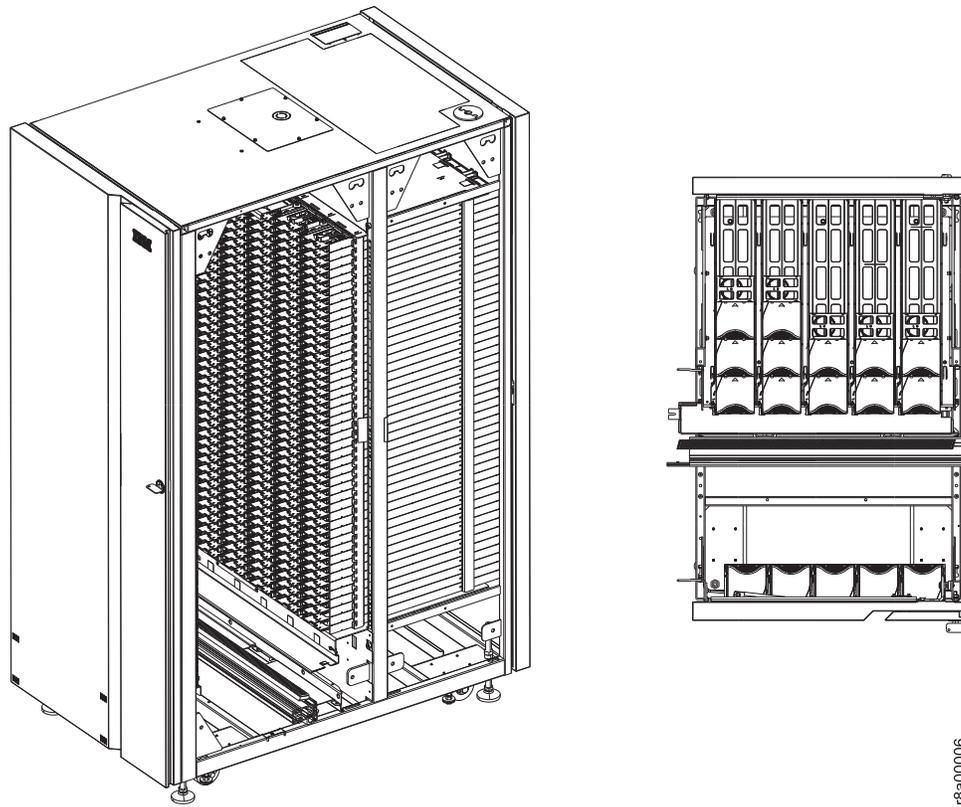
Figure 5. The HD frame (left) and top-down view of row in an HD frame (right)

All HD slots are black, however the location of the cartridge retention latch differentiates LTO HD slots from 3592 HD slots. The cartridge retention latch is on the left side of LTO HD slots and on the right side of 3592 HD slots.

Attention: The HD slots have a constant force spring for maintaining forward pressure on the tape cartridges. Use caution when you are inserting or removing cartridges from HD slots.

HD frame model S24 provides storage for up to 1 000 IBM 3592 tape cartridges. HD frame model S54 provides storage for up to 1 320 LTO tape cartridges. The base capacity of Model S24 is 600 cartridges, which are stored in Tiers 0, 1, and 2. The base capacity of Model S54 is 660 cartridges, which are stored in Tiers 0, 1, and 2. To increase capacity to the maximum for each frame, it is necessary to purchase the High Density Capacity on Demand (HD CoD) feature. This feature provides a license key that enables the use of the storage space in the remaining tiers. For more information, see the appropriate section in the *IBM TS3500 with ALMS Introduction and Planning Guide*.

Note: These numbers represent raw capacity and do not reflect actual capacity. It is recommended that actual capacity does not exceed 99% of the raw capacity due to the need to maintain unused slots that are required for *shuffle* operations.

In HD frames, the cartridge accessor performs a *shuffle* operation in order to access the cartridges that are stored in Tier 2 and beyond. A shuffle is the process of moving cartridges in lower tiers into the gripper, or other available slots, in order to access cartridges in higher tiers (Tier 2 or greater). To reduce shuffle operations and take advantage of repeated accesses of certain cartridges, the role of *cartridge cache* is assigned to all single-deep (Tier 0) slots in an HD library. To maintain

efficient shuffle operations, the library uses *load balancing* to store cartridges across all HD slots in the library string. In other words, all HD slots are filled to a minimum tier level until that tier is full across the library. For more information, see the section about library performance in the *IBM TS3500 with ALMS Introduction and Planning Guide*.

Second generation HD (HD2) frames provide the following enhancements:
- Can be installed in the leftmost library position (frame position 1)
- Offer drive-capable models that support up to 16 HD2-compatible tape drives when in frame position 2 or higher

Note: Non-HD2 frames cannot be upgraded to HD2 frames.

HD frame models S24 and S54 can be attached to installed Dx2, Dx3, Lx2, and Lx3 frames and these frames can be intermixed in the same library configuration. In addition, HD frame models S24 and S54 can support shuttle stations in order to attach multiple library strings in a shuttle complex. For more information about a shuttle complex, see "Structure of the shuttle complex."

Notes:
- If you convert an existing HD frame from a service bay to an expansion frame, a Capacity on Demand (CoD) feature (1645 or 1646) is required to use the full capacity of the frame. If an HD frame is ordered to be used as service bay B, it does not require a CoD feature.
- To support mixed media in an HD library with dual accessors, service bay B must be a model Dxx frame. This configuration requires feature code 1697, which ensures that the service bays provide both LTO and 3592 HD test slots.
- When you are expanding an installed library, an expansion frame is installed at the end of the library string. In order to have the expansion frame installed somewhere other than the end of the library string, the IBM service representative must obtain a service contract to uninstall additional frames as necessary to accommodate the customer's request.

  Note: The *end of the library string* refers to the very last frame or, if requested by the customer, the last frame before service bay B.

Structure of the shuttle complex

In order to meet the needs of large data center archives that have to store increasing amounts of data, the TS3500 tape library offers shuttle technology that enables flexible library growth on a z-axis. This growth flexibility, enabled by shuttle connection between HD libraries, allows a higher maximum capacity for a single library image of multiple TS3500 library strings. This flexibility also accommodates constrained data center layouts that do not have room to expand on the x-axis, as well as data centers with large archives that exceed the maximum cartridge count of an individual TS3500 tape library string.

Unlike passthrough automation technologies that pass tape cartridges through intermediary libraries, the TS3500 tape library transports tape cartridges in shuttle cars that pass over the libraries. This method of transporting cartridges is called *direct flight*. With the direct flight capability, if there is no drive available in the home logical library, the cartridge is moved across a *shuttle connection* to a logical library with an available drive. This configuration of interconnected parallel library strings is called a *shuttle complex*. The components of a shuttle complex (shown in Figure 6 on page 12) are described in these details:

1 **Shuttle station**

The shuttle station mounts on top of an HD frame. It consists of a base pad and a shuttle slot. The shuttle slot docks into the base pad. When the shuttle slot is all the way down into the frame station it can accept or deliver a cartridge. Each shuttle station has its own import/export element (IEE) address.

2 **Shuttle span**

One or more shuttle spans are linked together in order to form a shuttle connection between HD frames in parallel library strings. Shorter shuttle spans support distances between library strings ranging from 762 mm (30 in) to 1 524 mm (60 in). Longer shuttle spans support distances between library strings ranging from 1 524 mm (60 in) to 2 743.2 mm (108 in).

3 **Shuttle connection**

A shuttle connection is comprised of one shuttle car, two or more shuttle stations, and one or more spans between these shuttle stations. Each shuttle connection supports one shuttle car.

Shuttle car (not shown)

The shuttle car is the mechanism that carries one tape cartridge through the shuttle connection to another library string. Each shuttle car carries one tape cartridge at a time.
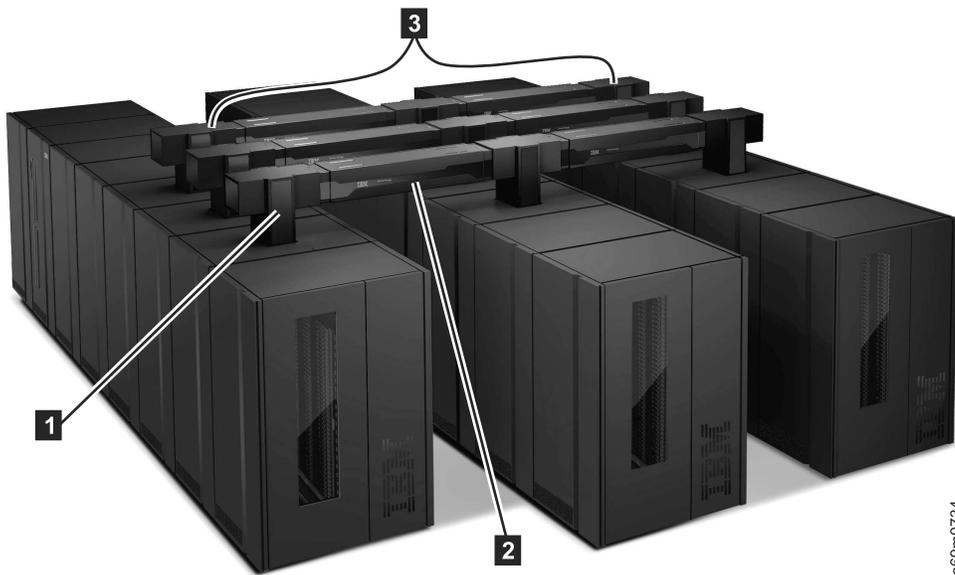
Figure 6. TS3500 tape library shuttle complex

Physical configuration of the shuttle complex

A shuttle complex is comprised of between two and 15 parallel library strings that are interconnected by shuttle connections between HD frames. Each library string in a shuttle complex has access to one or more shuttle cars that each provide at least one direct route to each of the remote library strings. (At least two direct routes are recommended for redundancy.)

A shuttle complex supports library strings with varying numbers of frames to the left or right of each connection. A shuttle complex also supports shuttle connections with varying numbers of spans. This support enables flexible shuttle

complex configurations in order to accommodate most data center arrangements. It is required that the front doors of each library string in the shuttle complex face the same direction.

Shuttle connections attach to shuttle stations that are mounted on HD frames.

Logical configuration of the shuttle complex

A shuttle complex enables multiple TS3500 tape library strings to appear as a single library image to the host. Each library string is still its own SCSI library, however a library manager application such as HPSS, aggregates the multiple SCSI libraries into a single library image. This allows sharing of tape drive resources across multiple logical libraries in different library strings.

Each library string in a shuttle complex contains up to 192 logical libraries. Each shuttle station can be assigned to one logical library per library string or can remain unassigned. It is required that all shuttle stations on the same connection are assigned to logical libraries of the same media type. Shuttle stations are assigned to logical libraries through the TS3500 tape library web specialist interface.

Supported tape drives

The IBM LTO Ultrium tape drives and the 3592 tape drives are high-performance, high-capacity data-storage units that can be installed in the TS3500 tape library. Up to 12 drives can be installed in each base and expansion frame of the library, but the two types of drives cannot be mixed in the same frame. You can identify a drive by examining the logo at the front of the drive canister or by inspecting the label at the rear of the drive canister.

Note: No drives are installed in the storage-only HD frames (Models S24 and S54).

Table 6 provides an overview of supported tape drives.

Table 6. Tape drives that are supported by the TS3500 tape library

Supported Tape Drives				
Type of Drive	Speed of Connectivity	Native Data Rate	Native Capacity	Other Information
IBM TS1070 tape drive[1, 2]	8 Gbps Fibre	300 MB/s	6 000 GB (5587.94 GiB)	Also known as the Ultrium 7 tape drive or the 3588 Model F7A
IBM TS1060 tape drive[1, 3]	8 Gbps Fibre	160 MB/s	2 500 GB (2328.31 GiB)	Also known as the Ultrium 6 tape drive or the 3588 Model F6A
IBM TS1050 tape drive[1]	8 Gbps Fibre	140 MB/s	1 500 GB (1396.98 GiB)	Also known as the Ultrium 5 tape drive or the 3588 Model F5A
IBM TS1040 tape drive	4 Gbps Fibre	120 MB/s	800 GB (745.06 GiB)	Also known as the Ultrium 4 tape drive or the 3588 Model F4A
IBM TS1030 tape drive Model F3B	4 Gbps Fibre	80 MB/s	400 GB (372.53 GiB)	Both of these drives are also known as the Ultrium 3 tape drive
IBM 3588 tape drive Model F3A	2 Gbps Fibre	80 MB/s	400 GB (372.53 GiB)	
IBM LTO Ultrium 2 tape drive	2 Gbps Fibre 160 MB/s (LVD SCSI) 40 MB/s (HVD SCSI)	35 MB/s	200 GB (186.26 GiB)	Also known as the Ultrium 2 tape drive
IBM LTO Ultrium 1 tape drive	1 Gbps Fibre 80 MB/s (LVD SCSI) 40 MB/s (HVD SCSI)	15 MB/s	100 GB (93.13 GiB)	Also known as the Ultrium 1 tape drive
IBM TS1150 tape drive[1]	8 Gbps Fibre	360 MB/s	10 TB[6] (9.1 TiB) 7 TB[5] (6.37 TiB)	Also known as the 3592 Model E08

Table 6. Tape drives that are supported by the TS3500 tape library (continued)

Supported Tape Drives				
Type of Drive	Speed of Connectivity	Native Data Rate	Native Capacity	Other Information
IBM TS1140 tape drive[1]	8 Gbps Fibre	250 MB/s	4 TB[5] (3.64 TiB) 1.6 TB[4] (1.46 TiB)	Also known as the 3592 Model E07
IBM TS1130 tape drive	4 Gbps Fibre	160 MB/s	1 000 GB[4] (931.32 GiB) 640 GB[3] (596.05 GiB)	Also known as the 3592 Model E06 or EU6
IBM TS1120 tape drive	4 Gbps Fibre	100 MB/s	700 GB[4] (651.93 GiB) 500 GB[3] (465.66 GiB)	Also known as the 3592 Model E05
IBM 3592 tape drive Model J1A	2 Gbps Fibre	40 MB/s	300 GB (279.39 GiB)	Withdrawn from marketing as of September 2006

Notes:

1. To support Ultrium 5, TS1140, or later tape drives, all node cards in the library must be model xx3-equivalent node cards. For node cards in model xx2 frames, an xx3 model conversion OR the enhanced node cards feature (FC 1700 or 1701) is required.
2. Ultrium 7 tape drives are not supported in model x32 frames.
3. To support Ultrium 6 tape drives, libraries with an L32 frame require enhanced grippers (FC 2205 or 2304).
4. JA/JW cartridge
5. JB/JX cartridge
6. JC/JY cartridge
7. JD/JZ cartridge

You or your IBM service representative can update firmware for the LTO Ultrium 2 and newer Ultrium tape drives and all 3592 tape drives without scheduling downtime. This enhancement is called a *nondisruptive drive firmware update*. It is available through the IBM Tape Library Specialist web interface and (for IBM service representatives) through CETool, but is not supported by the SCSI interface. For more information, go to "Updating drive firmware" on page 223.

LTO Ultrium tape drives

There are seven generations of Linear Tape-Open (LTO) Ultrium tape drives. The newest of these drives, the IBM TS1070 tape drive Model F7A, is a dual-ported drive that facilitates 8 Gbps Fibre Channel connectivity. This drive is also known as the Ultrium 7 tape drive and is differentiated by its machine type and model number 3588 F7A.

Note: In order to support Ultrium 5 and later tape drives, all node cards in the library must be model xx3-equivalent node cards. For node cards in model xx2 frames, this requires an xx3 model conversion OR the enhanced node card(s) feature (FC 1700 or 1701). Ultrium 7 tape drives are not supported in model x32 frames. In order to support Ultrium 6 tape drives, libraries with an L32 frame require enhanced grippers (FC 2205 or 2304).

These are the seven generations of LTO Ultrium drives":
* IBM TS1070 tape drive (8 Gbps, dual ports)
* IBM TS1060 tape drive (8 Gbps, dual ports)
* IBM TS1050 tape drive (8 Gbps, dual ports)
* IBM TS1040 tape drive (4 Gbps, single port)
* IBM TS1030 tape drive Model F3B (4 Gbps, single port)
* IBM TS1030 tape drive Model F3A (2 Gbps, single port)
* IBM LTO Ultrium 2 tape drive (2 Gbps, single port)
* IBM LTO Ultrium 1 tape drive (1 Gbps, single port)

You can identify all Ultrium 2 and later Ultrium tape drives by the logo at the front of the drive or by the label at the rear of the drive's canister. You can identify the Ultrium 1 tape drive by the label at the rear of its canister. An Ultrium 3 write-once-read-many (WORM)-capable drive can be identified by the level of code it contains. If the code level is 54K1 or higher, the Ultrium 3 drive is capable of WORM functionality. Ultrium 3 and newer tape drives with WORM capability can recognize WORM-compatible media.

Ultrium 3 drives with WORM-capable firmware and newer Ultrium tape drives read and write non-WORM media. This means that you can load WORM-capable firmware on your Ultrium 3 and newer tape drives and use any media that are supported by these drives. In this case, only the data that is written on the WORM media is treated as WORM data; data written on other types of media can be overwritten.

Ultrium tape drives do not read from or write to 3592 tape cartridges, and 3592 tape drives do not read or write to Ultrium tape cartridges. Refer to the *IBM TS3500 with ALMS Introduction and Planning Guide* for detailed information about cartridge and drive compatibility.

The Ultrium tape drives can read tapes that have been written by non-IBM Ultrium drives. They also write to tapes that can be read by non-IBM Ultrium drives.

All generations of Ultrium tape drives and cartridges can reside in the same frame.

When a cartridge is labeled according to proper IBM bar code label specifications, the last character of its volume serial (VOLSER) number indicates the generation of the medium. For example, a cartridge with a VOLSER of 000764**L7** is an Ultrium 7 cartridge; a cartridge with a VOLSER of 000764**L6** is an Ultrium 6 cartridge; and so forth.

To enhance library performance, Ultrium 2 and newer Ultrium tape drives include speed matching, channel calibration, and power management. Speed matching dynamically adjusts the drive's native (uncompressed) data rate to the slower data rate of a server. Channel calibration customizes each read/write data channel for optimum performance. The customization enables compensation for variations in the recording channel transfer function, media characteristics, and read/write head characteristics. Power management reduces the drive's power consumption during idle power periods.

Encryption

Ultrium 4 and later tape drives are encryption capable, which means they can convert data into a cipher that ensures data security. To perform encryption, the drive must be encryption enabled by your selection of one of three methods of encryption management. Two of these methods, system-managed and library-managed encryption, require the purchase of FC 1604 (Transparent LTO Encryption). A key is required to encrypt and decrypt the data. How a key is generated, maintained, controlled, and transmitted depends on the operating environment where the Ultrium 4 or later tape drive is installed. Some data management applications are capable of performing key management. For an alternative solution, IBM provides a key manager that works in conjunction with the keystore of your choice to perform all necessary key management tasks. There is no recovery for lost encryption keys. For more information about encryption, see the sections about tape encryption in the *IBM TS3500 with ALMS Introduction and Planning Guide*. Also refer to the IBM Encryption Key Manager and Tivoli Key Lifecycle Manager publications listed in the **Related information** section. To choose a method of encryption management, refer to "Setting or changing a drive's method of encryption" on page 226.

To ensure that your tape drive conforms to IBM's specifications for reliability, use only IBM LTO Ultrium tape cartridges. You can use other LTO-certified data cartridges, but they might not meet IBM standards of reliability.

Refer to the *IBM TS3500 with ALMS Introduction and Planning Guide* for Ultrium tape drive performance specifications.

3592 tape drives

There are five generations of 3592 tape drives: TS1150 (Model E08), TS1140 (Model E07), TS1130 (Models E06 and EU6), TS1120 (Model E05), and J1A. All generations of 3592 tape drives and cartridges can reside in the same TS3500 tape library frame. Each generation of drive offers an increased data rate and increased native capacity from the previous model, in addition to other enhancements. Each generation of drive also offers dual-port Fibre Channel host attachment interfaces. This feature provides flexibility in an Open Systems environment because the drives can directly attach to Open Systems servers with Fibre Channel attachments. All TS1120 and later tape drives are encryption capable, however some TS1120 tape drives require feature code 5592 or 9592 in order to be encryption capable. Refer to Table 7 on page 18 for details about these and other 3592 tape drive features.

Note: The 3592 EU6 tape drive is a 3592 E05 tape drive canister upgraded to contain a Model E06 drive through the Miscellaneous Equipment Specification (MES) process. The EU6 model name is only used when information specific to the Model EU6 is discussed.

All 3592 tape drives include an RS-422 library interface port for communication with the TS3500 tape library. The 3592 tape drives use the Statistical Analysis and Reporting System to isolate failures between media and hardware. The TS1130, TS1140, and TS1150 tape drives (3592 Models E06, E07, and E08) also come with an Ethernet port, however use of this port for service or remote monitoring is not supported in a TS3500 tape library environment.

A 3592 tape drive cannot read or write to a 3590 High Performance Cartridge Tape (media type J) or to a 3590 Extended High Performance Cartridge Tape (media type K).

Table 7 shows the basic features of each generation of the 3592 tape drive. Refer to the *IBM TS3500 with ALMS Introduction and Planning Guide* for additional 3592 tape drive performance specifications.

Table 7. Features of the 3592 tape drive

Feature	3592 tape drives				
	TS1150 (Model E08)	TS1140 (Model E07)	TS1130 (Model E06 or EU6)	TS1120 (Model E05)	Model J1A
Native sustained data rate	360 MB/s (E08 format) 250 MB/s (E07 format)	250 MB/s (E07 format) 160 MB/s (E06 format)	160 MB/s (E06 format) 140 MB/s (E05 format) 70 MB/s (J1A format)	100 MB/s (E05 format) 50 MB/s (J1A format)	40 MB/s (J1A format)
Compressed sustained data rate (at maximum compression)	700 MB/s (E08 format)	650 MB/s (E07 format)	350 MB/s (E06 format)	280 MB/s (E05 format)	120 MB/s (J1A format)
Native Capacity	10 TB (9.1 TiB)[1] 7 TB (6.37 TiB)[2] 2 TB (1.82 TiB)[3] 900 GB (838.19 GiB)[4]	4 TB (3.64 TiB)[2] 1.6 TB (1.46 TiB)[5] 500 GB (465.66 GiB)[4]	1 000 GB (931.32 GiB)[5] 640 GB (596.05 GiB)[6] 128 GB (119.21 GiB)[7]	700 GB (651.93 GiB)[5] 500 GB (465.66 GiB)[6] 100 GB (93.13 GiB)[7]	300 GB (279.39 GiB)[6] 60 GB (58.88 GiB)[7]
Write-once-read-many (WORM) capability	Yes				
Capacity scaling and short cartridge	Yes				
Read/write capability	If encryption-enabled, reads and writes Model E08 and Model E07 encrypted format	If encryption-enabled, reads and writes Model E07 and Model E06 encrypted format	If encryption-enabled, reads and writes Model E06 and Model E05 encrypted format	Reads and writes Model E05 format	Reads and writes Model J1A format
	Reads and writes Model E08 and Model E07 format	Reads and writes Model E07 and Model E06 format	Reads and writes Model E06 and Model E05 format	Reads and writes Model J1A format	
		Reads Model E05	Reads Model J1A format		
Host (server) attachment	Supports dual-port, 8 Gbps Fibre Channel interface	Supports dual-port, 8 Gbps Fibre Channel interface	Supports dual-port, 4 Gbps Fibre Channel interface		Supports dual-port, 2 Gbps Fibre Channel interface
	Maximum interface burst transfer rate of 800 MB/s	Maximum interface burst transfer rate of 800 MB/s	Maximum interface burst transfer rate of 400 MB/s		Maximum interface burst transfer rate of 200 MB/s
	Supports N and L ports with autoconfigure				

Table 7. Features of the 3592 tape drive (continued)

Encryption	All TS1150 tape drives are encryption capable	All TS1140 tape drives are encryption capable	All TS1130 tape drives are encryption capable	With feature code 9592 or 5592	Not supported
Notes:					
1. Using JD/JZ media					
2. Using JC/JY media					
3. Using JL media					
4. Using JK media					
5. Using JB/JX media					
6. Using JA/JW media					
7. Using JJ/JR media					

The 3592 tape drives provide the following performance, capacity, and availability features:

N+1 power supplies
When installed in the TS3500 tape library frame, this helps to increase drive availability in the event of a power failure.

Media reuse
The 3592 tape drives can reuse different types of tape and multiple densities (logical formats) across various drive generations. Certain models can only support a subset of densities (such as the 3592 J1A tape drive, which can only read and write at a single density), while the later tape drives can read and write at multiple densities. Enterprise format 1 (EFMT1) records 512 tracks on 8 channels. Enterprise format 2 (EFMT2) records 896 tracks on 16 channels. Enterprise format 3 (EFMT3) records 1152 tracks on 16 channels. Enterprise format 4 (EFMT4) records 2560 tracks on 32 channels. Enterprise format 5 (EFMT5) records 5120 tracks on 32 channels. These logical formats can be divided into multiple sub-format options, such as segmentation and capacity scaling. For more information about capacity scaling and for a complete matrix of read and write compatability, refer to the *IBM TS3500 with ALMS Introduction and Planning Guide*.

Speed matching
When operating in a host environment where the net host data rate is less than the maximum drive native data rate, 3592 tape drives automatically perform dynamic speed matching to minimize backhitches. Dynamic speed matching adjusts the native data rate of the drive as closely as possible to the net host data rate (after data compressibility has been factored out). A reduction in backhitches improves system performance.

HRTD The HRTD directory structure, located in 3592 tape drives, allows the drive to have fast and consistent nominal and average access times for locate operations.

Channel calibration and on-the-fly adaptive equalization
To gain optimum performance, channel calibration allows the drive to automatically customize each read and write data channel. The customization compensates for variations in the recording channel transfer function, for media characteristics, and for read and write head characteristics. Initial calibration settings are calculated and stored at the time of manufacture. For optimum error rate performance, TS1120 and

later tape drives also use on-the-fly adaptive equalization hardware on an ongoing basis to adjust the read equalization response.

Recursive accumulating backhitchless flush
The TS1120 and later tape drives use an algorithm known as recursive accumulating backhitchless flush (or non-volatile caching) to increase effective data rate performance from host servers that force explicit synchronize operations during write operations.

Backhitchless backspace
Backhitchless backspacing enables some backspace operations to be virtualized without physical backhitching. If you write and overwrite multiple trailer labels, this firmware feature provides major performance improvements. For more information, refer to the appendix about WORM behavior in the *IBM 3592 Tape Drive SCSI Reference*.

Capacity scaling
If you want to exchange capacity for improved access times, 3592 tape drives support multiple format options, such as scaling and segmentation modes. These tape drives can sense and report the scaling state of current medium by using the SCSI Mode Sense command and specifying Mode Page X'23'. Capacity scaling is only offered on the JA, JB, JC, and JD media types. For the exact Mode Select commands and settings necessary to invoke scaling, refer to the IBM TS3500 SCSI Reference.

WORM
The 3592 tape drives support write-once-read-many (WORM) behaviors and format attributes. Five WORM cartridge types are supported: JW (full length), JR (short length), JX Extended WORM cartridge (for TS1120, TS1130, and TS1140 tape drives), JY Advanced Type C WORM cartridge (for TS1140 and TS1150 tape drives), and JZ Advanced Type D WORM cartridge (for TS1150 tape drives). WORM cartridges are factory-formatted as WORM cartridges and may not be converted to data cartridges. The 3592 tape drives allow append operations to data already on WORM cartridges, but do not allow data to be overwritten under any circumstances.

Capacity-based and position-based LEOT reporting
The TS1120 and later tape drives use enhanced logic to report logical end-of-tape (LEOT) data. The drive reports LEOT based on a combination of indicators of capacity-based LEOT and position-based LEOT. These drives monitor the total accumulated physical tape files written to the cartridge and report the LEOT based on the capacity-based LEOT value, rather than reporting LEOT based on the physical position on the tape (position-based LEOT). To summarize, this technique reports LEOT based on the amount of compressed data that is recorded to the cartridge and reduces the variation in the amount of data recorded before LEOT is issued. For applications that use LEOT to stop the write process, a more consistent capacity is recorded to the media. For a higher percentage of the time, this process allows tape copies to complete without overflow.

Enhanced format for recording error-correction codes (ECCs)
The logical formats of TS1120 and later tape drives offer improved error-correction-code capabilities over the 3592 J1A and LTO formats by increasing the power of one of the two orthogonal Reed-Solomon ECCs that protect the data on tape. The correction power of the inner code is approximately double that of the 3592 J1A and thus offers superior reliability of the data.

Drive mechanical and electrical reliability

The mechanism of the TS1120 and later tape drives is specified at a mean-cycles-between-failure rate of 300,000 cycles, which is the highest reliability rating in the industry. The mechanism contains special mechanical and electrical features to prevent damage to the media on power-down or reset. These features also prevent the dropping of the leader pin or other thread failures during similar interruptions. It also tolerates extremely high vibration and shock environments without data loss or degraded operation.

Multiple subsystem and automation support

The 3592 tape drives and their cartridges support multiple automation libraries and can be easily transported between environments.

Data compression

The 3592 tape drives use the data-compression method known as streaming lossless data compression algorithm. The compression logic for TS1120 and later tape drives operates at more than twice the overall transfer rates of the 3592 J1A tape drive.

Data buffer with read ahead feature

The 3592 J1A tape drive includes a data buffer of 134.22 MB (128 MiB). The TS1120 tape drive includes a data buffer of 536.87 MB (512 MiB). The TS1130 tape drive and TS1140 tape drive each include a data buffer of 1.07 GB (1 GiB). The TS1150 tape drive includes a data buffer of 2.15 GB (2 GiB). Along with enabling performance characteristics in buffered Write and Read commands, the data buffer also supports a Read Ahead feature. When the drive processes a command to locate or read a block, the drive automatically continues to stream down the tape and read ahead until the data buffer is full. This allows subsequent Locate or Read commands to be fulfilled from the data buffer at faster speeds, rather than requiring access to the tape.

Offboard data string searching

The TS1120 and later tape drives can search the data content of host server records for string matches. The function is called *offboard data string searching* because the data search workload can be performed offboard from the host. Each drive performs a search at its own respective maximum data rate. This greatly reduces the amount of data transfer and host search times.

Encryption

All TS1130 and later tape drives are encryption capable, which means they can convert data into a cipher that ensures data security. With IBM feature code 9592 or 5592, TS1120 tape drives are encryption capable as well. To perform encryption, the drive must be encryption-enabled by your selection of one of three methods of encryption management. A key is required to encrypt and decrypt the data. How a key is generated, maintained, controlled, and transmitted depends on the operating environment where the TS1120 and later tape drives are installed. Some data management applications are capable of performing key management. For an alternative solution, IBM provides a key manager that works in conjunction with the keystore of your choice to perform all necessary key management tasks. There is no recovery for lost encryption keys.

For more information about encryption, see the tape encryption overview in the *IBM TS3500 with ALMS Introduction and Planning Guide*. Also refer to the IBM Encryption Key Manager and Tivoli Key Lifecycle Manager publications listed in the **Related information** section of this document. To

choose a method of encryption management, see "Setting or changing a drive's method of encryption" on page 226.

Firmware for each model of 3592 tape drive (TS1150, TS1140, TS1130, TS1120, or J1A) only works in that specific model.

The 3592 tape drive supports four types of the IBM 3592 tape cartridge. For more information about the supported cartridges, refer to the *IBM TS3500 with ALMS Introduction and Planning Guide*.

Supported tape cartridges

Note: Management and handling of media cartridges is a customer function and responsibility.

In the TS3500 tape library, frames that are installed with Ultrium tape drives use Ultrium tape cartridges. Frames that are installed with 3592 tape drives use 3592 tape cartridges. A frame cannot house both Ultrium tape drives and 3592 tape drives. Similarly, in an HD library, Model S24 contains HD slots that house only 3592 tape cartridges and Model S54 contains HD slots that house only Ultrium tape cartridges. However, in a library that includes both types of frames, you may insert 3592 tape cartridges into the lower I/O station of a Model L53, L52, or L32 frame for transport (by the cartridge accessor) to a Model D23, D22, or S24 frame. Similarly, you may insert Ultrium tape cartridges into the lower I/O station of a Model L23 or L22 frame for transport (by the cartridge accessor) to a Model D53, D52, D32, or S54 frame. (Note that in both of these scenarios, your library must contain an I/O station that will accept the type of cartridge that is being inserted. Also note that Ultrium 7 tape drives are not supported in model x32 frames.)

Table 8 shows the capacity of supported Ultrium tape cartridges. Table 9 on page 24 shows the capacity of supported 3592 tape cartridges.

Table 8. Capacity of Ultrium tape catridges

Supported tape cartridges	Native capacity	Compressed capacity [1,2]
IBM LTO Ultrium-7 6000 GB data cartridge	6 000 GB (5587.94 GiB)	15 TB (13.63 TiB)
IBM LTO Ultrium-6 2500 GB data cartridge	2 500 GB (2328.31 GiB)	6.25 TB (5.68 TiB)
IBM LTO Ultrium-5 1500 GB data cartridge	1 500 GB (1396.98 GiB)	3 TB (2.73 TiB)
IBM LTO Ultrium-4 800 GB data cartridge	800 GB (745.06 GiB)	1 600 GB (1 490.12 GiB)
IBM LTO Ultrium-3 400 GB data cartridge[3]	400 GB (372.53 GiB)	800 GB (745.06 GiB)
IBM 3589 Ultrium tape cartridge Models 028 and 029[4]	400 GB (372.53 GiB)	800 GB (745.06 GiB)
IBM LTO Ultrium-2 200 GB data cartridge	200 GB (186.26 GiB)	400 GB (372.53 GiB)
IBM LTO Ultrium-1 data cartridge	100 GB (93.13 GiB)	200 GB (186.26 GiB)
Notes:		
1. The compressed capacity for the Ultrium 6 cartridge and Ultrium 7 cartridge uses a 2.5:1 compression ratio.		
2. The compressed capacity for the Ultrium 5 cartridge uses a 2:1 compression ratio.		
3. This cartridge is for the Ultrium 3 tape drives with or without write once read many (WORM) capability.		
4. This cartridge is for the Ultrium 3 tape drives with WORM capability.		

Table 9. Capacity of 3592 tape cartridges

3592 tape cartridge	Media type	Native capacity	Compressed capacity[1]
E08 tape drive format[2, 3]	JD, JZ	10 TB (9.1 TiB)	30 TB (27.3 TiB)
	JL	2 TB (1.82 TiB)	6 TB (5.46 TiB)
	JC, JY	7 TB (6.37 TiB)	21 TB (19.1 TiB)
	JK	900 GB (838.19 GiB)	2.7 TB (2.46 TiB)
E07 tape drive format[2, 5]	JC, JY	4 TB (3.64 TiB)	12 TB (10.91 TiB)
	JB, JX	1.6 TB (1.46 TiB)	4.8 TB (4.37 TiB)
	JK	500 GB (465.66 GiB)	1.5 TB (1.36 TiB)
E06 tape drive format[5]	JB, JX	1 000 GB (931.32 GiB)	3 TB (2.73 TiB)
	JA, JW	640 GB (596.04 GiB)	1.9 TB (1.75 TiB)
	JJ, JR	128 GB (119.21 GiB)	384 GB (357.63 GiB)
E05 tape drive format[4, 5]	JB, JX	700 GB (651.93 GiB)	2.1 TB (1.91 TiB)
	JA, JW	500 GB (465.66 GiB)	1.5 TB (1.36 TiB)
	JJ, JR	100 GB (93.13 GiB)	300 GB (279.40 GiB)
J1A tape drive format[3, 4, 5]	JA, JW	300 GB (279.39 GiB)	900 GB (838.19 TiB)
	JJ, JR	60 GB (58.88 GiB)	180 GB (167.64 GiB)

Notes:

1. The 3592 tape cartridges use a 3:1 compression ratio.
2. JA, JJ, JR, and JW media are not supported by this format.
3. JB and JX media are not supported by this format.
4. JC, JK, and JY media are not supported by this format.
5. JD, JL, and JZ media are not supported by this format.

Certain restrictions apply to the use of tape cartridges with drives.

Cleaning cartridges are identified by a volume serial (VOLSER) number that begins with a prefix of `CLNI` or `CLNU` for LTO Ultrium cleaning cartridges, and `CLN` for 3592 cleaning cartridges.

IBM Tape System Reporter

The IBM Tape System Reporter application is a Java-based monitoring server with an optional Windows-based graphical user interface (GUI) that allows you to monitor and gather data for multiple libraries. You can generate general and specific data reports for the multiple tape cartridges, tape drives, and frames that you are monitoring.

The IBM Tape System Reporter application enables operators and administrators of the TS3500 tape library to monitor and report on storage devices from any location in an enterprise environment. This application communicates directly with the library to collect and store pertinent data enabling you to generate and view performance trends. The IBM Tape System Reporter application is bundled with your Advanced Library Management System (ALMS) purchase.

Data is available from 3592 tape drives (models J1A, E05, E06, EU6, E07, and E08) and from LTO 2 and newer LTO tape drives.

The ccSARS data is available from 3592 E05, LTO 4, and newer tape drives.

Notes:

1. Data is not collected for the LTO Ultrium 1 tape drive.
2. Use of the IBM Tape System Reporter application requires that you establish database connectivity through firewalls and to any tape libraries that it is monitoring.

The IBM Tape System Reporter application operates by collecting information from the TS3500 tape library, aggregating the data in a database, and providing you the ability to generate a report. You can generate a General SQL Query or custom report on the utilization and performance of tape cartridges, tape drives, and the tape library. The application can be installed by you or by IBM Lab Services. Figure 7 illustrates how the Tape System Reporter application collects information from the tape libraries, aggregates the data in a database, and provides you with the opportunity to generate a general query or custom report.
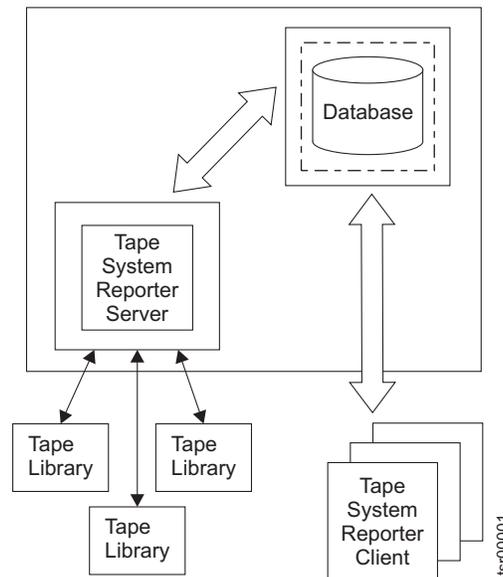
Figure 7. Tape System Reporter data flow

Note: It is suggested that you install the Tape System Reporter application on a dedicated server machine that is separate from your client machine or machines. This is particularly effective when workload balancing is a consideration.

For more information about the prerequisites for using the IBM Tape System Reporter, installing and setting up the application, working with the Apache Derby, DB2®, or Oracle databases, and generating reports, refer to the *IBM Tape System Reporter User's Guide* (GA32-0589). You can also find information about the IBM Tape System Reporter on the web at http://www-01.ibm.com/support/docview.wss?uid=ssg1S4000680.

Compatible servers and software

The TS3500 tape library is supported by a wide variety of servers, operating systems, and adapters. There are many ways to determine the servers and software that support the TS3500 tape library.

These attachments can change throughout the lifecycle of the product. To determine the latest attachments, or to get a comprehensive list of compatible software, perform one of the following actions:

- Visit the web:
  - For a list of compatible software, operating systems, and servers for LTO tape drives, visit the web at `http://www.ibm.com/storage/lto`. Under TS3500 Library, select Product details. Under Learn more, select Interoperability matrix or select Independent Software Vendor (ISV) matrix for LTO.
  - For a list of compatible software, operating systems, and servers for 3592 tape drives, visit the web at `http://www.ibm.com/servers/storage/tape/drives`. Scroll to the correct tape drive and select Product details. Under Learn more, select Interoperability matrix or Independent Software Vendor (ISV) matrix.
  - For complete IBM storage interoperability information, including operating systems, servers, switches, and adapters supported by the TS3500 tape library in a storage-area network (SAN) configuration, visit the IBM System Storage® Interoperation Center (SSIC) at: http://www-03.ibm.com/systems/support/storage/ssic/interoperability.wss.
- Contact your IBM sales representative.

Notes:

1. IBM does not provide application software with the TS3500 tape library. To order software, contact your IBM sales representative, IBM business partner, or an independent software provider.
2. If you attach your library to a non-IBM platform with non-IBM software, it is recommended that you contact your software vendor to obtain a matrix of compatible hardware, software, firmware revisions, and adapter cards.

Supported device drivers

IBM provides device driver support for the LTO and 3592 tape drives, as well as the robotics in the TS3500 tape library.

IBM maintains the latest levels of device drivers and driver documentation on the web. Go to http://www.ibm.com/support/fixcentral and perform the following steps in order to access this material.

1. From the Fix Central Web page, select **System Storage** from the Product Group list.
2. Select **Tape systems** from the System Storage list.
3. Select **Tape drivers and software** from the Tape systems list.
4. Select **Tape device drivers** from the Tape drivers and software list.
5. Select the appropriate operating system from the Platform list and click **Continue**.
6. Select the appropriate driver from the list that displays.

For a complete description of the mtlib program and command syntax, see the *IBM Tape Device Drivers Installation and User's Guide*.

The *IBM Tape Device Drivers Installation and User's Guide* can be found on the web: http://www-01.ibm.com/support/docview.wss?rs=577&uid=ssg1S7002972 .

Communication with TSLM

The IBM Tape System Library Manager (TSLM) provides a resource management layer between applications such as Tivoli Storage Manager and the tape library hardware.

Essentially, TSLM decouples tape resources from applications. Decoupling simplifies both the aggregation and the sharing of tape resources.

TSLM provides the following benefits:
- Consolidated, mainframe-class media management services
- Centralized repository, access control, and administration
- Management beyond physical library boundaries
    - Access multiple TS3500 or TS4500 tape libraries as a single library image.
    - The libraries can be separate (at SAN distances) or connected in a shuttle complex (TS3500 tape library only)
- Dynamic sharing of resources across heterogeneous application boundaries
- Security features to allow or prevent application access to tapes
    - Helps to enable common scratch pool and private pools for every application
    - Secures the usage and visibility
- Policy-based drive and cartridge allocation
- Policy-based media-lifecycle management
- 3494 Emulation
    - Emulation of an IBM 3494 library on top of an attached IBM TS3500 or TS4500 tape library.

For more information about TSLM, see the *IBM Tape System Library Manager User's Guide* (GA32-2208).

Secure Socket Layer (SSL) functionality

The TS3500 tape library supports secure socket layer (SSL), which is a protocol for transmitting private documents across the Internet.

Important: Enabling SSL for TS3500 web communications introduces significant delays for the display of some TS3500 web pages.

Secure socket layer uses a cryptographic system that uses these two keys to encrypt data:

- a public key known to everyone
- a private key known only to the recipient of the message

Many web sites use this protocol to obtain confidential user information, such as credit card numbers. By convention, uniform resource locators (URLs) that require an SSL connection start with https: instead of http:.

The TS3500 tape library provides the ability to enable or disable SSL for web browser communication. The action is performed using the Tape Library Specialist web specialist.

Storage Authentication Service

The Storage Authentication Service (SAS) is an option for web login requests on the TS3500 tape library.

Note: TS3500 Storage Authentication Service is not supported with Tivoli Storage Productivity Center V5.1 and later.

Remote authentication is supported on a TS7700 virtualization engine or TS3500 tape library using the Tivoli Secure Authentication Service client and server, and the WebSphere® Federated Repositories. The TS7700 virtualization engine or TS3500 tape library must connect to a System Storage Productivity Center (SSPC) appliance or a server using Tivoli Storage Productivity Center (TPC). The SAS client is integrated into the TS7700 virtualization engine microcode or the TS3500 tape library firmware, while the SAS server and the WebSphere Federated Repositories are integrated into TPC 4.1 and later. TPC is available as a software-only package or as an integrated solution on the SSPC appliance.

When SAS is enabled, the TS3500 tape library passes user authentication requests to the SAS server on the SSPC or TPC, where they are forwarded to the customer's Lightweight Directory Access Protocol (LDAP) or Microsoft Active Directory (AD) server. The LDAP or AD server then authenticates the user's ID and password. If they are valid, then one or more user groups are assigned. The TS3500 tape library then assigns the user a role based on the LDAP or AD group.

This central repository allows you to accomplish the following security tasks from a single interface, without logging in to a TS3500 tape library:

- Add or remove a user
- Reset or change a password
- Assign, change, or delete the LDAP or AD group of a user

A central repository can also simplify the process of responding to new security requirements for one or more tape libraries. For instance, rules for passwords can be changed in one location without reconfiguring multiple, affected machines. By

comparison, when local authentication is employed, each individual machine maintains an internal database of user IDs, with corresponding passwords and roles.

LDAP dependency

The WebSphere Federated Repositories component of the SSPC or TPC receives authentication requests from the TS3500 tape library through the SAS. The SAS passes user ID and password information to the LDAP or AD server.

The LDAP or AD server returns authentication status to the SSPC or TPC, which forwards the authentication status through the SAS to the TS3500 tape library . The LDAP or AD server attached to the SSPC or TPC manages the following information:

User ID
    A string to identify a specific user

User password
    A password for each user ID

Groups
    Strings to identify one or more groups of users. The TS3500 tape library maps each LDAP group to a TS3500 tape library role.

Each user is defined as a member of one or more groups, meaning the user assumes the roles defined by those groups.

Notes:
- The User ID and User password cannot exceed 15 characters. LDAP users that exceed this maximum might not be able to authenticate to the TS3500 Tape Library Specialist Web interface when SAS is enabled.
- The maximum length of a group is 15 characters. Groups exceeding 15 characters in length will not map to a defined role in the TS3500 tape library.

Mapping groups to roles

When a user is successfully authenticated using the Storage Authentication Service, the resulting user information includes a list of groups that the user belongs to. You can use the to define how groups are mapped to roles. For successful authorization, at least one LDAP group in the list must have the same name as a role that is defined in the TS3500 tape library. The first LDAP group to match a role determines the role of the user. Avoid ambiguity of multiple matches by making sure that only one group matches a role in the TS3500 tape library.

Note: Prior to firmware level A040, a user in an Admin LDAP group is required to enable and disable SAS.

For more information about TPC, visit the web at http://www-03.ibm.com/ systems/storage/software/center/index.html. For additional information about TPC security features, including how to use Microsoft Active Directory for authentication, visit the web at http://www.ibm.com/support/knowledgecenter/ SSEQTP_7.0.0/com.ibm.websphere.base.doc/info/aes/ae/cwim_fedrepos.html.

IPv6 functionality

The TS3500 tape library supports internet protocol (IP) addresses in IPv4 and IPv6 formats.

Internet protocol version 6 (IPv6) is designed to allow the Internet to grow steadily, both in terms of the number of hosts connected and the total amount of data traffic transmitted. Both the operator panel and the Tape Library Specialist Web interface allow the definition of IPv4 and IPv6 addresses. The Key Proxy determines the IP version used and presents the correct IP address and parameters to the IP Stack.

IPv4 and IPv6 address formats

Octets or segments, or a combination of both, make up Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6) addresses.

An IPv4 address has the following format: x . x . x . x where *x* is called an *octet* and must be a decimal value between 0 and 255. Octets are separated by periods. An IPv4 address must contain three periods and four octets. The following examples are valid IPv4 addresses:

- 1 . 2 . 3 . 4
- 01 . 102 . 103 . 104

The following example shows a screen that uses IPv4 addresses.

```
Ethernet IPv4              Panel 0175

Current Settings Frame 1:

MAC Address: 18:36:F3:98:4F:9A
IP Address (IPv4):  19.117.63.126
Subnet Mask (IPv4): 255.255.253.0
Gateway (IPv4):     19.117.63.253

Ethernet Mode:  Manual IP Entry

Press ENTER to Change Settings

[BACK]  [ UP ]  [DOWN]   [ENTER]
```

An IPv6 address can have either of the following two formats:
- Normal - Pure IPv6 format
- Dual - IPv6 plus IPv4 formats

An IPv6 (Normal) address has the following format: y : y : y : y : y : y : y : y where *y* is called a *segment* and can be any hexadecimal value between 0 and FFFF. The segments are separated by colons - not periods. An IPv6 normal address must have eight segments, however a short form notation can be used in the Tape Library Specialist Web interface for segments that are zero, or those that have leading zeros. The short form notation can not be used from the operator panel.

The following list shows examples of valid IPv6 (Normal) addresses:
- 2001 : db8: 3333 : 4444 : 5555 : 6666 : 7777 : 8888
- 2001 : db8 : 3333 : 4444 : CCCC : DDDD : EEEE : FFFF
-   : : (implies all 8 segments are zero)
-   2001: db8: : (implies that the last six segments are zero)
- : : 1234 : 5678 (implies that the first six segments are zero)

- `2001 : db8: : 1234 : 5678` (implies that the middle four segments are zero)
- `2001:0db8:0001:0000:0000:0ab9:C0A8:0102` (This can be compressed to eliminate leading zeros, as follows: `2001:db8:1::ab9:C0A8:102`)

The following example shows a screen that uses IPv6 addresses:

```
Ethernet IPv6              Panel 0178

Current Settings
Frame 1, Port B

MAC Address: 18:36:F3:98:4F:9A
Manual IP (IPv6):  684D:1111:222:3333:4444:5555:6:77
DHCP IP (IPv6): Disabled
Stateless Auto IP (IPv6): 0:0:0:0:0:0:0:0

Press ENTER to Change Settings

[BACK]   [ UP ]   [DOWN]    [ENTER]
```

An IPv6 (Dual) address combines an IPv6 and an IPv4 address and has the following format: y : y : y : y : y : y : x . x . x . x. The IPv6 portion of the address (indicated with y's) is always at the beginning, followed by the IPv4 portion (indicated with x's).

- In the IPv6 portion of the address, *y* is called a *segment* and can be any hexadecimal value between 0 and FFFF. The segments are separated by colons - not periods. The IPv6 portion of the address must have six segments but there is a short form notation for segments that are zero.
- In the IPv4 portion of the address *x* is called an *octet* and must be a decimal value between 0 and 255. The octets are separated by periods. The IPv4 portion of the address must contain three periods and four octets.

The following list shows examples of valid IPv6 (Dual) addresses:

- `2001 : db8: 3333 : 4444 : 5555 : 6666 : 1 . 2 . 3 . 4`
- `: : 11 . 22 . 33 . 44` (implies all six IPv6 segments are zero)
- `2001 : db8: : 123 . 123 . 123 . 123` (implies that the last four IPv6 segments are zero)
- `: : 1234 : 5678 : 91 . 123 . 4 . 56` (implies that the first four IPv6 segments are zero)
- `: : 1234 : 5678 : 1 . 2 . 3 . 4` (implies that the first four IPv6 segments are zero)
- `2001 : db8: : 1234 : 5678 : 5 . 6 . 7 . 8` (implies that the middle two IPv6 segments are zero)

Subnet masks (IPv4) and prefixes (IPv6)

Subnet masks (IPv4) and prefix lengths (IPv6) identify a range of IP addresses that are on the same network.

IPv4 subnet masks

All IP addresses are divided into portions. One part identifies the network (the network number) and the other part identifies the specific machine or host within the network (the host number). Subnet masks (IPv4) and prefixes (IPv6) identify the range of IP addresses that make up a subnet, or group of IP addresses on the

same network. For example, a subnet can be used to identify all the machines in a building, department, geographic location, or on the same local area network (LAN).

Dividing an organization's network into subnets allows it to be connected to the Internet with a single shared network address. Subnet masks and prefixes are used when a host is attempting to communicate with another system. If the system is on the same network or subnet, it attempts to find that address on the local link. If the system is on a different network, the packet is sent to a gateway that then routes the packet to the correct IP address. This routing is called Classless-InterDomain Routing (CIDR).

In IPv4, the subnet mask `255.255.255.0` is 32 bits and consists of four 8-bit octets. The address: `10.10.10.0` subnet mask `255.255.255.0` means that the subnet is a range of IP addresses from `10.10.10.0 - 10.10.10.255.`

The prefix-length in IPv6 is the equivalent of the subnet mask in IPv4. However, rather than being expressed in four octets like it is in IPv4, it is expressed as an integer between 1 through 128. For example: `2001:db8:abcd:0012::0/64` specifies a subnet with a range of IP addresses from:
2001:db8:abcd:0012:`0000:0000:0000:0000` –
2001:db8:abcd:0012:`ffff:ffff:ffff:ffff`. The portion in bold is called the network portion of the IP address, or the prefix. The non-bold portion is called the host portion of the IP address, since it identifies an individual host on the network.

IPv6 addresses

An IPv6 address is eight groupings of numbers:
- **Network address** - the first three groupings of numbers (first 48 bits) in the subnet mask
- **Subnet address** - the fourth grouping of numbers (the 49th through 64th bits) in the subnet mask
- **Device address** - the last four groupings of numbers (the last 64 bits) in the subnet mask

For example, in the following IPv6 address:
`2001:db8:abcd:0012:0000:0000:0000:0000`

The network address is `2001:db8:abcd`, and the subnet address is `12` (using the short form notation and eliminating the leading zeroes). Together, these two groupings are the IPv6 *prefix*. The device address in the example is `0000:0000:0000:0000`.

Each device in the network has a unique device address. But, the network address and subnet address portions of the IPv6 address are the same for every device in the network. So, the first four groupings of numbers in every IPv6 address remain constant, and the last four groupings of numbers vary with each device. You can simplify your list of devices by substituting a prefix-length in place of the device address portion of the IPv6 address. The prefix-length specifies a range of devices. It is expressed as a slash (/), followed by an integer between 1 through 128. For example, a prefix-length of **/64** specified like this: `2001:db8:abcd:0012::/64` tells the system to divide the network into 64 subnetworks. Each subnetwork contains 1/64th of the devices on the network. Table 10 on page 33 shows the resulting network ranges for prefix lengths of IPv6 addresses.

Table 10. Network ranges for prefix lengths of IPv6 addresses.

Expanded notation of IPv6 address at start of the range	IPv6 address (condensed notation)	IPv6 Address with prefix length	Device range in subnetwork
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::/64	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:FFFF:FFFF:FFFF:FFFF
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::/80	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:FFFF:FFFF:FFFF
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::/96	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:0000:FFFF:FFFF
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::/112	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:0000:0000:FFFF
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::/128	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:0000:0000:0000

Chapter 2. Main components

This chapter introduces the main components of the IBM TS3500.

Overview of main components

This section provides an illustration of the main components of the TS3500 tape library.

Figure 8 shows the main components of the TS3500 tape library.

1	Library frame	**5**	Door safety switch
2	Cartridge storage slots	**6**	Upper I/O station
3	Tape drive	**7**	Lower I/O station
4	Front door	**8**	Operator panel
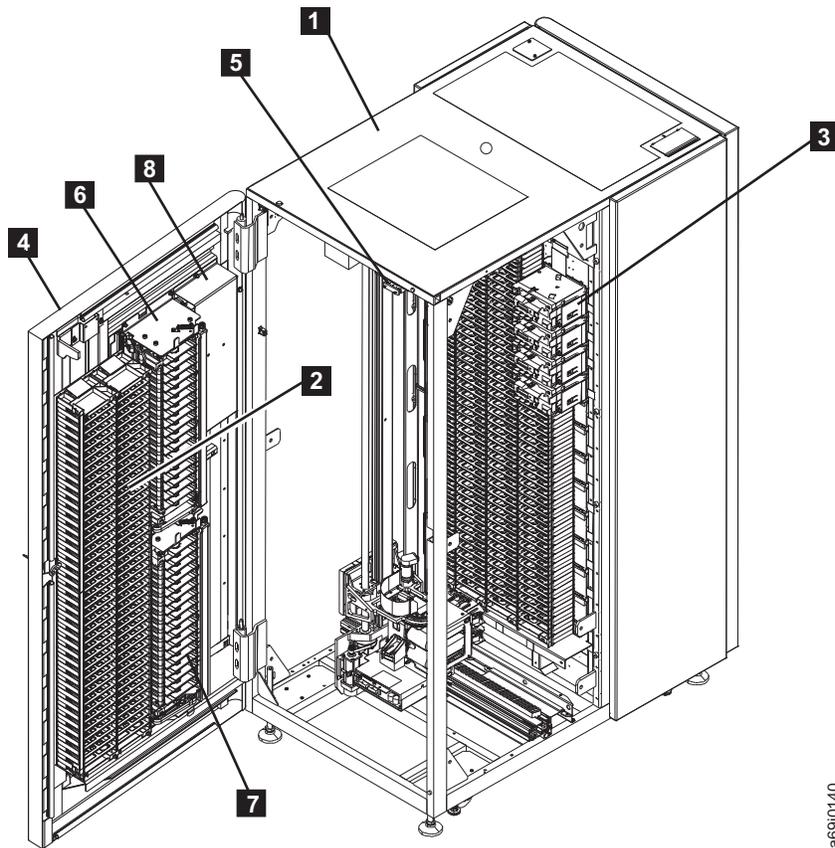
Figure 8. Main components of the IBM TS3500 Model L52. The front door is open and the side of the library is cut away to show the components.

The sections that follow describe each component.

Library frame

This section describes the library frames of the TS3500 tape library.

The library frame is the basic building block for the TS3500 tape library.

A base frame is:
- Models L32, L52, and L53 for LTO Ultrium tape media
- Models L22 and L23 for 3592 tape media

An expansion frame is:
- Models D32, D52, D53, and S54 for LTO Ultrium tape media
- Models D22, D23, and S24 for 3592 tape media

A high availability frame (contains dual accessor) is:
- Model HA1

Base and expansion frame models Lxx and Dxx contain a rail assembly, cartridge storage slots, and 12 drive slots. The high density (HD) expansion frame models Sxx contain a rail assembly and cartridge storage slots. These storage-only models do not contain drive slots. The base frame also includes:
- Cartridge accessor
- Accessor controller
- One upper input/output (I/O) station with 16 storage slots for cartridges
- One optional lower I/O station with 16 storage slots for cartridges

    Note: The lower I/O station is optional for libraries that use only one type of media and required for libraries that use both 3592 tape drives and LTO Ultrium tape drives. In a mixed media configuration, the upper I/O station is the media type of the Lxx frame and the lower I/O station is the alternate media type.
- Operator panel
- Operator panel controller

The high availability frame contains a rail assembly and gripper test slots. For more information about the high availability frame (service bay), see "Dual accessors and service bays" on page 8.

All components of the TS3500 tape library are contained inside the frames. The tops of the frames have windows that admit ambient lighting, except for the HD frames, which are outfitted with LED lighting. Windows are also located at each end of the library.

Note: The LED lighting in the HD frames (models S24 and S54) is designed for use only in the TS3500 tape library. It is not suitable for household room illumination or other applications.

Located at the front of each frame is a front door. The door lets you access the cartridge storage slots and allows service personnel to access the rail assembly, cartridge accessor, and accessor controller. The front door of the base frame includes the operator panel, power switch, I/O stations, handle for opening the door, and keylock. The front doors of the expansion frame and the high availability frame include a handle and a keylock.

Inside each base frame and expansion frame, cartridge storage slots are mounted on the interior of the front door. Opposite the front door, cartridge storage slots and drives are mounted on the frame wall. The cartridge accessor accesses these storage slots and drives.

For more information about HD frames and HD technology, see "High-density technology" on page 9. For more information about frames that are used as service bays, see "Dual accessors and service bays" on page 8.

At the rear of each frame is a service access door that allows service personnel access the tape drives and the power structure (see **1** in Figure 9 on page 38). For Models L22, D22, L32, D32, L52, and D52, the power structure is called the *frame control assembly*. It comprises a sheet-metal unit that houses circuit breakers, ac outlets for powering the tape drives and all other components in that frame, and a receptacle for the incoming main ac power. For Models L23, D23, L53, and D53, the power structure is called the e*nhanced frame control assembly*. It comprises a separate device that is called the Medium Changer assembly, as well as a sheet-metal unit that houses power supplies, and incoming main ac power.

Up to 15 expansion frames can be added to the base frame. An additional expansion frame is added as a service bay in a high-availability library. Expansion frames are attached to the right of the base frame (as you face the operator panel), and are numbered consecutively from left to right. For more information, see "Structure of the library" on page 4.

The IBM Tape Library Specialist web interface and 10/100 Ethernet support are included with Models L22, L23, L52, and L53. For Model L32, they are available as feature codes 1662 and 1660, respectively.
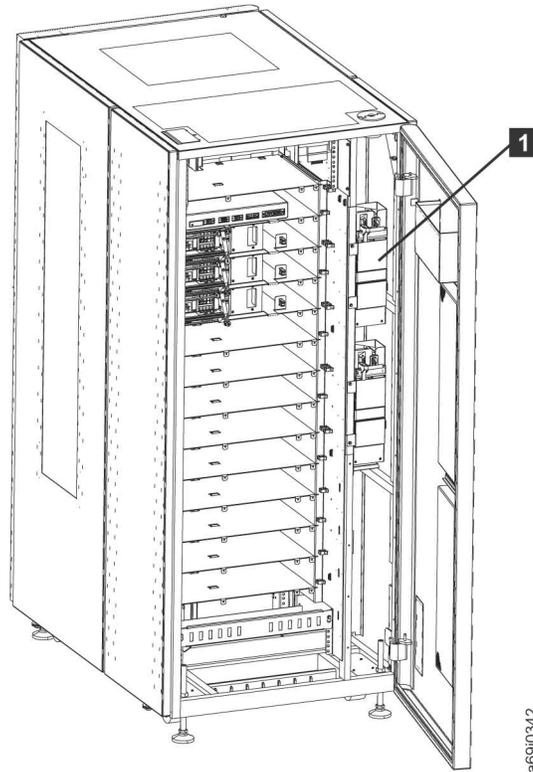
Figure 9. Location of the power structure in a library frame. The picture shows a Model L53 frame, which uses the enhanced frame control assembly.

Frames used as service bays

This topic defines how frames can be used as service bays in the TS3500 tape library.

If you order a second accessor, you must also order a 3584 high availability (HA1) frame (service bay A) and a new D22, D23, D52, D53, S24, or S54, frame (service bay B). As you view the library from the front, service bay A is on the far left and service bay B is on the far right. Service bay B contains the second accessor.

Note: In order to support mixed media in an HD library with dual accessors, service bay B must be a model Dxx frame. This configuration requires feature code 1697, which ensures that the service bays provide both LTO and 3592 HD test slots.

Figure 10 on page 39 shows the location of slots in the service bays. Service bay A (the HA1 frame) contains only gripper test slots (**1** in Figure 10 on page 39) for diagnostic cartridges. Service bay B contains gripper test slots (**2**) for diagnostic cartridges, and also contains unusable storage slots (**3**). The storage slots in service bay B are not used if the frame is configured as a service bay. Place only diagnostic cartridges in the service bays; do not place data or cleaning cartridges in them.
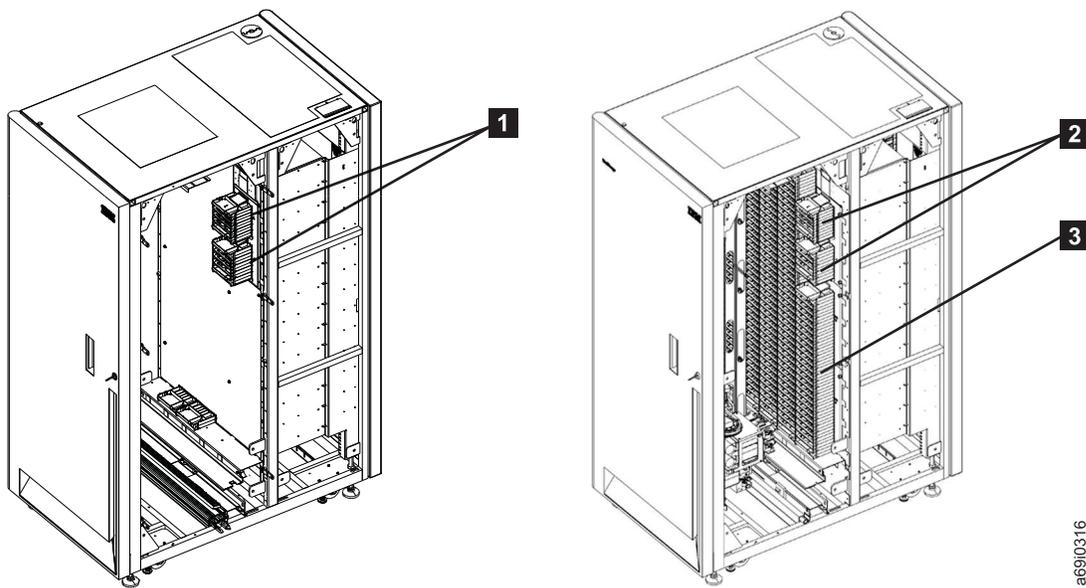
Figure 10. Cartridge slots in the service bays of the TS3500 tape library. Service bay A (the HA1 frame) is on the left and contains only gripper test slots for diagnostic cartridges. An example of a frame as service bay B is on the right and contains both gripper test slots for diagnostic cartridges and unused storage slots.

Frames used for shuttle connections

In a TS3500 tape library shuttle complex, shuttle stations are mounted on high density (HD) frames (model S24 or S54) by an IBM service representative during the shuttle complex installation. Shuttle stations cannot be mounted on HD frames that are used as service bay B.

The shuttle car, which transports cartridges, docks in a slot in the shuttle station and moves between library strings by traveling across a shuttle connection.

Attention: Only the cartridge accessor should insert or remove tape cartridges from the shuttle car. Do not manually place tape cartridges in the shuttle car, shuttle car slot, or shuttle station.

For more information about the TS3500 tape library shuttle complex, refer to "Structure of the shuttle complex" on page 11.

Cartridge storage slots

This section describes the cartridge storage slots in frames of the TS3500 tape library.

Cartridge storage slots are mounted inside the frames of the TS3500 tape library to store tape cartridges. Each storage slot has a unique address to indicate its physical location. In non-HD libraries, the storage slot address consists of three values: frame number, column number, and row number. In HD libraries, that is libraries with HD frames, the storage slot address contains a fourth value: tier number.

Frame number
> Represented as Fxx, where F equals the frame and xx equals its number. For the base frame, the frame number is 01; for each adjacent expansion frame, the frame number increments by one.

Column number
> Represented as Cyy, where C equals the column and yy equals its number. For each frame, the left frame wall column is column number 1. The column number increments in a zig-zag pattern, alternating between the frame wall and the door wall, and progressing from left to right. Thus, all column numbers on the frame wall are odd numbers, and all column numbers on the door wall are even numbers. The base frame has eight columns; the expansion frame has ten columns.

Row number
> Represented as Rzz, where R equals the row and zz equals its number. For each column, the row number is 1 for the top storage position in a column and increments by one for each row below the top position. Regardless of whether a storage slot is installed in row number 1, the row numbering is the same for every column.

Tier number
> Represented as Tx, where T equals the tier and x equals its number. Tier 0 is any non-HD slot. Tiers 1 through 5 represent positions in HD slots; tier number increasing toward the rear of the frame.

For example, the storage slot address F02,C03,R22 means:

F02 Frame 2 (first expansion frame)

C03 Column 3 (second column from left on drive side)

R22 Row 22 (twenty-second position down from the top of the column)

And the storage slot address F02,C03,R06,T2 means:

F02 Frame 2 (first expansion frame)

C03 Column 3 (second column from left on the drive side)

R06 Row 6 (sixth position down from the top of the column)

T2 Tier 2 (second tier of the HD slot)

Non-HD cartridge storage slots in LTO Ultrium frames are black. Non-HD cartridge storage slots in 3592 frames may be gray or black. In 3592 frames with black slots, a 3592 label above the drives or slots indicates that the slots are for 3592 media. HD slots are all black, however the location of the cartridge retention latch distinguishes the two storage slots. The cartridge retention latch on LTO Ultrium HD slots is on the left; the cartridge retention latch on 3592 HD slots is on the right.

Accessible cartridge storage slots

A library frame contains a variable number of accessible storage slots, depending on the type of tape cartridge that it uses, the quantity of I/O stations that are installed, and the quantity of drives that are installed on the drive side. To determine the quantity of slots available for each frame, refer to Chapter 9, "Frame capacity," on page 381.

Inaccessible cartridge storage slot

The base frames of the TS3500 tape library (Models L22, L23, L32, L52, and L53) each contain one inaccessible cartridge storage slot for a diagnostic cartridge at physical address F01,C01,R01. Additionally, the first expansion frame of a different media type (LTO or 3592) in a mixed media library contains one inaccessible cartridge slot for a diagnostic cartridge at physical address Fxx,C01,R01 (where xx equals the first expansion frame for the second type of media). There are no inaccessible slots in all other expansion frames.

If you purchase a second accessor, the accompanying two service bays each contain a diagnostic cartridge.

Inaccessible cartridge storage slots do not have SCSI element addresses.

Tape drives

This section describes the tape drives supported by the TS3500 tape library.

Each Lxx and Dxx frame in the TS3500 tape library can contain one of the following types of tape drives:
- IBM LTO Ultrium tape drives (Ultrium 7, Ultrium 6, Ultrium 5, Ultrium 4, Ultrium 3, Ultrium 2, or Ultrium 1 tape drives)
- IBM 3592 tape drives (TS1150, TS1140, TS1130, TS1120, or 3592 J1A tape drives)

Your commands for library operations and their responses pass through one or more Ultrium tape drives or 3592 tape drives to the accessor controller circuit board located on each accessor. The accessor controller handles all requests that require motion of the accessor, including calibrations, movement of cartridges, and inventory updates. If your library includes a second accessor, it has two accessor controllers. Because the accessor controller (and other components of the library) has no direct access to a server, the Ultrium tape drive or 3592 tape drive serves as a conduit for communication between the two and interprets the protocol.

LTO Ultrium tape drives and 3592 tape drives can be placed into rows 1 through 12. Row 0, if present, is not used.

For information about rear access to the drives, see the section about drive and power supply compartments.

For information about rear access to the drives, refer to the appropriate topics within "Power Structures" on page 359.

Certain conditions apply to mixing drives and media. To learn about compatible combinations, see the *IBM TS3500 Introduction and Planning Guide*.

The sections that follow describe each type of tape drive in the TS3500 tape library, and define their physical and logical addresses.

Ultrium tape drives

This section describes the Ultrium tape drives supported by the TS3500 tape library.

Ultrium tape drives write data to and read data from IBM LTO Ultrium data cartridges. The Ultrium 1 and Ultrium 2 tape drives communicate with the server by using one of three types of attachment interfaces: fibre channel, low voltage differential (LVD) SCSI, or high voltage differential (HVD) SCSI. The Ultrium 3 and and newer tape drives communicate by using only the fibre channel interface. Library SCSI commands and SCSI status pass to and from a server through logical unit number 1 (LUN 1) of the first drive of any logical library of the TS3500 tape library.

Figure 11 shows Ultrium tape drives inside the TS3500 tape library.
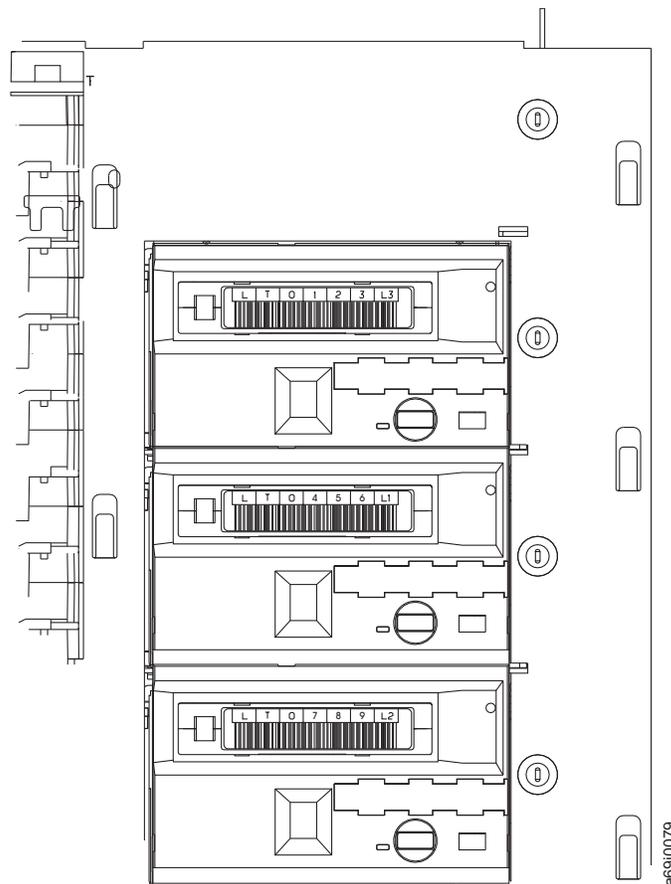
Figure 11. Ultrium tape drives mounted inside the TS3500 tape library and loaded with LTO Ultrium tape cartridges

3592 tape drives

This section describes the 3592 tape drives supported by the TS3500 tape library.

The 3592 tape drives write data to and read data from the 3592 tape cartridge. The drives communicate with the server through one of two fibre channel ports. The ports can be used as multiple paths of communication or for failover.

Figure 12 shows the 3592 tape drives inside the TS3500 tape library.
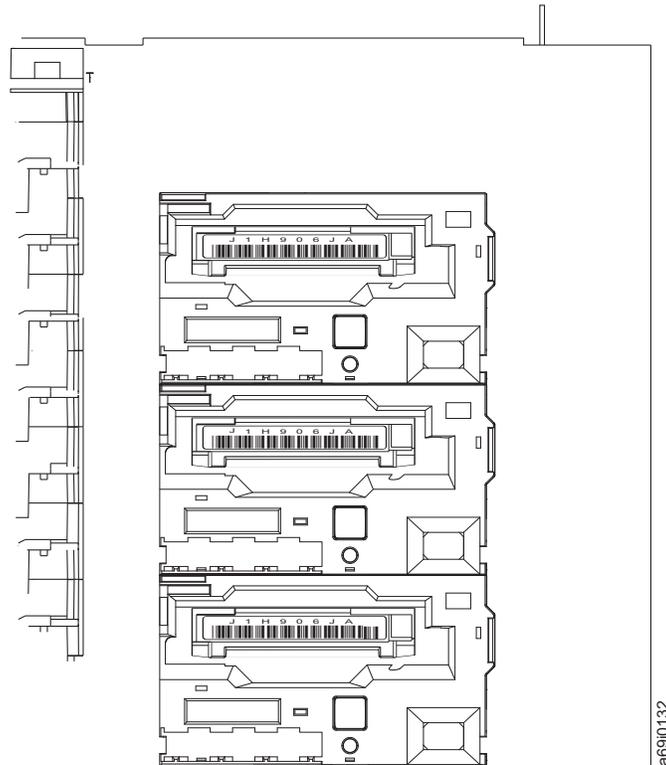
Figure 12. 3592 tape drives mounted inside the TS3500 tape library and loaded with 3592 tape cartridges

Physical addresses of drives

The TS3500 tape library assigns each tape drive a unique address to indicate its physical location. You can then use the address whenever you initiate an operation, such as moving a tape cartridge or performing manual cleaning. The drive address consists of two values: a frame number and a row number. The values are defined as follows:

Frame number
Represented as Fxx, where F equals the frame and xx equals its number. Regardless of whether any drives are installed, the frame number for the base frame is 01 and increments by one for each adjacent expansion frame.

Row number
Represented as Rzz, where R equals the row and zz equals its number. Rows 1 through 12 are available for drives. Regardless of whether drives are installed, the row numbering is the same for every frame.

Thus, a drive address of F02,R10 means frame 2 (the first expansion frame), row 10.

Logical addresses of drives

The TS3500 tape library assigns each drive a SCSI element address that consists of a value that defines a logical location in the library to the SCSI interface. This logical address is represented on the operator panel as xxxx(yyyh), where xxxx is a decimal value and yyyh is a hexadecimal value. It is assigned and used by the application when the server processes SCSI commands. The SCSI element address for a drive is unique to the drive's location; it does not vary based on other drives in the library. For a list of the SCSI element addresses for storage slots, I/O slots, and drives, see Chapter 10, "Addresses of SCSI Elements," on page 385.

Doors

This section describes the doors of the frames of the TS3500 tape library.

Located at the front of each frame in the TS3500 tape library is the front door. The door lets you access the cartridge storage slots that are mounted on the door wall and frame wall (service personnel use the door to access the rail assembly, cartridge accessor, and accessor controller).

The operator panel (**1** in Figure 13) is mounted on the front door of the base frame. Also located on the base frame's door are the power switch **2** and up to two input/output (I/O) stations **3** and **4** . A door handle **5** and a keylock (with key) **6** are included on the front door of all frames (the keys to all front doors are interchangeable). To unlock and open the door of any frame, insert the key into the keylock and turn it counterclockwise approximately 180°.
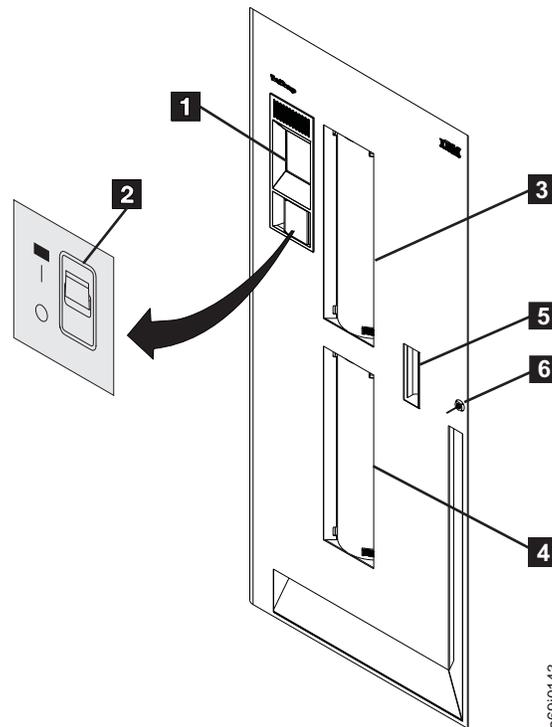
Figure 13. Front door of the TS3500 tape library. The operator panel is mounted on the front door of the base frame. A Model L22 or L52 is shown.

Each frame of the TS3500 tape library also includes a rear door with a keylock and key (the keys to all rear doors are interchangeable). To unlock the rear door of any frame, insert the key into the keylock and turn it clockwise.

The keys to the front and rear doors are not interchangeable.

With the exception of the service bays, if you open the front door of any frame during an operation the TS3500 tape library fails the active operation and rejects new requests for operations until all doors are closed. Note that application processes may fail if you do not halt the application before opening the front door. Approximately 15 seconds after you have closed all doors, the library performs an inventory update for frames whose doors have been opened (a process that determines whether cartridges have been added to or removed from the library, or moved within the library). Following the inventory, the library accepts new requests for operations.

If you need to open the door of a service bay, press the PAUSE key to avoid failing the active operation (the PAUSE key is located on the Activity screen). For more information, see "PAUSE key" on page 51.

Door safety switch

This section describes the safety switch located on the doors of TS3500 tape library frames.

Each frame in the TS3500 tape library (excluding the service bays) has a door safety switch that automatically turns off the power to the cartridge accessor (but not the tape drive) whenever you open the front door. The power does not automatically turn off if you open the rear door. The action of automatically turning off the power to the accessor is modified for the service bays if the IBM Service Representative has installed the safety barrier. After you close the front door, the library automatically performs an inventory of the tape cartridges of that frame.

I/O stations

This section describes the Input/Output (I/O) stations of the TS3500 tape library.

Note: In the TS3500 tape library, place only LTO Ultrium tape cartridges into Ultrium frames with black, Ultrium-supported I/O slots; place only 3592 tape cartridges into 3592 frames with gray-supported I/O slots.

The I/O stations let you insert or remove cartridges while the TS3500 tape library is performing other operations.

The TS3500 tape library comes with one 16-cartridge I/O station. To add greater capacity, you can order additional 64 or 16-cartridge LTO I/O or 3592 I/O stations to be installed by your IBM Service Representative.

TS3500 tape library supports four I/O stations in newly purchased Models D23 or D53 frames. The D-frame with I/O installed is comprised of four independently accessible I/O station doors that have a total of 64 slots (16 in each I/O station). Additionally, two LED indicators are provided for each I/O station in a D-frame in order to indicate if the I/O station is empty or full and if the I/O station door is locked or unlocked. This plant feature reduces the frame storage slot capacity by 160 for a Model D23 and by 176 for a Model D53. The I/O stations increase the maximum library I/O slot capacity from 32 to 224 due to a maximum of three D23 or D53 I/O frames in a 16-frame library. The multiple I/O stations double the maximum insert/eject throughput. The newly purchased D23 and D53 Models

remain compatible with existing Models L22, L32, L52, D22, D32, and D52. For a graphical representation of four I/O station doors and storage slot addresses, see Figure 15 on page 48

To open the door of an upper I/O station, grasp its handle at the bottom right and slide the door to the left. To open the door of a lower I/O station, grasp its handle at the top right and slide the door to the left. When an I/O station door is open, you can access its I/O storage slots. When the door is closed, the cartridge accessor can access the slots. Each I/O station has sensors and a locking mechanism to prevent you and the cartridge accessor from simultaneously accessing it.

If an I/O station door will not close, verify that the orientation of the cartridges is correct. Ensure that you are not attempting to insert an LTO cartridge into a 3592 I/O slot, or a 3592 cartridge into an LTO I/O slot.

Each I/O station slot has a unique address to indicate its physical location. The I/O station slot address consists of two values: a frame number and a row number:

Frame number
Represented as Fxx, where F equals the frame and xx equals its number. The frame number is always 01 in an I/O station in an L-frame.

Row number
Represented as Rzz, where R equals the row and zz equals its number. The row number is 1 for the top cartridge in the upper I/O station in a L-frame or the upper left I/O station in a D-frame, and increments by one for each row below the top slot.

A frame with two I/O stations assigns its I/O slot addresses as if the two stations were one. For example, in an L-frame (which is assigned F01),
- An I/O slot address of F01,R05 means frame 1, slot 5 (fifth row from the top of the upper I/O station; see **1** in Figure 14 on page 47).
- An I/O slot address of F01,R19 means frame 1, slot 19 (third row in the lower I/O station of a Model L22 or L52; see **2**).
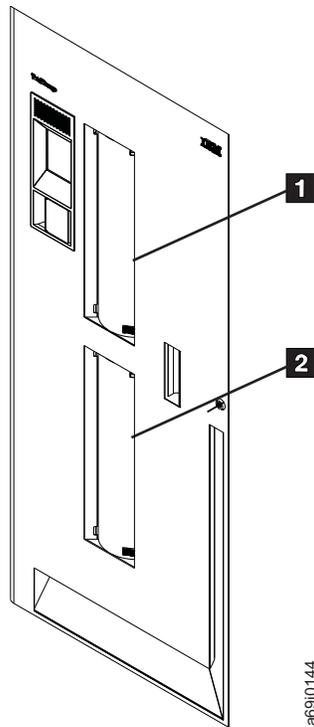
Figure 14. Storage slot addresses in the I/O stations of the TS3500 tape library. The door of a Model L22 or L52 frame is shown.

A D23 or D53 frame with multiple I/O stations assigns its I/O slot addresses as if the multiple stations were one. For example, in a D-frame:

- An I/O slot address of F02,R05 means frame 1, slot 5 (indicates the fifth row from the top of the upper left I/O station)
- An I/O slot address of F04,R40 means frame 3, slot 8 (indicates the eighth row from the top of the upper right I/O station)

Note: Because the L-frame is always frame number F01, D-frame numbers begin with F02.

(see Figure 15 on page 48)
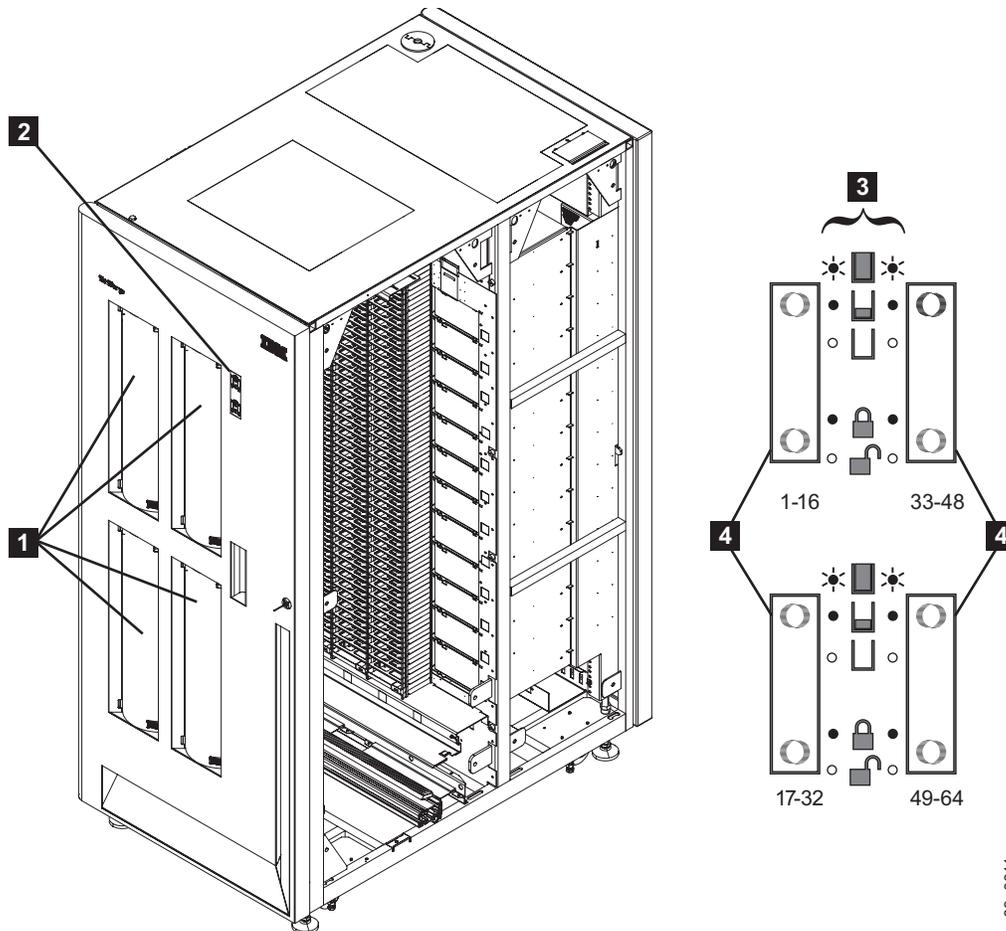
Figure 15. Storage slot addresses in four I/O station frames in the TS3500 tape library. The door of a Model D23 frame is shown.

Table 11. Location of I/O slots and LED display in frames with four I/O stations

1	Indicates the location of the 4 I/O stations on a D23 frame.
2	Indicates the LED display.
3	Indicates the various on/off and locked/unlocked states of the LED display.
4	Indicates the 4 I/O stations, and below each I/O station, shows the rows assigned to each station: • Rows 1-16 are assigned to the upper left I/O station. • Rows 17-32 are assigned to the lower left I/O station. • Rows 33-48 are assigned to the upper right I/O station. • Rows 49-64 are assigned to the lower right I/O station.

Operator panel

This section describes the operator panel of the TS3500 tape library.

In the TS3500 tape library, the operator panel is located on the front door of the base frame. The panel provides an indicator light and controls that let you perform operations and determine the status of the library. It consists of the following components (see Figure 16 on page 49):

1 **Library power switch**

A toggle switch that lets you power the TS3500 tape library on and off.

2 **Power-on indicator**

A green light that, when lit, indicates that dc power is available within the library.

3 **Power switch door**

For Models L22, L23, L52, and L53 only (not Model L32), a transparent door that protects the power switch and power-on indicator. To access the power switch, pull the transparent door toward you.

4 **Touchscreen LCD**

A liquid crystal display (LCD) that, when touched on the touch keys, shows the library's status and menus. Use the display to perform basic and advanced operations (service personnel use the display to run diagnostic tests and observe results). The LCD displays 12 to 15 lines of characters.

5 **Touch keys**

An array of small, touch-sensitive keypads that lets you select and navigate through menus. For most menus, the keypads are defined as BACK, UP, DOWN, and ENTER. To acknowledge that it has been pressed, a touch key initiates an audible beep when you press it. To disable the keypress beep, refer to the section about enabling or disabling the keypress beep.
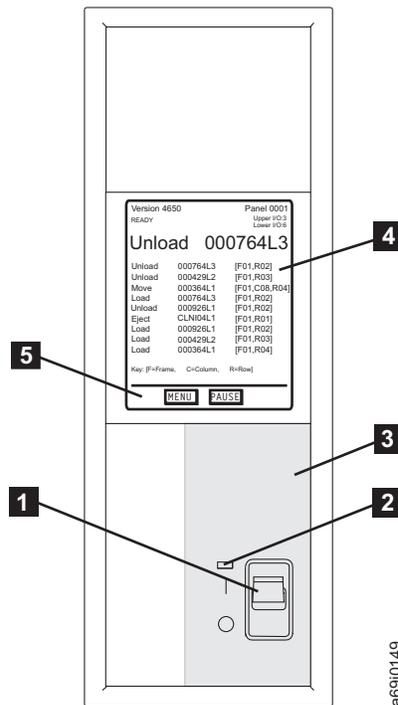
Figure 16. Sample screen on the operator panel of the IBM TS3500, Model L22 or L52

Activity screen

This section describes the activity screen of the TS3500 tape library.

The Activity screen (see Figure 17 on page 50) displays on the touchscreen LCD when the TS3500 tape library is ready (that is, when the host applications may interact with the library). The first line on the screen shows the current level of library firmware and the panel (screen) number. The left field on the second line

indicates whether the library is ready, not ready (not interacting with host applications), or initializing. The right field indicates the status of one or more input/output (I/O) stations.

```
┌─────────────────────────────────────┐
│ Version 4650              Panel 0001 │
│ READY                    Upper I/O:3 │
│                          Lower I/O:6 │
│                                      │
│  Unload   000764L3                   │
│                                      │
│  Unload      000764L3    [F01,R02]   │
│  Unload      000429L2    [F01,R03]   │
│  Move        000364L1    [F01,C08,R04]│
│  Load        000764L3    [F01,R02]   │
│  Unload      000926L1    [F01,R02]   │
│  Eject       CLNI04L1    [F01,R01]   │
│  Load        000926L1    [F01,R02]   │
│  Load        000429L2    [F01,R03]   │
│  Load        000364L1    [F01,R04]   │
│                                      │
│  Key: [F=Frame,   C=Column,   R=Row] │
│  ─────────────────────────────────   │
│        ┌──────┐   ┌───────┐          │
│        │ MENU │   │ PAUSE │          │
│        └──────┘   └───────┘          │
└─────────────────────────────────────┘
```
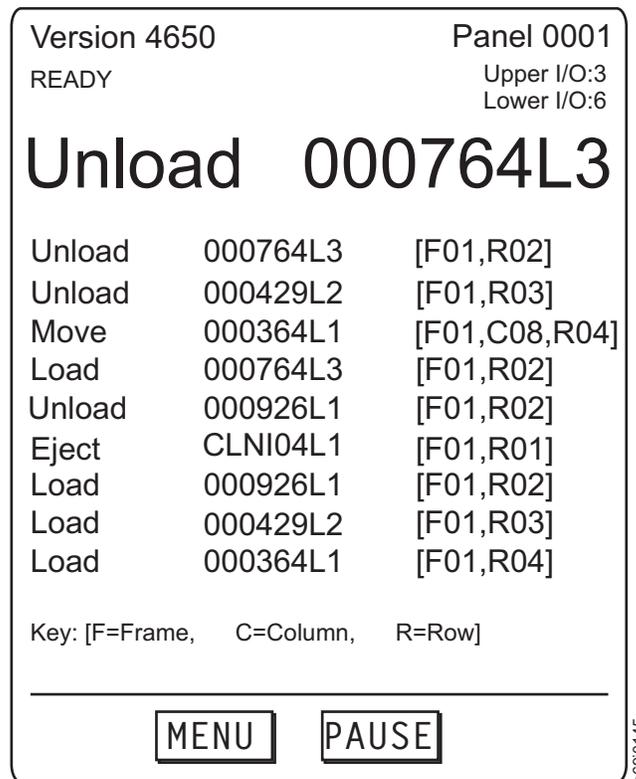
Figure 17. Sample Activity screen on the TS3500 tape library

The text in the I/O field varies, depending on whether the library has one or two I/O stations:

- If the library contains only one I/O station, I/O: displays.
- If the library contains two I/O stations, Upper I/O: and Lower I/O: display.

The values that can appear in the I/O field are:

- OPEN (when the door of an I/O station is open)
- LOCKED (when the door of an I/O station is closed and locked, and when the library is accessing or scanning cartridges)
- xx (where xx equals the quantity of tape cartridges in an I/O station)

The Activity screen also shows the current activity in a large font type and provides a history of preceding operations in a smaller font type. The operations are listed from top to bottom, with the most recent at the top and the oldest at the bottom. The first line of smaller font type gives a detailed description of the current activity (for example, in the sample Activity screen shown in Figure 17, a cartridge with a volume serial (VOLSER) number of 000764L3 was unloaded from the drive in frame 1, row 2). The last character of an LTO VOLSER can be 1, 2, 3, 4, 5, T, U, or V. Numbers 1 through 5 indicate the generation of the media; T indicates an LTO 3 WORM cartridge, U indicates an LTO 4 WORM cartridge, and V indicates an LTO 5 WORM cartridge.

The information in the Activity screen is automatically replaced by an error message when the TS3500 tape library detects these conditions:

- A permanent error occurred.
- A drive requires cleaning and one of these conditions exists:
  - Automatic cleaning was disabled.
  - No cleaning cartridge is present in the library.
  - The cleaning cartridge expired.

The presence or absence of the LOCK and UNLOCK buttons on the Activity screen depends on whether the frame supports the security feature for the operator panel and whether that feature has been enabled. Models L23 and L53 support the optional security feature; Models L22, L32, and L52 do not. When the operator panel's security feature is both supported and enabled, you can use the LOCK and UNLOCK buttons to control access to the panel. To enable or disable security for the operator panel, use the IBM Tape Library Specialist Web interface (see "Enabling or disabling security for the operator panel" on page 101).

Table 12 illustrates the conditions under which the LOCK, UNLOCK, and MENU buttons display.

Table 12. Presence or absence of the LOCK, UNLOCK, and MENU buttons on the Activity screen of the TS3500 tape library

Type of Frame	Presence or Absence of Buttons on the Activity Screen		
	UNLOCK	LOCK	MENU
Models L22, L32, and L52 (security for the operator panel is not supported)	No	No	Yes
Models L23 and L53 when security for the operator panel is disabled	No	No	Yes
Models L23 and L53 when security for the operator panel is enabled and the operator panel is locked	Yes	No	No
Models L23 and L53 when security for the operator panel is enabled and the operator panel is unlocked	No	Yes	Yes

Most screens that are left unattended for more than 5 minutes automatically default to the Activity screen.

PAUSE key

The TS3500 tape library activity screen features a PAUSE touch key that you should press before you power off the library or open the front door. The PAUSE key causes the cartridge accessor to park itself (to quickly resume operation later) and give you clear access to the interior of the library should you need to open the front door. In a TS3500 tape library shuttle complex, the PAUSE key also causes any shuttle cars that are present in the current library to move to another library in the shuttle complex.

If you press the PAUSE key by mistake, wait until the end of the 30-second timeout. The library will automatically resume the operation.

Attention: After you open the front door, the library rejects requests for new operations until you close the door and the inventory is completed. IBM recommends that you halt the application (for example, Tivoli Storage Manager, Legato, or Veritas) prior to pressing the PAUSE Key. Process failures may occur if you do not halt the application before you open the front door.

Chapter 3. Operating procedures

This chapter introduces the procedures that you can perform with the TS3500 tape library.

You can operate the library from the operator panel or by using the IBM Tape Library Specialist web interface. You can also perform some operations by using the TS3500 Tape Library Command Line Interface (CLI).

Overview of operating procedures

This section lists the procedures that you can perform with the TS3500 tape library.

Not all operating procedures are available from both the operator panel and the Tape Library Specialist web interface. The following tables provide links to the overview information for each procedure and indicates whether the procedure can be performed from the web, from the operator panel, or from both. The detailed information about how to perform the task, from the Tape Library Specialist web interface or the operator panel, follows the overview information for each procedure.

If your library uses both LTO Ultrium and 3592 tape drive media, certain screens on the operator panel may display a **Media Type** field. This field confirms the type of media that you chose for a particular operation.

Note: This information addresses the level of firmware that was available at the time of publication. If you update your firmware to the latest level, the look and functionality of the interface could be different from what is shown here.

Managing the TS3500 tape library

Table 13. Managing the TS3500 tape library

Managing the TS3500 tape library		From the web	From the operator panel
Advanced Library Management System (ALMS)	"Enabling the Advanced Library Management System" on page 159	X	
	"Managing licensed features" on page 156	X	X
	"Creating or removing a logical library" on page 162	X	
Accessors	"Setting or changing the preferred zone of an accessor" on page 165	X	X
Bar code scanner speed	"Adjusting the scanner speed" on page 224	X	
Cleaning	"Automatic cleaning" on page 95	X	X
	"Inserting a cleaning cartridge into the library" on page 95	X	X
	Automatic eject of expired cleaning cartridges: "Library preferences" on page 138	X	

Table 13. Managing the TS3500 tape library (continued)

Managing the TS3500 tape library		From the web	From the operator panel
Configuring the Library	"Displaying the existing library configuration" on page 151	X	X
	"Enabling or disabling the reporting of a 6-character or 8-character VOLSER" on page 201	X	
	"Discovering new hardware in the TS3500 tape library" on page 165		X
	"Enabling or disabling Secure Socket Layer (SSL) settings" on page 203	X	
Library IP addresses	"Using DHCP server settings" on page 195		X
	"Enabling stateless autoconfiguration for IPv6 addresses" on page 197		X
Control paths	"Displaying control paths" on page 178	X	X
	"Enabling or disabling a control path in a logical library" on page 120	X	
Data cartridges	"Enabling or disabling the reporting of a 6-character or 8-character VOLSER" on page 201	X	
	"Assigning cartridges to a logical library" on page 117	X	
	"Working with a cartridge assignment policy" on page 122	X	
	"Using the I/O stations to insert data cartridges when virtual I/O slots are enabled" on page 79	X	
	"Using the I/O stations to insert data cartridges when virtual I/O slots are disabled" on page 75		X
Date and time	"Changing the date and time" on page 199	X	X
Downloading information	"Accessing logs for the library" on page 215	X	
	"Accessing statistics about the library" on page 218 (only available for Models L23 and L53)	X	
	"Accessing port statistics for drives" on page 218	X	
Drives (physical library)	"Adding a drive to a physical library" on page 118	X	
	"Removing a drive from a physical library" on page 121	X	
Drives (logical library)	"Adding a drive to a logical library" on page 119	X	
	"Removing a drive from a logical library" on page 121	X	
	"Detecting gaps between drive element addresses in a logical library" on page 122	X	
Encryption key manager address	"Working with key manager addresses" on page 227	X	
	"Testing a key manager address" on page 228	X	X
	"Using the web to run key path diagnostics" on page 229	X	
Error log for library	"Viewing the library error log" on page 219	X	
Frames	"Performing an inventory of a frame in the library" on page 141	X	X
	"Determining the status of storage slots" on page 130	X	X
Firmware	"Updating firmware for the library" on page 220	X	
Hardware	"Discovering new hardware in the TS3500 tape library" on page 165		X

Table 13. Managing the TS3500 tape library (continued)

Managing the TS3500 tape library		From the web	From the operator panel
I/O Stations	"Enabling or disabling virtual I/O slots" on page 161	X	
	"Changing the quantity of virtual I/O slots in a logical library" on page 164	X	
	"Using the I/O stations to insert data cartridges when virtual I/O slots are enabled" on page 79	X	
	"Using the I/O stations to insert data cartridges when virtual I/O slots are disabled" on page 75		X
	"Enabling or disabling the Insert Notification setting" on page 202	X	X
Insert notification	"Enabling or disabling the Insert Notification setting" on page 202	X	X
Inventories	"Performing an inventory of a frame in the library" on page 141	X	X
	"Performing an inventory of the library" on page 140	X	X
Keypress beep	"Enabling or disabling the keypress beep" on page 200		X
Licensed features	"Managing licensed features" on page 156	X	X
	"Enabling the Advanced Library Management System" on page 159	X	
Logical library	"Creating or removing a logical library" on page 162	X	
	"Changing the name of a logical library" on page 162	X	
	"Working with a cartridge assignment policy" on page 122	X	
	"Assigning cartridges to a logical library" on page 117	X	
	"Changing the maximum allowable quantity of cartridges in a logical library" on page 163	X	
	"Sharing drives in a logical library" on page 120	X	
	"Adding a drive to a logical library" on page 119	X	
	"Removing a drive from a logical library" on page 121	X	
	"Detecting gaps between drive element addresses in a logical library" on page 122	X	
Operator panel	"Locking or unlocking the operator panel" on page 101 (for models L23 and L53 only)		X
	"Enabling or disabling security for the operator panel" on page 101 (for models L23 and L53 only)	X	
Passwords (operator panel)	"Enabling or disabling security for the operator panel" on page 101	X	
Passwords (web interface)	"Enabling or disabling password protection for Web screens" on page 106	X	
	"Modifying a Web user account" on page 112	X	
	"Changing your Web password" on page 112	X	
	"Enabling or disabling the Storage Authentication Service" on page 106	X	

Managing the TS3500 tape library		From the web	From the operator panel
Physical library	"Adding a drive to a physical library" on page 118	X	
	"Removing a drive from a physical library" on page 121	X	
	"Library preferences" on page 138	X	
	"Viewing capacity utilization of the library" on page 139	X	
Power	"Powering on" on page 71	N/A	N/A
	"Powering off" on page 72		X
Storage slot status	"Determining the status of storage slots" on page 130	X	X
Tape Library Specialist web interface:	"Enabling or disabling password protection for Web screens" on page 106	X	
	"Enabling or disabling the Storage Authentication Service" on page 106	X	
	"Managing Secure Socket Layer certificates" on page 109	X	
	"Choosing the timeout setting for Web screens" on page 110	X	
	"Modifying a Web user account" on page 112 (performed by administrator)	X	
	"Changing your Web password" on page 112 (performed by Web interface user)	X	
Vital product data (VPD)	"Accessing vital product data for the library" on page 209	X	X
	"Accessing vital product data for node cards in the library" on page 211	X	X

Table 14. Managing a shuttle complex

Managing a shuttle complex		From the web	From the operator panel
Managing shuttle stations	"Managing shuttle stations" on page 154	X	
Shuttle station status	"Determining the status of shuttle stations" on page 135	X	
Shuttle station VPD	"Accessing vital product data for shuttle stations" on page 213	X	

Table 15. Managing Drives

Managing Drives		From the web	From the operator panel
Adding or removing a drive (physical library)	"Adding a drive to a physical library" on page 118	X	
	"Removing a drive from a physical library" on page 121	X	
Adding or removing a drive (logical library)	"Adding a drive to a logical library" on page 119	X	
	"Removing a drive from a logical library" on page 121	X	
Cleaning tape drives	"Automatic cleaning" on page 95	X	X
	"Performing manual cleaning of drives in the library" on page 96	X	X

Table 15. Managing Drives (continued)

Managing Drives		From the web	From the operator panel
Drive element addresses in a logical library	"Detecting gaps between drive element addresses in a logical library" on page 122	X	
Drive logs	"Accessing logs for drives or saving a drive dump" on page 222	X	
	"Viewing a drive error log" on page 222	X	
Emulation mode	"Viewing the drive emulation mode of TS1120 tape drives" on page 135	X	X
Encryption method	"Viewing a drive's method of encryption" on page 234	X	
	"Setting or changing a drive's method of encryption" on page 226	X	
Firmware	"Updating drive firmware" on page 223	X	
Remote drive power cycle	"Performing a remote drive power cycle" on page 225	X	
SCSI ID (Loop ID (AL_PA) of a tape drive)	"Displaying the SCSI ID or Loop ID of a Drive" on page 167	X	X
	"Changing the SCSI ID or Loop ID of a drive" on page 168	X	X
Statistics	"Accessing statistics about drives" on page 217	X	
Status	"Determining drive status" on page 125	X	X
Usage	"Determining drive usage" on page 207	X	X
Vital product data (VPD) for drives	"Accessing Vital Product Data (VPD) for drives in the library" on page 210	X	X

Table 16. Managing Tape Cartridges

Managing Cartridges		From the web	From the operator panel
Cartridge accessor	"Determining the status of the cartridge accessor" on page 124	X	X
	"Determining accessor usage" on page 205	X	X
	"Setting or changing the preferred zone of an accessor" on page 165	X	X
Cartridge assignment policy, creating and deleting	"Working with a cartridge assignment policy" on page 122	X	
Encryption	"Determining whether a cartridge is encrypted" on page 235	X	
	"Working with key manager addresses" on page 227	X	
	"Testing a key manager address" on page 228	X	X
	"Working with a barcode encryption policy" on page 231	X	
	"Rekeying an encrypted cartridge" on page 236	X	
I/O station status	"Determining the status of an I/O station" on page 128	X	X

Table 16. Managing Tape Cartridges (continued)

Managing Cartridges		From the web	From the operator panel
Cleaning cartridges	"Inserting a cleaning cartridge into the library" on page 95	X	X
	"Removing a cleaning cartridge from the library" on page 98	X	X
	Automatic eject of expired cleaning cartridges: "Library preferences" on page 138	X	
Data and scratch cartridges	"Inserting data or scratch cartridges" on page 73		X
	"Removing data cartridges from the library" on page 86	X	X
	"Removing a data cartridge from a drive in the library" on page 89		X
	"Removing data cartridges from an HD slot in the library" on page 91		X
	"Moving a cartridge" on page 143	X	X
Location	"Determining the location of cartridges" on page 133	X	X
Logical library cartridges	"Using the I/O stations to insert data cartridges when virtual I/O slots are disabled" on page 75		X
	"Using the I/O stations to insert data cartridges when virtual I/O slots are enabled" on page 79		X
	"Enabling or disabling the Insert Notification setting" on page 202	X	X
	"Changing the maximum allowable quantity of cartridges in a logical library" on page 163	X	
Mount history	"Accessing the mount history of tape cartridges" on page 216	X	
Storage slot status	"Determining the status of storage slots" on page 130	X	X
Volume serial number (VOLSER)	"Initializing a tape volume serial number" on page 99	N/A	N/A
	"Enabling or disabling the reporting of a 6-character or 8-character VOLSER" on page 201	X	
	"Determining the location of cartridges" on page 133	X	X
	"Enabling bar code compatibility" on page 100		X

Table 17. Managing Ports

Managing Ports		From the web	From the operator panel
Ethernet	"Viewing Ethernet Address Settings" on page 184	X	X
	"Disabling an Ethernet connection" on page 198		X
Fibre Channel	"Viewing or changing Fibre Channel port speeds and topologies" on page 172	X	X
	"Displaying Fibre Channel port status" on page 176	X	X
	"Viewing a World Wide Node Name" on page 171	X	X
	"Viewing a World Wide Port Name" on page 170	X	X
SNMP IP addresses	"Viewing or changing the Simple Network Management Protocol (SNMP) destination IP configuration and remote port" on page 182	X	

Table 18. Managing Access

Managing Access		From the web	From the operator panel
Ethernet	"Changing the Ethernet address settings" on page 187	X	X
	"Changing the speed of the Ethernet link" on page 193		X
	"Disabling an Ethernet connection" on page 198		X
Library IP addresses (configuring settings)	"Using DHCP server settings" on page 195		X
	"Enabling or disabling Secure Socket Layer (SSL) settings" on page 203	X	
	"Enabling stateless autoconfiguration for IPv6 addresses" on page 197		X
Library IP addresses (viewing and changing settings)	"Viewing Ethernet Address Settings" on page 184	X	X
	"Changing the Ethernet address settings" on page 187	X	X
Security (operator panel)	"Enabling or disabling security for the operator panel" on page 101 (performed by administrator)	X	
Security (Web interface)	"Enabling or disabling password protection for Web screens" on page 106 (performed by administrator)	X	
	"Enabling or disabling the Storage Authentication Service" on page 106	X	
	"Establishing the administrator's Web password" on page 102 (performed by administrator)		X
	"Adding a web user account" on page 111 (performed by administrator)	X	
	"Modifying a Web user account" on page 112	X	
	"Changing your Web password" on page 112 (performed by Web user)	X	
	"Deleting a Web user account" on page 112 (performed by administrator)	X	
	"Viewing Web users with active sessions" on page 113 (performed by administrator)	X	
Session timeout	"Enabling or disabling security for the operator panel" on page 101	X	
	"Choosing the timeout setting for Web screens" on page 110	X	
SMI-S	"Enabling and disabling the SMI-S agent" on page 204	X	

Table 18. Managing Access (continued)

SNMP	"Enabling or disabling SNMP authentication trap settings" on page 180	X	
	"Enabling or disabling Simple Network Management Protocol (SNMP) traps" on page 179	X	
	"Setting the version of SNMP traps" on page 180	X	
	"Sending a test SNMP trap" on page 182	X	
	"Viewing or changing the SNMP trap community name" on page 183	X	
	"Viewing or changing the SNMP request community name" on page 183	X	
	"Viewing or changing SNMP system data" on page 181	X	
	"Viewing or changing the Simple Network Management Protocol (SNMP) destination IP configuration and remote port" on page 182	X	
SSL	"Enabling or disabling Secure Socket Layer (SSL) settings" on page 203	X	

Table 19. Managing Encryption

Managing Encryption		From the web	From the operator panel
Cartridge encryption	"Determining whether a cartridge is encrypted" on page 235	X	
	"Working with key manager addresses" on page 227	X	
	"Working with a barcode encryption policy" on page 231	X	
	"Mapping encrypted cartridge key labels" on page 233	X	
	"Rekeying an encrypted cartridge" on page 236	X	
Drive's encryption method	"Viewing a drive's method of encryption" on page 234	X	
	"Setting or changing a drive's method of encryption" on page 226	X	
Encryption policy	"Working with a barcode encryption policy" on page 231 (also known as a scratch encryption policy)	X	
Encryption key	"Rekeying an encrypted cartridge" on page 236	X	
Key manager addresses	"Working with key manager addresses" on page 227 (adding, changing, and deleting)	X	
	"Testing a key manager address" on page 228	X	X
	"Using the web to run key path diagnostics" on page 229	X	
SSL	"Enabling or disabling Secure Socket Layer (SSL) settings" on page 203	X	

Functions of the operator panel

Figure 18 on page 62 shows the functions of the operator panel on the TS3500 tape library. The operator panel also includes a Service category that is not shown in this flowchart. To view the complete set of service functions that are available from the library operator panel, refer to the *IBM TS3500 Maintenance Information* guide.

Activity Screen → Pause Library

Main Menu

Library Status →
- Accessor Status
- Drive Status
- Drive Display
- Storage Slot Status
- Storage Slot Statistics
- Cartridge Locations
- Fibre Port Status

Manual Operations →
- **Inventory** → Inventory Library / Inventory Frame
- Move Cartridge
- Clean Drive
- Insert Cleaning Cartridge
- Remove Cleaning Cartridge

Settings →
- **Configuration** → Display Configuration / Configure Library / Advanced Configuration / Discover Hardware Changes
- Cleaning Mode
- **SCSI/Loop IDs** → Display SCSI/Loop IDs / Change SCSI/Loop IDs
- **Fibre Ports** → World Wide Port Names / World Wide Node Names / Set Fibre Port Speed/Topology / Display Fibre Port Settings / Display Fibre Port Status
- **Control Ports** → Display Control Paths / Change Control Paths
- **Network**
- Date/Time
- Sounds
- Insert Notification

Network →
- **Ethernet IPv4** → Disable Ethernet / Enable with DHCP / Enable with Static IP
- **Ethernet IPv6**
- **Ethernet Speed/Duples** → Set Speed to Auto Negotiate / Set Speed to 100 Full Duplex / Set Speed to 100 Half Duplex / Set Speed to 10 Full Duplex / Set Speed to 10 Half Duplex
- **Web Server** → Reset Security/Admin Password

Advanced Settings →
- Change Accessor Zones
- Drive Emulation
- Drive RS422 BAUD Rate

Usage Statistics →
- Accessor Usage
- Drive Usage
- Cleaning Cartridge Usage

Vital Product Data →
- Library VPD
- Drive VPD
- Node Card VPD
- Drive Serial Numbers
- World Wide Port Names
- World Wide Node Names

Service → To "Service Menu"

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Figure 18. Functions of the operator panel on the TS3500 tape library

Functions of the Tape Library Specialist web interface

The Tape Library Specialist interface lets you perform many library functions from the web. Figure 19 shows the functions that are available. Depending on the configuration of your TS3500 tape library, some of the options shown in the following information might not be available.

Note: Items in the Service menu are discussed in the *IBM TS3500 Maintenance Information* guide.

Figure 19. Functions of the Tape Library Specialist web interface

Operating the library from the operator panel

The operator panel of the TS3500 tape library allows you to make your choices by touching the touchscreen LCD. You begin operation by pressing **MENU** on the Activity screen. Highlight your choice on any screen by pressing **UP** or **DOWN**, then activate it by pressing **ENTER**. You can return to previous screens by pressing **BACK** (or where specified, **ENTER**).

When performing functions, remember to press **ENTER** after each choice that you have highlighted. For example, if you are setting your initial admin password, the first step reads:

```
From the library's Activity touchscreen, press MENU -> Settings ->
Network -> Web Server -> ENTER.
```

To get to the next screen and ensure that the overall function of setting your initial admin password is successful, you must press **ENTER** after you highlight **Settings**, **Network**, and **Web Server**.

Throughout this book, it is assumed that you press **ENTER** after you highlight your choices on the touchscreen LCD.

Operating the library from the web interface

How to use the web interface to operate the TS3500 tape library.

To use the IBM Tape Library Specialist web interface, perform the following steps:

1. Ensure that you have available the Ethernet Internet Protocol (IP) address of the frame to which you want to connect (for example, **http://10.1.1.1**). To determine the Ethernet IP address, see the sections about viewing Ethernet settings.
2. Access Internet Explorer 5.0 (or higher), Firefox 1.0 (or higher), or Opera 2.5 (or higher).
3. Type the Ethernet IP address on the URL line of the browser and press Enter.

If password protection is enabled on the library, the IBM TS3500 Tape Library Sign On screen displays. If password protection is not enabled, the System Summary screen of the Tape Library Specialist web interface displays.

The IBM TS3500 Tape Library Login screen prompts you to enter a User name and Password. The screen also indicates whether you are using local or remote authentication to verify the ID and password. After entering the User name and Password fields, click **Log In** to continue to the System Summary screen. Refer to "Storage Authentication Service" on page 28 for additional information about remote authentication.

Note: If you are using remote authentication and the login fails, refer to "Using the operator panel to change the administrator's Web password" on page 105 in order to disable the Storage Authentication Service using the operator panel. You can then log in using your local user account.

The System Summary screen displays the main components and physical configuration of your TS3500 tape library (see Figure 20 on page 66). In addition to the information and links available on the System Summary screen, the Work Items navigation panel on the left side of the screen allows you to access library

functions from any page. Detailed information about the contents of each screen is available by selecting the Help link in the upper right corner of each page.

System summary

This topic describes the information and functions that are available on the System Summary page of the TS3500 tape library web specialist.

The System Summary screen (see Figure 20 on page 66) displays the main components and physical configuration of your TS3500 tape library. This screen is divided into two sections: Library Status and Frame or Shuttle View. The contents of this screen vary depending on the configuration of your library.

The Library Status section displays the status of the cartridge accessor, the capacity utilization of the library by media type, and the number of active errors. In a TS3500 tape library shuttle complex, the status of all shuttle stations is also displayed. Any component that is in a warning or critical state links to the web specialist page for that component.

The next section of the System Summary page displays a Frame View and a Shuttle View. The Shuttle View is only available in a TS3500 tape library shuttle complex. The Frame View, which is the default view, displays an image of the library and a Configuration and Cartridge Count table. This table contains details about storage slots, accessors, I/O slots, cartridges, drives, and node cards. You can view information for the entire library, or for a specific frame by clicking the picture of a frame or selecting it from the drop-down menu. The table provides links to each component.

Library Status:

Accessor	☑ OK
LTO Capacity Utilization	☑ 35%
3592 Capacity Utilization	☑ 36%
Shuttle Stations	☑ OK

Frame View | Shuttle View

All Frames ▼   Inventory/Audit

All Frames

Total storage slots	1578
LTO Licensed Capacity	219
LTO Unlicensed Capacity	0
3592 Licensed Capacity	959
3592 Unlicensed Capacity	400
Total empty storage slots	1393
Offline storage slots	240
Accessors	1
Total I/O slots	32
Empty I/O slots	32
Total LTO data cartridges	78
LTO Ultrium-1	6
LTO Ultrium-2	35
LTO Ultrium-3	33
LTO Ultrium-4	4
LTO Ultrium-5	0
LTO Ultrium Not Labeled	0
Total 3592 data cartridges	108
3592	108
3592 Not Labeled	0
Cleaning cartridges	1
Drives	8
Node cards	6
Total frames	3
Active frames	3
Service bays	0

Figure 20. Sample System Summary of the Tape Library Specialist web interface

In a shuttle complex, the Shuttle View displays an aerial view of the complex (see Figure 21 on page 67). The current library is highlighted and all shuttle connections and connected libraries are shown. When you hover over the first frame of each library with the cursor, the IP address of that library displays at the bottom of the browser window. When you roll over the current library, which is outlined in blue, the name of the shuttle station and its status (red circle for critical; green circle for OK) are displayed.

System Summary

Library Status:

Accessors	☑	OK
LTO Capacity Utilization	☑	27%
3592 Capacity Utilization	☑	1%
Shuttle Stations	☑	OK

Frame View	**Shuttle View**

Aerial View of Shuttle Complex:

Shuttle Station 1 = Normal
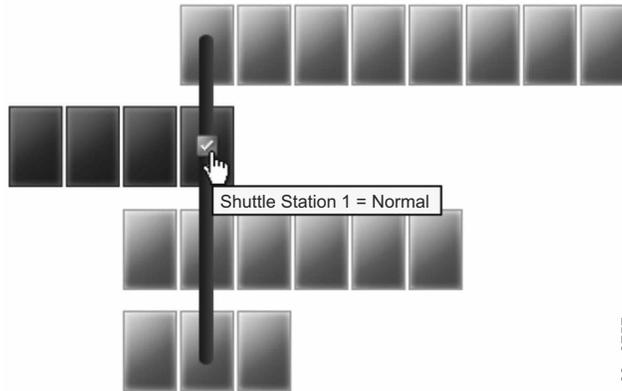
Figure 21. View of shuttle complex from the Tape Library Specialist web interface

Display of active errors under Library Status

The TS3500 Library status chart also reports the number of active errors on the System Summary Page along with the accessor and shuttle station status.

The number of active errors will include the TS3500 events icon with red/yellow/green color as follows:

- A red icon is displayed if there's any active critical error record
- A yellow icon is displayed if there are only active warning error records
- A green icon with word "None" is displayed if there are no active critical records or active warning error records

The icon provides a hotlink to View Library Error Log with a pre-filtered time period that is the minimum required to include all active error records either Critical or Warning (however all error records in that time period will be displayed).

The word None is also a hotlink to View Library Error Log with a pre-filtered time period, that is the minimum required to display at least one error record of any severity.

Navigating through the Tape Library Specialist web interface

This section describes the navigational elements that are used in the Tape Library Specialist interface.

Figure 22 shows the elements and navigational aids in a typical screen.
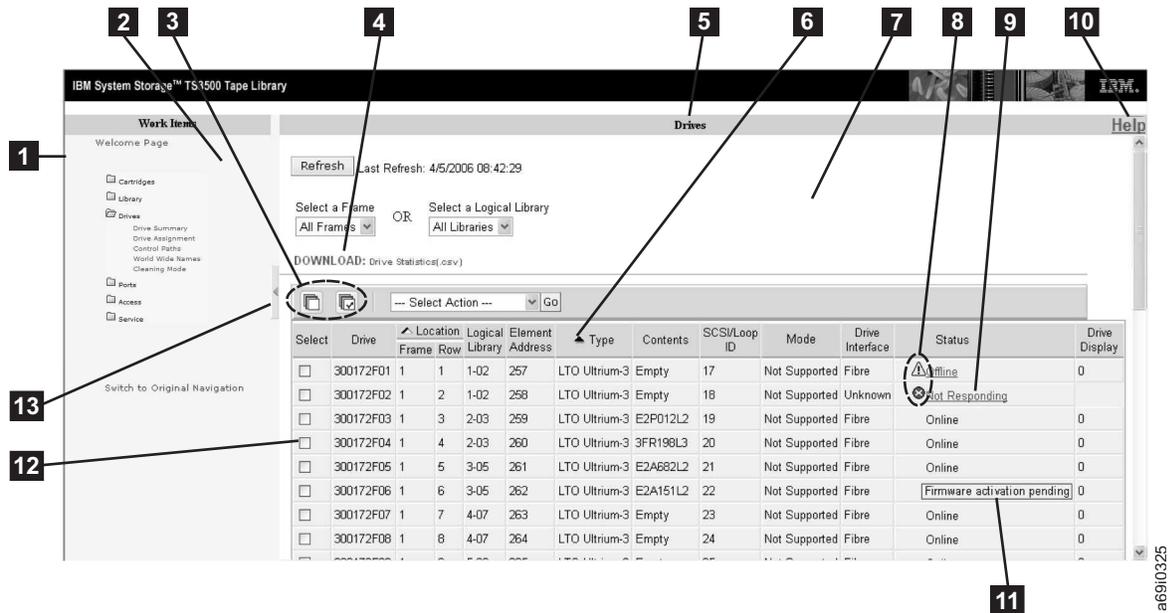
Figure 22. Elements in a typical Tape Library Specialist web screen

1 **Expanding or collapsing icons**

A closed folder icon (expanding) or an open folder icon (collapsing) at the left of each function in the navigation area. Select the closed folder icon to display a list of subfunctions. Select the open folder icon to collapse the list.

2 **Navigation area**

A selection of functions that you can perform. When you select a function, subfunctions display. Select the subfunctions to go to related menus. You can select more than one function at a time.

3 **Select All or Deselect All icons**

Icons that allow you to choose all selectable items or to void your selection of all items. The icons include:

A stack of blank pages. Select this icon to deselect all items.

A stack of pages marked with a checkmark. Select this icon select all items.

4 **DOWNLOAD: Drive Statistics (.csv)**

A link that downloads performance and usage information about the drives in the TS3500 tape library.

5 **Screen title**

A navigational tool to help you track your location in the application.

6 **Sort indicators**

A filled triangle indicates that the field can be sorted. An empty triangle indicates that the field has been sorted.

7 **Content area**

A collection of information that lends meaning to a query or a function, such as the number of the frame or row, an element address, the type of drive, an indication of whether a drive is occupied or empty, a drive's interface, and its SCSI or Loop ID.

8 **Error indicators**

Icons that indicate a problem. Select the hyperlinked text to the right of the icon to display an error or informational message. The icons include:

A yellow triangle with a black exclamation point indicates a problem of low to medium severity. Action is required, but the problem is not urgent.

A red circle with a white **X** indicates a problem of severe to fatal severity. Immediate action is required or the function cannot continue.

9 **Link**

Represented as underscored text, a link is an electronic path that leads to another screen. For example, if a problem exists, select Not Responding to go to another screen that describes the problem and gives possible actions.

10 **Help icon on title bar**

An icon that, when selected, goes to the Help topics. Help is context-sensitive and includes screen overviews and troubleshooting tips. After you select the Help icon, select the icons at the bottom left of the screen to access a table of contents and an index.

11 **Firmware activation pending icon**

An icon that displays in the Status column. When you place your mouse over the icon, a message notifies you that firmware has been queued for update.

12 **Buttons**

Screen entities that indicate selection. Radio buttons (round buttons) signify objects; select buttons (rectangular buttons) signify actions. For example, to download the log of a particular drive, in the Download Drive Log screen select the round button beside that drive. From the Select Action drop-down box, select Download then select Go. You cannot select multiple radio buttons.

13 **Collapse or expand arrow**

An icon that collapses or expands a navigation heading.

TS3500 Tape Library Command Line Interface

The TS3500 Tape Library Command Line Interface (CLI) program provides the ability to access TS3500 tape library functions through a CLI.

In order to use the TS3500 Tape Library CLI, the following prerequisites apply:

- The TS3500 tape library must be at firmware level 8xxx (or higher).
- The Advanced Library Management System (ALMS) must be installed and enabled.
- Secure Socket Layer (SSL) for the Web must be disabled.

The TS3500 Tape Library CLI, along with additional information including supported actions and command parameters, can be found here: http://www-01.ibm.com/support/docview.wss?uid=ssg1S4000854.

Powering on

This section explains the procedure for turning on the power to the TS3500 tape library.

About this task

Use the following steps to power on the TS3500 tape library:

Procedure

1. In the section about the operator panel, review the information about the library power switch and power on indicator.
2. While watching for the green power-on indicator to turn on and stay on (see **1** in Figure 23), move the library power switch (see **2**) to |. When you move the switch, the base library and the expansion frame (if attached) power on at the same time. If the green power-on indicator fails to light, call your IBM Service Representative.

Results

When you power on the library, it executes a power on initialization sequence for about 2 minutes. During that time, the menus on the touchscreen display are not available for use. After the power on initialization sequence, the library performs an inventory of the tape cartridges, which takes less than 60 seconds per frame. The sequence is complete and the library is available for use when the message **READY** displays on the Activity screen.
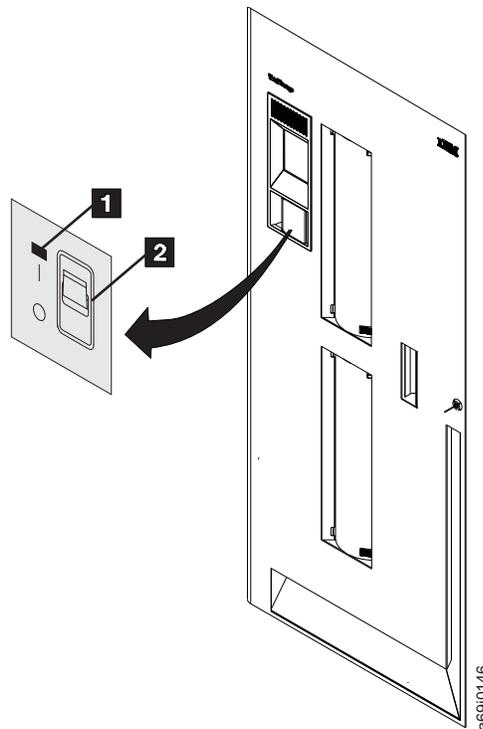
Figure 23. Powering on the TS3500 tape library. The library power switch and the power-on indicator are located on the operator panel of the base frame (in this example, a model L23 or L53 frame).

Powering off

This section explains the procedure for turning off the power to the TS3500 tape library.

About this task

Always press the PAUSE key before you power off the TS3500 tape library. If you power off before pausing, the library may take longer to go online after the next power on.

Note: In a TS3500 tape library shuttle complex, pressing the PAUSE key causes any shuttle cars that are present in the current library to move to another library in the shuttle complex.

Use the following steps to power off the TS3500 tape library after normal operation and not during an emergency:

Procedure
1. Ensure that the host application has removed cartridges from all drives and that the library is varied offline from the host (if the host is attached).
2. Press the PAUSE key on the display. The library displays the message **If you open the door the library will go Not Ready and any remaining jobs in the work queue may fail. Press ENTER to continue.**
3. Press ENTER. The message **PAUSE in Progress** displays. The library parks the cartridge accessor in the base frame and displays the message **The library is now paused. Normal operations will resume in 30 seconds.**
4. Move the library power switch to **0**. If you do not power off within 30 seconds, the Activity screen displays again.

Inserting data or scratch cartridges

A description of cartridges that are used by the TS3500 tape library and two ways to insert data and scratch cartridges.

Notes:
- Management and handling of media cartridges is a customer function and responsibility.
- Never insert any type of cartridge into service bays.

After you install the TS3500 tape library, you can insert cartridges into it. The following types of cartridges can be inserted:

Data or scratch cartridge
> A tape cartridge that is designed to receive information recorded to it by a tape drive. A scratch cartridge is a data cartridge whose tape no longer contains useful information and which can be overwritten. To ensure that your tape library conforms to IBM's specifications for reliability, use only the IBM LTO Ultrium Data Cartridge in Ultrium tape drives and the IBM 3592 Enterprise Tape Cartridge in 3592 tape drives. You can use other LTO- or 3592-certified media, but they may not meet the standards of reliability established by IBM. If you are using mixed drive types, place only LTO Ultrium tape cartridges into Ultrium frames with black I/O slots; similarly, place 3592 tape cartridges into 3592 frames with gray I/O slots. For more information, see "Using the I/O stations to insert data cartridges when virtual I/O slots are disabled" on page 75, "Using the I/O stations to insert data cartridges when virtual I/O slots are enabled" on page 79, "Bulk loading cartridges into non-HD storage slots" on page 81, "Bulk loading cartridges into HD slots" on page 83, or "Removing data cartridges from the library" on page 86.

Cleaning cartridge
> A tape cartridge that is used by the library to clean the heads of its tape drives. Use only the IBM LTO Ultrium Cleaning Cartridge or an IBM-approved cleaning cartridge to clean an Ultrium tape drive. Use only the IBM 3592 Cleaning Cartridge or an IBM-approved cleaning cartridge to clean a 3592 tape drive. The procedure for inserting and removing cleaning cartridges is different than the procedure for inserting and removing data and scratch cartridges. For more information, see"Inserting a cleaning cartridge into the library" on page 95 or "Removing a cleaning cartridge from the library" on page 98.

LTO Diagnostic cartridge or 3592 CE cartridge
> A tape cartridge that is used by the IBM Service Representative to service the TS3500 tape library. The service representative installs the cartridge at the same time that the library is installed. For libraries that use Ultrium and 3592 tape drives, the service representative installs a diagnostic cartridge for each type of drive.

The quantity of cartridges that you can add to the TS3500 tape library is equal to the maximum number of available storage slots (for more information, go to the section about frame capacity). Before you insert data or scratch cartridges, make sure that there are enough available slots. To check the availability of storage slots, see "Determining the status of storage slots" on page 130.

Conditions apply to mixing drives and media. For more information, see the appropriate sections in the *IBM TS3500 with ALMS Introduction and Planning Guide*.

There are two ways to insert data and scratch cartridges:

- Insert the cartridges into an I/O station and let the host application software move the cartridges into the library.
- Open the front door of a frame and bulk load the cartridges directly into empty storage slots.

The sections that follow describe each method of inserting data and scratch cartridges.

Using the I/O stations to insert data cartridges when virtual I/O slots are disabled

Follow this procedure to insert data cartridges using the I/O stations when virtual I/O slots are disabled.

About this task

Use the following steps to insert the cartridges into the I/O stations and move them into the TS3500 tape library:

Procedure

1. On the library's Activity screen, look at the right field on the second line and determine whether the I/O station that you want to use is locked. If the field reads **I/O:LOCKED**, use your application software to unlock the I/O station.

2. Open the door of the intended I/O station and insert the cartridges so that the bar code label faces the interior of the library and the write-protect switch is on the right. For easy insertion, IBM recommends that you grasp the cartridge so that your fingers (and not your thumb) rest comfortably on the top (see Figure 24 on page 76).
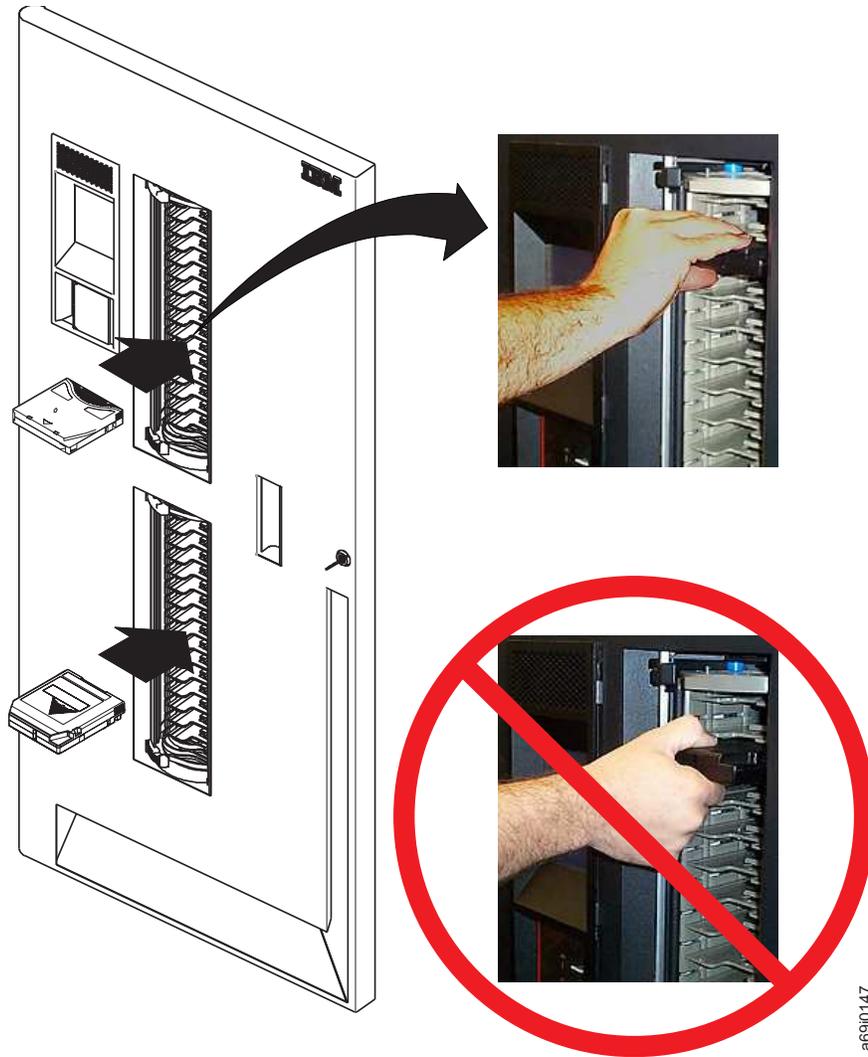
Figure 24. Using an I/O station to insert cartridges. Ensure that the bar code label faces the interior of the library and the write-protect switch is on the right. After you insert cartridges, use the host application software to move them to the library's storage slots or drives. The figure shows a library that uses Ultrium and 3592 drives and cartridges.
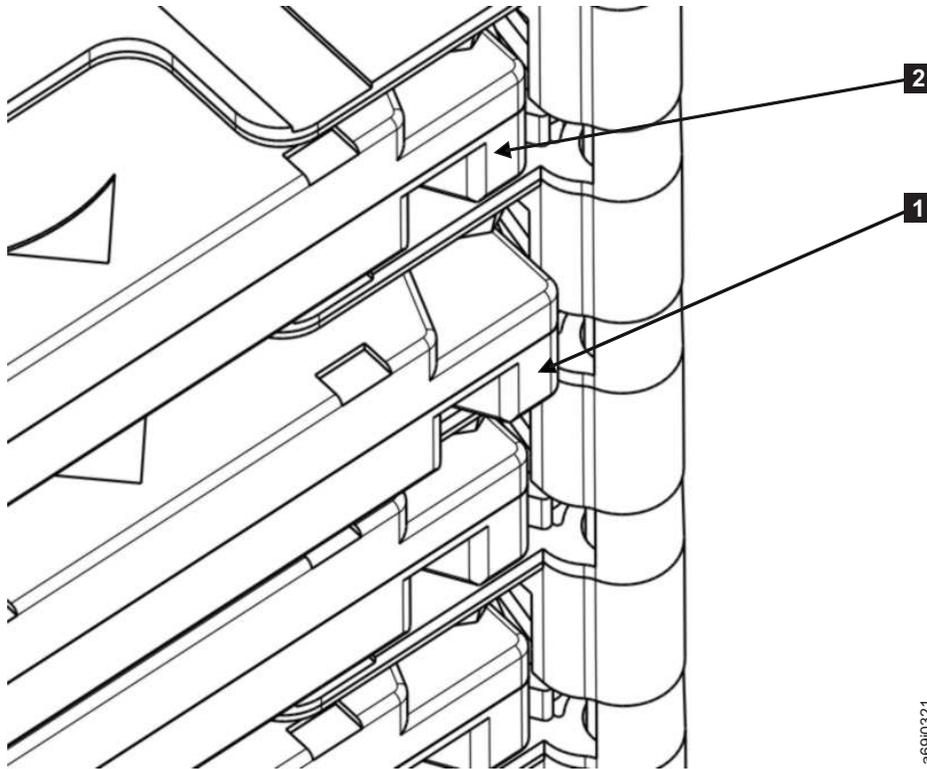
Figure 25. Positioning an LTO Ultrium tape cartridge in the I/O station

To correctly seat an LTO Ultrium tape cartridge, insert it in the correct orientation and position it as shown in **1** in Figure 25. Continue to push the cartridge until its face is flush **2** with the I/O cell.

One of the following actions occurs:

- If the cartridges are in the Cartridge Assignment Policy, the library will automatically assign them to a specific logical library.

- If the Insert Notification setting is enabled, the Insert Notification screen prompts you for a logical library to which you can assign the cartridges. Press UP or DOWN to select the logical library that you want for that cartridge and press ENTER. (To determine whether Insert Notification is enabled, go to the section about enabling or disabling Insert Notification.)

- If the Insert Notification setting is disabled, the cartridge is made available to any logical library until the cartridge is moved to a storage slot by a host or by the user interface.

Note: In a library that is not partitioned into logical libraries, the Insert Notification screen does not display and the cartridge will be automatically assigned to the first logical library of its media type.

```
Please select a logical          Panel 0191
library to assign the
new cartridges to.

Logical Library:  1

30 seconds until
automatic return to the
Activity Panel

[BACK]   [ UP ]          [ENTER]
```

3. Close the door of the I/O station. If the door will not close, check the type and orientation of the tape cartridge that you are using. Ensure that you are not inserting an LTO cartridge into a 3592 I/O slot, or a 3592 cartridge into an LTO I/O slot. If necessary, repeat step 2 on page 75.

4. Perform one of the following to move the cartridges into the library:
   - Use your host's application software to move the cartridges; refer to your application software's documentation.
   - Manually move the cartridges from the I/O station to the library's storage slots or drives. (To manually move the cartridges, see "Moving a cartridge" on page 143.)

Using the I/O stations to insert data cartridges when virtual I/O slots are enabled

Follow this procedure to insert data cartridges using the I/O stations when virtual I/O slots are enabled.

About this task

Note: With the Advanced Library Management System (ALMS), you can use the Tape Library Specialist web interface to enable virtual I/O slots and make the host application operate as if the library has more I/O slots than actually exist. For details, refer to "Enabling or disabling virtual I/O slots" on page 161.

To use I/O stations to insert cartridges into the TS3500 tape library when virtual I/O slots are enabled, perform the following steps:

1. When virtual I/O slots are enabled, physically seat the cartridges into the I/O station by using the same instructions as when virtual I/O slots are disabled (see "Using the I/O stations to insert data cartridges when virtual I/O slots are disabled" on page 75).

2. After you have seated the cartridges, the library will automatically move them into storage slots. How each cartridge is assigned to a logical library varies, depending on whether the cartridge assignment policy and insert notification features are set. For additional details, see Figure 26 on page 80.

3. Refer to one of the following to virtually move the cartridges into the logical library:
   - Documentation for your host's application software.
   - See Figure 26 on page 80, then follow the procedure in "Assigning cartridges to a logical library" on page 117.

Virtual IO Slots - Import Flow
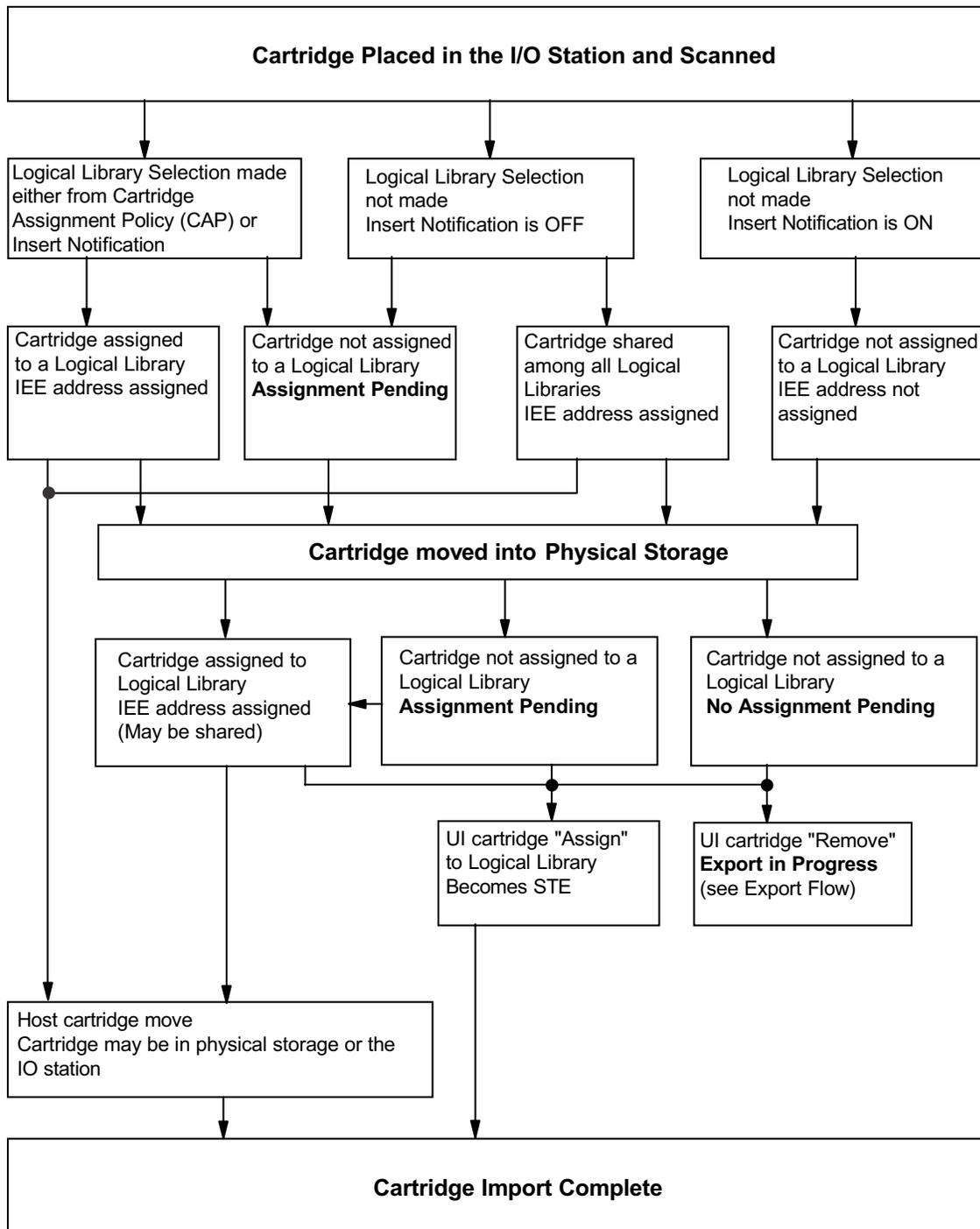
Figure 26. Scenarios for importing cartridges into the TS3500 tape library when virtual I/O slots are enabled

The states that a tape cartridge can be in (after you place it into the I/O station) as an exception to the normal import flow are listed below. As the library imports or exports cartridges, the states may display in the Element Address column of the Data Cartridges screen on the Tape Library Specialist Web interface.

Assignment Pending

The state that a tape cartridge is in after the operator places it into the I/O station and the library has not yet assigned it an Import/Export Element

(IEE) address. The reason that an address may not yet be assigned could be that there are no IEE addresses available, either for this logical library or, in the case of a shared cartridge, across all logical libraries.

Export in Progress
> The state that a tape cartridge is in after the operator selects a remove operation from the Tape Library Specialist Web interface and the cartridge is queued to be moved to the I/O station.

No Assignment Pending
> The state that a tape cartridge is in when the operator places it in an I/O station, the cartridge accessor moves it into the library, the insert notification feature is enabled, and no logical library selection was made by the operator. When the cartridge is in this state, the operator must make a logical library assignment through the Tape Library Specialist Web interface.

Bulk loading cartridges into non-HD storage slots

Follow this procedure to bulk load (manually insert) cartridges directly into non-HD storage slots of the TS3500 tape library.

About this task

Notes:
- With the Advanced Library Management System (ALMS) enabled, cartridges that are not in a cartridge assignment policy will not be added to any logical library.
- In order to bulk load cartridges into HD slots, refer to "Bulk loading cartridges into HD slots" on page 83. Only bulk load cartridges into HD slots during initial cartridge insertion.

Procedure

1. From the library's Activity screen (see Figure 27 on page 82), press the PAUSE key. The library displays the message **If you open the door the library will go Not Ready and any remaining jobs in the work queue may fail. Press ENTER to continue.**

```
Version 4650                    Panel 0001
                                Upper I/O:3
READY                           Lower I/O:6

Unload   000764L3

Unload      000764L3    [F01,R02]
Unload      000429L2    [F01,R03]
Move        000364L1    [F01,C08,R04]
Load        000764L3    [F01,R02]
Unload      000926L1    [F01,R02]
Eject       CLNI04L1    [F01,R01]
Load        000926L1    [F01,R02]
Load        000429L2    [F01,R03]
Load        000364L1    [F01,R04]

Key: [F=Frame,    C=Column,    R=Row]


        [ MENU ]   [ PAUSE ]
```
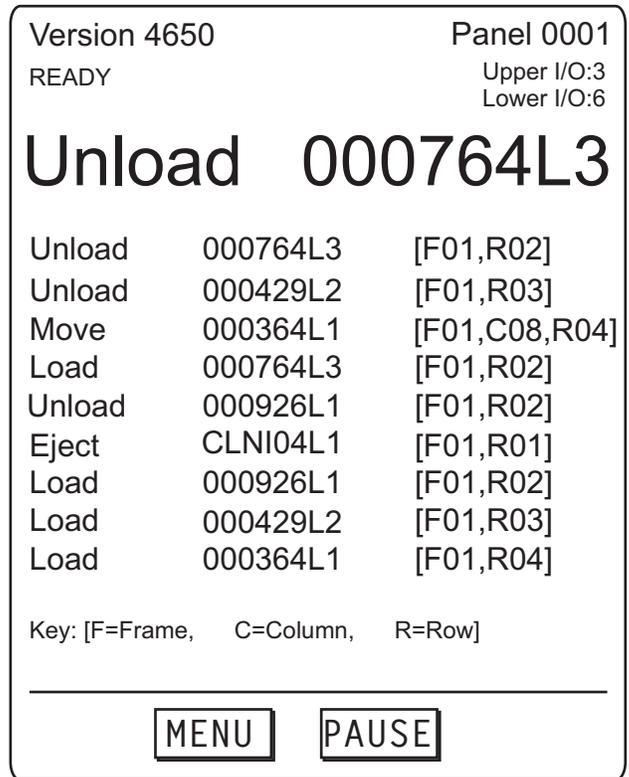
Figure 27. Activity screen on the front panel of the IBM TS3500. Use the screen to pause the library.

2. Press ENTER. The message **PAUSE in Progress** displays. The library parks the cartridge accessor in the base frame and displays the message **The library is now paused. Normal operations will resume in 30 seconds.**

3. Within 30 seconds, unlock and open the front door on any frame. If you do not open the door within 30 seconds, the Activity screen redisplays.

4. Insert the cartridges into any empty storage slots, except for the slots reserved for diagnostic cartridges (that is, F01,C01,R01, or, if you are using mixed drive types, Fxx,C01,R01 where **xx** equals the first expansion frame for the second type of media).

Note: Non-HD cartridge storage slots in LTO Ultrium frames are black. Non-HD cartridge storage slots in 3592 frames are gray. Place only Ultrium cartridges in Ultrium slots and place only 3592 cartridges in 3592 slots.

⚠ **CAUTION:**
Only place cartridges in a frame whose front door is open. Do not add or remove cartridges from an adjacent frame.

The write-protect switch is located on the left side of both Ultrium and 3592 cartridges. Insert Ultrium and 3592 cartridges into the storage slots so that the write-protect switch is on the left and the volume serial (VOLSER) number label is visible (see Figure 28 on page 83 and Figure 29 on page 83). The orientation differs from the orientation in an I/O slot.
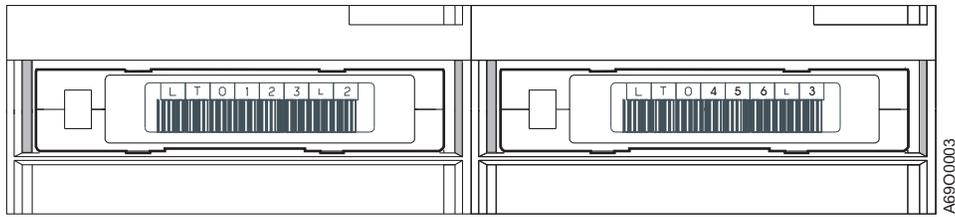
Figure 28. Proper orientation of LTO Ultrium tape cartridges in cartridge storage slots
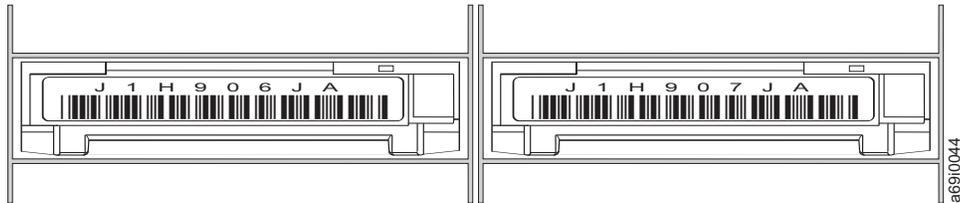
Figure 29. Proper orientation of 3592 tape cartridges in cartridge storage slots

5. Gently close and lock the front door.
6. After approximately 15 seconds, the TS3500 tape library automatically inventories the frame of the door that you opened. During the inventory, the message **INITIALIZING** displays on the Activity screen. When the inventory is complete, **READY** displays.

   Note: Do not insert cartridges into an adjacent frame. However, if you do insert cartridges into an adjacent frame, you must perform an inventory of that frame or of the entire library. For instructions, see "Performing an inventory of a frame in the library" on page 141 or "Performing an inventory of the library" on page 140.

Bulk loading cartridges into HD slots

Follow this procedure to bulk load (manually insert) cartridges directly into HD slots of the TS3500 tape library.

About this task

Important:
- With the Advanced Library Management System (ALMS) enabled, cartridges that are not in a cartridge assignment policy are not added to any logical library.
- Only bulk load cartridges into HD frames during initial cartridge insertion.

Procedure

1. From the library's Activity screen (see Figure 30 on page 84), press the PAUSE key. The library displays the message: If you open the door the library will go Not Ready and any remaining jobs in the work queue may fail. Press ENTER to continue.

```
Version 4650                    Panel 0001
READY                           Upper I/O:3
                                Lower I/O:6

Unload   000764L3

Unload      000764L3      [F01,R02]
Unload      000429L2      [F01,R03]
Move        000364L1      [F01,C08,R04]
Load        000764L3      [F01,R02]
Unload      000926L1      [F01,R02]
Eject       CLNI04L1      [F01,R01]
Load        000926L1      [F01,R02]
Load        000429L2      [F01,R03]
Load        000364L1      [F01,R04]

Key: [F=Frame,    C=Column,    R=Row]
_____
           [MENU]   [PAUSE]
```

Figure 30. Activity screen on the front panel of the IBM TS3500. Use the screen to pause the library.

2. Press **ENTER**. The message PAUSE in Progress displays. The library parks the cartridge accessor in the base frame and displays the message: The library is now paused. Normal operations will resume in 30 seconds.

3. Within 30 seconds, unlock and open the front door on any HD frame. If you do not open the door within 30 seconds, the Activity screen redisplays.

4. Insert the cartridges into any HD slot that accepts cartridges by gently pushing the cartridges into the slot against the resistance of the constant force spring. Insert cartridges until the retention latch locks around front of the cartridge or until the slot accepts no more cartridges because it is full. For the initial bulk load on a newly installed frame, do not insert cartridges into HD slots with the black and yellow bar code labels that are shown in Figure 31 on page 85.

Important:

All HD slots are black, however the location of the cartridge retention latch differentiates LTO HD slots from 3592 HD slots. The cartridge retention latch is on the left side of LTO HD slots and on the right side of 3592 HD slots.

Place only LTO tape cartridges into the LTO HD slots (see Figure 32 on page 85); place only 3592 tape cartridges into the 3592 HD slots (see Figure 33 on page 85).

⚠️ **CAUTION:**
Only place cartridges in a frame whose front door is open. Do not add or remove cartridges from an adjacent frame.

CAUTION:

When you are doing a bulk load on newly installed HD frames, do not load cartridges into slots with the black and yellow label that is shown in Figure 31. These slots must be empty for the initial audit of the frame to start. The initial audit fills these slots and then they are used like any other HD slot in subsequent library operations.
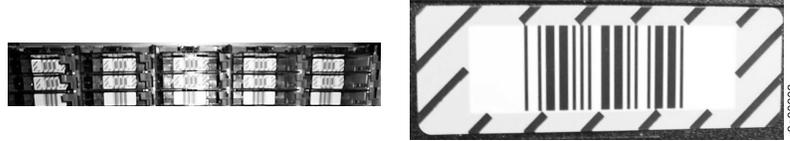
Figure 31. Black and yellow bar code label

The write-protect switch is on the left side of both LTO and 3592 cartridges. Insert LTO and 3592 cartridges into HD slots so that the write-protect switch is on the left and the volume serial (VOLSER) number label is visible (see Figure 32 and Figure 33). The orientation differs from the orientation in an I/O slot.
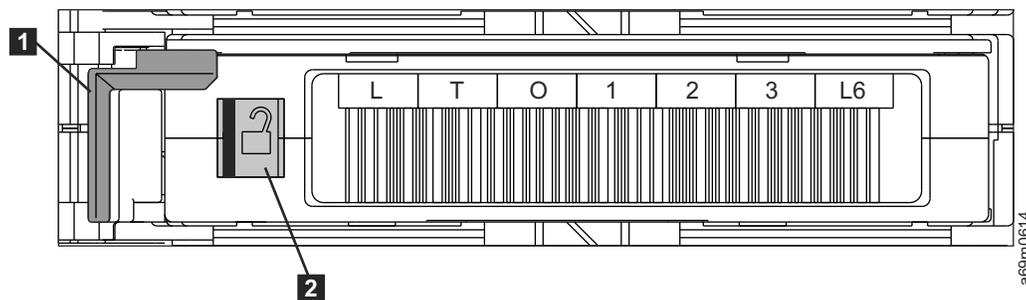
Figure 32. Proper orientation of LTO tape cartridges in HD slots. The cartridge retention latch (**1**) and write-protect switch (**2**) are shown.
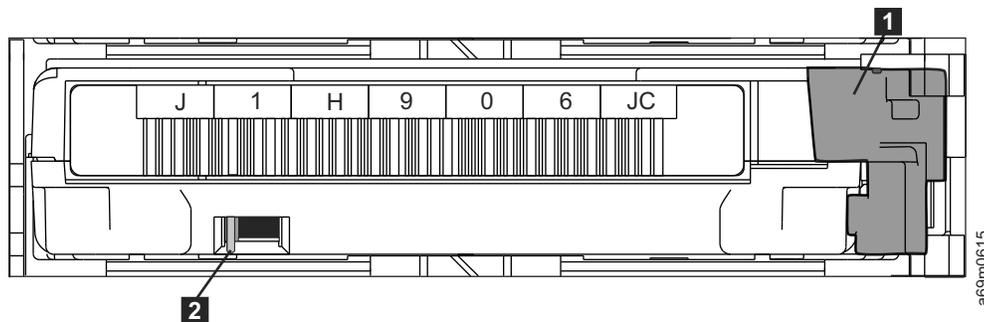
Figure 33. Proper orientation of 3592 tape cartridges in HD slots. The cartridge retention latch (**1**) and write-protect switch (**2**) are shown.

5. Gently close and lock the front door.

6. After approximately 15 seconds, the TS3500 tape library automatically inventories the frame of the door that you opened. During the inventory, the message INITIALIZING displays on the Activity screen. When the inventory is complete, READY displays.

Notes:

- Do not insert cartridges into an adjacent frame. However, if you did insert cartridges into an adjacent frame, you must also perform an inventory of that frame or of the entire library. For instructions, see "Performing an inventory of a frame in the library" on page 141 or "Performing an inventory of the library" on page 140.
- The inventory in an HD frame after a full bulk load takes approximately 45 minutes. Refer to the section about library performance in the *IBM TS3500 with ALMS Introduction and Planning Guide* for more information.

Removing data cartridges from the library

In addition to removing data cartridges by using your host application software, you can also use other methods. This section introduces other ways to remove a data cartridge from the TS3500 tape library.

Notes:
- Management and handling of media cartridges is a customer function and responsibility.
- It is the customer's responsibility to remove affected data cartridges before any service procedure.

To remove a data cartridge from the TS3500 tape library, use one of the following methods.

Using the Web to remove data cartridges
About this task

Note: With the Advanced Library Management System (ALMS), you can use the Tape Library Specialist Web interface to enable virtual I/O slots and make the host application operate as if the library has more I/O slots than actually exist. If a data cartridge is in a virtual I/O slot, you can export and remove it. When virtual I/O slots are enabled, if you remove a cartridge by using the Tape Library Specialist Web interface, the export operation has a higher priority than all server export commands. For details, see "Enabling or disabling virtual I/O slots" on page 161.

To remove data cartridges from the TS3500 tape library by using the Tape Library Specialist Web interface, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Cartridges —> Data Cartridges**. The Data Cartridges screen displays.
2. Select a Frame (or all frames) or Logical Library (or all libraries), then select Search. A list of cartridges based on the selection criteria you entered is displayed.
3. Select a Sort By option. Options are Volume Serial, SCSI Element Address, or Location.
4. Select a cartridge, then from the Select Action drop-down list, select Remove, then select Go. The library displays a message that the cartridge has been removed. Close the window.
5. Look at the Activity screen on the operator panel to determine whether the I/O station that you want to use is locked or unlocked. If the station is locked, use your application software to unlock it.
6. Open the door of the I/O station and remove the cartridge.

7. Close the door of the I/O station.

Using the operator panel to remove data cartridges
About this task

To remove data cartridges from the TS3500 tape library by using the operator panel, perform the following steps:

Procedure
1. Perform one of the following actions:
   - Use your host's application software to move the cartridges to an I/O station.
   - Manually move the cartridges to an I/O station (see "Moving a cartridge" on page 143).
     Each time that you move a cartridge from a storage slot to an I/O station, the library updates the display to show the quantity of cartridges in the station.
2. Look at the Activity screen to determine whether the I/O station that you want to use is locked or unlocked. If the station is locked, use your application software to unlock it.
3. Open the door of the I/O station and remove the cartridges.
4. Close the door of the I/O station.

Removing data cartridges when virtual I/O slots are enabled

Follow this procedure to remove data cartridges when virtual I/O slots are enabled.

About this task

When the Advanced Library Management System (ALMS) and virtual I/O slots are enabled, and a cartridge is exported to the I/O station, removed from the I/O station, and reinserted into the I/O station in a different slot, that cartridge can become a new importable cartridge and be automatically moved back into the physical library. This requires that the server import and export the cartridge again to move it back to the I/O station for removal. Optionally, you can use the operator panel or the Tape Library Specialist web interface to remove the cartridge to the I/O station (see "Using the Web to remove data cartridges" on page 86 or "Using the operator panel to remove data cartridges.")

Results

Figure 34 on page 88 shows the flow and the status of cartridges when you export them from the library with virtual I/O slots enabled.

Virtual IO Slots - Export Flow
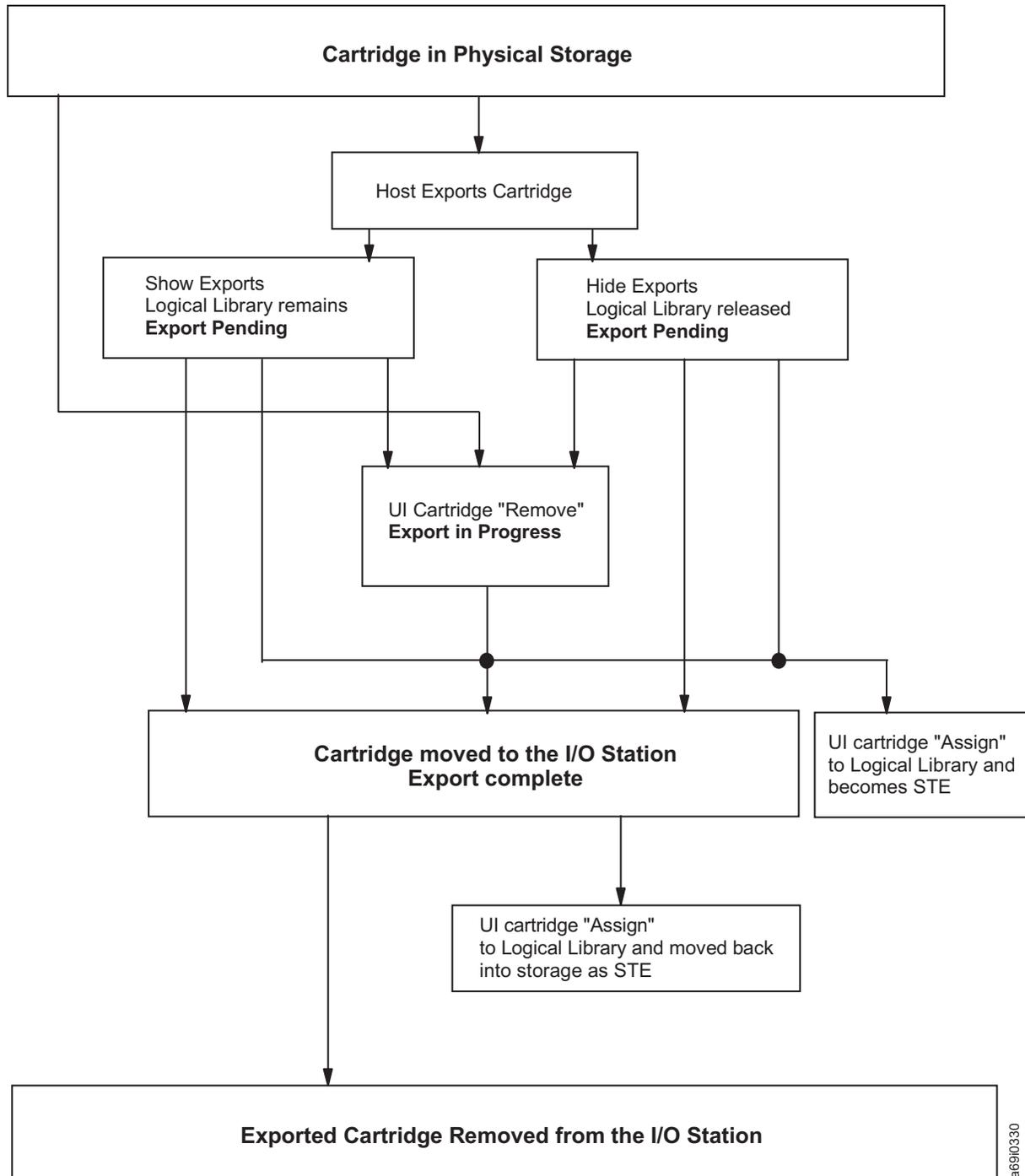
Figure 34. Flow of cartridges that are exported from the TS3500 tape library with virtual I/O slots enabled

The following states that a tape cartridge can be in after an administrator issues the command to remove it from the library and place it into the I/O station (see Figure 34) are listed below. As the library imports or exports cartridges, the states may display in the Element Address column of the Data Cartridges screen on the Tape Library Specialist Web interface.

Export Pending
> The state that a tape cartridge is in after the server issues a Move

command from the Storage Element to Import/Export Element, and the cartridge is queued to be moved to the I/O station.

Export in Progress
>The state that a tape cartridge is in after the operator selects a remove operation from the Tape Library Specialist Web interface and the cartridge is queued to be moved to the I/O station.

Export Complete
>The state that a tape cartridge is in after the cartridge has been moved to the I/O station. This state is cleared if the cartridge is moved by the operator to any other location, including a different I/O station slot.

Hide Exports
>The selection in the library's Tape Library Specialist Web interface that prevents a software application from detecting cartridges that are in one of the three export states (`Export Pending`, `Export in Progress`, or `Export Complete`).

Show Exports
>The selection in the library's Tape Library Specialist Web interface that allows a software application to detect cartridges which are in one of the three export states (`Export Pending`, `Export in Progress`, or `Export Complete`).

Removing a data cartridge from a drive in the library

This section describes how to remove a data cartridge from an LTO Ultrium or 3592 tape drive in the TS3500 tape library.

About this task

In a rare situation, you may need to remove a cartridge directly from a drive in the TS3500 tape library without transferring it to an I/O station. In order to remove a cartridge directly from a drive, complete the following steps.

Note: If you encounter a stuck tape cartridge (that is, a cartridge that will not unload after receiving an Unload command from the host), follow this procedure. If after completing these steps the cartridge still does not unload, contact your IBM service representative.

Procedure

1. From the library's Activity screen, press the PAUSE key. The library displays the message **If you open the door the library will go Not Ready and any remaining jobs in the work queue may fail. Press ENTER to continue.**
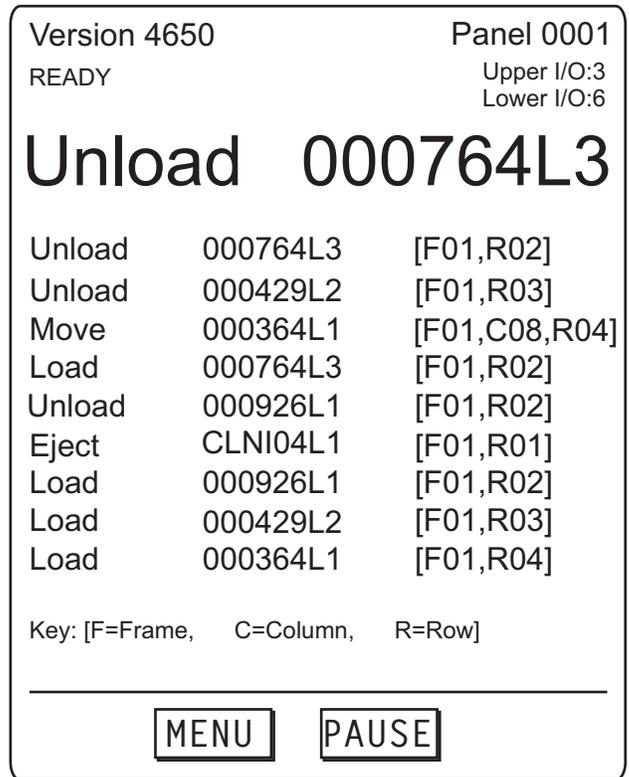2. Press ENTER. The message **PAUSE in Progress** displays. The library parks the cartridge accessor in the base frame and displays the message **The library is now paused. Normal operations will resume in 30 seconds.**
3. Within 30 seconds, unlock and open the front door on any frame. If you do not open the door within 30 seconds, the Activity screen redisplays and library operations resume.

> ⚠ **CAUTION:**
> **Only remove cartridges from a frame whose front door is open. Do not add or remove cartridges from an adjacent frame.**

4. Locate the drive that contains the cartridge that you want to unload and perform the following procedure:

- For the Ultrium tape drive:
  a. Press and release the unload button (**1** in Figure 35).
  b. Wait for the cartridge to rewind and eject.

  Note: A typical tape cartridge rewind and eject time can take as long as five minutes, although some conditions can extend this time to as long as one hour.

  c. Remove the cartridge.
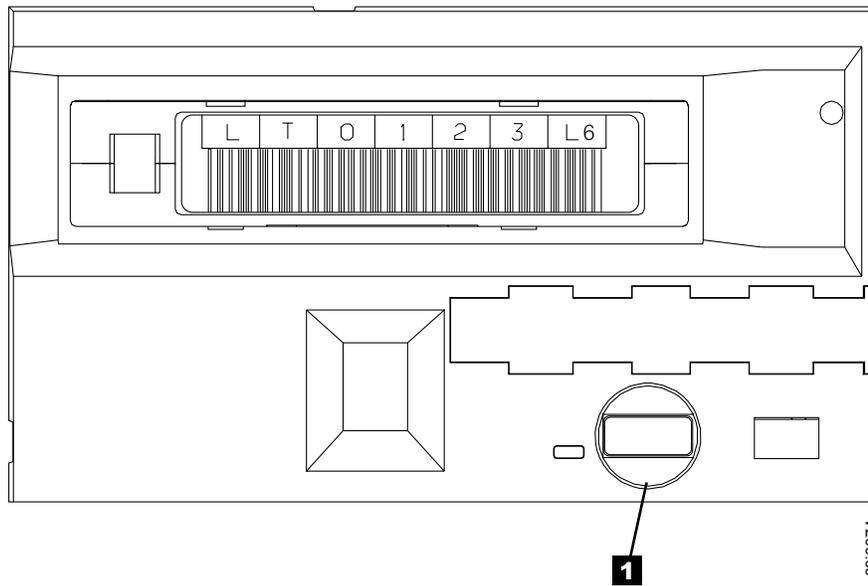
Figure 35. Removing a cartridge from an Ultrium tape drive

- For the 3592 tape drive:
  a. Ensure that the green power indicator light is on (see **1** in Figure 36 on page 91).
  b. Press and release the unload button **2**.
  c. Wait for the cartridge to rewind and eject.

  Note: A typical tape cartridge rewind and eject time can take as long as five minutes, although some conditions can extend this time to as long as one hour.

  d. Remove the cartridge.
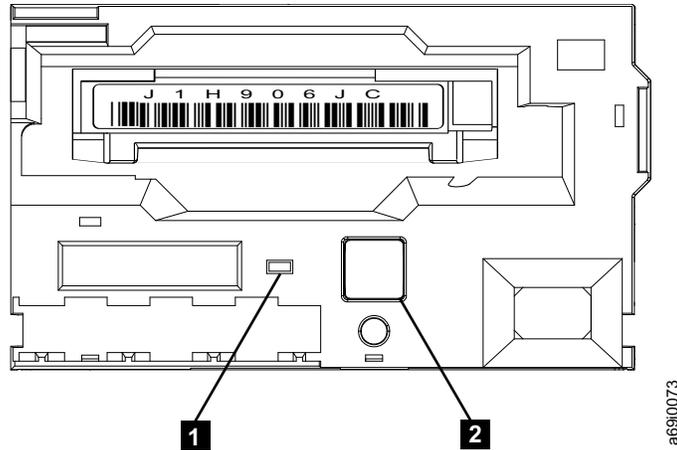
Figure 36. Removing a cartridge from a 3592 tape drive

5. Gently close and lock the front door.
6. After approximately 15 seconds, the TS3500 tape library automatically inventories the frame of the door that you opened. During the inventory, the message **INITIALIZING** displays on the Activity screen. When the inventory is complete, **READY** displays.

What to do next

Note: Your library could be in the "Not Ready" state for up to one hour if you perform this procedure. If the cartridge does not unload within five minutes and you need library operations to resume, you may close the library door. After one hour, follow steps 1 through 3 of this procedure to open the library door and remove the cartridge from the drive. Then continue with the remaining steps.

Removing data cartridges from an HD slot in the library

This topic describes how to remove data cartridges from a high density (HD) slot in the TS3500 tape library.

About this task

Note: It is the customer's responsibility to remove any affected cartridges before any service procedure.

To remove cartridges manually from an HD slot, perform the following procedure:

Procedure

1. From the library's Activity screen, press the PAUSE key. The library displays the message **If you open the door the library will go Not Ready and any remaining jobs in the work queue may fail. Press ENTER to continue.**
2. Press ENTER. The message **PAUSE in Progress** displays. The library parks the cartridge accessor in the base frame and displays the message **The library is now paused. Normal operations will resume in 30 seconds.**
3. Within 30 seconds, unlock and open the front door on the HD frame. If you do not open the door within 30 seconds, the Activity screen redisplays and library operations resume.

CAUTION:

- **HD slots have a constant force spring for pushing cartridges forward when a cartridge is being removed from the slot.**
- **Only remove cartridges from a frame whose front door is open. Do not add or remove cartridges from an adjacent frame.**

4. Locate the HD slot containing the cartridges you want to remove and perform the following procedure:

   - For HD slots in an LTO frame:

     a. See Figure 37. Use the middle finger and thumb on your left hand to grab the cartridge as shown. Apply outward pressure with the middle finger to open the cartridge gate assembly as you release and slowly remove the cartridge as shown in Figure 38.

Figure 37. LTO HD slot gate release

Figure 38. LTO cartridge removal from an HD slot

b. Figure 39 shows the removed cartridge.

Figure 39. LTO cartridge removed from an HD slot

   c. Use the same procedure to remove other data cartridges from the storage slot.

- For HD slots in a 3592 frame:

   a. See Figure 40. Use the middle finger and thumb on your right hand to grab the cartridge as shown. Apply outward pressure with the middle finger to open the cartridge gate assembly as you release and slowly remove the cartridge as shown in Figure 41 on page 94.
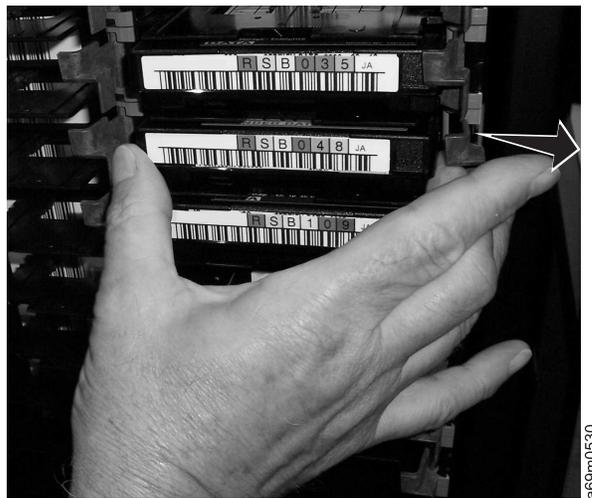
Figure 40. 3592 HD slot gate release
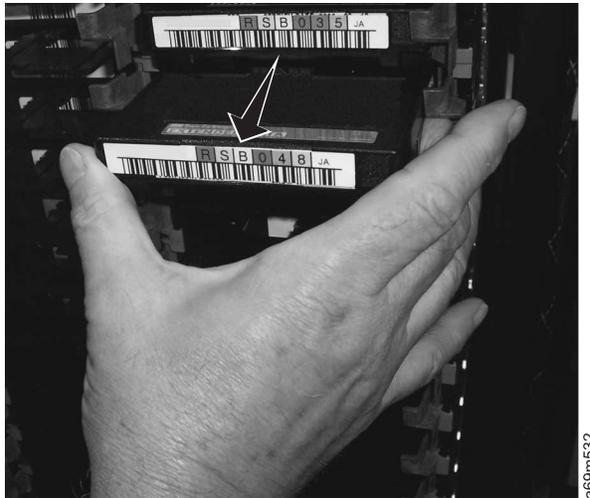
Figure 41. 3592 cartridge removal from an HD slot

    b. Figure 42 shows the removed cartridge.

Figure 42. 3592 cartridge removed from an HD slot

    c. Use the same procedure to remove other data cartridges from the storage slot.

5. Gently close and lock the front door.
6. After approximately 15 seconds, the TS3500 tape library automatically inventories the frame of the door that you opened. During the inventory, the message **INITIALIZING** displays on the Activity screen. When the inventory is complete, **READY** displays.

What to do next

Notes:
- If it is necessary to remove cartridges from more than one HD slot, repeat this procedure until all affected slots are emptied.

- To reinstall the cartridges, follow the steps in "Inserting data or scratch cartridges" on page 73.

Automatic cleaning

This topic describes automatic cleaning of tape drives in the TS3500 tape library.

Automatic cleaning enables the TS3500 tape library to automatically respond to any tape drive's request for cleaning and to begin the cleaning process without an operator's intervention. Automatic cleaning applies to all logical libraries that are configured for the TS3500 tape library. It is required (and cannot be disabled) when the Advanced Library Management System (ALMS) is enabled.

Inserting a cleaning cartridge into the library

This section introduces methods to insert a cleaning cartridge into the TS3500 tape library.

Attention: Never insert any type of cartridge into service bays.

To ensure that your TS3500 tape library conforms to IBM's specifications for reliability, use only one of the following cartridges to clean the heads of the tape drives:
- For LTO Ultrium tape drives, use the IBM Universal LTO Cleaning Cartridge or an IBM-approved cleaning cartridge
- For 3592 tape drives, use the IBM 3592 Enterprise Cleaning Cartridge or an IBM-approved cleaning cartridge

To insert a cleaning cartridge into the TS3500 tape library, use one of the following methods. You may insert as many as 100 cartridges.

Using the Web to insert a cleaning cartridge

Complete this task to insert a cleaning cartridge using the Web.

About this task

Note: If virtual I/O slots are enabled, your library will automatically import cleaning cartridges.

To use the Tape Library Specialist Web interface to insert a cleaning cartridge into the TS3500 tape library, perform the following steps:
1. Open the door of the I/O station and insert the cartridge so that the bar code label faces the interior of the library and the write-protect switch is on the right.
2. Close the door of the I/O station.
3. From the Work Items navigation pane, select **Cartridges —> I/O Station**. The I/O Station screen displays.
4. Follow the instructions on the screen.

Using the operator panel to insert a cleaning cartridge
About this task

To use the operator panel to insert a cleaning cartridge into the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Manual Operations —> Insert Cleaning Cartridge —> ENTER**. The library displays the message **Insert Cleaning Cartridge into I/O station before you continue. Do you want to continue?**

2. Open the door of the I/O station and insert the cartridge so that the bar code label faces the interior of the library and the write-protect switch is on the right.

3. Close the door of the I/O station.

4. Press YES. The message **Moving cleaning cartridge** displays while the library scans for one or more cleaning cartridges in the I/O stations:

   - If one or more cleaning cartridges are present, the library moves the cleaning cartridges (one by one) to the lowest empty slots. If the library uses both LTO and 3592 tape cartridges, the accessor moves each cleaning cartridge to a storage location that contains like media (using a separate move operation for each type of media). The library displays the message **Insertion of Cleaning Cartridges has completed**.

   - If no cleaning cartridges are in the I/O stations, the library displays the message **No cleaning cartridge found in the I/O station**.

5. Press ENTER to return to the Manual Operations menu.

6. Press BACK until you return to the Activity screen.

Performing manual cleaning of drives in the library

This section introduces two ways that you can perform manual cleaning of drives in the library.

Attention: Before performing a manual cleaning operation on the TS3500 tape library, make sure that the tape drive is empty. To learn whether a drive is empty, refer to the sections that describe how to use the web, operator panel, or Simple Network Management Protocol (SNMP) to determine drive status. If a cleaning operation does not complete within 9 minutes, the drive might contain a cartridge. In this case, an error message appears.

IBM does not recommend that you clean a drive on a periodic basis; the drive detects when it needs cleaning and the library displays a message that indicates which drive needs to be cleaned. However, if the library does not issue a message and you determine that a specific tape drive needs to be cleaned, perform the manual cleaning operation.

To perform manual cleaning, use one of the methods that follow.

Using the web to perform a manual cleaning operation

About this task

To use the Tape Library Specialist web interface to perform a manual cleaning operation on the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives** > **Drive Summary**. The Drives screen displays all of the drives in the library.
2. Select a frame (or all frames) or logical library (or all libraries). A list of drives based on the selection criteria you entered is displayed.
3. Select a drive, then from the Select Action drop-down list, select **Clean**. Then, click **Go**. The library initiates the cleaning process.
4. Follow the instructions on the screen.

Using the operator panel to perform a manual cleaning operation

Complete this task to use the operator panel to perform a manual cleaning operation.

About this task

To use the operator panel to perform a manual cleaning operation on the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Manual Operations —> Clean Drive —> ENTER**. The Select Drive screen displays with a list of tape drives in the library.

```
Select Drive      Panel 0028

Key: F=Frame, R=Row, L=LTO Ultrium,
 J = Enterprise Tape

Drive [F01,R01] L1
Drive [F01,R02] L1
Drive [F01,R03] L2
Drive [F01,R04] L2
Drive [F01,R05] L4
Drive [F01,R06] L3
Drive [F01,R07] L1
Drive [F01,R08] L1
Drive [F02,R01] J2
Drive [F02,R02] J1


[BACK][ UP ][DOWN][ENTER]
```

2. Highlight the drive that you want to clean, then select it. The library locates a cleaning cartridge and moves it to the drive that you specified. The message **Cleaning is queued for drive [Fxx,Rzz]** displays and the cleaning cartridge with the highest usage count cleans the head of the drive. For Ultrium tape cartridges, the cleaning cycle takes up to 2 minutes. For 3592 tape cartridges, the cleaning cycle can take up to 5 minutes. The library then returns the cleaning cartridge to its original slot and displays the message **Drive [Fxx,Rzz] has been cleaned** (see the preceding explanation for **Fxx,Rzz**).

Note: If the message **No cleaning cartridges in the library** displays, press ENTER to return to the Manual Operations menu, then go to "Inserting a cleaning cartridge into the library" on page 95.

3. Press ENTER to return to the Select Drive screen.
4. To clean another drive, repeat step 2.
5. Press BACK until you return to the Activity screen.

Removing a cleaning cartridge from the library

This section introduces two ways to remove a cleaning cartridge from the TS3500 tape library.

To remove a cleaning cartridge from the TS3500 tape library, use one of the following methods. Refer to "Library preferences" on page 138 in order to enable automatic eject of expired cleaning cartridges.

Using the web to remove a cleaning cartridge from the library
About this task

To use the Tape Library Specialist web interface to remove a cleaning cartridge from the TS3500 tape library, perform the following steps:

1. From the Work Items navigation pane, select **Cartridges** > **Cleaning Cartridges**. The Cleaning Cartridges screen displays.
2. Select a cleaning cartridge. Then, from the Select Action drop-down list, select Remove. Click **Go**.
3. Look at the Activity screen on the operator panel to determine whether the I/O station that you want to use is locked or unlocked. If the station is locked, use your application software to unlock it.
4. Open the door of the I/O station and remove the cleaning cartridge.
5. Close the door of the I/O station.

Using the operator panel to remove a cleaning cartridge from the library
About this task

To use the operator panel to remove a cleaning cartridge from the TS3500 tape library, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Manual Operations —> Remove Cleaning Cartridge —> ENTER**. The Cleaning Cartridge Usage screen displays with a list of the cleaning cartridges in the library and a count of how many cleans remain on the cartridge. For libraries that use both LTO and 3592 media, the screen also indicates whether the cartridge is an LTO or 3592 cartridge. To display more cleaning cartridges, press DOWN; to return to cartridges that you have viewed, press UP.

```
Cleaning Cartridge Usage        Panel 0220

CLN101JA     025     3592
CLNI02L1     020     LTO
CLNI03L1     015     LTO
CLNI04L1     010     LTO
CLN105JA     005     3592
CLN106JA     000     3592
CLNI07L1     000     LTO
CLN108JA     000     3592
CLN109JA     000     3592
CLNU10L1     000     LTO

[BACK]  [ UP ]  [DOWN]
```

2. Press UP or DOWN to highlight the cleaning cartridge that you want to remove, then press ENTER to remove the cartridge to an empty slot in an I/O station:

   - If a cleaning cartridge is present, the library begins the removal and displays the message **Move in Progress**. After the library places the cleaning cartridge into an I/O station, **Move Complete** displays.
   - If no empty slot is available in an I/O station, the library displays the message **The Destination Element is Full. Please remove cartridges and restart operation**. Open the door of the I/O station and remove one or more cartridges, then press ENTER to resume the operation.

3. Press ENTER to return to the Manual Operations menu.
4. Press BACK until you return to the Activity screen.
5. Open the door of the I/O station and remove the cleaning cartridge.

Initializing a tape volume serial number

Complete this task to ensure that the volume serial number (VOLSER) on a tape cartridge bar code label matches the VOLSER written to the tape.

About this task

Many tape management applications use Standard Label tape processing. To maintain compatibility with this type of processing in the TS3500 tape library, the VOLSER number on the bar code label must match the VOLSER written to the tape.

Complete the following steps to initialize tape cartridges:

Procedure

1. Attach a bar code label to the recessed label location on each tape cartridge.
2. Insert the cartridges into the library.
3. Use your software application to write the bar code VOLSER to the tape (for more information, see the documentation for your software application).

Assigning a volume serial (VOLSER) number to a tape with an unknown VOLSER

About this task

Many tape management applications use Standard Label tape processing. To maintain compatibility with this type of processing in the TS3500 tape library, the

VOLSER number on the bar code label must match the VOLSER written to the tape. If a tape's VOLSER is unknown, you will be unable to use it until a VOLSER is established.

Complete the following steps to use the Tape Library Specialist web interface to assign a VOLSER number to a tape with an unknown VOLSER:

Procedure

1. Make sure that the cartridge is in an I/O station or virtual I/O (VIO) slot. If the cartridge is not in an I/O station or VIO slot, move the cartridge to the I/O station (see "Using the Web to remove data cartridges" on page 86).
2. From the Work Items navigation pane, select **Cartridges —> Data Cartridges**. The Cartridges screen displays.
3. Select a Frame (or all Frames) or a Logical Library (or all Libraries), then select SEARCH. The Cartridges screen displays a filtered list of data cartridges based on the selection criteria that you entered.
4. Select the cartridge from the list, then from the Select Action drop-down list select **Fix Unknown Volume Serial**, and select Go. The Fix Unknown Volume Serial Number pop-up window is displayed.
5. Enter a VOLSER by first entering the first six characters of the volume serial number, then selecting the last two characters of the volume serial number (specifying the cartridge type) from the drop-down box.
6. Select Apply. The library displays a message that the volume serial number was successfully assigned.
7. Move the cartridge back to the storage slot (see "Using the Web to move a cartridge" on page 143).

Enabling bar code compatibility

Complete this task to enable bar code compatibility to allow the TS3500 tape library to read Silo-style bar code labels.

About this task

In order for the TS3500 tape library to read Silo (Sun StorageTek Powderhorn 9310) style bar code labels, bar code compatibility mode must be enabled. Complete the following steps to enable bar code compatibility mode using the operator panel.

Procedure

1. From the library's Activity touchscreen, press **MENU** > **SERVICE** > **Test/Tools** > **Barcode Compatibility**. The Change Barcode Compatibility screen displays.
2. Press **UP** or **DOWN** to change the barcode compatibility mode setting. Then press **ENTER**. A confirmation message displays.
3. Press **ENTER**.
4. Press **BACK** until the Main Menu displays.

What to do next

Refer to "Guidelines for using Silo-style bar code labels" on page 278 for information on how to apply the bar code label.

Enabling or disabling security for the operator panel

For Models L23 and L53, this section describes how to provide security for the operator panel of the TS3500 tape library.

About this task

If you are an administrator or superuser, you can use the Web interface to enable or disable security for the operator panel. If you enable security, you must create a password. You can also specify a timeout period which, when exceeded, causes the operator panel to lock.

To enable or disable security for the operator panel, establish a timeout period, or create or change a password for the operator panel, perform the following steps:

Procedure

1. Access the TS3500 Tape Library Specialist Web interface.
2. From the Work Items navigation pane, select **Access —> Operator Panel Security**. The Operator Panel Security screen displays.
3. Select whether to enable or disable operator panel security.
4. If desired, select the timeout period for the operator panel to automatically lock.
5. Perform one of the following (only available when operator panel security is enabled):
   - To create a password for the first time, enter the password twice.
   - To change a password, enter the new password twice.
6. From the Select Action drop-down box, select **Apply**, then select **Go**. A confirmation message displays.
7. Select **Close**.

What to do next

To lock or unlock the operator panel, see "Locking or unlocking the operator panel."

Locking or unlocking the operator panel

This topic explains to lock the operator panel on the TS3500 tape library (Models L23 and L53), as well as how to unlock the operator panel by entering a password.

Before you begin

Before you lock or unlock the operator panel, an administrator or superuser must enable security for it (see "Enabling or disabling security for the operator panel").

About this task

To lock the operator panel, on the Activity screen, press the **LOCK** button. The screen refreshes and the UNLOCK button displays.

To unlock the operator panel, perform the following steps:

Procedure

1. On the Activity screen, press the **UNLOCK** button. The Password Entry screen displays. The screen initially displays without any asterisks or characters in the line above the keypad.

```
Password Entry        Panel 0156

Enter password:
          **************p

[ a [ [ b ] [ c ] [ d ] [ e ] [ f ]

[ g [ [ h ] [ i ] [ j ] [ k ] [ l ]

[ m [ [ n ] [ o ] [ p ] [ q ] [ r ]

[ s [ [ t ] [ u ] [ v ] [ w ] [ x ]

[ y [ [ z ] [ 1 ] [ 2 ] [ 3 ] [ 4 ]

[ 5 [ [ 6 ] [ 7 ] [ 8 ] [ 9 ] [ 0 ]

          [Backspace]

[BACK]                [ENTER]
```

2. Press the first character of the password. A password may be 8 to 15 characters in length.
3. If the password is more than one character, press the next character. The first character is added as an asterisk to the line above the keypad. As you press each character, the previously entered character displays as an asterisk. When you type the last character and press **ENTER**, it displays not as an asterisk but as the character that you entered.
4. When you have finished entering the password, press **ENTER**. The Activity panel redisplays with the LOCK, MENU, and PAUSE buttons.

Web security

The topics in this section explain how to implement security for the Tape Library Specialist Web interface of the TS3500 tape library.

The Web Security screen of the Tape Library Specialist Web interface provides four tabs for managing the following security options:

- Password protection
- Storage Authentication Service
- SSL certificates
- Session timeout

Establishing the administrator's Web password

This section describes how to initially establish an administrator's password to the Tape Library Specialist Web interface of the TS3500 tape library.

About this task

An administrator can use this procedure to establish the administrator's password to the Tape Library Specialist Web interface. This procedure can only be performed from the operator panel.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Web Server —> ENTER**. The Web Server menu displays.

```
Web Server              Panel 0186

Reset Security/Admin Password

[BACK]                  [ENTER]
```

2. Press **ENTER**. One of the following occurs. You may want to record the password.
   - If Web security is enabled, the Web Server menu displays text that reads **Your 'admin' password has been set to xxxxxxxx** (where **xxxxxxxx** equals a value that is assigned by the library).
   - If Web security is disabled, the Web Server menu displays text that reads **Your 'admin' password has been set to xxxxxxxx but your web security is disabled. To enable web security you must use the web user interface**. To enable Web security, see"Enabling or disabling password protection for Web screens" on page 106.

3. Press **BACK** until you return to the Activity screen.

What to do next

Note: To change the password that is assigned by the library, see"Changing the administrator's Web password."

Changing the administrator's Web password

The TS3500 tape libraryhas password policies for the administrator's password. You can change the password in the Tape Library Specialist Web interface.

Password policies

The following table lists the rules when changing, setting, or resetting passwords.

Table 20. Password rules

Password Rule	Allowed Range	Factory Default	Field Default (if originally shipped without this capability)	Comments
Minimum number of characters	8 - max	8	8	max = maximum password length supported by the library
Minimum number of upper case alphabetic characters (A-Z)	0-3	1	0	Example: A-Z
Minimum number of lower case alphabetic characters (a-z)	0-3	1	0	Example: a-z

Table 20. Password rules (continued)

Password Rule	Allowed Range	Factory Default	Field Default (if originally shipped without this capability)	Comments
Minimum number of numeric characters (0-9)	0-3	1	0	Example: 0-9
Minimum number of special characters: ! @ # $ % ^ & * ( ) _+ - = { } | [ ] \ ; ' : " < > ? , . /	0-3	0	0	Example: *@$
Cannot contain the UserID	N/A	Enforced	Enforced	N/A
Maximum number of identical consecutive characters	0-3	2	0	0=no limit
Maximum number of failed logins before password is locked	0-10	5	0	0=no limit
Maximum number of days before password must be changed	0-365	90	0	0=no limit
Minimum number of days before password can be changed	0-365	1	0	Not applicable to admin reset
Number of password changes before an old password can be used again	0-8	8	0	0=no limit

Note:

If the library has current firmware without this capability and it's upgraded to a level that supports these new password rules, a field default value is used for each password rule. These default values will allow this upgrading to be transparent as users log in.

Using the Web to change the administrator's Web password

This section describes how to use the Tape Library Specialist Web interface to change an administrator's Web password.

About this task

Only an administrator can use this procedure to change the administrator's password to the Tape Library Specialist Web interface.

Note: This page is not available if the Storage Authentication Service is enabled.

To use the Tape Library Specialist Web interface to change the administrator's password, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Web Security**. The Web Security screen displays.

2. Select the **Password Protection** tab.

3. Enter admin for the User ID, then enter the Web password that the library assigned in "Establishing the administrator's Web password" on page 102. Select **Apply**. The screen displays the message Password protection is enabled.

4. Select **Access —> Change Web Password**. The Change Web Password screen displays.

5. Enter admin for the User ID, the current Web password, new Web password, and the new Web password again for confirmation. Select **Apply**. A pop-up window displays the message The password change is complete.

6. Select **Apply** to close the pop-up window.

Using the operator panel to change the administrator's Web password

Complete this task to use the operator panel of the TS3500 tape library to change an administrator's password to the Tape Library Specialist Web interface.

About this task

Only an administrator can use this procedure to change an administrator's password to the Tape Library Specialist Web interface.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Web Server —> ENTER**. The Web Server menu displays.

```
Web Server              Panel 0186

Reset Security/Admin Password

[BACK]                  [ENTER]
```

2. Press **ENTER**. One of the following occurs. You may want to record the password.

   Note: If the Storage Authentication Service (SAS) is enabled, you will receive a message confirming that it will be disabled.
   - If Web security is enabled, the Web Server menu displays text that reads **Your 'admin' password has been set to xxxxxxxx** (where **xxxxxxxx** equals a value that is assigned by the library).
   - If web security is disabled, the Web Server menu displays text that reads **Your 'admin' password has been set to xxxxxxxx but your web security is disabled. To enable web security you must use the web user interface**. To enable Web security, see "Enabling or disabling password protection for Web screens" on page 106.

3. Press **BACK** until you return to the Activity screen.

Enabling or disabling password protection for Web screens

This topic describes activating or deactivating password protection for Web screens of the TS3500 tape library.

About this task

For the TS3500 tape library, the function of choosing password protection for Web screens is available only through the Tape Library Specialist Web interface; it is not available through the operator panel.

The Tape Library Specialist Web interface offers three levels of security access for its screens. Prior to activating password protection, an administrator must choose the type of security access that a user needs to perform library functions. Table 21 describes each level.

Table 21. Types of password protection for Web screens

Type of Password Protection	Description
No password protection	You are never prompted to sign on.
Local password protection	You are prompted to sign on whenever you access the interface.
Storage Authentication Service	User authentication requests are sent to a centralized productivity center for verification.

The factory default for the Tape Library Specialist is no password protection.

To enable or disable password protection for Web screens, an administrator must perform the following steps from the Tape Library Specialist Web interface:

Procedure

1. From the Work Items navigation pane, select **Access —> Web Security**. The Web Security screen displays.
2. Select the Password Protection tab.
3. To enable password protection, enter your User ID and password.
4. Click **Apply**. The screen redisplays and indicates that password protection is enabled.

Enabling or disabling the Storage Authentication Service

Complete this task to enable or disable the Storage Authentication Service using the Tape Library Specialist Web interface.

About this task

Note:
- TS3500 Storage Authentication Service is not supported with Tivoli Storage Productivity Center V5.1 and later.
- Password protection must be turned on in order to enable the Storage Authentication Service (SAS). If password protection is not turned on, the SAS tab is not available. To enable password protection, refer to "Enabling or disabling password protection for Web screens."

In order to enable the Storage Authentication Service in the TS3500 tape library, it is necessary to configure the following settings:

- Primary Server URL
- Secondary Server URL (optional)
- Service Connection User ID
- Service Connection User Password

If you are using Hypertext Transfer Protocol Secure (HTTPS) Uniform Resource Locators (URLs), additional steps at the end of this procedure are necessary to enable SAS and to manage the TIP server Secure Socket Layer (SSL) certificates as described in the following information.

HTTPS connection involves a client (in this case the TS3500 tape library) verifying the credentials of the server using the TIP server's SSL certificates. This implies that the TIP server's genuine SSL certificates should be available in the client to compare with the SSL information the server sends over the connection before secure communication begins using HTTPS.

If there are no certificates available locally, the TS3500 tape library automatically gets the needed SSL certificate in-band using the HTTPS connection and presents the certificate details on the **SSL Certificates** tab of the **Web Security** page of the Tape Library Specialist Web interface. An administrator can then verify the contents of the certificate and either accept or reject the certificates. Details for any additional steps required are provided at the end of this procedure.

To enable or disable the Storage Authentication Service, an administrator must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Web Security**. The Web Security screen displays.
2. Select the Storage Authentication Service tab.
3. Select the **Enable Storage Authentication Service** check box to enable SAS. Deselect the **Enable Storage Authentication Service** check box to disable SAS.

   Notes:
   - It is also possible to disable SAS by resetting the security/admin password on the operator panel. Refer to "Using the operator panel to change the administrator's Web password" on page 105 in order to use this method.
   - When SAS is disabled, all users with active sessions continue with the same permissions that were obtained when SAS was enabled.
   - You cannot change the SAS configuration while SAS is enabled.
4. If you are enabling SAS, insert values for the following fields. If you are disabling SAS, proceed to step 5 on page 108.
   - **Primary Server URL:** This should be set to the HTTPS URL using the IP address of the host running the TIP server and the communication port used by SAS. An example of the Primary Server URL is: https://192.168.0.10:16311 where 192.168.0.10 is the TIP host server and 16311 is the authentication service port.

     The TS3500 tape library does not support Domain Name Service (DNS) host names. Only IP addresses can be used in the URL. The URL can have a maximum of 254 characters. For the TIP Authentication Service, the default HTTP port is 16310 and the default HTTPS port is 16311. Contact your TPC

administrator if the TIP server is configured differently and you need to verify the host IP and port number for the TIP server.

- **Secondary Server URL:** Optionally, a Secondary Server URL can be given for making SAS highly available in case the TIP server using the Primary Server URL is not reachable. The TIP server URL given here must adhere to the following rules:
  - Both the Primary Server URL and the Secondary Server URL must be either HTTP or HTTPS.
  - Both of the TIP servers must have the same common set of user credentials.

  When the Secondary Server URL is given, SAS uses this secondary URL as follows.
  - When enabling SAS, authentication and authorization for the given Admin User ID and password must succeed using both URLs.
  - When logging in or disabling SAS, the Primary Server URL is tried first and if there is no communication failure, the results are returned back to the user. Other potential failures, such as failure to authenticate (an unknown user or a wrong password) or failed authorization (not an Admin) do not cause SAS to use the secondary server URL. The Secondary Server URL is only used if there is a communication failure with the Primary Server URL.
- **Service Connection User ID and Password:** The TS3500 tape library uses this User ID and Password for connecting to the TIP Authentication Service using HTTP basic authentication. The User ID can be configured in TIP to be any User ID in LDAP or a User ID that is also used by TPC. Contact your IBM Tivoli Storage Productivity Center administrator to obtain the authentication service User ID and Password.

  Note: The User ID and Password cannot exceed 14 characters each.

5. Enter the User ID and Password of a user in an Admin LDAP group and select **Apply**.

   If you are using only HTTP URLs, you have completed this procedure. If you are also using HTTPS URLs, proceed according to the following scenarios:

   Note: It can take up to two minutes to enable SAS when using HTTPS URLs.
   - If an acceptable SSL certificate exists, no error message displays and you are finished with this procedure.
   - If there are no SSL certificates, the following error message displays: **Request Failed - New Certificate Required**. Proceed to step 6 on page 109.
   - If there is a mismatch with an existing certificate (for example an expired certificate or the subject does not match) the following error message displays: **Certificate Error Has Occurred**. Proceed to step 7 on page 109.

   Notes:
   - When submitting any changes to the settings on this tab, you must also provide the User ID and Password to be confirmed using the Storage Authentication Service.
   - Should the login with the SAS User ID and Password fail for any reason, refer to "Using the operator panel to change the administrator's Web password" on page 105 in order to disable SAS using the operator panel. You can then log in using your local user account.

6. If the **Request Failed - New Certificate Required** error message displays, verify and accept an SSL certificate by completing the following substeps:

   a. From the Web Security screen, select the **SSL Certificates** tab.

   b. Verify the hostname in the **Issued To** field to ensure that it corresponds to the IP in the URL.

   c. Verify that the expiration date is still valid in the **Expiration** field.

      Note: The date and time are in Universal Time Coordinated (UTC) format. Since the tape library does not maintain local time zone information, there is a minor discrepancy in verifying the validity dates of a certificate. SAS may declare a certificate invalid a few hours early or a few hours too late depending on the difference between local time and UTC.

   d. Verify the value in the **Fingerprint** field by using a browser connected to the TIP Server console and looking at the certificate details used in the browser connection.

   e. Take one of the following actions:

      • To accept the certificate, return to the **Storage Authentication Service** tab. Enter the User ID and Password and select **Apply**. Once accepted, certificates are stored in compact flash in the TS3500 tape library.

      • To reject one or more certificates because the hostname, expiration date, or fingerprint values do not match, select the certificate(s). Then select **Delete** from the Select Action drop-down menu and click **Go**.

         Note: Certificates can only be deleted when SAS is disabled.

7. If the **Certificate Error Has Occurred** error message displays, delete the existing certificate by completing the following substeps:

   a. From the Web Security screen, select the **SSL Certificates** tab.

   b. Select the certificate(s) to be deleted. Then select **Delete** from the Select Action drop-down menu and click **Go**.

   c. Go back and complete step 6.

What to do next

For more information about TPC, visit the Web at http://www-03.ibm.com/systems/storage/software/center/index.html.

For more information about the Storage Authentication Service, see "Storage Authentication Service" on page 28.

Managing Secure Socket Layer certificates

Complete this task to manage Secure Socket Layer (SSL) certificates.

About this task

In order to manage SSL certificates, perform the steps listed in the following procedure. For additional information, refer to "Enabling or disabling the Storage Authentication Service" on page 106.

Note: Certificates can only be deleted when the Storage Authentication Service (SAS) is disabled. If you need to delete a certificate, first disable SAS and then enable SAS again once the action is complete.

Procedure

1. From the Work Items navigation pane, select **Access** > **Web Security**. The Web Security screen displays.
2. Select the SSL Certificates tab.
3. Verify the certificate by performing the following substeps:
   a. Verify the host name in the **Issued to** field.
   b. Verify the date in the **Expiration** field.
   c. Verify the value in the **Fingerprint** field by using a browser to connect to the TIP Server console and looking at the certificate details used in the browser connection.
4. To reject or delete a certificate, select the certificate that you want to delete. Then, select **Delete** from the Action drop-down menu. A confirmation messages displays.

   If you accept the certificate, no action is necessary.
5. Click **OK** to continue.

Choosing the timeout setting for Web screens

This section explains how to set the timeout value for the screens in the Tape Library Specialist Web interface. The interface is used by the TS3500 tape library.

Procedure

1. From the Work Items navigation pane, select **Access —> Web Security**. The Web Security screen displays.
2. Select the Password Protection tab.
3. Select the number of hours and minutes from the Session Timeout menus or select **Do not time out**.

   Note: The maximum selectable timeout is 24 hours; the minimum selectable timeout is 10 minutes.
4. Select **Apply**.

What to do next

If you do not want the Web screens to timeout, select Do not time out. Although the hours and minutes will default to 24 hours and 00 minutes, the Tape Library Specialist Web screens will not time out.

The Web screen timeout settings apply whether the other security settings are enabled or not.

Understanding roles defined by the web interface

This section explains the roles that the administrator of the TS3500 tape library assigns to users. The roles define the type of access to the library.

When enabling password protection for users of the TS3500 tape library, the administrator may want to reserve some functionality for specific users. The Tape Library Specialist web interface uses the concept of roles to restrict or enable specific actions that can be performed by selected users.

Administrators can also create up to 16 of their own roles and define each role's access to libraries and pages. This provides customizable web access.

The predefined roles include:

Monitor

Can view all physical and logical library data, but not user accounts, web security, or sessions.

Service

Can perform only service-related functions, such as update firmware, download logs, and view vital product data (VPD).

SuperUser

Can view all physical and logical library data, change library settings, and perform library operations. Cannot access or modify user accounts, web security, or sessions.

Admin

Can perform all tasks on the web.

Note: Any user can change their own password.

Managing user accounts

Complete the tasks in this section to add, modify, or delete user accounts.

Adding a web user account

This section describes how to add a new web user account to the TS3500 Tape Library Specialist web interface.

About this task

Note: Only an administrator can add a new user account to the Tape Library Specialist web interface. Password protection must be enabled. To enable password protection, see "Enabling or disabling password protection for Web screens" on page 106.

An administrator can create up to 79 additional web user accounts. To add a web user account, the administrator must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> User Accounts**.
2. From the Select Action dropdown menu, select **Create**. Then select **Go**.
3. Enter a User ID in the User ID field. The User ID can be up to fifteen case-sensitive, alphanumeric characters.
4. From the Role dropdown menu, select a role for the new User ID. Both predefined and custom roles are listed. Only one role can be selected for a user.
5. Enter any comments, up to 30 characters, about the new user in the Comments field. Suggested comments are the user's full name, job responsibility, or anything that helps associate the user ID with the user.
6. Enter the password in the password field. The password can be up to fifteen case-sensitive, alphanumeric characters.
7. From the Select Action dropdown box, select **Apply**. Then click **Go**. The library displays a message indicating that the new user account was successfully created.

Results

Note: In addition to the four predefined roles, an administrator can create up to 18 custom roles used to access specific libraries and pages. See "Customized web access" on page 113.

You can continue to use the preceding web password or you can change the password to a new one. To change your web password, see "Changing your Web password."

Modifying a Web user account

This section describes how to change the settings of a user account on the Tape Library Specialist Web interface.

About this task

To modify the settings, an administrator must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> User Accounts**.
2. Select the appropriate User ID.
3. From the Select Action dropdown menu, select **Update**. Then select **Go**.
4. Edit the User ID, role, password, and comment fields.

   Note: For the administrator account, the username and the role cannot be changed.
5. From the Select Action dropdown menu, select **Apply**. Then select **Go**.

Deleting a Web user account

This section describes how to delete a Web user account from the Tape Library Specialist Web interface.

About this task

To delete a user account, an administrator must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> User Accounts**.
2. Select the appropriate user account.
3. From the Select Action dropdown menu, select **Remove**. Then select **Go**.

   Note: You cannot delete the administrator user account.
4. At the prompt **Are you sure?**, select the **Yes** button.

Changing your Web password

This section introduces ways to change your password to the Tape Library Specialist Web interface of the TS3500 tape library.

About this task

Any user can change their own Web password by using the Tape Library Specialist Web interface, but not by using the library's operator panel. Only an administrator can change a user's Web password by using the operator panel.

Note: This page is only available when Web Security is enabled and the Storage Authentication Service is disabled.

To change your password, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Access —> Change Web Password**. The Change Web Password screen displays.
2. Enter the new password.
3. Re-enter the new password.
4. For verification, enter your current password
5. Select **Apply**. A confirmation screen displays and indicates that your password has been successfully changed.

Viewing Web users with active sessions
This section describes how an administrator can view the users of the TS3500 tape library who are connected through the Tape Library Specialist Web interface.

About this task

Note: This page is only available if Web Security is enabled.

To view active Web users of the TS3500 tape library, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Access —> Sessions**. The Active Sessions screen displays.
2. View the list of users who are currently connected to the Tape Library Specialist Web interface. The maximum number of active users is five.

Customized web access

This section describes customized web access for the TS3500 Tape Library Specialist web interface.

About this task

Customized web access provides a way for the administrator or superuser to add roles with access to specific libraries and specific pages within the libraries for the Tape Library Specialist web interface. Like the standard roles that are delivered with the Tape Library Specialist, these custom roles can be assigned to multiple users. See "Adding a web user account" on page 111.

Customized web access pages are not available unless web security is enabled and password protection is turned on. To enable web security and password protection, see "Enabling or disabling password protection for Web screens" on page 106.

There are two ways to create custom roles:
- Create a new role (see "Adding a customized role" on page 114).
- Duplicate, then modify an existing role "Adding a customized role by copying an existing role" on page 114.

After they are created, customized web access roles can be modified. If a role is assigned to any users, their access is also modified (see "Modifying a customized

web access role" on page 115). Customized web access roles can also be deleted, however, you cannot delete a role if users are assigned to it (see "Deleting a customized web access role" on page 116).

Adding a customized role

How to add customized web access by adding a new role to the TS3500 Tape Library Specialist web interface.

About this task

Only an administrator or superuser can add a custom role to the Tape Library Specialist web interface. Web security must be enabled and password protection must be on. A role can be added by either creating a new role, or by copying, then changing an existing role. See "Adding a customized role by copying an existing role" for instructions on how to add a role by copying an existing role.

To add a customized role, the administrator or superuser must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Roles and Permissions**.
2. From the Select Action drop-down box, select **Create**, then select **Go**.
3. On the Define Roles page, enter the Role Name and Description, then select **Next**.
4. On the Define Pages page, set permissions for each page for a logical library or libraries (which you will select on the next screen), then select **Next**. Click the **Access** header to change the permission for all pages, or an individual cell to change the permission for that page only. Click to toggle thru view-only access, modify access, or no access. White indicates no access, light blue indicates view-only access, and dark blue indicates update access.
5. On the Define Logical Libraries page, select the logical libraries that the role has access to, then select **Next**. The library displays the message "The Customized Role change is complete." Select **Close**.

Results

You can now assign users to this role. You can assign only one role to a user, but you can assign multiple users to a role. See "Adding a web user account" on page 111.

Adding a customized role by copying an existing role

How to add a customized web access role by copying an existing role and adding it to the TS3500 Tape Library Specialist web interface.

About this task

Copying an existing role, then changing it, is an efficient method to use to create multiple roles with similar permissions. When a role is duplicated, all the permissions that it has for libraries and pages are also duplicated. You only need to change the role name and the specific permissions that differ from the duplicated role. Only an administrator can add a custom role to the Tape Library Specialist web interface. This function is not available unless web security is enabled and password protection is on.

To add a customized role by copying an existing role, the administrator must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Roles and Permissions**.
2. On the Roles and Permissions page, select the role that you want to copy.
3. From the Select Action drop-down box, select **Duplicate**, then click **Go**.
4. On the Define Roles page, enter the new Role Name and Description, then click **Next**.
5. On the Define Pages page, leave the permissions as they are, or set permissions for each page for a logical library or libraries (which you will select on the next screen), then click **Next**. Click the **Access** header to change the permission for all pages, or click an individual cell to change the permission for that page only. Click to toggle through the view-only access, modify access, or no access options. White indicates no access, light blue indicates view-only access, and dark blue indicates update access.
6. On the Define Logical Libraries page, select the logical libraries that the role has access to, then click **Next**. The library displays the message "The Customized Role change is complete." Click **Close**.

Results

You can now assign users to this role. You can assign only one role to a user, but you can assign multiple users to a role. See "Adding a web user account" on page 111.

Note: You can also copy, then modify an existing role to create a new role.

Modifying a customized web access role

This section describes how to add a new role to the TS3500 Tape Library Specialist web interface.

About this task

Note: Only an administrator or superuser can change a customized web access role to the Tape Library Specialist web interface.

If you change access for a custom role, access is modified for all web users that are assigned to that role according to the changes you make.

To change a customized role, the administrator or superuser must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Roles and Permissions**.
2. On the Roles and Permissions page, select a role.
3. From the Select Action drop-down box, select **Modify**, then click **Go**.
4. Make any of the following changes:
   - Change the role description.

- Change the library page access for the role. Access to each page is determined by toggling through access levels by clicking the box next to the page. White indicates no access, light blue indicates view-only access, and dark blue indicates update access.
- Change the logical libraries that the role has access to.

5. Click **Next**. The library displays a message indicating that the role was successfully modified.

Results

The access of all users assigned to role will be changed according to the modifications applied.

Deleting a customized web access role

This section describes how to delete a customized web access role from the Tape Library Specialist web interface.

About this task

Only an administrator or superuser can delete a customized web access role from the Tape Library Specialist web interface.

You cannot delete a customized web access role if any web users are assigned to that role. To see a list of which users are assigned to a role, select **Access —> Users**. See "Modifying a Web user account" on page 112 for instructions on how to change a user's role.

To delete a customized web access role, the administrator must perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Roles and Permissions**.
2. On the Roles and Permissions page, select a role.
3. From the Select Action drop-down box, select **Delete**, then click **Go**.
4. At the prompt `Are you sure you want to delete this role?`, click **OK**. The page refreshes and does not show the user role. If a user is assigned to the role that you want to delete, the "`Unable to delete customized web role. At least one user account exists with role.`" error message displays and the role is not deleted.

Results

The role is deleted and no longer displays in the list of roles.

Viewing logical library capacity

This section describes how an administrator can use the Web to view the assigned and maximum cartridge capacities of logical libraries in a TS3500 tape library.

About this task

To view the assigned and maximum cartridge capacities of logical libraries in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library —> Logical Libraries**. The Logical Libraries screen displays.

2. View the **# Cartridges** column in the table. The following logical library states are indicated:

    ⚠️ **Insert Limited:** The number of assigned cartridges is nearly at the maximum number of cartridges allowed.

    ❌ **Full:** The number of assigned cartridges is equal to the maximum number of cartridges allowed.

3. If the logical library is at an **Insert Limited** or **Full** state, either unassign some cartridges or increase the maximum number of cartridges allowed. (Refer to "Assigning cartridges to a logical library" or "Changing the maximum allowable quantity of cartridges in a logical library" on page 163 for more information.

Assigning cartridges to a logical library

How to assign data cartridges to a logical library in the TS3500 tape library.

About this task

Note: It is normal for a cleaning cartridge to be unassigned.

To assign a data cartridge to a logical library in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Cartridges —> Data Cartridges**. The Data Cartridges screen displays.

2. Select the logical library to which the cartridge is currently assigned and select how you want the cartridge range to be sorted. (The library can sort the cartridge by volume serial number (VOLSER), SCSI element address, or frame, column, and row location.) Select **Search**. The Cartridges screen displays all ranges for the logical library that you specified.

3. Select the range that contains the data cartridge that you want to assign.

4. Select the data cartridge, then from the Select Action drop-down list, select **Assign**, then select **Go**.

5. In the Select a Logical Library pop-up window, select the logical library to which you want to assign the data cartridge.

6. Select **Next** to complete the function.

7. When a message is displayed that the data cartridge is assigned, select **Close**.

    Note: If the cartridges were assigned to a logical library that is attached to a 3953 L05 library manager, the operator must initiate an inventory upload from the operator panel or through the Web specialist of the 3953 L05 library manager. This action is required because the inventory of the library manager does not automatically update when data cartridges are assigned to logical libraries through the Tape Library Specialist Web interface of the TS3500 tape library.

Using the drive assignment web page

This section introduces the drive assignment web page of the TS3500 tape library, which is available through the Tape Library Specialist web interface. The page enables you to add or remove a drive from a library configuration. It also enables you to add, remove, and share drives in a logical library, and to change a control path.

By using the drive assignment page of the TS3500 tape library, you accomplish the following tasks:

- **Add new drives to a logical library**. When you add a new drive to a library, it is marked as unassigned. When you view the Drive Assignment screen, the drive is displayed in the Unassigned column. You can assign the drive to any logical library that is of the same media type.
- **Remove drives**. You can remove any drive to the Unassigned column.
- **View dedicated drives**. You can display dedicated drives (drives that exist in one logical library or that are unassigned). These drives appear with blue table backgrounds.
- **Share drives**. You can share drives in up to ten logical libraries. Drives can only be shared if they are not control paths and they do not contain a cartridge. These drives appear with gold table backgrounds.
- **Determine non-communicating drives**. You can identify drive that is no longer communicating. These drives appear with gray table backgrounds.
- **Change control paths**. All logical libraries must contain at least one control path drive. In a logical library, you can designate any empty, dedicated drive to become a control path drive. A drive that is loaded with a cartridge cannot become a control path until you remove the cartridge. Similarly, any drive that is a control path cannot be disabled until you remove the cartridge that it contains.

  Note: In order to increase the maximum number of cartridges to more than 6 887, logical libraries must use LTO Ultrium 4, 3592 E05, or later tape drives as control path drives. Ultrium 4 control path drives require a minimum code level of 97F0. For logical libraries with shuttle stations assigned, Ultrium 4 control path drives require a minimum code level of A480 and Ultrium 5 control path drives require a minimum code level of B170.

- **Detect gaps between drives in logical libraries**. As you reassign drives among logical libraries, you may be creating gaps in the range of drive element addresses. If so, the Web screen displays the name of the affected logical library in yellow.

The sections that follow describe how to add and remove a drive to or from the physical tape library. For a logical library, they also describe how to add, remove, and share drives, and how to change a control path.

Adding a drive to a physical library

Complete this task to add a drive to a physical library.

Procedure

1. Add the tape drive to a physical TS3500 tape library. Then, continue with the following steps.

   Note: 3592 tape drives are installed by a service representative, however the installation of LTO tape drives is a customer responsibility. For more

information, and a link to the customer setup unit (CSU) instructions, refer to the section about TS3500 tape library feature codes in the *IBM TS3500 with ALMS Introduction and Planning Guide*.

2. From the Work Items navigation pane, select **Drives —> Drive Assignment**. The Drive Assignment screen displays.

3. Follow the instructions on the screen to select a drive or logical library, and select **Continue**.

4. Verify that the drive you added is displayed in the Unassigned column. If the drive does not display, a communications problem exists. Verify that all cables are properly seated.

5. Select **Cancel** or select **Settings —> Drive Assignment** to refresh the data and display the drive.

Adding a drive to a logical library

Complete this task to add a drive to a logical library.

About this task

Certain guidelines exist for adding a drive to a logical library. In a TS3500 tape library with the Advanced Library Management System (ALMS), all encryption-enabled drives within a logical library must be managed the same way; either library managed, application managed, or system managed. Encryption-enabled drives cannot be shared.

To add a tape drive to a logical library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives —> Drive Assignment**. The Logical Drive Assignment Filter screen displays.

2. Follow the instructions on the screen to select a drive or logical library, and select **Continue**. The Drive Assignment screen displays. The screen includes:

   - **Drive column**. When you select the link to each drive, the Drive Details screen displays the drive's World Wide Node Name, type (LTO or 3592), physical location (frame and row), type of interface, SCSI or Loop ID, status of contents, and type of encryption method.

   - **Logical Library column**. Up to 192 columns for the logical libraries that you can create.

   - **Totals of dedicated and shared drives**. Located at the bottom of the screen.

   - **Cancel**. When you select Cancel, the firmware erases the changes that you made to the drives and refreshes the Drive Assignment screen with the previous entries (the same occurs if you leave the Drive Assignment screen before you select Assign; all of the changes that you made are lost and the screen restores the previous entries).

3. For each drive that you want to add, select the check box in the Logical Library column.

4. When you have selected the check boxes for all of the drives that you want to assign, from the Select Action drop-down box, select **Apply**, then select **Go**. The Drive Assignment Operation in Progress screen displays, followed by a Success screen that indicates that the changes are complete.

5. Select **Close**. The Drive Assignment screen redisplays with the new assignments.

Sharing drives in a logical library

Complete this task to share drives in a logical library.

About this task

After you add one or more drives to a logical library in the TS3500 tape library, you can share drives with the same media type among multiple logical libraries.

To share drives with the same media type among one or more logical libraries, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives —> Drive Assignment**. The Drive Assignment screen displays.
2. Select one or more drives in the Drive column, then select one or more logical libraries to share the drives (you can share a drive in a maximum of ten logical libraries).
3. When you have selected all of the drives that you want to share and all of the logical libraries in which you want to include them, from the Select Action drop-down box, select **Apply**, then select **Go**. The Operation in Progress screen displays, followed by a Success screen that indicates that the changes are complete.
4. Select **Close**. The Drive Assignment screen redisplays with the new assignments.

Enabling or disabling a control path in a logical library

Complete this task to enable or disable a control path in a logical library.

About this task

After you add one or more drives to a logical library in the TS3500 tape library, you can enable or disable a control path. You can use this function to choose multiple control paths for a single library, or multiple pairings of control paths and logical libraries. A logical library must contain at least one control path.

Note: Logical libraries with a maximum number of cartridges greater than 6 887 must use LTO Ultrium 4, 3592 E05, or newer tape drives as control path drives. Ultrium 4 control path drives require a minimum code level of 97F0. For logical libraries with shuttle stations assigned, Ultrium 4 control path drives require a minimum code level of A480. Ultrium 5 control path drives require a minimum code level of B170.

To enable or disable a control path in a logical library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives** > **Drive Assignment**. The Drive Assignment screen displays.
2. In the Drive column, select the drive that you want to enable or disable as the control path drive.
3. Locate the intersection of the logical library column and drive row that you want, then select the control path icon to the left of the check box.

4. From the Select Action drop-down box, select **Apply**, then click **Go**. The Operation in Progress screen displays, followed by a Success screen that indicates that the changes are complete.

5. Click **Close**. The Drive Assignment screen redisplays with the new assignments.

Removing a drive from a logical library

Complete this task to remove a drive from a logical library.

About this task

Attention: If you remove a drive from the middle of a logical library, this will cause noncontiguous element address ranges and may result in problems with certain Independent Software Vendor (ISV) software.

To remove a tape drive from a logical library in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives —> Drive Assignment**. The Drive Assignment screen displays.

2. Locate the intersection of the logical library column and drive row that you want, and then follow the appropriate instructions:
   - If the drive is a shared drive, select the check mark to remove it as a shared drive. Then, select the box in the Unassigned column to add a check mark (which removes the check mark in the logical library box).
   - If the drive is a dedicated drive, select the check mark (to delete it) in the logical library box or select the box in the Unassigned column to add a check mark.

3. When you have selected (deleted) the check marks in the Unassigned column for all of the drives that you want to remove, from the Select Action drop-down box, select **Apply**, then select **Go**. The Drive Assignment Operation in Progress screen displays. After a short delay, the Success screen displays to indicate that the changes are complete.

4. Select **Close**. The Drive Assignment screen redisplays. The drives that you selected are checked in the Unassigned column and are no longer available to the logical libraries.

   Note: To remove a drive canister from a library, go to the section about removing a drive from a physical library.

Removing a drive from a physical library

Complete this task to remove a drive from a physical library.

About this task

Note: In the TS3500 tape library, a drive that has already been assigned, but has lost communication, will not be removed from the configuration data. It is only removed if it is unassigned.

Procedure

1. From the Work Items navigation pane, select **Drives —> Drive Assignment**. The Drive Assignment screen displays.

2. For each drive to be removed, select the box in the Unassigned column to add a check mark (this removes the check mark in the logical library box).

   Note: You cannot move a drive into the Unassigned column if it contains a cartridge. Also, if the drive to be removed is a control path drive, you must ensure that a second drive is designated as the control path drive before you remove the first control path drive.

3. From the Select Action drop-down box, select **Apply**, then select **Go**. The Drive Assignment Operation in Progress screen displays. After a short delay, the Success screen displays to indicate that the changes are complete.

4. Select **Close.** The Drive Assignment screen redisplays. The drives that you selected are checked in the Unassigned column and are no longer available to the logical libraries.

5. Use the appropriate procedure to physically remove an LTO Ultrium Fibre Channel drive or a 3592 Fibre Channel drive from the physical library. For help, see "Removing or replacing a drive canister assembly - LTO fibre channel hot swap" on page 365 or "Removing or replacing a drive canister assembly - 3592 Fibre Channel hot swap" on page 368.

6. After you remove the drive from the library, select **Drives —> Drive Assignment**. After a short delay, the Drive Assignment screen redisplays.

7. Ensure that the drive does not display in the Drive Assignment screen. If it displays, wait a few moments and refresh the screen again (some delay in this procedure is expected).

   Note: If you physically remove a drive that is not assigned to a logical library, that drive will not display in the Drive Assignment screen; if you remove a drive that is assigned to a logical library, its background in the Drive Assignment screen becomes gray. This indicates that the drive no longer communicates. The drive remains in its associated logical library until you unassign it by using the procedure to remove a drive from a logical library.

Detecting gaps between drive element addresses in a logical library

Complete this task to detect gaps between drive element addresses in a logical library.

About this task

In a TS3500 tape library, to detect gaps between drive element addresses in a logical library perform the following steps:

Procedure

From the Work Items navigation pane, select **Manage Drives —> Drive Assignment**. The Drive Assignment screen displays. Yellow column headings indicate which logical libraries contain element address gaps.

Working with a cartridge assignment policy

This section defines a cartridge assignment policy. It gives procedures for creating, changing, or removing the policy.

About this task

Note: The cartridge assignment policy does not reassign an assigned tape cartridge. To reassign a cartridge, use the procedure for assigning cartridges to a logical library (see "Assigning cartridges to a logical library" on page 117).

When you insert a cartridge into the library and its VOLSER is within a range, the cartridge assignment policy assigns the cartridge to its logical library. The cartridge must be of the same media type as that logical library. For example, if you create a cartridge assignment policy of VOLSERs that range from ABC000 to ABC999 for Logical Library 1 (a library of Ultrium drives), and then you insert a cartridge with VOLSER ABC123, the library recognizes that VOLSER as belonging to the range and assigns it to Logical Library 1. The library does this provided that the cartridge is an Ultrium tape cartridge (and not a different media type, such as a 3592 tape cartridge).

A cartridge assignment policy can also be created for All Other Volsers. This represents all VOLSERs not covered by specific ranges in the cartridge assignment policy. If you do not want these cartridges to be assigned to an active logical library, then you can create a new drive-less logical library and have the All Other Volsers automatically assigned to that logical library. In this way, the drive-less logical library becomes a safe media vault. Note that a drive-less logical library consumes no additional resources in a TS3500 tape library with ALMS. Subsequently, these All Other Volsers can be manually assigned to a different logical library using the Tape Library Specialist web interface or the TS3500 tape library command line interface (CLI).

Within a physical library, the maximum quantity of ranges that can be created by the cartridge policy assignment is 300; for logical libraries, the sum of all cartridge assignment policies must not exceed 300.

To establish a cartridge assignment policy, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Cartridges—> Cartridge Assignment Policy**. The Cartridge Assignment Policy screen displays a list of logical libraries (by number) and the cartridge assignment policies that are currently assigned to them.
2. Perform one of the following tasks:
   - **To create a new cartridge assignment policy**: From the Select Action drop-down box select Create, then click Go. Enter the VOLSERs that begin and end the range that you want (ensure that you type alphabetical characters in uppercase). Select the logical library that you want and click Apply, then Close. The Cartridge Assignment screen redisplays with the new cartridge assignment policy.
   - **To change a cartridge assignment policy**: Select the policy that you want to change. From the Select Action drop-down box select Modify, then click Go. The Cartridge Assignment Policy screen displays. You can move the policy to another logical library or edit the existing policy in its current logical library. If the VOLSER range is set to **All Other LTO/3592 Volsers**, it is possible to select **Enable reporting of Unit Attentions**. This option allows the host to be notified of the insertion of one or more new cartridges. After you have finished making your changes, click Apply, then Close. The Cartridge Assignment screen redisplays with the changes to the cartridge assignment policy.

- **To delete a cartridge assignment policy**: Select the VOLSER range of that policy. From the Select Action drop-down box select Delete, then select Go. The library displays the message **Are you sure you want to remove the volume serial range?** Select OK. The Cartridge Assignment screen redisplays with the cartridge assignment policy removed.

Determining the status of components in the library

This section introduces procedures for determining the status of the accessor, tape drives, I/O stations, storage slots, and cartridges in the TS3500 tape library.

Determining the status of the cartridge accessor

This section introduces two ways to determine the status of the cartridge accessor.

To determine whether tape cartridges are present in the cartridge accessor of the TS3500 tape library, use one of the following methods.

Using the Web to determine the status of the cartridge accessor
About this task

To determine the status of the cartridge accessor of the TS3500 tape library using the Web, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Library** > **Accessor**. The Accessor screen displays the state of operation for the accessor and its components (gripper, scanner, and calibration sensor). It also gives usage statistics. If you have a second cartridge accessor, the screen also displays status and usage information for this accessor. If you have an HD frame, tier mount statistics are also displayed.
2. View the state of operation for the accessor and its components (gripper, scanner, and calibration sensor), as well as accessor usage statistics. In a dual accessor library, state of operation and usage statistics are displayed for both accessors. In an HD library, tier mount statistics are also displayed.

Using the operator panel to determine the status of the cartridge accessor
About this task

To use the operator panel to determine whether tape cartridges are present in the cartridge accessor of the TS3500 tape library, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Library Status —> Accessor Status —> ENTER**. The Accessor Status screen displays.

```
Accessor Status              Panel 0004

  Accessor A - Online Preferred
    Gripper 1 - Operational
                3592/LTO
    Gripper 2 - Failed VOL031L3
                3592/LTO

  Accessor B - Online
    Gripper 1 - Failed
                3592/LTO
    Gripper 2 - Operational
                3592/LTO

[BACK]
```

If you have a second accessor, the screen displays the status for both accessors. If a cartridge is present in a gripper, the screen displays the cartridge's volume serial (VOLSER) number. If no cartridge is present, the screen indicates that the gripper is **Operational**. If the screen displays **Failed** and a cartridge's VOLSER, a problem has occurred with that cartridge. If the screen simply displays **Failed**, the gripper is empty but broken, and a message about its failed status is reported to the Activity screen. If the library cannot read the VOLSER, the screen displays **Unknown**. For libraries that use both LTO and 3592 media, the Accessor Status screen lists the type of gripper for that media. 3592 media is represented as **3592** and LTO Ultrium media is represented as **LTO**.

To show current status, the Accessor Status screen refreshes every 10 seconds.

2. Press BACK until you return to the Activity screen.

Determining drive status

This section introduces three ways to determine drive status in the TS3500 tape library.

To determine whether the tape drives in the TS3500 tape library are functioning properly and contain tape cartridges, use one of the following methods.

Using the Web to determine drive status
About this task

Perform the following steps to use the Tape Library Specialist Web interface to determine the status of tape drives in the TS3500 tape library:

Procedure

1. From the Work Items navigation pane, select **Drives —> Drive Summary** (presents the drives by frames and logical libraries).
2. (Optional) Select the Frame or Library.

   The Drives screen displays the state of operation for all of the drives in the library.

Using the operator panel to determine drive status
About this task

To use the operator panel to determine the status of drives in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Library Status —> Drive Status —> ENTER** The Drive Status screen displays.

```
Drive Status              Panel 0005

Key: L=LTO Ultrium, J = Enterprise Tape

Frame 1    Media type: LTO

Drive 1    L3   Online     VOL110L3
Drive 2    L4   Offline    Empty
Drive 3    L2   Online     Empty
Drive 4    J1   Online     VOL111J1
Drive 5    L2   Offline    Empty
Drive 6    J1   CommFail
Drive 7    J2   Online     Empty
Drive 8    L5   Online     Empty
Drive 9         Not Installed
Drive 10        Not Installed
Drive 11        Not Installed
Drive 12        Not Installed


[BACK]   [UP]   [DOWN]
```

If you have more than one frame, scroll through the frames by pressing UP or DOWN.

For libraries that use both LTO and 3592 media, the Drive Status screen lists the type of media in each frame. The screen lists the drives and (if they are LTO Ultrium drives) gives their generation as **Lx**, where **x** equals 1, 2, 3, 4, or 5 (for the LTO Ultrium 1, Ultrium 2, Ultrium 3, Ultrium 4, or Ultrium 5 tape drive, respectively). If the drives are 3592 tape drives, the screen lists them as **J1** for Model J1A, **J2** for Model E05, and **J3** for Model E06.

The screen also provides the following information for each drive:

- **Online**: The drive is functioning properly.
- **Offline**: The drive is offline for service.
- **CommFail**: The drive has an RS-422 connection to the library that is not functioning.
- **Failed**: The drive is communicating over the RS-422 interface but it is not usable.
- **Empty**: No cartridge is present in the drive.
- VOLSER number: If a cartridge is present in a drive, the screen displays the cartridge's VOLSER number.

To show current status, the Drive Status screen refreshes every 10 seconds.

2. Press BACK until you return to the Activity screen.

Using SNMP to determine drive status

Complete this task to use SNMP to determine tape drive status.

You can use your management agent for Simple Network Management Protocol (SNMP) to request data about the mediaAccessDeviceGroup. This is an object ID (category) that gives you a list of all drives and their status. For information about how to request the data, see the documentation for your SNMP management agent. The following is sample output.

```
mediaAccessDeviceIndex.1 = 1
mediaAccessDeviceObjectType.1 = tapeDrive(3)
mediaAccessDevice-Name.1 = "IBM      03592J1A          0001300180"
mediaAccessDevice-Status.1 = "deprecated"
mediaAccessDevice-Availability.1 = runningFullPower(3)
mediaAccessDevice-NeedsCleaning.1 = false(2)
mediaAccessDevice-MountCount.1 =  Hex: 00 00 00 00 00 00 35 47
mediaAccessDevice-DeviceID.1 = "50 05 07 63 00 01 03 01"
mediaAccessDevice-PowerOnHours.1 =  Hex: 00 00 00 00 00 00 0E 59
mediaAccessDevice-TotalPowerOnHours.1 =  Hex: 00 00 00 00 00 00 0E 59
mediaAccessDevice-OperationalStatus.1 = ok(2)
mediaAccessDevice-Realizes-StorageLocationIndex.1 = 1
mediaAccessDevice-Realizes-softwareElementIndex.1 = 1
```

For detailed descriptions of these fields, see "Library monitoring with SNMP MIBs" on page 324.

Viewing drive displays

This section introduces two ways to view the characters that display on the front of a 3592 tape drive or an Ultrium tape drive in the TS3500 tape library.

Using the Web to view drive displays

Complete this task to use the Web to view drive displays.

About this task

For tape drives that support it, characters on a drive's display are included in the TS3500 tape library. To use the Tape Library Specialist Web interface to view the characters, perform the following steps:

Procedure

From the Work Items navigation pane, select **Drives —> Drive Summary**. The Drives screen displays. For both Ultrium tape drives and 3592 tape drives, the screen shows the characters that appear on their displays. The display of the Ultrium tape drive can show only a single character; the display of the 3592 tape drive can show up to 80 characters.

Using the operator panel to view drive displays

Complete this task to use the operator panel to view drive displays.

About this task

To use the operator panel to view the characters that appear on the displays of Ultrium tape drives or 3592 tape drives in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Library Status —> Drive Display —> ENTER**. The Drive Display screen displays. For both Ultrium tape drives and 3592 tape drives, the screen shows the characters that appear on their displays. The display of the Ultrium tape drive can show only a single character; the display of the 3592 tape drive can show up to 80 characters. The following screens shows an example of the Drive Display screen for each type of drive.

```
Drive Display          Panel 0019

Key: L=LTO Ultrium

Frame n            Media type:  LTO

 Drive 1   L1  0
 Drive 2   L4  6
 Drive 3   L2  0
 Drive 4   L3  0
 Drive 5   L2  0
 Drive 6   L2  0
 Drive 7       Not Installed
 Drive 8       Not Installed
 Drive 9       Not Installed
 Drive 10      Not Installed
 Drive 11      Not Installed
 Drive 12      Not Installed

[BACK]  [ UP ]  [DOWN]
```

```
Drive Display          Panel 0019

Key: J=Enterprise Tape

Frame n            Media type:  3592

 Drive 1   J1  READY*
 Drive 2   J1  READ*
 Drive 3   J2  @LOAD
 Drive 4   J2  READ*
 Drive 5   J1  WRITE*
 Drive 6   J1  EMPTY*
 Drive 7   J1  EMPTY*
 Drive 8       Not Installed
 Drive 9       Not Installed
 Drive 10      Not Installed
 Drive 11      Not Installed
 Drive 12      Not Installed

[BACK]  [ UP ]  [DOWN]
```

If you have more than one frame, scroll through the frames by pressing UP or
DOWN. For libraries that use both LTO and 3592 media, the Drive Display
screen lists the type of media in each frame. The screen lists the drives in that
frame and (if they are LTO Ultrium drives) gives their generation as Lx, where
x equals 1, 2, 3, 4, 5, T, U, or V (for the LTO Ultrium 1, Ultrium 2, Ultrium 3,
Ultrium 4, Ultrium 5, Ultrium 3 WORM, Ultrium 4 WORM, or Ultrium 5
WORM cartridges, respectively). If the drives are 3592 tape drives, the screen
lists them as J1 for Model J1A, J2 for Model E05, and J3 for Model E06. If the
drive text area of the screen (the section on the right) is blank, it means that the
library could not retrieve information from the drive. This could be because the
drive is busy, or, in the case of the 3592 tape drive, the code level of the drive
does not support the viewing of drive displays. The Drive Display screen does
not refresh to show changes.

2. Press BACK until you return to the Activity screen.

Determining the status of an I/O station

This section introduces three ways to determine whether one or more tape
cartridges are present in an I/O station of the TS3500 tape library.

To determine whether one or more tape cartridges are present in an I/O station of the TS3500 tape library, use one of the following methods.

Using the Web to determine the status of an I/O station
About this task

To use the Tape Library Specialist Web interface to determine the status of an I/O station in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Cartridges —> I/O Station**. The I/O Station screen displays cartridges that are contained in available I/O stations.

Using the operator panel to determine the status of an I/O station
About this task

To use the operator panel to determine the status of an I/O station in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Library Status —>Select I/O Station —>ENTER**. The Select I/O Station screen displays. It lists each I/O Station and displays information about whether it is open, locked, and the number of cartridges in the I/O station.

```
Select I/O Station        Panel 0037

KEY: R=Row

    Frame  1    R01-R10:     OPEN
    Frame  1    R11-R26:        3
    Frame 12    R01-R16:   LOCKED
    Frame 12    R17-R32:        0
    Frame 12    R33-R48:     OPEN
    Frame 12    R49-R64:    12

[BACK]   [ UP ]   [DOWN]
```

   OPEN displays next to frames that are open; locked displays next to frames that are locked; the number indicates how many cartridges are in the I/O station.

2. Select an I/O Station and press **ENTER**. The I/O Station Status screen displays. For libraries that use both LTO and 3592 media, the screen shows the type of media used in each I/O station. It lists the storage slots in the I/O station and indicates whether they are occupied by a cartridge or are empty. If occupied, the cartridge is identified by its volume serial (VOLSER) number and logical library name (in the example below, `Admin` and `Finan`).

```
I/O Station Status        Panel 0006

Media Type: LTO

   Slot 1    VOL110L3   LL:  Admin
   Slot 2    Empty
   Slot 3    Empty
   Slot 4    VOL111L3   LL:  Finan
   Slot 5    Empty
   Slot 6    Empty
   Slot 7    Empty
   Slot 8    Empty
   Slot 9    Empty
   Slot 10   Empty

[BACK]   [ UP ]   [DOWN]
```

To show current status, the I/O Station Status screen refreshes every 10 seconds.

3. Press UP or DOWN to redisplay the next or previous 16 I/O slots.

4. Press BACK until you return to the Activity screen.

Using SNMP to determine the status of an I/O station

Complete this task to use SNMP to determine the status of an I/O station.

You can use your management agent for Simple Network Management Protocol (SNMP) to request data about the limitedAccessPortGroup. This is an object ID (category) that gives you a list of all I/O stations and their status. For information about how to request the data, see the documentation for your SNMP management agent. The following is sample output.

```
limitedAccessPortIndex.1 = 1
limitedAccessPort-DeviceID.1 = "I/O Element Address: 0x301, Frame: 1, Row: 1"
limitedAccessPort-Extended.1 = false(2)
limitedAccessPort-ElementName.1 = "I/O Element Address: 0x301"
limitedAccessPort-Caption.1 = "I/O Element Address: 0x301, Frame: 1, Row: 1"
limitedAccessPort-Description.1 = "I/O Element Address: 0x301, Frame: 1, Row: 1"
limitedAccessPort-Realizes-StorageLocationIndex.1 = 5
```

For detailed descriptions of these fields, see "Library monitoring with SNMP MIBs" on page 324.

Determining the status of storage slots

To determine how many storage slots are occupied in the TS3500 tape library, use one of the following methods.

Using the Web to determine the status of storage slots

Complete this task to determine storage slot status using the Web.

About this task

The System Summary screen of the Tape Library Specialist Web interface displays the storage slot status for the entire library in the All Frames table. To determine the status of storage slots for individual frames in the TS3500 tape library, perform the following steps:

Procedure

1. On the System Summary screen, select a specific frame from the Frame drop-down list or select the picture of that frame. The System Summary screen redisplays with detailed information for the selected frame.

2. View the total number of storage slots, total number of offline storage slots, and the total number of empty storage slots.

Using the operator panel to determine the status of storage slots

Complete this task to determine the status of storage slots using the operator panel.

About this task

To use the operator panel to determine the status of storage slots in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Library Status —> Storage Slot Status —> ENTER**. The Storage Slot Status screen displays.

```
Storage Slot Status   Panel 0008

Library Totals      LTO      3592
  Cartridges:
    Data:         11234   10695
    Cleaning:        15      10
  Empty Slots:      375     360
  Total Capacity: 11724   11565
  Licensed:       11724   11065

Frame n Totals
  Cartridges:
    Data:           121       0
    Cleaning:         8       0
  Empty Slots:     1216       0
  Total Capacity:   345       0

[BACK][ UP ][DOWN][DETAIL]
```

For both the library and the frame that you specify, the screen displays the quantity of data cartridges and cleaning cartridges, as well as the quantity of empty slots. The screen also displays the total capacity of the library and the available licensed capacity. (If the library contains only one frame, the Frame Totals are redundant and are not displayed.)

To select a frame, press UP or DOWN to increment or decrement the value. Then, to determine which slots are occupied, press DETAIL. The Storage Slot Detail screen displays.

```
Storage Slot Detail       Panel 0010


Key:F=Frame, C=Column, R=Row, T=Tier
Media Type: LTO

[F02,C01,R01,T01]     VOL011L1
[F02,C01,R02,T01]     VOL012L1
[F02,C01,R03,T01]     VOL013L1
[F02,C01,R04,T01]     VOL014L1
[F02,C01,R05,T01]     CLNI01L1
[F02,C01,R06,T01]     VOL015L1
[F02,C01,R07,T01]     VOL016L1
[F02,C01,R07,T02]     VOL017L1
[F02,C01,R08,T01]     VOL018L1
[F02,C01,R08,T02]     VOL019L1



[BACK][ UP ][DOWN]
```

For libraries that use both LTO and 3592 media, the Storage Slot Detail screen shows the type of media used in each frame. The screen displays the location of occupied storage slots in the library as **[Fxx,Cyy,Rzz]** (where **F** equals frame and **xx** equals its number, **C** equals column and **yy** equals its number, and **R** equals row and **zz** equals its number). In libraries with HD frames, the screen also displays the tier notation where **T** equals tier and **xx** equals its number in the HD slot storage locations. In addition, the screen identifies the cartridge that occupies the slot by its volume serial (VOLSER) number. To view additional slots, press DOWN; to return to slots that you have viewed, press UP.

2. Press BACK until you return to the Activity screen.

Using SNMP to determine the status of storage slots

Complete this task to determine the status of storage slots using SNMP.

You can use your management agent for the Simple Network Management Protocol (SNMP) to request data about the storageMediaLocationGroup. This is an object ID (category) that gives you a list of all storage slots, drives, and I/O stations and their contents. For information about how to request the data, see the documentation for your SNMP management agent. The following is sample output.

```
storageMediaLocationIndex.263 = 263
storageMediaLocation-Tag.263 = "International Business Machines IBM Total Storage
UltraScalable Tape Library 1340010 Storage Slot located at Frame: 2, Col: 1, Row: 5"
storageMediaLocation-LocationType.263 = slot(2)
storageMediaLocation-LocationCoordinates.263 = "Storage Slot located at
Frame: 2, Col: 1, Row: 5"
storageMediaLocation-MediaTypesSupported.263 = tape(2)
storageMediaLocation-MediaCapacity.273 = 1
storageMediaLocation-Association-ChangerDeviceIndex.263 = 1
physicalMediaEntry.physicalMediaPresent.263 = true(1)
physicalMediaEntry.physicalMedia-Removable.263 = true(1)
physicalMediaEntry.physicalMedia-Replaceable.263 = true(1)
physicalMediaEntry.physicalMedia-HotSwappable.263 = true(1)
physicalMediaEntry.physicalMedia-Capacity.263 =  Hex: 00 00 00 45 D9 64 B8 00
physicalMediaEntry.physicalMedia-MediaType.263 = tape(2)
physicalMediaEntry.physicalMedia-MediaDescription.263 = "IBM TotalStorage Enterprise
Tape Cartridge - Data"
physicalMediaEntry.physicalMedia-CleanerMedia.263 = false(2)
physicalMediaEntry.physicalMedia-DualSided.263 = false(2)
physicalMediaEntry.physicalMedia-PhysicalLabel.263 = "J1M174JA"
physicalMediaEntry.physicalMedia-Tag.263 = "J1M174JA"
```

For detailed descriptions of these fields, see "Library monitoring with SNMP MIBs" on page 324.

Determining the location of cartridges

This section introduces three ways to determine the location of cartridges.

To determine the location of any tape cartridge in the TS3500 tape library, use one of the following methods.

Note: You can locate a data cartridge by specifying its volume serial (VOLSER) number in the Tape Library Specialist Web interface. This function is not available from the operator panel.

Using the Web to determine the location of cartridges

Complete this task to determine the cartridge location using the Web.

About this task

To use the Tape Library Specialist Web interface to determine the location of cartridges in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Cartridges —> Data Cartridges** OR **Cartridges —> Cleaning Cartridges** OR **Cartridges —>I/O Station** .
Each screen displays a common format, title, and similar display options. For the Data Cartridges screen, you can make selections to view cartridges by library, frame, or logical library. You can also view the cartridge initially sorted by volume serial (VOLSER) number, physical location, or SCSI element address. You can locate a data cartridge by specifying its entire or partial VOLSER. This functionality also exists on the I/O Station page, but not on the Cleaning Cartridge page. On all three pages, you can resort the displayed list by VOLSER, physical location, or SCSI element address.

Using the operator panel to determine the location of cartridges

Complete this task to determine cartridge location using the operator panel.

About this task

To use the operator panel to determine the location of cartridges in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Library Status —> Cartridge Locations —> ENTER**.
2. Press UP or DOWN to select the range of volume serial (VOLSER) numbers that contains the cartridge that you want. Then, press ENTER. If your library contains a large quantity of cartridges, you may need to repeat this step until you locate the range that contains the cartridge that you want. The Cartridge Locations screen displays.

```
Cartridge Locations        Panel 0009

Key: F=Frame, C=Column, R=Row

VOL001L1   Slot   [F02,C03,R01,T01]
VOL002L1   Drive  [F02,R03]
VOL003L1   I/O    [F01,R03]
VOL004L1   Slot   [F02,C03,R01,T02]
VOL005L1   Slot   [F02,C03,R02,T01]
VOL006L1   Slot   [F02,C03,R03,T01]
VOL007L1   Slot   [F02,C03,R04,T01]
VOL008L1   Slot   [F02,C03,R05,T01]
VOL009L1   Slot   [F02,C03,R06,T01]
VOL010L1   Slot   [F02,C03,R07,T01]

[BACK]  [ UP ]  [DOWN]
```

The screen shows the location of each cartridge in each frame (whether in a storage slot, drive, or I/O station slot). The cartridges are sorted by their volume serial (VOLSER) number and their location is given as **[Fxx,Cyy,Rzz]** or **[Fxx,Rzz]**, (where **F** equals frame and **xx** equals its number, **C** equals column and **yy** equals its number, and **R** equals row and **zz** equals its number). For libraries with high-density frames, the cartridge location also includes **Txx**, where **T** equals tier and **x** equals its number. To view additional cartridges, press DOWN; to return to cartridges that you have viewed, press UP.

3. Press BACK until you return to the Activity screen.

Using SNMP to determine the location of cartridges

Complete this task to determine cartridge location using SNMP.

You can use your management agent for the Simple Network Management Protocol (SNMP) to request data about the storageMediaLocationGroup. This is an object ID (category) that gives you a list of all storage slots, drives, and I/O stations and their contents. For information about how to request the data, see the documentation for your SNMP management agent. The following is sample output.

```
storageMediaLocationIndex.263 = 263
storageMediaLocation-Tag.263 = "International Business Machines IBM Total Storage
UltraScalable Tape Library 1340010 Storage Slot located at Frame: 2, Col: 1, Row: 5"
storageMediaLocation-LocationType.263 = slot(2)
storageMediaLocation-LocationCoordinates.263 = "Storage Slot located at
Frame: 2, Col: 1, Row: 5"
storageMediaLocation-MediaTypesSupported.263 = tape(2)
storageMediaLocation-MediaCapacity.273 = 1
storageMediaLocation-Association-ChangerDeviceIndex.263 = 1
physicalMediaEntry.physicalMediaPresent.263 = true(1)
physicalMediaEntry.physicalMedia-Removable.263 = true(1)
physicalMediaEntry.physicalMedia-Replaceable.263 = true(1)
physicalMediaEntry.physicalMedia-HotSwappable.263 = true(1)
physicalMediaEntry.physicalMedia-Capacity.263 =  Hex: 00 00 00 45 D9 64 B8 00
physicalMediaEntry.physicalMedia-MediaType.263 = tape(2)
physicalMediaEntry.physicalMedia-MediaDescription.263 = "IBM TotalStorage Enterprise
Tape Cartridge - Data"
physicalMediaEntry.physicalMedia-CleanerMedia.263 = false(2)
physicalMediaEntry.physicalMedia-DualSided.263 = false(2)
physicalMediaEntry.physicalMedia-PhysicalLabel.263 = "J1M174JA"
physicalMediaEntry.physicalMedia-Tag.263 = "J1M174JA"
```

For detailed descriptions of these fields, see "Library monitoring with SNMP MIBs" on page 324.

Determining the status of shuttle stations

About this task

In a TS3500 tape library shuttle complex, the System Summary screen of the Tape Library Specialist web interface displays the shuttle station status for the current library in the Library Status table. If a station is in a warning or critical state, you can drill down to obtain details by clicking on the status icon. To view shuttle station status and other details, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library** > **Shuttle Stations**. The Shuttle Stations page displays.
2. View the status of each shuttle station in the Status column of the Shuttle Stations table.

Viewing the drive emulation mode of TS1120 tape drives

This section introduces two ways to view the current drive emulation mode of TS1120 tape drives in the TS3500 tape library.

To view the emulation mode of TS1120 tape drives, use one of the following methods:

Using the Web to view the drive emulation mode of TS1120 tape drives

Complete this task to view the current drive emulation modes of TS1120 tape drives in the TS3500 tape library.

About this task

To view the emulation mode of a TS1120 tape drive, perform the following steps:

Procedure

From the Work Items navigation pane, select **Drives —> Drive Summary**. The Drives screen displays. The Drive Emulation Mode column lists the current emulation mode for each drive. Values are J1A (for the 3592 J1A) or E05 (for the TS1120 tape drive).

Using the operator panel to view the drive emulation mode of TS1120 tape drives

Complete this task to use the operator panel to view the drive emulation mode of TS1120 tape drives.

About this task

To use the operator panel to view the drive emulation mode of one or more TS1120 tape drives in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Advanced Settings —> Drive Emulation —> ENTER**. The Drive Emulation screen displays.

```
Drive Emulation                      Panel 0040

Display Emulation Settings
Set Drive Emulation

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

2. Press **UP** or **DOWN** to highlight Display Emulation Settings, then press
   ENTER. The Display Drive Emulation screen shows the physical location of
   each type of 3592 tape drive and gives its current mode of drive emulation. The
   physical locations are listed as **[Fxx,Rzz]** (where **F** equals a frame and **xx**
   equals its number, and where **R** equals a row and **zz** equals its number). The
   drive emulation for a 3592 J1A is represented as **3592J1A** and the drive
   emulation for a TS1120 tape drive is represented as **3592E05**. Other possible
   values are **Not Supported** (the drive may require a firmware update) or
   CommFail. If CommFail displays, the drive's RS-422 connection to the library is
   not functioning, the drive firmware image may be corrupted, or the drive may
   be defective. Unplug and replug the RS-422 cable or cycle power to the drive. If
   CommFail continues to display, contact your IBM Service Representative.

```
Display Drive Emulation                Panel 0041

Key: F=Frame, R=Row

[F01,R04]   3592E05
[F01,R05]   3592E05
[F01,R06]   3592J1A
[F02,R01]   3592J1A
[F02,R03]   Not Supported
[F02,R04]   3592J1A
[F02,R05]   CommFail

[BACK]   [ UP ]   [DOWN]
```

3. Press **BACK** until you return to the Activity screen.

Changing the drive emulation mode of TS1120 tape drives

This section introduces two ways to configure the TS3500 tape library so that one
or more TS1120 tape drives can emulate a 3592 J1A.

If your library includes 3592 J1A tape drives and you want to add a TS1120 tape
drive but not change your software, you can change the drive emulation mode so
that the TS1120 tape drive behaves like the 3592 J1A.

Note: The TS1120 tape drive is the only 3592 tape drive capable of emulation.
To change the emulation mode, use one of the following methods:

Using the Web to change the drive emulation mode of TS1120 tape drives

Complete this task to configure the TS3500 tape library so that a TS1120 tape drive
that is installed in the library can emulate a 3592 J1A.

About this task

If your library includes 3592 J1A tape drives and you want to add a TS1120 tape
drive but not change your software, you can change the drive emulation mode so
that the TS1120 tape drive behaves like the 3592 J1A. To change the emulation
mode, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives —> Drive Summary**. The Drives screen displays. The Drive Emulation Mode column lists the current emulation mode for each drive. Values are 3592-J1A (for the 3592 J1A) or 3592-E05 (for the TS1120 tape drive).
2. Select the check boxes of the drives whose emulation you want to change.
3. From the Select Action drop-down box, select **Change Emulation Mode** and select **Go**. The Change Emulation Mode pop-up window displays.
4. From the drop-down box next to New Emulation Mode, select the type of emulation that you want. Choices are 3592J1A (for the 3592 J1A) or 3592E05 (for the TS1120 tape drive).
5. Select **Change**. A confirmation message displays.

Using the operator panel to change the drive emulation mode of TS1120 tape drives

Complete this task to change the drive emulation mode of TS1120 tape drives.

About this task

When you use the operator panel to change the drive emulation of a TS1120 tape drive, you can change it for a single drive, for the drives in a logical library, or for all the TS1120 tape drives in the TS3500 tape library.

To use the operator panel to change the drive emulation mode of one or more TS1120 tape drives, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Advanced Settings —> Drive Emulation —> ENTER**. The Drive Emulation screen displays.

   ```
   Drive Emulation                 Panel 0040

   Display Emulation Settings
   Set Drive Emulation

   [BACK]  [ UP ]  [DOWN]  [ENTER]
   ```

2. Press **UP** or **DOWN** to highlight Set Drive Emulation, then press **ENTER**. The Set Drive Emulation screen displays. You can specify to change drive emulation for a single TS1120 tape drive, a TS1120 tape drive drive in a logical library, or for all the TS1120 tape drives.

   ```
   Set Drive Emulation             Panel 0042

   Set By Drive
   Set by Logical Library
   Set All Drives

   [BACK]  [ UP ]  [DOWN]  [ENTER]
   ```

   • To specify a drive emulation mode for a single TS1120 tape drive, highlight **Set by Drive** and press **ENTER**. The Select Drive screen shows the physical location and media type of only the TS1120 tape drives. The physical locations are listed as **[Fxx,Rzz]** (where **F** equals a frame and **xx** equals its number, and where **R** equals a row and **zz** equals its number). The media identifier is represented as J2). Press **UP** or **DOWN** to highlight the drive to which you want to apply emulation and press **ENTER**.

```
Select Drive                      Panel 0043

Key: F=Frame, R=Row

[F01,R04]  J2
[F01,R05]  J2
[F01,R06]  J2
[F02,R01]  J2
[F02,R03]  J2
[F02,R04]  J2
[F02,R05]  J2

[BACK]  [ UP ]  [DOWN]  [ENTER]
```

- To specify a drive emulation mode for the TS1120 tape drives in a logical library, highlight **Set by Logical Library** and press **ENTER**. The Select Logical Library screen displays a logical library that contains TS1120 tape drives. Press UP or DOWN to view another logical library that contains TS1120 tape drives. Continue this process to view all logical libraries that contain TS1120 tape drives. When you identify a logical library to which you want to apply emulation for all drives, press **ENTER**.

```
Select Logical Library            Panel 0025

Log lib 3    Media Type: 3592

[BACK]  [ UP ]  [DOWN]  [ENTER]
```

- To specify a drive emulation mode for TS1120 tape drives in the 3584 tape library, highlight **Set All Drives** and press **ENTER**.

3. The Select Emulation Mode screen displays with the two choices of emulation. The emulation mode for a 3592 J1A tape drive is represented as 3592J1A; the emulation mode for a TS1120 tape drive is represented as 3592E05. Press UP or DOWN to highlight the emulation mode that you want and press ENTER. The message **Completed setting drive emulation mode** displays.

```
Select Emulation Mode             Panel 0044

3592J1A
3592E05

[BACK]  [ UP ]  [DOWN]  [ENTER]
```

4. Press **BACK** until you return to the Activity screen.

Library preferences

This section introduces how to use the Web to view or change certain TS3500 tape library preferences, including preferred accessor zones, the capacity utilization warning threshold, and home cell settings.

It is possible to view and modify certain TS3500 tape library preference settings using the IBM Tape Library Specialist Web interface. To learn how to view or change these settings, refer to the following topic.

Using the Web to view or change library preferences

Complete this task to use the Web to view or change TS3500 tape library preferences, including preferred accessor zones, capacity warning utilization, and home cells.

About this task

Perform the following steps in order to view or change these library preferences:
* Preferred accessor zones
* Capacity utilization warning threshold
* Home cell
* Automatic eject of expired cleaning cartridges

Procedure

1. From the Work Items navigation pane, select **Library —> Library Preferences**. The Library Preferences screen displays the current accessor zone designation, the current capacity utilization warning setting, and the current home cell setting.

2. Complete the following tasks to modify the library preferences:
   * **To change the preferred accessor zones:** Refer to "Using the Web to set or change the preferred zone of an accessor" on page 166, or follow the instructions on the screen.

     Note: This option is only available in libraries with dual accessors.
   * **To change the capacity utilization warning threshold:** Select the desired percentage from the Capacity Utilization Warning dropdown menu. The warning threshold options go from 50% to 99%. The default setting is 99%.

     Note: The capacity utilization displays on the System Summary screen. A yellow indicator appears if utilization is at 99%. A red indicator appears if utilization is at 100% or higher.
   * **To select fixed or floating home cell:** Select **Fixed home cell** or **Floating home cell** from the Home cell setting dropdown menu.

     Notes:
     – Floating home cell is the manufacturing default for HD libraries.
     – Fixed home cell is the manufacturing default for non-HD libraries.
   * **To select automatic eject of expired cleaning cartridges:** Select the **Auto-eject expired cleaning cartridges** check box. Clear the check box to turn off automatic eject for expired cleaning cartridges.

     Note: Virtual input/output (VIO) slots must be enabled in order to enable automatic eject of expired cleaning cartridges.

3. Ensure that all library preference settings are correct and click **Apply**. The Library Preferences screen redisplays with the modified settings.

Viewing capacity utilization of the library

This section introduces how to view licensed and unlicensed capacity of the library and total capacity utilization of the TS3500 tape library.

To view licensed and unlicensed capacity and total capacity utilization of the TS3500 tape library, use the following method.

Using the Web to view capacity utilization of the library
About this task

To use the Tape Library Specialist Web interface to licensed and unlicensed capacity and overall capacity utilization of the TS3500 tape library, perform the following steps:

Procedure

1. On the System Summary screen, under Library Status, view Capacity Utilization. If utilization is at 99%, a yellow indicator will appear. If utilization is 100% or higher, a red indicator will appear.
2. View licensed and unlicensed capacity under the Total Storage Slots section beneath All Frames.

Performing an inventory of the library

This section introduces two ways to conduct an inventory, or an inventory with audit, of the TS3500 tape library.

To perform an inventory, or an inventory with audit, of the entire TS3500 tape library, use one of the following methods.

Using the Web to perform an inventory of the library
About this task

To use the Tape Library Specialist Web interface to conduct an inventory, or an inventory with audit, of the TS3500 tape library, perform the following steps:

Procedure

1. From the System Summary screen, select All Frames from the Frames drop-down menu. Then, select the Inventory or Inventory/Audit link.

   Note: The inventory with audit option is only available in libraries with HD frames.
2. The Confirm Inventory Library, or Confirm Inventory/Audit Library, pop-up window displays, warning you that if you continue with the inventory, all jobs in the work queue may be delayed while the inventory is performed.
3. Select **Perform Inventory** or **Perform Inventory with Audit** if you want to continue, and then select **OK**. The Inventory or Inventory/Audit is performed.

Using the operator panel to perform an inventory of the library
About this task

To use the operator panel to conduct an inventory of the TS3500 tape library, perform the following steps:

Note: The host application must request the library inventory to be uploaded. The library does not automatically perform this function.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Manual Operations —> Inventory —> ENTER**. The Inventory menu displays.

Note: If only one frame exists in the library, the menu displays `Inventory Library`; if more than one frame exists in the library, the menu displays `Inventory Library` and `Inventory Frame`.

```
Inventory                    Panel 0016

Inventory Library

[BACK]  [ UP ]  [DOWN]  [ENTER]
```

2. If necessary, press UP or DOWN to highlight Inventory Library, then press ENTER. If the library contains HD frames, the user is first prompted to select the inventory type. (See Panel 0041.) Press UP or DOWN to select `Inventory` or `Inventory with Audit`. Press ENTER and the library then displays the warning message **If you continue all jobs in the work queue will be delayed while the inventory is performed. Press ENTER to continue. The estimated inventory time is xxx minutes.** If the library does not contain any HD frames, the library only displays the warning message.

```
Select Inventory Type  Panel 0041

Inventory

Inventory with Audit

[BACK][ UP ][DOWN][ENTER]
```

3. Press ENTER. The message **Inventory in Progress** displays, and the inventory of the library begins. When the inventory is finished, **Inventory Complete** displays.
4. Press ENTER to return to the Inventory menu.
5. Press BACK until you return to the Activity screen.

Performing an inventory of a frame in the library

This section introduces two ways to conduct an inventory, or inventory with audit, of a frame in the TS3500 tape library.

To perform an inventory, or an inventory with audit, of a frame in the TS3500 tape library, use one of the following methods.

Using the Web to perform an inventory of a frame in the library

Complete this task to conduct an inventory of a library frame using the Web.

About this task

To use the Tape Library Specialist Web interface to conduct an inventory, or inventory with audit, of a frame in the TS3500 tape library, perform the following steps:

Procedure

1. From the System Summary screen, use the drop-down menu to select a specific frame in the library. Then select the Inventory or Inventory/Audit link.

   Note: The inventory with audit option is only available in libraries with HD frames.

2. The Confirm Inventory Library or Confirm Inventory/Audit Library pop-up window displays, warning you that if you continue with the inventory, all jobs in the work queue may be delayed while the inventory is performed.

3. If you want to continue, select **OK**. The inventory, or inventory with audit, is performed.

Using the operator panel to perform an inventory of a frame in the library

About this task

To use the operator panel to conduct an inventory, or an inventory with audit, of a frame in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Manual Operations —> Inventory —> ENTER**. The Inventory menu displays.

   Note: If only one frame exists in the library, the menu displays `Inventory Library`; if more than one frame exists in the library, the menu displays `Inventory Library` and `Inventory Frame`.

   ```
   Inventory                    Panel 0016

   Inventory Library
   Inventory Frame

   [BACK]  [ UP ]           [ENTER]
   ```

2. Press UP or DOWN to highlight Inventory Frame, then press ENTER. The library displays the warning message **If you continue all jobs in the work queue will be delayed while the library inventory is performed. Press ENTER to continue. The estimated inventory time is xxx minutes.**

3. Press ENTER. The Select Frame screen displays.

   ```
   Select Frame            Panel 0007

   Select a frame:

   Frame Number 2
   Media Type: 3592

   [BACK]  [ UP ]  [DOWN]  [ENTER]
   ```

4. Specify the number of the frame that you want by pressing UP or DOWN to increment or decrement the value. For libraries that use both LTO and 3592 media, the Select Frame screen shows the type of media used in the frame that you selected.

5. When the desired frame number displays, press ENTER. If the selected frame is an HD frame, it is necessary to also select the inventory type: `Inventory` or `Inventory with Audit`. The library displays the warning message **If you continue all jobs in the work queue will be delayed while the inventory is performed. The estimated inventory time is xxx minutes.** This is followed with the message **Inventory in Progress**, and the inventory of the frame begins. When the inventory is finished, **Inventory Complete** displays.

6. Press ENTER to return to the Inventory menu.

7. Press BACK until you return to the Activity screen.

Moving a cartridge

This section introduces two ways to move a cartridge in the TS3500 tape library.

At times, you may want to tell the library to move a specific tape cartridge. For example, if a single host controls the library and the host fails during an operation, you can use menus on the Web or operator panel to move cartridges and continue the operation.

To move a specific cartridge in the TS3500 tape library, use one of the following methods.

Using the Web to move a cartridge

Complete this task to use the Web to move a cartridge.

About this task

To use the Tape Library Specialist Web interface to move a cartridge in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Cartridges —> Data Cartridges**. The Data Cartridges screen displays.
2. Select a frame (or all frames), a logical library (or all libraries), or sort by location, volser, SCSI element address, or usage. Then, select **Search**. A list of cartridges based on the selection criteria you entered is displayed.
3. Select a cartridge, then from the Select Action drop-down list, select **Move**, then select Go.
   - In a **non-HD library**, the Select Move Method window displays with the following options:
     - Move to First Empty Storage Slot
     - Select Physical Location
     - Select a SCSI Element Address
   - In an **HD library**, different Select Move Method windows display depending on the location of the cartridge or cartridges to be moved.
     - **If the cartridge is in physical storage**, the Select Move Method window displays with the following options:
       - Mount to Drive
       - Prestage to Cartridge Cache
       - Destage from Cartridge Cache

       Note: If Mount to Drive is selected, the Select New Physical Location Range Screen displays. Proceed with the following substeps:
       a. Select the wanted range from the drop-down menu. Then, select **Next**.
       b. Select the wanted location from the drop-down menu. Then, select **Finish**.
     - **If the cartridge is in a drive**, the Select Move Method screen displays with the following options:
       - Move to First Available Address
       - Move to Home Address

– **If the cartridge is in a physical I/O station**, the Select Move Method screen displays with the following options:
- Move to First Available Address
- Mount to Drive

Note: If the cartridges are all the same type, the operator can select more than one and then do a bulk access move. The operator is not able to move unassigned cartridges.

4. Select a move method, then select **OK**. A warning displays while the cartridge is being moved. When the move is completed, a message is displayed indicating that the cartridge has been moved. Close the window.

Using the operator panel to move a cartridge
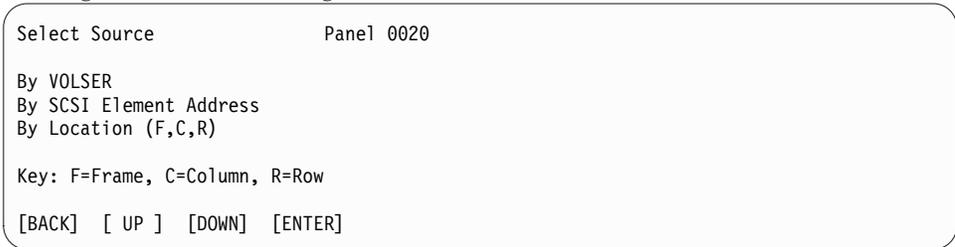### About this task

When you use the operator panel to move a cartridge in the TS3500 tape library, you can identify that cartridge by its volume serial (VOLSER) number, its SCSI element address, or its frame, column, or row location.

To use the operator panel on the TS3500 tape library to move a cartridge, perform the following steps:

Note: The operator panel does not allow you to move incompatible media to a storage slot or drive. For example, if you select an Ultrium 3 cartridge, the operator panel does not display Ultrium 1 and Ultrium 2 drives as valid destinations.

Procedure
1. Vary the library offline at the host.
2. From the library's Activity touchscreen, press **MENU —> Manual Operations —> Move Cartridge —> ENTER**. The Select Source screen displays. You can specify which cartridge to move by its VOLSER, SCSI element address, or frame, column, and row location. Choices are available for LTO Ultrium cartridges and 3592 cartridges.

```
Select Source                 Panel 0020

By VOLSER
By SCSI Element Address
By Location (F,C,R)

Key: F=Frame, C=Column, R=Row

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

Notes:
a. By Location (F,C,R) is only an option in a non-HD library. In an HD library, this option is displayed as By Drive Location (F,C).
b. The gripper is displayed as a source if there is a cartridge in the gripper.
c. Moves to or from an I/O station are not allowed when virtual I/O is enabled.
• To specify the cartridge (in this example, an LTO cartridge) to be moved by its VOLSER, highlight **By VOLSER** and press ENTER. The Select Source Volume screen displays with one of the following:

– A list of ten or fewer LTO cartridges in the library, identified by their VOLSERs and their physical locations.

– If the library contains more than ten LTO cartridges, a range of cartridges identified by their VOLSERs and their physical locations.

Cartridge locations are listed as **[Fxx,Cyy,Rzz]** or **[Fxx,Rzz]**, (where **F** equals frame and **xx** equals its number, **C**, equals column and **yy** equals its number, and **R** equals row and **zz** equals its number). If the cartridge location is in an HD slot, a tier notation is also displayed (**[Fvv,Cxx,Ryy,Tzz]**), where **T** equals tier and **xx** equals its number. Perform one of the following:

– Press UP or DOWN to select the VOLSER of the cartridge that you want, then press ENTER.

– Press UP or DOWN to select the range of VOLSERs that contains the cartridge that you want, then press ENTER (if your library contains a large quantity of cartridges, you may have to repeat this step until you locate the range that contains the cartridge that you want). Press UP or DOWN to select the VOLSER of the cartridge that you want and press ENTER.

```
Select Source Volume        Panel 0022

Key: F=Frame, C=Column, R=Row
     L=LTO Ultrium

Media Type: LTO

VOL011L2    Slot    [F01,C03,R01]
VOL012L2    Drive   [F02,R03] L2
VOL013L1    I/O     [F01,R03]
VOL014L1    Slot    [F01,C03,R01]
VOL015L1    Slot    [F01,C03,R02]
VOL016L3    Slot    [F01,C03,R03]
VOL017L1    Slot    [F01,C03,R04]
VOL018L1    Slot    [F01,C03,R05]
VOL019L3    Slot    [F01,C03,R06]
VOL020L1    Slot    [F01,C03,R07]

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

• To specify the cartridge (in this example, an LTO cartridge) to be moved by a specific SCSI element address, highlight **By SCSI Element Address** and press ENTER. The Select Source Element screen displays with one of the following:

– A list of LTO cartridges in the library, identified by their SCSI element addresses (in both decimal and hexadecimal format) and their VOLSERs.

– A range of LTO cartridges in the library, identified by their SCSI element addresses (in both decimal and hexadecimal format).

Note: In the following procedures, note that different logical libraries can contain the same element addresses. Because of this, when the Advanced Library Management System (ALMS) is enabled, you must first select which logical library that you want before selecting an element address.
Perform one of the following:

– Press UP or DOWN to select the SCSI element address of the cartridge that you want, then press ENTER.

– Press UP or DOWN to select the range of SCSI element addresses that contains the cartridge that you want, then press ENTER (if your library contains a large quantity of cartridges, you may have to repeat this step

until you locate the range that contains the cartridge that you want). Press
UP or DOWN to select the SCSI element address of the cartridge that you
want and press ENTER.

```
Select Source Element      Panel 0023

Media Type: LTO

1025   401h   VOL011L1
1026   402h   VOL012L3
1027   403h   VOL013L1
1028   404h   VOL014L1
1029   405h   CLNI01L1
1030   406h   VOL015L1
1031   407h   VOL016L1
1032   408h   VOL017L1
1033   409h   VOL018L2
1034   40Ah   VOL019L3

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

Note: Media type is only displayed in mixed media libraries.

- To specify the cartridge (in this example, an LTO cartridge) to be moved by a
  specific frame, column, or row location, highlight **By Location (F,C,R)** and
  press ENTER.

  Note: This option is only available in non-HD libraries.
  The Select Source Location screen displays with one of the following:

  – A list of LTO cartridges in the library, identified by their physical frame,
    column, or row location and their VOLSERs.

  – A range of LTO cartridges in the library, identified by their physical frame,
    column, or row locations.

  The locations are listed as **[Fxx,Cyy,Rzz]** or **[Fxx,Rzz]**, (where **F** equals
  frame and **xx** equals its number, **C** equals column and **yy** equals its number,
  and **R** equals row and **zz** equals its number). Perform one of the following:

  – Press UP or DOWN to select the physical frame, column, or row location
    of the cartridge that you want, then press ENTER.

  – Press UP or DOWN to select the range of physical frame, column, or row
    locations that contains the cartridge that you want, then press ENTER (if
    your library contains a large quantity of cartridges, you may need to
    repeat this step until you locate the range that contains the cartridge that
    you want). Press UP or DOWN to select the physical frame, column, or
    row location of the cartridge that you want and press ENTER.

```
Select Source Location      Panel 0024

Key: F=Frame, C=Column, R=Row

Media Type: LTO

Drive   [F02,R12] L1    VOL003L1
I/O     [F01,R01]       VOL004L1
Slot    [F01,C01,R01]   VOL005L1
Slot    [F01,C01,R02]   VOL006L3
Slot    [F01,C02,R01]   VOL007L1
Slot    [F02,C01,R02]   CLNI01L1
Slot    [F02,C01,R03]   CLNI02L1
Slot    [F02,C01,R04]   VOL008L1

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

The library locates the cartridge to be moved and performs one of the following:

- If the cartridge is already assigned to a logical library in a <u>non-HD library</u>, this Select Destination screen displays:

```
Select Destination          Panel 0021

First Empty Storage Slot
By SCSI Element Address
By Location (F,C,R)
To Home Slot

Key: [F=Frame, C=Column, R=Row]

[BACK]          [DOWN]  [ENTER]
```

If the cartridge is already assigned to a logical library in an <u>HD library</u>, this Select Destination screen displays:

```
Select Destination          Panel 0021

Mount to Drive
Prestage to Cartridge Cache
Destage from Cartridge Cache
Remove to I/O

[BACK]  [UP]  [DOWN]  [ENTER]
```

- If the cartridge is not assigned to a logical library, the Select Logical Library screen displays. You must specify the number of the logical library into which you want to move the cartridge by pressing UP or DOWN to increment or decrement the value. When the desired number displays, press ENTER. The library displays the Select Destination screen.

```
Select Logical Library      Panel 0025

Select a logical library:

Logical Library 2

Media Type: LTO

[BACK]  [ UP ]  [DOWN]  [ENTER]
```

Important: The Select Destination options are different in non-HD and HD libraries. If you are moving a cartridge in a non-HD library, continue with Step 3. If you are moving a cartridge in an HD library, skip to Step 4.

3. In the Select Destination screen for non-HD libraries, you can specify that the library move the cartridge into the first empty storage slot, a slot with a specific SCSI element address, a slot with a specific frame, column, and row location, or to the home slot (a specific drive).

   - To move the cartridge to the first available empty slot, press UP or DOWN to highlight **First Empty Storage Slot** and press ENTER.

     Note: If the cartridge was previously loaded in a specific logical library, the move operation is restricted to that logical library.

   - To move the cartridge to a location with a specific SCSI element address, press UP or DOWN to highlight **By SCSI Element Address** and press ENTER. The Select Destination Element screen displays with one of the following:

– A list of the library's SCSI element addresses for drives, I/O station slots, and storage slots that have been configured and are empty. The SCSI element addresses display in both decimal and hexadecimal format. The screen also lists the physical locations of these SCSI element addresses.

– A range of the library's SCSI element addresses for drives, I/O station slots, and storage slots that have been configured and are empty. The SCSI element addresses display in decimal and hexadecimal format.

The physical locations are listed as **[Fxx,Cyy,Rzz]** or **[Fxx,Rzz]**, (where **F** equals frame and **xx** equals its number, **C** equals column and **yy** equals its number, and **R** equals row and **zz** equals its number).

The screen gives the generation of the drive as **Lx**, where **x** equals 1 (the LTO Ultrium 1 drive), 2 (the LTO Ultrium 2 drive), 3 (the LTO Ultrium 3 drive), 4 (the LTO Ultrium 4 drive, or 5 (the LTO Ultrium 5 drive).

Perform one of the following:

– Press UP or DOWN to select the SCSI element address of the destination that you want, then press ENTER.

– Press UP or DOWN to select the range of SCSI element addresses that contains the destination that you want, then press ENTER (if your library contains a large quantity of possible destinations, you may need to repeat this step until you locate the range that contains the destination that you want). Press UP or DOWN to select the SCSI element address of the destination that you want and press ENTER.

```
Select Destination Element      Panel 0026

Key: [F=Frame, C=Column, R=Row]
     L=LTO Ultrium

Media Type: LTO

257     101h    Drive
258     102h    Drive
769     301h    I/O
1028    404h    Slot
1029    405h    Slot
1030    406h    Slot
1031    407h    Slot
1032    408h    Slot
1033    409h    Slot
1034    40Ah    Slot

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

Note: If the cartridge was previously loaded in a specific logical library, the move operation is restricted to that logical library.

- To move the cartridge to a specific frame, column, or row location, press UP or DOWN to highlight **By Location (F,C,R)** and press ENTER. The Select Destination Location screen displays with one of the following:

– A list of the library's empty storage slots, I/O slots, or drives, identified by their physical frame, column, or row location.

– A range of the library's empty storage slots, I/O slots, or drives, identified by their physical frame, column, or row location.

The physical locations are listed as **[Fxx,Cyy,Rzz]** or **[Fxx,Rzz]**, (where **F** equals frame and **xx** equals its number, **C** equals column and **yy** equals its number, and **R** equals row and **zz** equals its number). Drives are further identified as **L1** (Ultrium 1), **L2** (Ultrium 2), **L3** (Ultrium 3), **L4** (Ultrium 4), or **L5** (Ultrium 5). Perform one of the following:

– Press UP or DOWN to select the frame, column, and row location of the destination that you want, then press ENTER.
– Press UP or DOWN to select the range of frame, column, and row locations that contains the destination that you want, then press ENTER (if your library contains a large quantity of possible destinations, you may need to repeat this step until you locate the range that contains the destination that you want). Press UP or DOWN to select the frame, column, and row location of the destination that you want and press ENTER.

```
Select Destination Location         Panel 0027

Key: F=Frame, C=Column, R=Row
     L=LTO Ultrium

Media Type: LTO

Drive    [F01,R01]   L1
Drive    [F01,R02]   L2
I/O      [F01,R03]
Slot     [F01,C01,R04]
Slot     [F01,C01,R05]
Slot     [F01,C01,R06]
Slot     [F01,C01,R07]
Slot     [F01,C01,R08]
Slot     [F01,C01,R09]
Slot     [F01,C01,R10]

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

Note: If the cartridge was previously loaded in a specific logical library, the move operation is restricted to that logical library.

• To move the cartridge to the source location that is stored in the element descriptor, press UP or DOWN to highlight **To Home Slot** and press ENTER.

After you press ENTER, the message **Move in Progress** displays and the cartridge accessor moves the cartridge to the home slot. When the move is finished, **Move Complete** displays.

Note: With ALMS enabled, if the cartridge is being moved between cartridge storage slots, it may not physically move. Instead, it may be assigned a new element address.

4. In the Select Destination screen for HD libraries, you can specify that the library move the cartridge by Mount to Drive, Prestage to Cartridge Cache, Destage from Cartridge Cache, or Remove to I/O.

• To mount the cartridge to a drive, press UP or DOWN to highlight **Mount to Drive** and press ENTER. The Select Destination Location screen displays a list of drive locations. Press UP or DOWN to highlight the desired drive and press ENTER.

• To prestage the cartridge to the cartridge cache, press UP or DOWN to highlight **Prestage to Cartridge Cache** and press ENTER. A screen with the message Move in Progress displays. When the prestage is complete, a screen with the message Move Complete displays.

• To destage the cartridge from the cartridge cache, press UP or DOWN to highlight **Destage from Cartridge Cache** and press ENTER. A screen with the message Move in Progress displays. When the destage is complete, a screen with the message Move Complete displays.

- To move the cartridge to an I/O slot, press UP or DOWN to highlight **Remove to I/O** and press ENTER. A screen with the message Move in Progress displays. When the move is complete, a screen with the message Move Complete displays.

5. Press ENTER to return to the Manual Operations menu.
6. Press BACK until you return to the Activity screen.

Managing storage slots

This section introduces two ways to set storage slots online or offline in the TS3500 tape library.

To set storage slots online or offline in the TS3500 tape library, use one of the following methods.

Using the Web to set storage slots online or offline
About this task

To use the Tape Library Specialist Web interface to set storage slots online or offline in the TS3500 tape library, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Service —> Manage Storage Slots**. The Manage Storage Slots screen displays.
2. Select a frame from the **Frame** dropdown menu. Then, select the desired slot from the table.
3. From the **Select Action** dropdown menu, select **Set online**, **Set offline**, or **Reset Statistics**. The Set Storage Slot Online, Set Storage Slot Offline, or Reset Statistics screen displays.
4. If **Set offline** was selected, the Set Storage Slot Offline screen prompts you to select a frame, column, and row from dropdown menus. Then press **OK**.

Using the operator panel to set storage slots online or offline
About this task

To use the operator panel on the TS3500 tape library to set storage slots online or offline, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Service —> Tests/Tools --> Tools --> Manage HD Storage Slot –> ENTER**.

   Note: Manage HD Storage Slot is only displayed in HD libraries.
   The Select Slots to Display screen displays.

   ```
   Select Slots to Display   Panel 0046

   All Storage Slots

   Offline Storage Slots

   [BACK][ UP ][DOWN][ENTER]
   ```

2. Press **UP** or **DOWN** to select All Storage Slots and press **ENTER**. The Storage Slot Status screen displays.

```
                         Panel 0045
Storage Slot Status

Location        Status    Puts
[F02,C01,R01,T01] Online    3460
[F02,C01,R02,T01] Online       0
[F02,C01,R03,T01] Online       0
[F02,C01,R04,T01] Online       0
[F02,C01,R05,T01] Offline 123456
[F02,C01,R06,T01] Online   74599
[F02,C01,R07,T01] Online       0
[F02,C01,R08,T01] Online       0
[F02,C01,R09,T01] Online       0
[F02,C01,R10,T01] Online       0
[F02,C01,R11,T01] Online       0
[F02,C01,R12,T01] Online       0
[F02,C01,R13,T01] Online       0
[F02,C01,R14,T01] Online       0
[F02,C01,R15,T01] Online       0
[F02,C01,R16,T01] Online       0
[F02,C01,R17,T01] Online       0
[F02,C01,R18,T01] Online       0

[BACK][ UP ][DOWN][ENTER]
```

Notes:
- The Tier location (Txx) only displays for HD frames.
- The Puts column only displays for HD slots.

3. Press **UP** or **DOWN** to select the slot you want to manage and press **ENTER.**
   The Select Storage Slot Action screen displays.

```
Select Storage Slot Action  Panel 0047

Set Storage Slot Offline

Set Storage Slot Online

Reset Storage Slot Counts

[BACK][ UP ][DOWN][ENTER]
```

4. Press **UP** or **DOWN** to select **Set Storage Slot Offline** or **Set Storage Slot Online** and press **ENTER**. The message Changing Storage Slot Status displays. After the library completes the change, the Storage Slot Status screen displays again showing the changed slot status.
5. Press **ENTER** to return to the Manual Operations menu.
6. Press **BACK** until you return to the Activity screen.

Displaying the existing library configuration

To display the current physical and logical configuration of the TS3500 tape library, use one of the following methods.

Using the Web to display the existing library configuration

Complete this task to use the Web to display the library configuration.

About this task

Perform the following steps to use the Tape Library Specialist Web interface to display the existing configuration of the TS3500 tape library:

Procedure

1. From the System Summary screen, select a specific frame from the Frames drop-down menu or click the picture of the specific frame. The System Summary screen redisplays with detailed information for the selected frame.

2. From the System Summary screen in a TS3500 tape library shuttle complex, you can also click the Shuttle View tab to view the shuttle complex configuration.

3. From the System Summary screen, you can also select **Library —> Logical Libraries** for a logical configuration of the library.

Using the operator panel to display the existing library configuration

Complete this task to use the operator panel to display the library configuration.

About this task

To use the operator panel to display the existing configuration of the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Configuration —> Display Configuration —> ENTER**. The Physical Configuration screen displays. The screen shows the total quantity of drives, storage slots, and I/O slots in the library's physical configuration. For libraries that use both LTO and 3592 media, the screen provides totals for each media type. The Mode field indicates the menu selection (Configure Library or Advanced Configure) that was used to create the current library configuration.

   Note: With the Advanced Library Management System (ALMS) is enabled, the Mode is **ALMS**.

```
Physical Configuration          Panel 0102

Total Frames:              4
     LTO:          1
     3592          1
     Service Bays: 2

Total Drives:              7
     LTO:          4
     3592:         3

Total Storage Slots:       280
     LTO:        180
     3592:       100

Total I/O Slots:           26
     LTO:         10
     3592:        16


Configuration Mode: Advanced

[BACK]              [DETAIL]   [ENTER]
```

You can view the physical configuration for each frame, or you can view the configuration for each logical library:

- To view the quantity of physical drives, storage slots, and I/O slots in each frame, press DETAIL. The Configuration Details screen displays. For libraries that use both LTO and 3592 media, the Media Type field indicates the type of media used in the frame.

```
Configuration Details      Panel 0104

Frame 1    Media Type: LTO

  Drives:          9
    Ultrium-1      3
    Ultrium-2      3
    Ultrium-3      1
    Ultrium-4      2
  Storage Slots:  280
  I/O Slots:       10

[BACK]    [ UP ]   [DOWN]
```

```
Configuration Details      Panel 0104

Frame 1    Media Type: 3592

  Drives:          3
    3592-J1A       1
    3592-E05       2
  Storage Slots:  272
  I/O Slots:       32


[BACK]    [ UP ]   [DOWN]
```

To view the details for additional frames, press UP. The Configuration Details screen displays for the next frame. To return to frames that you have viewed, press DOWN. To return to the Physical Configuration screen, press BACK.

*   To view the library's logical configuration, from the Physical Configuration screen press ENTER. The Configuration Summary screen displays. The screen shows the total quantity of storage slots and drives in the logical library configuration. It shows the element address range for the slots and drives. The screen indicates which drives are control paths. It also indicates the quantity of control paths.

    Note: With ALMS enabled, the key, the **Location Start** field, and the **Location End** field do not display.

```
Configuration Summary      Panel 0103

Key: LL=Logical Library, F=Frame,
     C=Column, R=Row


LL:  Logical Library 1
Media Type: LTO

Storage Slots:    1451
Elem Addr Range:  1025 - 2475
First Location:   [F01,C01,R02]
Last Location:    [F01,C08,R44]

Drives:           012
Elem Addr Range:  0257 - 0268
First Location:   [F01,R01]
Last Location:    [F01,R12]

Control paths:    001

[BACK]   [UP]
```

The Element Addr Range field is the range of SCSI element addresses defined for this logical library. To view the summaries for additional logical libraries, press UP. The Configuration Summary screen displays for the next logical library.

```
Configuration Summary      Panel 0103

Key: LL=Logical Library, F=Frame,
     C=Column, R=Row


LL:  Logical Library 2
Media Type: 3592

Storage Slots:    0359
Elem Addr Range:  1026 - 1384
First Location:   [F02,C01,R03]
Last Location:    [F02,C10,R36]

Drives:           012
Elem Addr Range:  0305 - 0316
First Location:   [F02,R01]
Last Location:    [F02,R02]

Control paths:    001

[BACK]   [DOWN]
```

To return to summaries that you have viewed, press DOWN.

2. Press BACK until you return to the Activity screen.

Managing shuttle stations

Complete these tasks to manage and monitor the shuttle stations in your TS3500 tape library shuttle complex from the Tape Library Specialist web interface.

About this task

The Shuttle Stations page of the Tape Library Specialist web interface displays a table with the following information for each shuttle station:

- Serial number
- Assigned logical library
- Attached frame
- Vital product data (VPD)
- Online or offline status
- Shuttle car status
- Shuttle station status
- Code version

To manage shuttle stations, complete the following steps:

Procedure

1. From the Work Items navigation pane, select **Library** > **Shuttle Stations**.
2. Select the check box next to the appropriate shuttle station and select one of the following actions from the Select Action menu:
   - Assign
   - Unassign

- Set Beacon LED Off
- Set Beacon LED On
- Set Beacon LED Blink
- Set Station Online
- Set Station Offline

3. Refer to the following tasks for detailed instructions for each action.

Assigning shuttle stations

Complete this task to assign shuttle stations in a TS3500 tape library shuttle complex to a logical library.

Procedure

1. From the Work Items navigation pane, select **Library** > **Shuttle Stations**. The Shuttle Stations page displays.
2. Select the shuttle station to be assigned.
3. Ensure that the selected shuttle station is offline. If not, set the station offline before continuing with the assignment.
4. Select **Assign** from the Select Action menu. The Select a Logical Library window displays.
5. Select the correct logical library from the Logical Library menu, or select **Unassigned**. Then click **Next** to proceed or **Cancel** to cancel the operation.

   Notes:
   - Logical libraries with shuttle stations assigned must use LTO Ultrium 4, 3592 E05, or later tape drives as control path drives. Ultrium 4 control path drives require a minimum code level of A480. Ultrium 5 control path drives require a minimum code level of B170.
   - In order to assign a shuttle station to a logical library of a different media type, virtual I/O (VIO) slots must be enabled.
6. Monitor the progress of the shuttle station assignment in the Operation in Progress window. A Success window confirms when the shuttle station assignment change is complete.

Related tasks:

"Setting shuttle stations online or offline" on page 156
Complete this task to set shuttle stations online or offline in a TS3500 tape library shuttle complex.

"Unassign shuttle stations"
Complete this task to unassign shuttle stations in a TS3500 tape library shuttle complex.

Unassign shuttle stations

Complete this task to unassign shuttle stations in a TS3500 tape library shuttle complex.

Procedure

1. From the Work Items navigation pane, select **Library** > **Shuttle Stations**. The Shuttle Stations page displays.
2. Select the check box for the shuttle station to be unassigned.
3. Ensure that the selected station is offline. If not, set the station offline before proceeding with the unassignment.

4. Select **Unassign** from the Select Action menu. A confirmation message displays.

5. Click **OK** to unassign the shuttle station.

6. Monitor the progress of the change in the Operation in Progress window. A Success window confirms when the shuttle station is unassigned.

Related tasks:

"Setting shuttle stations online or offline"
Complete this task to set shuttle stations online or offline in a TS3500 tape library shuttle complex.

"Assigning shuttle stations" on page 155
Complete this task to assign shuttle stations in a TS3500 tape library shuttle complex to a logical library.

Setting the beacon LED

Complete this task to set a shuttle station beacon light emitting diode (LED) to on, off, or blink in a TS3500 tape library shuttle complex.

About this task

The beacon LED is visible on the side panel of each shuttle station in TS3500 tape library shuttle complex. This LED can be used to indicate when a shuttle station is in service.

Complete the following steps to set the beacon LED to on, off, or blink:

Procedure

1. From the Work Items navigation pane, select **Library** > **Shuttle Stations**. The Shuttle Stations page displays.

2. Select the shuttle station for which you are setting the beacon LED.

3. Choose **Set Beacon LED On**, **Set Beacon LED Off**, or **Set Beacon LED Blink** from the Select Action menu and then click **Go**. A Success window displays indicating that the shuttle station beacon LED change is complete.

Setting shuttle stations online or offline

Complete this task to set shuttle stations online or offline in a TS3500 tape library shuttle complex.

Procedure

1. From the Work Items navigation pane, select **Library** > **Shuttle Stations**. The Shuttle Stations page displays.

2. Select one or more shuttle stations that are to be set online or offline.

3. Select **Set Station Online** or **Set Station Offline** from the Select Action menu and click **OK**.

4. Monitor the progress of the shuttle station status in the Operation in Progress window. A Success window indicates when the change is complete.

Managing licensed features

This section introduces two ways to view the licensed features of the TS3500 tape library and two ways to install or remove these features.

Some features available for the IBM TS3500 require a license key in order to enable their advanced function. The license keys required to activate the following features are purchased as feature codes:

- Advanced Library Management System (ALMS)
- Path Failover
- LTO Transparent Encryption
- Capacity Expansion
- Capacity on Demand (CoD)
- High Density Capacity on Demand (HD CoD)

It is possible to view the licensed features of a TS3500 tape library using the operator panel or the IBM Tape Library Specialist Web interface. It is also possible to install and remove these features using the license keys via the operator panel or the Web. The following procedures provide instructions for viewing, installing, or removing licensed features.

Using the Web to view licensed features

This section describes how to use the Web to view licensed features and their status for the frames of the TS3500 tape library.

About this task

To view licensed features, perform the following steps:

Procedure

From the Work Items navigation pane, select **Service —> Feature Licenses**. The Feature Licenses screen displays the available features and indicates whether they are `Installed` or `Not Installed`.

- Available features for Models L22, L23, L52, and L53 include ALMS, control path failover, LTO transparent encryption, intermediate capacity expansion, and full capacity expansion.
- Available features for Model L32 include ALMS, control path failover, and capacity expansion.
- Available features for Models S24 and S54 include ALMS and HD Capacity on Demand.

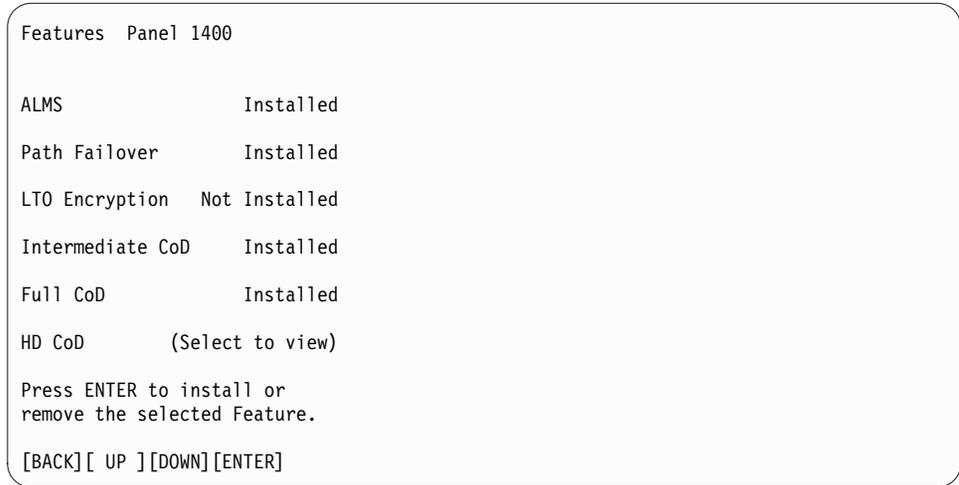# Using the operator panel to view licensed features

This section describes how to use the operator panel to view licensed features and their status for the frames of the TS3500 tape library.

About this task

To use the operator panel to view licensed features and their status, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Service —> Firmware update —> Features —> Enter**. The Features screen displays.

```
Features  Panel 1400


ALMS                Installed

Path Failover       Installed

LTO Encryption   Not Installed

Intermediate CoD    Installed

Full CoD            Installed

HD CoD       (Select to view)

Press ENTER to install or
remove the selected Feature.

[BACK][ UP ][DOWN][ENTER]
```

2. The Features screen displays the available features and indicates whether they are Installed or Not Installed.
   - Available features for Models L22, L23, L52, and L53 include ALMS, control path failover, LTO transparent encryption, intermediate capacity expansion, and full capacity expansion.
   - Available features for Model L32 include ALMS, control path failover, and capacity expansion.
   - Available features for Models S24 and S54 include ALMS and HD Capacity on Demand.

Using the Web to install or remove licensed features

This section describes how to use the Web to install or remove licensed features of the TS3500 tape library.

About this task

To install or remove licensed features, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Service —> Feature Licenses**. The Feature Licenses screen displays the available features and indicates whether they are Installed or Not Installed.
2. Select the feature you want to install by clicking the appropriate radio button. Then select Install or Remove from the Select Action dropdown menu.
3. If you select a feature to install, the Install Feature License window displays and you are prompted to enter the license key. If you select a feature to remove, the Remove Feature License window displays and you are prompted to enter the license key.
4. Enter the license key for the selected feature. Then, select **OK**.

Using the operator panel to install or remove licensed features

This section describes how to use the operator panel to install or remove of the TS3500 tape library.

About this task

To use the operator panel to install or remove licensed features, perform the
following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Service —>
   Firmware update —> Features —> Enter**. The Features screen displays.

```
Features   Panel 1400


ALMS                Installed

Path Failover       Installed

LTO Encryption   Not Installed

Intermediate CoD    Installed

Full CoD            Installed

HD CoD        (Select to view)

Press ENTER to install or
remove the selected Feature.

[BACK][ UP ][DOWN][ENTER]
```

2. The Features screen displays the available features and indicates whether they
   are `Installed` or `Not Installed`

3. Press UP or DOWN to highlight the feature to install or remove and press
   ENTER.
   - If a feature that is installed is selected, a warning screen displays with the
     message `This will remove the xxxxxxxx license. In order to re-install`
     `this feature later, you will need the license key.` To continue with
     removing the feature, press ENTER.
   - If a feature that is not installed is selected, the Product ID screen displays.
     Enter the license key and press ENTER.
   - If HD CoD is selected, the HD Capacity on Demand screen displays with a
     list of each HD frame in the library and whether the HD CoD feature is
     `Installed` or `Not Installed` on that frame. Press UP or DOWN to select the
     desired frame to install or remove HD CoD and press ENTER. If a frame
     with HD CoD not installed is selected, you are prompted to enter the license
     key.

Enabling the Advanced Library Management System

Complete this task to enable the Advanced Library Management System (ALMS)
in the TS3500 tape library.

About this task

Notes:
- You can enable ALMS in the TS3500 tape library by using the Tape Library
  Specialist Web interface, but not by using the operator panel.
- It is necessary to pause all applications before the enablement process.

To enable ALMS, perform the following steps:

Procedure

1. Enter the ALMS license key (to perform this procedure, see "Managing licensed features" on page 156).
2. From the Work Items navigation pane, select **Library —> ALMS**. The Advanced Library Management System Mode screen displays.
3. Follow the instructions on the screens to enable ALMS.

What to do next

ALMS enables the transition from static partitioning to dynamic partitioning in the TS3500 tape library. When ALMS is enabled for the first time in a library that is partitioned, the following events occur:

- The contents of each partition are automatically migrated to ALMS logical libraries. No action is required with any logical library labels that are present. These labels will be ignored after ALMS is enabled.
- Each logical library is given a default name that can then be changed as required.
- During the enablement process, the library is unavailable for about 5 minutes, in addition to the time it takes to re-inventory each frame. (Refer to the section about library performance in the *IBM TS3500 with ALMS Introduction and Planning Guide* for more information.)
- Virtual input/output (I/O) slots are enabled by default. To disable this feature, refer to "Enabling or disabling virtual I/O slots" on page 161.

Note: After ALMS is enabled, it is possible to increase the **Maximum cartridges** and **Maximum VIO cartridges** values for the logical library.

Virtual I/O slots

With the Advanced Library Management System (ALMS), virtual I/O slots enhance the import and export capabilities of the library.

When ALMS is enabled in a TS3500 tape library, virtual I/O slots are enabled by default so that the library automatically queues all cartridge moves between the I/O station and the storage slots. This capability makes the process of adding and removing cartridges easier and faster. To disable this feature, refer to "Enabling or disabling virtual I/O slots" on page 161. For information about the default setting for maximum available virtual I/O slots (Max VIO Slots) and how to change that setting, refer to "Import/export element addresses with virtual I/O slots enabled" on page 385.

The TS3500 tape library has I/O stations with I/O slots that allow you to import and export up to 224 cartridges at any time. The I/O slots are also known as import/export elements (IEEs). Virtual I/O slots increase the quantity of available I/O slots by allowing storage slots to appear to the host as I/O slots. These storage slots are also called virtual import/export elements (VIEEs). With virtual I/O slots, the library automatically moves cartridges from the I/O stations to the storage slots, enhancing import and export performance, while also decoupling physical cartridge movement from the application thus increasing operator efficiency.

The goal of virtual I/O slots is to reduce the dependencies between the system administrator and library operator so that each performs their import and export tasks without needing the other to perform any actions.

- In a typical import scenario without virtual I/O slots, a library operator is needed to stand at the physical library and fill the I/O station with cartridges; a system administrator is needed to cause the applications to send commands for moving cartridges out of the I/O station and into library storage slots. After operators fill the I/O station with cartridges, the they must wait for the I/O station to be cleared before they are able to insert more cartridges, which means they must wait on the system administrator to clear the I/O station of each set of inserted cartridges. If the library is enabled with virtual I/O slots, the operator can continuously insert cartridges into the I/O station and the administrator does not need to issue commands to move each new set of inserted cartridges. Instead, the library automatically moves the cartridges and places them into virtual I/O slots until they are ready to be processed later as one composite set of inserted cartridges.
- In a typical export scenario without virtual I/O slots, the system administrator might need to export many cartridges from the library. However, after the I/O station is filled, the administrator must wait for the operator to physically remove cartridges from the entire I/O station before the administrator can issue another export command. This operation can be inconvenient. If the library is enabled with virtual I/O slots, the administrator does not have to wait to issue all export commands (up to 255 export commands can be issued at the same time for each logical library) and the operator can remove cartridges from the I/O stations as soon as the accessor automatically moves them from the storage slots.

With virtual I/O slots enabled, the library has various mechanisms for selecting the best storage slot location for each inserted cartridge, as well as the best accessor and I/O station for each ejected cartridge. These mechanisms vary depending on the configuration of your library.

For ejects with virtual I/O slots enabled and I/O stations in both preferred zones of a dual accessor library, the library selects the accessor and I/O stations that are in the same preferred zone as the physical slot of the cartridge to be ejected, but maintains first in, first out (FIFO) order for each zone. For ejects with virtual I/O slots enabled and I/O stations in only one zone of a dual accessor library, the library selects the accessor in that preferred zone and maintains FIFO order.

For detailed information about import and export performance in libraries with virtual I/O slots enabled, go to the section about library performance in the *IBM TS3500 with ALMS Introduction and Planning Guide*.

Enabling or disabling virtual I/O slots

This topic describes how to enable or disable virtual I/O slots in the TS3500 tape library so that the host operates as if it has access to more I/O slots than are actually available. It also describes how to disable virtual I/O slots.

Before you begin

For information about the default setting for maximum available virtual I/O slots (Max VIO Slots) and how to change that setting, refer to "Import/export element addresses with virtual I/O slots enabled" on page 385.

About this task

Note: ALMS must be enabled and the I/O station must be empty before you can enable or disable virtual I/O slots. For information about entering the license key

and enabling ALMS, see "Managing licensed features" on page 156 and "Enabling the Advanced Library Management System" on page 159.

When the Advanced Library Management System (ALMS) is enabled in the TS3500 tape library, virtual I/O slots are enabled by default so that the library automatically queues all cartridge moves between the I/O station and the storage slots. This makes adding and removing cartridges easier and faster.

To enable or disable virtual I/O slots, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library—> Virtual IO**. The Virtual IO screen displays a message that indicates whether virtual I/O slots are enabled or disabled.
2. Select Enable Virtual IO or Disable Virtual IO. The screen automatically refreshes to show the changed setting.

Creating or removing a logical library

Complete this task to create or remove a logical library from a TS3500 tape library.

About this task

Note: You can create or remove a logical library from the TS3500 tape library by using the Tape Library Specialist Web interface, but not by using the operator panel. You can remove a logical library only if you reassign all associated cartridges and only if you remove all associated drives, move them to another logical library or change them to unassigned drives. For help in performing these procedures, see "Assigning cartridges to a logical library" on page 117 or "Using the drive assignment web page" on page 118.

To create or remove a logical library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library —> Logical Libraries**. The Manage Logical Libraries screen displays.
2. Perform one of the following tasks:
   - To add a logical library, follow the instructions on the screens to enter a logical library name of up to 15 characters (duplicate names are not allowed). Select the media type for the logical library.
   - To remove a logical library, select it. From the drop-down box select **Remove**, then select **Go**. The library displays the message **Are you sure you want to remove this logical library?**
3. Select **OK.** The Success screen displays.
4. Select **Close**. The Manage Library screen redisplays with the new data.

Changing the name of a logical library

Complete this task to change the name of a logical library in the TS3500 tape library.

About this task

Note: With the Advanced Library Management System (ALMS) is enabled, you can change the name of a logical library in the TS3500 tape library by using the Tape Library Specialist Web interface, but not by using the operator panel.

To change the name of a logical library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library —> Logical Libraries**. The Manage Logical Libraries screen displays.
2. Select the name of the logical library that you want to change. From the dropdown box select **Rename**, then select **Go.**
3. Enter the new name (up to 15 characters) and select **Apply**. The Success screen displays.

   Note: The media type cannot be changed.
4. Select **Close**. The Manage Library screen redisplays with the new name.

Changing the maximum allowable quantity of cartridges in a logical library

Complete this task to change the maximum number of cartridges that are allowed in a logical library of the TS3500 tape library.

About this task

Notes:
- You can change the quantity of cartridges in a logical library by using the Tape Library Specialist web interface, but not by using the operator panel.
- In order to increase the maximum number of cartridges to more than 6 887, logical libraries must use Ultrium 4, 3592 E05, or later tape drives as control path drives. Ultrium 4 control path drives require a minimum code level of 97F0.

To change the maximum allowable quantity of cartridges in a logical library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library** > **Logical Libraries**. The Manage Logical Libraries screen displays.
2. Select a logical library.
3. From the Action dropdown list, select **Maximum Cartridges**. The library displays a warning about changing the quantity of cartridges.
4. Click **Continue**. The Change Maximum Number of Cartridges screen displays.
5. Enter the maximum allowable quantity of cartridges that you want and click **Apply**. The Success screen displays.
6. Click **Close**. The Manage Library screen displays with the new quantity.

Changing the quantity of virtual I/O slots in a logical library

Complete this task to increase or decrease the quantity of virtual I/O slots in a logical library.

About this task

Note: This function is only valid and available if virtual I/O slots are enabled. In the TS3500 tape library, you can change the quantity of virtual I/O slots in a logical library by using the Tape Library Specialist Web interface, but not by using the operator panel.

To change the quantity of virtual I/O slots in a logical library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library —> Logical Libraries**. The Manage Logical Libraries screen displays.
2. Select a logical library, then from the Select Action drop down list, select **Maximum VIO cartridges**. The library displays a warning that changing maximum settings for a logical library may require reconfiguration of the host applications for selected logical libraries.
3. Select **Continue**. The Change Number of VIO Slots screen displays.
4. Enter the quantity of virtual I/O slots that you want and select **Apply**. The Success screen displays.
5. Select **Close**. The Manage Library screen redisplays with the new quantity.

Hiding a host application's view of cartridges that have been queued for export

Complete this task to hide a host application's view of a cartridge in the TS3500 tape library that you have queued for export.

About this task

Note: This function is only valid and available if virtual I/O slots are enabled. In the TS3500 tape library, you can hide an application's view of cartridges that you have queued for export by using the Tape Library Specialist Web interface, but not by using the operator panel.

To hide the view, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library —> Logical Libraries**. The Manage Logical Libraries screen displays.
2. Select the check box next to a logical library, then from the Select Action drop-down list, select **Hide/Show Queued Exports** and select **Go**. A pop-up window displays the message Do you want to change the Hide Queued Export flag for this logical library?
3. Select **OK** to toggle between the Hide or Show setting. The Manage Logical Libraries screen redisplays with the new Hide or Show setting.

Discovering new hardware in the TS3500 tape library

About this task

Note: In the TS3500 tape library, you can identify new hardware (such as frames, cartridges, and changes to the amount of storage for existing frames) by using the operator panel, but not by using the Tape Library Specialist Web interface.

To determine changes, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Configuration —> Configure Library —> Discover New Hardware —> ENTER**. The library displays the message **If you open the door the library will go Not Ready and any remaining jobs in the work queue may fail.** The library detects any hardware changes.
2. To view the hardware in the library (including hardware changes), from the operator panel press **MENU —> Settings —> Configuration —> Display Configuration —> ENTER**.
3. Press **BACK** until you return to the Activity screen.

Setting or changing the preferred zone of an accessor

This section introduces two ways to set or change the preferred zone of a cartridge accessor in a TS3500 tape library with dual accessors.

In a TS3500 tape library with dual accessors, accessor A provides access to the frames in the left half of the library and accessor B provides access to the right. The location of the drive that you specify for a mount or demount dictates which accessor performs the operation. For example, if the drive to be mounted is in frame 1 and a move command is issued for a cartridge in frame 16, the accessor for frame 1 (accessor A) performs the mount, rather than the accessor for frame 16 (accessor B). This is the default preferred accessor zone setting.

However, in order to optimize mount performance for one or more logical libraries, the TS3500 tape library offers two other options for setting the preferred accessor zone: frame location and service bay A. These options enable you to select an accessor zone that can reduce the distance the accessor must travel or the quantity of commands that are issued to an accessor.

The frame location option enables you to specify any frame in the library string as the zone boundary. For example, if frames 1 through 4 contain 3592 tape drives and cartridges and frames 5 through 16 contain Ultrium tape drives and cartridges, you can use the web to specify frame 4 as the preferred zone for accessor A. Accessor A would then perform operations for the 3592 tape drives while accessor B would perform operations for the Ultrium tape drives.

The service bay A option allows you to designate service bay A as the preferred zone for accessor A. This selection gives accessor A access to service bay A, while accessor B performs operations for the rest of the library string.

Note that the TS3500 tape library ordinarily uses the accessor of a preferred zone. However, in the event that one accessor has a problem, the other accessor that is functioning properly is used in that zone.

To set or change the preferred zone of an accessor, use one of the following methods.

Using the Web to set or change the preferred zone of an accessor

About this task

Note: This procedure is applicable only to libraries with dual accessors.

Perform the following steps to use the Tape Library Specialist Web interface to set or change the preferred zone of an accessor:

Procedure

1. From the Work Items navigation pane, select **Library —> Library Preferences**. The Library Preferences screen displays and shows the current frame zone designation.
2. Select the frame that you want to be the boundary for Accessor A from the **Zone Designator** menu.

   Note: The frame boundary is for Accessor A; Accessor B is then the preferred accessor for the remaining active frames. Setting the frame boundary to service bay A sets the zone preference for Accessor B to all active frames; setting the frame boundary to the last active frame in the library sets the zone preference for Accessor A to all active frames. Automatic (center) is the manufacturing default.
3. Ensure that the other settings on the Library preferences screen are correct and select **Submit changes**.
4. The Library Preferences screen re-displays and the Preferred Accessor Zones shows the change frame zone designation.

Using the operator panel to view or change the preferred zone of an accessor

About this task

Note: This procedure is applicable only to libraries with dual accessors.

To use the operator panel to set or change an accessor's preferred zone, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Advanced Settings —> Change Accessor Zones —> ENTER**. The Set Preferred Zone screen displays. Each pound sign (#) represents a frame in the library.

```
Set Preferred Zone           Panel 1139


A#########B
         ^
         |
         |
         |
        05

Press Up or Down to select
the preferred zone boundary.
The arrow indicates the last
frame preferred by accessor
A. Press back to return to
the previous screen.


[BACK]   [ UP ]   [DOWN]   [ENTER]
```
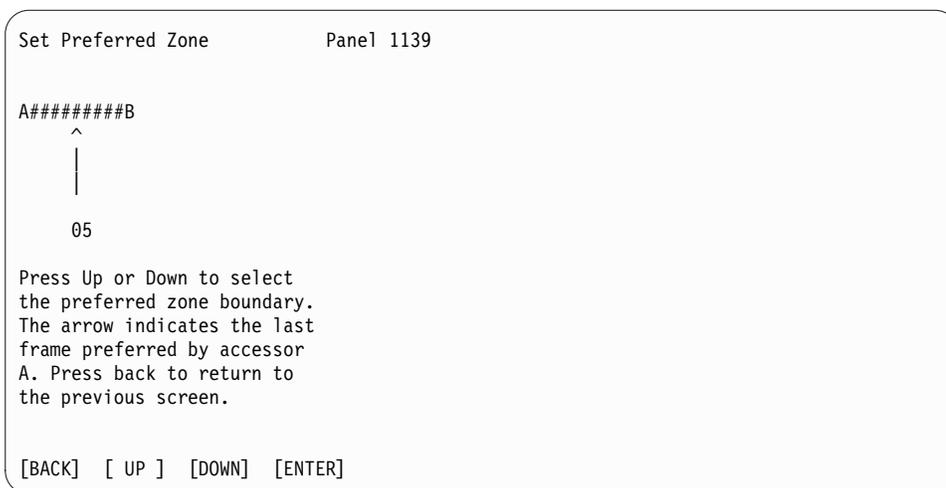
2. Decide the frames in which Accessor A and Accessor B will operate.
3. Press UP or DOWN to move the arrow and set the boundary for Accessor A. The remaining frames will belong to Accessor B. UP moves the arrow right; DOWN moves the arrow left.
4. Press Enter. The library displays the message **Accessor Zone Change Complete press [ENTER] to return to the previous screen.**
5. Press Enter.
6. Press BACK until you return to the Activity screen.

Displaying the SCSI ID or Loop ID of a Drive

This section introduces two ways to view the SCSI ID or Loop ID of a tape drive in the TS3500 tape library.

You can display the IDs of drives in the TS3500 tape library. For Ultrium 1 or Ultrium 2 tape drives, you can display the SCSI IDs of low voltage differential (LVD) or high voltage differential (HVD) interfaces, or the Fibre Channel Loop IDs. For 3592 tape drives and Ultrium 3 and newer Ultrium tape drives, you can display the Fibre Channel Loop IDs. To display this information, use one of the following methods.

Using the Web to display the SCSI ID or Loop ID of a drive
About this task

To use the Tape Library Specialist Web interface to display the SCSI ID or Loop ID of a drive in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Drives —> Drive Summary**. The Drives screen displays. For Ultrium 1 and Ultrium 2 tape drives, the screen shows the SCSI IDs of low voltage differential (LVD) or high voltage differential (HVD) interfaces, or the Fibre Channel Loop IDs. For 3592 tape drives and Ultrium 3 and newer Ultrium drives, the screen shows the Fibre Channel Loop IDs.

Using the operator panel to display the SCSI ID or Loop ID of a drive

About this task

To use the operator panel to display the SCSI ID or Loop ID of a drive in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> SCSI/Loop IDs —> Display SCSI/Loop IDs —> ENTER**. The Display SCSI/Loop IDs screen displays a list of the tape drives, with their physical locations and SCSI IDs.

```
Display SCSI/Loop IDs        Panel 0121

Key: F=Frame, R=Row

Drive [F01,R01]     SCSI ID   01
Drive [F01,R02]     SCSI ID   02
Drive [F01,R03]     SCSI ID   03
Drive [F01,R04]     SCSI ID   04
Drive [F01,R05]     SCSI ID   05
Drive [F01,R06]     SCSI ID   06
Drive [F02,R01,P0]  Loop ID 26
Drive [F02,R01,P1]  Loop ID 27

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

2. The locations of the Ultrium tape drives are listed as **[Fxx,Rzz]** (where **F** equals frame and **xx** equals its number, and **R** equals row and **zz** equals its number). The locations of the 3592 tape drives are listed as **[Fxx,Rzz,Py]** (where the same values apply, but **P** equals port and **y** equals its number). To display more drives, highlight the bottom item and press DOWN. To return to the previous list of drives, highlight the top item and press UP.
3. Press BACK until you return to the Activity screen.

Changing the SCSI ID or Loop ID of a drive

This section introduces two ways to change the SCSI ID or Loop ID of a drive in the TS3500 tape library.

The TS3500 tape library assigns a default SCSI ID to each Ultrium tape drive that uses a low voltage differential (LVD) or high voltage differential (HVD) interface, and a Loop ID to each Ultrium tape drive or 3592 tape drive that uses a Fibre Channel interface. To change a SCSI ID or Loop ID, use one of the following methods.

Using the Web to change the SCSI ID or loop ID of a drive

About this task

To use the Tape Library Specialist Web interface to change the SCSI ID or Loop ID of a drive in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives —> Drive Summary**. The Drives screen displays the SCSI IDs or Loop IDs of the Ultrium tape drives or it displays the Loop IDs of the 3592 tape drives.

2. Select the drive that has the ID that you want to change. From the Action Menu select Change ID, then select GO. A window lists the SCSI drives and the selected IDs. Next to each ID, a drop-down box displays the available IDs.

3. Select the new ID, then select Change.

Using the operator panel to change the SCSI ID or loop ID of a drive

About this task

To use the operator panel to change the SCSI ID or Loop ID of a drive in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> SCSI/Loop IDs —> Change SCSI/Loop IDs —> ENTER**. The Change SCSI/Loop IDs screen displays a list of the tape drives, with their physical locations and SCSI IDs.

```
Display SCSI/Loop IDs        Panel 0121

Key: F=Frame, R=Row

Drive [F01,R01]     SCSI ID   01
Drive [F01,R02]     SCSI ID   02
Drive [F01,R03]     SCSI ID   03
Drive [F01,R04]     SCSI ID   04
Drive [F01,R05]     SCSI ID   05
Drive [F01,R06]     SCSI ID   06
Drive [F02,R01,P0]  Loop ID 26
Drive [F02,R01,P1]  Loop ID 27


[BACK]   [ UP ]   [DOWN]   [ENTER]
```

The locations of the Ultrium tape drives are listed as **[Fxx,Rzz]** (where **F** equals frame and **xx** equals its number, and **R** equals row and **zz** equals its number). The locations of the 3592 tape drives are listed as **[Fxx,Rzz,Py]** (where the same values apply, but **P** equals port and **y** equals its number). To display more drives, highlight the bottom item and press DOWN. To return to the previous list of drives, highlight the top item and press UP.

2. Press UP or DOWN to highlight the drive that you want to change and press ENTER. The library displays the message **Changing SCSI(Loop) IDs will interrupt library and drive activities, and may require reconfiguration of host computers. Press ENTER to continue.**

3. Press ENTER. The Change SCSI/Loop ID screen displays with one of two types of content:

   • If you selected an LTO Ultrium tape drive with a Fibre Channel interface, the screen gives the physical location of the selected drive and its current Loop ID.

```
Change SCSI/Loop ID      Panel 0122

Key: [F=Frame, R=Row]

Drive [F01,R02]  Loop ID [22]
                 AL_PA C6h

Press UP or DOWN to select a new
Loop ID, then press ENTER
to activate the change.

[CANCEL]  [ UP ]  [DOWN]   [ENTER]
```

- If you selected a SCSI drive, the screen gives the physical location of the selected drive and its current SCSI ID.

```
Change SCSI/Loop ID      Panel 0122

Key: F=Frame, R=Row

Drive [F01,R02]  SCSI ID [02]

Press UP or DOWN to select a new
SCSI ID, then press ENTER
to activate the change.

[CANCEL]  [ UP ]  [DOWN]   [ENTER]
```

4. Specify the number of the ID that you want to change by pressing UP or DOWN to increment or decrement the value. When the wanted ID number is displayed, press ENTER. The message **Fibre Loop ID Change Complete** or **SCSI ID Change Complete** displays.

   Note: If you press CANCEL, no change will occur.

5. Press ENTER to return to the Display SCSI/Loop IDs screen.
6. Press BACK until you return to the Activity screen.

Viewing a World Wide Port Name

This section introduces two ways to view a World Wide Port Name (WWPN) for each drive slot in the TS3500 tape library.

The TS3500 tape library assigns a WWPN to each drive slot in the library. The WWPN does not change whenever a drive is swapped, replaced, or rebooted. Thus, if a drive needs service or replacement, host parameters do not need to be changed or reconfigured. In addition, the library's configuration can easily survive a reboot. To determine the WWPN for a drive, use one of the following methods.

Using the Web to view a World Wide Port Name
About this task

To use the Tape Library Specialist Web interface to view a World Wide Port Name in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Drives —> World Wide Names**. The World Wide Names screen displays with the port name of each drive that uses a Fibre Channel interface.

Using the Operator Panel to View a World Wide Port Name
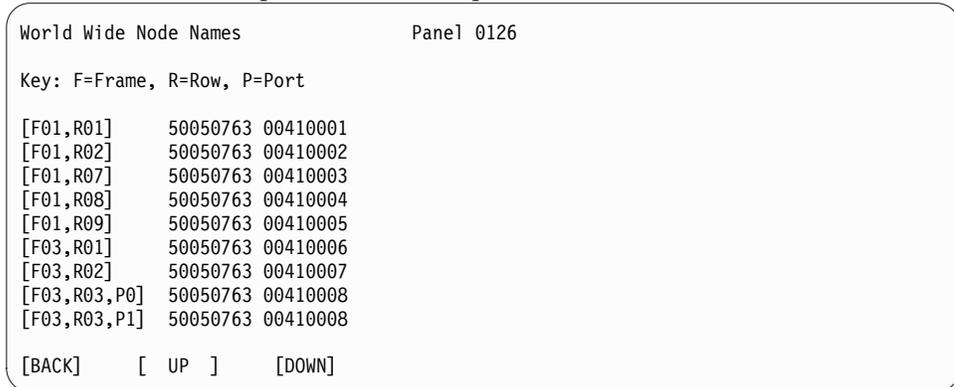
Complete this task to use the operator panel to view a World Wide Port Name.

About this task

To use the operator panel to view a world wide port name in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Fibre Ports —> View World Wide Port Names —> ENTER**. The World Wide Port Names screen displays. For each configured Fibre Channel drive in Frame 1, the screen lists its physical location and World Wide Port Name. To display additional drives in Frame 1 or to display the drives in other frames, press DOWN. To return to previous screens, press UP.

```
World Wide Port Names                    Panel 0125

Key: F=Frame, R=Row, P=Port

[F01,R01]     50050763 00410001
[F01,R02]     50050763 00410002
[F01,R07]     50050763 00410003
[F01,R08]     50050763 00410004
[F01,R09]     50050763 00410005
[F03,R01]     50050763 00410006
[F03,R02,P0] 50050763 00410007
[F03,R03,P1] 50050763 00410008

[BACK]     [  UP  ]     [DOWN]
```

2. Press BACK until you return to the Activity screen.

Viewing a World Wide Node Name

This section introduces two ways to view a World Wide Node Name (WWNN) for each drive slot in the TS3500 tape library.

Like the World Wide Port Name, the WWNN is used as an identifier by the TS3500 tape library for each Fibre Channel tape drive. To determine the World Wide Node Name for a drive, use one of the following methods.

Using the Web to view a World Wide Node Name

Complete this task to view a World Wide Node Name using the Web.

About this task

To use the Tape Library Specialist Web interface to view a World Wide Node Name in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Drives —> World Wide Names**. The World Wide Names screen displays
2. View the node name of each drive that uses a Fibre Channel interface.

Using the operator panel to view a World Wide Node Name
About this task

To use the operator panel to view a World Wide Node Name in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Fibre Ports —>View World Wide Node Names —> ENTER**. The World Wide Node Names screen displays. For each configured Fibre Channel drive in Frame 1, the screen lists its physical location and World Wide Node Name. To display additional drives in Frame 1 or to display the drives in other frames, press DOWN. To return to previous screens, press UP.

```
World Wide Node Names                 Panel 0126

Key: F=Frame, R=Row, P=Port

[F01,R01]      50050763 00410001
[F01,R02]      50050763 00410002
[F01,R07]      50050763 00410003
[F01,R08]      50050763 00410004
[F01,R09]      50050763 00410005
[F03,R01]      50050763 00410006
[F03,R02]      50050763 00410007
[F03,R03,P0]   50050763 00410008
[F03,R03,P1]   50050763 00410008

[BACK]    [ UP ]      [DOWN]
```

2. Press BACK until you return to the Activity screen.

Viewing or changing Fibre Channel port speeds and topologies

Complete this task to view or change the speeds and topologies for the Fibre Channel ports that are located in the tape drives of the TS3500 tape library.

Using the Web to view or change Fibre Channel port speeds and topologies
About this task

To use the Tape Library Specialist Web interface to view or change the speeds and topologies for the Fibre Channel ports of drives in the TS3500 tape library, perform the following steps:

Note: You must have the role of superuser or administrator to perform this procedure.

Procedure

1. From the Work Items navigation pane, select **Ports—> Fibre Channel Summary**. The Fibre Channel Summary screen displays speed and topology information about each drive port in the TS3500 tape library.
2. Select one or more drive(s) and port(s) that you want to change.
3. From the Select Action drop-down list, select Set Link Speed/Topology, then select Go. A window displays in which you change the link speed and the topology.

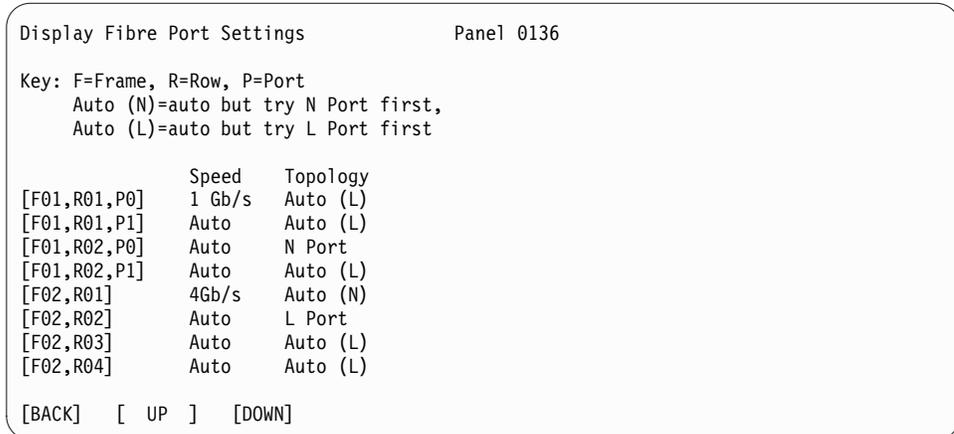4. Select the link speed and topology that you want and select Change. A confirmation screen displays.
5. Select Close. The Fibre Channel Summary screen redisplays with the change.

Using the operator panel to set or change Fibre Channel port speeds and topologies

About this task

To use the operator panel to set or change the speeds and topologies for the Fibre Channel ports of drives in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Fibre Ports —> Set Fibre Port Speed/Topology —> ENTER**. The Fibre Speed/Topology screen displays.

```
Fibre Speed/Topology              Panel 0035

Set by Drive
Set by Logical Library
Set All Fibre Drives

[BACK]                [DOWN]   [ENTER]
```

2. To set a drive's speed or topology, press UP or DOWN to select Set by Drive and press ENTER. The library displays the warning **Changing the drive(s) fibre speed and topology will interrupt library and drive activities. Press ENTER to continue.**

3. Press ENTER. The Select Drive screen displays.

```
Select Drive          Panel 0210

Key: F=Frame, R=Row L=LTO Ultrium,
     J = Enterprise Tape

Drive [F01,R01]    L1
Drive [F01,R02]    L1
Drive [F01,R03]    L2
Drive [F01,R04]    L3
Drive [F01,R05]    L4
Drive [F01,R06]    L1
Drive [F01,R07]    L1
Drive [F01,R08]    L2
Drive [F02,R01]    J2
Drive [F02,R02]    J1

[BACK]   [ UP ]   [DOWN]    [ENTER]
```

4. Press UP or DOWN to select the drive that you want, then press ENTER. The Fibre Port Speed/Topology screen displays.

```
Fibre Port Speed/Topology            Panel 0138

Key: F=Frame, R=Row
     Auto (N)=auto but try N Port first,
     Auto (L)=auto but try L Port first
By Drive: [F01,R01]

Port 0 Speed:     [Auto]
Port 1 Speed:     [4Gb/s]
Port 0 Topology:  [Auto]
Port 1 Topology:  [Auto (N)]
Commit Changes

[BACK]   [ UP ]   [DOWN]  [ENTER]
```

- If you press UP or DOWN and ENTER for a speed, the Select Speed screen displays.

```
Select Speed            Panel 2131

Setting Port 1: No Change

Press Up or Down to select the
Fibre speed behavior.  Press
back to return to the
previous screen

[BACK]   [ UP ]   [DOWN]
```

Valid choices are:

No change
>   Do not change the current setting

Auto   Auto-negotiated by drive and fiber switch. Auto is the default.

1 Gb/s Operate at 1 Gigabit per second

2 Gb/s Operate at 2 Gigabits per second

4 Gb/s Operate at 4 Gigabits per second (if your drive supports this speed)

8 Gb/s Operate at 8 Gigabits per second (if your drive supports this speed)

- If you press UP or DOWN and ENTER for a topology, the Select Topology screen displays.

```
Select Topology            Panel 2131

Key: Auto (N)=auto but try N Port first,
     Auto (L)=auto but try L Port first

Setting Port 0: Auto

Press Up or Down to select the
Fibre topology behavior.  Press
back to return to the
previous screen

[BACK]   [ UP ]   [DOWN]
```

Valid choices are:

No change
>   Do not change the current setting

Auto (N)

Auto-negotiated; try N-Port first

Auto (L)

Auto-negotiated; try L-Port first. Auto (L) is the default.

All settings are not available on some drives.

5. Press UP or DOWN to indicate the speed or topology that you want, then press ENTER.

6. Press BACK to return to the Fibre Port Speed/Topology screen. Press DOWN to highlight Commit Changes, then press ENTER. The library displays the message **The configuration process is complete.** Press ENTER.

7. Press BACK until you return to the Activity screen.

Viewing or changing Fibre Channel port settings

The following topics explain how to display the settings of the Fibre Channel ports that are located in the tape drives of the TS3500 tape library.

Using the Web to view or change Fibre Channel port settings

About this task

To use the Tape Library Specialist Web interface to view or change the settings of the Fibre Channel ports of drives that are located in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Ports—> Fibre Channel Summary**. The Fibre Channel Summary screen displays information about each drive port in the TS3500 tape library.

2. You can change only the configured link speed and topology for each drive. To change these settings, select a drive, then from the Select Action drop-down list, select Set Link Speed/Topology, and select Go. A window displays in which you change the link speed and the topology.

3. Select the link speed and topology that you want and select Change.

Using the operator panel to view or change Fibre Channel port settings

About this task

To use the operator panel to view or change the Fibre Channel port settings of drives in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Fibre Ports —> Display Fibre Port Settings —> ENTER**. The Display Fibre Port Settings screen displays with the locations of the drives in the library, their speeds and their topologies.

```
Display Fibre Port Settings              Panel 0136

Key: F=Frame, R=Row, P=Port
     Auto (N)=auto but try N Port first,
     Auto (L)=auto but try L Port first


                  Speed      Topology
[F01,R01,P0]     1 Gb/s    Auto (L)
[F01,R01,P1]     Auto      Auto (L)
[F01,R02,P0]     Auto      N Port
[F01,R02,P1]     Auto      Auto (L)
[F02,R01]        4Gb/s     Auto (N)
[F02,R02]        Auto      L Port
[F02,R03]        Auto      Auto (L)
[F02,R04]        Auto      Auto (L)

[BACK]    [  UP  ]    [DOWN]
```

2. Press UP or DOWN to view more drives.
3. Press BACK until you return to the Activity screen.

Displaying Fibre Channel port status

To display the status of the Fibre Channel ports that are located in the tape drives of the TS3500 tape library, use one of the following methods.

Using the Web to display Fibre Channel port status
About this task

To use the Tape Library Specialist Web interface to display the status of the Fibre Channel ports in drives that are located in the TS3500 tape library, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Ports—> Fibre Channel Summary**. The Fibre Channel Summary screen displays a list of Fibre Channel tape drives.
2. You can change only the configured link speed and topology for each drive. To change these settings, select a drive, then from the Select Action box, select Set Link Speed/Topology, and select Go. A window displays in which you change the link speed and the topology.
3. Select the link speed and topology that you want and select Change.

Using the operator panel to display Fibre Channel port status
About this task

To view the status of Fibre Channel ports that are located in the LTO Ultrium and 3592 tape drives in the TS3500 tape library, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Settings —> Fibre Ports —> Display Fibre Port Status —> ENTER**. The Display Fibre Port Status screen displays with the locations of the drives in the library and their status.

```
Display Fibre Port Status            Panel 0137

Key: F=Frame, R=Row, P=Port

[F01,R01]      No Light Detected
[F01,R02]      Negotiating Link
[F01,R07]      1Gb/s L Port
[F01,R08]      Not Supported
[F01,R09]      1Gb/s N Port
[F03,R01,P0]   Unavailable
[F03,R02,P1]   Unavailable
[F03,R03,P0]   1Gb/s L Port
[F03,R03,P1]   2Gb/s N Port


[BACK]   [  UP  ]   [DOWN]
```

The screen includes the following settings.

No Light Detected
No light is detected by the drive on this port.

Negotiating Link
A link has been established with the fabric or loop, but has not yet completed.

1Gb/s L Port
An L Port connection has been established at the rate of 1 gigabit per second.

1Gb/s N Port
An N Port connection has been established at the rate of 1 gigabit per second.

2Gb/s L Port
An L Port connection has been established at the rate of 2 gigabits per second.

2Gb/s N Port
An N Port connection has been established at the rate of 2 gigabits per second.

4Gb/s L Port
An L Port connection has been established at the rate of 4 gigabits per second.

4Gb/s N Port
An N Port connection has been established at the rate of 4 gigabits per second.

8Gb/s L Port
An L Port connection has been established at the rate of 8 Gigabits per second.

8Gb/s N Port
An N Port connection has been established at the rate of 8 Gigabits per second.

Unavailable
The library is unable to communicate with a drive. Check the RS-422 connection between the drive and the library.

Not Supported
The level of the drive's firmware does not support the reporting of its current fibre port status over the library's drive interface.

2. Press UP or DOWN to view more drives.
3. Press BACK until you return to the Activity screen.

Displaying control paths

This section introduces two ways to view the control paths of the TS3500 tape library.

The TS3500 tape library has no direct SCSI connection to a server. Thus, when a server communicates with the library, it must send the communication through an Ultrium tape drive or 3592 tape drive that is designated as a control path. A control path is a logical path into the library through which a server sends standard SCSI Medium Changer commands to control a specific logical library. When you add multiple control paths to the TS3500 tape library, any single, configured logical library can be accessed by multiple servers. Additional control paths also reduce the possibility that failure in one control path will cause a loss in host communication for the entire library.

Notes:
- Microsoft Windows 2000 Removable Storage Manager (RSM) does not support multiple control paths within a logical library.
- Logical libraries with a maximum number of cartridges greater than 6 887, or with shuttle stations assigned, must use LTO Ultrium 4, 3592 E05, or later tape drives as control path drives. To support more than 6 877 cartridges, Ultrium 4 control path drives require a minimum code level of 97F0. To support shuttle stations, Ultrium 4 control path drives require a minimum code level of A480 and Ultrium 5 control path drives require a minimum code level of B170.

To display control paths, use one of the following methods.

Using the web to display control paths

Complete this task to display control paths using the Tape Library Specialist Web interface.

Procedure

From the Work Items navigation pane, select **Drives —> Control Paths**. The Control Paths screen shows where the control path (drive) for each logical library is located (which frame and row), and whether the control path is required, enabled, or disabled.

Using the operator panel to display control paths
About this task

To use the operator panel to display the control paths of the TS3500 tape library, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Settings —> Control Paths —> Display Control Paths —> ENTER**. The Control Paths screen displays a list of logical libraries, the drives in the logical libraries (and their physical locations), and whether the control paths for the drives are required, enabled, or disabled. For the first drive in the logical library the setting is always Required. The names of the logical libraries are listed in the first

column (in the following example, **Name 1**, **Name 2**, **LogLib**, and so forth). The locations of the drives are listed as **[Fxx,Rzz]**, (where **F** equals frame and **xx** equals its number, and **R** equals row and **zz** equals its number). To display more drives, highlight the bottom item and press DOWN. To return to the previous list of drives, highlight the top item and press UP.

```
Control Paths              Panel 0131

Key: LL=Logical Library, F=Frame, R=Row

LL:   Name 1    [F01,R01]    Required
LL:   Name 2    [F01,R02]    Disabled
LL:   LogLib    [F01,R03]    Required
LL:   Admin     [F01,R04]    Disabled
LL:   Engine    [F01,R05]    Required
LL:   Engine    [F01,R06]    Disabled
LL:   Admin     [F01,R07]    Required
LL:   Admin     [F01,R08]    Disabled
LL:   LogLib    [F01,R09]    Enabled
LL:   LogLib    [F01,R10]    Disabled

[BACK]   [ UP ]   [DOWN]   [ENTER]
```

2. Press BACK until you return to the Activity screen.

Managing the Simple Network Management Protocol (SNMP)

The topics in this section introduce ways to manage SNMP for the TS3500 tape library.

Note: You can manage the SNMP using the Tape Library Specialist Web interface of the TS3500 tape library, but not by using the operator panel.

Enabling or disabling Simple Network Management Protocol (SNMP) traps
About this task

This topic explains hot to enable or disable informational messages (traps) that are gathered from and transmitted by the TS3500 tape library through the use of the Simple Network Management Protocol (SNMP)

SNMP is a networking protocol that, when enabled, allows the TS3500 tape library to automatically gather and transmit information about alerts and status to other entities in the network (such as an SNMP monitoring server). The information is called an SNMP trap.

After you enable SNMP traps, you can set the version that is supported by the SNMP monitoring server, set the destination IP address of the trap, then send the test trap). While setting the parameters for the trap, you can optionally set the remote port and community name.

For help in understanding SNMP traps, see "Interpreting SNMP traps" on page 319.

To enable or disable SNMP traps for the TS3500 tape library, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Access —> SNMP Settings**.

2. In the SNMP Setting field, view the current setting. Then, select or deselect **Enable SNMP Trap** to enable or disable SNMP traps.
3. Then select **Apply**.

Setting the version of SNMP traps

This topic explains how to set the version level of Simple Network Management Protocol (SNMP) traps.

About this task

Some SNMP monitoring server's applications only support Version 1 SNMP traps, while others only support Version 2 traps (your SNMP operations staff will know the supported version). The TS3500 tape library supports both Version 1 and Version 2c.

To set the version of Simple Network Management Protocol (SNMP) traps for the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> SNMP Settings**.
2. View the current setting. Then, select the correct version number from the drop-down menu.
3. Confirm other settings are correct and select **Apply**.

Enabling or disabling SNMP authentication trap settings

This topic defines an authentication trap and describes how to enable or disable its settings.

About this task

An authentication trap is a Simple Network Management Protocol (SNMP) trap that the library sends to a monitoring station when it detects that a device is trying to read the library's SNMP data by using the wrong community name.

To enable or disable authentication trap settings, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Settings —> SNMP Settings**.
2. Select or deselect **Enable Authentication Trap** to enable or disable this setting.
3. Confirm that other settings are correct and select **Apply**.

Enabling or disabling SNMP audit logging

This topic describes how to enable or disable SNMP audit logging in the TS3500 tape library.

About this task

Notes:
- SNMP traps must be enabled in order to enable SNMP audit logging.
- An up-to-date Management Information Base (MIB) is required. Refer to "Obtaining a Management Information Base" on page 181.

When Simple Network Management Protocol (SNMP) audit logging is enabled, the TS3500 tape library provides notification, in the form of SNMP traps, when the following activities are performed:

- Log in attempt granted or denied
- Logout (timeout, logout, or force logout)
- Any configuration change
- Any data or cleaning cartridge move initiated from a library user interface
- Any code load operation (library or drive) initiated from a library user interface and not associated with a FRU replacement
- Any prepare or finish service procedure initiated from a library user interface including set storage slot offline or online
- Any drive serial number change not associated with a FRU replacement
- Any drive power cycle initiated from a library user interface
- Any node card reset initiated from a library user interface

To enable or disable SNMP audit logging, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> SNMP Settings**.
2. Select or deselect **Enable SNMP Audit Logging** to enable or disable this setting.
3. Confirm that other settings are correct and select **Apply**.

Obtaining a Management Information Base
Complete this task to obtain an up-to-date Management Information Base.

About this task

An up-to-date Management Information Base (MIB) is required if SNMP audit logging is enabled. Complete the following steps to locate and download an SNMP MIB file:

Procedure

1. Open the following link in your web browser: http://www.ibm.com/support/fixcentral.
2. Select **System Storage** from the Product Group menu.
3. Select **Tape systems** from the Storage Software menu.
4. Select **Tape autoloaders and libraries** from the Storage Software menu.
5. Select **TS3500 Tape Library** from the Tape autoloaders and libraries menu and click **Continue**. The Select fixes page displays.
6. Select the appropriate microcode level for your library. A sign on page displays.
7. Log on with your IBM ID and password in order to view available MIB files for download.

Viewing or changing SNMP system data

This topic describes how to view or change the Simple Network Management Protocol (SNMP) configuration and contact information about the TS3500 tape library.

About this task

SNMP system data is SNMP configuration and contact information about the TS3500 tape library that you can view or change.

To view or change SNMP system data, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> SNMP System Data**.
2. See your system administrator to obtain and enter the information necessary in the Community Names field.
3. Enter information about the library that you want to make available through SNMP in the System Group Information fields.
4. Assign a text name in the System Name field.
5. Select **Apply**.

Results

Note: Note that the contact information in the system data is also used by the library when it uses the Call Home capability.

Viewing or changing the Simple Network Management Protocol (SNMP) destination IP configuration and remote port
About this task

This topic introduces the way to view the identifier of a Simple Network Management Protocol (SNMP) monitoring server that is used by the TS3500 tape library. It also provides basic information about the library's remote port.

A destination IP (Internet Protocol) configuration is the identifier of an SNMP monitoring server to which SNMP alerts are sent. The configuration is unique to each monitoring server. It consists of an address that is assigned by your system administrator. The maximum quantity of monitoring servers and IP addresses per library is five.

The TS3500 tape library defaults to a remote port value of 162. For information about the remote port, see the documentation for your monitoring server.

To view or change the destination Internet Protocol (IP) configuration and remote port of the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> SNMP Destinations**.
2. In the SNMP screen, view or enter the IP addresses and ports of any Simple Network Management Protocol (SNMP) monitoring servers to which you want to send SNMP alerts.
3. Select **Apply** to accept the information.

Sending a test SNMP trap

This topic introduces the way to send a Simple Network Management Protocol (SNMP) trap that tests whether the TS3500 tape library and the application for the SNMP monitoring station are connected.

About this task

You can send a test SNMP trap to ensure that the TS3500 tape library and the SNMP monitoring server's application are properly connected.

To send a test Simple Network Management Protocol (SNMP) trap and ensure proper connection of the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> SNMP Settings**. The SNMP settings screen displays.
2. Select <u>**Send Test Trap**</u> to send an SNMP test trap.

Viewing or changing the SNMP trap community name

This topic introduces the way to view or change the trap community name that is associated with the TS3500 tape library.

About this task

The trap community name is sent with a trap. For information about the trap community name, see the documentation for your monitoring station.

To view or change the community name that is associated with the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> SNMP System Data**.
2. See your system administrator to obtain and enter the information necessary in the Community Names field.
3. Select **Apply**.

Viewing or changing the SNMP request community name

This topic defines the request community name for the TS3500 tape library and describes how to view or change it.

About this task

The request community name is data that is required to receive a get-response message.

To view or change the request community name, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> SNMP Settings**.
2. See your system administrator to obtain and enter the information necessary in the Community Names field.
3. Select **Apply**.

Viewing Ethernet Address Settings

This section introduces procedures for viewing the Ethernet address settings of frames that are part of the TS3500 tape library and which contain single or dual Ethernet ports. If you use the operator panel, different screens are displayed for ports using IPv4 and those using IPv6 addresses.

To view a frame's Ethernet address settings, use one of the following methods.

Using the Web to view library IP address settings

This section describes how to use the Tape Library Specialist Web interface to view the settings for single or dual Ethernet ports using IPv4 or IPv6 addresses in frames of the TS3500 tape library.

About this task

The Library IP Addresses page allows you to view and modify the IP addresses used by your TS3500 tape library for all frames or for individual frames. Individual frames and ports can be configured to use IPv4, IPv6, or both types of addresses. The initial configuration is done using the operator panel. After the initial configuration is performed, the settings are changed by using the Tape Library Specialist Web interface.

To view or modify the IP addresses used by an individual frame use the following method:

Procedure

From the Work Items navigation pane, select **Access —> Library IP Addresses**. The Library IP Addresses screen displays.

Using the operator panel to view Ethernet settings (IPv4)

This section describes how to use the operator panel to view the settings for single or dual Ethernet ports using IPv4 addresses in frames of the TS3500 tape library.

About this task

To view the settings for single or dual Ethernet ports using IPv4 addresses, use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet IPv4—> ENTER**. If you're using IPv4, and more than one port, a screen like the following displays:

```
Ethernet IPv4              Panel 0175

Current Settings
Frame 1, Port B÷

MAC Address (IPv4): 18:36:F3:98:4F:9A
IP Address (IPv4):  19.117.217.67
Subnet Mask (IPv4): 255.255.255.0
Gateway (IPv4:     19.117.63.253

Ethernet Mode:  Static IP

INITIALIZING

[BACK]   [ UP ]   [DOWN]    [ENTER]
```

The screen includes the following settings (though not all settings may display at the same time).

Current Settings
> The Ethernet screen displays Ethernet settings for Frame 1. If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, the settings for Port A display. Press UP to view the settings for Port B. Press DOWN to return to the settings for Port A.

MAC Address (IPv4)
> The Media Access Control (MAC) address is defined by the manufacturer of the Ethernet chip and cannot be changed.

IP Address (IPv4)
> The Internet Protocol (IP) Address is an identifier that is unique to each library and is necessary for communication with the server. This panel is used for IPv4 addresses. The IP Address (IPv6) screen is used for IPv6 addresses.
>
> **Note:** This address is not the same as the Simple Network Management Protocol (SNMP) IP address.

Subnet Mask (IPv4)
> The Subnet Mask address identifies the library's local area network (LAN).

Gateway (IPv4)
> The Gateway Address is the location at which networks attach to each other. The link state indicates whether the Ethernet cable is properly connected to the library.

Ethernet Mode
> The Ethernet Mode field indicates how the IP information was set. Values are Dynamic Host Configuration Protocol (DHCP) or Static IP.

Setting
> The Setting field indicates whether the DHCP lets another machine assign the library a Destination IP Address, or whether you assigned the address manually. Values are DHCP or Static IP.

2. Press BACK until you return to the Activity screen.

Using the operator panel to view Ethernet settings (IPv6)

This section describes how to view the settings for single or dual Ethernet ports using IPv6 addresses in frames of the TS3500 tape library.

About this task

To view the settings for single or dual Ethernet ports using IPv6, use the following method.

Procedure

From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet IPv6—> ENTER**. If the port is configured for IPv6 addresses, a screen like the following displays:

```
Ethernet IPv6              Panel 0178

Current Settings
Frame 1, Port B÷

MAC Address: 18:36:F3:98:4F:9A

Static IP (IPv6):  684D:1111:222:3333:4444:5555:6:77

DHCP IP (IPv6): Disabled

Stateless Auto IP (IPv6): 0:0:0:0:0:0:0:0

Press ENTER to Change Settings

[BACK]   [ UP ]   [DOWN]    [ENTER]
```

The screen includes the following settings (though not all settings may display at the same time).

Current Settings
> The Ethernet screen displays Ethernet settings for Frame 1. If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, the settings for Port A display. Press UP to view the settings for Port B. Press DOWN to return to the settings for Port A.

MAC Address
> The Media Access Control (MAC) address is defined by the manufacturer of the Ethernet chip and cannot be changed.

Static IP (IPv6)
> The IPv6 Internet Protocol that identifies each library and is necessary for communication with the server. An IPv6 (Normal) address has the following format: $y : y : y : y : y : y : y : y$ where y is called a *segment* and can be any hexadecimal value between 0 and FFFF. The segments are separated by colons - not periods. An IPv6 normal address must have eight segments, however a short form notation can be used for segments that are zero. The last eight hexadecimal digits are the subnet.

> **Notes:**
> 1. Only the long form notation can be used from the Operator Panel. A short form notation can be used for segments that are zero from the Tape Library Specialist web interface.
> 2. This address is not the same as the Simple Network Management Protocol (SNMP) IP address.

DHCP IP (IPv6)
> Displays whether DHCP is Disabled or Enabled. If enabled, the DHCP server assigns an internet address.

Stateless Auto IP (IPv6)
　　　　Displays the whether Stateless Auto IP is Disabled or Enabled. Stateless
　　　　Auto IP automatically assigns IPv6 addresses if enabled.

Changing the Ethernet address settings

This section introduces procedures for changing the Ethernet address settings of frames that are part of the TS3500 tape library and which contain single or dual Ethernet ports.

To change a frame's Ethernet address settings, use one of the following methods.

Using the Web to change library IP address settings

This section describes how to use the Tape Library Specialist Web interface to change the settings for single or dual Ethernet ports using IPv4 or IPv6 addresses in frames of the TS3500 tape library.

About this task

The Library IP Addresses page allows you to view and modify the IP addresses used by your TS3500 tape library for all frames or for individual frames. Individual frames and ports can be configured to use IPv4, IPv6, or both types of addresses. The initial configuration is done by using the operator panel. After the initial configuration is performed, the settings are changed by using the Tape Library Specialist Web interface.

To view or modify the IP addresses used by an individual frame use the following method:

Procedure

1. From the Work Items navigation pane, select **Access —> Library IP Addresses**. The Library IP Addresses screen displays.
2. To modify a library IP address, select the Frame and Port, select Modify. Then, select Go.
3. On the Modify IP Address page, select one of the following check boxes and enter additional information if required.
   a. Select **IPv4** and then select the method for obtaining the IP address. Choose whether to use the port for the call home master console:
      - **Obtain an IP Address Automatically (DHCP)**: Select to use Dynamic Host Configuration Protocol (DHCP) to automatically assign IP addresses.
      - **Use static IP address**: Select to enter a static manual address, then specify the following information:
         - **IP Address**: Specify the IPv4 address
         - **Net Mask**: Enter the length of the subnet mask
         - **Gateway**: Enter the IPv4 gateway address
      - **Use this port for Master Console**: Select if this port will be used for the call home master console
   b. **IPv6**
      - **Obtain an IP Address Automatically (DHCP)**: Select to use Dynamic Host Configuration Protocol (DHCP) to automatically assign IP addresses.
      - **Obtain an IP Address Automatically (Stateless Auto Config)**: Select to use stateless auto IP configuration to automatically assign IP addresses.

- **Use static IP address**: Select to enter a static manual address, then specify the following information:
  - **IP Address/Prefix Length**: Specify the IPv6 address and prefix length.
  - **Gateway**: Enter the IPv6 gateway address.
4. After you have select the options for the frame, click Apply.

Using the operator panel to change the Ethernet IPv4 address settings of a frame

This section describes how to change the Ethernet IPv4 address settings for a frame that is part of the TS3500 tape library and has one or two Ethernet ports.

About this task

You can disable Ethernet settings, manually enable them, or let another machine enable them by using Dynamic Host Configuration Protocol (DHCP). You can also set a specific speed for the Ethernet port or specify the library to automatically negotiate the speed.

To change the Ethernet IPv4 address settings for a frame, use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet IPv4—> ENTER**. The Ethernet screen displays Ethernet settings for Frame 1 (for an explanation of the fields in the Ethernet screen, see "Using the operator panel to view Ethernet settings (IPv4)" on page 184).

```
Ethernet IPv4              Panel 0175


Current Settings
Frame: 1  Port: A÷

MAC Address (IPv4): 18:36:F3:98:4F:9A
IP Address (IPv4):  19.117.63.126
Subnet Mask (IPv4): 255.255.255.0
Gateway (IPv4):     19.117.63.253

Ethernet Mode:  Static IP

Change Settings

[BACK]   [ UP ]  [DOWN]   [ENTER]
```

2. To change the Ethernet address settings, press ENTER. The Ethernet Settings menu displays.

```
Ethernet Settings IPv4        Panel 0176

Disable Ethernet
Enable with DHCP
Enable with Static IP

[BACK]          [DOWN]   [ENTER]
```
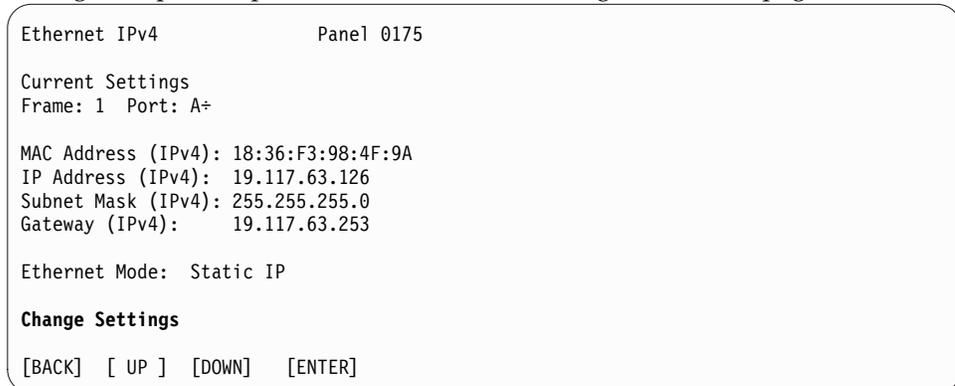
3. Press UP or DOWN to highlight Enable with Static IP and press ENTER. The Static IP Settings IPv4 screen displays.

```
Static IP Settings IPv4      Panel 0177

Frame: 1

IP Address (IPv4):  19.117.217.67
Subnet Mask (IPv4): 255.255.255.0
Gateway (IPv4:      19.117.63.253

Use keypad below to change
highlighted value.

 [0]  [1]  [2]  [3]  [4]

 [5]  [6]  [7]  [8]  [9]



        [Backspace]


[BACK][ UP ][DOWN][ENTER]
```

To change an octet in the IPv4 address, select the octet, then press the numbers in the keypad to select the correct value. After the correct octet value is selected, press ENTER. The keypad values will replace the currently entered value in the octet and the next octet will be highlighted. Repeat this procedure for the third and fourth octets. After you modify the fourth octet and press ENTER, the library highlights the first octet of the Subnet Mask. Continue to change numbers as necessary. When you press ENTER after the last octet in Gateway, the library displays the message **Updating. This may take up to four minutes.** followed by **Ethernet Settings updated**. Press ENTER. The Ethernet screen displays with the new settings for Port A.

Notes:
- After an IP address is selected, if the subnet mask and gateway are set to 0.0.0.0, the subnet mask will default it to a class C subnet mask
- After a gateway is selected, if the subnet mask and gateway are both 0.0.0.0, the gateway will default to the default gateway based on the subnet mask. For example IP: 9.4.5.2 Subnet: 255.255.255.0 Gateway: 9.4.5.1
- If you select 0 for the first octet, the rest of the octets in the address will be set to zero, and the fourth octet will be highlighted.

```
Ethernet IPv4             Panel 0175

Current Settings
Frame: 1  Port: A÷

MAC Address (IPv4): 18:36:F3:98:4F:9A
IP Address (IPv4):  19.117.63.126
Subnet Mask (IPv4): 255.255.255.0
Gateway (IPv4):     19.117.63.253

Ethernet Mode:  Static IP

Change Settings

[BACK]   [ UP ]            [ENTER]
```

4. To optionally change the settings of Port B, press UP. The Ethernet screen redisplays to show Frame 1, Port B.

```
Ethernet IPv4           Panel 0175

Current Settings
Frame: 1  Port: B÷

MAC Address (IPv4): 18:36:F3:98:4F:9A
IP Address (IPv4):  19.117.63.126
Subnet Mask (IPv4): 255.255.255.0
Gateway (IPv4):     0.0.0.0


Ethernet Mode:  Static IP

Change Settings

[BACK]          [DOWN]   [ENTER]
```

5. Press ENTER. The Ethernet Settings IPv4 screen displays.

```
Ethernet Settings IPv4      Panel 0176

Disable Ethernet
Enable with Static IP

[BACK]  [ UP ]  [DOWN]   [ENTER]
```

6. Press UP or DOWN to highlight Enable with Static IP and press ENTER. The
   Static IP Settings IPv4 screen displays.

```
Static IP Settings IPv4      Panel 0177

Frame: 1

Port B must only be
configured for connection to
a Master/System console.

IP Address (IPv4):  10.1.1.31
Subnet Mask (IPv4): 255.255.255.0

Use keypad below to change
highlighted value.

 [0]  [1]  [2]  [3]  [4]

 [5]  [6]  [7]  [8]  [9]



        [Backspace]


[BACK][ UP ][DOWN][ENTER]
```

Refer to step 3 for instructions about changing the values of the octets in the IP
Address and Subnet Mask. When you have finished, press ENTER. The
Ethernet screen displays with the new settings for Port B.

7. Press BACK until you return to the Activity screen.

Using the operator panel to change Ethernet settings (IPv6)

This section describes how to change the settings for single or dual Ethernet ports
using IPv6 addresses in frames of the TS3500 tape library.

About this task

To change the settings for single or dual Ethernet ports using IPv6, use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet IPv6—> ENTER**. If the port is configured for IPv6 addresses, a screen like the following displays:

```
Ethernet IPv6            Panel 0178

Current Settings
Frame 1, Port A÷

MAC Address: 18:36:F3:98:4F:9A

Static IP (IPv6):  684D:1111:222:3333:4444:5555:6:77

DHCP IP (IPv6): Disabled

Stateless Auto IP (IPv6): 0:0:0:0:0:0:0:0

Press ENTER to Change Settings

[BACK]   [ UP ]   [DOWN]    [ENTER]
```

The screen includes the following settings (though not all settings may display at the same time).

Current Settings
> The Ethernet screen displays Ethernet settings for Frame 1. If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, the settings for Port A display. Press UP to view the settings for Port B. Press DOWN to return to the settings for Port A.

MAC Address
> The Media Access Control (MAC) address is defined by the manufacturer of the Ethernet chip and cannot be changed.

Static IP (IPv6)
> The IPv6 Internet Protocol identifies each library and is necessary for communication with the server. An IPv6 (Normal) address has the following format: $y : y : y : y : y : y : y : y$ where y is called a *segment* and can be any hexadecimal value between 0 and FFFF. The segments are separated by colons - not periods. An IPv6 normal address must have eight segments.
>
> **Notes:**
> a. Only the long form notation can be used from the Operator Panel. A short form notation can be used for segments that are zero from the Tape Library Specialist web interface.
> b. This address is not the same as the Simple Network Management Protocol (SNMP) IP address.

DHCP IP (IPv6)
> Displays whether Dynamic Host Configuration Protocol (DHCP) is Disabled or Enabled. The DHCP server acts as an administrator for the network. If you do not assign an internet protocol (IP) address for the library, the DHCP can assign it.

Stateless Auto IP (IPv6)

Displays the whether Stateless Auto IP is Disabled or Enabled. Stateless Auto IP allows a host to generate its own IPv6 addresses using a combination of the router prefix used to identify the subnet associated with a link, and a host-generated "interface identifier" that uniquely identifies the interface on the subnet.

2. To change the Ethernet IPv6 address settings, press ENTER. The Ethernet Settings IPv6 menu displays.

```
Ethernet Settings IPv6        Panel 0179
Enable with DHCP
Enable with Static IP
Disable Stateless Auto Config

[BACK]          [DOWN]    [ENTER]
```

3. To enable Static IP, press UP or DOWN to highlight **Enable with Static IP** and press ENTER. The Static IP Settings IPv6 screen displays.

```
                         Panel 0180
Static IP Settings IPv6


IP Address (IPv6):
  684D:1111:2222:3333:4444:5555:6:77
Prefix Length (IPv6):
  127

Gateway (IPv6):
  0:0:0:0:0:0:0:0

Use keypad below to change
highlighted value.

 [0]  [1]  [2]  [3]  [4]

 [5]  [6]  [7]  [8]  [9]

 [A]  [B]  [C]  [D]  [E]  [F]

         [Backspace]

[BACK]              [ENTER]
```

4. To change the value in a segment (colon separated group) in the IPv6 address:

   • Select the segment that you want to change, then press the numbers in the keypad to select the correct value. After the correct value is selected, press ENTER. The keypad values will replace the currently entered value in the segment and the next segment will be highlighted.

   • Repeat this procedure for the second through eighth segments. After you modify the eighth group and press ENTER, the library highlights the first segment of the Prefix Length. Continue to change numbers as necessary.

   • When you press ENTER after the last segment in Gateway, the library displays the message **Updating. This may take up to four minutes.** followed by **Ethernet Settings updated**.

   • Press ENTER. The Ethernet screen displays with the new settings for the selected Frame and Port.

5. To optionally change the settings of another port, press UP until the port is displayed. The Ethernet IPv6 screen redisplays to show Frame 1, Port B.

```
Ethernet IPv6              Panel 0178

Current Settings
Frame 1, Port B÷

MAC Address: 18:36:F3:98:4F:9A

Static IP (IPv6):  684D:1111:222:3333:4444:5555:6:77

DHCP IP (IPv6): Disabled

Stateless Auto IP (IPv6): 0:0:0:0:0:0:0:0

Press ENTER to Change Settings

[BACK]   [ UP ]  [DOWN]   [ENTER]
```
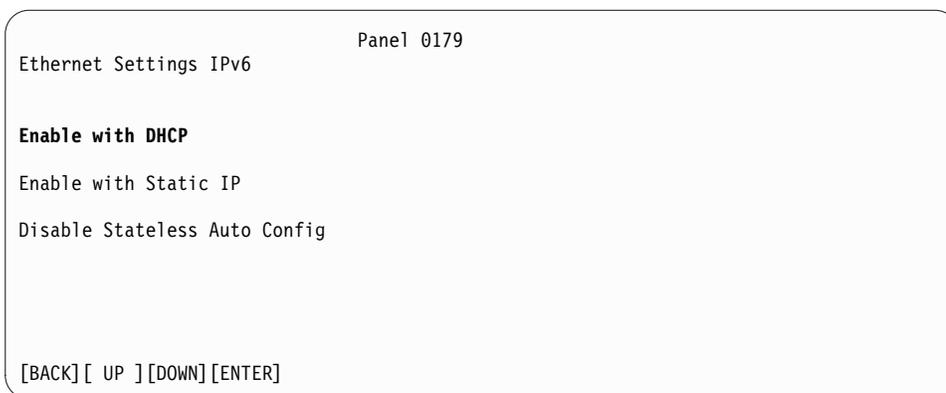
6. When you are finished changing the settings, press BACK until you return to the Activity screen.

7. Press BACK until you return to the Activity screen.

Changing the speed of the Ethernet link

This section describes how to change the speed of the Ethernet link to the TS3500 tape library.

About this task

Note: You can change the speed of the Ethernet link by using the operator panel on the TS3500 tape library, but not by using the Tape Library Specialist Web interface.

You can specify that data be transmitted across the Ethernet network at a specified rate or indicate that the library automatically negotiate that rate. The rates of transmission are 100 Mb/s at full duplex, 100 Mb/s at half duplex, 10 Mb/s at full duplex, and 10 Mb/s at half duplex.

To change the speed of the library's Ethernet port, use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet Speed/Duplex—> ENTER**. The Ethernet screen displays Ethernet settings for Frame 1 (for an explanation of the fields in the Ethernet screen, see "Using the operator panel to view Ethernet settings (IPv4)" on page 184 or "Using the operator panel to view Ethernet settings (IPv6)" on page 185). If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, press UP or DOWN to view the settings for each port.

```
                                   Panel 0181
Ethernet Speed/Duplex


Current Settings
Frame 1, Port B:

Link State: Connected
Speed:      100
Duplex:     Half
Set:        Auto




Press ENTER to Change Settings

[BACK][ UP ][DOWN][ENTER]
```

The screen includes the following settings (though not all settings may display at the same time).

Current Settings
> The Ethernet screen displays Ethernet settings for Frame 1. If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, the settings for Port A display. Press UP to view the settings for Port B. Press DOWN to return to the settings for Port A.

Link State
> Indicates the presence of an Ethernet cable plugged into the MCC card. Valid settings are Connected and Not Connected.

Speed Indicates the cable speed, duplex, and how the speed setting was set. Valid settings are:
- Speed: 100 or 10
- Duplex: Full or Half
- Set: Auto or Fixed

2. To change the Internet speed settings, press ENTER. The Ethernet Speed/Duplex menu displays.

```
                                   Panel 0182
Ethernet Speed/Duplex




Set Speed to Auto Negotiate

Set Speed to 100 Full Duplex

Set Speed to 100 Half Duplex

Set Speed to 10 Full Duplex

Set Speed to 10 Half Duplex


[BACK][ UP ][DOWN][ENTER]
```

3. Select the line with the desired setting, and then press ENTER.

- The message **Updating Ethernet Settings this may take up to four minutes** is displayed.
- After the system has changed the settings, the message **Ethernet Settings Updated** is displayed.
- Press ENTER to display the Internet Speed Duplex panel with the new settings.

4. Press BACK until you return to the Activity screen.

Using DHCP server settings

This section describes how to use Dynamic Host Configuration Protocol (DHCP) to assign an Internet Protocol (IP) address from the operator panel of the TS3500 tape library.

About this task

Note: You can use the DHCP server settings by using the operator panel on the TS3500 tape library, but not by using the Tape Library Specialist Web interface.

The DHCP server acts as an administrator for the network. If you do not assign an Internet Protocol (IP) address for the library, the DHCP can assign it.

To specify that the DHCP server assign an IP address, use one of the following methods, depending on whether your connection uses IPv4 or IPv6 addresses.

Using DHCP server settings to assign an IPv4 address

Complete this task to use DHCP server settings to assign an IPv4 address.

About this task

To specify that the DHCP server assign an IPv4 address, use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet IPv4—> ENTER**. The Ethernet screen displays Ethernet settings for Frame 1 (for an explanation of the fields in the Ethernet screen, see "Using the operator panel to view Ethernet settings (IPv4)" on page 184). If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, press UP or DOWN to view the settings for each port.

```
Ethernet IPv4                 Panel 0175

Current Settings Frame 1:

MAC Address: 18:36:F3:98:4F:9A
IP Address (IPv4):  19.117.63.126
Subnet Mask (IPv4): 255.255.253.0
Gateway (IPv4):     19.117.63.253

Ethernet Mode:  Static IP

Press ENTER to Change Settings

[BACK]   [ UP ]  [DOWN]   [ENTER]
```

2. To change the Ethernet setting, press ENTER. The Ethernet Settings menu displays.

```
Ethernet Settings IPv4        Panel 0176

Disable Ethernet
Enable with DHCP
Enable with Static IP

[BACK]  [ UP ]  [DOWN]   [ENTER]
```

3. Press UP or DOWN to highlight Enable with DHCP and press ENTER.
   - The library displays the message **If you select ENTER, the Ethernet Settings will be obtained through the DHCP server. Press ENTER to continue.** Press ENTER to obtain the settings.
   - The library displays the message **Enabling DHCP settings. This may take up to four minutes.** followed by **DHCP Enabled**.
   - Press ENTER. The Ethernet menu redisplays with the new setting.
4. Press BACK until you return to the Activity screen.

Using DHCP server settings to assign an IPv6 address

Complete this task to use DHCP server settings to assign an IPv6 address.

About this task

To specify that the DHCP server assign an IPv6 address, use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet IPv6—> ENTER**. The Ethernet screen displays Ethernet settings for Frame 1 (for an explanation of the fields in the Ethernet screen, see "Using the operator panel to view Ethernet settings (IPv6)" on page 185). If the library contains more than one frame, press **UP** or **DOWN** to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, press **UP** or **DOWN** to view the settings for each port.

```
                          Panel 0178
Ethernet IPv6


Current Settings
Frame 1, Port B
MAC Address: 18:36:F3:98:4F:9A

Static IP (IPv6):
  684D:1111:222 :3333:4444:
  5555:6:77

DHCP IP (IPv6):
  Disabled

Stateless Auto IP (IPv6):
  0:0:0:0:0:0:0:0




Press ENTER to Change Settings

[BACK][ UP ][DOWN][ENTER]
```

2. Press **ENTER** to change the settings. The Ethernet Settings IPv6 menu displays.

```
                                     Panel 0179
Ethernet Settings IPv6


Enable with DHCP

Enable with Static IP

Disable Stateless Auto Config




[BACK][ UP ][DOWN][ENTER]
```

3. Press **UP** or **DOWN** to highlight Enable with DHCP and press **ENTER**.
   - The library displays the message **If you select ENTER, the Ethernet Settings will be obtained through the DHCP server. Press ENTER to continue.** Press **ENTER** to obtain the settings.
   - The library displays the message **Enabling DHCP settings. This may take up to four minutes.** followed by **DHCP Enabled**.
   - Press **ENTER**. The Ethernet IPv6 screen redisplays with the new setting.
4. Press **BACK** until you return to the Activity screen.

Enabling stateless autoconfiguration for IPv6 addresses

Stateless autoconfiguration allows a host to generate its own addresses using a combination of the router prefix, which is used to identify the subnet associated with a link, and a host-generated an "interface identifier" that uniquely identifies an interface on a subnet.

About this task

To enable stateless autoconfiguration use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet IPv6—> ENTER**. The Ethernet screen displays Ethernet settings for Frame 1 (for an explanation of the fields in the Ethernet screen, see). If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, press UP or DOWN to view the settings for each port.

```
                                Panel 0178
Ethernet IPv6


Current Settings
Frame 1, Port B
MAC Address: 18:36:F3:98:4F:9A

Manual IP (IPv6):
  684D:1111:222 :3333:4444:
  5555:6:77

DHCP IP (IPv6):
  Disabled

Stateless Auto IP (IPv6):
  0:0:0:0:0:0:0:0




Press ENTER to Change Settings

[BACK][ UP ][DOWN][ENTER]
```

2. Press ENTER to change the settings. The Ethernet Settings IPv6 menu displays.

```
                                Panel 0179
Ethernet Settings IPv6


Enable with DHCP

Enable with Manual IP Entry

Enable Stateless Auto Config




[BACK][ UP ][DOWN][ENTER]
```
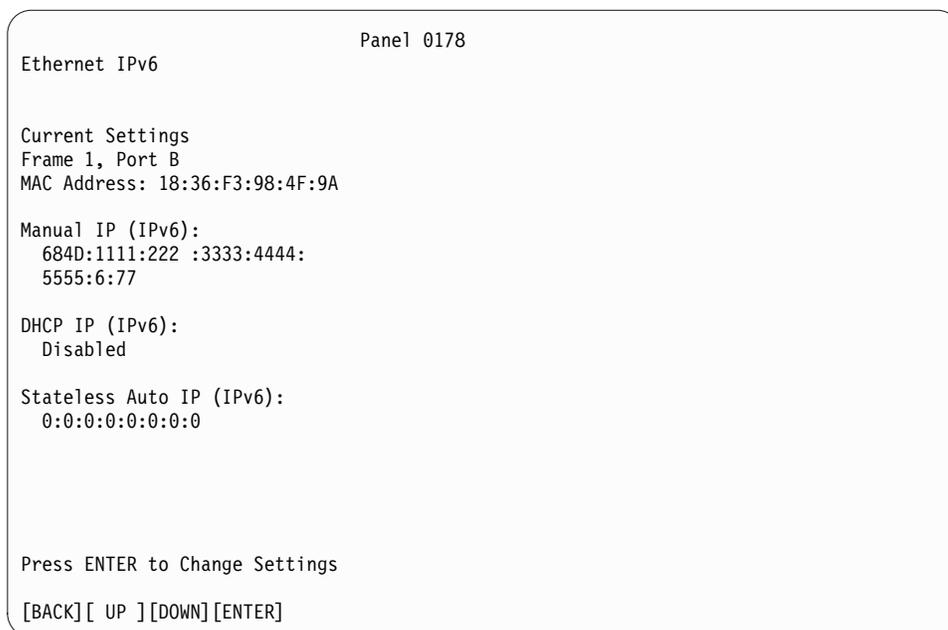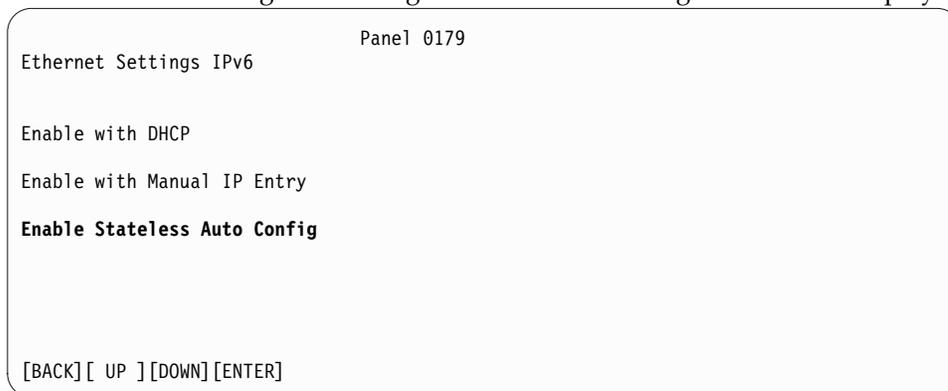
3. Press UP or DOWN to highlight Enable Stateless Auto Config and press
   ENTER.
   • The library displays the message **Enabling Stateless Auto Configuration**
     followed by **Stateless Auto Configuration Enabled** when the processing is
     completed.
   • Press ENTER. The Ethernet IPv6 screen redisplays with the new setting.
4. Press BACK until you return to the Activity screen.

Disabling an Ethernet connection

This section describes how to disable an Ethernet connection to the TS3500 tape
library.

About this task

Note: You can disable an Ethernet connection by using the operator panel on the
TS3500 tape library, but not by using the Tape Library Specialist Web interface.

To disable an Ethernet connection, use the following method.

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Network —> Ethernet —> ENTER**. The Ethernet screen displays Ethernet settings for Frame 1 (for an explanation of the fields in the Ethernet screen, see "Using the operator panel to view Ethernet settings (IPv4)" on page 184). If the library contains more than one frame, press UP or DOWN to view the settings for the next or previous frame. If the frame contains more than one Ethernet port, press UP or DOWN to view the settings for each port.

```
Ethernet              Panel 0175

Current Settings Frame 1:

MAC Address: 18:36:F3:98:4F:9A
IP Address:  19.117.63.126
Subnet Mask: 255.255.253.0
Gateway:     19.117.63.253

Link State:  Connected
Speed:  100 Full duplex (Auto)

Ethernet Mode:  Static IP

Change Settings

[BACK]  [ UP ]   [ENTER]
```

2. To change the Ethernet setting, press ENTER. The Ethernet Settings menu displays.

```
Ethernet Settings      Panel 0176

Disable Ethernet
Enable with DHCP
Enable with Static IP
Set Speed to Auto Negotiate
Set Speed to 100 Full Duplex
Set Speed to 100 Half Duplex
Set Speed to 10 Full Duplex
Set Speed to 10 Half Duplex

[BACK]   [DOWN]   [ENTER]
```

3. Press UP or DOWN to highlight Disable Ethernet and press ENTER. The library displays the message **If you select ENTER, the Ethernet Settings will be disabled. Press ENTER to continue.** Press ENTER to disable the settings. The library displays the message **Disabling Ethernet. This may take up to four minutes.** followed by **Ethernet Disabled**.
4. Press ENTER. The Ethernet menu redisplays with the new setting.
5. Press BACK until you return to the Activity screen.

Changing the date and time

This section introduces two ways to change the date and time on your TS3500 tape library.

Errors and internal logs contain a time stamp to indicate when the error occurred or when the log was generated. To change the date and time settings on your TS3500 tape library, use one of the following methods.

Using the Web to change the date and time
About this task

To use the Tape Library Specialist Web interface to change the date and time on the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library —> Date and Time**. The Date and Time screen displays.
2. Follow the instructions on the screen.

Using the operator panel to change the date and time
About this task

To use the operator panel to change the date and time on the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Date/Time —> ENTER**. The Date/Time menu displays with the current date and time. It also includes a list of parameters that you can change. They include the minute, hour, day, month, and year.
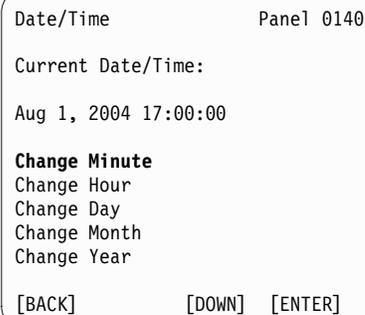
```
Date/Time              Panel 0140

Current Date/Time:

Aug 1, 2004 17:00:00

Change Minute
Change Hour
Change Day
Change Month
Change Year

[BACK]          [DOWN]   [ENTER]
```

2. Press UP or DOWN to highlight the parameter that you want to change and press ENTER. Depending on the parameter that you chose, a screen similar to the following screen displays.

```
Set Minute              Panel 0141

Aug 1, 2004 17:00:00

[BACK]   [ UP ]  [DOWN]    [ENTER]
```

3. Press UP or DOWN to increment or decrement the minute, hour, day, month, or year setting.
4. Press ENTER to redisplay the screen with the new setting.
5. Press BACK until you return to the Activity screen.

Enabling or disabling the keypress beep

This section describes how to enable or disable the beep that sounds when you press a key on the TS3500 tape library.

About this task

Note: Not implemented in the Tape Library Specialist Web interface.

The TS3500 tape library uses a beep to acknowledge that you pressed a touch key on the touchscreen LCD. Use the following steps to enable or disable the keypress beep:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Sounds —> ENTER**. The Sounds screen displays with the current setting of the beep.
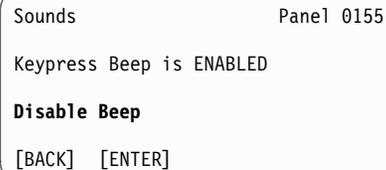
```
Sounds                    Panel 0155

Keypress Beep is ENABLED

Disable Beep

[BACK]   [ENTER]
```

2. Press ENTER to change the setting of the beep to DISABLED or ENABLED. The library displays the message **You are about to set Keypress Beep Mode to x. Do you want to continue?** (where **x** equals `DISABLED` or `ENABLED`).
3. Press YES. The Sounds screen redisplays with the new setting.
4. Press BACK until you return to the Activity screen.

Enabling or disabling the reporting of a 6-character or 8-character VOLSER

This section describes how to configure the TS3500 tape library so that it reports to the server only the first 6 characters of the volume serial (VOLSER) number of a tape cartridge's bar code label or it reports the full 8 characters of the VOLSER. Reporting 8 characters is the default.

About this task

Notes:
- You can perform this function by using the Tape Library Specialist Web interface, but not by using the operator panel.
- Do not enable the reporting of a 6-character VOLSER if your TS3500 tape library is attached to an IBM 3953 Tape System. If you enable 6-character VOLSER reporting, the 3953 Tape System does not recognize the cartridges and sets them to manually eject.
- Enabling or disabling 6-character VOLSER can be done on a logical library basis with ALMS is enabled.

If you are migrating cartridges to a TS3500 tape library from a library that previously reported 6-character VOLSERs, it may be necessary to enable the reporting of 6-character VOLSERs on the TS3500 tape library.

To use the Tape Library Specialist Web interface to enable or disable the reporting of a 6-character VOLSER by the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library —> Logical Libraries**. The Manage Logical Libraries screen displays.
2. Select the logical library you want to change to 6-character VOLSER reporting.
3. In the **Select Action** drop-down list, select **Modify Volser Reporting**. Then, select **GO**.
4. Under **Volser Reporting** select either **8 (default)** or **6** then click **APPLY** and **CLOSE**. The library displays the message Logical Library Volser reporting change is complete.

Results

The 6-character VOLSER is reported to all servers that are attached to this specific logical library; the full 6-character or 8-character VOLSER appears on the Web interface and library operator panel.

Enabling or disabling the Insert Notification setting

This section introduces two ways to enable or disable Insert Notification, which is the setting that monitors and assigns new media to a logical library in the TS3500 tape library.

Note: Insert notification is no longer recommended and is not supported in any library that includes an HD frame. In HD libraries, insert notification is automatically disabled. It is recommended that the Cartridge Assignment Policy be configured to provide automated assignment of all cartridges inserted into a partitioned library.

The TS3500 tape library offers an Insert Notification setting that monitors the library for new media and asks you to assign the media to a logical library. This can occur if you open the door of the I/O station and place a cartridge into an empty I/O slot or move a cartridge from one I/O slot to another.

When the Insert Notification setting is enabled, unassigned cartridges are inaccessible to any logical library, but user interfaces are still able to move cartridges to logical libraries and make them accessible to the host.

Note: The cartridge assignment policy overrides the method of assigning a cartridge to a logical library through the use of the Insert Notification setting. For more information, see "Working with a cartridge assignment policy" on page 122. Also refer to the sections about Insert Notification and Cartridge Assignment Policies in the *IBM TS3500 with ALMS Introduction and Planning Guide*.

To enable or disable the Insert Notification setting, use one of the following methods.

Using the Web to enable or disable the insert notification setting

Before you begin

Note: The insert notification setting is automatically disabled in libraries with HD frames.

About this task

To use the Tape Library Specialist Web interface to enable or disable insert notification on the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Cartridges —> Insert Notification**. The Change Insert Notification screen displays.
2. Follow the instructions on the screen.

Using the operator panel to enable or disable the insert notification setting

Before you begin

Note: The insert notification setting is automatically disabled in libraries with HD frames.

About this task

The Insert Notification setting of the TS3500 tape library allows you to assign a cartridge in the I/O station to a logical library. To use the operator panel to enable or disable the insert notification setting, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Settings —> Insert Notification —> ENTER**. The Change Insert Notification screen displays. If the setting is enabled, the screen prompts you for a logical library and identifies the new cartridges to the server.

```
Change Insert Notification              Panel 0190

Insert Notification: ENABLED

Insert Notification will prompt
for a logical library when the I/O
station door is opened. New cartridges
in the I/O will be assigned to the
selected logical library.

Press [UP] or [DOWN] to change the
Insert Notification setting, then
press [ENTER] to activate the
changes.


[BACK]    [ UP ]   [DOWN]   [ENTER]
```

2. Press UP or DOWN to specify whether you want to enable or disable the setting, then press ENTER. A confirmation screen displays.
3. If the new setting is correct, press ENTER. The screen redisplays with the new setting.
4. Press BACK until you return to the Activity screen.

Enabling or disabling Secure Socket Layer (SSL) settings

This section defines a Secure Socket Layer (SSL) and describes how to enable or disable its settings.

About this task

Important: Enabling SSL for TS3500 web communications introduces significant delays for the display of some TS3500 web pages.

Secure Socket Layer (SSL) is a protocol for transmitting private documents through the Internet. SSL uses a cryptographic system that uses these two keys to encrypt data:

- a public key known to everyone
- a private key known only to the recipient of the message

Most browsers support SSL. Many Web sites use this protocol to obtain confidential user information, such as credit card numbers. By convention, URLs that require an SSL connection start with https: instead of http:.

The TS3500 tape library provides the ability to enable or disable SSL for Web browser communication. The action is performed using the Tape Library Specialist Web specialist.

Note: You can enable or disable SSL settings by using the Web specialist of the TS3500 tape library, but not by using the operator panel.

See also "Secure Socket Layer (SSL) functionality" on page 28.

To enable or disable SSL settings for Web communication, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Secure Socket Layer**. The Secure Socket Layer screen displays.
2. View the current SSL settings, then select the button to enable or disable Secure Socket Layer.
3. Select Apply. A popup message displays confirming that the SSL change has been submitted. Select OK.
4. Reload the Web browser using the https protocol (if enabling) or the http protocol (if disabling) in order for the change to take effect.

Enabling and disabling the SMI-S agent

This topic provides instructions for users to view and change the status of the Storage Management Initiative Specification (SMI-S) Agent on the TS3500 tape library.

Before you begin

Note: Beginning with code level B4xx, an embedded SMI-S agent is no longer provided with, or supported by, the TS3500 tape library. For this reason, this page is not available on the Tape Library Specialist web interface for libraries at code level B4xx or later. It is still possible, however, to use a proxy SMI-S Agent for Tape on a separate Linux machine or to enable SNMP messaging as an alternative to SMI-S.

This page allows users to view and change the status of the Storage Management Initiative Specification (SMI-S) Agent on the TS3500 tape library. The SMI-S Agent is IBM's implementation of the Common Information Model (CIM). The CIM is an

interface standard that enables interoperability for hardware and software products, in your enterprise's storage network environment, that might come from different manufacturers. The CIM provides common protocols and data models that storage product manufacturers can use to ensure ease of both use and manageability of the storage network environment.

The SMI-S Agent follows the security settings of the Web server. When Secure Socket Layer (SSL) is disabled, it listens on the standard CIM HTTP port 5988. When SSL is enabled, it uses the CIM HTTPS port 5989. Note that SSL slows down the performance of the CIM interface. When user security is enabled, the CIMOM requires a Web User ID and password that are part of the Administrator or Monitor roles. When the Storage Authentication Service (SAS) is enabled, the CIMOM requires the LDAP User ID and password. The SMI-S agent uses the namespace root/ibm.

About this task

Follow these steps to enable or disable the SMI-S agent:

Procedure
1. From the Work Items navigation pane, select **Access —> SMI-S Agent**.
2. View the current setting, then select the button to either enable or disable the SMI-S agent.

Determining usage of library components

This section introduces procedures for determining usage for the accessor, drive, or cleaning cartridge in the TS3500 tape library.

Determining accessor usage

To determine usage information about the cartridge accessor in the TS3500 tape library, use one of the following methods.

Using the Web to determine accessor usage
About this task

To use the Tape Library Specialist Web interface to determine usage of the accessor in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Library —> Accessor**. The Accessor screen displays statistics about the accessor's usage.

Using the operator panel to determine accessor usage
About this task

To use the operator panel to determine usage of the accessor in the TS3500 tape library, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Usage Statistics —> Accessor Usage —> ENTER**. Depending on whether your library has one or two cartridge accessors, different screens display:

- If your library has only one accessor, the Accessor Usage screen displays. The screen lists how many pivots of the accessor, gets and puts for each gripper, and bar code scans have occurred since the library's first operation. It also lists how many meters the accessor has traveled on the X and Y axes. When you finish viewing the information, go to step 2 on page 207.

```
Accessor Usage          Panel 0201

Accessor A:
  Pivots:           14591
  Gripper 1
    Gets:           30792
    Puts:           30791
  Gripper 2
    Gets:           19036
    Puts:           19036
Scans:              31879
X Dist.(m)          31879
Y Dist.(m)          40172

[BACK]      [DOWN]
```

- If your library has two accessors, the Select Accessor screen displays both.

```
Select Accessor         Panel 0031

Accessor A

Accessor B

[BACK]      [UP]      [DOWN]    [ENTER]
```

Press UP or DOWN to select the accessor for which you want usage information (in this example, Accessor A), then press ENTER. The Accessor Usage Cumulative for Life of Library screen displays for the accessor that you selected. For the library's first operation to its most recent operation, the screen lists how many pivots of the accessor, gets and puts for each gripper, and bar code scans have occurred for that library. It also lists how many meters the accessor has traveled on the X and Y axes.

```
Accessor Usage          Panel 0201

Cumulative for Life of Library
Accessor A:
  Pivots:           14591
  Gripper 1
    Gets:           30792
    Puts:           30791
  Gripper 2
    Gets:           19036
    Puts:           19036
Scans:              31879
X Dist.(m)          31879
Y Dist.(m)          40172

[BACK]      [DOWN]
```

To view usage for each component in the accessor, press DOWN. The Accessor Usage For Life of Component screen displays how many pivots of the accessor, gets and puts for each gripper, and bar code scans have occurred for that particular component. It also lists how many meters that accessor has traveled on the X and Y axes. When you finish viewing the information, go to step 2 on page 207.

```
Accessor Usage        Panel 0201

Cumulative for Life of Component
Accessor A:
  Pivots:            14591
  Gripper 1
    Gets:             1258
    Puts:             1258
  Gripper 2
    Gets:            19036
    Puts:            19036
Scans:               31879
X Dist.(m)           31879
Y Dist.(m)           12278

[BACK]      [UP]
```

2. Perform one of the following:
   - To return to a previous menu, press UP.
   - To return to the Activity screen, press BACK until you locate that screen.

Determining drive usage

To determine usage information about a drive in the TS3500 tape library, use one of the following methods.

Using the Web to determine drive usage
About this task

To use the Tape Library Specialist Web interface to determine usage of a drive in the TS3500 tape library, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Drives —> Drive Summary**. The Drives screen displays.
2. Select the drive that you want.
3. From the Select Action drop-down box, select Details. Then, select Go to display usage statistics.

Using the operator panel to determine drive usage
About this task

To use the operator panel to determine usage of a drive in the TS3500 tape library, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Usage Statistics —> Drive Usage —> ENTER**. The Select Drive screen displays with a list of drives in the library and their physical locations. The locations are listed as **[Fxx,Rzz]**, (where **F** equals frame and **xx** equals its number, and **R** equals row and **zz** equals its number). To display more drives, highlight the bottom item and press DOWN. To return to the previous list of drives, highlight the top item and press UP.

```
Select Drive         Panel 0210

Key: F=Frame, R=Row L=LTO Ultrium,
                       J = Enterprise Tape

Drive [F01,R01]   L3
Drive [F01,R02]   L1
Drive [F01,R03]   L2
Drive [F01,R04]   L3
Drive [F01,R05]   L2
Drive [F01,R06]   L1
Drive [F01,R07]   L1
Drive [F01,R08]   L2
Drive [F02,R01]   J2
Drive [F02,R02]   J1

[BACK]  [ UP ]  [DOWN]   [ENTER]
```

2. Press UP or DOWN to highlight the drive that you want to review and press
   ENTER. Another Drive Usage screen displays with data about the drive that
   you chose. Because the library and the drive each track statistics for the drive
   independently, the screen contains two sections of statistics. If a drive is
   exchanged, however, the load and unload statistics tracked by the drive will be
   different than the statistics tracked by the library. Additional data on the screen
   includes information about how many times tape cartridges have been loaded
   into and unloaded from the drive, how many megabytes of data the drive has
   written and read (represented as **MB Written** and **MB Read**), and how many
   cleanings the drive has had (**MB Written**, **MB Read**, and **Unloads** are not available
   for the 3592 tape drive). The location of the drive is listed as **[Fxx,Rzz]**, (where
   F equals frame and **xx** equals its number, and **R** equals row and **zz** equals its
   number).

```
Drive Usage          Panel 0211

Key: F=Frame, R=Row

Drive  [F01, R01]   Media Type: LTO

Library Statistics

  Loads:                    0003024
  Unloads:                  0003024

Drive Statistics

  Loads:                    0000001
  Unloads:                  0000001
  MB Written:               0000001
  MB Read:                  0000002
  Cleanings:                0000000

[BACK]   [ UP ]  [DOWN]
```

Note: If the drive replaced a drive that was removed for service, its load and
unload statistics may be lower than those of the library.

3. Press BACK until you return to the Activity screen.

Determining cleaning cartridge usage

To determine how many times the cleaning cartridge has been used in the TS3500
tape library, use one of the following methods.

Using the Web to determine cleaning cartridge usage
About this task

To use the Tape Library Specialist Web interface to determine usage of the cleaning cartridge in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Cartridges —> Cleaning Cartridges**. The Cleaning Cartridges screen displays a list of all cleaning cartridges in the library and their usage statistics.

Using the operator panel to determine cleaning cartridge usage
About this task

To use the operator panel to determine usage of the cleaning cartridge in the TS3500 tape library, perform the following steps:

Procedure
1. From the library's Activity touchscreen, press **MENU —> Usage Statistics —> Cleaning Cartridge Usage —> ENTER**. The Cleaning Cartridge Usage screen displays with a list of the cleaning cartridges in the TS3500 tape library and how many cleans remain on the cartridge. For libraries that use both LTO Ultrium and 3592 media, the screen also indicates whether the cartridge is an LTO (Ultrium) or 3592 cartridge. To display more cleaning cartridges, highlight the bottom item and press DOWN. To return to the previous list of cleaning cartridges, highlight the top item and press UP.

```
Cleaning Cartridge Usage        Panel 0220

CLN101JA      025      3592
CLNI02L1      020      LTO
CLNI03L1      015      LTO
CLNI04L1      010      LTO
CLN105JA      005      3592
CLN106JA      000      3592
CLNI07L1      000      LTO
CLN108JA      000      3592
CLNU09JA      000      3592
CLNU10L1      000      LTO

[BACK]   [ UP ]   [DOWN]
```

2. Press BACK until you return to the Activity screen.

Accessing vital product data for library components

This section introduces how to access vital product data (VPD) for the TS3500 tape library, its drives, or its node cards. It also introduces how to access the serial numbers of drives in the library.

Accessing vital product data for the library

Vital product data (VPD) for the TS3500 tape library includes the machine types, model numbers, and serial numbers of its frames, as well as the type of media each frame uses. To determine VPD for the library, use one of the following methods.

Using the Web to access Vital Product Data (VPD) for the library
About this task

To use the Tape Library Specialist Web interface to access VPD for the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Service —> Library VPD**. The Vital Product Data screen displays the machine type, model number, and serial numbers of each frame, as well as the type of media each frame uses.

Using the operator panel to access Vital Product Data (VPD) for the library
About this task

To use the operator panel to access VPD for the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Vital Product Data —> Library VPD —> ENTER**. The Library VPD screen displays. The screen lists the machine type, model number, and serial number for Frame 1. For libraries that use both LTO Ultrium and 3592 media, the Media Type field indicates the type of media used in the frame. To display the VPD for additional frames (if applicable), press DOWN. To return to a previous screen, press UP.

```
Library VPD              Panel 0301

Frame 1

  Machine Type:    3584
  Model:           L52
  Serial:          7810001
  Media Type:      LTO

[BACK]   [ UP ]   [DOWN]
```

2. Press BACK until you return to the Activity screen.

Accessing Vital Product Data (VPD) for drives in the library

The VPD for an Ultrium tape drive or 3592 tape drive in the TS3500 tape library includes the physical location of the drive, the SCSI Inquiry identification, and the version of firmware loaded. To determine VPD for a drive, use one of the following methods.

Using the Web to access Vital Product Data (VPD) for drives in the library
About this task

To use the Tape Library Specialist Web interface to access VPD for drives in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Service —> Drive VPD**. The Vital Product Data screen displays the location, SCSI Inquiry identification (drive type),

version of firmware, and serial number for each drive.

Using the operator panel to access Vital Product Data (VPD) for drives in the library
About this task

To use the operator panel to access VPD for drives in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Vital Product Data —> Drive VPD —> ENTER**. The Drive VPD screen displays. For each configured drive in Frame 1, the screen lists the physical location of the drive and its SCSI Inquiry identification (such as **ULT3580-TD5** for Ultrium 5 tape drives, **ULT3580-TD4** for Ultrium 4 tape drives, **ULT3580-TD3** for Ultrium 3 tape drives, **ULT3580-TD2** for Ultrium 2 tape drives, **ULT3580-TD1** for Ultrium 1 tape drives, **03592J1A** for the 3592 J1A, **03592E05** for the TS1120 tape drive, and **03592E06** for the TS1130 tape drive). It also gives the version of firmware loaded on each drive and whether the drive uses a SCSI LVD, SCSI HVD, or Fibre Channel (FC) interface. To display additional drives for Frame 1 and the VPD for the drives in other frames, press DOWN. To return to previous screens, press UP.

```
 Drive VPD                 Panel 0310

 Key: F=Frame, R=Row

 [F01,R01] ULT3580-TD4 1234 FC
 [F01,R02] ULT3580-TD3 1234 FC
 [F01,R03] ULT3580-TD1 1234 LVD
 [F01,R04] ULT3580-TD1 1234 FC
 [F01,R05] ULT3580-TD1 1234 FC
 [F01,R06] ULT3580-TD1 1234 FC
 [F01,R07] ULT3580-TD2 1234 FC
 [F01,R08] ULT3580-TD1 1234 HVD
 [F01,R09] ULT3580-TD1 1234 HVD
 [F02,R01] 03592J1A    1234 FC
 [F02,R02] 03592E05    1234 FC


 [BACK]  [ UP ]  [DOWN]
```

2. Press BACK until you return to the Activity screen.

Accessing vital product data for node cards in the library

Node cards are the four circuit boards (accessor controller card, motor driver assembly, and operator panel assembly) that communicate with each other. Depending on the type of frame and power structure that your library has, the fourth circuit board is for the Medium Changer Card pack (MCP) or the Medium Changer Assembly (MCA). Models L22, D22, L52, and D52 use the node card for the MCP; models L23, D23, L53, and D53 use the node card for the MCA. In a TS3500 tape library shuttle complex, an additional circuit board, the Shuttle Management Card (SMC), is used for communication with shuttle components.

Note: In order to support code level 9500 or higher, all node cards in the library must be xx3-equivalent node cards. For xx2 models, this requires a xx3 model conversion OR the Enhanced Node Card(s) feature (FC 1700 or 1701).

For the TS3500 tape library, node card VPD includes the part number and serial number of the card, as well as the version of firmware loaded and the number of the frame in which the card is located.

The part number of the node card indicates whether it is an enhanced node card or not. The part numbers in Table 22 are assigned to enhanced node cards.

Table 22. Part numbers for enhanced node cards

Enhanced node card	Part number
MCP+ (xx2 frames)	45E0071
MCC	95P3669
	23R7984
	23R7981
	95P2426
ACC	46X5961
	95P5525
	23R7181
	23R7979
	23R7830
	23R6191
MDA	95P8618
	23R7985
	23R7983
	95P1914
Operator panel	39U3468
	95P9241
	45E8955
	95P9035
	95P5530
	95P5056
	95P4715
	23R7986
	23R3683

To determine VPD for a node card, use one of the following methods.

Using the Web to access Vital Product Data (VPD) for node cards in the library
About this task

To use the Tape Library Specialist Web interface to access vital product data (VPD) for node cards in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Service —> Node Cards**. The Node Cards screen displays the location of the library's node cards and version of their software.

Using the operator panel to access Vital Product Data (VPD) for node cards in the library
About this task

To use the operator panel to access VPD for node cards in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Vital Product Data —> Node Card VPD —> ENTER**. The Node Card VPD screen displays for Frame 1. The screen shows the part number and serial number of the accessor controller card, as well as the level of firmware in the library.

```
Node Card VPD           Panel 0320

Frame 1:
 Accessor Controller Card

  Part Number:      1234567
  Serial Number:    YN100002W123
  Firmware Version: 4321

[BACK]  [ UP ]  [DOWN]
```

To view VPD for the motor driver assembly, Medium Changer card pack, and operator panel assembly in Frame 1, press UP. Continue to press UP to view the VPD for node cards in other frames. To return to previous screens, press UP.

Note: If the MCP node card is enabled for web use, the same screen displays but includes the version of the web (see the screen that follows). If `Mismatch` displays in the Web Version field, the web and the code card versions are not the same code versions. To access the web, reload the firmware or contact your IBM Service Representative.

```
Node Card VPD           Panel 0320

Frame 1:
 Accessor Controller Card

  Part Number:      1234567
  Serial Number:    YN100002W123
  Firmware Version: 4321
  Web Version:      4321

[BACK]  [ UP ]  [DOWN]
```

2. Press BACK until you return to the Activity screen.

Accessing vital product data for shuttle stations

Complete this task to access shuttle station vital product data (VPD).

About this task

To use the Tape Library Specialist web interface to access the VPD for shuttle stations in a TS3500 tape library shuttle complex, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library** > **Shuttle Stations**. The Shuttle Stations screen displays.
2. View the values in the Serial Number column and the VPD Info column.

Resetting the library control system

Complete this task to reset one or more node cards should the TS3500 tape library experience a hang state.

About this task

Attention: If you reset a node card, you could potentially lose data that is necessary for analyzing the problem.

Note: You can reset node cards by using the Tape Library Specialist Web interface, but not by using the operator panel.

To use the Web to reset node cards in the TS3500 tape library, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Service —> Node Cards**. The Node cards screen displays a list of the library's node cards.
2. Select one or more node cards that you want to reset.
3. From the Select Action drop-down box, select Reset Node Cards, then select Go. A confirmation message displays indicating that the cards have been reset.

   Note: A node card that is reset could take up to 3 minutes to return to active status on the Node Cards screen. To view the new status, select Refresh. If you reset the node card that is serving your Web connection, you will need to reconnect to the Web server after the card resets.
4. Select **Close**.

Accessing drive serial numbers
About this task

You can view the serial numbers of both LTO Ultrium and 3592 tape drives without opening the doors of the TS3500 tape library. This function is particularly useful for 3592 tape drives because these drives are tracked as separate machines with their own warranty or maintenance agreement (MA). By using this function and determining a drive's serial number, you can verify whether an MA exists for it. In addition, to save time the IBM Service Representative can use this function to see all of the serial numbers without opening all of the covers and can verify that a serial number was preserved correctly when a drive fails and must be replaced.

To access the drive serial number for an LTO Ultrium or 3592 tape drive in the TS3500 tape library, use one of the following methods.

Using the Web to access serial numbers of drives
About this task

To use the Tape Library Specialist Web interface to access the serial numbers of drives in the TS3500 tape library, perform the following steps:

Procedure

From the Work Items navigation pane, select **Service —> Drive VPD**. The Drive Vital Product Data screen displays the serial numbers (not the world wide names) of the drives in the TS3500 tape library.

Using the operator panel to access serial numbers of drives
About this task

To use the operator panel to access the serial numbers of the drives in the TS3500 tape library, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU —> Vital Product Data —> Drive Serial Numbers —> ENTER**. The Drive Serial Numbers screen displays. The screen gives the location of the LTO and 3592 tape drives in the library and their serial numbers.

```
Drive Serial Numbers            Panel 0311

Key: F=Frame, R=Row

[F01,R01]  JP002750
[F01,R02]  1310101156
[F01,R03]  1310100797
[F01,R04]  JP00001289
[F01,R05]  1310100772
[F02,R01]  0123456789AB0
[F01,R03]  0123456789AB1

[BACK]   [ UP ]   [DOWN]
```

   Press UP to view additional drive serial numbers. To return to previous screens, press UP.
2. Press BACK until you return to the Activity screen.

Accessing logs for the library

Complete this task to access logs for the library using the web.

Procedure

From the Work Items navigation pane, perform one of the following options:
- Select **Service —> View Library Error Log**. The Library Error Log screen displays. By default, only records from the last 24 hours are displayed. If there are no records within the last 24 hours, the library displays the next time period in which there is at least one record.

  Note: In a shuttle complex, the library also provides the option to access this log page from a critical status link on the shuttle stations page. When this occurs, only shuttle station records are displayed.

To view a specific time period or the entire library error log, complete the following steps:

1. Select a number of days or **None - Show All** from the Time Period menu and click **Filter**.

2. Wait while the page refreshes with all of the records for the selected time period. This can take a few seconds, many minutes, or longer depending on the number of records in the log.

To mark a record as inactive, complete the following steps.

Note: This option is only available when a shuttle station is present in the library.

1. Select the record(s) to be marked.

2. Select **Mark as Inactive** from the Select Action menu and click **Go**. The page redisplays and reflects the change(s) in the Active column.

To view record details, complete the following steps:

1. Select the record for which you want to obtain details. You can only select one record at a time.

2. Select **View Details** from the Select Action menu and click **Go**. A new window displays with detailed information.

3. View the record details. Click **Close** to close the details window or click the blue arrows to move forward or back one entry in the log.

- Select **Service —> Download Library Logs**. The Download Library Logs screen displays a list of devices and logs that you can download. They include event logs, servo logs, NVRAM event logs, Fatal Exception logs, and so forth.

  1. Select the log that you want to download

  2. Select Download. If you select `NVRAM Backup/Memory Dump`, the library attempts to get a snapshot of the current library configuration.

  3. Specify the directory to which you want to download the log.

  4. Select Save.

Accessing enhanced data gathering and reporting files

The topics in this section introduce four enhanced methods by which the TS3500 tape library gathers data and reports files.

The TS3500 tape library can access physical and logical library statistics, mount history, drive statistics, and port statistics. Data is available from 3592 tape drive, as well as from the Ultrium 2 and newer tape drives. Data is not available from the Ultrium 1 Tape Drive.

The sections that follow describe how to download each category of data.

Accessing the mount history of tape cartridges

This section describes how to obtain the Mount History log, which gives the mount history of one or more cartridges in the TS3500 tape library. It also describes how to access information from the customer-centric Statistical Analysis and Reporting System (ccSARS). The ccSARS information is available for Ultrium 4 tape drives, TS1120 tape drives at firmware level 16E4 or later, and newer Ultrium and 3592 tape drives.

About this task

The Mount History log displays a list of cartridges in descending order, starting with the most recently demounted cartridge and going back.

To access the mount history for one or more cartridges and to access ccSARS data for tape drives, use the following method:

Procedure

1. From the Work Items navigation pane, select **Cartridges—> Data Cartridges**. The Cartridges screen displays.

   Note: You may need to flush your browser and turn off browser caching in order to capture and download ccSARS data.
2. Select the Mount History (.csv) link. The File Download prompt displays.
3. Select Save.
4. Specify the directory to which the log is to download. If you have problems downloading the .csv file, associate it with Microsoft Excel or Lotus 1-2-3 in Windows.
5. Select Save.

What to do next

Note: For an explanation of each field provided in the log, refer to the Help link on the Data Cartridges screen.

Accessing statistics about drives

This section describes how to obtain the Drive Statistics file, which contains statistics about drives in the TS3500 tape library.

About this task

The Drive Statistics file displays data about the drives that have resided in the library since the date and time in the first row of the file. The data is captured whenever you reset the library or a node card, or when you update the library's firmware.

To access statistics about the drives, use the following method:

Procedure

1. From the Work Items navigation pane, select **Drives—> Drive Summary**. The Drives screen displays.
2. Select the DOWNLOAD: Drive Statistics (.csv) link. The File Download prompt displays.
3. Select Save. If you have problems downloading the .csv file, associate it with Microsoft Excel or Lotus 1-2-3 in Windows.
4. Specify the directory to which the file is to download.
5. Select Save.

What to do next

Note: For an explanation of each field provided in the log, refer to the Help link on the Drives Summary screen.

Accessing port statistics for drives

This section describes how to obtain the Fibre Port Statistics file, which contains statistics about Fibre Channel drives in the TS3500 tape library.

About this task

The Fibre Port Statistics file displays data about the Fibre Channel drives that have resided in the library since the date and time in the first row of the file.

To access statistics about the drives, use the following method:

Procedure

1. From the Work Items navigation pane, select **Ports—> Fibre Channel Summary**. The Fibre Channel Summary screen displays.
2. Select the `Fibre Port Statistics (.csv)` link. The File Download prompt displays.
3. Select Save.
4. Specify the directory to which the file is to download. If you have problems downloading the .csv file, associate it with Microsoft Excel or Lotus 1-2-3 in Windows.
5. Select Save.

What to do next

Note: For an explanation of each field provided in the log, refer to the Help link on the Fibre Channel Summary screen.

Accessing statistics about the library

This section describes how to obtain the Library Statistics file, which contains statistics about the physical TS3500 tape library, as well as its logical libraries.

About this task

Note: This function is only available for Models L23 and L53.

Library statistics can help you determine the efficiency of your logical library partitions, particularly if some logical libraries are used more heavily than others. Information from the statistics can help you decide whether to re-partition your library to increase performance. For both the physical library and its logical libraries you can download the Library Statistics file.

To access statistics about the library, use the following method:

Procedure

1. From the Work Items navigation pane, select **Library—> Logical Libraries**. The Manage Logical Libraries screen displays.
2. Select the `Library Statistics (.csv)` link. The File Download prompt displays.
3. Select Save.
4. Specify the directory to which the file is to download. If you have problems downloading the .csv file, associate it with Microsoft Excel or Lotus 1-2-3 in Windows.

5. Select Save.

What to do next

Note: For an explanation of each field provided in the log, refer to the <u>Help</u> link on the Manage Logical Libraries screen.

Viewing the library error log

Complete this task to view the library error log for the TS3500 tape library.

About this task

This page displays the error log for the library. By default, only records from the last 24 hours are displayed. If there are no records within the last 24 hours, the library displays the next time period in which there is at least one record. In order to view additional records, you can override the default by selecting a number of days, or show all, from the Time Period menu.

Note: In a shuttle complex, the library also provides the option to access this log page from a critical status link on the shuttle stations page. When this occurs, only shuttle station records are displayed.

Procedure

1. From the Work Items navigation pane, select **Service** > **View Library Error Log**. The Library Error Log screen displays.
2. To mark a record as inactive, complete the following substeps:

   Note: This option is only available when a shuttle station is present in the library.
   a. Select the record(s) to be marked.
   b. Select **Mark as Inactive** from the Select Action menu and click **Go**. The page redisplays and reflects the change(s) in the Active column.
3. To view record details, complete the following substeps:
   a. Select the record for which you want to obtain details. You can only select one record at a time.
   b. Select **View Details** from the Select Action menu and click **Go**. A new window displays with detailed information.
   c. View the record details. Click **Close** to close the details window or click the blue arrows to move forward or back one entry in the log.
4. To view logs for a certain time period, or to view the entire library error log, complete the following substeps:
   a. Select a time period or **None - Show All** from the Time Period menu and click **Filter**.
   b. Wait while the page refreshes with all of the records for the selected time period. This can take a few seconds, many minutes, or longer depending on the number of records in the selected period.

What to do next

For an explanation of each field provided in the log, refer to the <u>Help</u> link on the View Library Error Log screen.

Updating firmware for the library

This section introduces ways to update library firmware for the TS3500 tape library.

The TS3500 tape library offers a nondisruptive library firmware update, that is the ability to update library firmware without scheduling downtime and without interrupting job flow or reducing productivity. An IBM service representative can perform the update by using the CETool software application, or you can perform the update from the web. Certain levels of library and drive firmware are required. Table 23 shows the levels of firmware that are necessary for a nondisruptive library firmware update.

Note: It is recommended that all libraries in a TS3500 tape library shuttle complex are nominally at the same firmware level. However, in an installed complex it is possible to non-disruptively update one library at a time.

The TS3500 tape library firmware upgrade is generally performed by IBM. However, for some customer-initiated requests, the upgrade is the responsibility of the customer. Table 24 on page 221 lists some potential upgrade scenarios and the responsible party. It is recommended that you contact your IBM service representative with any questions regarding a specific scenario, who is responsible for the upgrade, and if there is, or is not, a charge.

Table 23. Minimum levels of library and drive firmware required for nondisruptive library firmware updates

Device[1]	Level of Firmware
3584 tape library	6050
Ultrium 7 tape drive	All Levels[2]
Ultrium 6 tape drive	All Levels
Ultrium 5 tape drive	All Levels
Ultrium 4 tape drive	All Levels
Ultrium 3 Tape Drive	62R0
Ultrium 2 tape drive	6750
TS1150 tape drive	All Levels
TS1140 tape drive	All Levels
TS1130 tape drive	All Levels
TS1120 tape drive	16E4
3592 J1A tape drive	0828
Note:	
1. The nondisruptive library firmware update is not applicable when a control path drive is an Ultrium 1 tape drive.	
2. Model x32 frames do not support LTO 7.	

Table 24. Library firmware upgrade scenarios

Upgrade scenario		Responsible party
If library code is updated as part of:	Installation of a chargeable feature	IBM
	Installation of nonchargeable feature	Customer (or customer can order FC 0500)
	Fixing a field issue	IBM
	Recommendation from IBM	IBM
	Customer initiative to upgrade code level	Customer (or customer can order FC 0500)

Using the web to update library firmware

About this task

The TS3500 tape library offers a nondisruptive library firmware update, that is the ability to update library firmware without scheduling downtime and without interrupting job flow or reducing productivity. An IBM service representative can perform the update by using the CETool software application, or you can perform the update from the web. Refer to "Updating firmware for the library" on page 220 in order to review the levels of library and drive firmware that are required for nondisruptive updates.

Note: It is recommended that all libraries in a TS3500 tape library shuttle complex are nominally at the same firmware level. However, in an installed complex it is possible to non-disruptively update one library at a time.

To update library firmware by using the web, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Service** > **Firmware Update**. The Firmware Update screen displays.
2. Follow the instructions on the screen to identify, download (from the Internet), and install the current firmware image for the library.

What to do next

You can also use the following method to update library firmware:
1. Go to http://www.ibm.com/support/fixcentral .
2. Select **System Storage** from the Hardware section of the Product Group menu.
3. Select **Tape systems** from the System Storage menu.
4. Select **Tape autoloaders and libraries** from the Tape Systems menu.
5. Select **TS3500 Tape Library** from the Tape autoloaders and libraries menu and click **Continue**. The Select fixes page displays.
6. Select the correct microcode level, sign in with your IBM ID and password, and follow the instructions on the screen.

Using a device driver to update library firmware from the host

To update TS3500 tape library firmware from the host by using a device driver, refer to the instructions in the *IBM Ultrium Device Drivers Installation and User's Guide*.

Using other methods to update library firmware

Besides using the Web or the host, other methods exist for updating TS3500 tape library firmware. For more information, contact your IBM Service Representative.

Accessing logs for drives or saving a drive dump

This section describes how to access logs for drives in the TS3500 tape library and how to save those drive dumps.

About this task

Note: You can access logs for drives in the TS3500 tape library or save those drive dumps by using the Tape Library Specialist Web interface but not through the library's operator panel.

To access logs for Ultrium or 3592 tape drives, or to save those drive dumps, use the following method:

Procedure

1. Ensure that the drive that you want to access is not in operation (that is, no host applications are using the drive). If the drive is operating and you attempt to download its logs, a drive error will occur.
2. From the Work Items navigation pane, select **Service —> Download Drive Logs**. The Download Drive Logs screen displays.
3. Select the drive that you want.
4. To obtain a drive log, specify the directory to contain the log, then select **Download**.
5. Select **Save**.

   Attention: In some instances it may be necessary to first obtain and save a drive dump. If this action is needed, chose the correct drive at the Download Drive Logs screen and then select **Stop Drive and Preserve Logs**. A window will appear to confirm that you want to proceed. Select **OK** to continue. After a message window verifies this action is complete, return to step 5 and continue with the download procedure.

   Note: The **Stop Drive and Preserve Logs** function is not supported on Ultrium 1 or Ultrium 2 drives.

Viewing a drive error log

This section describes how to view one or more error logs for tape drives in the TS3500 tape library. You can view logs for 3592 or Ultrium tape drives.

About this task

To view a drive error log, use the following method:

Procedure

1. From the Work Items navigation pane, select **Service —> View Drive Error Log**. The Drive Error Log screen displays.
2. From the Select a Drive drop-down box, select the name of the drive that you want and select Go. The Drive Error Log screen redisplays the current error log.

3. In the **<– Log x of y –>** field (where x equals the number of the current log entry and y equals the number of log entries) specify the number of the log entry that you want to view by selecting an arrow (the left arrow decrements the log entry number; the right arrow increments the log entry number). You may also enter the log entry number in the empty field and select Go. The log entry displays. Fields in the log vary depending on the type of drive that you specified (LTO Ultrium or 3592), fields in the log vary.

What to do next

Note: Select <u>Help</u> in the upper right corner of the screen to view a list of the fields in this log and their definitions.

Updating drive firmware

This section introduces ways to update firmware for tape drives in the TS3500 tape library.

For drives in the TS3500 tape library, you can copy firmware for like drive types from a firmware image. To update firmware for LTO Ultrium or 3592 tape drives, use one of the following methods.

Using the Web to update drive firmware
About this task

In the past, a firmware update to a drive that was performed through the library was disruptive to the host server; the operator had to stop host jobs that were queued to the drive and take the drive offline. The library now provides two nondisruptive options for updating drive firmware: **Activate on Drive Reset** and **Activate When Drive is Empty**. These options do not impact the host if they are used when the drive is not busy.

To use the Tape Library Specialist Web interface to update firmware for drives in the TS3500 tape library, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Service —> Firmware Update**. The Firmware Update screen displays.
2. Select the Launch Firmware Update Wizard, then select the choice to update a drive. The Specify Firmware Image File screen displays.
3. Select one or all drives to update, then select one of the following Firmware Activation options.

   Notes:
   a. Only the **Activate Immediately** option is available to the Ultrium 1 tape drive.
   b. Use the **Activate on Drive Reset** option for Control Path drives. The **Activate When Drive is Empty** option is not supported for Control Path drives.

Option	Description
Activate Immediately	Loads the drive code as soon as it completes downloading. Only **Activate When Drive is Empty** and **Activate on Drive Reset** can be performed non-disruptively.
Activate When Drive is Empty	Loads the drive code after the drive is unloaded and the cartridge is removed from the drive, or when the drive is empty. **Note:** This option is not used for Control Path drives. Control Path drives require **Activate on Drive Reset** (potentially disruptive) where the drive requires a manual power-on reset.
Activate on Drive Reset	Loads the drive code after the drive goes through a power-on reset. You can manually reset the drive at any convenient time, when the drive is idle, ensuring that the reset is non-disruptive. **Note:** This option is the default for Control Path drives.

4. Select Update.

Using a device driver to update drive firmware from the host

For the TS3500 tape library, to update drive firmware from the host by using a device driver refer to the instructions in the *IBM Ultrium Device Drivers Installation and User's Guide*.

Using other methods to update drive firmware in the TS3500 tape library

Besides using the Web or the host, other methods exist for updating drive firmware in the TS3500 tape library. For more information, contact your IBM Service Representative.

Adjusting the scanner speed

This section gives instructions for adjusting the speed at which the scanner, a laser device in the TS3500 tape library, reads bar code labels.

About this task

Note: If you suspect that the library is having problems reading the bar code labels, you can slow the scanner speed as part of problem determination. You may choose to slow the scanner speed rather than replace all labels, or you may want to slow the scanner speed while you wait for an opportunity to relabel the media. Depending on the severity of the problem, the error recovery procedure (ERP) for poor labels may greatly exceed the time lost by slowing the scanner. If you have cartridge bar code labels that meet the LTO bar code label specification, there is no need to slow the scanner speed.

To adjust the scanner speed of the TS3500 tape library, use the following method:

Procedure

1. From the Work Items navigation pane, select **Service—> Scanner Speed**. The Adjust Scanner Speed screen displays.

2. From the drop-down box, select the percentage of the normal speed that you want.

3. From the Select Action drop-down box, select Apply. Then, select Go.

Performing a remote drive power cycle

This section describes how to conduct a power cycle on the TS3500 tape library from a remote location.

About this task

Note: This function is available only through the Tape Library Specialist Web interface; it is not available through the operator panel.

On occasion, a drive in the TS3500 tape library may experience an error. Errors are represented by the message `Not Responding` and by error indicators in the Status column of the Drives screen. For intermittent, non-hardware problems (such as a drive hang), you can use the Tape Library Specialist Web interface to cycle power to the drive (turn it off, then on) from a remote location. The remote power cycle feature resets the drive.

To perform a remote power cycle, use the following steps:

Procedure

1. Ensure that the drive to which you want to apply the power cycle is not currently operating (if you cycle power to a drive that contains a cartridge, the rewind time may be of extended duration).

2. From the Work Items navigation pane, select **Drives —> Drive Summary**. The Drives screen displays.

3. Select the drive that you want, then from the Select Action drop-down box, select Power Cycle, then select Go. Select Refresh to redisplay the Drives screen and to return the status to Online.

Setting up and using encryption

This section introduces how to set up encryption and perform encryption-related tasks.

Attention: There is no recovery for lost encryption keys.

To set up and use encryption in your TS3500 tape library, perform the following tasks. The sections that follow give instructions for each task.

Notes:

- In the Tape Storage environment, the encryption function on tape drives (desktop, stand alone and within libraries) is configured and managed by the customer and the not the IBM Systems Services Representative (SSR). In some instances, the SSR is required to enable encryption at a hardware level when service access or service password controlled access is required. Customer setup support is by Field Technical Sales Specialist (FTSS), customer documentation,

and software support for encryption software problems. Customer " how to" support is also provided via support line contract.

- FC 1604, Transparent LTO Encryption, is a customer-setup unit (CSU) that is required in order to enable encryption on LTO Ultrium 4 and newer Ultrium tape drives if using LME or SME. For instructions on how to install or remove this feature, refer to "Managing licensed features" on page 156.
- When using LME with Ultrium 5 tape drives, the Tivoli Key Lifecycle Manager (TKLM) is required as the key manager.

1. **Set up to four key manager addresses.** (For library-managed encryption only.) A key manager is a software application that manages one or more encryption keys. A key manager address is the IP address of any key manager. For instructions, see "Working with key manager addresses" on page 227.

2. **Test the key manager addresses.** (For library-managed encryption only.) You can ping each key manager IP address to determine if communication is established. For instructions, see "Testing a key manager address" on page 228.

3. **Enable your encryption-capable tape drives.** To do so, select your preferred method of encryption management for the drives that you want to perform encryption. You can choose from among three methods. For instructions, see "Setting or changing a drive's method of encryption." If you select the application-managed method for your drives, no further steps are necessary. The drives are ready to perform encryption.

4. If you select library-managed encryption, you will need to choose between barcode encryption policy or internal label encryption policy:

   Note: 'Internal Label' selections are only used for Symantec's Veritas NetBackup™ or the EMC Legato NetWorker™.

   - **Set up one or more barcode encryption policies.** (Optional and for barcode encryption policy only.) A barcode encryption policy identifies to a 3592 E05, Ultrium 4, or newer tape drive which range of scratch cartridges will be encrypted. For instructions, see "Working with a barcode encryption policy" on page 231.
   - **Set up internal label encryption policies.** (Optional and for internal label encryption policy only.) When you use one of the Internal Label encryption policy options (Selective Encryption or Encrypt All), you optionally set up key label mapping. For instructions, see "Mapping encrypted cartridge key labels" on page 233.

Other encryption-related functions are available. To determine a drive's encryption method, see "Viewing a drive's method of encryption" on page 234. To learn if the data on a cartridge is encrypted, see "Determining whether a cartridge is encrypted" on page 235. To rekey a cartridge for extra protection or for reuse, see "Rekeying an encrypted cartridge" on page 236.

Setting or changing a drive's method of encryption

This section describes how to set or change the encryption method for encryption-capable tape drives.

About this task

Ensure that you have installed your key manager software before performing this procedure. Note that you can set or change a drive's method of encryption by using the Tape Library Specialist Web interface but not by using the operator panel.

To set or change the encryption method for each 3592 E05, Ultrium 4, or newer tape drive, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library—> Logical Libraries**. The Manage Logical Libraries screen displays. For each logical library, the Encryption Method column indicates whether encryption is `Library-Managed`, `Application-Managed`, `System-Managed`, is assigned no method (`None`), or is unable to be set to encryption (`N/A`).

2. To set or change a drive's method of encryption, select the check box of the logical library to which the drive belongs. If you select multiple logical libraries with dissimilar encryption methods, the Encryption Method field displays `Mixed` and no changes can be made.

3. From the Select Action drop-down box, select `Modify Encryption Method` and select Go. The Modify Encryption Method pop-up window displays.

4. In the Encryption Method field, select the type that you want.

   Note: If you select the system-managed method when using TS1120 tape drives, the screen displays the installed TS1120 tape drives and indicates whether they are encryption-capable. Select the encryption-capable drives that you want to become encryption-enabled, then select Apply.

5. If the encryption method is Library Managed Encryption, the Encryption Policy selections are:
   - Barcode (Default)
   - Internal Label - Selective Encryption
   - Internal Label - Encrypt All

   Notes:
   - 'Internal Label' selections are only used for Symantec's Veritas NetBackup or the EMC Legato NetWorker.
   - The default setting of the library-managed encryption method is to encrypt all cartridges in a logical partition.
   - When using LME with Ultrium 5 tape drives, the Tivoli Key Lifecycle Manager is required as the key manager.

What to do next

Advanced Encryption Settings: The purpose of Advanced Encryption Settings is to allow only IBM Support personnel (under the direction of the drive development team) to provide a solution to an unforeseen problem or to support a unique configuration. This option is not intended for the customer to use without the guidance of IBM Support.

Working with key manager addresses

This section describes how to set one or more key manager addresses. It also gives procedures for creating, modifying, or deleting a key manager address.

About this task

Note: You can create, modify, or delete a key manager address by using the Tape Library Specialist Web interface but not by using the operator panel. You can test a key manager address by using both the Web and the operator panel.

A key manager is a software application that manages one or more secret encryption keys. A key manager address is the IP address of a server that has one or more encryption key managers.

Procedure

1. From the Work Items navigation pane, select **Access—> Key Manager Addresses**. The Key Manager Addresses screen displays.

2. Perform one of the following actions:

   - **To create a key manager address:**
     a. Select **Create** from the Select Action drop-down menu. Then, select **Go**. The Key Manager Create screen displays.
     b. Select a logical library or All/Other Logical Libraries from the Logical Library drop-down menu.
     c. Enter the IP address and port of the key manager. Then, select **OK**.

   - **To change a key manager address:**
     a. Select the key manager address that you want to change. Select **Modify** from the Select Action drop-down menu. Then, select **Go**. The Key Manager Modify screen displays.
     b. Enter any necessary changes in the IP Address or Port fields. Then, select **OK**.

   - **To delete a key manager address:**
     a. Select the key manager address that you want to delete. From the Select Action drop-down menu, select **Delete**. Then, select **Go**.
     b. Select **OK** when the screen displays the message: **Are you sure you want to delete this key manager entry?**
     c. Select **Close** after a pop-up window confirms the deletion.

   - **To ping a key manager address:** Follow the procedure in "Testing a key manager address."

Testing a key manager address

This section introduces how to test the address of an encryption key manager. It also introduces two procedures for testing the key path and setup between an encryption-enabled tape drive and the encryption key manager.

A key manager is a software application that manages one or more secret encryption keys. A key manager address is the IP address of a server that has one or more encryption key managers.

On the Web, the test of a key manager address is known as a *ping*. To test the address of a key manager or the path between a drive and a key manager, using the Web, refer to "Using the Web to ping a key manager address."

To perform the key path diagnostics four-part test using the Web, refer to "Using the web to run key path diagnostics" on page 229.

Using the Web to ping a key manager address
About this task

To use the Tape Library Specialist Web interface to ping a key manager address, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Access —> Key Manager Addresses**. The Key Manager Addresses screen displays.
2. Select the key manager address that you want to ping.
3. From the Select Action drop-down box select Ping Address, then select Go. The library performs the ping and the screen displays a status message.
4. Select Close.

Using the web to run key path diagnostics

Complete this task to use the web to run diagnostic tests on encryption-capable drives in the TS3500 tape library.

Before you begin

Before you begin, ensure that all encryption-enabled tape drives (LTO Ultrium and 3592) in library-managed encryption (LME) logical libraries are empty prior to starting the key path diagnostics. The tests can fail if the tape drives contain cartridges when the tests begin.

About this task

The key path diagnostics consist of four tests for each drive: the drive test, the Ethernet test, the EKM path test, and the EKM configuration test. Each test is performed for each drive until all drives are tested. If the drive test fails for a specific drive, the remaining tests for that drive also fail even if they were not specifically tested. If the Ethernet test fails, the remaining tests continue.

To run diagnostic tests on encryption capable drives, perform the following steps from the TS3500 Tape Library Specialist web interface:

Procedure

1. From the Work Items navigation pane, select **Service** > **Key Path Diagnostics**. The Key Path Diagnostics screen displays.
2. Select a logical library.
3. Select **Start Tests** from the Select Action dropdown menu and click **Go**. The Key Path Diagnostics screen redisplays with diagnostic test results.

Using the operator panel to test the encryption key path and setup
Before you begin

Before you begin, ensure that all encryption-enabled tape drives (LTO Ultrium and 3592) in library-managed encryption (LME) logical libraries are empty prior to starting the key path diagnostics. The tests can fail if the tape drives contain cartridges when the tests begin.

About this task

To test the path and the setup of the 3592 E05, Ultrium 4 (second screen in the following procedure), or later tape drives and the encryption key manager, perform the following steps:

Procedure

1. From the library's Activity touchscreen, press **MENU** > **Service** > **Tests/Tools** > **Diagnostics** > **Test Encryption Key Path/Setup** > **ENTER**. The Test Encryption Key Path/Setup screen displays.

   Results for a TS1120 tape drive:

   ```
   Test Encryption Key Path/Setup            Panel 1070

   Key: F=Frame, R=Row

   Drive [F01,R03]  J2
   Drive [F01,R04]  J2
   Drive [F01,R05]  J2
   Drive [F02,R01]  J2
   Drive [F02,R02]  J2

   [BACK]   [ UP ]   [DOWN]    [ENTER]
   ```

   Results for a TS1040 (LTO Ultrium 4) Drive

   ```
   Test Encryption Key Path/Setup            Panel 1070

   Key: F=Frame, R=Row

   Drive [F01,R03]  L4
   Drive [F01,R04]  L4
   Drive [F01,R05]  L4
   Drive [F02,R01]  L4
   Drive [F02,R02]  L4

   [BACK]   [ UP ]   [DOWN]    [ENTER]
   ```

2. Press UP or DOWN to highlight the drive that you want to test, then press ENTER. The Test Encryption Key Path/Setup screen displays and automatically begins the following tests. If a test fails, see "Resolve errors with the library and the installed tape drives" on page 293.

   Ethernet
   > A diagnostic test that pings the EKM's IP address where the selected drive is registered. The library can ping up to four IP addresses. If successful, the screen displays Passed which means that the target server can be reached. If unsuccessful, the screen displays Failed. If at least one test passes, the testing continues; if all the tests fail, EKM Path and EKM Configuration will not run and ENTER displays.

   EKM Path
   > A diagnostic test that establishes a link to an encryption key manager. The test ensures that the communication path between the drive and the EKM (including the proxy server) is working. If successful, the screen displays Passed; if unsuccessful, it displays Failed. If EKM Path fails, EKM Configuration will not run and ENTER displays.

   EKM Configuration
   > A diagnostic test that establishes a link to a encryption key manager and requests a default key which ensures that the drive has been correctly installed and is able to service key requests.

   The following screen shows sample results of the three types of tests.

```
Test Encryption Key Path/Setup


Drive [F01,R03] J2

Ethernet
9.11.203.115    Passed
      684D:1111:2222:
   3333:4444:5555:
   6:77        Failed

9.11.203.117    Passed

EKM Path
9.11.203.115    Passed
9.11.203.117    Passed

EKM Configuration
9.11.203.115    Failed
9.11.203.117    Testing...


     [ UP ] [DOWN]            [ENTER]
```

> **Note:** With the longer IP address used for IPv6 the test results may not fit on one screen. If this occurs, the screen will start scrolling down as each new line is added. When the test is completed the UP and DOWN buttons will be displayed to allow the user to view the entire test results. The UP/DOWN buttons will only be displayed when they are valid options.

3. Press ENTER to return to the Test Encryption Key Path/Setup screen.

Working with a barcode encryption policy

This section defines a barcode encryption policy. It gives procedures for creating, modifying, or deleting a policy.

About this task

Note:
- You can create, modify, or delete a barcode encryption policy by using the Tape Library Specialist Web interface but not by using the operator panel.
- If your logical libraries are set to library-managed encryption, you use the default All/Other Volsers policy, or you can set the VOLSER ranges that will control encryption in all library-managed logical libraries.
- A Barcode Encryption Policy is only required if you have selected Library Managed Encryption with a Barcode Encryption Policy.

A barcode encryption policy allows the TS3500 tape library to identify to a 3592 E05, Ultrium 4, or newer tape drive which scratch cartridges will be encrypted on the next attempt to write from the beginning of the tape. A scratch cartridge is a labeled cartridge that is blank or contains no valid data, that is not currently defined, and that is available for use. A barcode encryption policy specifies what scratch cartridges to encrypt; it does not indicate which cartridges are currently encrypted. The maximum allowed barcode encryption policies is 300 for the entire TS3500 tape library.

When you create or change a barcode encryption policy, you must specify values according to the following criteria for these fields:

Key Label

An alias for the key material managed by the encryption key manager. The label and it's associated key(s) must be pre-generated at the encryption key manager.

- For the TS1130 tape drive and the TS1120 tape drive, the key label is an alias for the public/private wrapping key (wrapped key model). The TS1130 tape drive and TS1120 tape drive require two key labels.
- For the TS1040 (LTO Ultrium 4) and newer Ultrium tape drives, the key label is an alias for the symmetric data key (direct key model). TS1040 tape drives require one key label.

Key Mode

A key mode is the method by which a key manager identifies the public/private keys that were used to encrypt a data key. For each key label, you are also asked for a key mode.

- Choices for the TS1130 tape drive and TS1120 tape drive key mode are:
  - `Wrapped-Default` (The label was configured at the encryption key manager and the key label field is left blank).
  - `Wrapped-Clear` (The externally encoded data key (EEDK) is referenced by the specified key label. The key label field specifies a wrapping key).
  - `Wrapped-Hash` (The EEDK is referenced by a computer value which corresponds to the public key that is referenced by the specified key label. The key label field specifies a wrapping key).
- Choices for the TS1040 (LTO Ultrium 4) and newer Ultrium tape drives key mode are:
  - `Direct-Default Set` (the label was configured at the encryption key manager and the key label field is left blank)
  - `Direct-Specific` (the key label field specifies a symmetric data key)

To create, change, or delete a barcode encryption policy for a logical library, perform the following steps from the TS3500 Tape Library Specialist Web interface:

Procedure

1. From the Work Items navigation pane, select **Cartridges** > **Barcode Encryption Policy**. The Barcode Encryption Policy screen displays.
2. Perform one of the following actions:
   - **To create a barcode encryption policy:**
     a. From the Select Action menu, choose **Create**, then click **Go**. The Barcode Encryption Policy pop-up window displays.
     b. Select **Set All/Other Volsers** or enter the volume serial (VOLSER) numbers that begin and end the range of cartridges to be in the policy.
     c. Enter the key label(s) and key mode(s) for each.
        - For TS1120 and later 3592 tape drives, enter two key labels. Choices for key mode are `Wrapped-Default`, `Wrapped-Clear`, or `Wrapped-Hash`.
        - For TS1040 (LTO Ultrium 4) and later Ultrium tape drives, enter one key label. Choices for key mode are `Direct-Default Set` or `Direct-Specific.`
   - **To change a barcode encryption policy:**
     a. Select the VOLSER range of the policy that you want to change.

b. From the Select Action menu, select **Modify**, then click **Go**. The Barcode Encryption Policy pop-up window displays.

c. Enter your changes and click **Apply**. The screen redisplays with the changes.

- **To delete a barcode encryption policy:**

a. Select **All/Other Volsers** or select the VOLSER range of the policy that you want to delete.

b. From the Select Action menu, select **Delete**, then click **Go**. The library displays the message **Are you sure you want to remove the volume serial range?**

c. Click **OK**. The Barcode Encryption Policy screen redisplays with the barcode encryption policy removed. If only one barcode encryption policy exists, the library does not allow you to delete it.

Mapping encrypted cartridge key labels

This section describes how to create, change, or delete mappings from the cartridge key labels constructed by an encryption-enabled tape drive and stored on an encrypted tape cartridge, to the labels for the required key-encrypting keys in the key manager keystore.

About this task

The key label is an alias for the key material managed by the encryption key manager. The label and it's associated key(s) must be pre-generated at the encryption key manager.

Notes:
- You should only use the Key Label Mapping function for logical libraries using library-managed encryption by one of the two internal label mapping options (Selective Encryption or Encrypt All). Do not use Key Label Mapping for logical libraries using library-managed encryption by cartridge barcode. See "Setting or changing a drive's method of encryption" on page 226.
- 'Internal Label' selections are only used for Symantec's Veritas NetBackup or the EMC Legato NetWorker.

To create, modify, or delete encrypted key label mapping, perform the following steps:

Procedure
1. From the Work Items navigation pane, select **Cartridges—> Key Label Mapping**. The Key Label Mapping screen displays.
2. If you are modifying or deleting an existing key label mapping, select the Key Label Mapping.
3. From the Select Action drop-down box, select one of the following, then select Go.
   - **Create:** to create a new key label mapping (see Step 6.)
   - **Modify:** to change an existing key label mapping (see Step 6.)
   - **Delete:** to remove an existing key label mapping. After you select Go, a window displays asking you to confirm the deletion. Select OK, then, after receiving a confirmation message, close the window.
4. If creating or modifying the key label mapping, specify the mapping by entering values in the following fields:

- **Map from Key Label** Enter the key label(s) to map from. A key label is an alias for the key (cipher). It is used by the encryption key manager software. You can use the `previously selected key labels` drop-down list to quickly find a previously selected key label.
  - For TS1130 and TS1120 tape drives, two key labels are used. Use one of these methods to select the key labels:
    - Enter the two labels in `Key Label 1` and `Key Label 2`.
    - From each of the drop-down boxes titled `previously selected key labels`, select an existing key label.
  - For TS1040 (LTO Ultrium) and newer Ultrium tape drives, one key label is used. Use one of these methods to select the key label:
    - Enter the label in `Key Label`.
    - From the drop-down box titled `previously selected key labels`, select an existing key label.
- **Map to Key Mode** From the drop-down boxes beside the Map to Key Mode field(s), select the key mode to map to for each key label.
  - Choices for the TS1130 tape drive and TS1120 tape drive `Key Mode 1` and `Key Mode 2` are:
    - `Wrapped-Default` (The label was configured at the encryption key manager and the key label field is left blank).
    - `Wrapped-Clear` (The externally encoded data key (EEDK) is referenced by the specified key label. The key label field specifies a wrapping key).
    - `Wrapped-Hash` (The EEDK is referenced by a computer value which corresponds to the public key that is referenced by the specified key label. The key label field specifies a wrapping key).
  - Choices for the TS1040 (Ultrium 4) and newer Ultrium tape drive `Key Mode` are:
    - `Direct-Default Set` (the label was configured at the encryption key manager and the key label field is left blank)
    - `Direct-Specific` (the key label field specifies a symmetric data key)
- **Map to Key Label:** Enter the key label(s) to map to. For TS1130 and TS1120 tape drives, enter two key labels. For TS1040 (LTO Ultrium 4) and newer Ultrium tape drives enter one key label.
5. Select Apply. The Library displays a message that the requested policy or mapping change is complete. Select Close.

Viewing a drive's method of encryption

This section describes how to determine the encryption method used by an encryption-enabled tape drive.

About this task

Note: You can view a drive's method of encryption by using the Tape Library Specialist Web interface, but not by using the operator panel.

To view the encryption method for each encryption-enabled tape drive, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Library—> Logical Libraries**. The Manage Logical Libraries screen displays. For each logical library, the

Encryption Method column indicates whether encryption is `Library-Managed`, `Application-Managed`, `System-Managed`, is assigned no method (`None`), or is unable to be set to encryption (`N/A`).

2. To view a drive's method of encryption, select the check box of the logical library to which the drive belongs.

3. From the Select Action drop-down box, select `View Encryption Method`, and select Go. The View Encryption Method pop-up window displays.

4. Locate the entry in the Encryption Method field. To return to the previous screen, select Cancel.

5. If the encryption method is Library Managed Encryption, the Encryption Policy selections are:
   - Barcode (Default)
   - Internal Label - Selective Encryption
   - Internal Label - Encrypt All

   Note: 'Internal Label' selections are only used for Symantec's Veritas NetBackup or the EMC Legato NetWorker.

What to do next

<u>Advanced Encryption Settings</u>: The purpose of Advanced Encryption Settings is to allow only IBM Support personnel (under the direction of the drive development team) to provide a solution to an unforeseen problem or to support a unique configuration. This option is not intended for the customer to use without the guidance of IBM Support.

Determining whether a cartridge is encrypted

This section describes how to determine if the data on the tape cartridge is encrypted.

About this task

Note: You can find out whether a cartridge contains encrypted data by using the Tape Library Specialist web interface but not by using the operator panel.

To determine whether a cartridge is encrypted, perform the following steps:

Procedure

1. From the Work Items navigation pane, select **Cartridges** > **Data Cartridges**. The Cartridges screen displays.

2. Select a frame from the All Frames menu or select a logical library from the All Libraries menu.

3. Then select how you want the cartridges to be sorted from the Sort By menu and click **Search**. The page refreshes and displays a list of VOLSER ranges as links in the upper right. It also displays information about each cartridge in the library.

   Note: If there is at least one encrypted cartridge in the VOLSER range that is being displayed, an Encryption column appears on this page and indicates if a cartridge is `Encrypted`, `Not Encrypted`, or `Unknown`. An Unknown cartridge is one that has not been previously mounted in an encryption-enabled tape drive.

Rekeying an encrypted cartridge

Complete this task to assign a different encryption key (also known as *key label*) to a 3592 tape cartridge that has already been encrypted.

About this task

Notes:

- You can rekey an encrypted tape cartridge by using the Tape Library Specialist Web interface but not by using the operator panel.
- This procedure is applicable only if you have enabled encryption on one or more TS1120 or later tape drives.

The process of rekeying a cartridge is restricted to a tape drive within the cartridge's logical library. Whether a cartridge has been rekeyed on the last mount is tracked in the Mount History logs.

To rekey a cartridge, perform the following steps:

Procedure

1. Ensure that an encrypted cartridge is mounted in an encryption-enabled tape drive.
2. From the Work Items navigation pane, select **Cartridges** > **Data Cartridges**. The Cartridges screen displays.
3. Select whether the cartridges are in a frame or logical library, select how you want the cartridges to be sorted, then select **Search** . The page refreshes and displays a list of volser ranges as links in the upper right. It also displays information about each cartridge in the library.
4. Select the check box of the encrypted cartridge that you want to rekey.
5. From the Select Action drop-down box, select **Rekey Encryption** and select **Go**. The Rekey Encryption pop-up window displays the selected cartridge by volume serial number.
6. From the drop-down boxes beside the Key Mode field(s), select the key mode. A key mode is the method by which a key manager identifies the public/private keys that were used to encrypt a data key. Choices for the TS1120 and later 3592 tape drives `Key Mode 1` and `Key Mode 2` are:
   - `Wrapped-Default` (The label was configured at the encryption key manager and the key label field is left blank).
   - `Wrapped-Clear` (The externally encoded data key (EEDK) is referenced by the specified key label. The key label field specifies a wrapping key).
   - `Wrapped-Hash` (The EEDK is referenced by a computer value which corresponds to the public key that is referenced by the specified key label. The key label field specifies a wrapping key).
7. Specify the new key label by performing one of the following tasks. A key label is an alias for the key (cipher). It is used by the encryption key manager software.
   - Enter a new label in `Key Label 1` and `Key Label 2`.
   - From each of the drop-down boxes titled `previously selected key labels`, select an existing key label.
8. Click **Apply**.

Chapter 4. Using LTO tape drive media

The section introduces information about using LTO tape drive media.

The IBM TS3500 automates the storage and movement of IBM LTO tape cartridges.

Overview of LTO tape drive media

Within the TS3500 tape library and subject to certain restrictions, the supported LTO tape drives use the following cartridge types.

- IBM 6000 GB LTO Data Cartridge (LTO 7 cartridge without WORM capability)
- IBM 6000 GB LTO WORM Data Cartridge (LTO 7 cartridge)
- IBM 2500 GB LTO Data Cartridge (LTO 6 cartridge without WORM capability)
- IBM 2500 GB LTO WORM Data Cartridge (LTO 6 cartridge)
- IBM 1500 GB LTO Data Cartridge (LTO 5 cartridge without WORM capability)
- IBM 1500 GB LTO WORM Data Cartridge (LTO 5 cartridge)
- IBM 800 GB LTO Data Cartridge (LTO 4 cartridge without WORM capability)
- IBM 800 GB LTO WORM Data Cartridge (LTO 4 cartridge)
- IBM 400 GB LTO WORM Data Cartridge (LTO 3 cartridge)
- IBM 400 GB LTO Data Cartridge (LTO 3 cartridge without WORM capability)
- IBM 200 GB LTO Data Cartridge (LTO 2 cartridge)
- IBM 100 GB LTO Data Cartridge (LTO 1 cartridge)
- IBM Universal LTO Cleaning Cartridge
- IBM LTO Cleaning Cartridge
- Diagnostic cartridge

Figure 43 shows an IBM LTO data cartridge.
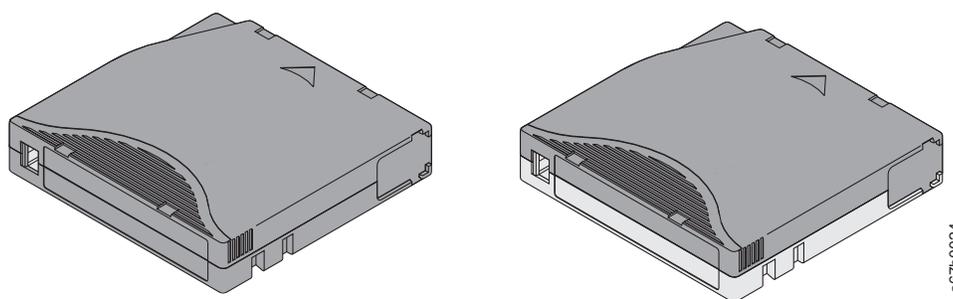
Figure 43. An IBM LTO data cartridge for LTO tape drives

WORM functionality for LTO tape drives and media

This topic describes the write-once-read-many (WORM) functionality that is used by the LTO Ultrium 3 and newer tape drives and supported cartridges.

The LTO 3 and later tape drives include the WORM feature, which is supported by the IBM LTO WORM Data Cartridge (formerly the IBM 3589 Ultrium Tape Cartridge Models 028 and 029). All IBM LTO 3 tape drives with firmware levels of 54K1 or higher and all later LTO drives support the WORM function. An LTO 3 or

later tape drive with WORM capability can recognize WORM-compatible media. More information and the required drive firmware can be found at the following URL: http://www.ibm.com/servers/storage/support/lto/3584/downloading.html

The IBM LTO WORM Data Cartridge is only for use on Ultrium 3 and later tape drives with WORM capable-microcode. The cartridge is designed for applications such as archiving and data retention, and is also suitable for applications that require an audit trail. The cartridge works with the Ultrium 3 and later tape drives to prevent the alteration or deletion of user data.

Additionally, IBM has taken the following steps to reduce tampering with data:
- The bottom of the WORM cartridge is molded in a color (gray) that is different from rewritable cartridges.
- A unique format is factory-written on each WORM cartridge.
- The WORM cartridge's memory, along with its unique format, protects the WORM character of the media.

Based on LTO technology, the format for the LTO WORM data cartridge provides the following capacities:

Table 25. LTO WORM cartridge capacities

Cartridge type	Native capacity	Compressed capacity†
LTO 7	6 000 GB (5587.94 GiB)	1.5 TB (1.36 TiB)
LTO 6	2 500 GB (2 328.31 GiB)	6.25 TB (5.68 TiB)
LTO 5	1 500 GB (1396.98 GiB)	3 TB (2.73 TiB)
LTO 4	800 GB (745.05 GiB)	1 600 GB (1490.12 GiB)
LTO 3	400 GB (372.53 GiB)	800 GB (745.05 GiB)
† The compressed capacity for the LTO 6 cartridge and LTO 7 cartridge uses a 2.5:1 compression ratio. The compressed capacity for LTO 5 and earlier LTO cartridges use a 2:1 compression ratio.		

LTO data cartridge

This section describes the capacity, construction, operation, and components of the IBM LTO data cartridge.

The IBM LTO 7 cartridge is purple with a silk screen label on top that specifies "Ultrium 7- 60000 GB." The IBM LTO 6 cartridge is black with a silk screen label on top that specifies "Ultrium 6 - 2500 GB." The IBM LTO 5 cartridge is burgundy with a silk screen label on the top that specifies "Ultrium 5 - 1500 GB." The IBM LTO 4 cartridge is green with a silk screen label on the top that specifies "Ultrium 4 - 800 GB." The IBM LTO 3 cartridge is blue-gray. The IBM LTO 2 cartridge is purple, and the LTO 1 cartridge is black. WORM data cartridges are two tones in order to distinguish them from other data cartridges. Each WORM cartridge is the color as the same generation of data cartridge on the top, but it is gray on the bottom. All generations of cartridges contain 1/2-inch, dual-coat, metal-particle tape. Capacity for the four types of cartridges is as follows:

* LTO 7 and LTO 7 WORM cartridges have a native data capacity of 6 000 GB (5 587.94 GiB) (1.5 TB [1.36 TiB] at 2.5:1 compression)
* LTO 6 and LTO 6 WORM cartridges have a native data capacity of 2 500 GB (2 328.31 GiB) (6.25 TB [5.68 TiB] at 2.5:1 compression)
* LTO 5 and LTO 5 WORM cartridges have a native data capacity of 1 500 GB (1396.98 GiB) (3 TB [2.73 TiB] at 2:1 compression)
* LTO 4 and LTO 4 WORM cartridges have a native data capacity of 800 GB (745.05 GiB) (1.6 TB [1.46 TiB] at 2:1 compression)
* LTO 3 and LTO 3 WORM cartridges have a native data capacity of 400 GB (372.53 GiB) (800 GB [745.05 GiB] at 2:1 compression)
* LTO 2 cartridge has a native data capacity of 200 GB (186.26 GiB) (400 GB [372.53 GiB] at 2:1 compression)
* LTO 1 cartridge has a native data capacity of 100 GB (93.13 GiB) (200 GB [186.26 GiB] at 2:1 compression)

When processing tape in the cartridges, the LTO tape drives use a linear, serpentine recording format. The LTO 7 drives read and write data on 3 584 tracks. The LTO 6 drives read and write data on 2 176 tracks and the LTO 5 drives read and write data on 1 280 tracks. The LTO 4 drives read and write data on 896 tracks; the LTO 3 drives read and write data on 704 tracks; the LTO 2 drives read and write on 512 tracks; and the LTO 1 drives read and write on 384 tracks. LTO 1 and LTO 2 drives read and write eight tracks at a time. The Ultrium 3 drives read and write 16 tracks at a time when using an Ultrium 3 cartridge and 8 tracks at a time when using Ultrium 1 or 2 cartridges. The LTO 4 drives read and write 16 tracks at a time when using Ultrium 4 and Ultrium 3 cartridges and read 8 tracks at a time when using Ultrium 2 cartridges. The LTO 5 and LTO 6 drives read and write 16 tracks at a time. The LTO 7 drives read and write 32 tracks at a time. The first set of tracks is written from near the beginning of the tape to near the end of the tape. The head then repositions to the next set of tracks for the return pass. This process continues until all tracks are written and the tape is full, or until all data is written. For additional information about LTO tape drive and cartridge compatability, refer to the topic about LTO tape drives.

Figure 44 on page 240 shows the IBM LTO data cartridge and its components.

#	Component	#	Component
1	LTO cartridge memory	4	Write-protect switch
2	Cartridge door	5	Label area
3	Leader pin	6	Insertion guide
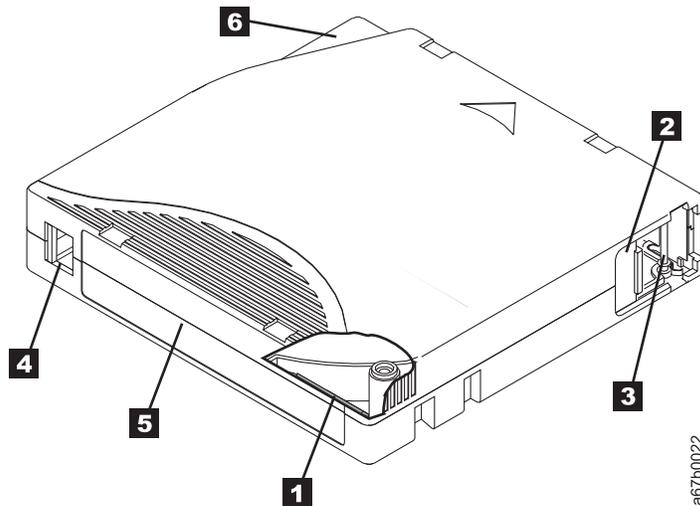
Figure 44. The IBM LTO data cartridge

All generations of the IBM LTO data cartridge include a Linear Tape-Open Cartridge Memory (LTO-CM) chip (**1** in Figure 44), that contains information about the cartridge and the tape (such as the name of the manufacturer that created the tape), as well as statistical information about the cartridge's use. The LTO-CM enhances the efficiency of the cartridge. For example, the LTO-CM stores the end-of-data location, which when you next insert a cartridge and issue the Write command, enables the drive to quickly locate the recording area and begin recording. The LTO-CM also aids in determining the reliability of the cartridge by storing data about its age, how many times it has been loaded, and how many errors it has accumulated. Whenever you unload a tape cartridge, the tape drive writes any pertinent information to the cartridge memory. The storage capacity of the LTO-CM is 4096 bytes.

The cartridge door **2** protects the tape from contamination when the cartridge is out of the drive. Behind the door, the tape is attached to a leader pin **3** . When you insert the cartridge into the drive, a threading mechanism pulls the pin (and tape) out of the cartridge, across the drive head, and onto a non-removable takeup reel. The head can then read or write data from or to the tape.

The write-protect switch **4** prevents data from being written to the tape cartridge. The label area **5** provides a location for you to place a label. Affix only a bar code label. When affixing a label, place it only in the recessed label area. A label that extends outside of the recessed area can cause loading problems in the internal drive or in the TS3500 tape library. The insertion guide **6** is a large, notched area that prevents you from inserting the cartridge incorrectly. You can order tape cartridges with the bar code labels included, or you can order custom labels.

Generation 3 and later generations of the LTO data cartridge have a nominal cartridge life of 20,000 load and unload cycles. Generations 1 and 2 of the LTO data cartridge have a nominal cartridge life of 10,000 load and unload cycles.

LTO cleaning cartridge

The IBM LTO cleaning cartridge is used to clean LTO tape drives.

To maintain the operating efficiency of the drive, IBM supplies a cleaning cartridge with the first frame of each media type. Each drive determines when it needs to be cleaned and alerts the library. Depending on which cleaning method you choose (automatic or manual), the library uses the cleaning cartridge to automatically clean the drive or you are required to select menus to initiate cleaning (for information about cleaning methods, see the section about drive cleaning in the *IBM TS3500 with ALMS Introduction and Planning Guide*).

Note: The volume serial (VOLSER) number on the cleaning cartridge's bar code label must begin with **CLNI** or **CLNU**, or the library treats the cleaning cartridge as a data cartridge during an inventory.

The IBM LTO Cleaning Cartridge (known as the universal cleaning cartridge) and the LTO Cleaning Cartridge are compatible with all LTO tape drives. To enable your LTO 1 drive to use these cartridges, see "Updating drive firmware" on page 223.

Before a drive can be cleaned, ensure that a cleaning cartridge is loaded in the library (to determine whether one or more cleaning cartridges are loaded, see "Removing a cleaning cartridge from the library" on page 98. You can load multiple cleaning cartridges and store them in any cartridge storage slots except the slot that is reserved for the diagnostic cartridge. For additional information, see "Inaccessible cartridge storage slot" on page 41.

The TS3500 tape library monitors the use of all cleaning cartridges. The IBM cleaning cartridges are valid for 50 uses. When the cartridge expires, the library displays the following sample message on the Activity screen (where xx equals characters of the cartridge's VOLSER):

```
Remove CLNUxxL1
Cleaning Cartridge Expired
```

You can also enable automatic eject of expired cleaning cartridges through the Tape Library Specialist web interface by selecting **Settings** > **Library** > **Cartridges**.

Note: It is the operator's responsibility to monitor the use of all cleaning cartridges and to remove and replace expired cartridges as necessary. In order to determine cleaning cartridge usage, refer to "Determining cleaning cartridge usage" on page 208. To enable or disable automatic cleaning, refer to "Automatic cleaning" on page 95. In order to determine how to use SNMP traps to receive notification about expired cartridges, refer to "Enabling or disabling Simple Network Management Protocol (SNMP) traps" on page 179. For steps on how to remove a cleaning cartridge, refer to "Removing a cleaning cartridge from the library" on page 98. In order to enable automatic ejects of expired cleaning cartridges, refer to "Library preferences" on page 138.

LTO diagnostic cartridge

An IBM service representative uses the LTO diagnostic cartridge to ensure that the LTO tape drives run correctly and to specification.

The LTO diagnostic cartridge is a cartridge with known good media that is reserved for diagnostic purposes only. One cartridge slot is reserved in the first LTO frame for the LTO diagnostic cartridge. The slot is at Column 1, Row 1.

Note: A new diagnostic cartridge is shipped with the LTO drive field install feature if it is the first drive of that type in the frame.

The volume serial (VOLSER) number for a diagnostic cartridge is represented as DG IxxLy, where xx equals alphanumeric characters and y equals the generation of the cartridge type. The characters of the VOLSER are white on a black background.

Table 26. Compatibility of diagnostic cartridges with LTO tape drives.

Cartridge generation (y)	LTO tape drives						
	LTO7	LTO6	LTO5	LTO4	LTO3	LTO2	LTO1
6	Yes	Yes	No	No	No	No	No
5	No	Yes	Yes	No	No	No	No
4	No	No	Yes	Yes	No	No	No
3	No	No	No	Yes	Yes	No	No
2	No	No	No	No	Yes	Yes	No
1	No	No	No	No	No	Yes	Yes

Because internal diagnostics for the LTO tape drive do not allow it to write to a WORM cartridge, all diagnostic tests that are selected from the operator panel and performed in maintenance mode cause the drive to eject a WORM cartridge and issue error code 7 on its single-character display. To run diagnostics, use a non-WORM cartridge.

LTO bar code label

Each LTO data, cleaning, and diagnostic cartridge that is processed by the TS3500 tape library must bear a bar code label.

The bar code label contains:
- A volume serial (VOLSER) number that you can read
- A bar code that the library can read

When read by the library's bar code reader, the bar code identifies the cartridge's VOLSER to the tape library. The bar code also tells the library whether the cartridge is a data, cleaning, or diagnostic cartridge. In addition, the bar code includes the two-character media-type identifier Lx, where x equals 1, 2, 3, 4, 5, 6, 7, T, U, V, W , or X. L identifies the cartridge as an LTO cartridge. 1 indicates that the cartridge is the first generation of its type. 2, 3, 4, 5, 6, or 7 indicates that the cartridge is the second, third, fourth, fifth, sixth, or seventh generation of its type; T indicates that the cartridge is generation 3 WORM cartridge; U indicates that the cartridge is generation 4 WORM cartridge; V indicates that the cartridge is a generation 5 WORM cartridge; W indicates that the cartridge is a generation 6 WORM cartridge; X indicates that the cartridge is a generation 7 WORM cartridge. Figure 45 on page 244 shows a sample bar code label for the LTO 7 tape cartridge.

You can order tape cartridges with the labels included, or you can order custom labels. The bar code must meet predefined specifications. They include (but are not limited to):
- Eight uppercase alphanumeric characters, where the last two characters must be L1, L2, L3, L4, L5, L6, L7, LT, LU, LV, LW, or LX
- Label and printing to be non-glossy
- Nominal narrow line or space width of 0.423 mm (0.017 in.)
- Wide to narrow ratio of 2.75:1
- Minimum bar length of 11.1 mm (0.44 in.)

To determine the complete specifications of the bar code and the bar code label, visit the web at http://www-304.ibm.com/support/docview.wss?uid=ssg1S7000429 to download the *IBM LTO Ultrium Cartridge Label Specification*. You can also contact your IBM Sales Representative for this specification.

When attaching a bar code label to a tape cartridge, place the label only in the recessed bar code label area. A label that extends outside of the recessed area can cause loading problems in the drive or the library.

Attention: Do not place any type of mark on the white space at either end of the bar code. A mark in this area may prevent the TS3500 tape library from reading the label.

You can use the Tape Library Specialist web interface to configure the library so that it reports to the server all eight characters of the VOLSER on the bar code label or only the first six characters. For more information, see "Enabling or disabling the reporting of a 6-character or 8-character VOLSER" on page 201.

Note: If you suspect that the library is having problems reading the bar code labels, you can slow the scanner speed as part of problem determination. You may choose to slow the scanner speed rather than replace all labels, or you might want to slow the scanner speed while you wait for an opportunity to re-label the media.

Depending on the severity of the problem, the error recovery procedure (ERP) for poor labels might greatly exceed the time lost by slowing the scanner. If you have cartridge bar code labels that meet the LTO bar code label specification, there is no need to slow the scanner speed. For more information, see "Adjusting the scanner speed" on page 224.

To order bar code labels, see "Ordering bar code labels for LTO tape cartridges" on page 263.
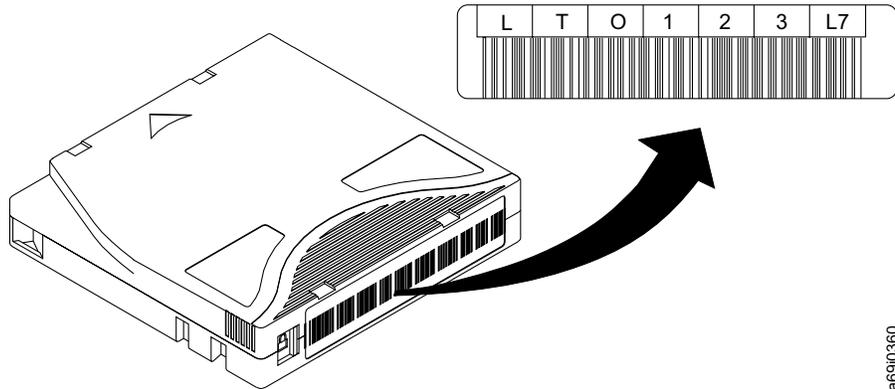
Figure 45. Sample bar code label on the LTO 7 tape cartridge. The volume serial number (LTO123) and bar code are printed on the label.

Guidelines for using LTO bar code labels

The guidelines listed in this topic must be followed when using LTO bar code labels.

Apply the following guidelines whenever you use LTO bar code labels:
- Use only IBM-approved bar code labels.
- Do not reuse a label or reapply a used label over an existing label.
- Before you apply a new label, remove the old label by slowly pulling it at a right angle to the cartridge case.
- Use peel-clean labels that do not leave a residue after they are removed. If there is glue residue on the cartridge, remove it by gently rubbing it with your finger. Do not use a sharp object, water, or a chemical to clean the label area.
- Examine the label before you apply it to the cartridge. Do not use the label if it has voids or smears in the printed characters or bar code (an application's inventory operation will take much longer if the bar code label is not readable).
- Remove the label from the label sheet carefully. Do not stretch the label or cause the edges to curl.
- Position the label within the recessed bar code label area.
- With light finger pressure, smooth the label so that no wrinkles or bubbles exist on its surface.
- Verify that the label is smooth and parallel, and has no roll-up or roll-over. The label must be flat to within 0.5 mm (0.02 in.) over the length of the label and have no folds, missing pieces, or smudges.
- Do not place other machine-readable labels on other surfaces of the cartridge. They might interfere with the ability of the bar code reader to read the bar code.

Setting the write-protect switch on an LTO tape cartridge

Use the write-protect switch to prevent data from being written to an LTO tape cartridge.

The position of the write-protect switch on an LTO tape cartridge (see **1** in Figure 46) determines whether you can write to the tape:

- If the switch is set to ⬛ (solid red), data cannot be written to the tape.
- If the switch is set to unlocked (black void), data can be written to the tape.

If possible, use your server's application software to write-protect your cartridges (rather than manually setting the write-protect switch). This allows the server's software to identify a cartridge that no longer contains current data and is eligible to become a scratch cartridge. Do not write-protect scratch (blank) cartridges; the tape drive will not be able to write new data to them.

If you must manually set the write-protect switch, slide it left or right to the desired position.
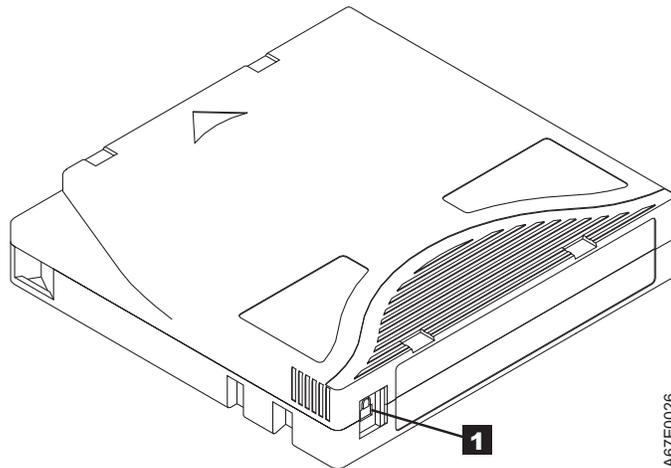
Figure 46. Setting the write-protect switch on an LTO tape cartridge

Handling LTO tape cartridges

Incorrect handling or an incorrect environment can damage IBM LTO tape cartridges or their magnetic tape. To avoid damage to your tape cartridges and ensure the continued high reliability of your IBM LTO tape drives, handle them properly as described in the following topics.

If the symbol is...   **It means...**

Attention: Do not insert a damaged tape cartridge into your TS3500 tape library. A damaged cartridge can interfere with the reliability of a drive and may void the warranties of the drive and the cartridge. Before inserting a tape cartridge, inspect the cartridge case, cartridge door, and write-protect switch for breaks. If you need to recover data from a damaged cartridge, contact your IBM Service Representative.

Provide training for using LTO tape cartridges

Provide proper training for people using LTO tape cartridges.

- Post procedures that describe proper media handling in places where people gather.
- Ensure that anyone who handles tape has been properly trained in handling and shipping procedures. This includes operators, users, programmers, archival services, and shipping personnel.
- Ensure that any service or contract personnel who perform archiving are properly trained in media-handling procedures.
- Include media-handling procedures as part of any services contract.
- Define and make personnel aware of data recovery procedures.

Ensure proper packaging of LTO tape cartridges

LTO tape cartridges must be packed and shipped according to specific guidelines in order to ensure they are not damaged during transport.

Adhere to the following guidelines when packaging or shipping LTO tape cartridges:

- When you ship a cartridge, ship it in its original or better packaging.
- Always ship or store a cartridge in a jewel case.
- Use only a recommended shipping container that securely holds the cartridge in its jewel case during transportation. LTO Turtle Cases (by Perm-A-Store) have been tested and found to be satisfactory (see Figure 47). They are available at `http://www.turtlecase.com`.

Figure 47. Tape cartridges in a Turtle Case

- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.
- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure that the following precautions are taken:
  - Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.
  - Pack the cartridge snugly to ensure that it does not move around.
  - Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes (see Figure 48 on page 248).

Figure 48. Double-boxing tape cartridges for shipping

Provide proper acclimation and environmental conditions for LTO tape cartridges

Certain conditions are required to ensure the safety and quality of LTO tape cartridges.

- Before you use a cartridge, let it acclimate to the normal operating environment for a minimum of 24 hours. If you see condensation on the cartridge, wait an additional hour
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields greater than 50 oersteds (4000 ampere/meter), such as terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies. Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the proper conditions for storing and shipping the cartridges.

Perform a thorough inspection of LTO tape cartridges

Inspect LTO tape cartridges to ensure they are not damaged before using them with your LTO tape drives and tape library.

After purchasing a cartridge and before using it, perform the following steps:

1. Inspect the packaging to determine if the cartridge was handled roughly.

   Note: When inspecting a cartridge, open only the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are held together with screws; separating them destroys the usefulness of the cartridge.

2. Inspect the cartridge for damage before using or storing it.

3. Inspect the rear of the cartridge (the part that you load first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case. (Refer to **1** in Figure 49 on page 249. If there are gaps in the seam, the leader pin may be dislodged and may need to be repositioned.)
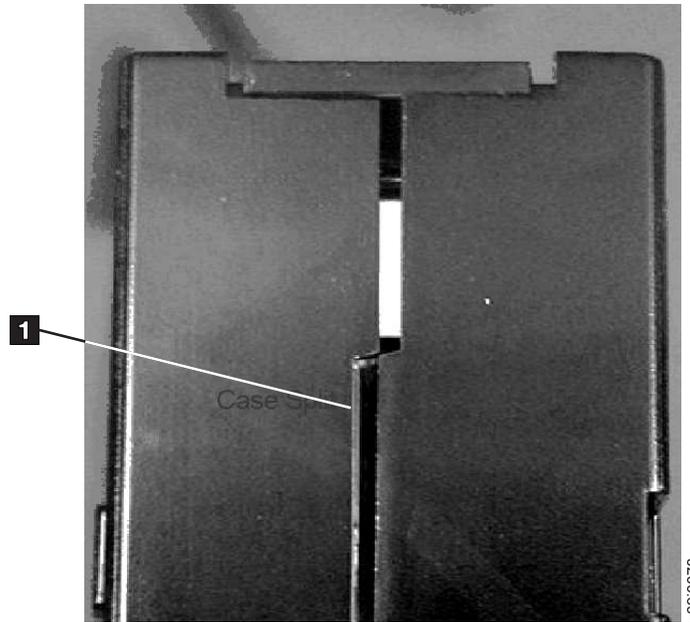
Figure 49. Gap in cartridge seam

Handle the LTO tape cartridge carefully

Handle the LTO tape cartridges carefully to ensure they do not get damaged.

- Do not drop the LTO tape cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly positioned in the pin-retaining spring clips. If the leader pin has become dislodged, perform the procedure to reposition it.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.
- Do not stack more than six cartridges.
- Do not degauss a cartridge that you intend to reuse. Degaussing makes the tape unusable.

Examples of problems with LTO tape cartridges

Occasionally you might encounter a problem with an LTO tape cartridge. If you do, you can try to resolve the problem and avoid any data loss.

Example: Split cartridge case

The cartridge's case is damaged. There is a high possibility of media damage and potential loss. Perform the following steps to determine the cause and recover data:

1. Look for cartridge mishandling.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly position the pin. Then, immediately use data recovery procedures to minimize chances of data loss.
3. Review media-handling procedures.

Example: Improper placement of leader pin

The leader pin is misaligned. Perform the following steps to determine the cause and recover data:

1. Look for cartridge damage.
2. Use the IBM Leader Pin Reattachment Kit (part number 08L9129) to correctly position the pin. Then, immediately use data recovery procedures to minimize chances of data loss.

Repositioning or reattaching a leader pin in an LTO tape cartridge

Use the following procedures to move a leader pin into its proper position in an LTO tape cartridge, or to reattach the pin if it has separated from the tape.

If the leader pin in your LTO tape cartridge becomes dislodged from its pin-retaining spring clips or detaches from the tape, you must use the IBM Leader Pin Reattachment Kit (part number 08L9129) to reposition or reattach it. Do not reattach the pin if you must remove more than 7 meters (23 feet) of leader tape.

If you see this symbol:	**Take this action:**
⚠	**Attention:** Use a repaired tape cartridge only to recover data and move it to another cartridge. Continued use of a repaired cartridge might void the warranties of the drive and the cartridge.

Repositioning a leader pin in an LTO tape cartridge
Before you begin

To place the leader pin in its proper position, you will need the following tools:
* Plastic or blunt-end tweezers
* Cartridge manual rewind tool (from Leader Pin Reattachment Kit, part number 08L9129)

About this task

A leader pin that is improperly positioned inside an LTO tape cartridge can interfere with the operation of the drive. Figure 50 on page 252 shows a leader pin in the incorrect **1** and correct **2** positions.
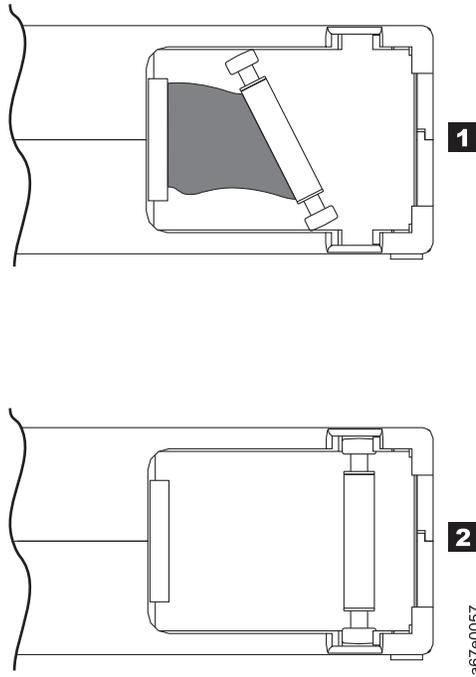
Figure 50. Leader pin in the incorrect and correct positions in an LTO tape cartridge. The cartridge door is open and the leader pin is visible inside the cartridge.

Procedure

Complete the following steps to reposition a leader pin:

1. Slide open the cartridge door (**1** in Figure 51 on page 253) and locate the leader pin **2** . You may need to shake the cartridge gently to roll the pin toward the door.
2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips **3** .
3. Press the leader pin gently into the clips until it snaps into place and is firmly seated. Ensure that there are no gaps in the seam of the cartridge **4** .

   Note: If gaps exist, do not continue with this procedure and do not use the cartridge. Instead, contact your IBM service representative.
4. Close the cartridge door.
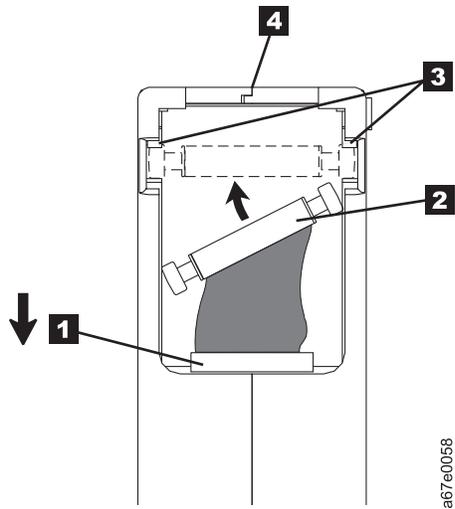
Figure 51. Placing the dislodged leader pin into the correct position. The cartridge door is open to show the leader pin.

5. To rewind the tape, insert the cartridge manual rewind tool (**1** in Figure 52) into the cartridge's hub **2** and turn it clockwise until the tape becomes taut.
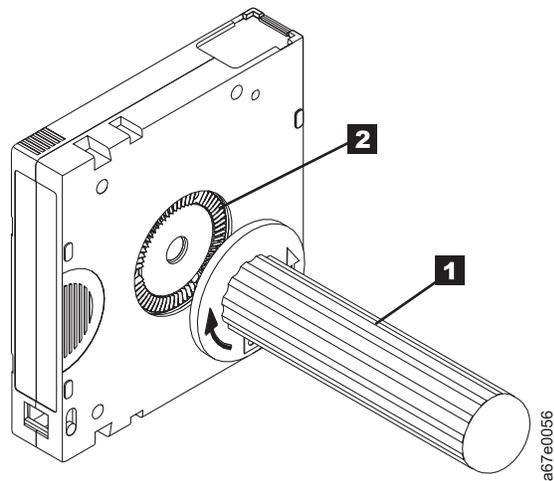
Figure 52. Rewinding the tape into the cartridge

6. Remove the rewind tool.

Reattaching a leader pin in an LTO tape cartridge

Reattach a leader pin if it has become detached from the magnetic tape and you must copy the cartridge's data onto another cartridge.

Before you begin

The first meter of tape in an LTO tape cartridge is leader tape. Once the leader tape has been removed there is a possibility of tape breakage. After reattaching the leader pin, transfer data from the defective tape cartridge. **Do not reuse the defective tape cartridge**.

The Leader Pin Reattachment Kit contains three parts:

- **Leader pin attach tool** (see **1** in Figure 53). A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** (see **2** in Figure 53). A device that fits into the cartridge's hub and lets you wind the tape into and out of the cartridge.
- **Pin supplies** (see **3** in Figure 53). Leader pins and C-clips.

Attention:

- Use only the IBM Leader Pin Reattachment Kit to reattach the leader pin to the tape. Other methods of reattaching the pin will damage the tape, the drive, or both.
- Use this procedure on your tape cartridge only when the leader pin detaches from the magnetic tape and you must copy the cartridge's data onto another cartridge. Destroy the damaged cartridge after you copy the data. This procedure may affect the performance of the leader pin during threading and unloading operations.
- Touch only the end of the tape. Touching the tape in an area other than the end can damage the tape's surface or edges, which may interfere with read or write reliability.
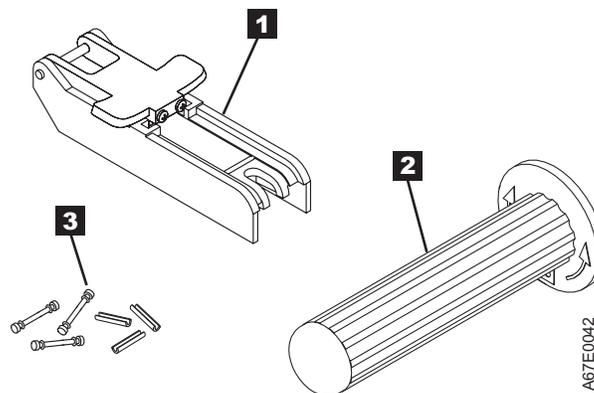
Figure 53. Leader Pin Reattachment Kit

Procedure

To reattach a leader pin by using the IBM Leader Pin Reattachment Kit, perform the following steps:

1. Attach the leader pin attach tool (**1** in Figure 54 on page 255) to the cartridge **2** so that the tool's hook **3** latches into the cartridge's door **4** . Pull the tool back to hold the door open, then slide the tool onto the cartridge.

Open the tool's pivot arm **5** .
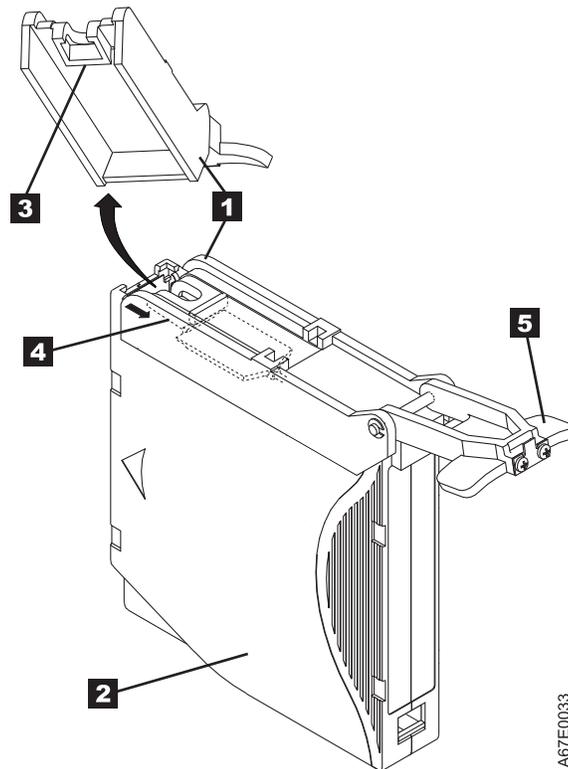
Figure 54. Attaching the leader pin attach tool to an LTO tape cartridge. To hold the cartridge door open, hook the tool into the door and pull the tool back.

2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool (**1** in Figure 55 on page 256) to the cartridge's hub **2** by fitting the tool's teeth between the teeth of the hub. Turn the tool clockwise until you see the end of the tape inside the cartridge. Then, slowly turn the rewind tool counterclockwise to bring the tape edge toward the cartridge door **3** .

3. Continue to turn the rewind tool counterclockwise until approximately 13 cm (5 in.) of tape hangs from the cartridge door. If necessary, grasp the tape and pull gently to unwind it from the cartridge.

4. Remove the rewind tool by pulling it away from the cartridge. Set the tool and the cartridge aside.
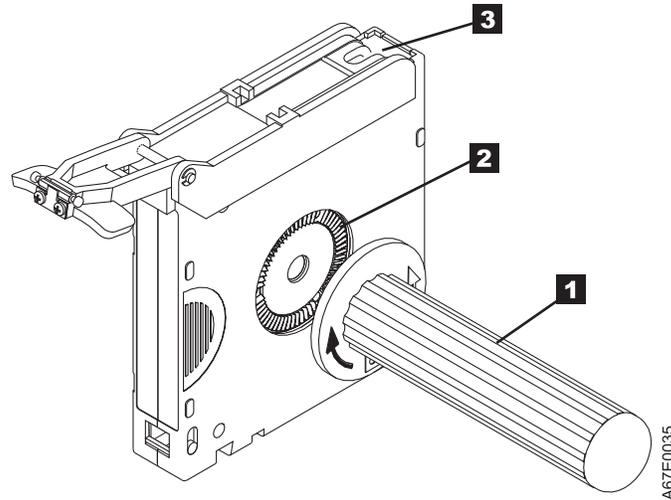
Figure 55. Winding the tape out of the LTO tape cartridge. Turn the cartridge manual rewind tool clockwise to see the end of the tape, then turn it counterclockwise to bring the tape to the cartridge door.

5. On the leader pin (**1** in Figure 56), locate the open side of the C-clip **2** . The C-clip is a small black part that secures the tape **3** to the pin.

6. Remove the C-clip from the leader pin by using your fingers to push the clip away from the pin. Set the pin aside and discard the clip.
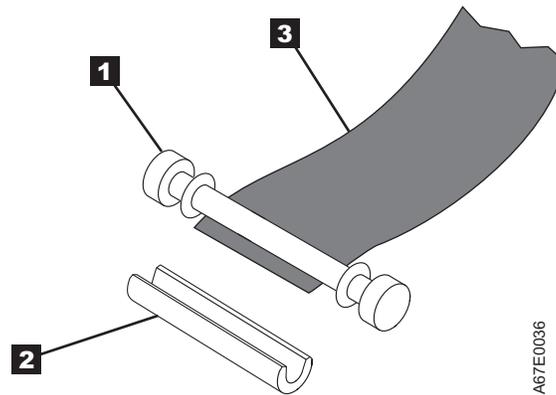
Figure 56. Removing the C-clip from the leader pin. Use your fingers to push the C-clip from the leader pin.

7. Position the tape in the alignment groove of the leader pin attach tool (see **1** in Figure 57 on page 257).

8. Place a new C-clip into the retention groove **2** on the leader pin attachment tool and make sure that the clip's open side faces up.

9. Place the leader pin (from step 6) into the cavity **3** of the leader pin attach tool.

10.

Attention: To prevent the leader pin from rolling into the cartridge, in this step, use care when folding the tape over the pin.
Fold the tape over the leader pin and hold it with your fingers (see Figure 57 on page 257).

Note: Use care to ensure that the tape is centered over the leader pin. Failure to properly center the tape on the pin will cause the repaired cartridge to fail.

When the tape is properly centered, a 0.25-mm (0.01-in.) gap exists on both sides of the pin.
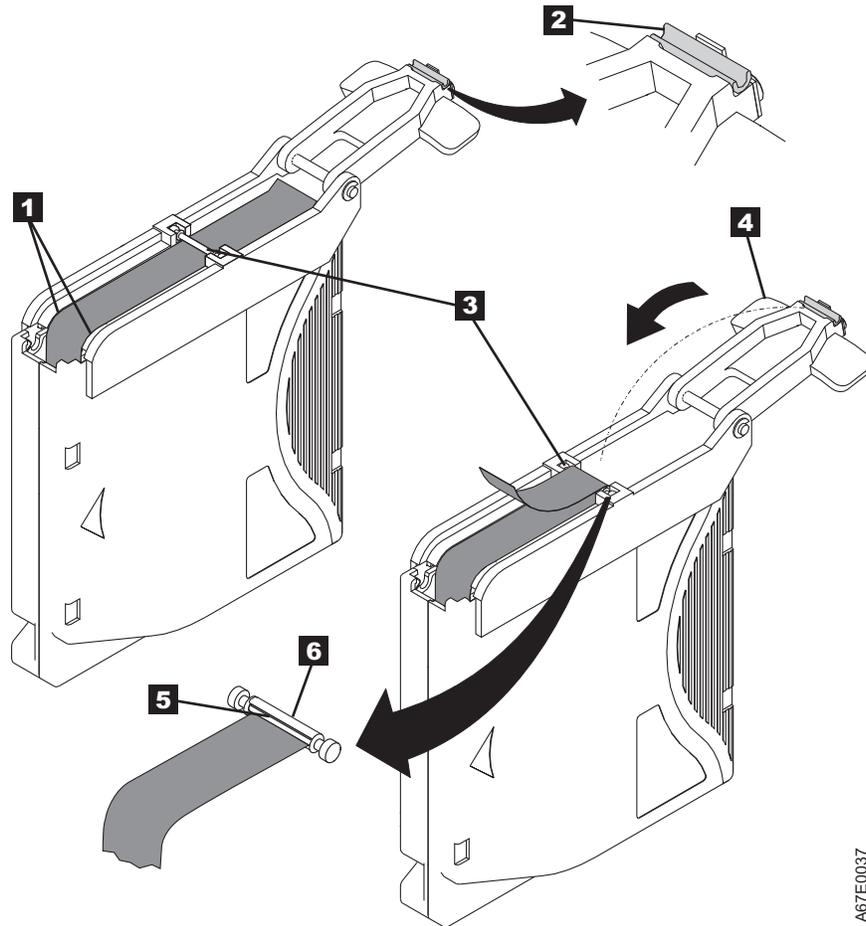
Figure 57. Attaching the leader pin to the tape

11. Close the pivot arm **4** of the leader pin attach tool by swinging it over the leader pin so that the C-clip snaps onto the pin and the tape.

12. Swing the pivot arm open and trim the excess tape **5** so that it is flush with the reattached leader pin **6** .

13. Use your fingers to remove the leader pin from the cavity **3** in the leader pin attach tool.

14. Use the cartridge manual rewind tool to wind the tape back into the cartridge (wind the tape clockwise). Ensure that the leader pin is latched by the pin-retaining spring clips on each end of the leader pin.

15. Remove the rewind tool.

16. Remove the leader pin attach tool by lifting its end up and away from the cartridge.

Environmental and shipping specifications for LTO tape cartridges

There are specific operating, storage, and shipping specifications for LTO tape cartridges.

Before you use an LTO tape cartridge, acclimate it to the operating environment for 24 hours or the amount of time necessary to prevent condensation in the drive. The time varies depending on the environmental extremes to which the cartridge was exposed.

The best storage container for the cartridges (until they are opened) is the original shipping container. The plastic wrapping prevents dirt from accumulating on the cartridges and partially protects them from humidity changes.

Attention: Depending on how many drives you have installed in the frame of a TS3500 tape library, the temperature inside the frame might be as high as 5°C (9°F) above the temperature outside the frame. To ensure continued reliability of your media, be sure to take this temperature difference into account when you set up the environment around your library.

When you ship a cartridge, place it in its jewel case or in a sealed, moisture-proof bag to protect it from moisture, contaminants, and physical damage. Ship the cartridge in a shipping container that has enough packing material to cushion the cartridge and prevent it from moving within the container.

Table 27 gives the environment for operating, storing, and shipping LTO tape cartridges.

Table 27. Environment for operating, storing, and shipping the LTO tape cartridges

Environmental Specifications				
Environmental Factor	**Operating**	**Operational Storage[1]**	**Archival Storage[2]**	**Shipping**
Temperature	10 to 45°C (50 to 113°F)	16 to 32°C (61 to 90°F)	16 to 25°C (61 to 77°F)	-23 to 49°C (-9 to 120°F)
Relative humidity (noncondensing)	10 to 80%	20 to 80%	20 to 50%	5 to 80%
Maximum wet bulb temperature	26°C (79°F)	26°C (79°F)	26°C (79°F)	26°C (79°F)
Magnetic field	Stray magnetic field at any point on tape not to exceed 50 oersteds (4000 ampere/meter).			
Notes:				
1. Operational storage equals less than 6 months.				
2. Archival storage equals greater than 6 months.				

Disposing of LTO tape cartridges

Dispose of LTO tape cartridges according to federal and other regulations.

Under the current rules of the U.S. Environmental Protection Agency (EPA), regulation 40CFR261, the LTO tape cartridge is classified as non-hazardous waste. As such, it may be disposed of in the same way as normal office trash. These regulations are amended from time to time, and you should review them at the time of disposal.

If your local, state, country (non-U.S.A.), or regional regulations are more restrictive than EPA 40CFR261, you must review them before you dispose of a cartridge. Contact your account representative for information about the materials that are in the cartridge.

If a tape cartridge must be disposed of in a secure manner, you can erase the data on the cartridge by using a high-energy ac degausser (use a minimum of 2800 oersteds over the entire space that the cartridge occupies). Degaussing makes the cartridge unusable.

If you burn the cartridge and tape, ensure that the incineration complies with all applicable regulations.

Ordering additional LTO cartridges and media supplies

Order additional LTO tape cartridges and other related media supplies by using any of the methods described in this topic.

You can use one of the following methods to order the cartridges and media supplies shown in Table 28:

- Order from your IBM Sales Representative or any authorized IBM Business Partner.
- Order by calling 1-888-IBM-MEDIA.
- Order through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`).

Note: For cartridges with preapplied bar code labels, specify the volume serial (VOLSER) characters that you want. If you would like cartridges with radio frequency identification (RFID) labels, also specify the correct feature code from the following table.

Table 28. Ordering LTO cartridges and media supplies

Supply Item	Method of Ordering	Feature Codes for RFID Labels
IBM LTO Ultrium 6000 GB Data Cartridge Bar code labels are preapplied to cartridges.	Specify Machine Type 3589 Model 551 and the VOLSER characters that you want. If you would like RFID[1] labels, also specify the feature code provided.	FC 5511
IBM LTO Ultrium 6000 GB Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 651.	N/A
IBM LTO Ultrium 6000 GB WORM Data Cartridge Bar code labels are preapplied to cartridges.	Specify Machine Type 3589 Model 571 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 5571
IBM LTO Ultrium 6000 GB WORM Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 671.	N/A
IBM LTO Ultrium 2500 GB Data Cartridge Bar code labels are preapplied to cartridges.	Specify Machine Type 3589 Model 550 and the VOLSER characters that you want. If you would like RFID[1] labels, also specify the feature code provided.	FC 5510
IBM LTO Ultrium 2500 GB Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 650.	N/A

Table 28. Ordering LTO cartridges and media supplies (continued)

Supply Item	Method of Ordering	Feature Codes for RFID Labels
IBM LTO Ultrium 2500 GB WORM Data Cartridge Bar code labels are preapplied to cartridges.	Specify Machine Type 3589 Model 570 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 5710
IBM LTO Ultrium 2500 GB WORM Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 670.	N/A
IBM LTO Ultrium 1500 GB Data Cartridge Bar code labels are preapplied to cartridges.	Specify Machine Type 3589 Model 014 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 1421
IBM LTO Ultrium 1500 GB Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 015.	N/A
IBM LTO Ultrium 1500 GB WORM Data Cartridge Bar code labels are preapplied to cartridges.	Specify Machine Type 3589 Model 034 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 3421
IBM LTO Ultrium 1500 GB WORM Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 035.	N/A
IBM LTO Ultrium 800 GB WORM Data Cartridge Bar code labels are preapplied to cartridges.	Specify Machine Type 3589 Model 032 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 3221
IBM LTO Ultrium 800 GB WORM Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 033.	N/A
IBM LTO Ultrium 800 GB Data Cartridge Bar code labels are preapplied to cartridges. Specify the feature code if you would like RFID labels.	Specify Machine Type 3589 Model 010 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 1021
IBM LTO Ultrium 800 GB Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 011.	N/A
IBM LTO Ultrium 400 GB WORM Data Cartridge Bar code labels are preapplied to cartridges. Specify the feature code if you would like RFID labels.	Specify Machine Type 3589 Model 028 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 2821

Table 28. Ordering LTO cartridges and media supplies (continued)

Supply Item	Method of Ordering	Feature Codes for RFID Labels
IBM LTO Ultrium 400 GB WORM Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 029.	N/A
IBM LTO Ultrium 400 GB Data Cartridge Bar code labels are preapplied to cartridges. Specify the feature code if you would like RFID labels.	Specify Machine Type 3589 Model 008 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	FC 0821
IBM LTO Ultrium 400 GB Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 009.	N/A
IBM LTO Ultrium 200 GB Data Cartridge Bar code labels are preapplied to cartridges. Specify the feature code if you would like RFID labels.	Specify Machine Type 3589 Model 006 and the VOLSER characters that you want. If you would like RFID labels, also specify the feature code provided.	6021
IBM LTO Ultrium 200 GB Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 007.	N/A
IBM LTO Ultrium Cleaning Cartridge (universal cleaning cartridge for use with all Ultrium tape drives) VOLSER labels are included.	Specify Machine Type 3589 Model 004 and the VOLSER characters that you want.	N/A
Jewel Case for IBM LTO Ultrium 400 GB WORM Data Cartridge	Order the jewel case as feature code 8000. This case can also be used for the Ultrium 2 and Ultrium 1 Tape Cartridges.	N/A
Leader Pin Reattachment Kit	Order as part number 08L9129.	N/A
Notes: 1. RFID = radio frequency identification. 2. N/A = Not applicable.		

Ordering bar code labels for LTO tape cartridges

Order labels from one of the following authorized suppliers of bar code labels for LTO tape cartridges.

Bar code labels with volume serial (VOLSER) numbers are required for LTO tape cartridges that are read by the TS3500 tape library. You can order these labels separately from the IBM data cartridges and cleaning cartridges.

Attention: The TS3500 tape library is designed to work with bar code labels that meet the specifications and requirements set forth in the *IBM LTO Ultrium Cartridge Label Specification (Revision 2)*. The label providers listed in the following table have demonstrated the ability to produce finished bar code labels that meet the foregoing specifications and requirements. This information is provided for the convenience of TS3500 tape library users only, and is not an endorsement or recommendation of such providers. IBM is not responsible for the quality of bar code labels procured from sources other than IBM. This information is applicable to bar code labels actually printed by the listed companies. IBM has not reviewed the quality of any labels produced by software or services offered by such companies that allow users to print labels on their own printing equipment.

Table 29. Authorized suppliers of custom bar code labels

In the Americas	In Europe and Asia
Dataware PO Box 740947 Houston, TX 77274 U.S.A. Telephone: 800-426-4844 or 713-432-1023 Fax: 713-432-1385 http://www.datawarelabels.com/	Not applicable
Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U.S.A. Telephone: 888-438-8362 or 303-464-3508 Fax: 888-438-8363 or 303-666-2166 http://www.tri-optic.com	EDP Europe Limited 43 Redhills Road South Woodham Ferrers Chelmsford, Essex CM3 5UL U.K. Telephone: 44 (0) 1245 322380 Fax: 44 (0) 1245 323484 http://www.edpeurope.com/media-labels.html
Netc, L.L.C.[1] 100 Corporate Drive Trumbull, CT 06611 U.S.A. Telephone: 203-372-6382 Fax: 203-372-0676 http://www.NetcLabels.com	Netc Europe Ltd[1] The Old Surgery 5a The Pavement North Curry TA3 6LX Somerset U.K. Telephone: 44 (0) 1823 491439 Fax: 44 (0)1823 491373 http://www.NetcLabels.co.uk
	Netc Asia Pacific Pty Ltd[1] PO Box 872 Cooroy QLD 4563 Australia Telephone: 61 (0) 7 5442 6263 Fax: 61 (0) 7 5442 6522 http://www.NetcLabels.com.au
Note: 1. This is an authorized supplier for radio frequency identification (RFID) labels.	

Chapter 5. Using 3592 tape drive media

The TS3500 tape library automates the storage and movement of IBM 3592 tape cartridges.

Overview of 3592 tape drive media

Use the provided table to view characteristics of the various cleaning and data cartridges that are used by the 3592 tape drives in the TS3500 tape library.

The 3592 tape drive uses twelve different data cartridge types and a cleaning cartridge. Characteristics of these cartridges are summarized in Table 30 on page 266.

Figure 58 shows an IBM 3592 tape cartridge.
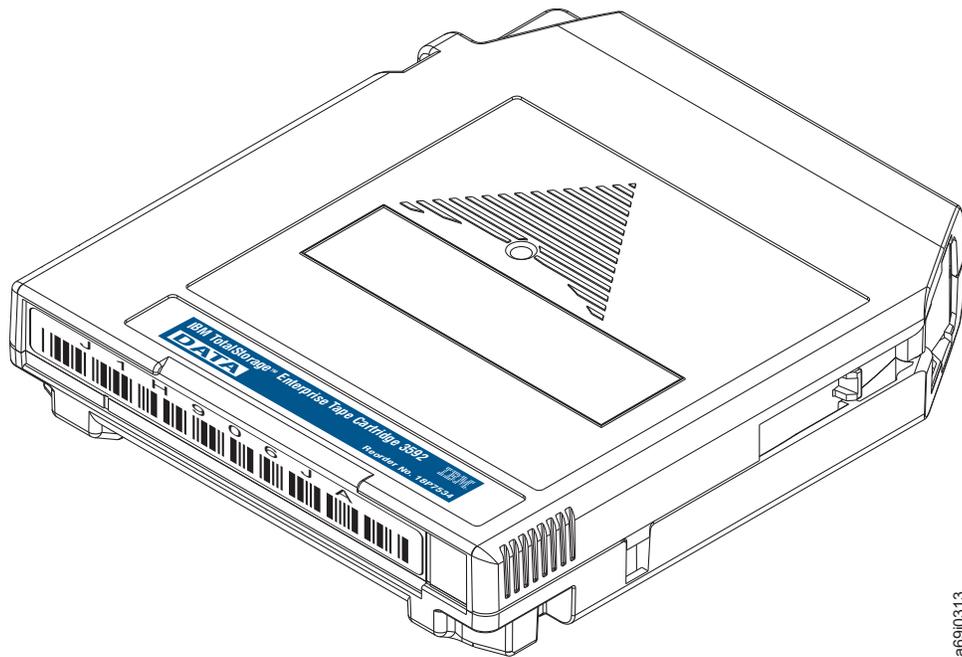
Figure 58. IBM 3592 tape cartridge

Cartridges can be distinguished by the text on the product label, as well as by the color of the cartridge case. Table 30 on page 266 displays the differences between the 3592 tape cartridge.

Table 30. Types of IBM 3592 tape cartridges

Text on product label and type of media[1]	Native capacity					Case color	Label, door, and write-protect switch color	Part number
	TS1150 (Model E08)	TS1140 (Model E07)	TS1130 (Model E06/EU6)	TS1120 (Model E05	J1A			
Data, JA	Not supported	640 GB (596.04 GiB) E06 format 500 GB (465.66 GiB) E05 format Read-only J1A format[2,3]	640 GB (596.04 GiB) E06 format 500 GB (465.66 GiB) E05 format 300 GB (279.39 GiB) J1A format	500 GB (465.66 GiB) E05 format 300 GB (279.39 GiB) J1A format	300 GB (279.39 GiB) J1A format	Black	Dark blue	18P7534
Extended data, JB	Not supported	1 600 GB (1490.12 GiB) E07 format 1 000 GB (931.32 GiB) E06 format 700 GB (651.93 GiB) E05 format	1 000 GB (931.32 GiB)	700 GB (651.93 GiB	Not supported	Black	Dark green	23R9830
Advanced Type C data, JC	7 TB (6.37 TiB) E08 format 4 TB (3.64 TiB) E07 format	4 TB (3.64 TiB)E07 format	Not supported	Not supported	Not supported	Black	Dark purple	46X7452
Advanced Type D read/write, JD	10 TB (9.1 TiB)[2,4] E08 format	Not supported	Not supported	Not supported	Not supported	Black	Burnt orange	2727263
Economy, JJ	Not supported	128 GB (119.21 GiB) E06 format 100 GB (93.13 GiB) E05 format Read-only J1A format[2,3]	128 GB (119.21 GiB) E06 format 100 GB (93.13 GiB) E05 format 60 GB (58.88 GiB) J1A format	100 GB (93.13 GiB) E05 format 60 GB (58.88 GiB) J1A format	60 GB (58.88 GiB) J1A format	Black	Light blue	24R0316

Table 30. Types of IBM 3592 tape cartridges (continued)

Text on product label and type of media[1]	Native capacity					Case color	Label, door, and write-protect switch color	Part number
	TS1150 (Model E08)	TS1140 (Model E07)	TS1130 (Model E06/EU6)	TS1120 (Model E05	J1A			
Advanced Type C economy, JK	900 GB (838.19 GiB) E08 format500 GB (465.66 GiB) E07 format	500 GB (465.66 GiB)	Not supported	Not supported	Not supported	Black	Light purple	46X7453
Advanced Type D economy, JL	2 TB (1.82 TiB)[2,4] E08 format	Not supported	Not supported	Not supported	Not supported	Black	Apricot	2727264
Economy WORM, JR	Not supported	128 GB (119.21 GiB) E06 format

100 GB (93.13 GiB) E05 format

Read-only J1A format[2,3] | 128 GB (119.21 GiB) E06 format

100 GB (93.13 GiB) E05 format

60 GB (58.88 GiB) J1A format | 100 GB (93.13 GiB) E05 format

60 GB (58.88 GiB) J1A format | 60 GB (58.88 GiB) J1A format | Platinum (silvery gray) | Light blue | 24R0317 |
| WORM, JW | Not supported | 640 GB (596.04 GiB) E06 format

500 GB (465.66 GiB) E05 format

Read-only J1A format[2,3] | 640 GB (596.04 GiB) E06 format

500 GB (465.66 GiB) E05 format

300 GB (279.39 GiB) J1A format | 500 GB (465.66 GiB) E05 format

300 GB (279.39 GiB) J1A format | 500 GB (465.66 GiB) E05 format

300 GB (279.39 GiB) J1A format | Platinum (silvery gray) | Dark blue | 18P7538 |
| Extended WORM, JX | Not supported | 1 600 GB (1490.12 GiB) E07 format

1 000 GB (931.32 GiB) E06 format

700 GB (651.93 GiB) E05 format | 1 000 GB (931.32 GiB) | 700 GB (651.93 GiB) | Not supported | Platinum (silvery gray) | Dark green | 23R9831 |

Table 30. Types of IBM 3592 tape cartridges (continued)

Text on product label and type of media[1]	Native capacity					Case color	Label, door, and write-protect switch color	Part number
	TS1150 (Model E08)	TS1140 (Model E07)	TS1130 (Model E06/EU6)	TS1120 (Model E05	J1A			
Advanced Type C WORM, JY	7 TB (6.37 TiB) E08 format 4 TB (3.64 TiB) E07 format	4 TB (3.64 TiB) E07 format	Not supported	Not supported	Not supported	Platinum (silvery gray)	Dark purple	46X7454
Advanced Type D WORM, JZ	10 TB (9.1 TiB)[2,4] E08 format	Not supported	Not supported	Not supported	Not supported	Platinum (Silvery gray)	Burnt orange	2727265
Cleaning, CLNxxxJA[5]	N/A	N/A	N/A	N/A	N/A	Black	Gray	18P7535

Notes:

1. This designation appears as the last two characters on standard bar code labels. In addition, for cleaning cartridges, the first three characters of the volume serial (VOLSER) number are CLN.

2. For more information about microcode level requirements for use with Model E07 and Model E08 media, see online TS1140 (Model E07) and TS1150 (Model E08) documentation available in IBM Knowledge Center. This information is also available in *IBM 3592 Tape Drives and TS1120 Controller Operator Guide*, GA32-0556.

3. The 3592-E07 supports reading JA, JJ, JR, and JW cartridges only with a microcode level updated to D3I3_5CD or later.

4. The 3592-E08 supports reading and writing JD, JL, and JZ media cartridges only with a microcode level updated to D314_460 or later.

5. Where xxx equals three numerals. All generations of 3592 tape drives can use this cleaning media. A native capacity value is not applicable for cleaning media, which is shown in this table row by the entry "N/A".

Note: In addition to these cartridges, there is a Customer Engineer (CE) diagnostic cartridge for use by IBM service representatives only. The VOLSER for this cartridge is "CE xxxJJ" or "CE xxxJK", where a space occurs after "CE" and "xxx" equals three numerals.

The 3592 tape drive does not support LTO formats.

Firmware for each type of 3592 tape drive (TS1150, TS1140, TS1130, TS1120 and J1A) will not work in any other 3592 tape drive.

You can update the firmware of a 3592 tape drive without scheduling downtime. This enhancement is called a *nondisruptive drive firmware update*. It is available through the IBM Tape Library Specialist web interface and (for IBM service representatives) through CETool, but. is not supported by the Small Computer System Interface (SCSI). For more information, go to "Updating drive firmware" on page 223.

WORM functionality for 3592 tape drives and media

Write-once-read-many (WORM) cartridges are designed for applications such as archiving and data retention, and to prevent the alteration or deletion of user data. They are also suitable for applications that require an audit trail.

All 3592 tape drives with the appropriate microcode version installed are capable of reading and writing WORM cartridges. The TS1120 and later 3592 tape drives support WORM behaviors and format attributes. These tape drives support the following five WORM media types:

JW (full length)
> Supported by J1A, TS1120, and TS1130 tape drives.

JR (short length)
> Supported by J1A, TS1120, and TS1130 tape drives.

JX (extended)
> Supported by TS1120, TS1130, and TS1140 tape drives.

JY (advanced)
> Supported by TS1140 and TS1150 tape drives.

JZ (advanced)
> Supported by the TS1150 tape drive.

WORM cartridges are formatted at the factory and cannot be converted to data cartridges. The WORM tape media are formatted differently than the standard read/write media. One field in the manufacturer's servo track tape identifier on the tape designates that the medium is WORM. In addition, the cartridge memory (CM) has a WORM indicator byte in the cartridge type field. Both of these conditions must be true for the drive to work with a WORM cartridge. If one condition is true and the other is false, an `ATTN DRV - Invalid Cartridge` message displays. When the drive senses that a cartridge is a WORM cartridge, the microcode prohibits the changing or altering of user data that is already written on the tape. The microcode tracks the last appendable point on the tape with an overwrite-protection pointer that is stored in the CM. Statistical Analysis and Reporting System (SARS) data can be written and updated on WORM tapes because the SARS data is not in the user area of the tape.

Each WORM cartridge is identified by using a unique cartridge identifier (UCID) that is permanent and locked, which provides another level of security for data that must be maintained. This permanent locked information is stored in both the cartridge CM and on the tape itself, and can also be associated with the unique bar code volume serial (VOLSER) number.

Some records retention and data security applications require the WORM function of tape data storage. This WORM function is accomplished on the 3592 tape drive by a combination of microcode controls in the drive and a WORM tape cartridge. Special tamper-proofing techniques and checking prevent WORM cartridges from being transported to or from a data cartridge shell or cartridge memory and being inadvertently processed as a read/write cartridge. The drive microcode leverages this support by providing an interface and control mechanisms that allow an application or system to manage as needed. The control and status mechanisms for this can be found primarily in mode pages X'23' and X'24'. For more information, see the *IBM 3592 Tape Drive SCSI Reference* (GA32-0466).

The 3592 tape drives allow append operations to data already on WORM cartridges, and allow overwriting of file marks and other non-data attributes to provide application transparency. However, they do not allow data overwriting under any circumstances. Once full of data, WORM cartridges cannot be reused or erased by the drive and must be physically destroyed or bulk degaussed to delete data. For full tape application usage, certain trailer and label record overwrites are allowed.

Capacity scaling and segmentation

The 3592 tape drive supports capacity scaling for tape cartridges of media types JA, JB, JC, and JD over a broad range of capacities. The effect of capacity scaling is to contain data in a specified fraction of the tape. This yields faster locate and read times. Alternatively, you can purchase economy tapes (the JJ, JK, or JL media type) to achieve this faster performance.

The 3592 J1A tape drive divides tape into longitudinal segments. Using this capability, it is possible, for example, to segment 300 GB (279.39 GiB) data tapes into two segments: one segment with 64.42 GB (60 GiB) very fast access, and another 200 GB (186.26 GiB) segment for additional capacity. You can purchase 300 GB (279.39 GiB) data tapes that are pre-formatted in these segments, or you can segment and capacity scale them at a later time. Segmentation is only available within a specified range of capacity scaling settings. Capacity scaling is not supported for economy or write-once-read-many (WORM) tapes. For information about implementing segmentation and capacity scaling, refer to the README files that pertain to your device driver on the web:

http://www.ibm.com/support/fixcentral

For more technical information regarding WORM, capacity scaling, and segmentation, see also the *IBM 3592 Tape Drive SCSI Reference* (GA32-0466).

All TS1120 and later tape drives also support multiple format options, such as scaling and segmentation modes, to allow you to trade capacity for improved access times. While 256 settings of the Capacity Scaling byte (and resulting fractional capacities) are supported on these drives, the following three primary settings are recommended for use:

- Full capacity default mode
- 20% scaled fast access mode (20% capacity scaled, front of tape used). The Capacity Scaling byte is x'35'.
- Performance scaling for 87% capacity and a segmented format with recursive accumulating backhitchless flush (RABF) capability (a non-volatile caching technique) for the full cartridge. For WORM firmware for the 3592 tape drives, the Capacity Scaling byte is x'E0'.

These settings are fully certified and are available as labeled and initialized part-numbered cartridges. For the exact Mode Select commands and settings that are necessary to invoke scaling, see the *IBM 3592 Tape Drive SCSI Reference* (GA32-0466).

Scaling support in drive

Capacity scaling in the TS1120 and later tape drives is controlled by the host program performing a Scaling operation. This is performed using the Capacity Scaling byte and the Capacity Scaling Valid control bit in Mode page X'23'. These tape drives do not change current cartridge scaling unless a SCSI Mode Select command that specifies Mode Page X'23' (with appropriate non-default parameter settings) is received while the cartridge is positioned at the beginning of the tape. The drive can sense and report the scaling state of the current medium by using a Mode Sense command that specifies Mode Page X'23'. The default unscaled capacity is 300 GB (279.39 GiB) for a JA cartridge in J1A density, 500 GB (465.66 GiB) for a JA cartridge in E05 density, 700 GB (651.93 GiB) for a JB cartridge in E05 density, and 1 000 GB (931.32 GiB) for a JB cartridge in E06 density. The default

unscaled capacity for a JY cartridge in E07 density is 4 TB (3.64 TiB). The default unscaled capacity for a JZ cartridge in E08 density is 10 TB (9.1 TiB).

- The cartridge can be rescaled from any current Capacity Scaling byte value to any supported new value. The tape is logically erased by this (End of Data mark written at beginning of tape), but not physically erased as with the long erase command. Scaling or rescaling one cartridge does not cause rescaling of the next cartridge; an explicit command must be issued for each cartridge to be rescaled.

- The drive provides the option of setting the scaling values of N/256ths of full capacity, where N ranges from X'16' (22 -- equals about 8% capacity) to X'EC' (236 -- equals about 92%).

- For scaling factors N, between X'4B' and X'EB', the drive scales to the specified amount and creates a fast-access 20% capacity segment in the beginning of the scaled region.

- At all scaling factors, the drive supports early warning at the end of the scaled region (with the appropriate unit attention to inform the software that it should flush buffers and close volume) and reports a physical end-of-tape check condition at the end of the scaled region, just as it would if unscaled tape had reached the real physical end of the tape.

Capacity scaling is not offered on any of the short length (economy) cartridge types (JJ, JK, or JL), or on the WORM cartridges (JW, JX, JY, JR, JY, and JZ). Capacity scaling is only offered on the JA, JB, JC, and JD cartridge types.

Three important attributes are controlled by the setting of the Capacity Scaling byte value:

- The total Medium Capacity
- The ability to perform the RABF function on an entire cartridge, including last wraps
- Information about whether the format is segmented. If the format is segmented, a fast-access segment is created on the front part of the tape followed by a larger remainder segment that occupies the remainder of the tape. The fast access segment is always filled (written) first, followed by the filling of the remainder segment. For some applications that want improved access attributes for partially filled cartridges but still want to use full capacity (if required) without re-scaling, this option is available.

It is important to note that the scaled state and attributes (segmentation, RABF) of the cartridge format is retained when a cartridge is reformatted between the J1A and E05 logical formats, although the exact resulting used capacity as a percentage of full capacity is not identical for all mapped settings.

3592 data cartridge

This section describes the capacity, construction, operation, and components of the IBM 3592 Enterprise Tape Cartridge.

The 3592 tape drive has a bidirectional read/write head with an Enterprise Tape 3592 format. The 3592 J1A writes or reads eight tracks at a time; the TS1120 tape drive and TS1130 tape drive write or read 16 tracks at a time. The TS1140 tape drive and TS1150 tape drive write or read 32 tracks at a time. The capacity of 3592 data cartridges varies by drive model and recording format. See the 3592 tape cartridges table in "Overview of 3592 tape drive media" on page 265 for these details.

TS1120 and newer tape drives that are encryption-enabled encrypt the data after compression.

Figure 59 shows an IBM 3592 tape cartridge and its components.

#	Component	#	Component
1	Cartridge case	5	IBM product label
2	Cartridge bar code label	6	Cartridge door
3	Volume serial (VOLSER) number	7	Write-protect switch
4	Label area	8	Stacking indent
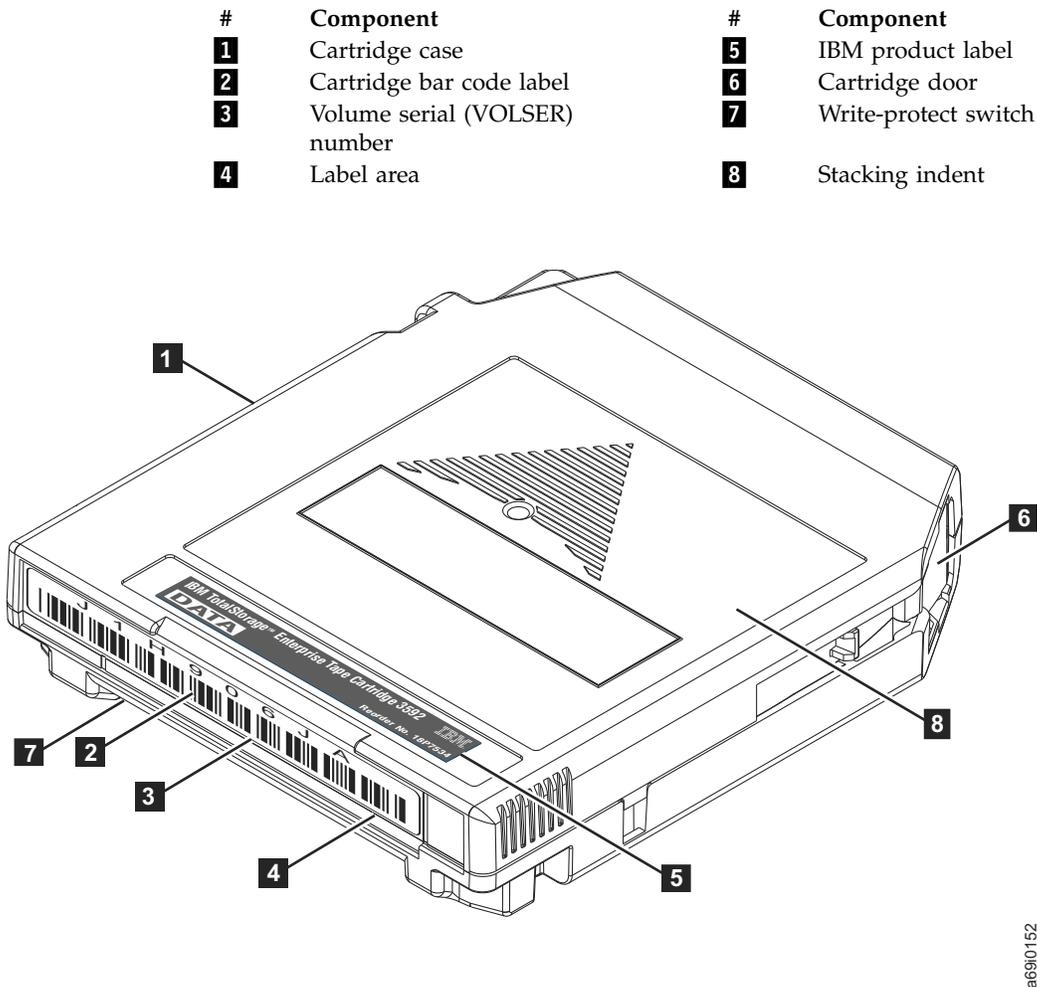
Figure 59. Components of the IBM 3592 tape cartridge

Through its vision system, the TS3500 tape library identifies the types of cartridges it contains during an inventory operation. The bar code reader reads the VOLSER (see 3 in Figure 59) of the cartridge bar code label 2 that is in the label area 4 of the cartridge. If your cartridge does not have a pre-attached bar code label and you attach one to it, place it entirely within the recessed label area. (See 3 and 4 as an example of proper placement.) The label must be flat to within 0.5 mm (0.02 inches) over the length of the label and have no folds, missing pieces, tears, or any extraneous markings. Failure to follow these placement requirements results in degraded readability.

The IBM product label 5 specifies the type of cartridge: data, economy, WORM, or cleaning. The indent on the top of the tape cartridge 8 is for stacking cartridges on top of each other. No labels are to be affixed in this area.

The cartridge door 6 protects the tape from contamination when the cartridge is out of the drive. When you insert the cartridge into the drive, a threading

mechanism pulls the tape out of the cartridge, across the drive head, and onto a non-removable takeup reel. The head can then read or write data from or to the tape.

Each data cartridge includes a write-protect switch **7** that you can set to prevent data from being overwritten or erased from the tape by the drive.

You can order tape cartridges with the bar code labels included, or you can order custom labels.

The 3592 data cartridge has a nominal cartridge life of 20,000 load and unload cycles. The quantity of load and unload cycles to reach this number depends on the environment in which the tape is used.

Cartridge memory in 3592 tape cartridges

Each 3592 data cartridge contains a passive, contactless, silicon storage device called cartridge memory (CM).

The CM module holds information about that specific cartridge, the media in the cartridge, and the data on the media. The cartridge and media information is stored in a protected, read-only area of the CM. When the cartridge is loaded into the drive, a CM reader in the drive uses a contactless, radio-frequency interface to read the information. The media's performance statistics are stored in an unprotected, read/write area of the CM module. Prior to when the cartridge is unloaded, these statistics are updated by the CM reader. They are maintained by a portion of the drive's microcode known as the Statistical Analysis and Reporting System (SARS). Each cleaning cartridge also contains a CM module, which tracks the number of cleaning uses and the location of the used cleaning media.

3592 cleaning cartridge

To help prevent errors caused by debris, it is important to clean the tape path of the 3592 tape drives and to manually clean the outside of its data cartridges, when needed.

For each TS3500 tape library, IBM supplies a specially labeled IBM 3592 cleaning cartridge with the first 3592 tape drive in the library. This cleaning cartridge may be used in all 3592 tape drives.

If the symbol is... **It means**

Attention: Insert only clean and undamaged cleaning cartridges into a tape system. Before you insert a cartridge into a drive or storage slot, inspect the cartridge for damage or debris. **Damaged or dirty cartridges can reduce system reliability and cause the loss of recorded data.** If debris appears on the cartridge, wipe the outside surfaces with a lint-free cloth lightly moistened with water. Do not allow any liquid to contact the tape. Ensure that all cartridge surfaces are dry and that the leader pin is in place (see **1** in Figure 60 on page 275) before you load the cartridge.

The cleaning of the tape path in the drive is an automatic procedure initiated by the drive when changes in drive performance generate a request for cleaning. This occurs when more than 5000 mounts have occurred, when more than 20 full file passes of data have been processed, or when the drive detects a degraded head or channel condition. If you load an expired cleaning cartridge, the drive will eject the cartridge and post a status message to indicate that cleaning was not performed. Failure to clean a drive can result in buildup of debris on the read/write head and drive malfunction. If no cleaning cartridges are installed in the library, or if the available cleaning cartridges have reached the maximum number of 50 uses, cleaning cannot be completed. For information about different cleaning methods (automatic, host, or manual), refer to the section about methods of cleaning drives in the *IBM TS3500 with ALMS Introduction and Planning Guide*. Also see "Performing manual cleaning of drives in the library" on page 96 and "Automatic cleaning" on page 95.

Note: It is the operator's responsibility to monitor the use of all cleaning cartridges and to remove and replace expired cartridges as necessary. In order to determine cleaning cartridge usage, refer to "Determining cleaning cartridge usage" on page 208. In order to use SNMP traps to receive notification about expired cartridges, refer to "Enabling or disabling Simple Network Management Protocol (SNMP) traps" on page 179. For steps on how to remove a cleaning cartridge, see "Removing a cleaning cartridge from the library" on page 98 and to enable automatic ejects of expired cleaning cartridges, see "Using the Web to view or change library preferences" on page 138.

Note: It is the operator's responsibility to monitor the use of all cleaning cartridges and to remove and replace expired cartridges as necessary. Use the to monitor cleaning cartridge usage, remove an expired cartridge, or enable automatic eject of expired cleaning cartridges.

Before you insert a cartridge into a drive or storage cell, inspect the cartridge for damage or debris. **Damaged or dirty cartridges can reduce system reliability and cause the loss of recorded data.** If debris appears on the cartridge, wipe the

outside surfaces with a lint-free cloth lightly moistened with water. No visible water residue or droplets should be observable on the cartridge during or after the wiping effort.

Attention: Do not allow any liquid to contact the tape itself. Special care should be made to never allow liquid water to enter the cartridge which can potentially wick into the layers of the tape and cause them to adhere to each other. This creates the risk that the coatings may pull out during unwind.

Ensure that all cartridge surfaces are dry and that the leader pin is in place (see **1** in Figure 60) before you load the cartridge.
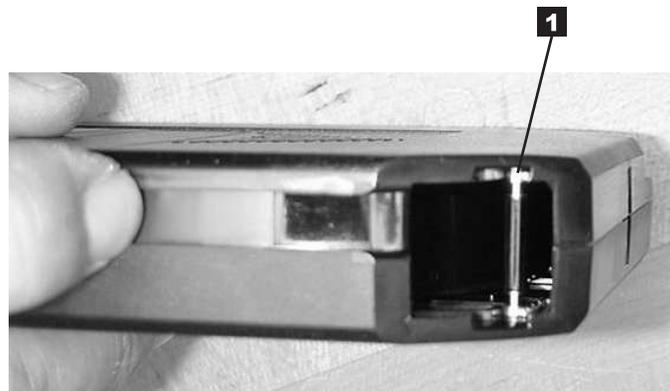
Figure 60. Leader pin in proper position in the 3592 cleaning cartridge (the cartridge door is manually retracted)

While the cleaning is in process, the 8-character message display on the drive shows the message, CLEAN*.

The IBM 3592 cleaning cartridge contains a cartridge memory (CM) device that automatically keeps track of the number of times it has been used. Cleaning cartridges need to be replaced after 50 uses. Automatic cleaning is only available if the appropriate cleaning cartridges are installed in the library and have remaining use.

The physical characteristics of the 3592 cleaning cartridge distinguish it from the 3592 data cartridge. The product label on the top of the cartridge is white, with the word CLEANING printed on it. In place of the write-protect switch, there is a non-moveable light gray block (see **1** in Figure 61 on page 276). If you order cleaning cartridges with pre-attached labels, the first three characters of the volume serial (VOLSER) number **2** are CLN. The cartridge door (see **1** in Figure 62 on page 276) is also light gray.

#	Component
1	Non-moveable light gray block
2	Sample label for cleaning cartridge

Figure 61. Characteristics that identify the 3592 cleaning cartridge

Figure 62. Door of the 3592 cleaning cartridge

Before a drive can be cleaned, you must ensure that an IBM 3592 cleaning cartridge is loaded in the library. You can load multiple cleaning cartridges and store them in any cartridge storage slot except the slot that is reserved for the diagnostic cartridge). To determine whether one or more cleaning cartridges are loaded, go to the section about inserting a cleaning cartridge into the TS3500 tape library. For more information go to the section about inaccessible cartridge storage slots.

3592 diagnostic cartridge

Information about the appearance and usage of the 3592 diagnostic cartridge.

The 3592 diagnostic cartridge is a cartridge with verified media that is reserved for diagnostic purposes only. In the TS3500 tape library, one storage slot is reserved in the first Model L22 or Model D22 frame for the 3592 diagnostic cartridge. The slot is located at Column 1, Row 1. During a service call, your IBM service representative uses the cartridge to ensure that the tape drives run correctly and to specification. The volume serial (VOLSER) number for the diagnostic cartridge is specified as shown, where a space occurs after `CE` and xxx equals three numerals: `CE xxxJJ` (for J1A, TS1120, and TS1130 tape drives) or `CE xxxJK` (for TS1140 tape drives and TS1150 tape drives). The diagnostic cartridge that is stored in the reserved slot should be the cartridge type that is used for the majority of drives in the library. In the event that the other type of 3592 diagnostic cartridge is required, the library requests it.

A new diagnostic cartridge is shipped with the TS1140 tape drive and TS1150 tape drive field install feature (feature code 1675) if it is the first drive of that type in the frame.

3592 bar code label

Each 3592 data, cleaning, and diagnostic cartridge that is processed by the TS3500 tape library must bear a bar code label.

The label contains:
- A volume serial (VOLSER) number that you can read
- A bar code that the library can read

When read by the library's bar code reader, the bar code identifies the cartridge's VOLSER to the tape library. The bar code also tells the cartridge type: data (JA), extended data (JB), advanced type C data (JC), advanced type D data (JD), economy (JJ), advanced type C economy (JK), advanced type D economy (JL), economy WORM (JR), WORM (JW), extended WORM (JX), advanced type C WORM (JY), advanced type D WORM (JZ), cleaning, or diagnostic cartridge. Figure 63 on page 278 shows a sample bar code label for the IBM 3592 Enterprise Tape Cartridge.

You can order tape cartridges with the labels included, or you can order custom labels. The labels have a peel-and-stick backing. The bar code must meet predefined specifications. The recommended specifications include (but are not limited to):
- Eight uppercase alphanumeric characters, where the last two characters must be `JA, JB, JC, JD, JJ, JK, JL, JR, JW, JX, JY,` or `JZ`.
- Label and printing to be non-glossy
- Nominal narrow line or space width of 0.500 mm (0.019 in.)
- Wide to narrow ratio of 2.75:1
- Minimum bar length of 7.0 mm (0.27 in.)

To determine the complete specifications of the bar code and the bar code label, visit the web at `http://www.storage.ibm.com/media/tapecartridges/index.html`. Under `Enterprise storage media`, select `3592 tape cartridges`. Under `Learn more`, select `Barcode Label Specification for use    with 3592 Tape Media`. Under `Content`, select the PDF file to view the *Label Specification for IBM 3592 Cartridges when used in IBM Libraries*. You can also contact your IBM sales representative for this specification.

When attaching a bar code label to a tape cartridge, place the label only in the recessed bar code label area (see Figure 63 on page 278). A label that extends outside of the recessed area can cause loading problems in the drive or the library.

Attention: Do not place any type of mark on the white space at either end of the bar code. A mark in this area may prevent the TS3500 tape library from reading the label.

By using the Tape Library Specialist web interface, you can configure the library so that it reports to the server all eight characters of the VOLSER on the bar code label or only the first six characters. For more information, see "Enabling or disabling the reporting of a 6-character or 8-character VOLSER" on page 201.

Note: If you suspect that the library is having problems reading the bar code labels, you can slow the scanner speed as part of problem determination. You can slow the scanner speed rather than replace all labels, or you could slow the scanner speed while you wait for an opportunity to relabel the media. Depending on the severity of the problem, the error recovery procedure for poor labels may

greatly exceed the time lost by slowing the scanner. If you have cartridge bar code labels that meet the LTO bar code label specification, there is no need to slow the scanner speed.For more information, see "Adjusting the scanner speed" on page 224.

To order bar code labels, see "Ordering 3592 bar code labels" on page 292.
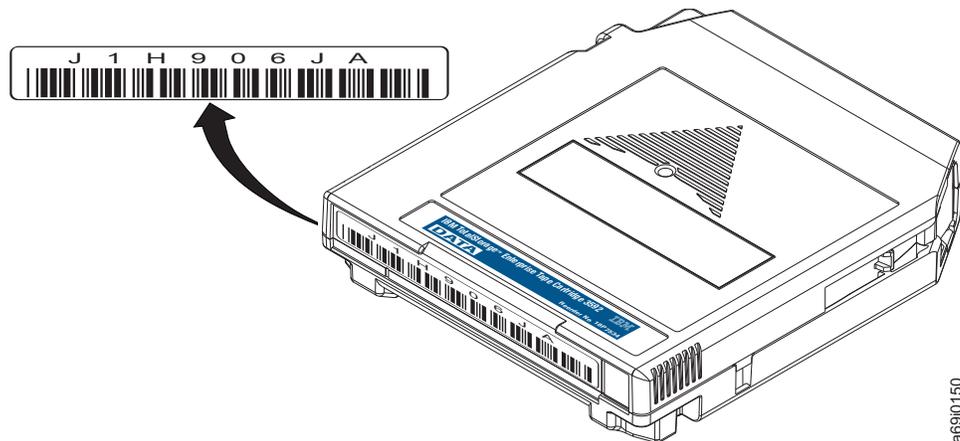
Figure 63. Sample bar code label on an IBM 3592 tape cartridge. The volume serial number (J1H906JA) and bar code are printed on the label.

Guidelines for using 3592 bar code labels

Apply the following guidelines whenever you use bar code labels:

- Use only IBM-approved bar code labels.
- Do not reuse a label or reapply a used label over an existing label.
- Examine the label before you apply it to the cartridge. Do not use the label if it has voids or smears in the printed characters or bar code (an application's inventory operation will take much longer if the bar code label is not readable).
- Position the label within the recessed bar code label area.
- Verify that the label is smooth and parallel, and has no roll-up or roll-over. The label must be flat to within 0.5 mm (0.02 in.) over the length of the label and have no folds, missing pieces, or smudges.
- Do not place other labels on any other cartridge surfaces. They might interfere with the ability of the bar code reader to read the bar code or cause the cartridge to get jammed.
- Use peel-clean labels that do not leave a residue after they are removed. If there is glue residue on the cartridge, remove it by gently rubbing it with your finger; do not use a sharp object, water, or a chemical to clean the label area.
- Before you apply a new label, remove the old label by slowly pulling it at a right angle to the cartridge case.
- Remove the label from the label sheet carefully. Do not stretch the label or cause the edges to curl.
- With light finger pressure, smooth the label so that no wrinkles or bubbles exist on its surface.

Guidelines for using Silo-style bar code labels

There are certain guidelines for using Silo-style bar code labels on 3592 tape cartridges.

The TS3500 tape library with firmware level 7368 or higher can also read Silo (Sun StorageTek Powderhorn 9130) style bar code labels on 3592 tape cartridges. In order for the library to read these labels, the following requirements apply:

- Bar code Compatibility Mode must be enabled on the TS3500 tape library
- The bar code reader must have a Microscan brand scanner.

  Note: This scanner is standard on most Lx3 libraries. However, if you are unsure or if the scanner is not reading the labels, contact your IBM Service Representative. The service procedure for verifying that the type of scanner is documented in RPQ 8B3510.
- The guidelines for using Silo-style bar code labels with the TS3500 tape library must be followed.

Proper placement of the bar code label is required for optimum bar code scanner performance. Follow these placement guidelines for Silo-style bar code labels on 3592 tape cartridges:

- Ensure that the label is top justified and centered within the recessed label area. The VOLSER label should not fall into the media type label area.
- Ensure that the label is applied to the cartridge with the bars facing down (text on top and bars on the bottom).
- Ensure that the label is applied straight, as a crooked label may cause label reading problems.

In addition to these specific guidelines, also adhere to the general label guidelines that are listed in "Guidelines for using 3592 bar code labels" on page 278.

Note that the bar code scanner only reads the VOLSER. If a single character media type identifier is applied, it is ignored by the library. Also, it is difficult to read the label of a cartridge mounted in the drive. Slower operation and repeated read attempts may be observed. This is normal for these labels.

Setting the write-protect switch on a 3592 cartridge

Use the write-protect switch to prevent data from being written to a 3592 tape cartridge.

The position of the write-protect switch on the 3592 tape cartridge (see Figure 64) determines whether or not you can write to the tape.

- To write data to or erase data from the cartridge, set the switch to **1** . This exposes a square hole.
- To prevent data from being overwritten or erased from the cartridge, set the switch to **2** . This covers the hole.
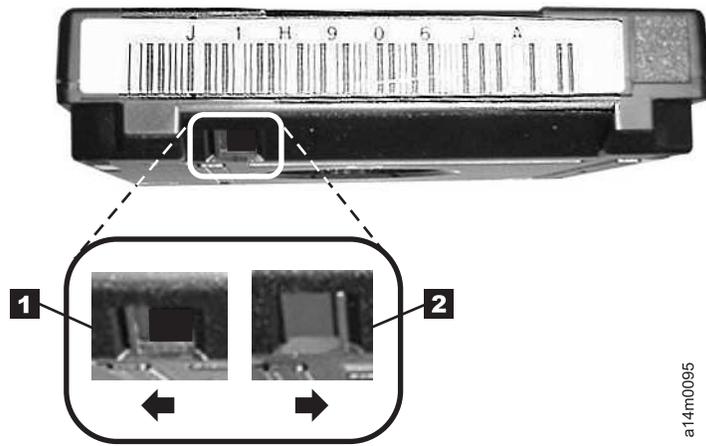
Figure 64. Setting the write-protect switch on the 3592 tape cartridge

Handling 3592 tape cartridges

Incorrect handling or an inhospitable environment can damage IBM 3592 tape cartridges or their magnetic tape. To avoid damage to your tape cartridges and ensure the continued high reliability of your IBM 3592 tape drives, handle them properly as described in the following topics.

If the symbol is...	It means...

Attention: Do not insert a damaged tape cartridge into your tape drive. A damaged cartridge can interfere with the reliability of a drive and may void the warranties of the drive and the cartridge. Before inserting a tape cartridge, inspect the cartridge case, cartridge door, and write-protect switch for breaks.

Provide training for using 3592 tape cartridges

Provide proper training for anyone that is handling 3592 tape cartridges.

It is recommended that you take the following precautions to ensure the 3592 tape cartridges are handled properly.

- Post procedures that describe proper media handling in places where people gather.
- Ensure that anyone who handles tape has been properly trained in handling and shipping procedures. This includes operators, users, programmers, archival services, and shipping personnel.
- Ensure that any service or contract personnel who perform archiving are properly trained in media-handling procedures.
- Include media-handling procedures as part of any services contract.
- Define and make personnel aware of data recovery procedures.

Ensure proper packaging of 3592 tape cartridges

3592 tape cartridges must be packed and shipped according to specific guidelines in order to ensure they are not damaged during transport.

To avoid damage to 3592 tape cartridges, adhere to the following guidelines for packaging and shipping:

- When you ship a cartridge, ship it in its original or better packaging.
- Use only shipping containers that securely hold the cartridge in place during transportation. Such containers can be procured from Perm-A-Store on the web at www.turtlecase.com. The 3592 tape cartridges support racks and storage containers that are designed for 3590 tape cartridges.
- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.
- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure that these precautions are taken:
  - Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.
  - Pack the cartridge snugly; do not allow it to move around.
  - Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes.

Provide proper acclimation and environmental conditions for 3592 tape cartridges

Certain conditions are required to ensure the safety and quality of 3592 tape cartridges.

- Before you use a cartridge, let it acclimate to the normal operating environment for a minimum of 24 hours. If you see condensation on the cartridge, wait an additional hour.
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields of greater than 50 Oersteds (4000 ampere/meter), such as terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies. Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the proper conditions for storing and shipping the cartridges.

Perform a thorough inspection of 3592 tape cartridges

After purchasing a 3592 tape cartridge and before using it, perform the following steps:

- Inspect the cartridge's packaging to determine potential rough handling.
- Ensure that no moisture or condensation exists on or in the cartridge shell or media.
- When inspecting a cartridge, open only the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are welded and held together with screws; separating them destroys the usefulness of the cartridge.
- Inspect the cartridge for damage before using or storing it.
- Check that the leader pin is properly positioned.
- Ensure that labels are affixed in a manner that does not adversely affect drive operation. Labels must only be affixed in the recessed bar code label area provided on the cartridge. No labels should be placed in the indent on the top of the cartridge.
- If you suspect that the cartridge has been mishandled but it appears usable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.

Handle the 3592 tape cartridge carefully

Handle 3592 tape cartridges carefully to ensure they do not get damaged.

- Do not drop the 3592 tape cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly positioned.
- Avoid mechanical loads that would distort the cartridge's shape.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.
- Do not stack more than six cartridges.
- Do not degauss a cartridge that you intend to reuse. Degaussing the tape erases the servo tracks and makes the tape unusable. An attached host can be used to

run a Data Security Erase if the data on the tape needs to be physically erased. This physically overwrites the data on the tape without damaging the servo tracks.

Repositioning a leader pin in a 3592 cartridge

Move a leader pin into its proper position in a 3592 tape cartridge in the event that the pin is improperly positioned.

Before you begin

If you see this symbol:	Take this action:
	Attention: Use a repaired tape cartridge only to recover data and move it to another cartridge. Continued use of a repaired cartridge might void the warranties of the drive and the cartridge.

If the leader pin in your 3592 tape cartridge becomes dislodged from its pin-retaining spring clips, you must use the IBM Leader Pin Reattachment Kit (part number 18P8887) to reposition it.

A leader pin that is improperly seated inside a cartridge can interfere with the operation of the drive. Figure 65 shows a leader pin in the incorrect **1** and correct **2** positions.

To place the leader pin in its proper position, you will need the following tools:
- Plastic or blunt-end tweezers
- Cartridge manual rewind tool (from the Leader Pin Reattachment Kit, part number 18P8887)
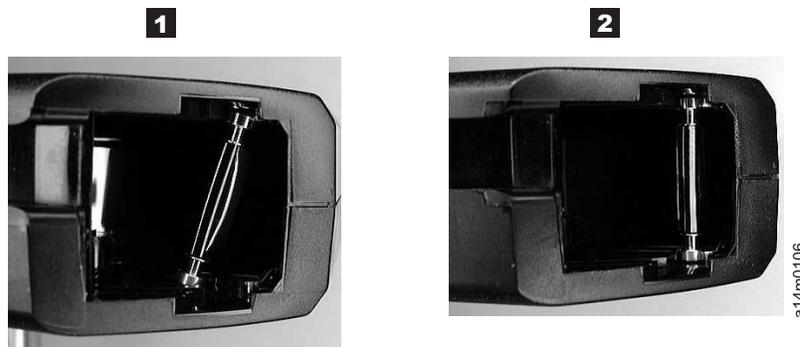
Figure 65. Leader pin in the incorrect and correct positions in a 3592 tape cartridge. The cartridge door is open and the leader pin is visible inside the cartridge.

To reposition the leader pin, perform the following steps.

Procedure

1. Slide open the cartridge door (see **1** in Figure 66 on page 284) and locate the leader pin **2** (you may need to shake the cartridge gently to roll the pin toward the door).
2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips **3** .

3. Press the leader pin gently into the clips until it snaps into place and is firmly seated.

4. Close the cartridge door.
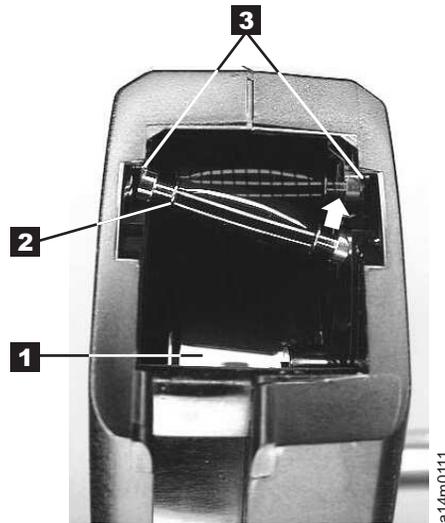
Figure 66. Placing the dislodged leader pin into the correct position. The cartridge door is open, showing the leader pin out of position.

5. To rewind the tape, insert the cartridge manual rewind tool (see **1** in Figure 67) into the cartridge's hub **2** and turn it clockwise until the tape becomes taut.
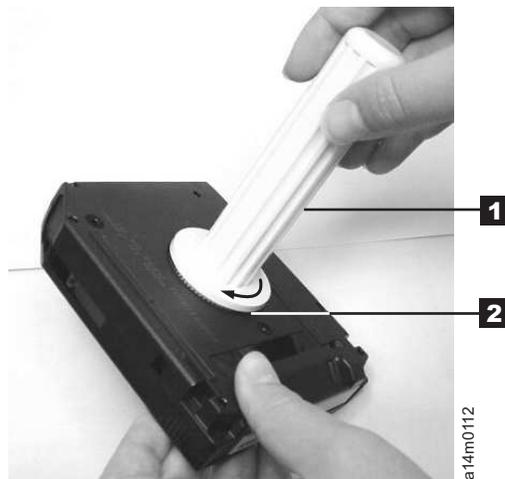
Figure 67. Rewinding the tape into the cartridge

6. Remove the rewind tool by pulling it away from the cartridge.

Environmental and shipping specifications for 3592 tape cartridges

There are specific operating, storage, and shipping requirements for 3592 tape cartridges.

Before you use a tape cartridge, acclimate it to the operating environment for 24 hours or the time necessary to prevent condensation in the drive (the time will vary, depending on the environmental extremes to which the cartridge was exposed).

The best storage container for the cartridges (until they are opened) is the original shipping container. The plastic wrapping prevents dirt from accumulating on the cartridges and partially protects them from humidity changes.

Attention: Depending on how many drives you have installed in the frame, the temperature inside the frame may be as much as 5°C (9°F) above the temperature outside the frame. To ensure continued reliability of your media, be sure to take this temperature difference into account when you set up the environment around your library.

When you ship a cartridge, place it in a sealed, moisture-proof bag to protect it from moisture, contaminants, and physical damage. Ship the cartridge in a shipping container that has enough packing material to cushion the cartridge and prevent it from moving within the container.

Table 31 lists the environmental conditions for operating, storing, and shipping IBM 3592 tape cartridges.

Table 31. Environment for operating, storing, and shipping the IBM 3592 tape cartridge

Environmental Specifications			
Environmental Factor	**Operational Storage[1,3]**	**Archival Storage[2,4]**	**Shipping**
Temperature	16 to 32°C (61 to 90°F)	16 to 25°C (61 to 77°F)	-23 to 49°C (-9 to 120°F)
Relative humidity (noncondensing)	20 to 80%	20 to 50%	5 to 80%
Wet bulb maximum temperature	26°C (79°F)	26°C (79°F)	26°C (79°F)
Magnetic field	Stray magnetic field at any point on tape not to exceed 50 Oersteds (4000 ampere/meter).		
Notes:			
1. Operational storage equals less than 6 months.			
2. Archival storage equals greater than 6 months.			
3. Cartridges shall be stored under these conditions if they will also be used in a drive during storage.			
4. Cartridges shall be stored under these conditions for archiving.			

Disposing of 3592 cartridges

Dispose of 3592 tape cartridges according to federal and other regulations.

Under the current rules of the U.S. Environmental Protection Agency (EPA), regulation 40CFR261, the IBM 3592 tape cartridge is classified as non-hazardous waste. As such, it may be disposed of in the same way as normal office trash. These regulations are amended from time to time, and you should review them at the time of disposal.

If your local, state, country (non-U.S.A.), or regional regulations are more restrictive than EPA 40CFR261, you must review them before you dispose of a cartridge. Contact your account representative for information about the materials that are in the cartridge.

If a tape cartridge must be disposed of in a secure manner, IBM recommends that you use a qualified service provider to degauss and destroy the media.

If you burn the cartridge and tape, ensure that the incineration complies with all applicable regulations.

Cartridge quality and library maintenance

Monitor the cartridges and library regularly to identify cartridges that need to be replaced to ensure proper operation of the tape drives and library.

The 3592 tape cartridge provides high performance and reliability with IBM magnetic tape cartridge drives when the cartridge is properly handled and stored. As stated previously, repeated handling or inadvertent mishandling can damage the physical parts of the cartridge and make it unusable.

The magnetic tape inside the cartridge is made of highly durable materials. However, the tape wears after repeated cycles in the tape system. Eventually, such wear can cause an increase in tape errors.

Track the error data available by monitoring both the cartridge and cartridge library performance. By monitoring error data, you can identify and replace cartridges that are no longer acceptable for continued use.

Proper maintenance of the TS3500 tape library helps to keep IBM magnetic tape cartridge systems operating in a reliable and efficient manner.

Ordering 3592 media supplies

Order more 3592 tape cartridges and other related media supplies by using any of the methods that are described in this topic.

You can order media supplies in two ways, by using the 3599 Tape Media method, or by using part numbers. The 3599 Tape Media method is available for ordering all types of data and cleaning cartridges. This method is typically used for ordering larger quantities and for ordering initialized or pre-labeled cartridges. Media supplies can also be ordered by using part numbers through IBM-authorized distributors.

Ordering 3592 media supplies by using the 3599 tape media method

If you order media by using the 3599 tape media method, IBM Enterprise Tape Media 3599 provides the ability to order unlabeled, pre-labeled, initialized, and bulk-packaged data cartridges in a variety of combinations. You can also order cleaning cartridges. See Table 32 for a list of data cartridges that can be ordered by using the 3599 tape media method.

With the 3599 tape media method of ordering, model numbers are used to identify the cartridge types, and feature code combinations are used to specify the quantities, labeling, and initialization options. Table 32 shows a few examples of ordering options for each cartridge type. Note that additional feature codes are required to completely specify all the characteristics that you want of the cartridges. Orders may be placed by calling 1-800-IBM-CALL (1-800-426-2255).

Table 32. Descriptions of 3599 tape media features.

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
011	JA/9030	1020	1021	9082	640 GB (596.05 GiB)	20-pack 3592 Data cartridges, labeled and initialized
				9081	500 GB (465.66 GiB)	
				9080	300 GB (279.39 GiB)	
012	JA/9030	2020	2021	N/A[3]	500 GB (465.66 GiB)	20-pack 3592 Data cartridges, labeled, not initialized
					300 GB (279.39 GiB)	
013	JA/9030	3020	N/A	N/A	500 GB (465.66 GiB)	20-pack 3592 Data cartridges, not labeled and not initialized
					300 GB (279.39 GiB)	
014	JB/9032	4020	4021	9084	1 600 GB (1490.12 GiB)	20-pack 3592 Extended Data cartridges, labeled and initialized
				9082	1 000 GB (931.32 GiB)	
				9081	700 GB (651.93 GiB)	
015	JB/9032	5020	5021	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended Data cartridges, labeled, not initialized
016	JB/9032	6020	N/A	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended Data cartridges, not labeled and not initialized
420	JC/9035	4211	4221	9084	4 TB (3.64 TiB)	20-pack 3592 Advanced Type C Data cartridges, labeled and initialized
520	JC/9035	5221	5231	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced Type C Data cartridges, labeled, not initialized

Table 32. Descriptions of 3599 tape media features (continued).

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
620	JC/9035	6200	N/A	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced Type C Data cartridges, not labeled and not initialized
425	JD/9036	4251	4261	9085	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D Data cartridges, labeled and initialized
525	JD/9036	5251	5261	N/A	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D Data cartridges, labeled, not initialized
625	JD/9036	6250	N/A	N/A	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D Data cartridges, not labeled and not initialized
E11	JJ/9050	1120	1121	9082	128 GB (119.21 GiB)	20-pack 3592 Economy cartridges, labeled and initialized
				9081	100 GB (93.13 GiB)	
				9080	60 GB (58.88 GiB)	
E12	JJ/9050	1220	1221	N/A	60 GB (58.88 GiB)	20-pack 3592 Economy cartridges, labeled, not initialized
E13	JJ/9050	1320	N/A	N/A	60 GB (58.88 GiB)	20-pack 3592 Economy cartridges, not labeled and not initialized
430	JK/9052	4300	4310	9084	500 GB (465.66 GiB)	20-pack 3592 Advanced Economy cartridges, labeled and initialized
530	JK/9052	5300	5310	N/A	500 GB (465.66 GiB)	20-pack 3592 Advanced Economy cartridges, labeled, not initialized
630	JK/9052	6300	N/A	N/A	500 GB (465.66 GiB)	20-pack 3592 Advanced Economy cartridges, not labeled and not initialized
435	JL/9054	4351	4361	9085	2 TB (1.8 TiB)	20-pack 3592 Advanced Economy cartridges, labeled and initialized
535	JL/9054	5351	5361	N/A	2 TB (1.8 TiB)	20-pack 3592 Advanced Economy cartridges, labeled, not initialized
635	JL/9054	6350	N/A	N/A	2 TB (1.8 TiB)	20-pack 3592 Advanced Economy cartridges, not labeled and not initialized

Table 32. Descriptions of 3599 tape media features (continued).

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
021[4]	JW/9040	2120	2121	9082	640 GB (596.05 GiB)	20-pack 3592 WORM cartridges, labeled and initialized
				9081	500 GB (465.66 GiB)	
				9080	300 GB (279.39 GiB)	
022[4]	JW/9040	2220	2221	N/A	500 GB (465.66 GiB)	20-pack 3592 WORM cartridges, labeled, not initialized
					300 GB (279.39 GiB)	
023[4]	JW/9040	2320	N/A	N/A	500 GB (465.66 GiB)	20-pack 3592 WORM cartridges, not labeled and not initialized
					300 GB (279.39 GiB)	
024[4]	JX/9044	2420	2421	9082	1 000 GB (931.32 GiB)	20-pack 3592 Extended WORM cartridges, labeled and initialized
				9081	700 GB (651.93 GiB)	
025[4]	JX/9044	2520	2521	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended WORM cartridges, labeled, not initialized
026[4]	JX/9044	2620	N/A	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended WORM cartridges, not labeled and not initialized
440	JY/9046	4400	4410	9084	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, labeled and initialized
540	JY/9046	5400	5410	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, labeled, not initialized
640	JY/9046	6400	N/A	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, not labeled and not initialized
445	JZ/9049	4455	4465	9085	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D WORM cartridges, labeled and initialized
545	JZ/9049	5451	5461	N/A	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D WORM cartridges, labeled, not initialized
645	JZ/9049	6450	N/A	N/A	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D WORM cartridges, not labeled and not initialized

Table 32. Descriptions of 3599 tape media features (continued).

| 3599 Model | Media ID/ Feature Code | Feature Code for Labeling, Initialization, and Quantity | | Format | Individual Cartridge Capacity[2, 5] | Description |
		Regular	RFID[1]			
E21[4]	JR/9042	3120	3121	9082	128 GB (119.21 GiB)	20-pack 3592 Economy WORM cartridges, labeled and initialized
				9081	100 GB (93.13 GiB)	
				9080	60 GB (58.88 GiB)	
E22[4]	JR/9042	3220	3221	N/A	100 GB (93.13 GiB)	20-pack 3592 Economy WORM cartridges, labeled, not initialized
					60 GB (58.88 GiB)	
E23[4]	JR/9042	3320	N/A	N/A	100 GB (93.13 GiB)	20-pack 3592 Economy WORM cartridges, not labeled and not initialized
					60 GB (58.88 GiB)	
017	JA	7005	N/A	N/A	cleaning, 50 uses	5-pack 3592 Cleaning Cartridges, with media identification labels
017	JA	7006	N/A	N/A	cleaning, 50 uses	5-pack 3592 Cleaning Cartridges without media identification labels

Notes:

1. Radio frequency identification labels

2. For more details about individual cartridge capacities, see the tables Types of IBM 3592 tape cartridges and Capacity of 3592 tape cartridges.

3. N/A = Not applicable

4. This product is no longer available for order by this method. Refer to "Ordering 3592 media supplies by using part numbers" to order this media type.

5. For cartridges that are not initialized, the actual cartridge capacity is dependent on the format used to write the cartridge.

Ordering 3592 media supplies by using part numbers

Table 33 on page 291 lists the data cartridges and media supplies that you can order for 3592 tape drives by using part numbers. The different methods for ordering are listed at the bottom of the table.

You can use one of the following methods to order the cartridges and media supplies shown in Table 33 on page 291 by part number:

- Order by part number through an IBM-authorized distributor (for the closest distributor, visit the web at `http://www.ibm.com/storage/media`).
- If you do not have Internet access, order the cartridges from any authorized IBM business partner or your IBM sales representative.
- Call 1-888-IBM-MEDIA.

Table 33. Ordering 3592 media supplies by using part numbers

Brand name	Tape Cartridge[1]	Type	Capacity[2]	Part number
IBM Enterprise	3592 Standard read/write	JA	E06 format: 640 GB (596.04 GiB) E05 format: 500 GB (465.66 GiB) J1A format: 300 GB (279.39 GiB)	18P7534
IBM Enterprise	3592 Extended read/write	JB	E07 format: 1600 GB (1490.12 GiB) E06 format: 1000 GB (931.32 GiB) E05 format: 700 GB (651.93 GiB)	23R9830
IBM Enterprise	3592 Advanced Type C Data	JC	E08 format: 7TB (6.37 TiB) E07 format: 4 TB (3.64 TiB)	46X7452
IBM Enterprise	3592 Advanced Type D Data	JD	E08 format: 10 TB (9.1 TiB)	2727263
IBM Enterprise	3592 Economy read/write	JJ	E06 format: 128 GB (119.21 GiB) E05 format: 100 GB (93.13 GiB) J1A format: 60 GB (58.88 GiB)	24R0316
IBM Enterprise	3592 Advanced Type C Economy	JK	E08 format: 900 GB (838.19 GiB) E07 format: 500 GB (465.66 GiB)	46X7453
IBM Enterprise	3592 Advanced Type D Economy	JL	E08 format: 2 TB (1.8 TiB)	2727264
IBM Enterprise	3592 Economy WORM	JR	E06 format: 128 GB (119.21 GiB) E05 format: 100 GB (93.13 GiB) J1A format: 60 GB (55.88 GiB)	24R0317
IBM Enterprise	3592 Standard WORM	JW	E06 format: 640 GB (596.04 GiB) E05 format: 500 GB (465.66 GiB) J1A format: 300 GB (279.39 GiB)	18P7538
IBM Enterprise	3592 Extended WORM	JX	E07 format: 1 600 GB (1490.12 GiB) E06 format: 1 000 GB (931.32 GiB) E05 format: 700 GB (651.93 GiB)	23R9831
IBM Enterprise	3592 Advanced Type C WORM	JY	E08 format: 7TB (6.37 TiB) E07 format: 4 TB (3.64 TiB)	46X7454
IBM Enterprise	3592 Advanced Type D WORM	JZ	E08 format: 10 TB (9.1 TiB)	2727265
IBM Enterprise	3592 Cleaning		Cleaning, 50 uses	18P7535
Notes:				
1. Be sure to order bar code labels for all cleaning and data cartridges. Order volume serial (VOLSER) labels separately.				
2. Cartridge capacities vary depending on tape drive and format. See Table 30 on page 266 for more detailed information.				

Ordering supplies for repairs

It is recommended that you keep the `Leader Pin Reattachment Kit` to maintain your cartridges. This kit contains the necessary tools to reattach the leader pin to the tape. It includes the rewind tool, which can be used to add tension to a tape if the leader pin is displaced. To order the kit, call 1-888-IBM-MEDIA to order as IBM part number 18P8887.

Ordering 3592 bar code labels

Order labels from one of the following authorized suppliers of bar code labels for 3592 tape cartridges.

Bar code labels with volume serial (VOLSER) numbers are required for 3592 tape cartridges that are used within a library. You can order these labels separately from the IBM data cartridges and cleaning cartridges.

Attention: The IBM TS3500 is designed to work with bar code labels that meet the specifications and requirements set forth in the *Label Specification for IBM 3592 Cartridges when used in IBM Libraries*. The label providers listed in the following table have demonstrated the ability to produce finished bar code labels that meet the foregoing specifications and requirements. This information is provided for the convenience of TS3500 tape library users only, and is not an endorsement or recommendation of such providers. IBM is not responsible for the quality of bar code labels procured from sources other than IBM. This information is applicable to bar code labels actually printed by the listed companies. IBM has not reviewed the quality of any labels produced by software or services offered by such companies which allow users to print labels on their own printing equipment.

Table 34. Authorized suppliers of custom bar code labels

In the Americas	In Europe and Asia
Dataware PO Box 740947 Houston, TX 77274 U.S.A. Telephone: 800-426-4844 or 713-432-1023 Fax: 713-432-1385 http://www.datawarelabels.com/	Not applicable
Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U.S.A. Telephone: 888-438-8362 or 303-464-3508 Fax: 888-438-8363 or 303-666-2166 http://www.tri-optic.com	EDP Europe Limited 43 Redhills Road South Woodham Ferrers Chelmsford, Essex CM3 5UL U.K. Telephone: 44 (0) 1245 322380 Fax: 44 (0) 1245 323484 http://www.edpeurope.com/media-labels.html
Netc, L.L.C.[1] 100 Corporate Drive Trumbull, CT 06611 U.S.A. Telephone: 203-372-6382 Fax: 203-372-0676 http://www.NetcLabels.com	Netc Europe Ltd[1] The Old Surgery 5a The Pavement North Curry TA3 6LX Somerset U.K. Telephone: 44 (0) 1823 491439 Fax: 44 (0)1823 491373 http://www.NetcLabels.co.uk
	Netc Asia Pacific Pty Ltd[1] PO Box 872 Cooroy QLD 4563 Australia Telephone: 61 (0) 7 5442 6263 Fax: 61 (0) 7 5442 6522 http://www.NetcLabels.com.au
Note: 1. This is an authorized supplier for radio frequency identification (RFID) labels.	

Chapter 6. Problem determination

This section introduces ways to help you assess symptoms and resolve possible problems with the TS3500 tape library. If you are connected to a Simple Network Management Protocol (SNMP) monitoring station, this section also introduces ways to help you analyze problems identified by SNMP traps.

Resolving errors

This section introduces symptoms and error messages that can help you to resolve problems with the TS3500 tape library, 3592 tape drives, and LTO tape drives.

Resolve errors with the library and the installed tape drives

Refer to a table of symptoms or errors that might occur with the TS3500 tape library and the installed tape drives. The table provides actions to correct the problems.

Table 35 on page 294 lists symptoms or errors that might occur with the TS3500 tape library and provides the required corrective actions. Figure 68 shows the front and Figure 69 on page 294 shows the rear of the 3592 J1A. Use these figures to resolve errors that are addressed in the table.

Note: The power beacon LED on the TS1140 tape drive or TS1150 tape drive is usually green, which indicates that the drive is powered on. Occasionally this LED can turn blue, which does not indicate an error.
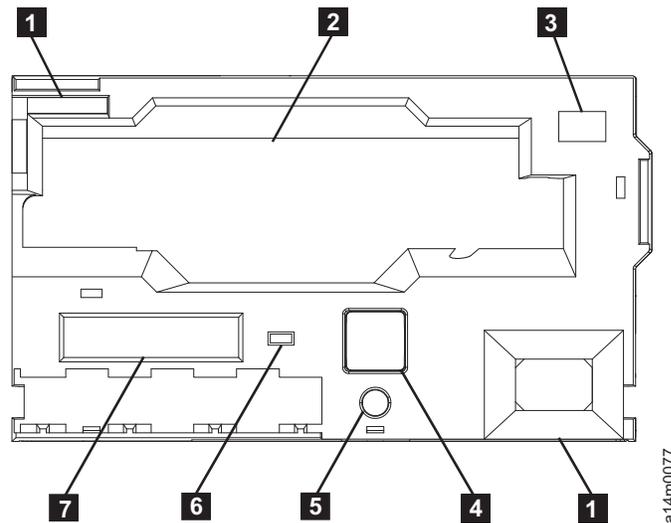
Figure 68. Front view of the 3592 J1A

#	Component		#	Component
1	Reflective fiducials		5	Reset button
2	Tape cartridge slot		6	LED power indicator
3	Nonreflective fiducial		7	eight-character message display
4	Unload area			
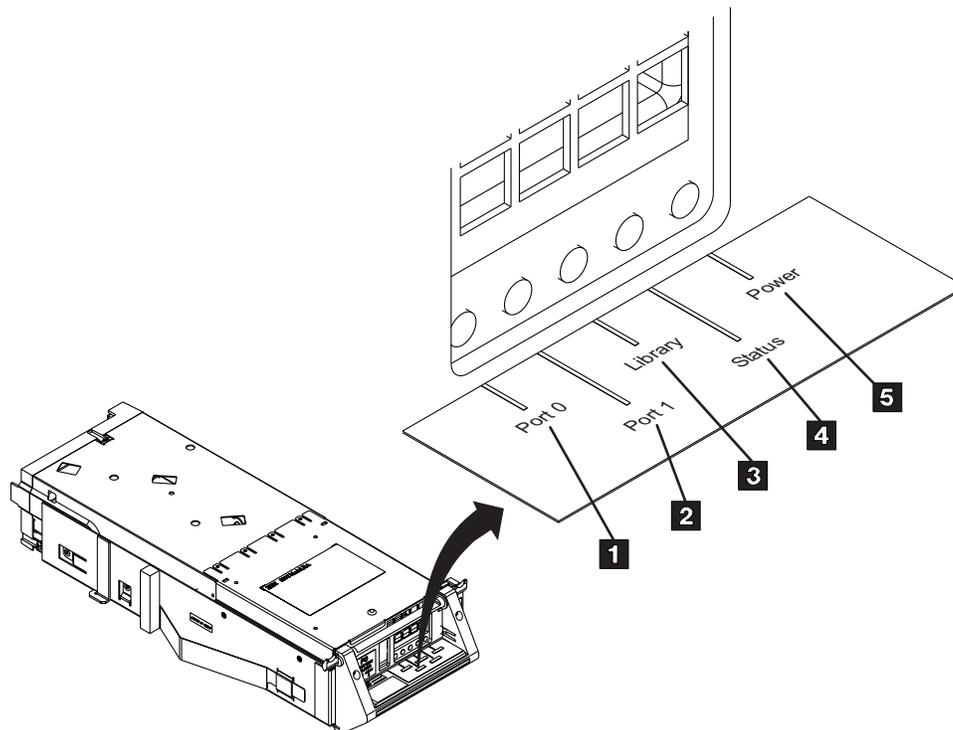
Figure 69. Rear view of the 3592 J1A

#	Component	#	Component
1	LED indicator for Port 0	4	LED indicator for drive status
2	LED indicator for Port 1	5	LED indicator for drive power status
3	LED indicator for library communications		

Table 35. Resolving errors with the IBM TS3500

Symptom or Error	Action
The library is powered off. All of the following conditions are true: • The touchscreen LCD is blank. • The power-on indicator is not lit. • The library and all of the drives do not respond to host commands.	1. Ensure that the library is powered on (the power indicator on the display panel on the base frame is illuminated). 2. Ensure that the power cord for the library is plugged into the wall receptacle. **Note:** Each frame might have a separate power cord. 3. Ensure that the power receptacle (into which the library's power cord is plugged) is active (for example, ensure that a circuit breaker is not tripped or turned off). 4. If the problem still exists, call your IBM service representative.
A message displays on the touchscreen and indicates that a front door is open.	1. Ensure that all front doors are closed and properly latched. 2. If the problem still exists, open and close each front door. 3. If the problem still exists, call your IBM service representative.

Table 35. Resolving errors with the IBM TS3500 (continued)

Symptom or Error	Action
A message displays on the touchscreen and the display panel of the base frame and indicates that the door of the I/O station is open or the I/O station is full of cartridges.	1. If the message indicates that the door of the I/O station is open, close the door. 2. If the message indicates that the I/O station is full of cartridges, open the I/O station door, remove the cartridges, and close the door. 3. If the problem still exists, call your IBM service representative.
A message displays on the touchscreen and indicates that a cleaning cartridge has expired.	Usage of the cleaning cartridge exceeded a specified threshold. Refer to the following procedures to remove and replace the cleaning cartridge: • "Removing a cleaning cartridge from the library" on page 98 • "Inserting a cleaning cartridge into the library" on page 95 • "Ordering additional LTO cartridges and media supplies" on page 260 • "Ordering 3592 media supplies" on page 286 • To enable automatic ejects of expired cleaning cartridges, see "Library preferences" on page 138.
A message displays on the touchscreen and indicates that a drive needs to be cleaned.	1. Ensure that a cleaning cartridge is present in the library inventory (see "Performing an inventory of the library" on page 140). If no cleaning cartridge is present, see "Inserting a cleaning cartridge into the library" on page 95. 2. Ensure that automatic cleaning is enabled (see "Automatic cleaning" on page 95). 3. If the host application is responsible for cleaning the drives, ensure that a cleaning cartridge is in the same logical library as the drive to be cleaned. 4. If the problem still exists, manually clean the drive (see "Performing manual cleaning of drives in the library" on page 96).
An error message displays on the touchscreen.	1. Record the error message, and any error codes, locations, and so forth. **Note:** For error message 48A0, refer to "No Motion Allowed (NMA) state" on page 315 for more information and recovery steps. 2. Press **MENU.** The library removes the error message from the touchscreen. 3. Call your IBM service representative.
Fibre Channel communications problem. The host is unable to communicate with one or more Fibre Channel devices in the library.	Refer to "Resolving errors with Fibre Channel communications" on page 300.
SCSI Communications Problem. The host is unable to communicate with one or more SCSI devices in the library.	Refer to "Resolving errors with SCSI communications" on page 303.
The host application software indicates that a cartridge is write protected.	1. Record the host message, including any information about which cartridge has the problem. 2. Use the application software to move the cartridge to the I/O station. 3. Open the door of the I/O station and remove the cartridge. 4. Set the cartridge write-protect switch to **enable writing** (see "Setting the write-protect switch on an LTO tape cartridge" on page 245 or "Setting the write-protect switch on a 3592 cartridge" on page 280). Insert the cartridge back into the I/O station and close the door. 5. Use the application software to move the cartridge back into the library.

Table 35. Resolving errors with the IBM TS3500 (continued)

Symptom or Error	Action
The host application software indicates that there is a problem with the cartridge.	1. Record the host message, including any information about which cartridge has the problem. 2. If possible, use the application software to copy data from the failing cartridge to another cartridge. 3. Use the application software to move the cartridge to the I/O station. **Note:** If the tape cartridge is stuck (that is, it will not unload after it receives an Unload command from the host), refer to "Removing a data cartridge from a drive in the library" on page 89. 4. Open the door of the I/O station and remove the failing cartridge. 5. Close the door of the I/O station.
The host application software indicates that there is a problem with the bar code on the cartridge.	1. Record the host message, including any information about which cartridge has the problem. 2. Use the application software to move the cartridge to the I/O station. 3. Open the door of the I/O station and remove the cartridge. 4. Check for a loose, damaged, or misaligned bar code label (see "Guidelines for using LTO bar code labels" on page 244 or "Guidelines for using 3592 bar code labels" on page 278). If there is an obvious problem, correct it. You might need to apply a new bar code label. 5. When the problem is corrected, insert the cartridge back into the I/O station and close the door. 6. Use the application software to move the cartridge back into the library. 7. If the problem still exists, call your IBM service representative.
The host application software indicates that there is a problem with the library inventory. For example, a move operation failed because: • The cartridge was not found. • The source location was empty. • The destination location was full.	1. Record the host message, including any information about which cartridges have the problem. 2. Perform an inventory validity check from the Data Cartridges page of the Tape Library Specialist web interface and review the Inventory Differences report. If any inconsistencies are listed, you can selectively remove and reinsert indicated cartridges, reset a specific node card (if indicated in the report), or power cycle the tape library. 3. Use the host application software to inventory the library. Depending on the application, an inventory might be called *inventory*, *initialize element status*, *audit*, *remap*, or *rebuild index*. 4. If the problem still exists, perform an inventory of the entire library from the Tape Library Specialist web interface (see "Using the Web to perform an inventory of the library" on page 140) . Then try again to use the host application software to inventory the library. 5. If the problem still exists, call your IBM service representative.

The host application software indicates that a drive failed.	1. Record the error message and any error codes.
	
	2. Try the job again (if possible, use a different cartridge for the retry; many problems that are reported as drive failures are caused by media defects).
	
	  • If the retry with a different cartridge is successful, consider the original cartridge defective. If necessary, copy the data from the cartridge and remove it from the library (see "Removing data cartridges from the library" on page 86).
	
	  • If the retry with a different cartridge fails, call your IBM service representative.

Table 35. Resolving errors with the IBM TS3500 (continued)

Symptom or Error	Action
The host application software indicates that the library failed.	1. Record the error message and any error codes. 2. Check the library's touchscreen for any error messages. If an error message is displayed, record it and any error codes. 3. Call your IBM service representative.
The library is powered on , but the touchscreen is blurry, unreadable, or blank.	Call your IBM service representative.
The touchscreen is readable, but the touch keys do not work.	Call your IBM service representative.

You cannot insert a 3592 tape cartridge into the library.	1. Ensure that you have the correct cartridge type and that it is oriented correctly (see Figure 24 on page 76)).
	
	2. Inspect the cartridge for damage (see "Perform a thorough inspection of LTO tape cartridges" on page 248 or "Perform a thorough inspection of 3592 tape cartridges" on page 282).
	
	3. Ensure that there is no other cartridge already in the library.
	
	4. Try to load another cartridge into the tape system. Use a scratch cartridge to avoid possible damage to a data cartridge (see "Inserting data or scratch cartridges" on page 73). If the new cartridge can be inserted into the drive, the original cartridge might be defective. Inspect the cartridge again for damage. Contact your IBM service representative if:
	  • The cartridge is not damaged but it cannot be inserted.
	  • The cartridge is damaged.

A message similar to FIDx XX alternates with an alphanumeric message on the display of the 3592 tape drive.	The code is a failure ID (FID). Record the code and see "Using FID messages generated by 3592 tape drives" on page 304.
The message ATTN DRV appears on the display of the 3592 tape drive.	The drive experienced a load error (indicated by the LOAD ERR alternating message) or an unload error (indicated by the UNLOAD E alternating message). If you receive either of these messages, contact your IBM service representative.

Table 35. Resolving errors with the IBM TS3500 (continued)

Symptom or Error	Action

The 3592 tape drive is not ready at load point.	1. Verify that the 3592 tape drive is powered on (the power indicator on the display panel on the base frame is illuminated, see **6** in Figure 68 on page 293).
	
	2. If the cartridge is not inserted correctly, remove the cartridge and insert it again (see "Removing data cartridges from the library" on page 86 and "Inserting data or scratch cartridges" on page 73). If the cartridge fails to load in the tape system, remove the cartridge and inspect it for correct type or damage. See "Perform a thorough inspection of LTO tape cartridges" on page 248 or "Perform a thorough inspection of 3592 tape cartridges" on page 282.
	
	3. If an FID or ATTN message appears on the message display, record the code, press the unload button (see **4** in Figure 68 on page 293), and try the operation again.
	  • If the drive does not become ready and no messages are displayed, call your IBM Service Representative.
	  • If an FID message appears on the message display, record it and see "Using FID messages generated by 3592 tape drives" on page 304 see "Using FID messages generated by 3592 tape drives" on page 304 for more information. If the code is ATTN DRV, the drive experienced either a load error (indicated by the LOAD ERR alternating message) or an unload error (indicated by the UNLOAD E alternating message). If you receive either of these messages, contact your IBM Service Representative.

A power failure occurred and the 3592 tape cartridge failed to eject.	If there is a power failure, the normal tape system process unloads a tape cartridge when power is restored to the device. The time that is required to complete the unload process can vary, but might take up to 15 minutes. If the device fails to unload a tape cartridge after this period, you can attempt to unload the cartridge by pressing the unload button on the front of the drive (see"Removing a data cartridge from a drive in the library" on page 89). • If the 3592 tape drive unloads the cartridge, remove it by grasping the cartridge, and pulling it towards you. • If, within 15 minutes, the 3592 tape drive does not unload the cartridge and a FID or ATTN message appears on the display, record the message and report the problem to your IBM service representative. If a FID or ATTN message appears on the message display, record it and see "Using FID messages generated by 3592 tape drives" on page 304. If the code is ATTN DRV, the drive experienced either a load error (indicated by the LOAD ERR alternating message) or an unload error (indicated by the UNLOAD E alternating message). If you receive either of these messages, contact your IBM service representative.

Table 35. Resolving errors with the IBM TS3500 (continued)

Symptom or Error	Action
The tape cartridge fails to unload from the 3592 tape drive.	If a tape cartridge is stuck (that is, it fails to unload from a drive after it receives an Unload command from the host), refer to "Removing a data cartridge from a drive in the library" on page 89 to remove the cartridge manually. If the cartridge still does not unload, refer to the following steps:
	1. If an error code or a FID message appears on the message display, record the error code or FID message and press the unload button again.
	2. If the drive does not rewind or unload, call your IBM service representative. If a FID or ATTN message appears on the message display, record it and see "Using FID messages generated by 3592 tape drives" on page 304. If the code is ATTN DRV, the drive experienced either a load error (indicated by the LOAD ERR alternating message) or an unload error (indicated by the UNLOAD E alternating message). If you receive either of these messages, contact your IBM service representative.
The message display on the front of the 3592 tape drive is blank.	1. Ensure that the library is powered on (the power indicator on the display panel on the base frame is illuminated) (see **6** in Figure 68 on page 293).
	• If the light is off, contact your IBM service representative.
	• If the power light is on, verify that a cartridge is in the drive. If not, insert a scratch cartridge (see "Inserting data or scratch cartridges" on page 73). Verify that the message display becomes active. If the panel still does not display a message, contact your IBM service representative.
The 3592 tape drive has read or write problems.	See "Media and hardware problem isolation for the 3592 tape drives" on page 314.
The host application software or tape hardware indicates an encryption-related error, or a backup/restore task to encryption hardware fails.	Check the host application's error logs, device driver logs, tape library error logs, and tape drive error logs for entries that are related to encryption. See "Viewing the library error log" on page 219, "Viewing a drive error log" on page 222, "Using FID messages generated by 3592 tape drives" on page 304, "Encryption-related ASC/ASCQ codes" on page 305, and "Key manager-Reported errors" on page 311.

Table 35. Resolving errors with the IBM TS3500 (continued)

Symptom or Error	Action

The host application software or tape hardware indicates a connection problem with the encryption key manager.	Perform the following checks:
	
	 • If you are using library-managed encryption, perform the encryption key manager connection test and the key path diagnostics (see "Using the Web to ping a key manager address" on page 228 and "Using the web to run key path diagnostics" on page 229).).
	
	   – If a test fails, a problem could exist with the IP address, the Ethernet cable, or the switches. Perform the following checks:
	    1. Refer to your network's documentation.
	    2. Check the Ethernet connection between the library and the key manager.
	    3. Check the TCP/IP configuration of the library and the server.
	
	   – If the test succeeds, test the encryption key path and setup from the library's operator panel (see "Using the operator panel to test the encryption key path and setup" on page 229):
	    - If the test succeeds the connection was properly tested and is good.
	    - If the test fails, perform the following checks. To obtain instructions for each task, see the documentation for your key manager.
	     1. Check that the key manager is correctly installed and configured, and that the key manager application is properly started.
	     2. Ensure that the encryption-enabled tape drive is registered in the key manager.
	     3. Ensure that a default key label is defined in the key manager.
	
	 • If the library does not provide the function of a key proxy server (that is, if you are using the application-managed encryption or system-managed encryption method), check your key proxy server's documentation for a similar test.

A power outage occurred and the system does not allow a cartridge to be ejected with Tivoli Storage Manager.	1. Verify that the library is powered on after the power outage. 2. Verify that no error messages are displayed at the drives. 3. Verify that no error messages are displayed on the library operator panel . 4. Manually remove the cartridge, and reinsert it.

Notes: If your library uses a SAN Data Gateway to connect a Fibre Channel server to a SCSI drive, ensure that the gateway has the appropriate level of firmware by performing the following steps:

1. Visit the web at `http://www-03.ibm.com/servers/storage/support/san/`
2. Select one of the following SAN tape gateways and routers:
    • Model 2108-R03
    • Model 2108-G07
3. Select the Download tab.
4. Select `Downloadable files`.
5. From `Product category`, select the item for the firmware code.

Resolving errors with Fibre Channel communications

Refer to a list of actions to identify and resolve communication errors with Fibre Channel devices.

About this task

The following steps help you to identify the source of the problem and resolve the error. Perform these steps if the host is unable to communicate with one of more Fibre Channel devices in the library.

Procedure

1. Ensure that all Fibre Channel cables from the host to the library are securely connected at both ends.
2. If multiple Fibre Channel drives exist on a single loop (as when multiple drives are connected to a hub), ensure that each device on the loop has a unique loop ID (see the section about Fibre Channel Addressing in the *IBM TS3500 with ALMS Introduction and Planning Guide*).
3. Ensure that all Fibre Channel host adapters are supported (for a list of supported adapters, refer to `http://www.ibm.com/servers/storage/tape/drives`. Under the appropriate tape drive, select `Product details`. Then, select `Host bus adapter`. Or, contact your IBM sales representative).
4. Ensure that the appropriate levels of device driver are installed and that any other prerequisites are satisfied (see "Supported device drivers" on page 27).
5. If you are connecting through a storage area network (SAN) Data Gateway, ensure that the gateway has the appropriate level of firmware (see note at the end of table).
6. If you have 4 Gb Fibre Channel backend switches (FC 4872 or 4873) or 8 Gb Fibre Channel backend switches (FC 4875 or 4877) installed on an L23 or D23 frame, contact your service representative. The TS7700 or 3592-C07 detects any problem with the Fibre Channel switches and generates a Call Home.
7. If the maximum number of cartridges is more than 6 887 for the logical library, or if the logical library has shuttle stations that are assigned, ensure that the logical library uses LTO Ultrium 4, 3592 E05, or later tape drives as control path drives. To support more than 6 887 cartridges, Ultrium 4 control path drives require a minimum code level of 97F0. For logical libraries with shuttle stations, Ultrium 4 control path drives require a minimum code level of A480. Ultrium 5 control path drives require a minimum code level of B170. Perform the following steps to ensure that you have the correct drives and code levels:

   a. Display the control paths using the Drive Assignment page on the Tape Library Specialist web interface . If an older generation tape drive is used as a control path, proceed with the next step.

   b. Follow the instructions in "Enabling or disabling a control path in a logical library" on page 120 to disable the older generation tape drive and enable the appropriate drive as the control path.

   c. Reconfigure the host to pick up the device again. Refer to your device driver documentation for additional instructions.

8. Some Fibre Channel devices (such as the SAN Data Gateway, or routers and switches) provide diagnostic routines that show all of the devices that are attached to them. Refer to the device documentation for details about the routines. If a Fibre Channel device that is positioned between the host and the library can see the library's devices, the problem is probably between the Fibre Channel device and the host.

9. Ensure that the host is configured with the correct World Wide Node Name or worldwide port name (see the section about using worldwide Names in the *IBM TS3500 with ALMS Introduction and Planning Guide*). If you want to view

the World Wide Names for a Fibre Channel Drive, see "Viewing a World Wide Node Name" on page 171 or "Viewing a World Wide Port Name" on page 170.

10. Refer to the problem determination information in the documentation for the device driver that you are using. If you are using the IBM Ultrium Device Drivers, refer to *IBM Tape Device Drivers Installation and User's Guide*. Ensure that the device driver is loaded and that it can communicate with the tape drives:

    a. If the device driver is not loaded, install it.

    b. If the device driver is loaded but cannot communicate with the tape drives, call your IBM service representative.

    c. If the device driver is loaded and can communicate with the tape drives, but the application software cannot communicate with the tape drives, contact the provider of your application software for assistance.

11. Current Fibre Channel components support various Fibre Channel speeds. Possible speeds are 1 Gb/s, 2 Gb/s, 4 Gb/s, 8 Gb/s. Refer to the machine configuration and ensure that all drives, switches, and host bus adapters use compatible speed settings.

12. **For a 3592 tape drive**, open the rear door of the library, locate the affected drive, and observe the status LEDs on the back of the drive canister. The LEDs have the following meaning:

    - Blank: no light is detected at the drive's Fibre Channel port. This indicates one of the following conditions:
      – A Fibre Channel cable is unplugged at the drive or at the nearest Fibre Channel device (host bus adapter, switch, or hub).
      – A Fibre Channel cable is broken between the drive and the nearest Fibre Channel device (host bus adapter, switch, or hub).
      – The drive or the nearest Fibre Channel device (host bus adapter, switch, or hub) is powered off or has a hardware problem.
    - Blinking Yellow: Fibre Channel connections between the drive and the Fibre Channel device to which it is connected (host bus adapter, switch, or hub) are good, but communication has not been established.
    - Blinking Green: Fibre Channel connections are good and data is being transferred.
    - Green (not blinking): Fibre Channel connections are good, but no data is being transferred. Note that the Fibre Channel wrap plug may be installed or that the drive may be offline (in maintenance mode).

13. **For an LTO tape drive**, open the rear door of the library, locate the affected drive, and observe the status LEDs on the back of the drive canister. The LEDs have the following meaning:

    - Blank: no light is detected at the drive's Fibre Channel port. This indicates one of the following conditions:
      – A Fibre Channel cable is unplugged at the drive or at the nearest Fibre Channel device (host bus adapter, switch, or hub).
      – A Fibre Channel cable is broken between the drive and the nearest Fibre Channel device (host bus adapter, switch, or hub).
      – The drive or the nearest Fibre Channel device (host bus adapter, switch, or hub) is powered off or has a hardware problem.
    - Yellow: Fibre Channel connections between the drive and the Fibre Channel device to which it is connected (host bus adapter, switch, or hub) are good, but communication has not been established.

- Green: Fibre Channel connections are good and communication has been established.

Resolving errors with SCSI communications

This topic presents a list of actions to identify and resolve communication errors with SCSI devices.

About this task

If the host is unable to communicate with one of more SCSI devices in the library, complete the following steps in order to identify the source of the problem and resolve the error.

Procedure

1. Ensure that all SCSI cables from the host to the library are securely connected at both ends.
2. Ensure that each SCSI bus is properly terminated (the bus is terminated at the SCSI host adapter card and at the last drive on the bus).
3. For each SCSI bus, ensure that all devices have a unique SCSI address. No two drives can have the same SCSI ID, and no drive can use the SCSI ID used by the SCSI host adapter (see the section about using persistent binding to ensure SCSI ID assignments in the *IBM TS3500 with ALMS Introduction and Planning Guide*).

   Note: Unless an RS/6000 High Availability (HA) configuration is used, the SCSI host adapter is typically set to SCSI ID 7. In an HA configuration, one SCSI host adapter is set to SCSI ID 5, the second SCSI host adapter is set to SCSI ID 6, and SCSI ID 7 is reserved.
4. Ensure that all SCSI host adapters, SCSI terminators, and drives on a single SCSI bus are compatible. For example, if a library contains LVD drives, you must use LVD terminators and LVD SCSI host adapters. Similarly, if the library contains HVD drives, you must use HVD terminators and HVD SCSI host adapters.
5. If there is any Fibre Channel equipment between the host and a SCSI tape drive, perform the following tasks:
   a. Follow steps 1 on page 301 through 9 on page 301 in "Resolving errors with Fibre Channel communications" on page 300.
   b. Ensure that the host is configured with the correct Loop ID or AL_PA (see the section about Fibre Channel Addressing in the *IBM TS3500 with ALMS Introduction and Planning Guide*).
6. Refer to the problem determination procedures in documentation for the device driver that you are using. If you are using the IBM Ultrium Device Drivers, refer to *IBM Ultrium Device Drivers Installation and User's Guide*. Ensure that the device driver is loaded and that it can communicate with the tape drives:
   a. If the device driver is not loaded, install it.
   b. If the device driver is loaded but cannot communicate with the tape drives, call your IBM service representative.
   c. If the device driver is loaded and can communicate with the tape drives, but the application software cannot communicate with the tape drives, contact the provider of your application software for assistance.
7. Ensure that the SCSI host adapter settings are correct. The following SCSI host adapter settings are necessary:
   - Wide SCSI must be enabled.

- Disconnect must be allowed.
- Multiple LUN support must be enabled (for any SCSI host adapter that connects to an Ultrium tape drive which serves as a control path).

8. If the maximum number of cartridges is more than 6 887 for the logical library, or if the logical library has shuttle stations assigned, ensure that the logical library uses LTO Ultrium 4, 3592 E05, or later tape drives as control path drives. In order to support more than 6 887 cartridges, Ultrium 4 control path drives require a minimum code level of 97F0. For logical libraries with shuttle stations assigned, Ultrium 4 control path drives require a minimum code level of A480. Ultrium 5 control path drives require a minimum code level of B170. Perform the following steps to ensure that you have the correct drives and code levels:

   a. Display the control paths using the Drive Assignment page on the Tape Library Specialist web interface. If an older generation tape drive is used as a control path, proceed with the next step.

   b. Follow the instructions in "Enabling or disabling a control path in a logical library" on page 120 to disable the older generation tape drive and enable the appropriate drive as the control path.

   c. Reconfigure the host to pick up the device again. Refer to your device driver documentation for additional instructions.

Using FID messages generated by 3592 tape drives

This section defines failure ID (FID) messages that are generated by 3592 tape drives in the TS3500 tape library. It includes a table that gives the FID, a short description of the failure, and corrective actions.

Failure ID (FID) messages are short codes that can be used by service technicians to isolate problems with the 3592 tape drive. If a FID message appears, you must note the message before contacting your service representative. This message is commonly a two-part, alternating message on the display of the 3592 tape drive. A FID error condition message has priority over all other types of messages, and persists until corrected. Technicians use the FID code to identify the failing FRU within the drive subsystem, therefore it is necessary for the operator to make note of the FID message to provide this information to the service representative. An example of the format of these messages is FID1 FF, alternating with an engineering error code, such as 931C9999. In this example, FID indicates to the operator that a hardware failure occurred and 1 indicates the severity code. FF is the FID number that the service representative uses to enter the Maintenance Package. The alternating display of the engineering error code provides specific support information to the service organization.

Table 36 describes FID messages and the actions that you must take. A FID can be displayed on the message display of the 3592 tape drive or obtained from host software or error logs.

Table 36. FID messages

FID	Description	Action
50	Drive canister problem	The encryption configuration that was installed during manufacturing is incorrect. Replace the drive canister. See "Removing or replacing a drive canister assembly - 3592 Fibre Channel hot swap" on page 368 .
51	Drive canister problem	The encryption hardware's power-on self test failed. Replace the drive canister. See "Removing or replacing a drive canister assembly - 3592 Fibre Channel hot swap" on page 368 .

Table 36. FID messages (continued)

FID	Description	Action
52	Hardware or firmware problem	The encryption firmware's power-on self test failed. Call for service.
53	Hardware or firmware problem	A specifically invoked encryption self test failed. Call for service.
54	Encryption diagnostic failure	An automatically invoked encryption diagnostic failed. Call for service.
55	Hardware problem	An unexpected failure of hardware function occurred. Call for service.
58	Encryption error	An error was detected during the encryption of data. Call for service.
59	Decryption error	An error was detected during the decryption of data. Call for service.
5A	Encryption key manager failure	An unexpected status was returned by the key manager. Check the library or proxy interface, then check the encryption key manager log. Not a drive or firmware problem. Requires investigation by the customer.
5B	Encryption proxy failure	A failure or timeout occurred on the proxy interface. Check the library or proxy interface, then check the encryption key manager log. Not a drive or firmware problem. Requires investigation by the customer.
5F	Security prohibited function	A function was attempted that is prohibited by the security settings. Requires investigation of the encryption application software by the customer.
81, 82, 8A, 90, AC, AE, AF, BF, C1, D8, E4, ED, F4	Hardware problem	Call for service.
83, E5	Firmware problem	Call for service.
84, E6	Hardware or firmware problem	Call for service.
86, F2	Hardware or media problem	1. Isolate between media and hardware (see "Media and hardware problem isolation for the 3592 tape drives" on page 314). 2. This failure may be caused by a damaged cartridge. Inspect the cartridge that was being used when the error occurred for physical defects (see "Perform a thorough inspection of 3592 tape cartridges" on page 282). Replace the cartridge if it is damaged. 3. Call for service if the problem remains.
AA, AD	Configuration problem	Call for service.
85, 87, F5, F6, FE, FF	Cartridge or drive problem	1. Isolate between media and hardware (see "Media and hardware problem isolation for the 3592 tape drives" on page 314). 2. Call for service if the problem remains.

Encryption-related ASC/ASCQ codes

Table 37 on page 306 provides additional sense codes (ASCs) and additional sense code qualifier (ASCQ) for encryption-related messages.

Table 37. ASC/ASCQ codes that are related to encryption

Sense Key	ASC ASCQ	Description	Impact	Explanation[1]	Action
5	EE 00	Encryption - Key Service Not Enabled	N/A[2]	N/A	No action required - feature is not enabled (license needed).
5	EE 02	Encryption - Key Service Not Available	N/A	The tape drive has not been configured with an encryption method (application-, system-, or library-managed). **Note:** This status is only presented by the drive; the key manager cannot see this status.	Configure the tape drive to resolve this error.
4	EE 0E	Encryption - Key Service Timeout	N/A	Library-managed only. The tape drive sent an encryption-related request to the library proxy server over the RS/422 connection and got an ACK from the library, but never received the full response from the key manager. Potential causes: loss of connection with the library after the ACK (unlikely); loss of Ethernet connection to the key manager; or key manager not running.	Run the key manager Path Check diagnostic from the library. If the Ethernet connection to the key manager is bad, verify that the correct IP address is specified and troubleshoot it as if it were a network problem. If the Ethernet connection to the key manager is good but the key manager is not responding, ask the customer to attempt to start the key manager. If the key manager reports an error, use that error to troubleshoot the problem.
4	EE 0F	Encryption - Key Service Failure	N/A	The tape drive sent an encryption-related request to the key manager and the key manager reported an error back to the tape drive. Potential causes: key manager software problem; problem with the key store (loss of network connection to the key store, hardware problem with the key store); or an undefined key label.	Obtain the flag data from the tape drive sense data for more specific information about the error. Analyze the flag data to determine the reason for the key manager-reported problem.
7	EF 10	Encryption - Key Required	key manager	This is not an error if the tape drive and proxy server are configured correctly. It is sense data that is used to initiate a key request. EE 10 and EF 10 have the same cause, but EE 10 is reported when the tape drive is configured for an application-managed encryption key path, and EF 10 is reported when the tape drive is configured for a system managed encryption key path.	If this sense is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed) and that the encryption proxy server is configured correctly. If this sense is NOT associated with a job failure, ignore this condition.

Table 37. ASC/ASCQ codes that are related to encryption (continued)

Sense Key	ASC ASCQ	Description	Impact	Explanation[1]	Action
5	EE 10	Encryption - Key Required	N/A	This is not an error if the tape drive and proxy server are configured correctly. It is sense data that is used to initiate a key request. EE 10 and EF 10 have the same cause, but EE 10 is reported when the tape drive is configured for an application-managed encryption key path, and EF 10 is reported when the tape drive is configured for a system-managed encryption key path. **Note:** If the application proactively serves a key you will not see this.	If this sense is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed) and that the encryption proxy server is configured correctly. If this sense is not associated with a job failure, ignore this condition.
7	EF 11	Encryption - Key Generation	key manager	This is not an error if the tape drive and proxy server are configured correctly. It is sense data that is used to initiate a key generation request. It is similar to EF 10, but this is a key-generation request instead of a request for an existing key.	If this sense is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed) and that the encryption proxy server is configured correctly. If this sense is not associated with a job failure, ignore this condition.
6	EE 12	Encryption - Key Change Detected	N/A	Information only - SCSI Unit Attention – a key has changed.	No action required. Key change detected (notification only) re-drive command.
7	EF 13	Encryption - Key Translate	key manager	This is not an error if the tape drive and proxy server are configured correctly. It is sense data that is used to initiate a key translation request to the library key path.	If this sense is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed) and that the encryption proxy server is configured correctly. If this sense is not associated with a job failure, ignore this condition.
0	EF 13	Encryption - Key Translate	key manager	This is not an error if the tape drive and proxy server are configured correctly. It is sense data that is used to initiate a key translation request to the application or system key path.	No action required. Key translation has been requested (in-band).

Table 37. ASC/ASCQ codes that are related to encryption (continued)

Sense Key	ASC ASCQ	Description	Impact	Explanation[1]	Action
6	EE 18	Encryption - Changed (Read)	N/A	Information only - SCSI Unit Attention - encryption characteristics (for example, key, method, and so forth) were changed prior to a read operation.	No action required. Try the command again if necessary.
6	EE 19	Encryption - Changed (Write)	N/A	Information only - SCSI Unit Attention - encryption characteristics (for example, key, method, and so forth were changed prior to a write operation.	No action required. Try the command again if necessary.
5	EE 23	Encryption - Key Conflict	key manager	An attempt was made to reuse a previously used Data Key Index (Dki). This is also known as a *key collision*. **Note:** This is expected to be a rare occurrence. It is only used in a multi-key environment.	Try the command again if necessary. If the problem persists, obtain a drive dump and key manager (or application, if no key manager is involved) traces, then contact your next level of support.
5	EE 25	Encryption - Key Format Not Supported	key manager	The tape drive received a corrupted or unrecognized message from the key manager. The most likely causes are an key manager code bug or incompatible code versions on the drive and key manager. **Note:** This is expected to be a rare occurrence.	Try the command again if necessary. If the problem persists, verify that the key manager and drive code versions are compatible. As an example, if the key manager code were updated to include a new function but the drive code version does not recognize the new key manager function, then the code versions are incompatible. If the problem still persists, obtain a drive dump and key manager (or application, if no key manager is involved) traces, then contact your next level of support.
5	EE 26	Encryption - Unauthorized Request - dAK	key manager	Key usage error. An invalid Drive Authentication Key (dAK) was used or a valid dAK was used incorrectly. This could be an authorized attempt to access data.	This sense may be reported after Service replaces a tape drive. If so, then it may be automatically corrected to support the new tape drive. If the problem persists, ensure that the Drive Authentication Keys are correct.

Table 37. ASC/ASCQ codes that are related to encryption (continued)

Sense Key	ASC ASCQ	Description	Impact	Explanation[1]	Action
5	EE 27	Encryption - Unauthorized Request - dSK	key manager	Key usage error. An invalid Drive Session Key (dSK) was used or a valid dSK was used incorrectly. This could be an unauthorized attempt to access data.	Try the command again if necessary. This sense may be reported after Service replaces a tape drive. If so, then it may be automatically corrected to support the new tape drive. If the problem persists, ensure that the Drive Session Keys are correct.
5	EE 28	Encryption - Unauthorized Request - eAK	key manager	Key usage error. An invalid External Authentication Key (eAK) was used or a valid eAK was used incorrectly. This could be an unauthorized attempt to access data. **Note:** A private key is needed for External Authentication.	Try the command again if necessary. If the problem persists, ensure that the External Authentication Keys are correct.
5	EE 29	Encryption - Authentication Failure	key manager	A corrupted or incorrectly signed message was detected. Potential causes: invalid signature on a message; key manager code bug; tape drive code bug; or drive hardware problem (unlikely). This could be an unauthorized attempt to access data.	Try the command again if necessary. If the problem persists, ensure that the signatures are correct. If the problem still persists, use tape drive diagnostics to ensure that the tape drive encryption hardware is functional.
5	EE 2B	Encryption - Key Incorrect	N/A	An incompatible key was written in a unsupported format. **Note:** This is expected to be a rare occurrence.	Ensure that the encryption keys are correct, then try the command again. If the problem persists, obtain a drive dump and key manager (or application, if no key manager is involved) traces, then contact your next level of support.
5	EE 2C	Encryption - Key Wrapping Failure	key manager	The key manager has a problem which resulted in building the Session Encrypted Data Key (SEDK) incorrectly. **Note:** The SEDK is a structure used to wrap a key or keys to send them to the tape drive. This is typically reported with ASC/ASCQ EE 0F, so this sense is typically only found in internal logging.	If a higher version of key manager is available, update the key manager. If the problem persists, obtain a drive dump and key manager (or application, if no key manager is involved) traces, then contact your next level of support.

Table 37. ASC/ASCQ codes that are related to encryption (continued)

Sense Key	ASC ASCQ	Description	Impact	Explanation[1]	Action
5	EE 2E	Encryption - Unsupported Type	key manager	The tape drive received a corrupted or unrecognized message from the key manager. The most likely causes are an key manager code bug or incompatible code versions on the drive and key manager. **Note:** This is expected to be a rare occurrence.	Try the command again if necessary. If the problem persists, verify that the versions of the key manager and drive code are compatible. As an example, if the key manager code were updated to include a new function but the drive code version does not recognize the new key manager function, then the code versions are incompatible. If the problem still persists, obtain a drive dump and key manager (or application, if no key manager is involved) traces, then contact your next level of support. **Note:** the byte and bit pointers may be used to indicate the first bad field in the message.
5	EE 30	Encryption - Prohibited Request	N/A	The requested operation was not allowed, due to the current mode or state. As an example, a key path diagnostic was not allowed because there was a cartridge in the tape drive.	Ensure that the requirements for the requested operation have been met. As an example, before running a key path diagnostic ensure that the tape drive is empty. If the problem persists, obtain a drive dump, then contact your next level of support.
5	EE 31	Encryption - Key Unknown	N/A	A key operation was not allowed because the key was not known (not a currently tracked key). The key that was used is not a match for this tape cartridge.	Try the command again by using the correct encryption key for the cartridge.
3	EE 60	Encryption - Proxy Command Error	N/A	A command resulted in a key transition that cannot be handled by the application or system proxy server. The proxy server reports this condition; this sense combination is typically not produced by the tape drive. **Note:** This is only expected in test environments, not in the field.	If the problem persists, obtain a drive dump and traces from the proxy server, then contact your next level of support.

Table 37. ASC/ASCQ codes that are related to encryption (continued)

Sense Key	ASC ASCQ	Description	Impact	Explanation[1]	Action
3	EE D0	Encryption - Data Read Decryption Failure	N/A	The tape drive was unable to decrypt data by using an application-provided key. The probable cause is use of the wrong encryption key. In rare cases this may also be caused by a failure in the tape drive's encryption hardware.	Try the command again by using the encryption key that was used when the cartridge was written. If the problem persists, use the tape drive diagnostics to determine whether there is a problem with the encryption hardware.
3	EE D1	Encryption - Data Read after Write Decryption Failure	N/A	The tape drive wrote encrypted data and was unable to decrypt it after reading it back. The most likely cause is a tape drive code or hardware problem.	Obtain a drive dump. Use the tape drive diagnostics to determine whether there is a problem with the encryption hardware. If the diagnostics do not indicate a problem, contact your next level of support.
3	EE E0	Encryption Key Translation Failure	key manager	A permanent error occurred during a key translation operation. The cartridge is in an indeterminate state.	The cartridge may need to be accessed with the old key or with the new key. This tape should be copied and retired.
5	EE E2	Encryption - Key Translation Disallowed	N/A	An encryption key translation was requested, but the encryption proxy server rejected the request. Possible causes: a prior translation is pending and has not yet completed, or the Externally-Encrypted Data Key (EEDK) on the cartridge is persistently unencrypted.	Verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed) and that the encryption proxy server is configured correctly.
3	EE F1	Encryption - Encryption Fenced (Write)	N/A	The key manager has set an encryption fence condition that prevents further writing. This fence condition is cleared when the cartridge is demounted. **Note:** This only occurs with the library-managed encryption method. Possible causes: a mismatch between the cartridge's volume serial (VOLSER) number and the VOLSER ranges used for an encryption policy.	Ensure that the cartridge's VOLSER is in the correct VOLSER range (because VOLSER ranges are associated with an encryption policy).

Notes:

1. All ASC EF sense combinations invoke key manager flow at the proxy server.

2. N/A = not applicable.

Key manager-Reported errors

Refer to a troubleshooting table that includes the error number, a short description of the failure, and corrective actions. Use this table when error messages related to the encryption-enabled tape drives are reported by the encryption key manager.

Table 38. Errors that are reported by the encryption key manager

Error Number	Description	Action
EE2D	Encryption Read Message Failure: Invalid Message Type	The key manager received a message out of sequence or received a message that it does not know how to handle. Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Enable debug on the key manager server. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
EE29	Encryption Read Message Failure: Invalid signature	The message received from the drive or proxy server does not match the signature on it. Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Enable debug on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
EE2E	Encryption Read Message Failure: Internal error: Invalid signature type	The message received from the drive or proxy server does not have a valid signature type. Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Enable debug on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
EE23	Encryption Read Message Failure: Internal error: "Unexpected error........"	The message received from the drive or proxy server might not be parsed because of general error. Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Enable debug on the key manager server. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
EE02	Encryption Read Message Failure: DriverErrorNotifyParameterError: "Bad ASC & ASCQ received. ASC & ASCQ does not match with either of Key Creation/Key Translation/Key Acquisition operation."	The request is for an unsupported action. Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Check the versions of drive or proxy server firmware and update them to the latest release, if needed (see "Updating drive firmware" on page 223). Enable debug tracing on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.

Error Number	Description	Action
EE2C	Encryption Read Message Failure: QueryDSKParameterError: "Error parsing a QueryDSKMessage from a device. Unexpected disk count or unexpected payload."	The request is for an unsupported function. Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Check the versions of drive or proxy server firmware and update them to the latest release, if needed (see "Updating drive firmware" on page 223). Enable debug tracing on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
EE2B	Encryption Read Message Failure: Internal error: "Either no signature in DSK or signature in DSK can not be verified."	Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Check the versions of drive or proxy server firmware and update them to the latest release, if needed (see "Updating drive firmware" on page 223). Enable debug tracing on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
EE0F	Encryption logic error: Internal error: "Unexpected error. Internal programming error in key manager."	Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Check the versions of drive or proxy server firmware and update them to the latest release, if needed (see "Updating drive firmware" on page 223). Enable debug tracing on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
EE01	Encryption Configuration Problem: "Drive not configured."	The drive that is trying to communicate with the key manager is not present in the drive table. Ensure that the `config.drivetable.file.url` is correct in the `KeyManagerConfig.properties` file, if that parameter is supplied. Run the `listdrives` command to check whether the drive is in the list. If not, configure the drive manually by using the `adddrive` command with the correct drive information or turn "auto-fill" ON by setting **drive.acceptUnknownDrives** to true using the `modconfig` command. Enable debug tracing and try the operation again. If the problem persists, contact IBM Support.

Table 38. Errors that are reported by the encryption key manager (continued)

Error Number	Description	Action
EE25	Encryption Configuration Problem: Errors that are related to the drive table occurred.	Ensure that the **config.drivetable.file.url** is correct in the KeyManagerConfig.properties file, if that parameter is supplied. Run the `listdrives -drivename <drivename>` command on the key manager to verify whether the drive is correctly configured (for example, the drive serial number, alias, and certifications are correct). Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Check the versions of drive or proxy server firmware and update them to the latest release, if needed (see "Updating drive firmware" on page 223). Enable debug tracing and try the operation again. If the problem persists, contact IBM Support.
EE31	Encryption Configuration Problem: Errors that are related to the keystore occurred.	Check the key labels that are used or configured for the defaults. Run the `listdrives -drivename <drivename>` command on the key manager to verify whether the drive is correctly configured (for example, the drive serial number, alias, and certifications are correct). Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Check the versions of drive or proxy server firmware and update them to the latest release, if needed (see "Updating drive firmware" on page 223). Enable debug tracing and try the operation again. If the problem persists, contact IBM Support.
EEE1	Encryption logic error: Internal error: "Unexpected error: EK/EEDK flags conflict with subpage."	Ensure that you are running the latest version of the key manager (to determine the latest version, contact your IBM Representative). Check the versions of drive or proxy server firmware and update them to the latest release, if needed (see "Updating drive firmware" on page 223). Enable debug on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.

Media and hardware problem isolation for the 3592 tape drives

Refer to steps to determine whether a problem with a 3592 tape drive in the TS3500 tape library is due to faulty media or faulty hardware.

About this task

An error code (FID FE) is generated when the 3592 tape drive experiences an error and cannot determine whether the tape cartridge or the drive hardware causes the problem. The FID FE is not displayed on the drive, but is logged in the sense information that is returned to the host system.

Media and drives can affect each other and the indications can be confusing. You must record the symptoms for the drive and the tape to make problem isolation possible. The failing component or tape must be isolated or the problems are not resolved. Problems can be intermittent, so careful record keeping is necessary. By keeping careful records of transient problems, you enable problem isolation and resolution.

To determine the cause of the read or write errors, use the steps that follow.

Procedure

1. Ensure that the cartridge maximum usage of 50 cleanings is not exceeded (see "Determining cleaning cartridge usage" on page 208).
   - If automatic cleaning is enabled, ensure that a cleaning cartridge is installed in the TS3500 tape library.
   - Ensure that the 3592 tape drive is not overdue for cleaning.
2. Determine which volume serial (VOLSER) numbers or cartridges are potential problems.
   - Note which VOLSERs fail during the operation. (It is possible to have multiple bad cartridges.)
   - Record the Media information Message (MIM) MESSAGE CODE at the host and associated VOLSER numbers, if the host supports MIM messages.
   - If you receive a Service information message (SIM) at the host, get the VOLSER numbers from the message and record those numbers in your TAPE SERIAL LOG.
3. Determine whether the cartridges are bad.
   - Examine the cartridge for damage (see "Perform a thorough inspection of 3592 tape cartridges" on page 282). Open the door to observe if the pin is properly seated, and examine the cartridge for cracks. If damaged, repair or replace the cartridge (see "Repositioning a leader pin in a 3592 cartridge" on page 283).

     Note: A repaired cartridge can be used long enough to recover data from that cartridge. When the data is recovered, the cartridge must then be taken out of service and discarded, or returned to the plant of origin.
   - If the cartridges appear undamaged and you have access to another 3592 tape drive, try the operation with the suspect cartridges in the other drive. If your cartridges fail in the other drive, replace the media.
4. Determine whether the drive is bad.
   - Try a new tape on the suspect drive. If it also fails, contact your IBM Service Representative.
   - If tapes show evidence of damage, do not put any more tapes on the drive until your IBM Service Representative examines the drive.

No Motion Allowed (NMA) state

Refer to a description of the No Motion Allowed (NMA) state and a list of recommended operator actions in an NMA scenario.

The NMA state is a condition set as a result of an accessor detecting an apparent obstruction to normal accessor movement. An obstruction can be detected in either X or Y motion. Unexpected motion of the pivot motor and unexpected activation of the cartridge present sensor are the detection mechanisms.

The NMA state can result from one or more of the following example conditions:

- The accessor collides with an obstacle in the accessor aisle, such as a cartridge that is sticking out of a cell. Other possible causes include debris in the lower X-rail gear rack such as a screw, piece of plastic, or other debris that would interfere with accessor motion.
- A cartridge is only partially in the gripper.
- The accessor detects a false obstruction.

When the NMA detection capability is set to ON and an accessor encounters an apparent obstruction, the library is placed into the protective NMA state. Error message 48A0 displays on the operator panel. If SNMP traps are enabled, a trap is also generated and sent. When the library goes into the NMA state, all motion immediately stops on the affected accessor. The NMA state protects the library from further damage as a result of a detected obstruction.

When the NMA detection capability is set to **OFF**, motion continues even after the accessor detects an apparent obstruction. However, if the *cartridge present* sensor is activated when the accessor moves, or if the gripper is not clear, the library is put into the NMA state. When the NMA detection capability is set to OFF, and accessor motion is allowed to continue despite an obstruction, there is a risk of damage to the library and storage cells.

It is recommended that the NMA detection capability is set to **ON** in both single and dual accessor libraries. Your IBM service representative can set this detection capability.

Note: Although the NMA detection capability is set to **OFF** by default, it might already be set to **ON** if the library was shipped from manufacturing after January 2010.

Customer recovery procedures in an NMA state

If the library goes into an NMA state, you can open a library door to check for and remove any obvious obstructions, such as a cartridge partially sticking out of a cell. If no obstructions are found, the accessor could have falsely sensed an obstruction. The action of opening the door resets the NMA state and allows the library to continue operations once the door is closed.

If no obvious obstructions are found, the problem could be related to other causes, which your IBM service representative can determine. If the root cause is not corrected, the library could once again enter an NMA state, which generates a Call Home.

Resolving errors with the LTO tape drives

This section lists error codes that can appear on the single-character display (SCD) of the LTO tape drives and describes each error.

The LTO tape drive has an SCD that displays a code which can aid in servicing the drive. While the TS3500 tape library is active, it can be difficult to see the SCD without opening the library door. An easier way to obtain information about a drive error is to determine which drive is reporting an error, then access the error log for that drive by using the operator panel or by using the Tape Library Specialist web interface. You can access a drive error log from the operator panel by using the **Service** and **Drive Error Logs** menus. To use the web, see "Accessing logs for drives or saving a drive dump" on page 222.

Figure 70 shows the front of the LTO drive and the location of the SCD.

1	Status light	3	Single-character display (SCD)
2	Unload button	4	SCD dot
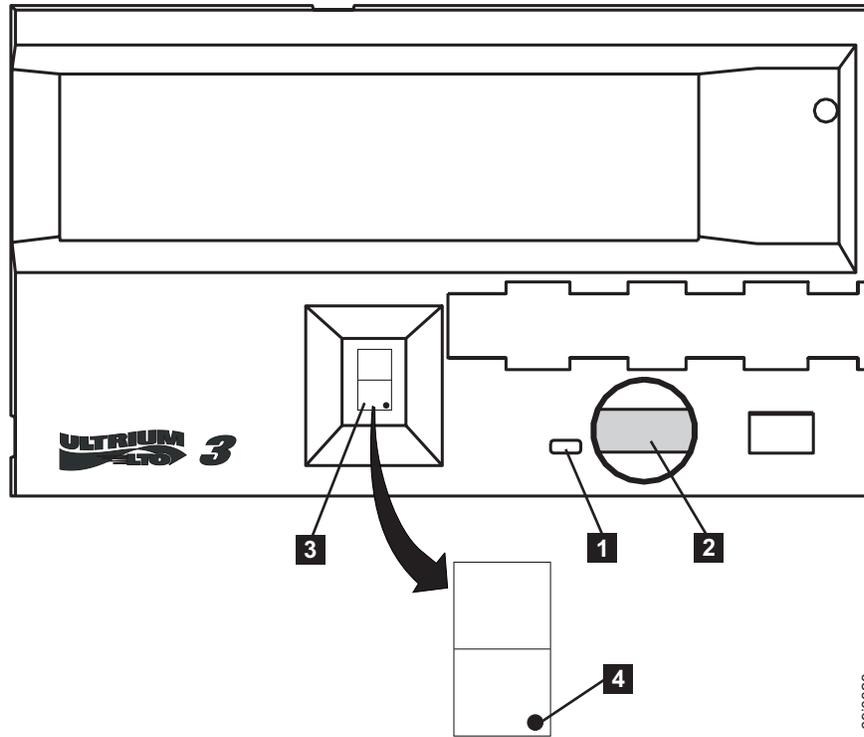
Figure 70. Front view of the LTO 3 tape drive

#	Component	#	Component
1	LED indicator for Port 0	4	LED indicator for drive status
2	LED indicator for Port 1	5	LED indicator for drive power status
3	LED indicator for library communications		

Table 39 gives the SCD error codes for the LTO tape drives. Use this table only if no sense data is available. Whenever possible, use sense data or a drive's Fault Symptom Code (FSC) instead of the SCD code. For information about sense data, see the *IBM LTO Tape Drive SCSI Reference*. For information about FSCs, see the *IBM TS3500 Maintenance Information* guide.

Table 39. SCD error codes for the LTO tape drives

SCD Code	Description
0	No Error. Ran successfully.
1	Cooling problem.
2	5V dc power problem. Tape drive detected that the Drive Power Supply is approaching the specified voltage limit (drive is still operating) or is outside the specified voltage range (drive is not operating).
3	Tape drive determined that a microcode error occurred.

Table 39. SCD error codes for the LTO tape drives (continued)

SCD Code	Description
4	Microcode or tape drive problem. Tape drive determined that a microcode or tape drive hardware failure occurred.
5	Tape drive problem. Tape drive determined that a hardware failure occurred.
6	Tape drive or media error. Tape drive determined that an error occurred, but it cannot isolate the error due to faulty hardware or to the tape cartridge.
7	Media error.
8	Tape drive, SCSI bus or fibre channel error.
9	Tape drive or RS-422 error.
A	Tape drive hardware problem.
B	No error or message is assigned.
C	Tape drive needs to be cleaned.
D	No error or message is assigned.
=	The Unload button on the drive was pushed in and did not release.

Note: The rear panel of LTO 5 and later tape drives has a power beacon LED that indicates the drive is powered on when green. Occasionally this LED can be blue, which does not indicate an error.

Attaching the library to open systems

This section directs you to information about attaching the TS3500 tape library to open systems.

For information about attaching the TS3500 tape library to open systems, refer to the *IBM Tape Device Drivers Installation and User's Guide*. To access the most current device driver installation and user guides on the Web, go to: `http://www-01.ibm.com/support/docview.wss?rs=577&uid=ssg1S7002972` .

Interpreting SNMP traps

This section provides information that helps you to understand the meaning of an Simple Network Management Protocol (SNMP) trap that is received by the TS3500 tape library.

The TS3500 tape library can alert you to possible problems by using a TCP/IP LAN network that is connected to an SNMP monitoring station. These alerts are called SNMP traps. The monitoring station must be loaded with systems management software (such as NetView[(R)]) that can receive and process the trap, or the trap is discarded. After the trap received, it must be interpreted.

If you have systems management software that includes an SNMP compiler, you may not need to manually interpret SNMP traps but you will need the library's Management Information Base (MIB). The MIB contains units of information that specifically describe an aspect of a system, such as the system name, hardware number, or communications configuration. Refer to "Obtaining a Management Information Base" on page 336 for step-by-step instructions for downloading the correct MIB for your operating system. After you obtain the MIB, load it into your management application. When the application next receives an SNMP trap, it will compile it into human-readable form so that you can gather information about the error.

If you do not have systems management software that includes an SNMP compiler, you will need to manually interpret the SNMP traps. Refer to "Manually interpreting an SNMP trap" for more information.

Manually interpreting an SNMP trap

About this task

To manually interpret a Simple Network Management Protocol (SNMP) trap:

Procedure

1. Observe the trap when it is received by systems management software and identify its components. Figure 71 on page 320 shows a sample SNMP trap. The trap consists of object identifiers (OIDs) on the left of the equal (=) sign and OID fields on the right.

   The characters 182 in the OID indicate that the device is an TS3500 tape library. The OID fields contain values that will help you to determine the nature of the problem.

   Note: Not every trap contains every field.

```
1.3.6.1.4.1.2.6.182.1.2.11.1.0 = 3584 L32 1312345
1.3.6.1.4.1.2.6.182.1.2.21.1.0 = 04 44 00
1.3.6.1.4.1.2.6.182.1.2.31.1.0 = 90 80
1.3.6.1.4.1.2.6.182.1.2.41.1.0 = 24
1.3.6.1.4.1.2.6.182.1.2.51.1.0 = A4D0
1.3.6.1.4.1.2.6.182.1.2.61.1.0 = 01 00
1.3.6.1.4.1.2.6.182.1.2.71.1.0 = The library has detected an error in its inventory
1.3.6.1.4.1.2.6.182.1.2.81.1.0 = 0A1
1.3.6.1.4.1.2.6.182.1.2.91.1.0 = 6
1.3.6.1.4.1.2.6.182.1.2.101.1.0 = 12762L2
1.3.6.1.4.1.2.6.182.1.2.11.1.0 = 1
```

Figure 71. Sample SNMP trap. OIDs are to the left of the equal sign; OID fields are to the right. Values in the fields provide information about the problem.

Table 40 shows the variables sent from the 3584 Library TapeAlerts for Traps 1 through 32. Table 41 on page 321 shows the variables sent from the LTO and 3592 tape drive TapeAlerts for Traps 200 through 254. Table 42 on page 321 shows the variables sent from the TS3500 tape library for events that are not covered by TapeAlerts for Traps 400 through 408.

Table 40. Variables sent from the library TapeAlerts for Traps 1 through 32

Variable Number	Variables Sent from Library TapeAlerts	Values	Description
1	ibm3584MIBObjectsMTMNLSN	Example "3584 L32 1300000"	The Space Delimited string with the machine type, model number, and serial number of the library.
2	ibm3584MIBObjectsSKASCASCQ	Example "04 4400"	The Space Delimited string with the SCSI Sense Key and ASC/ASCQ.
3	ibm3584MIBObjectsHECHECQ	Example "B884"	The string with the hardware error code for the problem.
4	ibm3584MIBObjectsTA	Example "3"	The string with the TapeAlert number of the problem encountered.
5	ibm3584MIBObjectsURC	Example "A428"	The URC error code that is used by the IBM Service Representative to isolate the problem.
6	ibm3584MIBObjectsFFFD	Example "01 05"	The Space Delimited string that indicates the frame and drive location of the problem.
7	ibm3584MIBObjectsTD	A problem with the I/O station exists: 1. Ensure that there is no obstruction in the I/O station. 2. Restart the operation. 3. If the problem persists, call your IBM Service Representative.	The string that describes the problem and a recommended corrective action.
8	ibm3584MIBObjectsSeverity	Example: 1	The string that indicates the severity of the problem, from informational to severe. For exact values, see the IBM 3584 MIB for Version 1 or Version 2c traps.

Table 41. Variables sent by LTO and tape drive TapeAlerts for Traps 200 through 254

Variable Number	Variables Sent from tape drive TapeAlerts	Values	Description
1	ibm3584MIBObjectsMTMNLSN	Example "3584 L32 1300000"	The Space Delimited string with the machine type, model number, and serial number of the library.
2	ibm3584MIBObjectsSKASCASCQ	Example "04 4400"	The Space Delimited string with the SCSI Sense Key and ASC/ASCQ.
3	ibm3584MIBObjectsTA	Example "3"	The string with the TapeAlert number of the problem encountered.
4	ibm3584MIBObjectsURC	Example "A428"	The URC error code that is used by the IBM Service Representative to isolate the problem.
5	ibm3584MIBObjectsFSC	Example "0000"	The 4-character string with the drive fault symptom code.
6	ibm3584MIBObjectsSCD	Example "6"	The character that is displayed on the front of the drive at the time of the failure.
7	ibm3584MIBObjectsVOLSER	Example "123456L2"	The 8-character volume label on the front of the cartridge in the drive at the time of the event.
8	ibm3584MIBObjectsFFFD	Example "01 05"	The space delimited string that indicates the frame and drive location of the problem.
9	ibm3584MIBObjectsTD	The tape cartridge has reached the end of its calculated useful life: 1. Copy any data that you need to another tape. 2. Discard the old tape.	The space that describes the problem and a recommended corrective action.
10	ibm3584MIBObjectsWWNN	Example "500507630F070641"	The world wide node name that is associated with the drive which reports the trap.
11	ibm3584MIBObjectsDrvSN	Example "0007811157"	The drive serial number that is associated with the drive which is reports the trap.
12	ibm3584MIBObjectsSeverity	Example: 1	The string that indicates the severity of the problem, from informational to severe. For exact values, see the IBM 3584 MIB for Version 1 or Version 2c traps.

Table 42. Variables sent by library for events that are not covered by TapeAlerts for Traps 400 through 408

Variable Number	Variables Sent from Library for Events that are not Covered by TapeAlerts	Values	Description
1	ibm3584MIBObjectsMTMNLSN	Example "3584 L32 1300000"	The Space Delimited string with the machine type, model number, and serial number of the library.

Table 42. Variables sent by library for events that are not covered by TapeAlerts for Traps 400 through 408 (continued)

Variable Number	Variables Sent from Library for Events that are not Covered by TapeAlerts	Values	Description
2	ibm3584MIBObjectsLL	Example "001"	The string that contains the logical library that is associated with this event.
3	ibm3584MIBObjectsVOLSER	Example "123456L2"	The 8-character volume label on the front of the cartridge in the drive at the time of the event.
4	ibm3584MIBObjectsTA	Example "3"	The string with the TapeAlert number of the problem encountered.
5	ibm3584MIBObjectsTD	An Enterprise Tape cleaning cartridge has expired.	The space that describes the problem and a recommended corrective action.
6	ibm3584MIBObjectsSeverity	Example: 1	The string that indicates the severity of the problem, from informational to severe. For exact values, see the IBM 3584 MIB for Version 1 or Version 2c traps.
7	ibm3584MIBGroupTD	Example: A library configuration setting has been changed.	This is the text description of the trap.
8	ibm3584MIBUserID	Examples: • *service* (or other User ID) if security is enabled • *webUI* if security is disabled	This is the User ID associated with a request from an external User Interface.

2. Refer to Table 43 to determine the meaning of the values in the OID fields. The fields are listed in the order in which they occur in an actual SNMP trap. Use the sample values to interpret the meaning of the example trap in Figure 71 on page 320.

Table 43. Fields in an SNMP trap

Object Identifier (OID) and Variable Name	Description of OID Field	Maximum Characters	Sample Value in Field
1.3.6.1.4.1.2.6.182.1.2.11.1.0 MTMNLSN	Machine type	4	3584
	Blank character	1	
	Model number	3	L32
	Blank character	1	
	Serial number	7	1312345
1.3.6.1.4.1.2.6.182.1.2.21.1.0 SKASCASCQ	SCSI sense key	2	04
	Blank character	1	
	SCSI additional sense code (ASC)	2	44
	Blank character	1	
	SCSI additional sense code qualifier (ASCQ)	2	00

Table 43. Fields in an SNMP trap (continued)

Object Identifier (OID) and Variable Name	Description of OID Field	Maximum Characters	Sample Value in Field
1.3.6.1.4.1.2.6.182.1.2.31.1.0 HECHECQ	Hardware error code (HEC)	2	90
	Blank character	1	
	Hardware error code qualifier (HECQ)	2	80
1.3.6.1.4.1.2.6.182.1.2.41.1.0 TA	TapeAlert number	2	24
1.3.6.1.4.1.2.6.182.1.2.51.1.0 URC	Unit reference code (URC)	4	A4D0
1.3.6.1.4.1.2.6.182.1.2.61.1.0 FFED	Failing frame number	2	01
	Blank character	1	
	Failing drive number	2	00
1.3.6.1.4.1.2.6.182.1.2.71.1.0 TD	Text message	255	The library has detected an error in its inventory
1.3.6.1.4.1.2.6.182.1.2.81.1.0 FSC	Drive fault symptom code	4	0A1
1.3.6.1.4.1.2.6.182.1.2.91.1.0 SCD	Drive single-character display	1	6
1.3.6.1.4.1.2.6.182.1.2.101.1.0 VOLSER	Cartridge volume serial number (refers to the volser of the bar code label)	8	127962L2
1.3.6.1.4.1.2.6.182.1.2.111.1.0 LL	Logical library number	3	1
1.3.6.1.4.1.2.6.182.1.2.121.1.0 WWNN	World Wide Node Name	16	500507630F070641
1.3.6.1.4.1.2.6.182.1.2.131.1.0 EA	Element Address	4	1026
1.3.6.1.4.1.2.6.182.1.2.141.1.0 SN	Serial Number	12	0007811157
1.3.6.1.4.1.2.6.182.1.2.151.1.0 SV	Severity	1	1

Results

To determine the meaning of the each OID field, use the following sources:

- For the SCSI sense key, ASC, and ASCQ, see the *IBM TS3500 SCSI ReferenceIBM TS3500 SCSI Reference.*
- For the TapeAlert flags, see Chapter 7, "TapeAlert flags," on page 337.

- For the URC, HEC, and HECQ, drive fault symptom code, and number in the drive's single-character display, see the *IBM TS3500 Maintenance Information* guide.

In general, the library generates SNMP traps when it detects TapeAlert error conditions. Additionally, the library also generates SNMP traps for other exception conditions. These traps are also assigned a unique OID in the MIB. They are generated under the following exception conditions:

- The I/O station is full for over an hour.
- The logical library is full for over an hour and contains no empty storage slots.
- The I/O station door is open for an extended period of time.
- There are no LTO or 3592 Cleaning Cartridges in the library.
- An LTO or 3592 cleaning cartridge has expired (the number of cleanings that remain on the cartridge has decreased to 0).
- The LTO or 3592 cartridge slots are approaching full capacity.
- All cartridge slots in the logical library are occupied.
- The logical library is nearing full capacity.
- All physical tape slots are allocated to a cartridge. No more cartridges can be added.
- A host attempt to use a shared drive failed because the drive was being used by another logical library.
- The library had a problem reading the barcode of a cartridge.
- The library attempted to call home but was unsuccessful.
- All library doors are closed.
- A cartridge that can not be encrypted has been loaded into a drive that is set for encryption.
- A new cartridge has been inserted in the library and is currently unassigned.
- An SNMP audit logging event has occurred (see "Enabling or disabling SNMP audit logging" on page 180).
- An encryption key manager communication failure has occurred.
- The library has reached 100% capacity.
- The library has reached the capacity threshold (see "Library preferences" on page 138).
- The library is in a No Motion Allowed (NMA) state (see "No Motion Allowed (NMA) state" on page 315).

Library monitoring with SNMP MIBs

A Simple Management Network Protocol (SNMP) monitoring station and Management Information Bases (MIBs). SNMP is used to check drive status, give information about the last SNMP trap, give library configuration information, and identify supported MIBs and supported SNMP messages. The data that is gathered from this process originates from the TS3500 tape library and is displayed on the SNMP monitoring station.

When SNMP is used to monitor your TS3500 tape library, make sure that the IBM 3584 Management Information Base (MIB) and Storage Networking Industry Association-Storage Media Library (SNIA-SML) MIB are loaded on your monitoring server. Refer to "Obtaining a Management Information Base" on page 336 for step-by-step instructions for locating and downloading the latest versions.

You can use SNMP to monitor the following information in the TS3500 tape library.

Drive status

To obtain a list of the status of all of the drives in the library:

1. Use your monitoring server to issue an SNMP get request on the object `numberOfMediaAccessDevices.0`. This request indicates how many drives are present in the library.

2. Use your monitoring server to issue an SNMP get request on the object `mediaAccessDevice-Availability.1` through `mediaAccessDevice-Availability.n` where `n` is the number returned by `numberOfMediaAccessDevices.0`. This request gives a list of the status of all of the drives in the library that are ordered by element address.

Last trap information

To poll the last trap or TapeAlert that was sent by the library, use your SNMP systems management software. Issue an SNMP get request on each of the following objects. This returns information about the last trap or TapeAlert.

ibm3584MIBObjectsMTMNLSN.0
ibm3584MIBObjectsSKASCASCQ.0
ibm3584MIBObjectsHECHECQ.0
ibm3584MIBObjectsTA.0
ibm3584MIBObjectsURC.0
ibm3584MIBObjectsTD.0
ibm3584MIBObjectsFSC.0
ibm3584MIBObjectsSCD.0
ibm3584MIBObjectsVOLSER.0
ibm3584MIBObjectsLL.0

Note: If a value is not valid for a specific TapeAlert, then the library returns an asterisk (*) in each defined character position.

Cartridge information

To obtain a list of all cartridges in the library, follow these steps:

1. Use your monitoring server to issue an SNMP get request on the object `numberOfPhysicalMedias.0`. This request indicates how many cartridges are present in the library.

2. Use your monitoring server to issue an SNMP get request on the object `physicalMedia-PhysicalLabel.1` through `physicalMedia-PhysicalLabel.n` where `n` is the number returned by `numberOfPhysicalMedias.0`. This request gives a list of cartridge labels in the library that are ordered by physical location.

Configuration information

You can use an SNMP monitoring server and a common Management Information Base (MIB) to query the configuration of TS3500 tape library.

Query configuration

The IBM_AUTOMATION_QUERY MIB file is a common MIB file for all IBM library types. This MIB allows the SNMP Get to return all the data that relates to

the configuration of the library. Using the default public community name provides an easy implementable way of gathering the data across all IBM library types.

The Configuration Query MIB contains an SNMP table for each of the major configuration components of the library. The MIB is broken into the following 5 tables:

1. Library Configuration
2. Frame or System Configuration
3. Logical Library Configuration
4. Media Access Device Configuration
5. User's Configuration

Configuration Data Tables

Each major configuration section is divided into tables supplied by the automation system based on the actual configuration of the system. Each table is explained in detail in the next sections.

Library Configuration

The following fields are supported for the library configuration table:

Table 44. Library configuration.

Name	Type	OID	Access	Supported by	Description
libraryConfiguration-NumberofChassis	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.1	Read-only	All	Number of Chassis.
libraryConfiguration-NumOfLogLib	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.2	Read-only	All	Number of Logical Libraries.
libraryConfiguration-NumOfStEs	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.3	Read-only	All	Number of Storage Elements.
libraryConfiguration-NumOfDtEs	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.4	Read-only	All	Number of Data Elements.
libraryConfiguration-NumOfIEEs	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.5	Read-only	All	Number of Import Export Elements
libraryConfiguration-VIOEnabled	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.6		TS3500, TS4500	Virtual IO Enabled flag.
libraryConfiguration-LTOEncryptionLicensed	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.7	Read-only	All	LTO Encryption Licensed flag.
libraryConfiguration-PFLicensed	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.8	Read-only	All	Path Failover Licensed flag.
libraryConfiguration-SSLEnabled	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.9	Read-only	All	WEB SSL Enabled flag
libraryConfiguration-AutoClean	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.10	Read-only	All	Auto Clean Enable flag.
libraryConfiguration-LDAP	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.11	Read-only	TS3310, TS4500	LDAP Enabled flag.

Table 44. Library configuration (continued).

Name	Type	OID	Access	Supported by	Description
libraryConfiguration-LDAPPrimaryURI	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.12	Read-only	TS3310, TS4500	LDAP Primary Repository URI.
libraryConfiguration-LDAPSecondaryURI	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.13	Read-only	TS3310, TS4500	LDAP Secondary Repository URI.
libraryConfiguration-LDAPGroupDN	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.14	Read-only	TS3310, TS4500	LDAP Group Domain Name.
libraryConfiguration-LDAPUserDN	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.15	Read-only	TS3310, TS4500	LDAP User Domain Name.
libraryConfiguration-LDAPStartTLS	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.16	Read-only	TS3310, TS4500	LDAP Over TLS Enabled flag.
libraryConfiguration-KerberosEnabled	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.17	Read-only	TS3310, TS4500	LDAP Over TLS Enabled flag.
libraryConfiguration-KerberosRealm	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.18	Read-only	TS3310, TS4500	Kerberos Realm. Same as company domain name.
libraryConfiguration-KerberosDomainMap	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.19	Read-only	TS3310, TS4500	Key Distribution Center server.
libraryConfiguration-KerberosKeyTab	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.20	Read-only	TS3310, TS4500	Kerberos Key Tab.
libraryConfiguration-TimeConfigured	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.21	Read-only	TS3310, TS4500	Time Configured flag. This flag indicates if the time is configured manually.
libraryConfiguration-TimeNTPEnabled	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.22	Read-only	TS3310, TS4500	NTP Enabled Flag.
libraryConfiguration-TimePrimaryNTPServer	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.23	Read-only	TS3310, TS4500	Primary NTP Server IP Address.
libraryConfiguration-TimeSecondaryNTPServer	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.24	Read-only	TS3310, TS4500	Secondary NTP IP Address.
libraryConfiguration-TimeTimeZone	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.25	Read-only	TS3310, TS4500	NTP Time Zone.
libraryConfiguration-PwdRulesAutoLogout	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.26	Read-only	All	Auto Log Out enabled flag.
libraryConfiguration-PwdLockAttempts	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.27	Read-only	All	Number of attempts before password is locked.
libraryConfiguration-PwdMinimumLength	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.28	Read-only	All	Password minimum Length.

Table 44. Library configuration (continued).

Name	Type	OID	Access	Supported by	Description
libraryConfiguration-PwdMinUpperCase	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.29	Read-only	All	Password minimum number of upper case characters.
libraryConfiguration-PwdMinLowerCase	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.30	Read-only	All	Password minimum number of lower case characters.
libraryConfiguration-PwdRulesMinNumericChars	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.31	Read-only	All	Password minimum number of numeric characters.
libraryConfiguration-PwdRulesMinSpecialChars	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.32	Read-only	All	Password minimum number of special characters.
libraryConfiguration-PwdRulesMaxSameChars	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.33	Read-only	All	Password maximum number of same identical character.
libraryConfiguration-PwdRulesPwdMinAge	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.34	Read-only	All	Password minimum age.
libraryConfiguration-PwdRulesPwdMaxAge	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.35	Read-only	All	Password maximum age.
libraryConfiguration-SMTP	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.36	Read-only	All except TS3500	SMTP Enabled flag.
libraryConfiguration-SMTPServerAddress	OctetString	.1.3.6.1.4.1.2.6.257.1.2.2.1.37	Read-only	All except TS3500	SMTP Server IP Address.
libraryConfiguration-SMTPAuthentication	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.38	Read-only	All except TS3500	SMTP Authentication flag.
libraryConfiguration-SNMP	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.39	Read-only	All	SNMP Enabled flag.
libraryConfiguration-CallHome	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.2.2.1.40	Read-only	TS3500, TS4500	Call Home Enabled flag.

Frame or System Configuration (Frame or Module or Chassis)

The following fields are supported for frame or system configuration data:

Table 45. Frame or System Configuration.

Name	Type	OID	Access	Supported by	Description
chassis -Index	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.3.2.1.1	Read-only	All	The current index value for the chassis, frame or module.
chassis –Type	Enumeration (1-LTO, 2- 3592)	.1.3.6.1.4.1.2.6.257.1.3.2.1.2	Read-only	All	Frame Media Type.
chassis -PS1Status	Enumeration (1-Not Installed, 2-ok,3-notok)	.1.3.6.1.4.1.2.6.257.1.3.2.1.3	Read-only	All	Frame Power Supply 1 status.
chassis -PS2Status	Enumeration (1-Not Installed, 2-ok,3-notok)	.1.3.6.1.4.1.2.6.257.1.3.2.1.4	Read-only	All	Frame Power Supply 2 status.
chassis –NumberofInstalledDrives	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.3.2.1.5	Read-only	All	Number of Installed Drives.
chassis -IOType	Enumeration (1-none, 2-small, 3-large, 4-fouriodoor,5-magazine)	.1.3.6.1.4.1.2.6.257.1.3.2.1.6	Read-only	All	Media Type of the I/O station installed in this chassis.
chassis –NumOfIOLocations	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.3.2.1.7	Read-only	All	Number of IO Physical Locations.
chassis -LicensedCapacity	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.3.2.1.8	Read-only	TS3310, TS3500, TS4500	Licensed Capacity.
chassis -SerialNumber	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.9	Read-only	All	Chassis Serial Number.
chassis -GroupWWNN	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.10	Read-only	All	Chassis Group World Wide Node Name.
chassis -MaxAvailCap	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.3.2.1.11	Read-only	All	Chassis Maximum Available Capacity
chassis –PortAEthernetEnabled	Enumeration (1-2)	.1.3.6.1.4.1.2.6.257.1.3.2.1.12	Read-only	All	Chassis Ethernet Port A Enabled flag.
chassis –PortAEthernetIP	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.13	Read-only	All	Chassis Port A Ethernet Port IP Address.
chassis –PortAGateWay	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.14	Read-only	All	Chassis Ethernet Port A Gateway Address.

Table 45. Frame or System Configuration (continued).

Name	Type	OID	Access	Supported by	Description
chassis PortANetmask	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.15	Read-only	All	Chassis Ethernet Port A Netmask.
chassis –PortAEthernetIPv6Enabled	Enumeration (1-2)	.1.3.6.1.4.1.2.6.257.1.3.2.1.16	Read-only	All	Chassis Ethernet Port A IPV6 Enabled flag.
chassis –PortAEthernetV6IP	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.17	Read-only	All	Chassis Port A Ethernet IPv6 Port IP Address.
chassis –PortAIPv6Netmask	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.18	Read-only	All	Chassis Port A Ethernet IPv6 Port Netmask.
chassis –PortAIPv6GateWay	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.19	Read-only	All	Chassis Port A Ethernet IPv6 Port Gateway.
chassis –PortBEthernetEnabled	Enumeration (1-2)	.1.3.6.1.4.1.2.6.257.1.3.2.1.20	Read-only	All	Chassis Ethernet Port B Enabled flag.
chassis -–PortBEthernetIP	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.21	Read-only	All	Chassis Port B Ethernet Port IP Address.
chassis -PortBGateWay	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.22	Read-only	All	Chassis Ethernet Port B Gateway Address.
chassis -PortBNetmask	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.23	Read-only	All	Chassis Ethernet Port B Netmask.
chassis –PortBEthernetIPv6Enabled	Enumeration (1-2)	.1.3.6.1.4.1.2.6.257.1.3.2.1.24	Read-only	All	Chassis Ethernet Port B IPV6 Enabled flag.
chassis –PortBEthernetIPv6	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.25	Read-only	All	Chassis Port B Ethernet IPv6 Port IP Address.
chassis –PortBIPv6Netmask	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.26	Read-only	All	Chassis Port B Ethernet IPv6 Port Netmask.
chassis –PortBIPv6GateWay	OctetString	.1.3.6.1.4.1.2.6.257.1.3.2.1.27	Read-only	All	Chassis Port B Ethernet IPv6 Port Gateway.

Logical library configuration

The following fields are supported for logical library configuration data:

Table 46. Logical Library configuration.

Name	Type	OID	Access	Supported by	Description
loglibrary-LogLibIdx	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.1	Read-only	All	Logical Library Index.
loglibrary-StartStEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.2	Read-only	All	Starting Storage Element Address.
loglibrary-EndStEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.3	Read-only	All	Ending Storage Element Address.
loglibrary-StartIEEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.4	Read-only	All	Starting Import Element Address.
loglibrary-EndIEEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.5	Read-only	All	Ending Import Export Element Address.
loglibrary-StartDTEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.6	Read-only	All	Starting Address for Data Transport Elements.
loglibrary-EndDTEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.7	Read-only	All	Ending Address for Data Transport Elements.
loglibrary-StartMTEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.8	Read-only	All	Starting Address for Medium Transport Elements.
loglibrary-EndMTEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.9	Read-only	All	Ending Address for Medium Transport Elements.
loglibrary-MediaType	Enumeration (1-lto,2-jag)	.1.3.6.1.4.1.2.6.257.1.4.2.1.10	Read-only	All	Logical Library Media Type.
loglibrary-HideLogLibExportCart	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.4.2.1.11	Read-only	TS3500, TS4500	Hide Logical Library Export Cartridge Flag.
loglibrary-SixCharVolser	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.4.2.1.12	Read-only	TS3500, TS4500	Six Character Volser Flag.
loglibrary-Name	OctecString	.1.3.6.1.4.1.2.6.257.1.4.2.1.13	Read-only	All	Logical Library Name.
loglibrary-EncryptionEnabled	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.4.2.1.14	Read-only	All	Encryption enabled flag.
loglibrary-EncryptionSSLEnabled	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.4.2.1.15	Read-only	All except TS3500	Encryption over SSL enabled flag.
loglibrary-EncryptionMethod	OctecString	.1.3.6.1.4.1.2.6.257.1.4.2.1.16	Read-only	All	Encryption Method.
loglibrary-EncryptionEKMIP-1	OctecString	.1.3.6.1.4.1.2.6.257.1.4.2.1.17	Read-only	All	Encryption EKM IP address for index 1.
loglibrary-EncryptionEKMPort-1	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.18	Read-only	All	Encryption EKM port for index 1.

Table 46. Logical Library configuration (continued).

Name	Type	OID	Access	Supported by	Description
loglibrary-EncryptionEKMIP-2	OctecString	.1.3.6.1.4.1.2.6.257.1.4.2.1.19	Read-only	All	Encryption EKM IP address for index 2.
loglibrary-EncryptionEKMPort-2	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.20	Read-only	All	Encryption EKM port for index 2.
loglibrary-EncryptionEKMIP-3	OctecString	.1.3.6.1.4.1.2.6.257.1.4.2.1.21	Read-only	TS3500	Encryption EKM IP address for index 3.
loglibrary-EncryptionEKMPort-3	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.22	Read-only	TS3500	Encryption EKM port for index 3.
loglibrary-EncryptionEKMIP-4	OctecString	.1.3.6.1.4.1.2.6.257.1.4.2.1.23	Read-only	TS3500	Encryption EKM IP address for index 4.
loglibrary-EncryptionEKMPort-4	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.4.2.1.24	Read-only	TS3500	Encryption EKM port for index 4.

Media Access Device Configuration

The following fields are supported for media access device configuration data:

Table 47. Media Access Device Configuration.

Name	Type	OID	Access	Supported by	Description
mediaAccessDevice-Index	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.1	Read-only	All	Index
mediaAccessDevice-FrameIdx	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.2	Read-only	All	Location Index.
mediaAccessDevice-ColumnIdx	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.3	Read-only	All	Column in Frame Index
mediaAccessDevice-RowIdx	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.4	Read-only	All	Row in Column Index
mediaAccessDevice-LogLib	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.5	Read-only	All	Logical Library
mediaAccessDevice-VEA	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.6	Read-only	All	Element Address
mediaAccessDevice–Installed	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.5.2.1.7	Read-only	All	Installed flag
mediaAccessDevice-IsControlPath	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.5.2.1.8	Read-only	All	Drive Is Control Path flag
mediaAccessDevice-DriveType	Enumeration (1-true,2-false)	.1.3.6.1.4.1.2.6.257.1.5.2.1.9	Read-only	All	Type
mediaAccessDevice-DriveGeneration	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.10	Read-only	All	Drive Generation. Examples of Generations: 6 for LTO-6, 4 for TS1140

Table 47. Media Access Device Configuration (continued).

Name	Type	OID	Access	Supported by	Description
mediaAccessDevice–Port0_ID	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.11	Read-only	All	Port 0 ID. In case of a SAS drive display the Hashed SAS Address.
mediaAccessDevice–Port1_ID	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.5.2.1.12	Read-only	All	Port 1 ID. In case of a SAS drive display the Hashed SAS Address.
mediaAccessDevice–Port0_State	Enumeration(1-No Light,2-LightDetected,3-Unknown)	.1.3.6.1.4.1.2.6.257.1.5.2.1.13	Read-only	All	Port 0 Signal State. For SAS drives this refer to the Signal bit in the SAS port status data format. . The system shall use the value of unknown if at any point of the SNMP get request the value is not known.
mediaAccessDevice–Port1_State	Enumeration(1-No Light,2-LightDetected,3-Unknown)	.1.3.6.1.4.1.2.6.257.1.5.2.1.14	Read-only	All	Port 1 Signal State. For SAS drives this refer to the Signal bit in the SAS port status data format. . The system shall use the value of unknown if at any point of the SNMP get request the value is not known.
mediaAccessDevice–Port0_Speed	Enumeration (1-Auto, 2-1Gbsec, 3-1.5Gbsec,4-2Gbsec, 5-3Gbsec 6-4Gbsec, 7-6Gbsec, 8-8Gbsec, 9-10Gbsec, 10-12Gbsec)	.1.3.6.1.4.1.2.6.257.1.5.2.1.15	Read-only	All	Port 0 Set Speed. This field indicates the speed setting for port 0.
mediaAccessDevice–Port1_Speed	Enumeration (1-Auto, 2-1Gbsec, 3-1.5Gbsec,4-2Gbsec, 5-3Gbsec 6-4Gbsec, 7-6Gbsec, 8-8Gbsec, 9-10Gbsec, 10-12Gbsec)	.1.3.6.1.4.1.2.6.257.1.5.2.1.16	Read-only	All	Port 1 Set Speed. This field indicates the speed setting for port 1.

Table 47. Media Access Device Configuration (continued).

Name	Type	OID	Access	Supported by	Description
mediaAccessDevice –Port0_Topology	Enumeration (1-Auto-L, 2-L, 3-N, 4-Auto-N,5-NotApplicable)	.1.3.6.1.4.1.2.6.257.1.5.2.1.17	Read-only	All	Port 0 Set Topology. This field indicates the topology setting for port 0. Topology for SAS drives needs to be set to Not Applicable.
mediaAccessDevice –Port1_Topology	Enumeration (1-Auto-L, 2-L, 3-N, 4-Auto-N,5-NotApplicable)	.1.3.6.1.4.1.2.6.257.1.5.2.1.18	Read-only	All	Port 1 Set Topology. This field indicates the topology setting for port 1. Topology for SAS drives needs to be set to Not Applicable.
mediaAccessDevice –Port0_Speed_Actual	Enumeration (1-1Gbsec, 2-1.5Gbsec,3-2Gbsec, 4-3Gbsec 5-4Gbsec, 6-6Gbsec, 7-8Gbsec, 8-10Gbsec, 9-12Gbsec, 10-Unknown)	.1.3.6.1.4.1.2.6.257.1.5.2.1.19	Read-only	All	Port 0 Actual Speed. This field indicates the speed that port 0 is operating at. The system shall use the value of unknown if at any point of the SNMP get request the value is not known.
mediaAccessDevice – Port1_Speed_Actual	Enumeration (1-1Gbsec, 2-1.5Gbsec,3-2Gbsec, 4-3Gbsec 5-4Gbsec, 6-6Gbsec, 7-8Gbsec, 8-10Gbsec, 9-12Gbsec, 10-Uknown)	.1.3.6.1.4.1.2.6.257.1.5.2.1.20	Read-only	All	Port 1 Actual Speed. This field indicates the speed that port 1 is operating at. The system shall use the value of unknown if at any point of the SNMP get request the value is not known.
mediaAccessDevice – Port0_Topology_Actual	Enumeration (1-L, 2-N,3-Unknown,4-NotApplicable)	.1.3.6.1.4.1.2.6.257.1.5.2.1.21	Read-only	All	Port 0 Actual Topology. This field indicates the topology that port 0 is operating at. Topology for SAS drives needs to be set to Not Applicable. The system shall use the value of unknown if at any point of the SNMP get request the value is not known.

Table 47. Media Access Device Configuration (continued).

Name	Type	OID	Access	Supported by	Description
mediaAccessDevice –Port1_Topology_Actual	Enumeration (1-L, 2-N,3-Unknown,4-NotApplicable)	.1.3.6.1.4.1.2.6.257.1.5.2.1.22	Read-only	All	Port 1 Actual Topology. This field indicates the topology that port 0 is operating at. Topology for SAS drives needs to be set to NotApplicable. The system shall use the value of unknown if at any point of the SNMP get request the value is not known.
mediaAccessDevice -Revision_Level	OctecString	.1.3.6.1.4.1.2.6.257.1.5.2.1.23	Read-only	All	Firmware Version
mediaAccessDevice –Port0_WWNN	OctecString	.1.3.6.1.4.1.2.6.257.1.5.2.1.24	Read-only	All	Port 0 WWPN
mediaAccessDevice –Port1_WWNN	OctecString	.1.3.6.1.4.1.2.6.257.1.5.2.1.25	Read-only	All	Port 1 WWPN
mediaAccessDevice -AssignedWWNN	OctecString	.1.3.6.1.4.1.2.6.257.1.5.2.1.26	Read-only	All	Assigned WWNN

User Configuration

The following fields are supported for user configuration data:

Table 48. User Configuration.

Name	Type	OID	Access	supported by	Description
Users-Index	INTEGER (0..'7fffffff'h)	.1.3.6.1.4.1.2.6.257.1.6.2.1.1	Read-only	All	Index
Users-Username	OctecString	.1.3.6.1.4.1.2.6.257.1.6.2.1.2	Read-only	All	User Name
Users-UsernameRole	OctecString	.1.3.6.1.4.1.2.6.257.1.6.2.1.3	Read-only	All	User Name Role
Users-UsernameActive	Enumeration (1-Active, 2-Inactive)	.1.3.6.1.4.1.2.6.257.1.6.2.1.4	Read-only	All	User Name Active flag.
endOfQueryConfigMIB	OBJECT-TYPE	1.3.6.1.4.1.2.6.257.1.7	NA	All	End of MIB.

Supported MIBs

The TS3500 tape library now supports the following MIBs:

- IBM 3584 MIB for Version 1 or Version 2c traps
- SNIA SML MIB Version 1.20b
- SNMP MIB-II (comes with your management software and is also available from the Web at http://www.ietf.org/rfc/rfc2011.txt.
- IBM_AUTOMATION_QUERY MIB

Supported SNMP messages

The following are supported SNMP messages:
- Get (a request for information about the library)
- GetNext (a request for the next sequential piece of information about the library)
- GetBulk (a request for a bundle of get requests)

SNMP Set messages are not supported at this time. Instead, use the Tape Library Specialist web interface to configure your SNMP settings. For more information, see:
- "Enabling or disabling Simple Network Management Protocol (SNMP) traps" on page 179
- "Setting the version of SNMP traps" on page 180
- "Enabling or disabling SNMP authentication trap settings" on page 180
- "Viewing or changing SNMP system data" on page 181 (note that the contact information in the system data is also used by the library when it uses the Call Home capability)
- "Enabling or disabling SNMP audit logging" on page 180
- "Viewing or changing the Simple Network Management Protocol (SNMP) destination IP configuration and remote port" on page 182
- "Viewing or changing the SNMP trap community name" on page 183
- "Viewing or changing the SNMP request community name" on page 183

Obtaining a Management Information Base

Complete this task to locate and download the latest Management Information Base (MIB) files.

About this task

When using SNMP to monitor your TS3500 tape library, you must have the IBM 3584 Management Information Base (MIB) and Storage Networking Industry Association-Storage Media Library (SNIA-SML) MIB loaded on your monitoring server. To obtain the MIBs or to download the latest versions, visit the web at http://www.ibm.com/support/fixcentral and perform the following steps:

Procedure
1. From the Fix Central web page, select **System Storage** from the Hardware section of the Product Group menu.
2. Select **Tape systems** from the System Storage menu.
3. Select **Tape autoloaders and libraries** from the Tape Systems menu.
4. Select **TS3500 Tape Library** from the Tape autoloaders and libraries menu and click **Continue**. The Select fixes page displays
5. Select the appropriate microcode level for your library. A sign on page displays.
6. Log on with your user ID and password in order to view available MIB files for download.

Chapter 7. TapeAlert flags

This section introduces the TapeAlert flags for the Ultrium tape drives, 3592 tape drives, and TS3500 tape library.

Overview of TapeAlert flags

Refer to a table of the TapeAlert flags that are used to resolve problems with the TS3500 tape library and its tape drives.

TapeAlert is a standard that defines status conditions and problems that are experienced by devices such as tape drives, autoloaders, and libraries. The standard enables a server to read TapeAlert messages (called *flags*) from a tape drive or library. The server reads the flags from Log Sense Page 0x2E.

The TS3500 tape library is compatible with TapeAlert technology, which provides error and diagnostic information about the drives and the library to the server.

For specific information, see "TapeAlert flags supported by the LTO tape drives" on page 338, "TapeAlert flags supported by the 3592 tape drives" on page 345, or "TapeAlert flags supported by the library" on page 351. The sections about the drives indicate whether the drive generates SNMP traps or call home messages that are based on that flag.

TapeAlert flags supported by the LTO tape drives

This section lists the TapeAlert Flags that are supported by the LTO tape drives.

Table 49 lists the TapeAlert flags that are supported by the LTO tape drives.

Table 49. TapeAlert Flags that are supported by the LTO tape drives

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
3	Hard error	03h	Set for any unrecoverable read, write, or positioning error. (This flag is set with flags 4, 5, or 6.)	See the Action Required column for Flag Number 4, 5, or 6 in this table.	203 (Warning)	No
4	Media	04h	Set for any unrecoverable read, write, or positioning error that is due to a faulty tape cartridge.	Replace the tape cartridge.	204 (Warning)	No
5	Read failure	05h	Set for any unrecoverable read error where isolation is uncertain and failure might be due to a faulty tape cartridge or to faulty drive hardware.	If Flag Number 4 is also set, the cartridge is defective. Replace the tape cartridge. If Flag Number 4 is not set, see Error Code 6in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317.	205 (Warning)	No

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
6	Write failure	06h	Set for any unrecoverable write or positioning error where isolation is uncertain and failure might be due to a faulty tape cartridge or to faulty drive hardware.	If Flag Number 9 is also set, make sure that the write-protect switch is set so that data can be written to the tape. See "Setting the write-protect switch on an LTO tape cartridge" on page 245. If Flag Number 4 is also set, the cartridge is defective. Replace the tape cartridge. If Flag Number 4 is not set, see Error Code 6 in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317.	206 (Warning)	No
7	Media life	07h	Set when the tape cartridge reached its end of life (EOL).	1. Copy the data to another tape cartridge 2. Discard the old (EOL) tape.	207 (Warning)	No
8	Not data grade	08h	Set when the cartridge is not data-grade. Any data that you write to the tape is at risk.	Replace the tape with a data-grade tape.	208 (Warning)	No
9	Write protect	09h	Set when the tape drive detects that the tape cartridge is write-protected.	Make sure that the cartridge's write-protect switch is set so that the tape drive can write data to the tape. See "Setting the write-protect switch on an LTO tape cartridge" on page 245.	N/A	No

Table 49. TapeAlert Flags that are supported by the LTO tape drives (continued)

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
10	No removal	0Ah	Set when the tape drive receives an UNLOAD command after the server prevented the tape cartridge from being removed.	Refer to the documentation for your server's operating system.	N/A	No
11	Cleaning media	0Bh	Set when you load a cleaning cartridge into the drive.	No action is required. Informational message only.	N/A	No
12	Unsupported format	0Ch	Set when you load an unsupported cartridge type into the drive or when the cartridge format is corrupted.	Use a supported tape cartridge.	N/A	No
14	Unrecoverable snapped tape	0Eh	Set when the tape split apart.	Do not attempt to extract the old tape cartridge. Call the tape drive supplier's help line.	214 (Error)	Yes
15	Cartridge memory chip failure	0Fh	Set when a cartridge memory (CM) failure is detected on the loaded tape cartridge.	Replace the tape cartridge. If this error occurs on multiple cartridges, see Error Code 6 in in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317.	215 (Error)	No
16	Forced eject	10h	Set when you manually unload the tape cartridge while the drive was reading or writing.	No action is required. Informational message only.	N/A	No
17	Read Only format	11h	Set when a write attempt is made on a read-only cartridge. The flag is cleared when the cartridge is ejected (this flag is not supported for Ultrium 1 or Ultrium 2).	No action is required. Informational message only.	N/A	No

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
18	Tape directory corrupted in the cartridge memory	12h	Set when the drive detects that the tape directory in the cartridge memory is corrupted.	Re-read all data from the tape to rebuild the tape directory.	218 (Warning)	No
20	Clean now	14h	Set when the tape drive detects that it needs cleaning.	Clean the tape drive. See the section about the methods for cleaning drives in the *IBM TS3500 with ALMS Introduction and Planning Guide*.	N/A	No
21	Clean periodic	15h	Set when the drive detects that it needs routine cleaning.	Clean the tape drive as soon as possible. The drive can continue to operate, but clean the drive soon. See the section about the methods for cleaning drives in the *IBM TS3500 with ALMS Introduction and Planning Guide*.	N/A	No
22	Expired clean	16h	Set when the tape drive detects an expired cleaning cartridge.	Replace the cleaning cartridge. See "Removing a cleaning cartridge from the library" on page 98.	222 (Warning)	No
23	Invalid cleaning tape	17h	Set when the drive expects a cleaning cartridge and the loaded cartridge is not a cleaning cartridge.	Use a valid cleaning cartridge.	223 (Warning)	No
25	Interface	19h	Set when the tape drive detects a problem with the SCSI, Fibre Channel, or RS-422 interface.	Locate Error Code 8 or 9 in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317.	225 (Error)	Yes

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
30	Hardware A	1Eh	Set when a hardware failure occurs that requires that you reset the tape drive to recover.	If resetting the drive does not recover the error, note the error code on the single-character display and see in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317 for the appropriate instructions.	230 (Error)	Yes
31	Hardware B	1Fh	Set when the tape drive fails its internal power-on self tests.	Note the error code on the single-character display and see in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317 for the appropriate instructions.	231 (Error)	Yes
32	Interface	20h	Set when the tape drive detects a problem with the SCSI, Fibre Channel, or RS-422 interface.	Locate Error Code 8 or 9 in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317.	232 (Error)	Yes
33	Eject media	21h	Set when a failure occurs that requires you to unload the cartridge from the drive.	Unload the tape cartridge; and reinsert it and restart the operation.	233 (Warning)	No
34	Download fail	22h	Set when an FMR image is unsuccessfully downloaded to the tape drive through the SCSI or Fibre Channel interface.	Ensure that it is the correct FMR image. Download the FMR image again.	N/A	No

Table 49. TapeAlert Flags that are supported by the LTO tape drives (continued)

Flag Number and Name	Hex code	Description	Action Required	SNMP Trap ID	Call Home
36 Drive temperature	24h	Set when the drive's temperature sensor indicates that the drive's temperature is exceeding the recommended temperature of the library.	See Error Code 1 in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317.	236 (Warning)	No
37 Drive voltage	25h	Set when the drive detects that the externally supplied voltages are either approaching the specified voltage limits or are outside the voltage limits (see the power specifications in the *IBM TS3500 Introduction and Planning Guide)..*	See Error Code 2 in "Resolving errors with the LTO tape drives" on page 316, Table 39 on page 317.	237 (Error)	Yes
51 Tape directory invalid at unload	33h	Set when the tape directory on the tape cartridge that was previously unloaded is corrupted. The file-search performance is degraded.	Use your backup software to rebuild the tape directory by reading all the data.	N/A	No
52 Tape system area write failure	34h	Set when the tape cartridge that was previously unloaded could not write its system area successfully.	Copy the data to another tape cartridge; and discard the old cartridge.	252 (Warning)	No
53 Tape system area read failure	35h	Set when the tape system area could not be read successfully at load time.	Copy the data to another tape cartridge; and discard the old cartridge.	253 (Warning)	No
55 Load failure	37h	The operation failed because the media cannot be loaded and threaded.	Remove the tape and try another. If the problem persists, contact your IBM Service Representative.	255 (Warning)	No
56 Unrecoverable unload failure	38h	The operation failed because the media cannot be unloaded.	Contact your IBM Service Representative.	256 (Warning)	No

Table 49. TapeAlert Flags that are supported by the LTO tape drives (continued)

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
59	WORM Medium - Integrity Check Failed	3Bh	Drive determined that data on tape is suspect, from a WORM point of view.	1. Copy the data to another WORM tape cartridge. 2. Discard the faulty WORM tape cartridge.	259 (Warning)	No
60	WORM Medium - Overwrite Attempted	3Ch	This flag is set when the drive rejects a write operation because the rules for allowing WORM writes are not met. Data can only be appended to WORM media. Overwrites to WORM media are not allowed.	Write the data to a WORM tape cartridge or write the data to a non-WORM tape cartridge.	N/A	No

TapeAlert flags supported by the 3592 tape drives

Refer to a table of TapeAlert flags that are supported by the 3592 tape drives.

Table 50. TapeAlert flags that are supported by the 3592 tape drives

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
1	Read warning	01h	Set when the tape drive is having problems reading data. No data has been lost, but there has been a reduction in the performance of the tape.	Isolate the fault between drive and tape by following these instructions: Use a known good tape cartridge in the suspect drive. If the drive fails, contact your IBM Service Representative. Use the suspect tape cartridge in a known good drive. If the test fails, discard the cartridge.	N/A	No
2	Write warning	02h	Set when the tape drive is having problems writing data. No data has been lost, but there has been a reduction in the capacity of the tape.	Isolate the fault between drive and tape by following these instructions: Use a known good tape cartridge in the suspect drive. If the drive fails, contact your IBM Service Representative. Use the suspect tape cartridge in a known good drive. If the test fails, discard the cartridge.	N/A	No
3	Hard error	03h	Set for any unrecoverable read, write, or positioning error. The flag is cleared when the cartridge is removed from the drive (this flag is set in conjunction with flags 4, 5, or 6).	Determine if flags 4, 5, or 6 exist; follow the actions there.	203 (Warning)	No
4	Media	04h	Set for any unrecoverable read, write, or positioning error that is due to faulty media. The flag is cleared when the cartridge is removed from the drive.	Discard the tape cartridge.	204 (Warning)	No

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
5	Read failure	05h	Set for any unrecoverable read error where the isolation is uncertain and the failure could be faulty media or drive hardware. The flag is cleared when the cartridge is removed from the drive.	Discard the tape cartridge. If the failure persists, contact your IBM Service Representative.	205 (Error)	Yes
6	Write failure	06h	Set for any unrecoverable write or positioning error where isolation is uncertain and failure could be faulty media or drive hardware. The flag is cleared when the cartridge is removed from the drive.	Discard the tape cartridge. If the failure persists, contact your IBM Service Representative.	206 (Warning)	No
7	Media life	07h	Set when the tape cartridge reached its end of life (EOL).	1. Copy the data to another tape cartridge. 2. Discard the old (EOL) tape cartridge.	207 (Warning)	No
8	Not data grade	08h	Set when the tape cartridge is not data-grade. Any data that you back up to the tape is at risk. The flag is set when severe servo problems are detected while loading a cartridge.	Discard the tape cartridge. If the failure persists, contact your IBM Service Representative.	208 (Warning)	No
9	Write protect	09h	Set when the tape drive detects that the tape cartridge is write-protected and the drivesees a write command. The flag is cleared when the cartridge is removed from the drive.	Set the write-protect switch on the cartridge to OFF (see "Setting the write-protect switch on a 3592 cartridge" on page 280. Ensure that the cartridge is not logically protected. If the problem persists, contact your IBM Service Representative.	N/A	No
10	No removal	0Ah	Set when an unload is attempted and SCSI Prevent Media Removal is set to ON. The flag is cleared when the cartridge is removed from the drive.	If the error is an operator error, no action is required; if the error is a customer software error, see the documentation for your server's operating system.	N/A	No

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
11	Cleaning media	0Bh	Set when a cleaning tape is loaded into the drive.	None. Status only.	N/A	No
12	Unsupported format	0Ch	Set when a non-supported cartridge type is loaded into the drive. It is cleared when the cartridge is removed from the drive. Can also be caused when a cartridge with a non-supported format is loaded into the drive.	Remove the invalid cartridge. If the problem persists, contact your IBM Service Representative.	N/A	No
14	Unrecoverable snapped tape	0Eh	Set when the tape in the drive snapped. The operator cannot remove the tape.	Contact your IBM Service Representative.	214 (Error)	Yes
15	Memory chip in cartridge	0Fh	Set when the memory in the tape cartridge failed.	Do not use the cartridge for further backup operation.	215 (Warning)	No
16	Forced eject	10h	Set when a tape cartridge was manually removed while reading and writing. It is cleared when a cartridge is loaded into the drive.	None. Status only.	N/A	No
17	Read-only format	11h	Set when a write attempt is made on a read-only formatted tape. The flag is cleared when the cartridge is removed from the drive.	None. Status only.	N/A	No
18	Tape directory corrupted on load	12h	Set when the tape drive detects that the directory has been corrupted and will result in longer file-search times. The flag is cleared when the cartridge is removed from the drive.	Operator action optional. The drive will automatically rebuild the directory as data is being read or the operator can re-read all data from the tape to rebuild the directory.	218 (Warning)	No
20	Clean now	14h	Set when the tape drive detects that it needs cleaning.	Clean the tape drive. See the section about the methods for cleaning drives in the *IBM TS3500 with ALMS Introduction and Planning Guide*.	N/A	No

Table 50. TapeAlert flags that are supported by the 3592 tape drives (continued)

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
21	Clean periodic	15h	Set when the tape drive detects that it needs routine cleaning.	Clean the tape drive as soon as possible. The drive can continue to operate, but you should clean it soon. See the section about drive cleaning in the *IBM TS3500 with ALMS Introduction and Planning Guide*.	N/A	No
22	Expired cleaning media	16h	Set when the tape drive detects a cleaning cartridge that has expired. It is cleared when a valid cleaning cartridge is loaded.	Replace the cleaning cartridge. See "Removing a cleaning cartridge from the library" on page 98.	N/A	No
23	Invalid cleaning cartridge	17h	Set when the drive expects a cleaning cartridge to be loaded and the loaded cartridge is not a cleaning cartridge.	Use a valid cleaning cartridge.	223 (Warning)	No
25	Dual-port interface error	19h	Set when a redundant Fibre interface port on the tape drive failed.	Contact your IBM Service Representative.	225 (Error)	Yes
26	Cooling fan failure	1Ah	Set when a tape drive cooling fan failed.	Contact your IBM Service Representative.	226 (Error)	Yes
27	Power supply	1Bh	Set when a power supply failed.	Contact your IBM Service Representative.	227 (Error)	Yes
30	Hardware A	1Eh	Set when a hardware failure occurred that requires a drive reset to recover.	The operator can reset the drive. If the problem persists, contact your IBM Service Representative.	230 (Error)	Yes
31	Hardware B	1Fh	Set when the tape drive fails and the failure is not read/write related, or set if the drive requires a power cycle to recover and is not cleared until the drive is powered OFF.	Contact your IBM Service Representative.	231 (Error)	Yes
32	Interface	20h	Set when the tape drive detects a problem with the Fibre Channel interface. It is cleared when the drive is powered OFF.	Contact your IBM Service Representative.	232 (Error)	Yes

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
33	Eject media	21h	Set when a failure occurs that requires the tape cartridge to be ejected from the drive and retried. The flag is cleared when the cartridge is removed from the drive.	Try different media. If the problem persists, contact your IBM Service Representative.	233 (Warning)	No
34	Download fail	22h	Set when an FMR image is unsuccessfully downloaded to the tape drive via the Fibre Channel or library interface. It is cleared when the drive is powered OFF or a successful microcode update is performed.	Contact your IBM Service Representative.	N/A	No
36	Drive temperature	24h	Set when the drive temperature sensor indicates that the drive is too hot.	Contact your IBM Service Representative.	236 (Warning)	No
37	Drive voltage	25h	Set when the drive detects power supply voltages outside of the specified voltage limits. It is cleared when the drive is powered OFF.	Contact your IBM Service Representative.	237 (Error)	Yes
50	Lost statistics	32h	Set when media statistics were lost at some time in the past.	None. Status only.	N/A	No
51	Tape directory invalid at unload	33h	Set when the tape directory on the tape cartridge that was previously unloaded is corrupted. The file-search performance is degraded.	Operator action optional. Drive will automatically rebuild the directory as data is being read, or the operator can use your backup software to rebuild the tape directory by reading all the data.	N/A	No
52	Tape system area write failure	34h	Set when the tape cartridge that was previously unloaded could not write its system area successfully.	Try another tape.	252 (Warning)	No
53	Tape system area read failure	35h	Set when the tape system area could not be read successfully at load time.	Try another tape.	253 (Warning)	No
54	No start of data	36h	Set when the start of data could not be found on the tape.	Try another tape.	254 (Warning)	No

Table 50. TapeAlert flags that are supported by the 3592 tape drives (continued)

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
55	Load failure	37h	The operation failed because the media cannot be loaded and threaded.	Remove the tape and try another. If the problem persists, contact your IBM Service Representative.	255 (Warning)	No
56	Unrecoverable unload failure	38h	The operation failed because the media cannot be unloaded.	Contact your IBM Service Representative.	256 (Warning)	No
57	Automation interface	39h	Set when the tape drive detects a problem with the automation interface. It is cleared when the drive is powered OFF.	The operator can reset the drive. If the problem persists, contact your IBM Service Representative.	257 (Warning)	No
59	WORM Medium - Integrity Check Failed	3Bh	Drive determined that data on tape is suspect, from a WORM point of view.	1. Copy the data to another WORM tape cartridge. 2. Discard the faulty WORM tape cartridge.	259 (Warning)	No
60	WORM Medium - Overwrite Attempted	3Ch	This flag is set when the drive rejects a write operation because the rules for allowing WORM writes have not been met. Data can only be appended to WORM media. Overwrites to WORM media are not allowed.	Write the data to a WORM tape cartridge or write the data to a non-WORM tape cartridge.	N/A	No

TapeAlert flags supported by the library

This section lists the TapeAlert flags that are supported by the TS3500 tape library.

Table 51. TapeAlert flags that are supported by the TS3500 tape library

TapeAlert Flags Supported by the TS3500 tape library				
Flag Number and Name	**Description**	**Action Required**	**SNMP Trap**	**Call Home**
1 Library hardware A	The library has trouble communicating with the drive.	1. Restart the operation. 2. If the problem persists, call your IBM service representative.	Yes	Yes
2 Library hardware B	The library has a hardware failure.	1. Restart the operation. 2. If the problem persists, call your IBM service representative.	Yes	Yes
4 Library hardware D	The library has a hardware fault that is not mechanically related.	1. Restart the operation. 2. If the problem persists, call your IBM service representative.	Yes	Yes
7 Predictive failure	The library detected that a hardware component is degraded but still operational.	Call your IBM service representative.	Yes	No
11 Library voltage limits	A potential failure of a power supply exists.	Call your IBM Service Representative.	Yes	Yes
16 Library door	A library front door is open and prevents the library from functioning.	1. Close the library front door. **Note:** (There are two types of doors, front doors and rear doors.) 2. If the problem persists, call your IBM service representative.	Yes	No
17 Library I/O station	A problem with an I/O station exists.	1. Ensure that there is no obstruction in the I/O station. 2. Restart the operation. 3. If the problem persists, call your IBM service representative.	Yes	Yes

Table 51. TapeAlert flags that are supported by the TS3500 tape library (continued)

		TapeAlert Flags Supported by the TS3500 tape library			
Flag Number and Name		**Description**	**Action Required**	**SNMP Trap**	**Call Home**
23	Library scan retry	The operation to scan the bar code on a cartridge had to perform an excessive number of retries before succeeding. A potential problem exists with the bar code label or the scanner hardware in the library mechanism.	1. Check for damaged, misaligned, or peeling bar code labels on cartridges. 2. If the problem persists, call your IBM service representative.	Yes	No
24	Library inventory	An inventory of the media was inconsistent.	1. Run a library inventory to correct the inconsistency. 2. Restart the operation. 3. If the problem persists, call your IBM service representative.	Yes	No
25	Library illegal operation	The library detected an illegal operation.	If the problem persists, call your IBM service representative.	Yes	No
28	Power supply	A redundant power supply failure exists inside the library.	Call your IBM service representative.	Yes	Yes
30	Shuttle mechanism failure	A failure has occurred in the shuttle mechanism while attempting to transfer a cartridge between two library strings.	1. Restart the operation. 2. If the problem persists, call your IBM service representative.	Yes	Yes

Table 51. TapeAlert flags that are supported by the TS3500 tape library (continued)

		TapeAlert Flags Supported by the TS3500 tape library			
Flag Number and Name		**Description**	**Action Required**	**SNMP Trap**	**Call Home**
32	Unreadable bar code label	During an inventory or scan, the library was unable to read a bar code label on a cartridge.	1. Check for damaged, misaligned, or peeling bar code labels on the cartridge. 2. If you find a damaged, misaligned or peeling barcode label, e replace it with a new barcode label. To request a new barcode label, call your IBM Service Representative. 3. If no problem is found, call your IBM service representative.	Yes	No

Chapter 8. Technical components of the library

This section introduces the major technical components of the TS3500 tape library.

Overview of technical components in the library

This section describes major technical components of the TS3500 tape library that are accessible from the front or rear door.

Figure 72 on page 356 shows the technical components of the TS3500 tape library that are accessible through the front door.

#	Component	#	Component
1	Rail assembly	**4**	Accessor controller
2	Cartridge accessor	**5**	Operator panel controller
3	Dual-gripper transport mechanism		
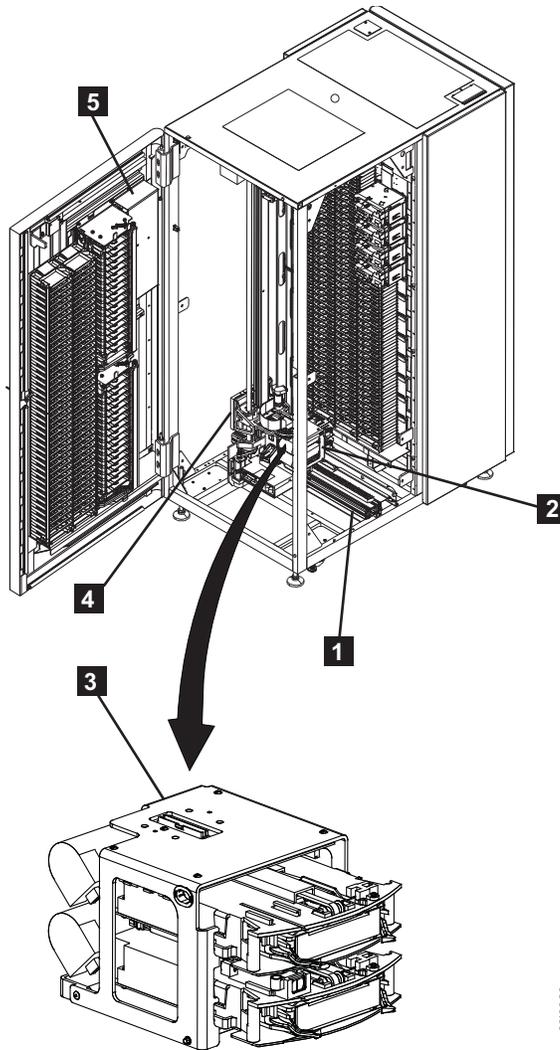
Figure 72. Technical components of the that are accessible through the front door. A Model L52 frame is shown.

The sections that follow describe each component.

Rail assembly

The cartridge accessor moves through the TS3500 tape library on a rail assembly. The system consists primarily of a main rail assembly and a support rail, and a trough for the power and control cable. The main rail assembly includes a main bearing way with a rack gear. Its support rail is an L-shaped rail that runs along the top of the frames and provides smooth transport for the cartridge accessor. The power and control cable is kept clear of the accessor in a covered trough located at the bottom rear of the library.

Cartridge accessor

The cartridge accessor moves cartridges between the storage slots, tape drives, and the I/O station of the TS3500 tape library. The accessor consists of several components:

X- and Y-axis motion assemblies
> A group of parts that includes a controller (circuit board) for the Controller Area Network interface, servo motor, pinion drive gear and lead screw.

These assemblies provide the motive force to move the accessor side to side (on the X-axis) and up and down (on the Y-axis). The controller part of this assembly is referred to as the XY controller.

Pivot assembly

A group of parts that provides a mounting platform for the gripper mechanism and the bar code reader. This assembly is capable of 180° rotation about the vertical axis.

Optimized dual gripper

An electromechanical device (mounted on the pivot assembly) that gets or puts cartridges from or to a storage slot, tape drive, or I/O station. The gripper is independently controlled and can grip a single cartridge. There are two grippers on the pivot assembly (Gripper 1 and Gripper 2). The grippers are located in the dual-gripper transport mechanism.

In libraries that mix drive types, the optimized dual gripper can handle both Ultrium and 3592 tape cartridges.

Bar code reader

A component that reads the bar code on a label that is affixed to a cartridge or to the rear of empty storage slots. The bar code reader is mounted on the pivot assembly. It is used during inventories, audits, insertions, and inventory updates (a process that is invoked each time you open a door; the inventory update determines whether cartridges have been added to or removed from the library, or moved within the library).

Calibration sensor

A component that provides a means to locate certain positions within the library very precisely during the calibration operation. The calibration sensor is mounted on the underside of Gripper 1 (for the optimized dual gripper, the sensor is mounted on the top of Gripper 2). All positions are calculated from these locating positions.

Accessor controller

The accessor controller is the controller (circuit board) for each cartridge accessor in the TS3500 tape library. If your library includes a second accessor, it has two accessor controllers. The accessor controller handles accessor motion requests, including calibrations, moves, and inventory updates. It also provides centralized management for other aspects of the entire library, including configuration, insert and eject operations, automatic drive cleaning, and determination of element status (for example, whether an element (such as a tape drive) is empty or occupied and the volume serial (VOLSER) number of the tape that occupies it).

The Controller Area Network (CAN) provides communication between the XY controller, accessor controller, Medium Changer card packs or Medium Changer assemblies, and operator panel controller. The Medium Changer card packs and the Medium Changer assemblies use the drives' RS-422 interfaces to communicate between each accessor controller and all drives within any one frame.

Operator panel controller

The operator panel controller facilitates communication between the accessor controller and the operator panel of the TS3500 tape library. It provides input to and output from the LCD, and senses and locks the I/O stations. In addition, the LCD activity and service menus are executed in the operator panel controller, with support from the accessor controller and the drives (via the Medium Changer card packs or Medium Changer assemblies).

The operator panel connects to the accessor controllers, all Medium Changer card packs or Medium Changer assemblies, and the XY controller through the Controller Area Network (CAN).

Power Structures

This section introduces the two types of power structures of the TS3500 tape library: the *frame control assembly* and the *enhanced frame control assembly*. Models L23, D23, L53, and D53 are equipped with the enhanced frame control assembly. All other models are equipped with the frame control assembly.

Frame control assembly

The frame control assembly (FCA) in the models L25, D25, L55, and D55 of the is a 2N power design with at least two power supplies available to power each load (drive canister). Each drive canister is connected to two associated power supplies, but only one is required. Each canister's power supply is connected to two canisters and is capable of powering both by itself.

Located at the right rear of the , the FCA houses the Medium Changer card pack, which contains the controller logic cards for the logical libraries. Also included in the FCA are a receptacle for the incoming main ac power, three circuit breakers, and ten AC outlets for powering the tape drives (one outlet is required for every two drives).

Figure 73 shows the elements of the FCA.

1	Medium Changer card pack (MCP)	**4**	Circuit breakers
2	37 V accessor power supplies	**5**	Incoming main AC power (dual AC line cords)
3	AC outlets		
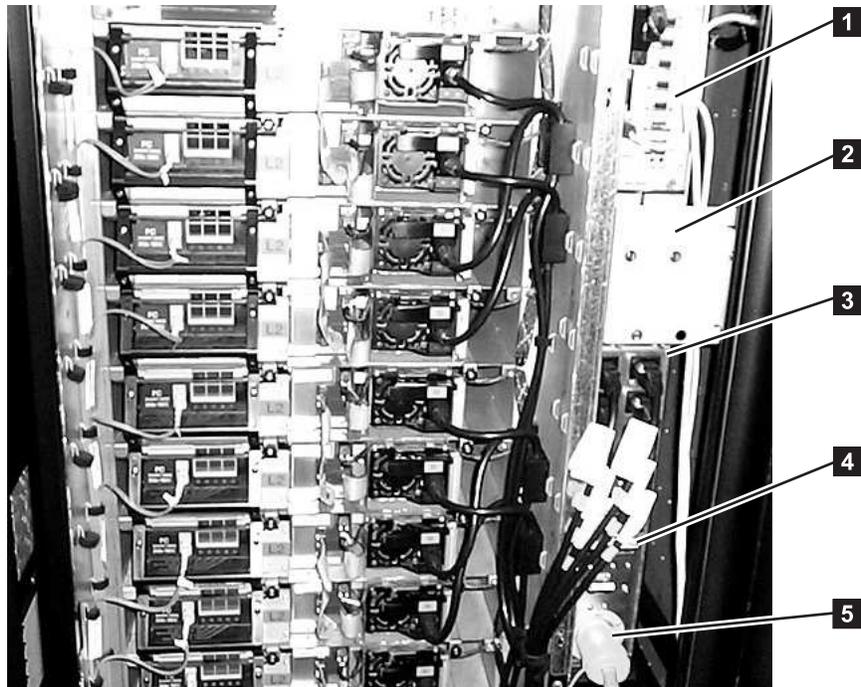
Figure 73. Components of the frame control assembly. Located at the right rear of the , this power structure comes with models L25, D25, L55, and D55. A model L52 frame is shown.

Medium Changer card pack: The built-in multiplicity of library control paths via the RS-422 interface gives the TS3500 tape library the ability to support multiple logical libraries (or Medium Changers, in SCSI terms). Because of this, controllers that are attached via the RS-422 interface are referred to as Medium Changer card packs (MCPs).

For each cartridge storage frame that contains at least one drive, there is one MCP logic card. The electronics of the card pack are located in the frame control assembly.

The MCP provides a communication path so that library commands can be funneled from the tape drives to the accessor. The MCP also provides management and service interfaces to outside hosts.

On Models L22, 32, and 52, the MCP also includes a port for 10/100 Mbps Ethernet support. MCPs with this capability are characterized by a design that is different from earlier MCP cards. Figure 74 shows an MCP with a 10/100 Mbps Ethernet port.
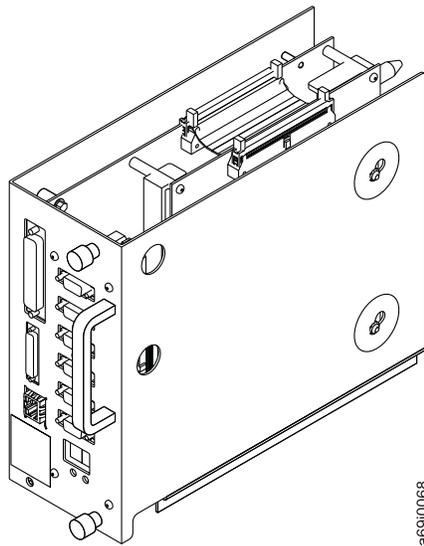
Figure 74. MCP with 10/100 Ethernet port

Drive and power supply compartment for models L22, D22, L32, D32, L52, and D52: For models L22, D22, L32, D32, L52, and D52, the TS3500 tape library is designed so that each Ultrium tape drive and 3592 tape drive is paired with an associated power supply. Each pairing is packaged side by side on a shelf in a frame. In addition, adjacent power supplies are cabled together such that redundant power becomes a standard function. The design enables a tape drive with a failed power supply to continue operating by using power from an adjacent power supply (also known as redundant drive power).

A frame contains 12 shelves. Each drive is housed in a removable canister, and each power supply is housed in a fixed tray. Both fit side by side on a shelf within the compartment and are identified by the following labels:

E08   IBM TS1150 tape drive

E07   IBM TS1140 tape drive

E06   IBM TS1130 tape drive

E05   IBM TS1120 tape drive

J1A   IBM 3592 tape drive Model J1A

L1   IBM Ultrium 1 tape drive

L2   IBM LTO Ultrium 2 tape drive

L3 - 2Gb
        IBM 3588 tape drive Model F3A (Ultrium 3 tape drive)

L3 - F3B
        IBM TS1030 tape drive Model F3B (Ultrium 3 tape drive)

L4 - F4A
        IBM TS1040 tape drive Model F4A (Ultrium 4 tape drive)

L5 - F5A
        IBM TS1050 tape drive Model F5A (Ultrium 5 tape drive)

FC-AL Fibre Channel Arbitrated Loop

FC-1Gb/s
        Fibre Channel - 1 Gigabit per second

FC-2Gb/s
        Fibre Channel - 2 Gigabit per second

FC SHORT-WAVE 4Gb/SEC
        Fibre Channel - 4 Gigabit per second

FC-8Gb/s
        Fibre Channel - 8 Gigabit per second

HVD   SCSI high voltage differential

LVD   SCSI low voltage differential

For drives that are equipped with a SCSI host interface, the library uses VHDCI SCSI connectors that connect to ports which are mounted between the power supplies and the drives. The earlier version of the SCSI drive uses HD68 connectors.

You can remove or replace any drive without disconnecting its SCSI cable. When removing and replacing a drive or power supply use the following guidelines.

Drive and power supply compartment for models L22 and D22:
Figure 75 shows the rear of the TS3500 tape library and the compartment that
contains the tape drives and power supplies for models L22 and D22.

1	Drive canister (customer accessible)	**4**	Drive power supply (customer accessible)
2	Fibre Channel cable connection	**5**	Fixed tray assembly (customer accessible)
3	Redundant drive DC power cable		
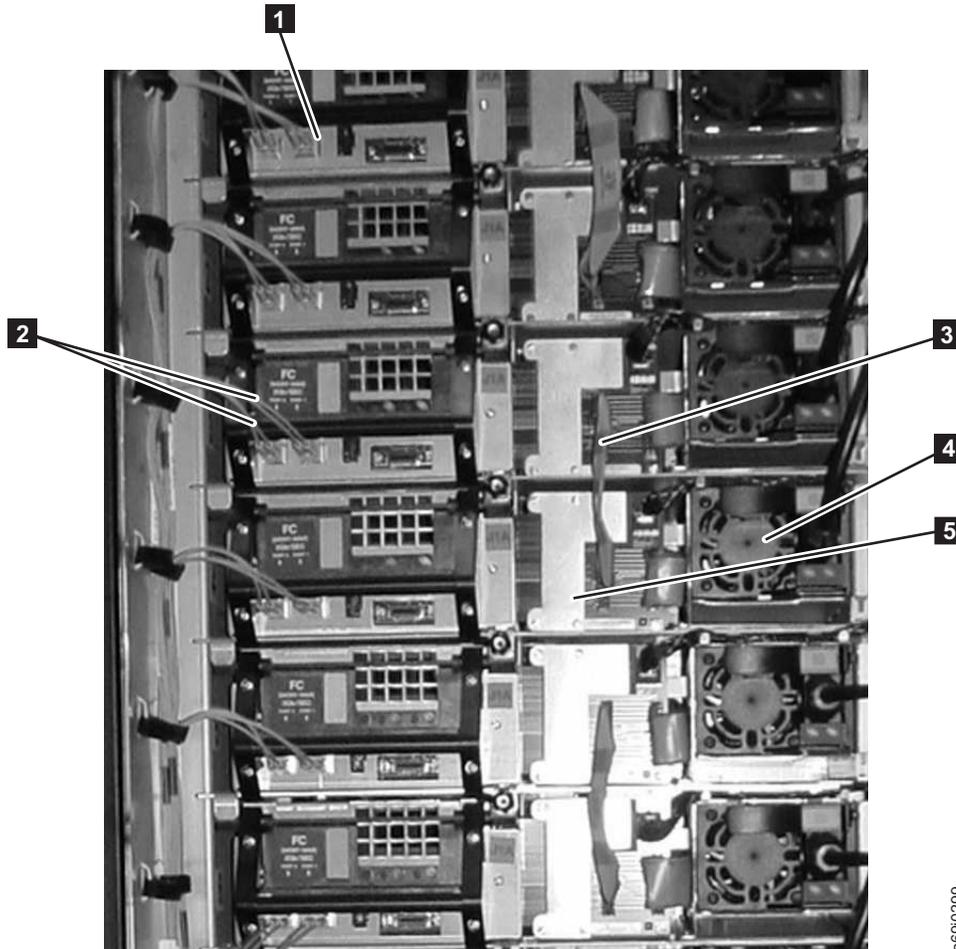
Figure 75. Compartment that houses the tape drives and the power supplies in model L22 or D22 frames. The view is
from the rear of the TS3500 tape library. The left side of the library has been removed. Only the items designated in
the preceding list are customer accessible. All other items are for service personnel.

Drive and power supply compartment for models L32 and D32:
Figure 76 shows the rear of the TS3500 tape library and the compartment that contains the tape drives and power supplies for models L32 and D32.

1	Drive canister (customer accessible)	**5**	Redundant drive DC power cable
2	Fibre Channel cable connection	**6**	Drive power supply (customer accessible)
3	VHDCI SCSI terminator	**7**	Fixed tray assembly (customer accessible)
4	SCSI cables		
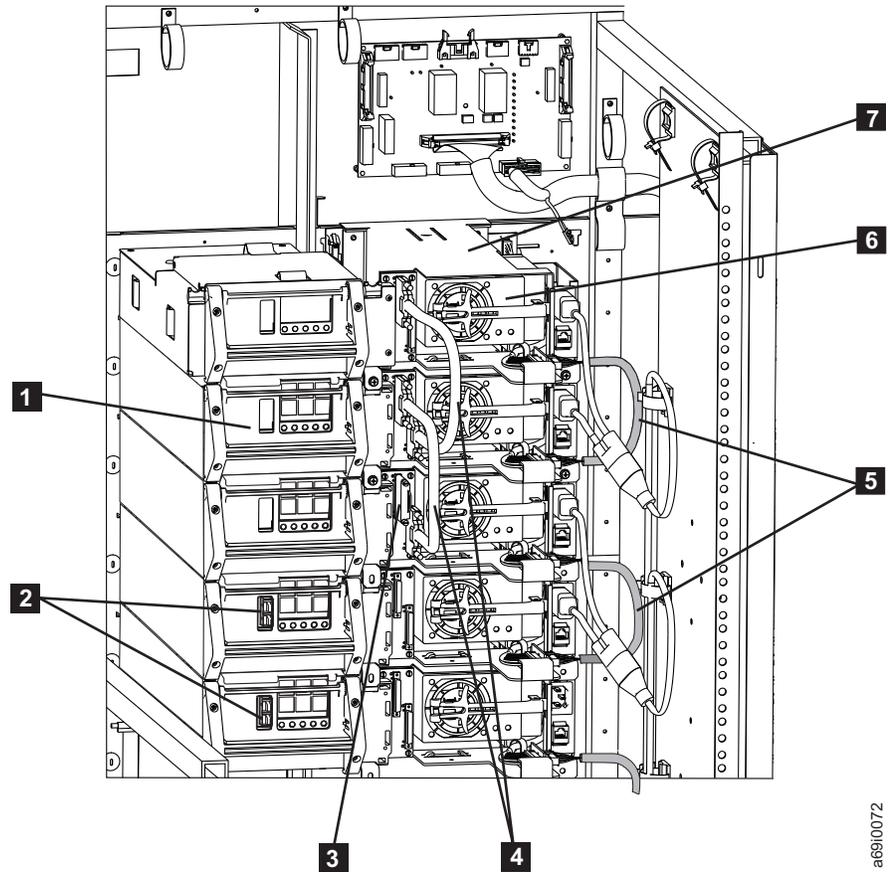
Figure 76. Compartment that houses the tape drives and the power supplies in model L32 or D32 frames. The view is from the rear of the TS3500 tape library. The left side of the library has been removed. Only the items designated in the preceding list are customer accessible. All other items are for service personnel.

Drive and power supply compartment for models L52 and D52:
Figure 77 shows the rear of the TS3500 tape library and the compartment that
contains the tape drives and power supplies for models L52 and D52.

1	Drive canister (customer accessible)	**4**	Drive power supply (customer accessible)
2	Fibre Channel cable connection	**5**	Fixed tray assembly (customer accessible)
3	Redundant drive DC power cable		
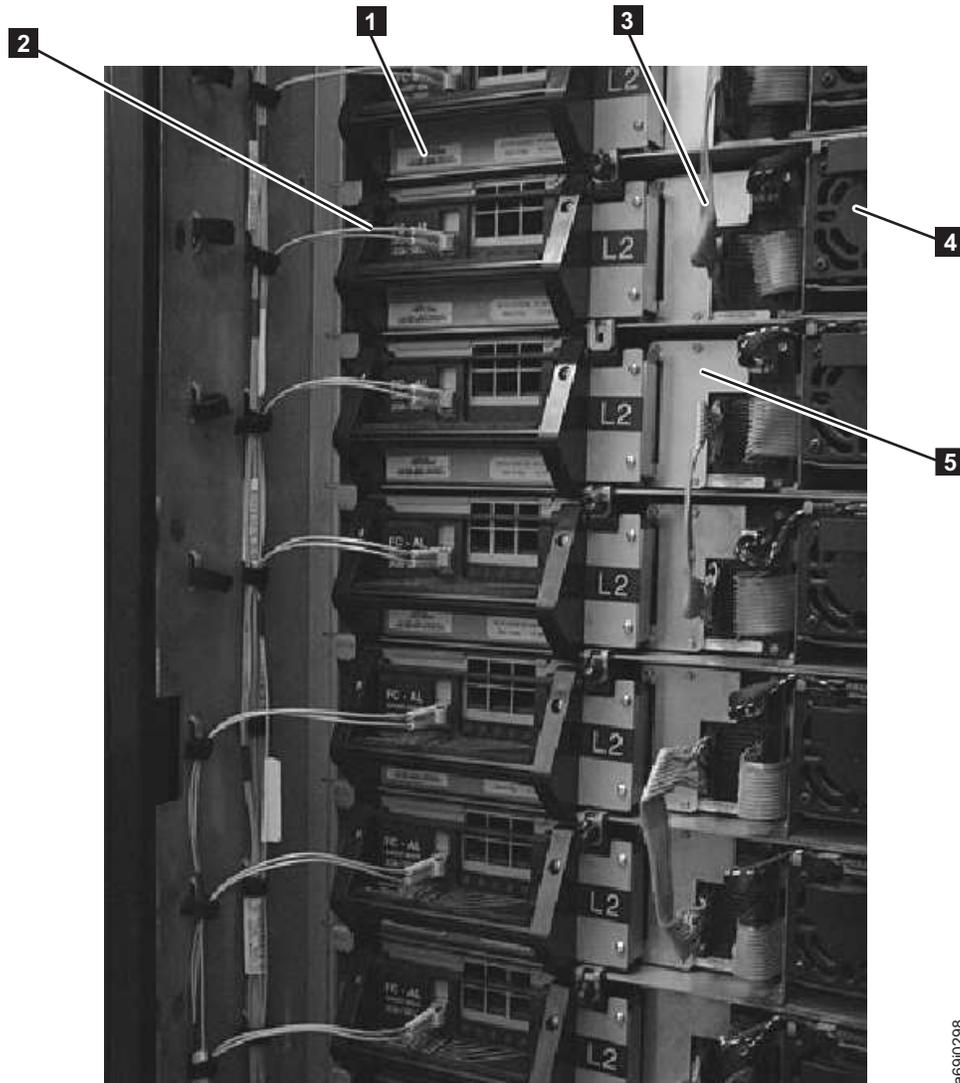
Figure 77. Compartment that houses the tape drives and the power supplies in model L52 or D52 frames. The view is
from the rear of the TS3500 tape library. The left side of the library has been removed. Only the items designated in
the preceding list are customer accessible. All other items are for service personnel.

Removing or replacing a drive canister assembly - LTO fibre channel hot swap:
About this task

To remove a drive canister assembly that is an LTO fibre channel hot swap from a
TS3500 tape library, perform the following steps:

1. Vary the drive offline.
2. From the library's Activity touchscreen, press **MENU —> Service —> FRU
   Replacement —> Prepare for Drive Replacement —> ENTER**.
3. Select the drive that you want to remove and replace, and press ENTER.
4. Open the rear door of the frame that contains the drive.
5. Refer to Figure 78. Unplug the fibre cable.
6. While holding up the locking lever **2** , grasp the drive canister's handle **3** .
   Firmly pull back on the handle to disengage the drive canister.
7. As you remove the drive canister from the fixed tray assembly, use your other
   hand to support the drive canister from the underside.
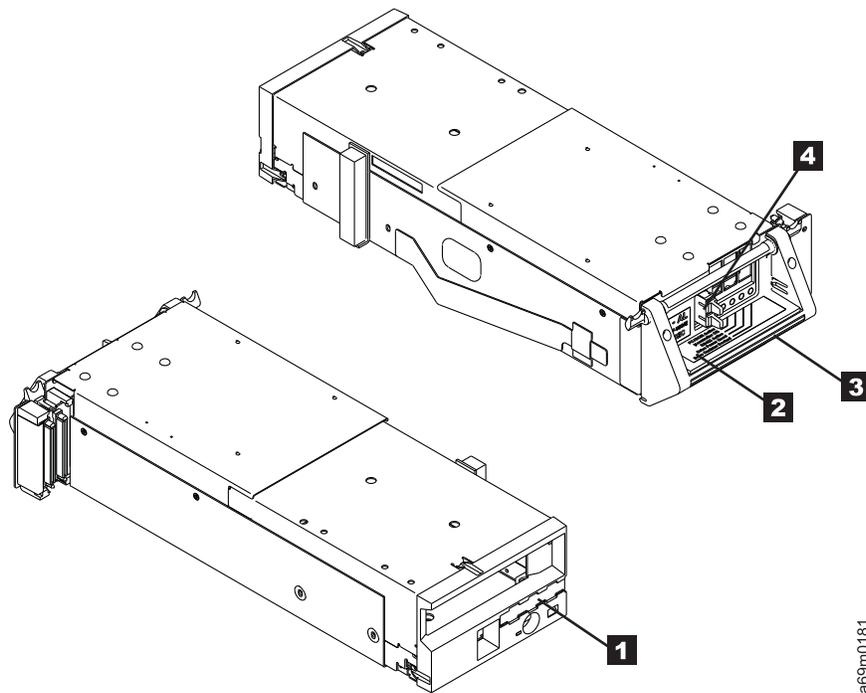
Figure 78. Removing and replacing a drive canister assembly - LTO fibre channel hot swap

The replacement procedure is the reverse of the removal procedure. To replace the
drive canister assembly in a TS3500 tape library, perform the following steps.

Notes:

- The removal of the drive canister creates a vacant area in the library. Do not reach through this area.
- If a logical library label (see **4** in Figure 78 on page 365) is attached to the old drive, remove it from the old drive and attach it to the new drive.
- The drive safety flaps in the frame must not be removed when you install the drive. The safety flaps will pivot up and out of the path when the drive is installed.
- If you are copying drive firmware to or from a control path drive, the drive and its entire logical library string of drives will be unavailable to the library until the firmware update is complete.
- Concurrent maintenance of a control path drive may require a logical library to be offline.

CAUTION:

Do not plug in the server's fibre cable until after the drive replacement process is complete and the drive has had its code updated, finished its POST, and Library Verify has completed. If you plug in the cable, a temporary incorrect Loop ID or World Wide Node Name may result.

1. Carefully slide the drive canister into the fixed tray assembly.
2. Hold the locking lever **2** up to ensure the tabs on both sides of the lever will clear the frame.
3. Grasp the drive canister's handle **3**, and carefully but firmly push the drive into position. Ensure that the connectors to the right correctly align and fully engage with the fixed tray connectors.
4. Lower the locking lever **2** until it snaps into place.
5. After you install a replacement drive canister, wait at least 3 minutes before continuing. This ensures that the library has time to automatically configure and calibrate the drive.

   Note: The drive firmware update may take as long as 20 minutes. Wait until the screen indicates that the update is complete.

6. From the FRU Replacement screen on the operator panel, press **Prepare for Drive Replacement —> ENTER**.
7. Select the drive that you replaced and press ENTER.
8. Follow the procedure on the screen. The library indicates that the drive is now ready for use.

   Notes:

   - If the drive that you replaced has a lower version of firmware than other drives of the same type in your library, the library attempts to update the drive firmware by reading code from another drive and writing it to the drive that you replaced. Depending on the drive type, this may take up to 1 hour. Let this process complete before you continue.
   - When asked whether you want to perform the Read/Write test, select Yes and press ENTER. The library attempts to load the diagnostic cartridge into the drive and perform the Read/Write test. This process may take up to 10 minutes. Let this process complete before you continue.

9. From the library's Activity touchscreen, press **MENU —> Vital Product Data —> Drive VPD —> ENTER**. View the drive firmware version for all drives in the library.

10. If the firmware in the drive that you replaced is correct, continue to the next step. If it is downlevel, update the drive firmware (go to the section about updating drive firmware).

11. Replug the fibre cable.

    Note: If the drive is connected to a System i (AS/400) server, you must perform an initial program load (IPL) on the server input/out processor (IOP) before it recognizes the replacement drive.

12. At the completion of the tests, place the drive online to the server.

Removing or replacing a drive canister assembly - 3592 Fibre Channel hot swap:
About this task

1. Vary the drive offline.
2. From the library's Activity touchscreen, press **MENU —> Service —> FRU Replacement —> Prepare for Drive Replacement —> ENTER**.
3. Select the drive that you want to remove and replace, and press ENTER.
4. Open the rear door of the frame that contains the drive.
5. Refer to Figure 79. Unplug the fibre cable.
6. Push up on the locking lever **2** and grasp the drive canister's handle **3**. Firmly pull back on the handle to disengage the drive canister.
7. As you remove the drive canister from the fixed tray assembly, use your other hand to support the drive canister from the underside.
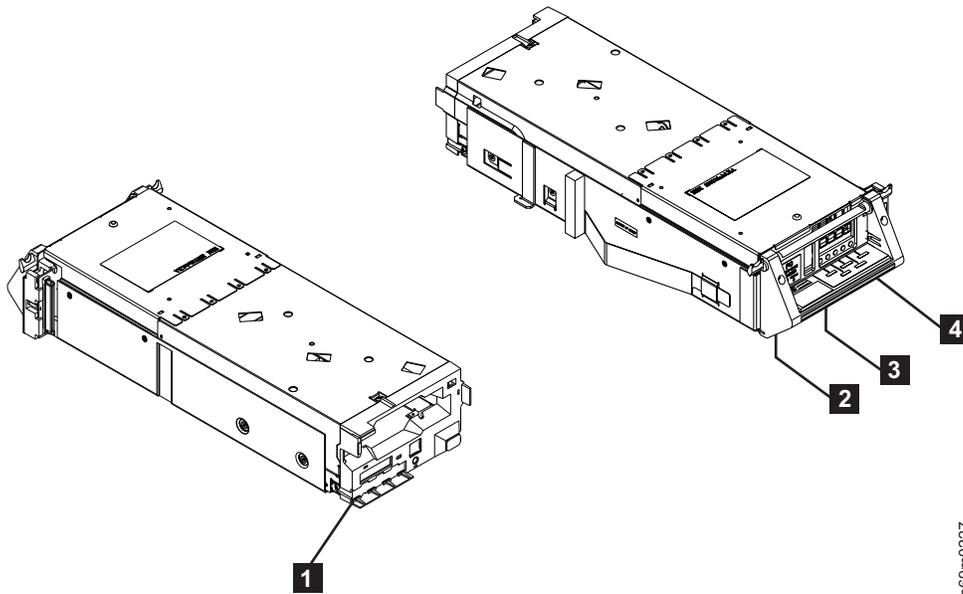
Figure 79. Removing or replacing a drive canister assembly - 3592 Fibre Channel hot swap

The replacement procedure is the reverse of the removal procedure. To replace the drive canister assembly in a TS3500 tape library, perform the following steps:

Notes:

- The removal of the drive canister creates a vacant area in the library. Do not reach through this area.
- If a logical library label (see **4** in Figure 79) is attached to the old drive, remove it from the old drive and attach it to the new drive.
- The drive safety flaps must not be removed when you install the drive. The safety flaps will pivot up and out of the path when the drive is installed.
- If you are copying drive firmware to or from a control path drive, the drive and its entire logical library string of drives will be unavailable to the library until the firmware update is complete.

CAUTION:

Do not plug in the server's fibre cable until after the drive replacement process is complete and the drive has had its code updated, finished its POST, and Library Verify has completed. If you plug in the cable, a temporary incorrect Loop ID or World Wide Node Name may result.

1. Carefully slide the drive canister into the fixed tray assembly.

2. Hold the locking lever **2** up to ensure that the tabs on both sides of the lever will clear the frame.

3. Grasp the drive canister's handle **3**, and carefully but firmly push the drive into position. Ensure that the connectors on the right correctly align and fully engage with the fixed tray connectors.

4. Lower the locking lever **2** until it snaps into place.

5. After installing a replacement drive canister, wait at least 3 minutes before continuing. This will ensure that the library has time to automatically configure and calibrate the drive.

   Note: The drive firmware update may take as long as 20 minutes. Wait until the screen indicates that the update is complete.

6. From the FRU Replacement screen on the operator panel, press **Finish Drive Replacement —> ENTER**.

7. Select the drive that you replaced and press ENTER.

8. Follow the procedure on the screen. The library indicates that the drive is now ready for use.

   Notes:
   - If the drive that you replaced has a lower version of firmware than other drives of the same type in your library, the library attempts to update the drive firmware by reading code from another drive and writing it to the drive that you replaced. Depending on the drive type, this may take up to 1 hour. Let this process complete before you continue.
   - When asked whether you want to perform the Read/Write test, select Yes and press ENTER. The library attempts to load the diagnostic cartridge into the drive and perform the Read/Write test. This process may take up to 10 minutes. Let this process complete before you continue.

9. From the library's Activity touchscreen, press **MENU —> Vital Product Data —> Drive VPD —> ENTER**. View the drive firmware version for all drives in the library.

10. If the firmware in the drive that you replaced is correct, continue to the next step. If it is downlevel, update the drive firmware (go to the section about updating drive firmware).

11. Replug the fibre cables.

    Note: If the drive is connected to an iSeries (AS/400) server, you must perform an initial program load (IPL) on the server input/out processor (IOP) before it recognizes the replacement drive.

12. At the completion of the tests, place the drive online to the server.

Removing or replacing a redundant power supply - models L32 or D32 hot swap:

Complete this task to remove or replace a redundant power supply in models L32 or D32 (hot swap).

About this task

To perform a hot swap removal of a redundant power supply in models L32 or D32, of the TS3500 tape library, use the following steps:

Note: One redundant power supply provides power to two drives. If the redundant power cable (N+1) is properly installed, you can remove and replace the power supply without affecting drive operation.

Procedure
1. Open the rear door of the frame that contains the power supply.
2. Use your thumb and index finger to pinch together the locking arms (see **1** in Figure 80) of the power supply.
3. Pivot the locking arm **2** outward to release it from the fixed tray assembly **4** .
4. Grasp the locking arm and firmly pull it back to release it from the fixed tray assembly.
5. As you remove the power supply canister **3** from the fixed tray assembly, use your other hand to support the end of the power supply.
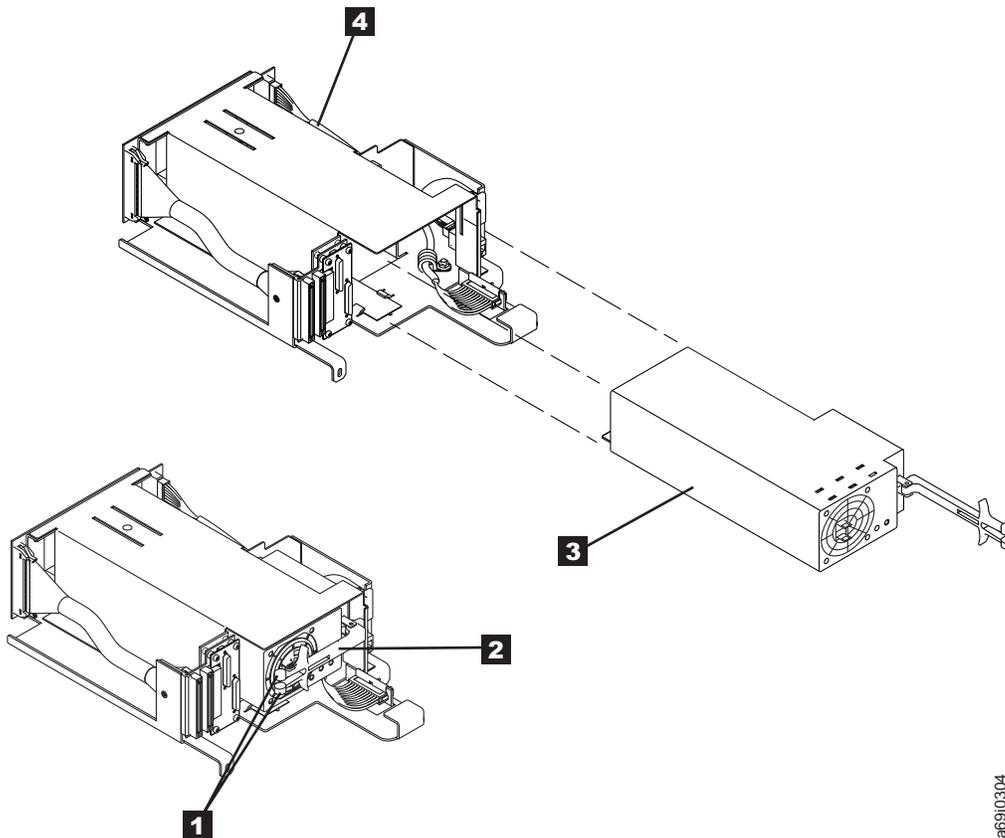
Figure 80. Removing or replacing a redundant power supply - models L32 or D32 hot swap

6. To perform a hot swap replacement of a redundant power supply in models L32 or D32 of the TS3500 tape library, use the following steps. The replacement procedure is the reverse of the removal procedure.

7. Carefully slide the power supply canister (**3** in Figure 80 on page 370) into the fixed tray assembly **4** .

8. Pinch together the locking arms **1** and slide in the power supply **3** , as you use the locking arm assembly **2** as a lever to move the power supply canister **3** into the locked position.

Removing or replacing a redundant power supply - models L22, D22, L52, or D52 hot swap:
About this task

To perform a hot swap removal of a redundant power supply in models L22, D22, L52, or D52 of the TS3500 tape library, use the following steps:

Note: One redundant power supply provides power to two drives. If the redundant power cable (N+1) is properly installed, you can remove and replace the power supply without affecting drive operation.

Procedure

1. Open the rear door of the frame that contains the power supply canister.
2. Disconnect the power cable (**1** in Figure 81) from the rear of the power supply.
3. Press the colored tab on the side of the locking arm **2** and pivot the arm outward to release the power supply **3** from the fixed tray assembly **5** .
4. Hold the locking arm and firmly pull it back to release it from the fixed tray assembly, while using your other hand to support the end of the power supply as you remove it from the fixed tray assembly.
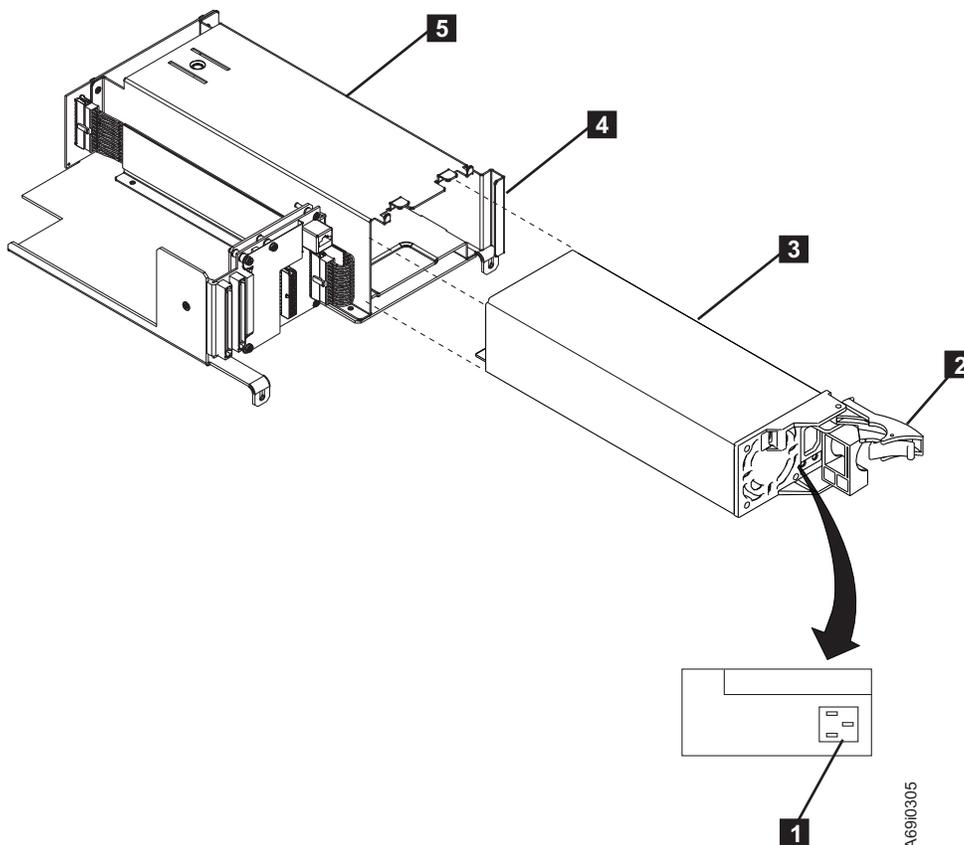
Figure 81. Removing or replacing a redundant power supply - models L22, D22, L52, or D52 hot swap

5. To perform a hot swap replacement of a redundant power supply in models L22, D22, L52, or D52 of the TS3500 tape library, use the following steps. The replacement procedure is the reverse of the removal procedure.

6. With the locking arm **2** in the outward position, carefully slide the power supply canister (see **3** in Figure 81 on page 372) into the fixed tray assembly **5** as far as it will go.

7. Pivot the locking arm in and make sure that it engages in the power tray frame **4** as you snap the arm into a locked position.

8. Reconnect the power cable **1** to the power supply.

Dual AC power: Dual AC power enhances availability of the TS3500 tape library by making another power source available in case of planned or unplanned power grid outages. The dual AC power feature provides a second power cord (110 V AC or 220 V AC) so that a frame can be connected to two independent branch power feeds. The power cords connect to a power switch (**3** in Figure 82) that monitors the AC line voltage on the primary power feed. By default, all power is drawn from the main power feed **1** . If the incoming voltage is lost, the power switch automatically draws power from the backup power feed **2** . When power is restored to the main power feed, the switch automatically returns the power back to the main power feed. Figure 82 shows the dual AC power feature, which you can order as feature code 1901.
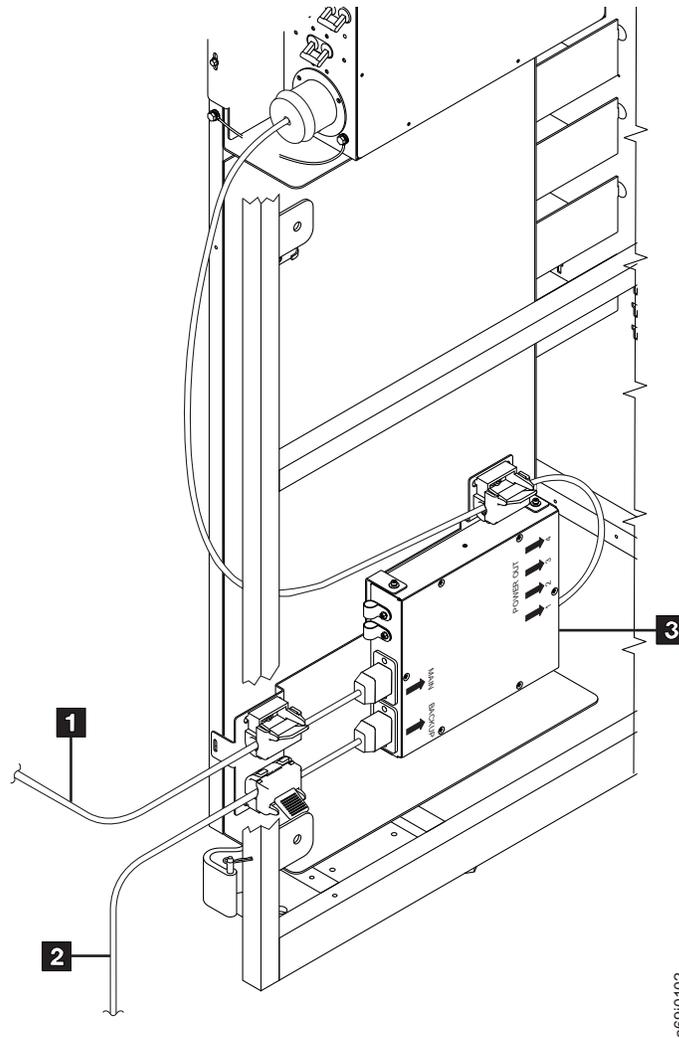
Figure 82. Dual AC power. The view is from the side and rear of a frame. The side panel has been removed to show the placement of the power switch and the two independent AC power cords.

Enhanced frame control assembly

This section describes the enhanced frame control assembly of the TS3500 tape library.

The enhanced frame control assembly is a 2N power design, but with fewer components than the frame control assembly. The enhanced frame control assembly has only two redundant power supplies which are fed directly by independent dual AC line cords. The assembly is constructed with hot-swappable, redundant parts, which (along with the dual AC line cords) remove the possibility of a single part causing failure. If one power supply fails, the remaining power supply provides all of the power to all of the library's elements.

The enhanced frame control assembly comes standard with Models L23 and L53, and can be ordered as a feature code for Models D23 and D53. The dual AC line cords are standard on Models L23, D23, L53, and D53, and do not have to be ordered separately.

Figure 83 shows the elements of the enhanced frame control assembly.

1 Medium Changer assembly (MCA)
2 Two 12 V power supplies
3 Incoming main AC power (dual AC line cords)
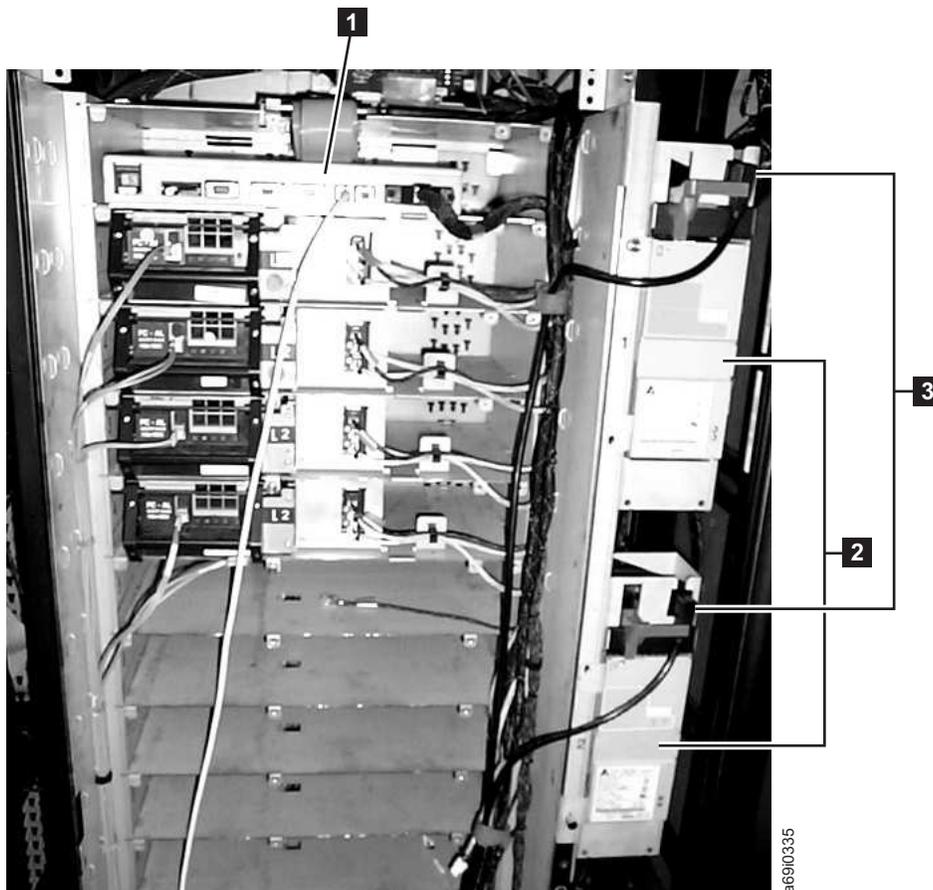
Figure 83. Components of the enhanced frame control assembly. This power structure comes with Models L23, D23, L53, and D53. A Model L53 frame is shown.

Medium changer assembly: Integral to the enhanced frame control assembly power structure is the Medium changer assembly (MCA) unit, a device located above the drives and the fixed power trays in Model L23, D23, L53, and D53 frames. The MCA handles communication between host applications and the library, and houses two Ethernet ports for connection to the IBM Tape Library Specialist Web interface or a master console.

Figure 84 shows the MCA in the TS3500 tape library.

Figure 84. Medium changer assembly. The MCA is located above the drives and the power trays, and is part of the enhanced frame control assembly power structure.

Although the two Ethernet ports in the MCA may be used interchangeably, IBM recommends that you use them as follows:

- Use Port A (**1** in Figure 84) to connect to the Tape Library Specialist Web interface.
- Use Port B (**2**) to connect to a TS3000 system console (TSSC).

You can establish up to five Web sessions to the Tape Library Specialist by using one physical Ethernet port. If you have multiple D23 or D53 frames, you can add an additional five connections per frame.

If Port A is connected to the Web and Port B is not connected to a TSSC, service personnel may use Port B to connect a laptop to the Tape Library Specialist Web interface. A special Ethernet crossover cable is needed to make the connection.

You can also use Port B for the Call Home feature of the TS3500 tape library. This feature retrieves library and drive logs (as well as other pertinent information) and saves them to the Remote Technical Assistance Information Network (RETAIN) where they can be examined for both failure and maintenance analysis. In the past, this was done by using an analog modem attached to a serial port or by using an Ethernet port in a second frame that was connected to the TS3000 system console (TSSC). The second frame was necessary because the TSSC required a private network that was separate from the customer network. The dual Ethernet ports of the MCA makes a second frame unnecessary.

Note: A customer rack-mountable TS3000 system console is available by ordering IBM feature code 2730 or 2732.

Ethernet cables to the MCA can be routed through the top or bottom of the frame.

Drive and fixed tray assembly compartment for models L23 and D23:
Figure 85 shows the rear of the TS3500 tape library and the compartment that contains the tape drives and fixed tray assemblies for Models L23 and D23.

1	Drive canister (customer accessible)	**3**	Fixed tray assembly (customer accessible)
2	Fibre Channel cable connection		
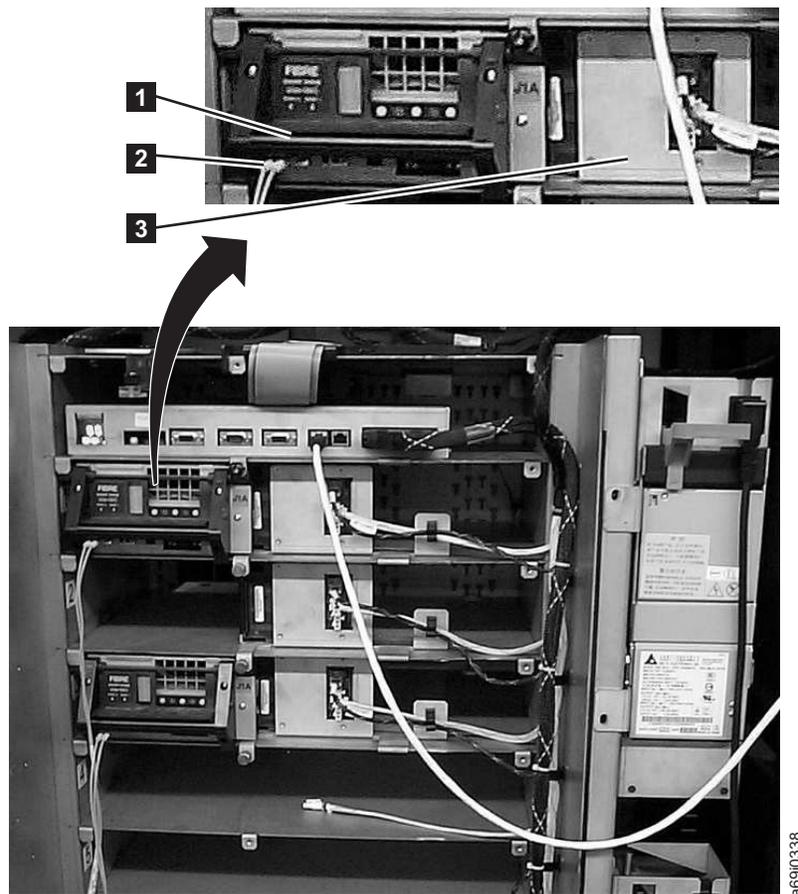
Figure 85. Compartment that houses the tape drives and the fixed tray assemblies in Model L23 or D23 frames. The view is from the rear of the TS3500 tape library. Only the items designated in the preceding list are customer accessible. All other items are for service personnel.

Figure 86 on page 378 shows the optional Power Distribution Units (PDU) (feature code 1950) **1** and the backend Fibre Channel switches (feature code 4872, 4873, 4875, or 4877) **2** and mounting hardware (feature code 4871). The PDUs each have their own independent ac line cord and provide redundant ac power to all loads in the frame. Feature codes 1950 and 4871 provide internal ac line cords to connect the PDU outlets to the power supplies of the Enhanced Frame Control Assembly and to the Fibre Channel switches. Each Fibre Channel switch has two redundant hot-swappable power supplies that are connected to both PDUs. This setup ensures that both switches remain powered on in the event that one PDU

fails or if one incoming main ac line loses power.
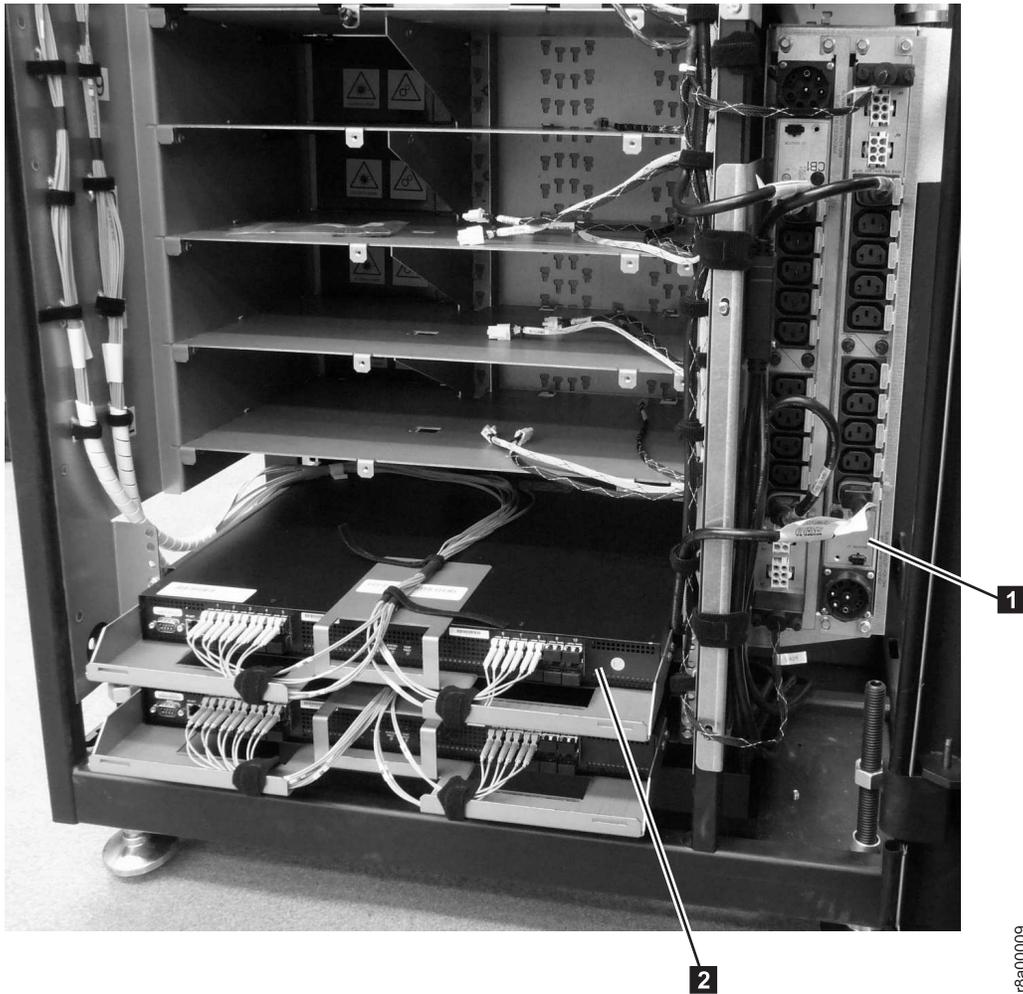
Figure 86. Power Distribution Unit and backend Fibre Channel switches. The view is from the rear of the L23 or D23 frame of the TS3500 tape library.

Drive and fixed tray assembly compartment for models L53 and D53:
Figure 87 shows the rear of the TS3500 tape library and the compartment that contains the tape drives and fixed tray assemblies for Models L53 and D53.

1   Drive canister (customer accessible)   **3**   Fixed tray assembly (customer accessible)

2   Fibre Channel cable connection
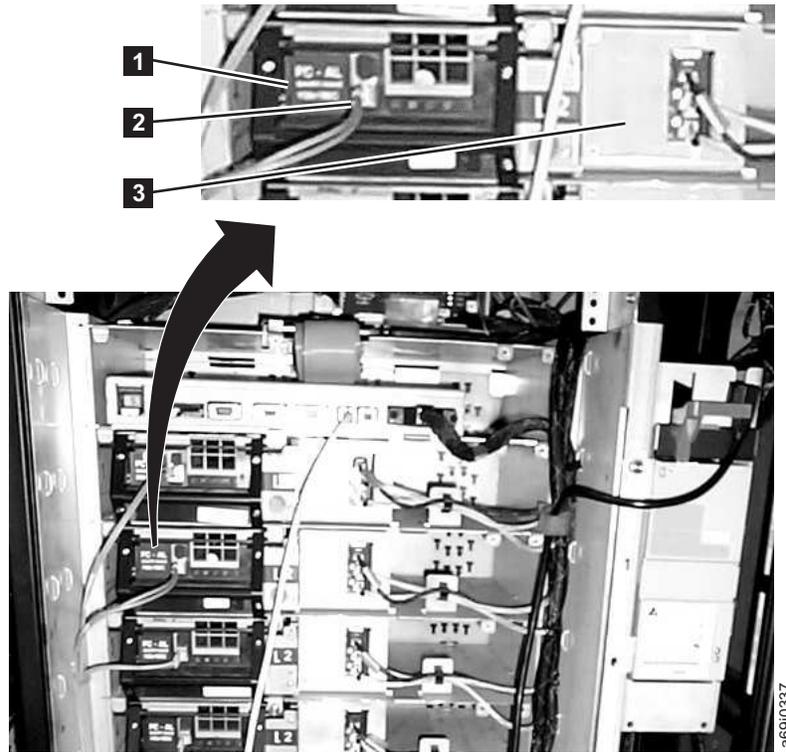
Figure 87. Compartment that houses the tape drives and the fixed tray assemblies in Model L53 or D53 frames. The view is from the rear of the TS3500 tape library. Only the items designated in the preceding list are customer accessible. All other items are for service personnel.

Chapter 9. Frame capacity

This section introduces the quantity of LTO Ultrium tape cartridges and 3592 tape cartridges that the TS3500 tape library supports, depending on whether the Capacity On Demand or Capacity Expansion Features are installed, the upper and lower I/O stations are used, and a specified quantity of drives are installed.

Capacity of Model L22, D22, L23, D23, and S24 Frames

This section gives the type of eligible Capacity On Demand feature and quantity of drives, I/O slots, and storage slots for L22, D22, L23, D23, and S24 frames.

Table 52. Quantity of storage slots in L22, D22, L23, D23, and S24 frames. The quantity depends on the type of Capacity On Demand feature installed, whether the upper and lower I/O stations are used, and the quantity of drives in a frame.

Type of Frame	Type of Capacity On Demand (CoD) Feature	Quantity of Drives	Quantity of I/O Slots	Quantity of Storage Slots
L22, L23	No CoD (Entry)	0 to 12	16	58
L22, L23	Intermediate CoD	0 to 12	16	117
L22, L23	Full CoD	0 to 4	16	260
			32	222
L22, L23	Full CoD	5 to 8	16	248
			32	210
L22, L23	Full CoD	9 to 12	16	237
			32	199
D22, D23[1]	N/A[2]	0	0	400
			64[3]	240
D22, D23[1]	N/A	1 to 4	0	383
			64[3]	223
D22, D23[1]	N/A	5 to 8	0	371
			64[3]	211
D22, D23[1]	N/A	9 to 12	0	360
			64[3]	200
S24	No CoD (Base)	0	0	600
S24	HD CoD (Maximum)	0	0	1000

Notes:

1. If the L frame is not an L22 or L23, then the first D frame of a mixed media library will have one less storage slot to accommodate a diagnostic cartridge.

2. N/A = not applicable.

3. The 64 Additional I/O Slots feature (FC 1656) is only available on frame model D23.

Capacity of Model L32 and D32 Frames

This section gives the quantity of drives and cartridge storage slots in Model L32 and D32 frames that do not have the Capacity Expansion feature. It also gives the quantity of cartridge storage slots in L32 and D32 frames that have the Capacity Expansion feature and differing numbers of I/O slots.

Table 53. Quantity of storage slots in Model L32 and D32 frames. The quantity depends on whether the Capacity Expansion feature is installed, whether the upper and lower I/O stations are used, and the quantity of drives in a frame.

Type of Frame	Quantity of Drives	Quantity of Slots in Frame (without Capacity Expansion Feature)	Quantity of Slots with Capacity Expansion Feature and 26 or 30 I/O Slots	Quantity of Slots with Capacity Expansion Feature and 10 I/O Slots
L32	1 to 4	141	229	281
L32	5 to 8	113	201	253
L32	9 to 12	87	175	227
D32	0	440	N/A (see Note)	N/A
D32	1 to 4	N/A	423	423
D32	5 to 8	N/A	409	409
D32	9 to 12	N/A	396	396
Note: N/A = not applicable.				

Capacity of Model L52, D52, L53, D53, and S54 Frames

This section gives the type of eligible Capacity On Demand feature and quantity of drives, I/O slots, and storage slots for Model L52, D52, L53, D53, and S54 frames.

Table 54. Quantity of storage slots in Model L52, D52, L53, D53, and S54 frames. The quantity depends on the type of Capacity On Demand Expansion feature installed, whether the upper and lower I/O stations are used, and the quantity of drives in a frame.

Type of Frame	Type of Capacity On Demand (CoD) Feature	Quantity of Drives	Quantity of I/O Slots	Quantity of Storage Slots
L52, L53	No CoD (Entry)	0 to 12	16	64
L52, L53	Intermediate CoD	0 to 12	16	129
L52, L53	Full CoD	0 to 4	16	287
			32	245
L52, L53	Full CoD	5 to 8	16	273
			32	231
L52, L53	Full CoD	9 to 12	16	261
			32	219
D52, D53[1]	N/A[2]	0	0	440
			64[3]	264
D52, D53[1]	N/A	1 to 4	0	422
			64[3]	246
D52, D53[1]	N/A	5 to 8	0	408
			64[3]	232
D52, D53[1]	N/A	9 to 12	0	396
			64[3]	220
S54	No CoD (Base)	0	0	660
S54	HD CoD (Maximum)	0	0	1320

Notes:

1. If the L frame is not an L32, L52, or L53, then the first D frame of a mixed media library will have one less storage slot to accommodate a diagnostic cartridge.

2. N/A = not applicable.

3. The 64 Additional I/O Slots feature (FC 1655) is only available on frame model D53.

Chapter 10. Addresses of SCSI Elements

This section introduces addresses of SCSI elements in the TS3500 tape library

Determining SCSI Element Addresses

This section introduces the rules to follow when you want to determine the SCSI element addresses of storage elements (storage slots), import/export elements (I/O slots or shuttle stations), and data transfer elements (drives) in the TS3500 tape library with ALMS.

Storage element addresses

With the Advanced Library Management System (ALMS) enabled in the TS3500 tape library, each storage element address is no longer associated with a specific storage slot. Instead, storage slots are virtualized by dynamically associating element addresses to them, as required. An element address is associated with a storage slot that is selected by the library as cartridges are moved and inventoried. In the case of a storage element that is empty due to a move, that source element address will be unassociated. Association of storage element addresses is accomplished in a way that is completely transparent to the application software.

With ALMS enabled, the first storage element address of any logical library is equal to 1024 plus the logical library number. For example, logical library 3 will have a starting storage element address of 1027 (X'403').

You can select the number of storage element addresses for a logical library (as reported to the host application software by the SCSI Mode Page X'1D') by changing the `Maximum Number of Cartridges` setting for that logical library through the Web user interface. For each logical library, the default value for `Maximum Number of Cartridges` is the number of accessible storage slots that are installed in the library for that cartridge type at the time that ALMS is first enabled, or after ALMS is enabled at the time that the logical library is created. You can change the `Maximum Number of Cartridges` setting for each logical library, but the value must always be greater than or equal to the number of actual cartridges that are currently assigned to that logical library. It is possible to set `Maximum Number of Cartridges` to a value that is higher than the number of accessible storage slots that are installed at the time in order to allow future library capacity expansion to be transparent to the host application software. However, application performance may degrade slightly due to the greater number of addresses. Take care not to exceed the license limitations of the host application software.

Import/export element addresses with virtual I/O slots disabled

When ALMS is enabled and virtual I/O slots are disabled, the TS3500 tape library assigns import/export element (IEE) addresses sequentially to all I/O slots. These assignments occur from top to bottom, regardless of media type, beginning at I/O slot 1 of the Model L22, L32, or L52, with address 769 (X'301').

Import/export element addresses with virtual I/O slots enabled

With ALMS and virtual I/O slots enabled on the TS3500 tape library, each import/export element (IEE) address is no longer associated with a specific

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physical I/O station slot. Instead, I/O slots are virtualized by dynamically associating element addresses to them as required. The association of IEE addresses is accomplished in a way that is completely transparent to the application software.

By using the IBM Tape Library Specialist web interface, you can select the number of IEE addresses for a logical library (as reported to the host application software by the SCSI Mode Page X'1D') by changing the Max VIO Slots setting for that logical library up to a value of 255. For each logical library, the default value for the quantity of that logical library's IEE addresses is one of the following, depending on when ALMS and virtual I/O slots are enabled:

- If you enable ALMS and virtual I/O slots **before** creating a logical library, the number of virtual I/O slots is 255.

  For example:

  1. ALMS and virtual I/O slots are enabled.
  2. One or more logical libraries are created.

     Virtual I/O slots for each logical library defaults to 255 (the maximum number possible).

- If you enable ALMS and virtual I/O slots **after** creating a logical library, the number of virtual I/O slots equals the number of physical I/O slots.

  For example:

  1. One or more logical libraries are created.
  2. ALMS and virtual I/O slots are enabled.

     The virtual I/O slots for each logical library equals the number of physical slots in the convenience I/O station for that logical library's media type. Two examples are presented in the following list:

     a. If the physical library has one 16-slot convenience I/O station and one or more logical libraries are created for the LTO media type, you would have 16 virtual I/O slots per each logical library. This number is equal to the number of physical I/O slots.

     b. If the physical library has two 16-slot LTO convenience I/O stations or two 16-slot 3592 convenience I/O stations, and a logical library is created for each media type, the logical library for LTO would have 32 virtual I/O slots and the logical library for 3592 would also have 32 virtual I/O slots.

When you use virtual import/export element addressing, the IEE address range includes addresses from 769 (X'301') to 1023 (X'3FF'), allowing for a maximum of 255 IEE addresses for each logical library.

Each logical library has a unique virtual IEE address space that is not accessible by other logical libraries. In previous firmware releases, the IEE space was made up of physical I/O station slots that were shared by all logical libraries. If a cartridge was moved to and remained in the I/O station, all logical libraries had one less IEE address with which to process imports and exports. Virtual IEEs, however, allow each logical library to use all 255 elements without impacting other logical libraries. For example, two logical libraries might both have 255 cartridges in virtual IEEs 769 through 1023, but the cartridges are actually located in different physical storage slots. Thus, competition for IEE space between logical libraries is eliminated and the effective quantity of IEEs is enhanced without physical modifications to the library. The automatic queuing of a cartridge's moves between the I/O station and the virtual storage slots makes it appear to the host application that the library contains more physical I/O slots than actually exist. Thus, instead

of sharing a maximum of 32 I/O slot addresses in Frame 1, each logical library can have up to 255 I/O slot addresses that are not shared.

Import/export element addresses for shuttle connections

This topic describes import/export element (IEE) addresses for shuttle connections in a TS3500 tape library shuttle complex.

In a TS3500 tape library shuttle complex that has one or more shuttle stations assigned to a logical library, the library has an additional set of IEE addresses that are automatically enabled for that logical library. The IEE address range reserved for the shuttle stations is 512 (X'200') through 768 (X'300'). The Mode Sense Element Address Assignment page X'1D' is updated to report the new range. Each element address in this range represents a specific shuttle station either on the local library or on remote library strings.

Data transfer element addresses

When the Advanced Library Management System (ALMS) is enabled for the first time in the TS3500 tape library, the Data Transfer Element (DTE) addresses of all installed or assigned tape drives are not changed from how they were set with ALMS disabled. However, after ALMS has been enabled, the DTE addresses for any newly installed or assigned drives are no longer dependent on drive position. Instead, the DTE address for any newly installed or assigned drive is determined by the sequence in which the drive is assigned to each logical library.

After ALMS is enabled, drives are assigned to logical libraries by using the Drive Assignment page of the IBM Tape Library Specialist Web interface. In the Web interface, the DTE address for the first drive that is assigned to a new logical library is 257 (X'101'). The DTE address for any other drive that is assigned to the logical library is based on the next available DTE address in that particular logical library. The next available DTE address is the lowest available DTE address after the starting DTE address (this fills any gaps between previously assigned DTE addresses that were created when the assignments for drives were removed or the drives themselves were removed). When a drive assignment is removed from a logical library through the Web interface, only that DTE address is made available for future assignment; no other DTE addresses are affected.

The Drive Assignment page also supports the option to share a drive between two or more logical libraries. The drive will be assigned a DTE address in more than one logical library. Note that the DTE addresses that are assigned to a shared drive may differ by logical library.

By using the flexible Drive Assignment capability of ALMS, any drive in any position within any frame is available to be assigned to any logical library without creating gaps in DTE addresses.

Accessibility

Accessibility features help users who have a disability, such as restricted mobility or limited vision, to use information technology products successfully.

Accessibility Features

The following list includes the major accessibility features in the *IBM TS3500 with ALMS Operator Guide*:

- Keyboard-only operation
- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen.

Keyboard navigation

This product uses standard Microsoft; Windows navigation keys. You can navigate the *IBM TS3500 with ALMS Operator Guide* information from the keyboard by using the shortcut keys for your browser or screen-reader software. See your browser or screen-reader software Help for a list of shortcut keys that it supports.

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Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:

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New Orchard Road
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Tel: 914-499-1900

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Technical Regulations, Abteilung M372
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Taiwan Contact Information

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```
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```

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Japan Electronics and Information Technology Industries Association Statement

This explains the Japan Electronics and Information Technology Industries Association (JEITA) statement for less than or equal to 20 A per phase.

高調波ガイドライン適合品   jjieta1

This explains the JEITA statement for greater than 20 A per phase.

高調波ガイドライン準用品 jjieta2

Korean Communications Commission Class A Statement

This explains the Korean Communications Commission (KCC) statement.

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Russia Electromagnetic Interference Class A Statement

This statement explains the Russia Electromagnetic Interference (EMI) statement.

ВНИМАНИЕ! Настоящее изделие относится к классу А.
В жилых помещениях оно может создавать
радиопомехи, для снижения которых необходимы
дополнительные меры

rusemi

Glossary

This glossary defines the special terms, abbreviations, and acronyms used in this publication and other related publications.

Numbers

2:1 or 3:1 compression
> The relationship between the quantity of data that can be stored with compression as compared to the quantity of data that can be stored without compression. In 2:1 compression, twice as much data can be stored with compression as can be stored without compression. In 3:1 compression, three times as much data can be stored with compression as can be stored without compression.

2N
> Twice the amount of a system's electrical power load. If the system has 2N power supplies, then there are two power supplies available for every load, which means greater redundancy and availability of electrical power. For example, the Enhanced Frame Control Assembly of the TS3500 offers a 2N power design with no single point of failure or single point of repair.

3588 tape drive
> See *IBM 3588 tape drive Model F3A*, *IBM TS1030 tape drive Model F3B*, *IBM TS1040 tape drive Model F4A*, *IBM TS1050 tape drive Model F5A*, *IBM TS1040 tape drive Model F5C*, *IBM TS1060 tape drive Model F6A*, and *IBM TS1040 tape drive Model F6C*

3592 tape controller Model J70
> See IBM 3592 tape controller Model J70.

3593 tape system
> The IBM 3953 tape frame Model F05 and the IBM 3953 library manager Model L05.

A

A Ampere.

AAP See *authorized assembler program*.

ac See *alternating current*.

accessible cartridge storage slots
> Within the TS3500, units that can contain tape cartridges and that are recognizable to the library by both a physical address

(such as F01-C05-R19) and a SCSI element (logical) address (such as 1112(X'458'). Accessible cartridge storage slots do not include I/O station slots or the inaccessible slots that are reserved for the diagnostic cartridges. The quantity of accessible cartridge storage slots per frame varies, depending on the quantity of drives that are installed in the frame.

accessor controller
> The logic card for the cartridge accessor. The accessor controller handles accessor motion requests, including calibrations, moves, and inventory updates. It also provides centralized management for other aspects of the entire library, including configuration, insert and eject operations, automatic drive cleaning, and determination of element status.

ac line voltage
> The input voltage (in volts) that is required by the TS3500 or TS4500 for normal operation.

Activity screen
> The primary screen on the touchscreen of the TS3500. The Activity screen gives the level of firmware in the library, shows whether the library is ready, not ready, or initializing, and tells the quantity of tape cartridges currently in the I/O stations. The screen also indicates the current activity being performed, the volume serial (VOLSER) number of the cartridge associated with the activity, and a history of previous activities. The Activity screen leads to the Main Menu.

adapter
> See *adapter card*.

adapter card
> A circuit board that adds function to a computer.

addressable cartridge storage slots
> See *accessible cartridge storage slots*.

Advanced Interactive eXecutive (AIX)
A UNIX operating system developed by IBM that is designed and optimized to run on POWER® microprocessor-based hardware such as servers, workstations, and blades.

Advanced Library Management System (ALMS)
The next generation of IBM's patented Multi-Path Architecture. ALMS enables logical libraries to consist of unique drives and ranges of VOLSERs, instead of fixed locations. It offers the ability to assign tape drives to any logical library by using the IBM Tape Library Specialist Web interface. Logical libraries can also be added, deleted, or easily changed without disruption.

aggregate sustained data transfer rate
For all of the drives in the TS3500 or TS4500, the sum of their average throughput of uninterrupted data.

AIX   See *Advanced Interactive eXecutive.*

ALMS   See *Advanced Library Management System.*

AL_PA
See *Arbitrated Loop Physical Address.*

alphanumeric
Pertaining to a character set that contains letters, numerals, and usually other characters, such as punctuation marks.

alternating current (ac)
An electric current that reverses its direction at regularly recurring intervals.

amp   Ampere.

ampere (A, amp)
A unit of measure for electric current that is equivalent to a flow of one coulomb per second, or to the current produced by one volt applied across a resistance of one ohm.

Arbitrated Loop Physical Address (AL_PA)
An 8-bit value used to identify a device in an arbitrated loop. Device ports communicate by using AL_PAs.

audit   The process of moving cartridges in an HD slot in order to scan each barcode label.

authorized assembler program (AAP)
A training program for selected IBM Business Partners that enables them to purchase incomplete machines and parts,
and provides them with the knowledge to assemble the components into a final configured product for sale to customers.

automatic cleaning
A method by which the library automatically responds to any tape drive's request for cleaning by beginning the cleaning process. An operator enables automatic cleaning by using the menus on the library's touchscreen or the web interface.

automatic inventory
A survey of the location of cartridges in the library. The inventory is performed when the library is powered on, or whenever the front door of any frame is opened and closed during operation.

B

backhitch
When the speed of the host server is slower than that of the drive, the action of stopping the tape, rewinding some distance, and restarting.

backup
The short-term retention of records used for restoring essential business and system files when vital data has been lost because of program or system errors or malfunctions.

Backup recovery and media services (BRMS)
A software program that runs on OS/400 and allows a business to plan, control, and automate the backup, recovery, and media management services for its AS/400 systems.

bar code
A code that represents characters by sets of parallel bars of varying thickness and separation. The bars are read optically by transverse scanning.

bar code label
A slip of paper bearing a bar code and having an adhesive backing. The bar code label must be affixed to a tape cartridge to enable the library to identify the cartridge and its volume serial number.

bar code reader
Located on the dual-gripper transport mechanism of the library, a laser device specialized for scanning and reading bar codes and converting them into either the

ASCII or EBCDIC digital character code. The bar code reader reads the bar code on the labels of cartridges or at the rear of empty storage slots.

base frame
The primary unit of the TS3500 tape library. The base frame is distinguished from an expansion frame by its I/O stations and operator panel. The base frame includes a rail assembly for the cartridge accessor and up to 12 tape drives.

beacon light-emitting diode (LED)
An LED that is visible through the side panel of each shuttle station that indicates station location and is typically used in service operations.

bel Ten decibels.

bit Either of the digits 0 or 1 when used in the binary numbering system.

bpi Bits per inch.

bridge A storage controller that forms a bridge between two external I/O buses.

British thermal unit (Btu)
The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at a specified temperature.

browser
A client program that initiates requests to a web server and displays the information that the server returns.

BRSM See *Backup recovery and media services*.

Btu See *British thermal unit*.

bulk load
To manually insert large quantities of tape cartridges into a tape library's empty storage slots.

bus See *SCSI bus*.

byte A string consisting of a certain number of bits (usually 8) that are treated as a unit and represent a character. A byte is a fundamental data unit.

C

calibration
Adjustment, tuning.

calibration sensor
Located on the cartridge accessor of the TS3500 tape library, the component that provides the means to find certain positions within the library very precisely during the calibration operation.

Call Home
A feature that allows the TS3500 tape library to report failures to a support center.

CAN See *Controller Area Network*.

CAP See *cartridge assignment policy*.

capacity
See *media capacity*.

Capacity expansion feature
Applicable only to the base frame of the TS3500 tape library, the cartridge storage slots that are located on the interior of the front door and enabled for additional storage. The Capacity Expansion Feature increases the maximum quantity of storage slots in the base frame.

Capacity on Demand
A feature that adds capacity to the library and that is only available through the field. See also *High Density Capacity on Demand*.

cartridge
See *tape cartridge*.

cartridge accessor
The mechanism in the TS3500 tape library that moves cartridges between the storage slots, tape drives, and the I/O stations. The accessor includes the X-axis motion assembly, Y-axis motion assembly, pivot assembly, cartridge gripper, bar code reader, and calibration sensor.

cartridge assignment policy (CAP)
With the TS3500 tape library, a method that is used to automatically assign cartridges to a logical library by using beginning and ending volume serial number ranges that are set by the user. See also *VOLSER ranges*.

cartridge cache
Non-HD slots (Tier 0) selected as preferred locations for frequently used cartridges. The library firmware tracks the most recent usage of each cartridge as a

means to arbitrate which cartridges should be maintained in the cartridge cache.

cartridge gripper
An electromechanical device on the cartridge accessor of the TS3500 tape library that gets or puts cartridges from or to a storage slot, tape drive, or I/O station. Two grippers (Gripper 1 and Gripper 2) are located on the pivot assembly of the accessor. One gripper can grip a single cartridge.

cartridge inventory time
The amount of time required for the TS3500 tape library to determine whether each cartridge storage slot in the library is empty or full.

cartridge manual rewind tool
A device that can be fitted into the reel of a cartridge and used to rewind tape into or out of the cartridge.

cartridge memory
See *LTO cartridge memory*.

cartridge move time
The time required for a cartridge accessor to pick a cartridge from a slot (or drive), move the cartridge to a drive (or slot), pivot (if required), and insert the cartridge into the drive (or slot).

cartridge storage slot
One of several containers that are mounted inside the frames of the TS3500 tape library and are used to store tape cartridges. See also *HD slot*.

caster One of four wheels that are mounted in swivel frames and used to support the weight of the library.

CETool
Used with the TS3500 tape library, CETool is a software program that is used by IBM Service personnel (also known as customer engineers or CEs) to update library and drive firmware, configure Call Home, collect library and drive logs, back up and restore the configuration for non-volatile random access memory (NVRAM), and perform other service-related tasks.

cell top cap
Located on each column of storage slots within the TS3500 tape library, a plastic

component to which a bar code label holder can be attached. The library uses the bar code label to establish the boundary of a logical library.

circuit board
A thin plate on which chips and other electronic components are placed. Computers consist of one or more boards, often called cards or adapters.

cleaning cartridge
A tape cartridge that is used to clean the heads of a tape drive. Contrast with *data cartridge*.

clearance
The distance by which one object clears another or the clear space between them.

compression
The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

configure
To describe to a system the devices, optional features, and programs installed on the system.

controller
A device that coordinates and controls the operation of one or more input/output devices (such as sensors and actuators), and synchronizes the operation of such devices with the operation of the system as a whole.

control path
(1) Designated by the operator of the TS3500 tape library, a logical path into the library through which a server sends standard SCSI Medium Changer commands to control a specific logical library.

(2) A tape drive that is designated by the operator of the TS3500 tape library to manage communication to and from a server and the library.

control path failover
In the event of a command failure, an optional feature of the TS3500 tape library that enables the host device driver to resend the command to an alternate control path for the same logical library. The device driver initiates error recovery and continues the operation on the

alternate control path without interrupting the application.

current
The quantity of charge per unit of time. Measured in amperes (amps, A).

D

daisy-chain
To serially interconnect a series of SCSI connectors for multiple devices on the SCSI bus.

data Any representations such as characters or analog quantities to which meaning is, or might be, assigned.

data cartridge
A tape cartridge dedicated to storing data. Contrast with *cleaning cartridge*.

data compression
See *compression*.

Data Facility Storage Management Subsystem (DFSMS)
An operating environment that helps automate and centralize the management of storage. To manage storage, DFSMS provides the storage administrator with control over data class, storage class, management class, storage group, and automatic class selection routine definitions.

data transfer element (DTE)
In SCSI terms, a tape drive.

data transfer element (DTE) address
In SCSI terms, the physical location of a tape drive.

data transfer rate
The average number of bits, characters, or blocks per unit of time that pass between corresponding equipment in a data transmission system. The rate is expressed in bits, characters, or blocks per second, minute, or hour.

dB Decibel.

dc Direct current.

decibel
A unit of measure that expresses the ratio of two amounts of electric or acoustic signal power that is equal to 10 times the common logarithm of this ratio.

decrypt
To decipher data.

In Cryptographic Support, to convert ciphertext into plaintext. See also *encrypt*.

degauss
To make a magnetic tape nonmagnetic by means of electrical coils carrying currents that neutralize the magnetism of the tape.

degausser
A device that makes magnetic tape nonmagnetic.

destage
The movement of a cartridge from the cartridge cache to an HD slot. A destage occurs automatically when the cartridge cache is full.

device Any hardware component or peripheral device, such as a tape drive or tape library, that can receive and send data.

device driver
A file that contains the code needed to use an attached device.

DFSMS
See *Data Facility Storage Management Subsystem*.

diagnostic cartridge
A tape cartridge that enables the detection and isolation of errors in programs and faults in equipment.

differential
See *high voltage differential*.

Direct flight
An automation technology that passes tape cartridges over intermediary libraries in a TS3500 tape library shuttle complex.

disable
To make nonfunctional.

door safety switch
Located on each frame of the TS3500 tape library, a mechanism that automatically turns off the power to the cartridge accessor whenever you open the front door.

drive See *tape drive*.

drive head
The component that records an electrical signal onto magnetic tape, or reads a signal from tape into an electrical signal.

DTE See *data transfer element*.

dual-gripper transport mechanism
Located on the cartridge accessor of the TS3500 tape library and mounted on the pivot assembly, the device that contains the two grippers that get and put cartridges into storage slots, drives, or the I/O stations.

E

eject To remove or force out from within.

electronic mail
Correspondence in the form of messages transmitted between user terminals over a computer network.

element address
The SCSI term for the host's view of a cartridge location.

email See *electronic mail*.

enable
To make functional.

encrypt
In Cryptographic Support, to systematically scramble information so that it cannot be read without knowing the coding key. See also *decrypt*.

encryption
The conversion of data into a cipher. A key is required to encrypt and decrypt the data. Encryption provides protection from persons or software that attempt to access the data without the key.

encryption key manager
A software program that assists IBM-encrypting tape drives in generating, protecting, storing, and maintaining encryption keys, which encrypt information written to and decrypt information read from tape media.

enhanced frame control assembly
The power structure for models L23, D23, L53, and D53. The assembly combines drive power, library power, and dual ac power cord capabilities into a 2N power design with no single point of failure or single point of repair.

enhanced node cards
Node cards with increased synchronous dynamic and nonvolatile random-access memory (RAM).

error-recovery procedures (ERP)
Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used with programs that record the statistics of machine malfunctions.

Ethernet
A 10-Mbps base band local area network that allows multiple stations to access the transmission medium at will without prior coordination, avoids contention by using carrier sense and deference, and resolves contention by using collision detection and delayed retransmission.

Expanded I/O Station
On the front door of the TS3500 tape library, the lower compartment into which you insert and remove cartridges into and from the library. Both stations are accessed by the cartridge accessor.

expansion frame
A unit that can be added to the base frame of the TS3500 tape library. The expansion frame includes a rail assembly for the cartridge accessor and up to 12 tape drives or HD storage slots.

F

FCA See *frame control assembly*.

FCB Frame control box. See *frame control assembly*.

Fibre Channel
A high-speed, full-duplex, serial communications technology that is capable of interconnecting LTO tape drives and 3592 tape drives to servers which are separated by as much as 11 kilometers (7 miles). Fibre Channel technology combines features of the input/output (I/O) and networking interfaces.

Fibre Channel address
For a tape drive that uses a Fibre Channel interface, an identifier (such as an AL_PA or Loop ID) that enables other device ports to communicate with that drive.

Fibre Channel cable
The cable that connects a Fibre Channel tape drive to another device. The conductive element within the cable is constructed of either copper wires or optical fibers. Generally, copper wires are

used for short distances (up to 30 meters
or 98 feet); optical fibers are used for
longer distances. Fiber-optic cabling is
referred to by mode or the frequencies of
light waves that are carried by a
particular cable type. Multi-mode fiber
cables are generally used for distances up
to 500 meters (1640 feet) and with
short-wave (780 nanometer) laser light.
Single-mode fiber cables are used for
distances greater than 500 m (1640 feet)
and with long-wave (1300 nanometer)
laser light.

fiber optics
A branch of optics dealing with the
transmission of light through fibers or
thin rods of glass or some other
transparent material of high refractive
index.

FICON/ESCON-enabled products
Any of the IBM tape products equipped
with Fibre Channel (FICON) or Enterprise
System Connection (ESCON) interfaces to
allow attachment to the System z server
(mainframe host).

field replaceable unit (FRU)
Any piece of hardware that is complete,
contained, and manufactured or
assembled as a whole unit and can be
replaced in the field by a customer
engineer (CE).

file A named set of records stored or
processed as a unit.

file transfer protocol (FTP)
In the Internet suite of protocols, an
application layer protocol that uses TCP
and Telnet services to transfer bulk-data
files between machines or hosts.

firmware
Proprietary code that is usually delivered
as part of an operating system. Firmware
is more efficient than software loaded
from an alterable medium and is more
adaptable to change than pure hardware
circuitry. An example of firmware is the
Basic Input/Output System (BIOS) in
read-only memory (ROM) on a PC
motherboard.

floating home cell
The concept of actively managing
cartridge placement by picking an optimal
new home for cartridges being

demounted. HD libraries use a floating
home cell approach for the entire library.

frame In Fibre Channel technology, a unit of
transmission that includes delimiters,
control characters, information, and
checking characters.

See *library frame*.

frame control assembly (FCA)
The assembly is a group of parts that
consists of a frame control box (FCB), one
or two 37 V power supplies for the
cartridge accessor, operator panel, and
I/O stations, and an MCC card pack that
runs the firmware that controls the ac and
dc power distribution in the . The
assembly also provides an RS-422
communication port to each tape drive in
a frame. The FCB contains 3 circuit
protectors, 10 ac outlets for powering the
tape drives and all other components in
that frame, and a receptacle for the
incoming main ac power.

front door
Located at the front of each frame in the
TS3500 tape library, the swinging barrier
by which entry is closed or opened to the
frame.

FRU See *field replaceable unit*.

FTP See *file transfer protocol*.

FTP site
Any electronic repository of information
that uses the File Transfer Protocol (FTP)
for transferring files to and from servers.
Use of an FTP site requires a user ID and
possibly a password.

full capacity expansion
A feature that increases the initial capacity
of the TS3500 tape library models. Model
L22, L23, L52, and L53 frames. Models
L22 and L23 increase from 58 to 199 or
260 cartridge slots for 3592 tape
cartridges. Models L52 and L53 increase
from 64 to 219 or 287 cartridge slots for
LTO tape cartridges.

full duplex
Simultaneous transmission and reception
of data between two nodes of a network.

G

GB See *gigabyte*.

Gb See *gigabit*.

Gbps Gigabits per second. One gigabit equals 1 000 000 000 bits.

get (1) In library operation, the act of a cartridge gripper retrieving a tape cartridge from a storage slot, drive, or I/O station.

(2) In Simple Network Management Protocol (SNMP), a request for information about the library that the operator issues through a monitoring server and which is transmitted by SNMP.

get-response
The information that is provided in response to an SNMP get.

GiB One gibibyte (GiB) = 1,073,741,824 bytes.

gigabit (Gb)
1 000 000 000 bits.

gigabyte (GB)
1 000 000 000 bytes.

H

HA See *high availability*.

HACMP
See *High Availability Clustered Multiprocessing*.

HBA See *host bus adapter*.

HD CoD
See *High Density Capacity on Demand*.

HD frame
See *High density frame*.

HD slot
See *High density slot*.

HD2 frame
See *High density frame*.

head See *drive head*.

heat output
The amount of heat (in kBtu/hr) that the TS3500 tape library dissipates during normal operation.

hertz (Hz)
A unit of frequency equal to cycle per second.

heterogeneous
Of unlike kind.

hex, hexadecimal
(1) Pertaining to a selection, choice, or condition that has 16 possible different values or states.

(2) Pertaining to a fixed-radix numeration system, with radix of 16.

(3) Pertaining to a system of numbers to the base 16; hexadecimal digits range from 0 through 9 and A through F, where A represents 10 and F represents 15.

high availability (HA)
A product that contains redundancy to continue work in case of a set of (but not all possible) failures. A library that is HA contains two separate cartridge accessors.

High Availability Clustered Multiprocessing (HACMP)
An IBM AIX solution that automatically detects system or network failures and eliminates a single point of failure by managing failover to a recovery processor. High availability clustering refers to the linking of two or more computers, one of which can provide operation if the other one fails.

High Density Capacity on Demand
Applicable only to expansion frame models Sx4 and Sx5, a feature that adds licensed capacity to the library.

High density frame
An expansion frame that contains HD slots. An HD2 frame is a second-generation HD frame that is capable of being installed in the leftmost position (frame 1) of the library. Drive-capable HD2 frames support up to 16 HD2-compatible tape drives when positioned as frame number 2 or higher. Models L25, L55, D25, D55, S25, and S55 are all HD2 frames. Non-HD2 frames cannot be upgraded to HD2 frames.

High density slot
A four-deep or five-deep container for cartridges in an HD frame.

High Voltage Differential (HVD)
A logic signaling system that enables data communication between a supported server and the TS3500 tape library. HVD signaling uses a paired plus and minus signal level to reduce the effects of noise on the SCSI bus. Any noise injected into the signal is present in both a plus and

minus state, and is thereby canceled. Synonymous with *differential*.

homogeneous
Of the same kind.

host The controlling or highest-level system in a data communication configuration. Synonymous with *server*.

host bus adapter (HBA)
An adapter that provides I/O processing and physical connectivity between a server and storage.

host cleaning
A method that enables the host (server) to detect the need to clean a tape drive and to control the cleaning process. Host cleaning with a cleaning cartridge is only supported when automatic cleaning is disabled, and only for the logical library in which each cleaning cartridge is stored.

HTTP See *Hyper Text Transfer Protocol*.

hub A communications device to which nodes on a multi-point bus or loop are physically connected. Hubs are commonly used in Fibre Channel networks to improve the manageability of physical cables. They maintain the logical loop topology of the network of which they are a part, while creating a "hub and spoke" physical star layout. Unlike switches, hubs do not aggregate bandwidth. They typically support the addition or removal of nodes from the bus while it is operating.

HVD See *High voltage differential*.

Hyper Text Transfer Protocol (HTTP)
The primary Internet protocol that is used to connect to most web servers. HTTP delivers content for web pages or downloads files.

Hz Hertz.

I

IBM IBM 3592 tape controller Model J70
Located in the 3953 tape frame Model F05, a device that links the IBM eServer zSeries server (mainframe host), the L05 library manager, and the tape drives in the TS3500 tape library.

IBM Tape Library Specialist web interface
A platform-independent, web-based interface that allows a user to configure and monitor the TS3500 tape library from a remote location.

IBM TS3500 tape library
Also known as the 3584 tape library, a device that can be attached to one or more supported servers and used to write data to and from magnetic tape. The library can include up to 16 frames and 192 drives, and any combination of LTO tape drives in LTO frames, and 3592 tape drives in 3592 frames.

IBM TS4500 tape library
Also known as the 3584 tape library, a device that can be attached to one or more supported servers and used to write data to and from magnetic tape. The library can include up to 4 frames and 64 drives.

IBM Tivoli Storage Productivity Center (TPC)
A software solution that manages storage infrastructures in Open Systems environments.

ID Identifier.

IEE See *import/export element*.

IEEA See *import/export element address*.

IEEE Institute of Electrical and Electronics Engineers.

IMC See *Integrated management console (IMC)*.

import/export element (IEE)
In SCSI terms, an I/O slot.

import/export element address (IEEA)
In SCSI terms, the location of an I/O slot.

inaccessible cartridge storage slot
In the TS3500 tape library, a cartridge storage slot that is designated for the diagnostic cartridge, which is used during service procedures. The Models L22, L23, L32, L52, and L53 base frames each contain one inaccessible cartridge storage slot for a diagnostic cartridge at physical address F01,C01,R01. Additionally, the first expansion frame of a different media type (3592 or LTO) in a mixed media library contains one inaccessible cartridge slot for a diagnostic cartridge at physical addresses Fxx,C01,R01 (where xx equals the first expansion frame for the second type of media).

independent software vendor (ISV)
>   A company that makes and sells software products that run on one or more computer hardware or operating system platforms.

initial program load (IPL)
>   (1) The initialization procedure that causes an operating system to commence operation.

>   (2) The process by which a configuration image is loaded into storage at the beginning of a work day or after a system malfunction.

>   (3) The process of loading system programs and preparing a system to run jobs.

initialize
>   To format a magnetic tape, write a label (VOLSER) on the tape, and leave the tape empty except for the system files containing the structure information. All former contents of the tape are lost.

initializing
>   The act of performing an inventory on the TS3500 tape library.

initiator
>   In SCSI terms, a SCSI device that requests an I/O process to be performed by another SCSI device (a target). In many cases, an initiator can also be a target.

input/output (I/O) station
>   On the front door of the TS3500 tape library, one or two compartments into which you insert and remove cartridges into and from the library. Both stations are accessed by the cartridge accessor.

inrush current
>   The momentary peak current (in amperes) into the TS3500 tape library when the ac line voltage is first applied.

insert Pertaining to the TS3500 tape library, a term used to describe the act of putting a tape cartridge into an I/O station or storage slot.

install (1) To set up for use or service.

>   (2) The act of adding a product, feature, or function to a system or device either by a singular change or by the addition of multiple components or devices.

Integrated management console (IMC)
>   With the TS4500 tape library, a built-in platform for tools that are used to manage the library.

interchange
>   The ability to process (read or write) given tape data on any one of a set of tape devices that support the form factor and recording format of the tape data.

interchange application
>   The preparation of tapes for use on other systems or devices, either local or remote, or the use of tape data prepared by another system.

intermediate capacity expansion
>   A feature that increases the initial capacity of Lxx frames. Models L22 and L23 increase from 58 to 117 cartridge slots for 3592 tape cartridges. Models L52 and L53 increase from 64 to 129 cartridge slots for LTO LTO tape cartridges. Models Lx5 increase from 100 to 200 slots.

Internet
>   The worldwide collection of interconnected networks that use the Internet suite of protocols and permit public access.

interposer
>   An adapter-like device that allows a connector of one size and style to connect to a mating connector of a different size and style.

inventory
>   (1) A survey of tape cartridges in the library and frames.

>   (2) To make an inventory of.

I/O station
>   See *input/output station*.

IPL Initial program load.

ISV See *independent software vendor*.

K

kBtu KiloBtu.

key label
>   An alias to a encryption key (cipher) used by the encryption key manager.

key manager
   In cryptography, a software application that manages one or more secret encryption keys.

key manager address
   In cryptography, the IP address of an encryption key manager.

keystore
   A database of private keys and their associated digital certificate chains used to authenticate the corresponding public keys.

KiB   One kibibyte (KiB) = 2^{10} bytes = 1,024 bytes.

KiloBtu
   1 000 Btu's.

KiloVolt
   1 000 volts.

kilowatt
   1 000 watts.

kVA   KiloVolt.

kW   Kilowatt.

L

label   See *bar code label* or *radio frequency identification label*.

label area
   On the LTO tape cartridge or 3592 tape cartridge, a recessed area next to the write-protect switch where a bar code label must be affixed.

LAN   See *local area network*.

LCD   See *liquid crystal display*.

LDAP   See *lightweight directory access protocol*.

leader pin
   On the LTO tape cartridge and 3592 tape cartridge, a small metal column attached to the end of the magnetic tape. During tape processing the leader pin is grasped by a threading mechanism, which pulls the pin and the tape out of the cartridge, across the drive head, and onto a take-up reel. The head can then read or write data from or to the tape.

leveling jackscrews
   Located on the bottom the TS3500 tape library, one of four screw-operated jacks for raising or lowering the library.

library frame
   The basic unit of the TS3500 tape library. The frame includes the hardware support structure, covers, mechanisms, and parts. Two types of frames are available: base frames (Models Lxx) and expansion frames (Models Dxx and Sxx).

library manager
   See *IBM 3953 library manager Model L05*.

library power switch
   Located on the front of the TS3500 tape library, a toggle switch that enables you to turn the power to the library on and off.

license key
   A key or password that is required to enable advanced function.

lightweight directory access protocol (LDAP)
   A set of protocols used to access information directories. LDAP, an open protocol, is based on the standards contained within the X.500 standard, but is significantly simpler. And unlike X.500, LDAP supports TCP/IP, which is necessary for any type of Internet access.

Linear Tape-Open (LTO)
   A type of tape storage technology developed by the IBM Corporation, Hewlett-Packard, and Certance. LTO technology is an "open format" technology, which means that its users have multiple sources of product and media. The "open" nature of LTO technology enables compatibility between different vendors' offerings by ensuring that vendors comply with verification standards. The LTO technology is implemented in two formats: the Accelis format focuses on fast access; the LTO format focuses on high capacity. The LTO format is the preferred format when capacity (rather than fast access) is the key storage consideration.

line frequency
   The frequency (in hertz) of the ac line voltage that the TS3500 tape library requires for normal operation.

link   In Fibre Channel technology, the physical (optical) connection between two nodes of a network, which includes the combination of the link connection (the

transmission medium) and two link stations, one at each end of the link connection.

liquid crystal display (LCD)
A low-power display technology used in computers and other I/O devices.

load Pertaining to the TS3500 tape library and following the insertion of a tape cartridge into a cartridge storage slot, the act (performed by the cartridge accessor) of transferring the cartridge from the storage slot to the drive and of positioning the tape (performed by the tape drive) for reading or writing by the drive head.

load and unload cycle
The act of inserting a cartridge into a tape drive, loading the tape to load point, rewinding the tape into the cartridge, and ejecting the cartridge from the drive.

load point
The beginning of the recording area on magnetic tape.

load-to-ready time
After a cartridge has been inserted into a drive, the amount of time between when the drive threads the tape and when the drive becomes ready to accept server commands.

local area network (LAN)
(1) A computer network located on a user's premises within a limited geographical area. Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation.

(2) A network in which a set of devices is connected to other sets of devices for communication and that can be connected to a larger network.

local authentication
The process of validating a user identity to the system according to the local operating system account to which the user logged in. If the user is authenticated, the user is mapped to a principal.

logical library
With the TS3500 tape library, a set of cartridge storage slots and tape drives that are defined as a library by an operator. The ability to create logical libraries makes it possible for similar and dissimilar hosts (servers) to share its robotics. As a result, hosts can simultaneously run separate applications in separate logical libraries.

logical library bar code label
A specially coded label that can be affixed to the tops of storage slot columns and drives inside the TS3500 tape library. The tape library reads the labels and uses them to establish the boundaries of one or more logical libraries.

logical library configuration
A way of using the TS3500 tape library so that its robotics are shared by homogenous (similar) and heterogeneous (dissimilar) servers. The TS3500 tape library can be partitioned into individual logical libraries that independently communicate with individual servers via individual control paths.

logical unit number (LUN)
A number associated with the target address of a drive. The server uses the number to identify the address of the drive.

loop ID
In Fibre Channel technology, the identifier that the TS3500 tape library assigned to an LTO or 3592 tape drive. The ID is based on the drive's physical location within the library and is used by other devices in the topology to communicate.

Low Voltage Differential (LVD)
A low-noise, low-power, and low-amplitude electrical signaling system that enables data communication between a supported server and the TS3500 tape library. LVD signaling uses two wires to drive one signal over copper wire. The use of wire pairs reduces electrical noise and crosstalk.

LTO See *Linear Tape-Open*.

LTO cartridge memory (LTO-CM)
Within each LTO data cartridge, an embedded electronics and interface module that can store and retrieve a cartridge's historical usage and other information.

LTO-CM
See *LTO cartridge memory*.

LUN See *logical unit number*.

LVD See *Low Voltage Differential*.

M

m Meter.

magnetic tape
A tape with a magnetizable surface layer on which data can be stored by magnetic recording.

Management Information Base (MIB)
Units of managed information that specifically describe an aspect of a system, such as the system name, hardware number, communications configuration or library configuration. A collection of related MIB objects is defined as an MIB. The TS3500 tape library can use the MIB to interpret problem alerts that are transmitted by SNMP traps.

management GUI
See *TS4500 management GUI*.

manual cleaning
A method by which an operator selects a menu option from the touchscreen of the TS3500 tape library or IBM Tape Library Specialist Web interface to perform cleaning on one or more of its tape drives.

master console
See *system console*.

MB See *megabyte*.

Mbps Megabits per second.

MCA See *Medium Changer assembly*.

MCC See *Medium Changer card pack*.

MCP See *Medium Changer card pack*.

mebibyte (MiB)
1•048•576 bytes.

media The plural of *medium*.

media capacity
The amount of data that can be contained on storage media and expressed in bytes of data.

media-type identifier
Pertaining to the bar code on the bar code label of the IBM LTO tape cartridge, a 2-character code (Lx), that represents

information about the cartridge. L identifies the cartridge as one that can be read by devices that incorporate LTO technology; x indicates the generation of cartridge; T, U, V, and W represent different generations of WORM cartridges.

medium
A physical material in or on which data may be represented, such as magnetic tape.

Medium Changer assembly (MCA)
In the enhanced frame control assembly power structure, the device that facilitates communication between host applications and the library. The MCA is located above the drives and the fixed power trays in model L23, D23, L53, and D53 frames. It houses two Ethernet ports for connection to the Tape Library Specialist Web interface or a system console.

Medium Changer card pack (MCC or MCP)
In the TS3500 tape library, a circuit board that provides a communication path to each tape drive (via the RS-422 interface) so that library commands can be funneled from the tape drives to the accessor. It includes one RS-422 interface allotted for each drive in the frame. It also provides management and service interfaces to outside servers. For each library frame that contains at least one drive, there is one MCP. The electronics of the card pack are located in the FCB.

Medium Changer Device
In SCSI terms, an instrument that moves removable storage units from and to storage slots and tape drives. The TS3500 tape library is a Medium Changer Device.

megabyte (MB)
1 000 000 bytes.

metal-particle tape
In the LTO and 3592 tape cartridges, tape that uses very small, pure metal particles (rather than oxide coatings) in the magnetic layer.

meter In the metric system, the basic unit of length; equal to approximately 39.37 inches.

MiB One mebibyte (MiB) = 1,048,576 bytes.

MIB See *Management Information Base*.

middleware
A vague term that refers to the software between an application program and the lower-level platform functions.

micron
One millionth of a meter (.000001 m).

Microsoft Systems Management Server (SMS) and Clustered Server Environments
A solution from Microsoft that automatically detects system or network failures in Windows operating systems and eliminates a single point of failure by managing failover to a recovery processor.

mid-range systems
A set of multi-user servers with a hard disk capacity of between 50 GB and 250 GB.

mixed drive types
The concept of using both LTO and 3592 tape cartridges in the TS3500 tape library. A library can consist of frames that house all LTO tape cartridges or all 3592 tape cartridges, but the two types of cartridges cannot be mixed in a single frame. However, both types of cartridges may be inserted or removed from the library through the base frame, provided that a lower I/O station is installed for the 3592 tape cartridges.

mixed media configuration
Different media and drive technologies, such as the LTO tape drive and the 3592 tape drive. LTO 1, LTO 2, and LTO 3 drives and media are not considered mixed media, but are considered different generations of the same type of media.

Model J1A
See *IBM 3592 tape drive Model J1A*.

mount The act of making a tape available for processing by a specific tape device. A mount consists of removing the cartridge from a drive, returning it to its storage slot, collecting another cartridge from a storage slot, moving it to the drive, and loading it into the drive.

mount/demount cycle
See *mount*.

mounted
The state of a tape while it is available for processing by a specific tape device.

mount throughput
The number of cartridges that a tape library can mount in a one-hour period.

N

N A measure of the electrical power load in a system. If there are N loads in the system, N power supplies are required to power all of the loads.

N/A Not applicable.

native data capacity
The amount of data that can be stored without compression on a tape cartridge.

NetView
(1) Pertaining to an IBM licensed program that is used to monitor a network, manage it, and diagnose its problems. The NetView licensed program can be used to provide network management services for OSI Communications Subsystem. (2) A network management product that can provide automated operations and rapid notification of events.

network
A configuration of data processing devices and software connected for information interchange.

network server
In a local area network, a personal computer that provides access to files for all of the workstations in the network.

node In Fibre Channel technology, a communicating device.

node card
Within the TS3500 tape library, one of four circuit assemblies (accessor controller card, motor driver assembly, Medium Changer card pack, and operator panel assembly) that communicate with each other.

nominal
Approximate.

nominal power
The amount of power (in kilowatts) that the TS3500 tape library dissipates during normal operation.

non-addressable cartridge storage slot
See *inaccessible cartridge storage slot*.

nondisruptive firmware update
The ability to update drive or library

firmware without scheduling downtime. The TS3500 tape library provides the ability to perform a nondisruptive update for its library firmware, as well as firmware for all 3592 tape drives and LTO 2 and later LTO tape drives.

non-volatile memory
Types of memory that retain their contents when the power is turned off. ROM is nonvolatile, whereas RAM is volatile.

not ready
The condition that exists when the TS3500 tape library is not ready for operation with the host.

O

Oersted
The unit of magnetic field strength in the unrationalized centimeter-gram-second (cgs) electromagnetic system. The Oersted is the magnetic field strength in the interior of an elongated, uniformly wound solenoid that is excited with a linear current density in its winding of one abampere per 4π centimeters of axial length.

operating environment
The temperature, relative humidity rate, and wet bulb temperature of the room in which the TS3500 tape library routinely conducts processing.

operating system
The master computer control program that translates the user's commands and allows software application programs to interact with the computer's hardware.

operator panel
A functional unit that controls the TS3500 tape library. The unit's LCD touchscreen provides information about the operation of the library.

operator panel controller
Within the TS3500 tape library, a circuit board that facilitates communication between the accessor controller and the operator panel. The controller provides input to and output from the LCD, and senses and locks the I/O stations. In addition, the LCD activity and service menus are executed in the operator panel

controller with support from the accessor controller and the drives (via the Medium Changer card packs).

optimized dual gripper
An electromechanical device that is mounted on the pivot assembly and gets or puts cartridges from or to a storage slot, tape drive, or I/O station.

P

partition
A fixed-size division of storage.

patch panel
Located at the rear of the base or expansion frame in a TS3500 tape library, an optional unit that houses the fiber cable connections between the servers and the individual drives.

Pause key
On the touchscreen of the TS3500 tape library, a touch key that causes the cartridge accessor to park itself and provide clear access to the library's interior when you power off the library or open the front door. The pause key enables quick recovery when you power on the library or close the front door.

PB   Petabyte.

PDF   See *Portable Document Format*.

Petabyte
1•000•000•000•000•000 bytes.

ping   (1) A command that calls an IP address.

(2) The act of issuing a command that calls an IP address.

pivot assembly
On the cartridge accessor of the TS3500 tape library, a group of parts that provides a mounting platform for the gripper mechanism and the bar code reader. The pivot assembly is capable of 180° rotation about the vertical axis.

point load
On a floor, one or more locations where the weight of an object is concentrated.

point-to-point topology
In communications, the physical or logical arrangement of nodes in a network to facilitate data transmission between two locations without the use of any intermediate display station or computer.

port (1) A system or network access point for data entry or exit.

(2) A connector on a device to which cables for other devices such as display stations and printers are attached.

(3) The representation of a physical connection to the link hardware. A port is sometimes referred to as an adapter; however, there can be more than one port on an adapter.

Portable Document Format (PDF)
A standard specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact, can be distributed globally (via email, the Web, intranets, or CD-ROM), and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

power cord
A cable that connects a device to a source of electrical power.

power cord plug
On a power cord, the male fitting for making an electrical connection to a circuit by insertion into a receptacle.

power distribution unit (PDU)
A unit that provides ac distribution within a TS3500 tape library frame by supplying multiple internal ac outlets from a single external ac power cord.

power off, powered off
(1) To remove electrical power from a device.

(2) The state of a device when power has been removed from it.

power on, powered on
(1) To apply electrical power to a device.

(2) The state of a device when power has been applied to it.

power-on indicator
Located beside the library power switch on the operator panel, a green light that, when lit, indicates that dc power is available within the TS3500 tape library.

power receptacle
The mounted female electrical fitting that contains the live parts of the circuit.

power supply
The electrical component of a computer system that converts standard ac current to the lower voltage dc current used by the computer. The amount of current a power supply can provide is rated in amperes.

power switch
See *library power switch*.

prestage
The movement of a cartridge from an HD slot to a cartridge cache. See also *destage*.

protocol
The meanings of, and the sequencing rules for, requests and responses used for managing a network, transferring data, and synchronizing the states of network components.

put Pertaining to the TS3500 tape library, to place, by means of a robotic device, a tape cartridge into a storage slot, drive, or I/O station.

Q

quiesce
To put a device into a temporarily inactive or inhibited state, but not remove it from the system.

R

RABF See *recursive accumulating backhitchless flush*.

radio frequency identification labels
An adhesive bar code label with an embedded radio frequency identification tag that can be used to track tape cartridges.

rail system
Within the TS3500 tape library, the support structure over which the cartridge accessor moves.

read To acquire or interpret data from a storage device, from a data medium, or from another source.

ready The operating condition that the TS3500 tape library is in when the host applications can interact with it.

recursive accumulating backhitchless flush (RABF)
A non-volatile caching technique used by the 3592 tape drives.

rekey In cryptography, the process of encrypting a data key a second time by using the public key of another party to create an additional externally encrypted data key. The cartridge can then be shipped to a business partner that holds the corresponding private key which allows the data key to be unwrapped and the tape decrypted on a different encryption-capable 3592 tape drive.

relative humidity
The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

remote authentication
The process of validating the user ID and password that are supplied by a user for a remote system to which the user requires access. If the user is authenticated, the user is mapped to a principal.

remote support
See *Call Home*.

Remote Technical Assistance Information Network (RETAIN)
Used by IBM Service Representatives, an internal host-based software application that contains records of service problems with IBM hardware and software, as well as tips on how to deal with the problems.

remove
Pertaining to the TS3500 tape library, a term used to describe the act of taking a tape cartridge out of an I/O station.

repeater
A device that regenerates signals to extend the range of transmission between data stations or to interconnect two branches. A repeater is a node of a local area network.

RETAIN
See *Remote Technical Assistance Information Network*.

RFID See *radio frequency identification labels*.

robotics
The cartridge accessor and any associated

mechanisms that move a tape cartridge within the TS3500 tape library.

RS-422 interface
An electrical interface standard approved by the Electronic Industries Association (EIA) for connecting serial devices. The RS-422 standard, which supports higher data rates and greater immunity to electrical interference, is an alternative to the older RS-232 interface and uses individual differential signal pairs for data transmission. Depending on data transmission rates, RS-422 can be used at distances to 1,275 m (4,000 ft). The RS-422 interface also supports multi-point connections.

S

SAN See *Storage Area Network*.

SARS See *Statistical Analysis and Reporting System*.

SC1 Model SC1. See *Shuttle connection*.

scratch cartridge
A labeled cartridge that is blank or contains no valid data, that is not currently defined, and that is available for use.

scratch encryption policy
A means of identifying to an ecryption-enabled tape drive which scratch cartridges will be encrypted on the next attempt to write from the beginning of the tape. A scratch encryption policy specifies what scratch cartridges to encrypt; it does not indicate which cartridges are currently encrypted. When used with library-managed encryption, a policy optionally lets you control cartridge encryption by VOLSER ranges in all logical libraries.

SCSI See *Small Computer Systems Interface*.

SCSI-2
A variation of the SCSI interface. See *Small Computer Systems Interface*.

SCSI bus
(1) A collection of wires through which data is transmitted from one part of a computer to another.

(2) A generic term that refers to the complete set of signals that define the activity of the Small Computer Systems Interface (SCSI).

SCSI address
See *SCSI ID*.

SCSI connector
One of the set of all female and male connectors on the SCSI bus.

SCSI device
Anything that can connect into the SCSI bus and actively participate in bus activity.

SCSI element address
A value that defines a logical location in the TS3500 tape library to the SCSI interface. This logical address is represented on the operator panel or IBM Tape Library Specialist Web interface as xxxx(yyyh), where xxxx is a decimal value and yyyh is a hexadecimal value. It is assigned by the library and used by the server when the server processes SCSI commands. The SCSI element address is not unique to a storage slot, drive, or I/O slot; it varies, depending on the quantity of drives in the library, whether the Capacity Expansion feature is installed, and whether an Expanded I/O Station is included.

SCSI ID
The hexadecimal representation of the unique address (0-F) that is assigned to a SCSI device. This identifier would normally be assigned and set in the SCSI device during system installation.

search time
The average time it takes for a tape drive to locate the starting point of a block of data.

secure sockets layer (SSL)
Protocol for transmitting private documents via the Internet. SSL uses a cryptographic system that uses two keys to encrypt data - a public key known to everyone and a private or secret key known only to the recipient of the message. Many web sites use the protocol to obtain confidential user information, such as credit card numbers. By convention, URLs that require an SSL connection start with https: instead of http:.

sequential access
The processing of information on a tape cartridge in a manner that requires the device to access consecutive storage locations (logical blocks) on the medium.

Sequential Access Device
In SCSI terms, a tape drive.

serial number
See *volume serial number*.

server A functional unit that provides services to one or more clients over a network. Examples include a file server, a print server, and a mail server. The IBM System p, IBM System i, HP, and Sun are servers. Synonymous with *host*.

service clearance
Surrounding the TS3500 tape library, the space required for an IBM Service Representative to perform maintenance on the unit.

service location protocol
(SLP) Protocol that provides a framework to allow networking applications to discover the existence, location, and configuration of networked services in enterprise networks. With SLP, the user only needs to know the description of the service he is interested in. SLP is then able to return the URL of the service that the user wants.

service ratings
The values for criteria associated with an electrical power cord. The criteria include maximum voltage, current, phases, and wires.

ship group
The group of supplies, cords, or documentation that is shipped with the TS3500 tape library.

shipping environment
The temperature, relative humidity rate, and wet bulb temperature of the environment to which the TS3500 tape library is exposed when being transferred from one location to another.

short-wave cable
In Fibre Channel technology, a laser cable

that uses a wavelength of 780 nanometers and is only compatible with multi-mode fiber.

shuffle
In HD frames, the process of moving cartridges in lower tiers into the gripper or other available slots in order to access cartridges in higher tiers.

shuttle car
The mechanism that carries one tape cartridge through the shuttle connection to another library string. Each shuttle car carries one tape cartridge at a time.

shuttle complex
Two or more parallel high density (HD) library strings that are interconnected by one or more shuttle connections.

shuttle connection
Also referred to as Model SC1, the shuttle connection is comprised of one shuttle car, two or more shuttle stations, and one or more spans between these shuttle stations. Each shuttle connection supports one shuttle car.

shuttle span
One or more shuttle spans are linked together in order to form a shuttle connection between HD frames in parallel library strings. Shorter shuttle spans support distances between library strings ranging from 762 mm (30 in) to 1 524 mm (60 in). Longer shuttle spans support distances between library strings ranging from 1 524 mm (60 in) to 2 743.2 mm (108 in).

shuttle station
The shuttle station mounts on top of an HD frame. It consists of a base pad and a shuttle slot. The shuttle slot docks into the base pad. When the shuttle slot is all the way down into the frame station it can accept or deliver a cartridge. Each shuttle station has its own import/export element (IEE) address.

Simple Network Management Protocol (SNMP)
In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices that are managed is defined and stored in the application's Management Information Base (MIB).

single-phase power
Pertaining to the TS3500 tape library, electricity that is transmitted via three wires (line, neutral, and ground), with a line-to-neutral voltage of 200-240 V ac

SLP See *Service Location Protocol*.

Small Computer Systems Interface (SCSI)
A standard used by computer manufacturers for attaching peripheral devices (such as tape drives, hard disks, CD-ROM players, printers, and scanners) to computers (servers). Pronounced "scuzzy." Variations of the SCSI interface provide for faster data transmission rates than standard serial and parallel ports (up to 160 megabytes per second). The variations include:

- Fast/Wide SCSI: Uses a 16-bit bus, and supports data rates of up to 20 MBps.
- SCSI-1: Uses an 8-bit bus, and supports data rates of 4 MBps.
- SCSI-2: Same as SCSI-1, but uses a 50-pin connector instead of a 25-pin connector, and supports multiple devices.
- Ultra SCSI: Uses an 8- or 16-bit bus, and supports data rates of 20 or 40 MBps.
- Ultra2 SCSI: Uses an 8- or 16-bit bus and supports data rates of 40 or 80 MBps.
- Ultra3 SCSI: Uses a 16-bit bus and supports data rates of 80 or 160 MBps.
- Ultra160 SCSI: Uses a 16-bit bus and supports data rates of 80 or 160 MBps.

SMI-S See *Storage Management Initiative - Specification*.

SMI-S Agent for Tape
See *Storage Management Initiative - Specification (SMI-S) Agent for Tape*.

SNMP
See *Simple Network Management Protocol*.

soft addressing
A method of creating or changing Loop IDs for drives in the TS3500 tape library. With soft-addressing, the drives automatically arbitrate the AL_PAs with

other Fibre Channel devices on the loop. This method avoids conflicts over the address.

Specialist web interface
A platform-independent, web-based interface that allows a user to configure and monitor the TS3500 tape library from a remote location.

See also *TS4500 management GUI*.

speed matching
The ability of the LTO 2 and later LTO tape drives to adjust their native data rate as closely as possible to the net host data rate (after data compressibility has been factored out).

SSL See *Secure Sockets Layer*.

stand-alone
Pertaining to operation that is independent of any other device, program, or system.

Statistical Analysis and Reporting System (SARS)
Firmware that is built into the 3592 tape drives and the LTO tape drives and which is used by the drive during problem determination to identify which single-character display code, ASC/ASCQ, and/or TapeAlert to report.

StE See *storage element*.

Storage Area Network (SAN)
A high-speed subnetwork of shared storage devices. A SAN's architecture makes all storage devices available to all servers on a LAN or WAN. As more storage devices are added to a SAN, they too will be accessible from any server in the larger network. Because stored data does not reside directly on any of a network's servers, server power is used for business applications, and network capacity is released to the user.

storage element (StE)
In SCSI terms, a cartridge storage slot.

storage environment
The temperature, relative humidity rate, and wet bulb temperature of the environment in which the TS3500 tape library is non-operational and being stored for future use.

Storage Management Initiative - Specification (SMI-S)
A design specification of the Storage Management Initiative (SMI) that was launched by the Storage Networking Industry Association (SNIA). The SMI-S specifies a secure and reliable interface that allows storage management systems to identify, classify, monitor, and control physical and logical resources in a Storage Area Network (SAN).

Storage Management Initiative - Specification (SMI-S) Agent for Tape
Software that is used by management software to communicate with storage devices in a SAN environment. The SMI-S Agent for Tape communicates by using the Web-Based Enterprise Management (WBEM) protocol, which allows management software to communicate with the TS3500 tape library.

sustained data transfer rate
Between the server and the tape drive, the average transfer rate of data across the SCSI interface to and from the tape drive during a transition from one end of the tape to the other end.

switch A network infrastructure component to which multiple nodes attach. Unlike hubs, switches typically have the ability to switch node connections from one to another. A typical switch can facilitate several simultaneous bandwidth transmissions between different pairs of nodes.

system console
A service tool that monitors the tape library and other components for early detection of unusual conditions and for error information that the components send to IBM's Remote Technical Assistance Information Network (RETAIN).

T

TapeAlert
A patented technology from Hewlett-Packard that monitors the status of a tape device and media, and detects problems as they occur.

TapeAlert flags
Status and error messages that are generated by the TapeAlert utility and

display on the host console. The messages indicate the type of problem and tell how to resolve it.

tape cartridge
A removable storage device that consists of a housing containing a belt-driven magnetic tape wound on a supply reel and a takeup reel.

tape drive
A data-storage device that controls the movement of the magnetic tape in a compatible tape cartridge. The tape drive houses the mechanism (drive head) that reads and writes data to the tape.

tape frame
See *IBM 3953 tape frame Model F05*.

Tape System Service Application (TSSA)
A set of software tools residing on the integrated management console (IMC) that aid in both local service and remote support of the attached TS4500 tape library. These tools are identical to those provided by the IBM TS3000 system console (TSSC), an externally rack-mounted system console.

target A SCSI device that performs an operation requested by the initiator. A target can also be an initiator.

TB Terabyte.

TCP/IP
See *transmission control protocol/Internet protocol*.

terabyte
1 000 000 000 000 bytes.

terminate, termination
To prevent unwanted electrical signal reflections by applying a device (a terminator) that absorbs the energy from the transmission line.

terminator
(1) A part used to end a SCSI bus.

(2) A single-port, 75-Ω device that is used to absorb energy from a transmission line. Terminators prevent energy from reflecting back into a cable plant by absorbing the radio frequency signals. A terminator is usually shielded, which prevents unwanted signals from entering or valid signals from leaving the cable system.

tier The depth of a cartridge location in an HD slot.

Tivoli Storage Manager (TSM)
An IBM client/server product that provides storage management and data access services in a heterogeneous environment. TSM supports various communication methods, provides administrative facilities to manage the backup and storage of files, and provides facilities for scheduling backups.

Tivoli Storage Productivity Center (TPC)
See *IBM Tivoli Storage Productivity Center*

topology
In communications, the physical or logical arrangement of nodes in a network, especially the relationships among nodes and the links between them.

touch keys
On the touchscreen of the TS3500 tape library, an array of small, touch-sensitive keypads that lets you select and navigate through menus. To acknowledge that it has been pressed, a touch key initiates an audible beep (if enabled) whenever you press it. The audible beep is the default.

touchscreen
See *liquid crystal display*.

TPC See *IBM Tivoli Storage Productivity Center* ..

track A linear or angled pattern of data written on a tape surface.

transfer rate
See *data transfer rate*.

transmission control protocol/Internet protocol (TCP/IP)
(1) The Transmission Control Protocol and the Internet Protocol, which together provide reliable end-to-end connections between applications over interconnected networks of different types.

(2) The suite of transport and application protocols that run over the Internet Protocol.

TS4500 management GUI
A web-based interface that allows users to configure, administer, monitor, and manage the TS4500 tape library locally from the IMC or from a remote location. See also *TS4500 integrated management console (IMC)*.

TSM See *Tivoli Storage Manager*.

TSSA See *Tape System Service Application*.

two-node arbitrated loop
In Fibre Channel technology, the connection of two nodes that communicate directly (without the use of a switch) and use the same protocol.

two-node switched fabric loop
In Fibre Channel technology, the connection of two or more nodes that may not use the same protocol and communicate by using a switch.

two-phase power
Pertaining to the TS3500 tape library, electricity that is transmitted via three wires (line, line, and ground), with a line-to-line voltage of 200-240 V ac. Sometimes referred to as *single phase power*.

U

Ultra SCSI
See *Small Computer Systems Interface*.

Ultra160 SCSI
See *Small Computer Systems Interface*.

Ultra2 SCSI
See *Small Computer Systems Interface*.

Ultra3 SCSI
See *Small Computer Systems Interface*.

Ultra320 SCSI
See *Small Computer Systems Interface*.

uniform resource locator (URL)
The address of an item on the World Wide Web. It includes the protocol followed by the fully qualified domain name (sometimes called the host name) and the request. The web server typically maps the request portion of the URL to a path and file name. For example, if the URL is http:// www.networking.ibm.com/nsg/ nsgmain.htm, the protocol is http; the fully qualified domain name is www.networking.ibm.com; and the request is /nsg/nsgmain.htm.

unload
Pertaining to the TS3500 tape library, a term used to describe the act of the drive

unthreading the tape from the internal tape path and returning the leader block to the tape cartridge.

URL See *uniform resource locator*.

V

V Volt.

V ac Volts ac (alternating current).

vital product data (VPD)
Pertaining to the TS3500 tape library, information about a product such as a library, drive, or node card. The VPD may include a machine type, model number, serial number, part number, or level of firmware.

void In character recognition, the inadvertent absence of ink within a character outline.

VOLSER
Volume serial number.

VOLSER ranges
With the TS4500 tape library, a method that is used to automatically assign cartridges to a logical library by using beginning and ending volume serial number ranges that are set by the user. See also *Cartridge assignment policy*.

volt The SI (international) unit of potential difference and electromotive force, formally defined to be the difference of electric potential between two points of a conductor carrying a constant current of one ampere, when the power dissipated between these points is equal to one watt.

volume serial number (VOLSER)
A number that a computer assigns to a tape cartridge when it prepares (initializes) the cartridge for use.

VPD See *vital product data*.

W

W Watts.

watt A metric unit of measure of power; the power required to keep a current of one ampere flowing under a potential drop of one volt; about 1/736 of one horsepower.

Web See *World Wide Web*.

wet bulb temperature
The temperature at which pure water must be evaporated adiabatically at

constant pressure into a given sample of air in order to saturate the air under steady-state conditions. Read from a wet-bulb thermometer.

World Wide Node Name
In Fibre Channel technology, the fixed, 64-bit name assigned to a device by its manufacturer and used to identify participants in a topology. The World Wide Node Name will be unique if the manufacturer has registered a range of addresses with the IEEE.

World Wide Port Name
Within a parent node, a unique 64-bit name that is assigned to a node port. The World Wide Port Name aids the accessibility of the port.

World Wide Web
A network of servers that contain programs and files. Many of the files contain hypertext links to other documents available through the network.

WORM
See *write once read many*.

write To make a permanent or transient recording of data in a storage device or on a data medium.

write once read many (WORM)
A technology that allows data to be written only once to LTO 3 and later LTO tape cartridges and all 3592 tape cartridges. After being written, the data cannot be altered, but can be read any number of times.

write protected
A tape cartridge is write protected if some logical or physical mechanism causes the device that is processing the tape to prevent the program from writing on the tape.

write-protect switch
Located on LTO and 3592 tape cartridges, a switch that prevents accidental erasure of data. Pictures of a locked and unlocked padlock appear on the switch. When you slide the switch to the locked padlock, data cannot be written to the tape. When you slide the switch to the unlocked padlock, data can be written to the tape.

X

X-axis and Y-axis motion assemblies
Within the TS3500 tape library, a group of parts that provides the motive force to move the accessor side to side (on the X-axis) and up and down (on the Y-axis).

Y

Y-axis motion assembly
See *X-axis and Y-axis motion assemblies*.

Z

zoning
A method of subdividing a storage area network into disjoint zones, or subsets of nodes on the network. Storage area network nodes outside a zone are invisible to nodes within the zone. Moreover, with switched SANs, traffic within each zone may be physically isolated from traffic outside the zone.

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T

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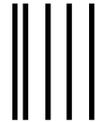Name _____   Address _____

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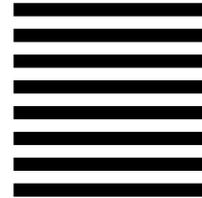
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