

TS4500 tape library

IBM

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IBM TS4500 documentation

Welcome to the IBM TS4500 online customer documentation, where you can find introductory, planning, and troubleshooting information about the TS4500 tape library.

Getting started

[Introduction](#)

[Structure of the library](#)

[Advanced Library Management System](#)

[Planning](#)

[Feature codes for the TS4500 tape library](#)

Common tasks

[What's New](#)

[Powering on the TS4500 tape library](#)

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[Connecting to the TS4500 management GUI](#)

[Using LTO tape drive media](#)

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Troubleshooting and support

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What's new

Information that is new or changed for the latest release of the IBM® TS4500 tape library.

Note: The IBM TS4500 online documentation is specific to the TS4500 tape library with the Advanced Library Management System (ALMS).

TS4500 Tape Library online documentation

The following table lists the enhancements to the TS4500 online documentation v1.8.0.3 and provides links to the related topics.

New hardware/functions	Description
REST API support for the destination Location parameter in the moveToSlot and moveToIOStation commands	See Move cartridge to I/O station .
REST API support for using sn (serial number) ID for all of the REST commands for drives	See Drives Start service on drive Complete service on drive Test drive .
REST API support to show the when an accessor state changed to NMA (No Movement Allowed) in addition to the preceding event.	See Get accessor information .
REST API support for to access event fix procedures.	See Get Event Fix Procedure .

Overview

The overview of the features and functions of the TS4500 tape library is useful for high-level evaluation of the product and planning for the implementation of the product.

- [Introduction to the IBM TS4500 tape library](#)
The TS4500 tape library is a next-generation cloud storage solution that delivers high storage density and integrated management.
- [TS4500 tape library structure](#)
- [Library performance](#)
The library performance values show the relative performance of the systems and are not meant to be absolute indicators of performance in your specific environment. Performance values, such as cartridge inventory times, mount performance, and cartridge move time, are obtained for the TS4500 tape library using specific measurements.
- [Tape drives](#)
The TS4500 tape library supports LTO and 3592 tape drives.
- [Tape cartridges](#)
Libraries that are installed with LTO tape drives use LTO tape cartridges. Libraries that are installed with 3592 tape drives use 3592 tape cartridges.
- [Elastic capacity](#)
In a dual-accessor configuration, the TS4500 tape library contains limited access columns that you can use for special situations. You can use these columns to store least recently used data cartridges, or as a temporary overflow area. The use of the limited access columns (Elastic Capacity) allows dual-accessor customers to achieve the same storage capacity as if the library was single accessor.
- [TS7700 backend switch support](#)
A TS4500 tape library can be connected to a TS7700 system using two 16 Gb fibre channel switches. The switches can be installed in the bottom of the TS4500 frame, or in a TR1 rack mounted above the TS4500.
- [Supported device drivers](#)
IBM® provides device driver support for the LTO and 3592 tape drives, and the robotics in the TS4500 tape library.
- [Compatible servers and software](#)
The TS4500 tape library is supported by a wide variety of servers, operating systems, and adapters. There are several ways to determine the servers and software that support the TS4500 tape library.
- [Attachment interfaces](#)
The TS4500 tape library uses the Fibre Channel interface for data transmission with attached tape drives and the Gigabit Ethernet interface for library communications.
- [Library sharing](#)
The tape library can be configured into one or more logical libraries that can be shared by multiple applications.
- [Advanced Library Management System](#)
The Advanced Library Management System (ALMS) allows the locations of cartridges in the tape library to be virtualized.
- [Power structure of the TS4500 tape library](#)
This section introduces the power structure that is provided by the TS4500 tape library.
- [Control path failover, data path failover, and load balancing](#)
The path failover feature of the TS4500 tape library ensures the use of a redundant communication path when the primary path fails.
- [Library Control Card failover](#)
The TS4500 tape library allows for automatic Library Control Card (LCC) failover.
- [VOLSER ranges](#)
Volume serial (VOLSER) ranges are used to assign cartridges to specific logical libraries in the tape library.
- [Increasing capacity](#)
Install capacity on demand (CoD) features to increase the cartridge capacity of frames in the TS4500 tape library.
- [Command-line interface](#)
Use the command-line interface (CLI) program to access tape library functions outside of the GUI interface.
- [Remote support](#)
Remote support for the TS4500 tape library involves the use of a Call Home feature to detect and solve problems. Also, remote support requires several important security functions.
- [Library monitoring and querying](#)
The TS4500 tape library provides several way to monitor library status and query the library for operating details.
- [Secure Socket Layer \(SSL\) functions](#)
The TS4500 tape library supports secure socket layer (SSL), which is a protocol for transmitting private documents across the Internet.
- [Remote authentication](#)
The TS4500 tape library supports remote authentication of user credentials using LDAP (with optional RACF authentication) or Kerberos.
- [IPv6 functionality](#)
The TS4500 tape library supports internet protocol (IP) addresses in IPv4 and IPv6 formats.

Introduction to the IBM TS4500 tape library

The TS4500 tape library is a next-generation cloud storage solution that delivers high storage density and integrated management.

Highlights

- Store up to 351PB (1,053PB compressed) per library with IBM 3592 cartridges
- Proactively monitor archived data with policy-based media verification
- Strengthen security and compliance with encryption and WORM media
- Simplify user access to data stored on tape via IBM Spectrum Archive
- Provide a flexible upgrade path to expand tape storage as needs grow
- Reduce the storage footprint and simplify cabling with 10U of rack space

IBM TS4500 tape library

Big data offers vast opportunities for business insight, but you need the right technology to help you manage and use that data. IBM cloud solutions can help you harness the power of big data while reducing costs and enabling a secure environment.

The next-generation IBM TS4500 tape library is designed to help midsized and large enterprises meet cloud storage challenges, including data volume growth, rising storage footprint costs, data migration efforts and the increased complexity of IT training and management as staff resources shrink.

TS4500 answers those business needs by incorporating the latest generation of industry-leading LTO technology that will help organizations handle the growing data demands of modern tape use cases like big data, cloud, media and entertainment, ultra high-definition editing, digital video surveillance, Internet of Things (IoT), active file archiving and, of course, backup.

TS4500 delivers the density that today's data growth requires—along with the efficiency and manageability to grow with business needs while preserving your existing investments in IBM tape library products. You can achieve both a low per-terabyte cost and high density, with up to 8.76 PB of data in a single 10 square-foot library using LTO Ultrium 8 cartridges or 12.37 PB with 3592 cartridges.

TS4500 provides advanced capabilities for integrated tape drive and media management, delivered within a single-pane-of-glass management console. The TS4500 graphical user interface (GUI) is based on the unified interface used in other IBM storage solutions. It includes key features to help guide storage administrators in completing critical tasks. For example, you can monitor a tape library via persistent, at-a-glance library utilization and health status indicators.

IBM TS4500 features such as automatic control-path and data-path failover, tape-drive encryption, dual robotic accessors and WORM media support improved management and help to reduce risk in the cloud.

In addition, IBM TS4500 now supports IBM z14, the latest generation of IBM Z servers. Mainframe administrators can trust TS4500 to help reduce floorspace costs and increase overall capacity.

Figure 1. IBM TS4500 tape library

Figure 2. Inside TS4500 tape library

Automates solutions for cloud environments

TS4500 is a tape drive integration leader, with features including a persistent worldwide name, multipath architecture, drive/media exception reporting, remote drive/media management and host-based path failover. TS4500 L25, D25 and S25 frames support the IBM TS1160, TS1155, IBM TS1150, and IBM TS1140 tape drives, while TS4500 L55, D55 and S55 frames support LTO Ultrium 8, 7, 6 and 5 tape drives. LTO Ultrium tape drives and TS1160, TS1155, TS1150 and TS1140 tape drives can be mixed within the TS4500 library, frame by frame. The L-frame and D-frame models help boost efficiency with improved hot-swappable drive packaging. All of the frames include high-density (HD) slot technology that can greatly increase a library's total capacity.

TS4500 frame models can be placed in any active position, so the library can grow from both the right and the left side of the first L frame for floorspace flexibility. A dual-accessor option can help increase mount performance and overall system reliability and availability. Accessors can be serviced at the ends of the library, eliminating the need for a dedicated service bay frame.

A top-rack offering can also provide 10U of rack space on top of the library for Fibre Channel switches, tape data movers or IBM Spectrum Archive nodes.

Delivers capacity on demand

The TS4500 library frame provides a more flexible upgrade path for users who want to expand their tape storage as their needs grow. Capacity-on-demand configurations for TS4500 L-frame models include an entry-level configuration, an intermediate configuration and a base-capacity configuration. All models also support HD capacity-on-demand configurations.

Includes advanced features

TS4500 is designed with advanced features to deliver cutting-edge performance and long-term value. For example, the Advanced Library Management System (ALMS) feature supports dynamic storage management, enabling you to create and change logical libraries and configure any drive into any logical library. TS4500 also offers automatic control-path and data-path failover to help improve business continuity and disaster recovery, and policy-based automatic media verification can help minimize data risk.

Centralizes management of tape resources

IBM offers a wide range of management software options for TS4500. The management software options include:

- **IBM Spectrum Archive**—Allows users and applications to directly access files and directories stored on tape
- **IBM TS4500 command-line interface (CLI)**—Provides access to TS4500 library management commands
- **Rocket Servergraph Professional**—Enables administrators to monitor and report on storage devices
- **IBM Tape System Library Manager**—Allows multi-library environments to be managed as a single system
- **IBM Security Key Lifecycle Manager**—Simplifies encryption key management with an intuitive user interface

IBM TS4500 tape library at a glance

Table 1. IBM TS4500 tape library at a glance

Frame definition	<ul style="list-style-type: none">• L25—Base frame for TS1160, TS1155, TS1150, and TS1140 (3592) drives and cartridges—includes 32 input/output (I/O) slots• D25—Drive-capable and storage expansion frame for TS1160, TS1155, TS1150 and TS1140 (3592) drives and cartridges• S25—Storage-only expansion frame for 3592 cartridges• L55—Base frame for LTO drives and cartridges—includes 36 I/O slots• D55—Drive-capable and storage expansion frame for LTO drives and cartridges• S55—Storage-only expansion frame for LTO cartridges
Tape drive types	TS1160, TS1155, TS1150, and TS1140 (3592), LTO Ultrium 9, 8, 7, 6 and 5 tape drives
Number of frames per library	One base frame, up to 17 expansion frames with maximum of 7 Dx5 frames
Number of drives	<ul style="list-style-type: none">• Up to 16 per frame (up to 12 in frame 1)• Up to 128 per library
Number of tape cartridges	<ul style="list-style-type: none">• L25—up to 660 (up to 550 in frame 1)• D25—up to 740 (up to 590 in frame 1)• S25—up to 1,000 (up to 798 in frame 1)• Total supported per library: up to 17,550• L55—up to 882 (up to 730 in frame 1)• D55—up to 970 (up to 774 in frame 1)• S55—up to 1,320 (up to 1,054 in frame 1)• Total supported per library: up to 23,170
Capacity*	<ul style="list-style-type: none">• 3592 advanced cartridges: up to 351 PB per library (1,053 PB with 3:1 compression)• LTO Ultrium 9 cartridges: up to 417 PB per library (up to 1.04 EB compressed per library)
Operating systems support	See the IBM System Storage Interoperation Center

*Capacity depends on drives installed, number and type of cartridges used, and compression ratio achieved. Listed capacity is physical. Usable capacity may be less.

TS4500 tape library structure

- **[TS4500 tape library frames](#)**
The TS4500 tape library is built from a single frame model that is called the base frame. The scalability of the library allows an increase in capacity by adding up to 17 more frames, called expansion frames. The frames join side by side and can grow to the left or to the right of the base frame. All frames are supported by a single accessor.
- **[TS4500 tape library frame models](#)**
- **[High-density technology](#)**
The TS4500 tape library offers high-density (HD), drive-capable and storage-only frame models that are designed to greatly increase storage capacity without increasing frame size or required floor space.
- **[Top racks](#)**
The TS4500 top racks provide extra rack space on any frame in a library without requiring more floor space. They also simplify cabling by providing extra rack space above the library for power distribution units, Fibre Channel switches, tape data movers, or IBM® Linear Tape File System (LTFS) nodes.
- **[Dual accessors and integrated service bays](#)**
When an optional second accessor is installed, the TS4500 tape library features high availability (HA), which enhances library performance. The extra accessor enables the library to operate without disruption if any component of one accessor fails. The integrated service bays reduce unusable service space by 40% compared to the TS3500 service bays. The default Maximum Capacity setting of the Elastic Capacity feature eliminates the remaining unusable service space.
- **[Components of the TS4500 tape library](#)**
The TS4500 tape library consists of one or more library frames, and other components for powering the library and installed tape drives and for handling and storing tape cartridges.

TS4500 tape library frames

The TS4500 tape library is built from a single frame model that is called the base frame. The scalability of the library allows an increase in capacity by adding up to 17 more frames, called expansion frames. The frames join side by side and can grow to the left or to the right of the base frame. All frames are supported by a single accessor.

The tape library supports second-generation high-density (HD2) frames. Like the first-generation HD frames, HD2 frames offer increased capacity without increasing frame size or required floor space by using high-density storage slots for tape cartridges. In addition, HD2 frames provide the following enhancements.

- Can be installed in the leftmost position of the library (frame number 1)
- Drive-capable HD2 frames support up to 16 HD2-compatible tape drives when positioned as frame number 2 or higher.

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

Related information

- [Increasing capacity](#)

TS4500 tape library frame models

The L25 and L55 (Lx5) frames and D25 and D55 (Dx5) frames are HD2 drive-capable frames. They contain high-density cartridge storage slots, and slots to house up to 16 tape drives. The S25 and S55 (Sx5) frames are HD2 storage-only frames. They contain high-density cartridge storage slots, but no tape drives. All HD frames provide internal LED lighting.

[Table 1](#) lists the frames that are supported by the library and their specific media type and capacity. Mixed media configurations within a single frame are not supported.

Table 1. TS4500 tape library frame models

Frame Model	Type	Media type	Capacity		Other
			Frame Position 1	Frame Position 2+	
L25	Base frame	3592	Up to 12 tape drives and 550 storage slots	Up to 16 tape drives and 660 storage slots	<ul style="list-style-type: none"> • Equipped with two 16 slot I/O stations • Optionally equipped with top rack (Model TR1)
L55	Base frame	LTO	Up to 12 tape drives and 730 storage slots	Up to 16 tape drives and 882 storage slots	<ul style="list-style-type: none"> • Equipped with two 18 slot I/O stations • Optionally equipped with top rack (Model TR1)
D25	Expansion frame	3592	Up to 12 tape drives and 590 storage slots	Up to 16 tape drives and 740 storage slots	<ul style="list-style-type: none"> • Optionally equipped with two 16 slot I/O stations • Optionally equipped with top rack (Model TR1) • Limited to any combination of seven D25 and D55 frames
D55	Expansion frame	LTO	Up to 12 tape drives and 774 storage slots	Up to 16 tape drives and 970 storage slots	<ul style="list-style-type: none"> • Optionally equipped with two 18 slot I/O stations • Optionally equipped with top rack (Model TR1) • Limited to any combination of seven D25 and D55 frames
S25	Storage-only expansion frame	3592	798 storage slots	1000 storage slots	<ul style="list-style-type: none"> • Optionally equipped with top rack (Model TR1)
S55	Storage-only expansion frame	LTO	1054 storage slots	1320 storage slots	<ul style="list-style-type: none"> • Optionally equipped with top rack (Model TR1)
S24	Storage-only expansion frame	3592	Unsupported	1000 storage slots	<ul style="list-style-type: none"> • Requires a TS4500 control upgrade • Cannot be installed to the left of an Lx5 frame • Cannot be installed as the rightmost frame in a dual accessor tape library
S54	Storage-only expansion frame	LTO	Unsupported	1320 storage slots	<ul style="list-style-type: none"> • Requires a TS4500 control upgrade • Cannot be installed to the left of an Lx5 frame • Cannot be installed as the rightmost frame in a dual accessor tape library

Related information

- [Increasing capacity](#)

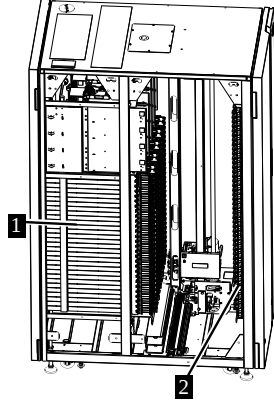
High-density technology

The TS4500 tape library offers high-density (HD), drive-capable and storage-only frame models that are designed to greatly increase storage capacity without increasing frame size or required floor space.

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. The maximum tier in an LTO HD slot is Tier 5. The maximum tier in a 3592 HD slot is Tier 4 because the 3592 tape cartridge is slightly longer than the LTO cartridge.

[Figure 1](#) shows the inside of an HD frame from the side. The single-deep slots on the door side 2 of HD frames are referred to as Tier 0 slots. The deep cell 1 contain Tier 1 thru Tier 5.

Figure 1. The HD frame



All HD slots are black. 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.

Note: The cartridge count should not exceed 99% of the reported library slot capacity. Unused slots are required for shuffle operations.

In HD frames, the cartridge accessor runs a shuffle operation 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) 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.

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.

Top racks

The TS4500 top racks provide extra rack space on any frame in a library without requiring more floor space. They also simplify cabling by providing extra rack space above the library for power distribution units, Fibre Channel switches, tape data movers, or IBM® Linear Tape File System (LTFS) nodes.

Both Top Rack models (TR1, and TR2) are installed in the field by an IBM service representative or service partners on one or more frames. The top racks, and any components that are housed in the racks, are supported and serviced independently of the TS4500 tape library.

Feature code 1750, top rack end covers, is required for the left and right ends of one or more adjacent top racks. This feature is only required for the first top rack that is ordered when multiple top racks are ordered for adjacent frames.

3584 Model TR2:

The TR2 provides an extra 5U of rack space on any frame. The lower overall size of Model TR2 compared to Model TR1 enables you to install TR2 where overhead space prevents TR1 from being installed. The components that are placed into the top rack should not exceed 30 lbs. per U, which is a maximum of 150lbs for the TR2.

Figure 1. TS4500 with TR2 installed



Feature codes 1755 (Front Door) and 1756 (Rear Door) are optional.

Rack Configurations

1. Standard 19" Rack (Feature code 1754)
The TR2 is configured in conformance with industry standard 19" racks. This provides 5U of 19" rack space
2. Olympus Rack (Feature code 1753)
The TR2 rack is configured in conformance with the Open Compute Project Olympus Rack Specification.

Feature code 1752, Enhanced PDU, can optionally be ordered for the TR2. Each PDU uses 1U of rack space. Up to two of FC 1752 can be ordered. Each Enhanced PDU provides six C13 outlets and three C19 outlets

Power Cords

- For single phase input power, for each PDU ordered you must order one power cord feature codes, 9954 thru 9958.
- For 3-phase (wye) input power, each PDU ordered you must order one power cord feature code 9948.

3584 Model TR1:

The optional top rack, 3584 Model TR1 ([Figure 2](#)), provides an extra 10U of rack space on any frame. The components that are placed into the top rack should not exceed 30 lbs. per U, which is a maximum of 300 lbs for the TR1.

Figure 2. Installed TR1



Feature code 1751 power distribution unit (PDU), or 1752 Enhanced PDU can optionally be ordered. Up to two PDUs can be ordered for the TR1. The first PDU does not use any of the 10U rack space. A second PDU, for redundancy, uses 1U of rack space.

One power cord feature, 9954 through 9959 or 9966, is required for each 1751 feature that is ordered. See below for the Enhanced PDU (1752) power cords.

Related information

- [Feature codes for the TS4500](#)

Dual accessors and integrated service bays

When an optional second accessor is installed, the TS4500 tape library features high availability (HA), which enhances library performance. The extra accessor enables the library to operate without disruption if any component of one accessor fails. The integrated service bays reduce unusable service space by 40% compared to the TS3500 service bays. The default Maximum Capacity setting of the Elastic Capacity feature eliminates the remaining unusable service space.

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 1442.

When dual accessors are installed and an attached host issues a command for cartridge movement, the library automatically determines which accessor to mount cartridge in the most timely manner. Depending on the settings, if the library's primary accessor fails, the second accessor assumes control and eliminates system outage or the need for operator immediate intervention.

If you already have an installed TS4500 tape library and you want to add a second accessor, your IBM® service representative can add the accessor. Converting from a single accessor to a dual accessor disrupts the operations of the library.

The second accessor ships inside a Dx5 or Sx5 frame. You can place that frame anywhere in the library string. However, the B accessor is always installed as the right-most accessor.

Dual Accessor Settings

You have three options to choose from. Each option changes the zones within which each accessor operates.

Dual active

Both accessors are online and active, and fulfill requests for media cartridges that fall within each accessor's preferred zone. In this option, the library is divided into two equally sized zones. While both accessors are active, the A accessor services the left zone and the B accessor services the right.

Accessor A Only

Only the A accessor is active and fulfills requests for media. The B accessor is online but parked in Service Bay-B. If the A accessor goes down, then the B accessor becomes active. In this option, the preferred zone for the A accessor includes the entire library with the exception of the area for Service Bay-B.

Accessor B Only

Only the B accessor is active and fulfills requests for media. The A accessor is online but parked in Service Bay-A. If the B accessor goes down, then the A accessor becomes active. In this option, the preferred zone for the B accessor includes the entire library with the exception of the area for Service Bay-A.

Service bays

Accessors are serviced through the side doors at the ends of the library. All front doors remain closed during accessor service, eliminating the need for dedicated service bay frames.

As you view the library from the front, Service Bay A is in the leftmost frame and it spans columns 3 - 8. Service Bay-A is where the A accessor moves to when it is placed in service. Service Bay-B is in the rightmost frame and it spans columns 5 - 10. Service Bay-B is where the B accessor moves to when it is placed in service. Integrated service bays reduce the number of unused storage columns in a dual accessor library from 22 to 14. While an accessor is in service, the media columns in that area are not available to the second accessor.

In frame one, the location of the I/O stations fall within the service bay area. Therefore, only Dx5 frames without the I/O station and Sx5 frames are supported as frame one in a dual accessor configuration. The rightmost frame can be an Lx5, Dx5, or Sx5 model.

Related concepts

- [Elastic capacity](#)

Components of the TS4500 tape library

The TS4500 tape library consists of one or more library frames, and other components for powering the library and installed tape drives and for handling and storing tape cartridges.

Refer to [Figure 1](#) to view the location of each component.

1 Library frames

The base frame (Lx5 models) and the expansion frames (Dx5 and Sx5 models) are the building blocks of the library. Each frame contains a rail system, high-density cartridge storage slots, and internal LED lighting. The Lx5 and Dx5 frames also contain slots for up to 16 tape drives.

Note: The LED lighting in the HD frames is specifically designed for use only in the TS4500 tape library and is not suitable for other applications

2 Rail system

The assembly on which the cartridge accessor moves through the library. The system includes the top and bottom rails.

3 Cartridge accessor

The assembly that moves tape cartridges between storage slots, tape drives, and the I/O stations.

4 Accessor controller

A circuit board that facilitates all accessor motion requests (such as calibrations, moves, and inventory updates).

5 Cartridge storage slots

Single-deep cells that are mounted on the door of the frame each store one tape cartridge. High-density cells inside of the frame each store 4 (3592) or 5 (LTO) tape cartridges. Mixed media (a combination of 3592 and LTO tape cartridges) is not supported within individual frames or within the TS4500 tape library.

6 IBM® LTO or 3592 tape drives

One or more units that are mounted in the frame that read and write the data that is stored on tape cartridges. IBM LTO tape drives and 3592 tape drives cannot be mixed in the same frame. IBM tape drives use LTO tape cartridges; 3592 tape drives use IBM 3592 tape cartridges.

7 Front door

The front door of any frame. The single-deep cartridge storage slots on the inside of the door are referred to as Tier 0 slots. Two I/O stations are installed on the front door of the base frame. Two extra I/O stations can optionally be installed on the front door of any Dx5 frame. The library's front door has a key lock. The key lock is the same for every front door, and the keys are shipped with the library.

Note: The side doors of the base frames (Lx5) also have a key lock, which is the same key lock that is used for the front door.

8 Door safety switch

One or more devices in each frame that shuts down the motion power to the cartridge accessor whenever the front door is opened.

9 I/O stations

Two cartridge compartments on the front door of the base frame that enable the insertion or removal of tape cartridges without the library performing a re-inventory of the frame. Two extra I/O stations can optionally be installed on any Dx5 expansion frames.

TS4500 integrated management console (IMC) (Not shown)

At either end of the library, the IMC includes an LCD screen and keyboard with touchpad to access the TS4500 management GUI. The IMC is also used by IBM service representatives to perform service functions.

10 Power cable hole

A covered opening for a power cable that must attach to an outlet mounted above the library.

11 Fibre Channel cable hole

A covered opening for Fibre Channel cables that must be routed above the library.

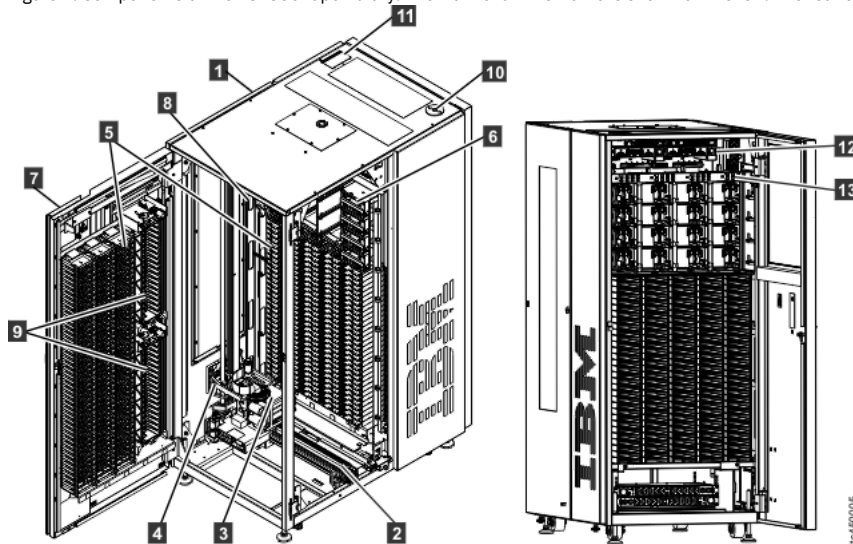
12 TS4500 frame control assembly

An assembly of components that facilitate Ethernet communication between the drives in a frame and the accessor controller. The frame control assembly is standard on all base frames (Lx5) and optional on any Dx5 expansion frames. The assembly includes one library controller card (LCC) and two power supplies, both of which can provide power to the library and all drives in a frame.

13 Patch panel

A panel that houses the cable connections for the tape drives.

Figure 1. Components of the TS4500 tape library. The front of an Lx5 frame is shown on the left. The rear of an Lx5 frame is shown on the right.



- [Display panel](#)
The display panel on the base frame houses the library power and pause buttons and displays indicators of library status.
- [Integrated management console](#)
The integrated management console (IMC) is a built-in platform for tools that are used to manage the TS4500 tape library. The IMC, which includes an LCD screen and a keyboard with touchpad, can be mounted on either end of your TS4500 tape library.
- [I/O stations](#)
Insert or remove cartridges with the input/output (I/O) stations while the TS4500 tape library is performing other operations without requiring an inventory.
- [Cartridge magazine](#)
The cartridge magazine is used to load and unload one or more tape cartridges independent of the TS4500 tape library.
- [Rail assembly](#)
This topic explains how the cartridge accessor moves through the TS4500 tape library on a rail assembly.
- [Cartridge accessor](#)
This topic explains how the cartridge accessor moves cartridges between storage slots, tape drives, and the I/O station of the TS4500 tape library.

Related information

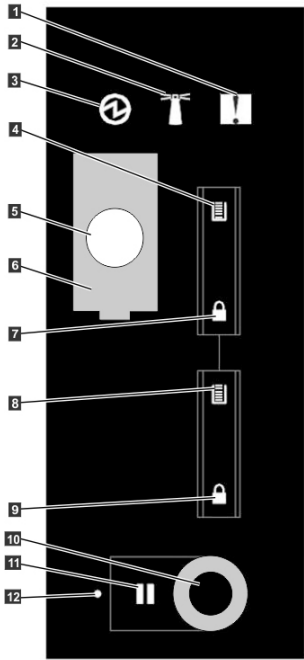
- [TS4500 tape library structure](#)

Display panel

The display panel on the base frame houses the library power and pause buttons and displays indicators of library status.

Expansion frames that have optional I/O stations that are installed also have a display panel. However, the panel on expansion frames does not include the library power or reset buttons.

Figure 1. Display panel



#	Component	#	Component
1	Warning indicator (yellow)	2	Library beacon (blue)
3	Power indicator (green)	4	Upper I/O station capacity indicator
5	Power button	6	Power button cover
7	Upper I/O station lock indicator	8	Lower I/O station capacity indicator
9	Lower I/O station lock indicator	10	Pause button (pauses the library for 60 seconds or as long as a frame door is open)
11	Pause indicator (white)	12	Access Recovery button

Integrated management console

The integrated management console (IMC) is a built-in platform for tools that are used to manage the TS4500 tape library. The IMC, which includes an LCD screen and a keyboard with touchpad, can be mounted on either end of your TS4500 tape library.

Normally, a library controller card (LCC) and power source are required within the end frame or an adjacent frame. Optionally, feature code FC 2737 (IMC separate power source) allows for the IMC to be mounted on a non-powered end frame, that is more than one frame away from a powered frame. This feature can be installed during the installation of expansion frames in an initial library installation, or later when more expansion frames are added to an existing library.

The IMC comes preinstalled with a system console application, which is a set of software tools that is used for local service and remote support of the attached TS4500 tape library. The system console application enables the IMC to provide service console capabilities, such as broadband call home.

The TS4500 management GUI runs on a web browser in kiosk mode on the IMC. Kiosk mode means that the menu bar, address bar, and stop and reload buttons of the browser are disabled. In addition, it is not possible to use bookmarks or multiple browser windows.

Related information

- [Remote support](#)
- [TS4500 management GUI Users page help](#)
- [TS4500 management GUI Roles page help](#)

I/O stations

Insert or remove cartridges with the input/output (I/O) stations while the TS4500 tape library is performing other operations without requiring an inventory.

The base frames (models L25 and L55) come with two I/O stations. Each I/O station has a cartridge magazine that allows cartridges to be loaded without interrupting the operation of the library. The cartridge magazine for LTO can hold up to 18 cartridges. The cartridge magazine for 3592 can hold up to 16 cartridges. On libraries with LTO and 3592 frames, the Lx5 frame I/O Stations can be used for both types of magazines or the first Dx5 frame (different from the Lx5) can have I/O station shipped with the magazines for the different drive type. Magazines for different media types can be ordered using FC 1628 for LTO, and FC 1629 for 3592.

Two extra I/O stations can be installed in any Dx5 expansion frame by ordering feature code 1652. This feature installs two I/O stations in one expansion frame. Each additional pair of I/O stations increases the maximum insert/eject throughput for the library. The total cartridge capacity for expansion frames with two I/O stations is reduced by 80 cartridges for model D25 and by 88 cartridges for model D55. Storage-only frames (models Sx5) do not support I/O stations.

You can remotely use the I/O station action menu, available from the System page of the TS4500 management GUI, to open and close the I/O station doors. At the library, you can press the eject button (9 in [Figure 1](#)) to open and close the doors. When the doors are open, it is possible to manually remove and replace the cartridge magazine to insert or remove cartridges. When the doors are closed, the cartridge accessor can access the cartridges. The lock status LED next to the eject button (also 7 in [Figure](#)

1) indicates that the I/O station is locked because the accessor could be inserting or removing cartridges. Do not attempt to open the station when the lock status indicator is illuminated.

Notes:

- Use the eject button (9 in [Figure 1](#)) or the management GUI to open and close the I/O station doors. Do not attempt to open the doors manually.
- If there is an obstruction in the I/O station, the doors automatically reopen.
- Always keep a cartridge magazine, even if the magazine is empty.

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.

[Figure 1](#) shows the location of the I/O stations and display panel. [Table 1](#) identifies each icon.

Figure 1. Location of I/O stations and display panel on an Lx5 frame

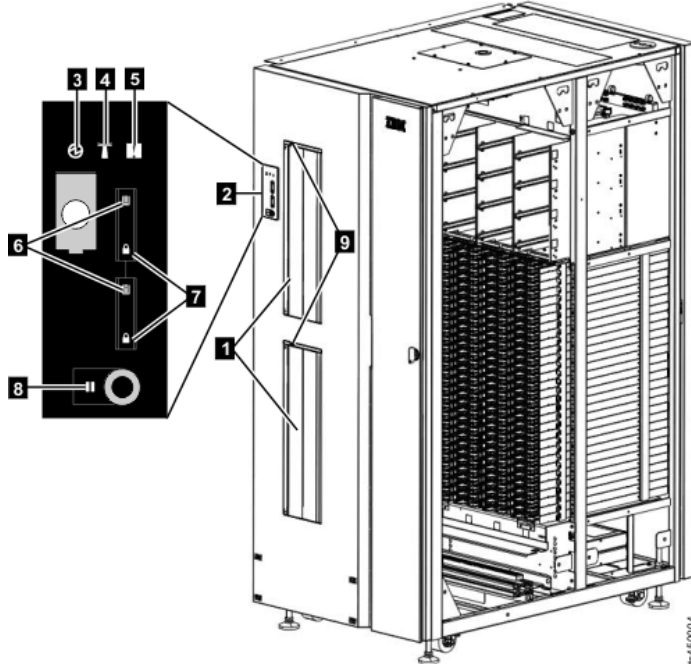


Table 1. I/O stations and display panel

#	Component	#	Component
1	I/O stations	6	I/O capacity indicator
2	Display panel	7	Lock status indicator
3	Power indicator (green)	8	Pause indicator (white)
4	Library beacon (blue)	9	Eject button
5	Warning indicator (yellow)		

Related information

- [TS4500 management GUI System page help](#)
- [Cartridge magazine](#)
- [Inserting tape cartridges](#)

Cartridge magazine

The cartridge magazine is used to load and unload one or more tape cartridges independent of the TS4500 tape library.

The base frame of the TS4500 tape library comes with two I/O stations. Any Dx5 expansion frame can optionally have two I/O stations installed. A removable cartridge magazine is installed in each I/O station and is used to insert or remove cartridges from the station. The cartridge magazine is accessed by opening the I/O station doors using either the eject button above the station or the TS4500 management GUI.

The cartridge magazines are media-specific. [Table 1](#) lists the dimensions and weight of each magazine. A bar code label at the top of the magazine is scanned by the cartridge accessor and indicates to the library whether the magazine is for LTO or 3592 cartridges. The LTO magazine holds up to 18 cartridges. The 3592 magazine holds up to 16 cartridges. A serial number label, affixed to the bottom of the magazine, is used for identification.

Table 1. Cartridge magazine physical specifications

Specification	3592 cartridge magazine	LTO cartridge magazine
Dimensions	Width: 127 mm (5 in) Height: 523 mm (20.6 in) Depth: 137 mm (5.4 in)	Width: 127 mm (5 in) Height: 523 mm (20.6 in) Depth: 160 mm (6.3 in)
Maximum weight (full of cartridges)	5.24 kg (11.6 lb)	5.14 kg (11.4 lb)
Minimum weight (no cartridges)	1.1 kg (2.5 lb)	1 kg (2.2 lb)

The magazine is always seated in the I/O station so that the handles are accessible when the I/O station doors are open. The magazine must also be positioned so that the bar code labels on the magazine and cartridges face inside the library and can be read by cartridge accessor. An up arrow and "THIS SIDE UP" engraving indicate how the magazine must be inserted into the I/O station. In addition, guide ribs on the top and bottom prevent the magazine from being inserted upside down.

The handles on the cartridge magazine are used to insert and remove the magazine, or to carry it during transport. The magazine safety lock retains cartridges in their slots and prevents them from falling out while the magazine is carried. When a magazine is removed from an I/O station, it is necessary to engage the safety lock until the magazine is placed on an accessible surface. It is then necessary to unlock the magazine to insert or remove cartridges. Attempting to insert or remove cartridges while the magazine safety lock is engaged might damage the magazine or the cartridges. After a magazine is reinserted into an I/O station, it is necessary to unlock the magazine so that the accessor can retrieve cartridges.

A universal dust cover comes with each magazine and can be used for shipping cartridges in the magazine. The bar code labels are visible through the clear cover.

Related information

- [Using I/O stations to insert cartridges](#)

Rail assembly

This topic explains how the cartridge accessor moves through the TS4500 tape library on a rail assembly.

The cartridge accessor moves through the TS4500 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 at the bottom rear of the library.

Cartridge accessor

This topic explains how the cartridge accessor moves cartridges between storage slots, tape drives, and the I/O station of the TS4500 tape library.

The cartridge accessor moves cartridges between the storage slots, tape drives, and the I/O station of the TS4500 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. The Pivot 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 scanner

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 scanner is mounted on the pivot assembly. It is used during inventories, audits, insertions, and inventory updates. An inventory update is a process that is invoked each time that you open a door. It determines whether cartridges were added to or removed from the library, or moved within the library.

Library performance

The library performance values show the relative performance of the systems and are not meant to be absolute indicators of performance in your specific environment. Performance values, such as cartridge inventory times, mount performance, and cartridge move time, are obtained for the TS4500 tape library using specific measurements.

Performance values for the TS4500 tape library, whether measured on test systems or modeled through simulations, are based on a fixed set of workload assumptions to ensure accurate comparisons; however, the results are not evaluated in all production environments.

Some of the specific assumptions may not pertain to a given operating environment. Actual performance may vary. Accordingly, the performance information for this product does not constitute a performance guarantee or warranty. Verify that the performance of the library is acceptable in your specific environment.

- [Inventory times](#)
Various types of inventories are supported by the TS4500 tape library. The amount of time required to create the inventory for the library or a frame in the library varies with each type of inventory.
- [Mount performance](#)
Mounts per hour is a measure of the overall capability of the cartridge accessor and tape drives. It is defined as the number of cartridges that the tape library can mount in one hour.
- [Cartridge import and export performance](#)
The cartridge import and export rates indicate the number of tape cartridges that can be imported and exported in an hour.

Inventory times

Various types of inventories are supported by the TS4500 tape library. The amount of time required to create the inventory for the library or a frame in the library varies with each type of inventory.

The tape library tracks the logical location of all of its elements by performing an automatic inventory as required. The automatic inventory improves application performance. You can also manually initiate an inventory, if necessary, from the System page of the TS4500 management GUI.

[Table 1](#) shows the typical time required for the tape library to inventory cartridges.

Table 1. Typical time required to inventory cartridges

Frame component	Typical time to inventory (in seconds)
Storage column (8 or 10 per frame)	6
Drive column (0-4 per frame)	6
I/O Station (0 or 2 per frame)	8

An inventory operation includes a check to determine whether each cartridge storage slot in the library is empty or full, and a scan of the bar code labels. An inventory occurs whenever you:

- Power on the tape library
- Issue the SCSI Initialize Element Status with Range command
- Close the front door after manually accessing the inventory. Only those frames whose doors were opened are inventoried.
- Initiate an inventory from the TS4500 management GUI

Inventory all tiers

A standard inventory is a scan of Tier 0 and Tier 1; however, at times it is necessary to inventory all tiers. This operation takes more time because it requires moving the cartridges to scan each bar code. For all inventory operations, tiers 2 and higher are only scanned when one of the following changes occurs:

- A Tier 1 cartridge bar code label has changed
- Enough Tier 1 bar code labels have changed in a column to warrant an inventory of the entire column
- **Scan all tiers** is selected when initiating a manual inventory from the TS4500 management GUI

[Table 2](#) shows the typical time required for the tape library to inventory all tiers during a bulk load.

Table 2. Typical time required to inventory all tiers

Frame component	Typical time to inventory all tiers (in seconds)
Full HD slot	15
Model L25/D25 column of full HD slots (0 - 5 per frame)	280
Model S24/S25 column of full HD slots (0 - 5 per frame)	415
Model L55/D55 column of full HD slots (0 - 5 per frame)	390
Model S54/S55 column of full HD slots (0 - 5 per frame)	580

[Table 3](#) provides typical inventory times for several example frame configurations.

Table 3. Typical time required to inventory a frame for example frame configurations

Frame configuration*	Typical time to inventory (in seconds)		
	No cartridges changed	One tier 1 cartridge changed	Initial bulk load
Model S55 in frame position 1	48	63	2344
Model D55 with 3 drive columns and no I/O stations in frame position 1	66	81	1602
Model L25 with 4 drive columns and 2 I/O stations in frame position 2	88	103	1458
Model S25 in frame position 2	60	75	2105

*Assumes that the frame is 99% full.

Mount performance

Mounts per hour is a measure of the overall capability of the cartridge accessor and tape drives. It is defined as the number of cartridges that the tape library can mount in one hour.

A mount, often called the demount and mount cycle, involves the following steps: (1) removing the cartridge from a drive; (2) returning it to a storage slot; (3) collecting another cartridge from a random storage slot; (4) moving it to the drive; and (5) loading the cartridge into the drive. [Table 1](#) shows the mount performance for a tape library with all mounts from Tier 0, which are the single-deep slots on the door side of the HD frame.

Table 1. Mount performance for a TS4500 tape library with all mounts coming from Tier 0

Library configuration	Maximum mounts per hour	
	Single accessor	Dual accessor
4 frames	360	730
6 frames	315	720
8 frames	270	680
12 frames	220	620
18 frames	180	550

Specifications were produced from models, but are consistent with test results. The dual accessor data assumes that each cartridge is mounted in a drive that is located within the same library zone.

The mount performance for a TS4500 tape library is dependent on the library configuration and cartridge usage. For most configurations, the impact of HD slots is not noticeable. For configurations with high accessor utilization (as measured in mounts per hour), the overall reduction in mount performance compared to tier 0 performance can range from no impact to a worst-case 50% reduction in mounts per hour (for a 99% full library). This reduction in mount performance is determined by the distribution of tiers that cartridges are mounted from and the need to destage least-recently-used (LRU) cartridges from the cartridge cache. The library configuration and cartridge usage influences the reduction in mount performance in the following ways:

- Unlicensed capacity decreases the mounts from the highest tiers and decreases the time required for shuffle operations (load balancing ensures the highest tiers are the last ones utilized)
- Lower capacity utilization decreases the mounts from the highest tiers and decreases the time required for shuffle operations (load balancing ensures the highest tiers are the last ones utilized)
- A higher ratio of cartridges that are mounted more than once (cartridge cache hits) increases the mounts from Tiers 0 and 1
- Cartridge eject operations prior to mount operations reduce the need to destage LRU cartridges (this is because eject operations empty some Tier 0 slots)

Cartridge import and export performance

The cartridge import and export rates indicate the number of tape cartridges that can be imported and exported in an hour.

The import and export rates will vary depending on the following factors:

- How busy the accessor is with other activities (all activity is interleaved so that no activity can be "starved").
- How quickly the operators fill the I/O slots or empty the magazines from the I/O stations.
- How many operators are inserting cartridges or emptying the magazines.

The maximum rates listed in [Table 1](#) assume:

- Minimal mount/demount activity.
- Less than 90 seconds for the operator to introduce each magazine into the I/O station or empty each magazine from the I/O station.
- For dual-accessor libraries, two operators inserting magazines into both accessor zones or emptying magazines from both accessor zones simultaneously.

Table 1. Import and export performance for a TS4500 tape library

Maximum imports per hour		Maximum exports per hour (8 to 18 frames; exports from tier 0 and tier 1)
Single-accessor library (up to 8 frames)	Dual-accessor library (8 to 18 frames)	
Over 600 cartridges	Over 1200 cartridges	Over 1200 cartridges

Tape drives

The TS4500 tape library supports LTO and 3592 tape drives.

The HD2 frames of the TS4500 tape library support HD2-compatible models of the TS1140, and LTO 9 tape drives.

Note: The non-HD2 and HD2-compatible models of these tape drives can be installed only in their respective non-HD2 or HD2 frames.

In a single accessor library, up to 12 drives can be installed in an Lx5 or Dx5 frame that is in frame position 1 (the leftmost frame) of the library. Also, up to 16 drives can be installed in each Lx5 or Dx5 frame that is in frame position 2 or higher.

No drives are installed in the storage-only frames (Models S25 and S55). 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.

You or your IBM® service representative can update firmware for the tape drives without scheduling downtime. This function is available through the TS4500 management GUI or TS4500 command line interface (`driveCodeUpdate` command).

- [Supported tape drives](#)
The TS4500 tape library supports LTO and 3592 tape drives.
- [Drive performance](#)
Performance data for LTO and 3592 tape drives.
- [Drive addresses](#)
Tape drives are assigned two addresses – a physical address that indicates the drive's location in the library and a logical address that indicates the drive's location to the SCSI interface.
- [Control path drives](#)
A control path is the path for SCSI Medium Changer commands sent by a server to control a specific logical library. The TS4500 tape library has no direct SCSI connection to a server. When a server communicates with the library, it sends the communication by way of an LTO or 3592 tape drive. The tape drive is designated as a control path.
- [Methods of cleaning drives](#)
Automatic cleaning of tape drives is enabled by default. However, it is also possible to initiate manual or host cleaning.
- [Mixed drives in a logical library](#)
The TS4500 tape library supports several combinations of drives, with certain limitations.
- [Mixed drives in frames](#)
You can mix drive models within a drive type in a TS4500 tape library frame. Different drive types such as, LTO and JAG cannot be mixed.
- [Mixed media in drives](#)
Not all cartridges that are supported by the TS4500 tape library are compatible with all drives. LTO cartridges are not supported by 3592 tape drives, and 3592 tape cartridges are not supported by LTO drives.

Related information

- [Updating drive firmware](#)
- [driveCodeUpdate CLI command](#)

Supported tape drives

The TS4500 tape library supports LTO and 3592 tape drives.

[Table 1](#) lists the supported LTO drives and [Table 2](#) lists the supported 3592 drives.

Table 1. Supported LTO tape drives

Type of drive	Speed of connectivity	Native data rate	Native capacity	Also known as	HD2-compatible model
LTO 9 (SAS)	12 Gbps SAS	400 MB/s	18 TB (16.37 TiB)	LTO Ultrium 9	IBM 3588 S9C
LTO9 (single-mode fibre)	8 Gbps Fibre	400 MB/s	18 TB (16.37 TiB)	LTO Ultrium 9	IBM 3588 F9S
LTO 9 (multi-mode fibre)	8 Gbps Fibre	400 MB/s	18 TB (16.37 TiB)	LTO Ultrium 9	IBM 3588 F9C
LTO 8 (single-mode fibre)	8 Gbps Fibre	360 MB/s	12 TB (10.91 TiB)	LTO Ultrium 8	IBM 3588 F8S
LTO 8 (multi-mode fibre)	8 Gbps Fibre	360 MB/s	12 TB (10.91 TiB)	LTO Ultrium 8	IBM 3588 F8C
LTO 7	8 Gbps Fibre	300 MB/s	6 TB (5.46 TiB)	LTO Ultrium 7	IBM 3588 F7C
LTO 6	8 Gbps Fibre	160 MB/s	2.5 TB (2.27 TiB)	LTO Ultrium 6	IBM 3588 F6C
LTO 5	8 Gbps Fibre	140 MB/s	1.5 TB (1.37 TiB)	LTO Ultrium 5	IBM 3588 F5C

Table 2. Supported 3592 tape drives

Type of drive	Speed of connectivity	Native data rate	Native capacity	Also known as	HD2-compatible model
IBM TS1160 Model 3592 60F	16 Gbps Fibre	400 MB/s	20 TB (18.19 TiB) ⁷ 15 TB (13.64 TiB) ⁵ 7 TB (6.37 TiB) ³ 5 TB (4.54 TiB) ⁶ 3 TB (2.73 TiB) ⁴ 900 GB (838.19 TB) ¹	IBM 3592 60F	IBM 3592 60F
IBM TS1160 Model 3592 60E	10 or 25 Gbps Ethernet	400 MB/s	20 TB (18.19 TiB) ⁷ 15 TB (13.64 TiB) ⁵ 7 TB (6.37 TiB) ³ 5 TB (4.54 TiB) ⁶ 3 TB (2.73 TiB) ⁴ 900 GB (838.19 TB) ¹	IBM 3592 60E	IBM 3592 60E
IBM TS1160 Model 3592 60S	12 Gbps SAS	400 MB/s	20 TB (18.19 TiB) ⁷ 15 TB (13.64 TiB) ⁵ 7 TB (6.37 TiB) ³ 5 TB (4.54 TiB) ⁶ 3 TB (2.73 TiB) ⁴ 900 GB (838.19 TB) ¹	IBM 3592 60S	IBM 3592 60S
IBM TS1155 Model 3592 55F	8 Gbps Fibre	360 MB/s	15 TB (13.64 TiB) ⁵ 7 TB (6.37 TiB) ³ 3 TB (2.73 TiB) ⁴ 900 GB (838.19 TB) ¹	IBM 3592 55F	IBM 3592 55F
IBM TS1155 Model 3592 55E	10 Gbps Ethernet	360 MB/s	15 TB (13.64 TiB) ⁵ 7 TB (6.37 TiB) ³ 3 TB (2.73 TiB) ⁴ 900 GB (838.19 TB) ¹	IBM 3592 55E	IBM 3592 55E
IBM TS1150	8 Gbps Fibre	360 MB/s	10 TB (9.1 TiB) ⁵ 7 TB (6.37 TiB) ³ 2 TB (1.82 TiB) ⁴ 900 GB (838.19 TB) ¹	IBM 3592 EH8	IBM 3592 EH8
IBM TS1140	8 Gbps Fibre	250 MB/s	4 TB (3.6 TiB) ³ 1.6 TB (1.46 TiB) ² 500 GB (.5 TB) ¹	IBM 3592 EH7	IBM 3592 EH7

Native capacity varies with cartridge type:

1. with JK cartridge.
2. with JB/JX cartridge.
3. with JC/JY cartridge.
4. with JL cartridge.
5. with JD/JZ cartridge.
6. with JM cartridge.
7. with JE/JV cartridge.

- [LTO tape drives](#)
The TS4500 tape library supports LTO 5 and later LTO tape drives.
- [3592 tape drives](#)
The TS4500 tape library supports the following 3592 tape drives:

LTO tape drives

The TS4500 tape library supports LTO 5 and later LTO tape drives.

The LTO 5, LTO 6, LTO 7, LTO 8, and LTO 9 (single and multimode) tape drives are dual-ported drives that facilitate 8 Gbps Fibre Channel connectivity. LTO 9 (Model 3588 F9S) provides 12 Gbps SAS connectivity. These drives are differentiated from other LTO drives by their machine type and model numbers. You can identify the LTO tape drives by the logo at the front of the drive or by the label at the rear of the drive's canister.

The following generations of HD2-compatible LTO drives are supported by the HD2 frames of the TS4500 tape library:

- LTO 9 Tape Drive (Model 3588 S9C, SAS)
- LTO 9 Tape Drive (Model 3588 F9S, single-mode fibre)
- LTO 9 Tape Drive (Model 3588 F9C, multi-mode fibre)
- LTO 8 Tape Drive (Model 3588 F8S, single-mode fibre)
- LTO 8 Tape Drive (Model 3588 F8C, multi-mode fibre)
- LTO 7 Tape Drive (Model 3588 F7C, multi-mode fibre)
- LTO 6 Tape Drive (Model 3588 F6C, multi-mode fibre)
- LTO 5 Tape Drive (Model 3588 F5C, multi-mode fibre)

Note: Drive models 3588 F8A, F7A, F6A, and F5A are not supported by the HD2 frames of the TS4500 tape library.

LTO tape drives communicate with the tape library through an internal Ethernet interface. They also use the Statistical Analysis and Reporting System (SARS) to isolate failures between media and hardware.

LTO tape drives read and write non-WORM media, so you can load WORM-capable firmware on your tape drives and use any media that is supported by these drives. In this case, only the data that is written on WORM media is treated as WORM data. Data that is written on other types of media can be overwritten.

LTO tape drives do not read from or write to 3592 tape cartridges, and 3592 tape drives do not read or write to LTO tape cartridges.

The LTO tape drives can read tapes that were written by non-IBM LTO drives. They also write to tapes that can be read by non-IBM LTO drives.

All supported generations of LTO tape drives and cartridges can be in the same frame.

When a cartridge is labeled according to IBM® bar code label specifications, the last character of its volume serial (VOLSER) number indicates the first drive generation that supports the media. For example:

- 000764**L9** is an LTO 9 cartridge
- 000764**L8** is an LTO 8 cartridge
- 000764**M8** is an LTO Ultrium 7 cartridge initialized as Type M media (M8)
- 000764**L7** is an LTO 7 cartridge
- 000764**L6** is an LTO 6 cartridge
- 000764**L5** is an LTO 5 cartridge

To enhance library performance, LTO tape drives include speed matching, channel calibration, and power management. Speed matching dynamically adjusts the drive's normal 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.

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

Encryption

LTO 5 and later LTO tape drives are encryption capable, which means they can convert data into a cipher that ensures data security. The drive must first be encryption-enabled. Select one of two methods of encryption management (application-managed and library-managed encryption). Library-managed encryption requires 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 tape drive is installed. Some data management applications can also do key management. For an alternative solution, IBM provides a key manager that works with the keystore of your choice to accomplish all necessary key management tasks. There is no recovery for lost encryption keys. Refer to the IBM Encryption Key Manager and IBM Security Key Lifecycle Manager (formerly Tivoli® Key Lifecycle Manager) publications in [Additional publications and resources](#).

3592 tape drives

The TS4500 tape library supports the following 3592 tape drives:

- TS1160 (Models 60F, 60E, and 60S)
- TS1155 (Models 55F and 55E)
- TS1150 (Models E8 and E08*)
- TS1140 (Models E7 and E07*)

*Models E07 and E08 are not supported by HD2 frames.

The following host attachment interface options are supported:

- Dual-port Fibre Channel, which provides flexibility in Open Systems environments because the drives can directly attach to Open Systems servers with Fibre Channel attachments. (Models EH7/E07, EH8/E08, 55F, and 60F.)
- Ethernet over optical fiber, which is optimized for cloud-based and hyper-scale environments. (Models 55E and 60E.)
- SAS (Serial Attached SCSI), which provides a dual-port 12 Gb interface that brings more versatility to businesses with substantial storage, backup, and archiving demands with a cost-competitive communications interface to help simplify storage management and system performance. (Model 60S.)

Note: Copper SAS cables longer than 3 meters in length are not supported.

The 3592 tape drive communicates with the tape library through an internal Ethernet interface and uses the Statistical Analysis and Reporting System to isolate failures between media and hardware.

The basic features of the supported 3592 tape drives are shown in [Table 1](#). Refer to [Drive performance](#) for more 3592 tape drive performance specifications.

Table 1. Features of the 3592 tape drive

Feature	TS1160 tape drive			TS1155 tape drive		TS1150 tape drive	TS1140 tape drive
	Model 60F	Model 60E	Model 60S	Model 55F	Model 55E		
Machine type model	3592-60F	3592-60E	3592-60S	3592-55F	3592-55E	3592-E08	3592-E07

Feature	TS1160 tape drive			TS1155 tape drive		TS1150 tape drive	TS1140 tape drive
	Model 60F	Model 60E	Model 60S	Model 55F	Model 55E		
Native sustained data rate	400 MB/s (60F format) ³	400 MB/s (60F format) ³	400 MB/s (60F format) ³	360 MB/s (55F format) ²	360 MB/s (55F format) ²	360 MB/s (E08 format)	250 MB/s (E07 format)
Compressed sustained data rate (at maximum compression) ¹	1,200 MB/s (60F format) ³	1,200 MB/s (60F format) ³	1,200 MB/s (60F format) ³	700 MB/s (55F format) ²	700 MB/s (55F format) ²	700 MB/s (E08 format)	650 MB/s (E07 format)
Native capacity	JK cartridge: 900 GB (838.2 GiB) JL cartridge: 3 TB (2.73 TiB) JM cartridge: 5 TB (4.55 TiB) JC/JY cartridge: 7 TB (6.37 TiB) JD/JZ cartridge: 15 TB (13.64 TiB) JE/JV cartridge: 20 TB (18.19 TiB)	JK cartridge: 900 GB (838.2 GiB) JL cartridge: 3 TB (2.73 TiB) JM cartridge: 5 TB (4.55 TiB) JC/JY cartridge: 7 TB (6.37 TiB) JD/JZ cartridge: 15 TB (13.64 TiB) JE/JV cartridge: 20 TB (18.19 TiB)	JK cartridge: 900 GB (838.2 GiB) JL cartridge: 3 TB (2.73 TiB) JM cartridge: 5 TB (4.55 TiB) JC/JY cartridge: 7 TB (6.37 TiB) JD/JZ cartridge: 15 TB (13.64 TiB) JE/JV cartridge: 20 TB (18.19 TiB)	JK cartridge: 900 GB (838.2 GiB) JL cartridge: 3 TB (2.73 TiB) JC/JY cartridge: 7 TB (6.37 TiB) JD/JZ cartridge: 15 TB (13.64 TiB)	JK cartridge: 900 GB (838.2 GiB) JL cartridge: 3 TB (2.73 TiB) JC/JY cartridge: 7 TB (6.37 TiB) JD/JZ cartridge: 15 TB (13.64 TiB)	JK cartridge: 900 GB (838.2 GiB) JL cartridge: 2 TB (1.82 TiB) JC/JY cartridge: 7 TB (6.37 TiB) JD/JZ cartridge: 10 TB (9.1 TiB)	JK cartridge: 500 GB (465.66 GiB) JB/JX cartridge: 1.6 TB (1.46 TiB) JC/JY cartridge: 4 TB (3.64 TiB)
Write-once-read-many (WORM) capability	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Capacity scaling and short cartridge	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Read/write capability	If encryption-enabled, reads and writes 60F encrypted format ³	If encryption-enabled, reads and writes 60F encrypted format ³	If encryption-enabled, reads and writes 60F encrypted format ³	If encryption-enabled, reads and writes 55F encrypted format ²	If encryption-enabled, reads and writes 55F encrypted format ²	If encryption-enabled, reads and writes Model E08 encrypted format	If encryption-enabled, reads and writes Model E07 encrypted format
	Reads and writes 60F format ³	Reads and writes 60F format ³	Reads and writes 60F format ³	Reads and writes 55F format ²	Reads and writes 55F format ²	Reads and writes Model E08 format	Reads and writes Model E07 format
Fibre Channel host (server) attachment interface	Supports dual-port, 16 Gbps Fibre Channel interface	Not supported	Not supported	Supports dual-port, 8 Gbps Fibre Channel interface	Not supported	Supports dual-port, 8 Gbps Fibre Channel interface	Supports dual-port, 8 Gbps Fibre Channel interface
	Maximum interface burst transfer rate of 1,600 MB/s	Not supported	Not supported	Maximum interface burst transfer rate of 800 MB/s	Not supported	Maximum interface burst transfer rate of 800 MB/s	Maximum interface burst transfer rate of 800 MB/s
	Supports N ports	Not supported	Not supported	Supports N and L ports with auto-configure	Not supported	Supports N and L ports with auto-configure	Supports N and L ports with auto-configure
Ethernet host (server) attachment interface	Not supported	10 Gb or 25 Gb	Not supported	Not supported	10 Gb (Model 55E)	Not supported	Not supported
SAS (Serial Attached SCSI) attachment interface	Not supported	Not supported	12 Gb	Not supported	Not supported	Not supported	Not supported
Encryption-capable	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes:

1. The compression ratio for the 3592 tape cartridges is 3:1.
2. The 55F format is the native format for both the Model 55F and Model 55E tape drives.
3. The 60F format is the native format for both the Model 60F, Model 60E, and Model 60S tape drives.

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

N+1 power supplies

When installed in a TS4500 tape library frame, these power supplies 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. These logical formats can be divided into multiple sub-format options, such as segmentation and capacity scaling.

Speed matching

When the drives operate 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 is factored out). A reduction in back-hitches improves system performance.

High resolution tape directory (HRTD)

The HRTD directory structure used by 3592 tape drives allows fast and consistent nominal and average access times for locate operations.

Channel calibration and dynamic 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, the supported 3592 tape drives also use dynamic adaptive equalization hardware on an ongoing basis to adjust the read equalization response.

Recursive accumulating backhitchless flush

The supported 3592 tape drives use an algorithm called recursive accumulating backhitchless flush (or non-volatile caching). This algorithm increases the 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 back-hitching. If you write and overwrite multiple trailer labels, this firmware feature provides major performance improvements.

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 JB, JC, JD, and JE media types.

WORM

The 3592 tape drives support write-once-read-many (WORM) behaviors and format attributes. Four WORM cartridge types are supported: JX Extended WORM cartridge, JY Advanced Type C WORM cartridge, JZ Advanced Type D WORM cartridge, and JV Advanced Type E WORM cartridge. WORM cartridges are factory-formatted as WORM cartridges and cannot 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.

Constant Capacity-based and Maximum Capacity-based LEOT reporting

The 3592 tape drives use enhanced logic to report logical end-of-tape (LEOT) data. The drive is configured to report LEOT using either a constant capacity-based LEOT algorithm or a maximum capacity-based LEOT algorithm. These drives use the constant capacity-based LEOT reporting. Constant capacity-based LEOT reporting monitors the number of data sets (i.e., physical records) written to the medium and reports early-warning (EW) based on the number of data sets written to tape (i.e., the number of data sets to hold the advertised native capacity). This reduces the variation in the amount of data that is recorded before EW is returned. For applications that stop writing upon receipt of EW, a more consistent capacity is recorded to the medium. This process allows tape copies to finish without overflow a higher percentage of the time.

Enhanced format for recording error-correction codes (ECCs)

The logical formats of the 3592 tape drives offer error-correction-code capabilities of two orthogonal Reed-Solomon ECCs that protect the data on tape.

Drive mechanical and electrical reliability

The mechanisms of the 3592 tape drives are 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 high vibration and shock environments without data loss or degraded operation.

Data compression

The 3592 tape drives use the data-compression method that is known as streaming lossless data compression algorithm or enhanced streaming lossless data compression algorithm depending on drive model.

Data buffer with read ahead feature

The 3592 tape drives include a data buffer of either 1 GiB or 2 GiB depending on model. 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 feature 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 3592 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 done offboard from the host. Each drive performs a search at its own respective maximum data rate. This feature greatly reduces the amount of data transfer and host search times.

Encryption

All 3592 tape drives are encryption capable, which means they can convert data into a cipher that ensures data security. To encrypt data, 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 tape drives are installed. Some data management applications can do key management. For an alternative solution, IBM® provides a key manager that works with the keystore of your choice to do all necessary key management tasks. There is no recovery for lost encryption keys.

Drive performance

Performance data for LTO and 3592 tape drives.

- [Media optimization](#)
Media optimization is a new feature for the LTO9 tape drive with L9/LZ media.
- [Performance specifications for LTO tape drives](#)
Performance data for LTO tape drives.
- [Performance specifications for 3592 tape drives](#)
Performance data for 3592 tape drives.
- [Rewind times for 3592 tape drives](#)
Rewind times for 3592 tape drives.
- [Average block locate time from load point for 3592 tape drives](#)
Average block locate time from load point for 3592 tape drives

Media optimization

Media optimization is a new feature for the LTO9 tape drive with L9/LZ media.

The increased number of tracks used to write data on tape requires greater precision. Media optimization creates a referenced calibration for each cartridge that enables the tape drive's intelligent alignment to optimize data placement. LTO-9 media optimization enhances LTO tape long-term media durability.

It is important to consider when media optimization will be performed:

- Media optimization will be performed on first load of L9/LZ media during initialization.
- Recommendation is to perform first load in the location of deployment, which should be in a stable environment that meets the recommended environmental specification (see [Environmental Specifications](#) for details).
- Media optimization is a one-time operation that can be completed on any drive in the environment, enabling the media to be used across all tape drives without further optimization.

Other considerations for media optimization:

- Media optimization averages 40 minutes per first load of a cartridge to a tape drive. Although most media optimizations will complete within 60 minutes some media optimizations may take up to 2 hours.
- Interruption of the process is not recommended.
- A different mount will not necessarily improve the time to complete the one-time optimization.

An update to software may be required. Contact your software application provider for more details. Customized software, not provided as a standard market product, may require modification to ensure the software can handle the extended first mount time. For additional details, review the detailed section of the [IBM LTO SCSI Reference](#).

Performance specifications for LTO tape drives

Performance data for LTO tape drives.

Table 1. Performance specifications for LTO tape drives

Generation	LTO 9	LTO 8	LTO 7	LTO 6	LTO 5
Inquiry	ULT3580-TD9 ULTRIUM-TD9	ULT3580-TD8 ULTRIUM-TD8	ULT3580-TD7 ULTRIUM-TD7	ULT3580-TD6 ULTRIUM-TD6	ULT3580-TD5 ULTRIUM-TD5
Interface (speed)	FC (8 Gb) SAS (12 Gb)	FC (8 Gb)	FC (8 Gb)	FC (8 Gb)	FC (8 Gb)
Native data rate	400 Mb/s (L9) 360 Mb/s (L8)	360 Mb/s (L8) 300 Mb/s (M8) 300 Mb/s (L7)	300 Mb/s (L7) 160 Mb/s (L6) 140 Mb/s (L5)	160 Mb/s (L6) 140 Mb/s (L5) 120 Mb/s (L4)	140 Mb/s (L5) 120 Mb/s (L4) 80 Mb/s (L3)
Sustained data rate (L6, L7, L8 and L9 compressed at 2.5:1 compression; L5 and earlier compressed at 2:1 compression)	FC 750 Mb/s (L9) 750 Mb/s (L8) SAS 1000 Mb/s (L9) 900 Mb/s (L8)	FC 750 Mb/s (L8) 750 Mb/s (M8) 750 Mb/s (L7)	FC 750 Mb/s (L7) 400 Mb/s (L6) 280 Mb/s (L5)	FC and SAS 400 Mb/s (L6) 280 Mb/s (L5) 240 Mb/s (L4)	FC and SAS 280 Mb/s (L5) 240 Mb/s (L4) 160 Mb/s (L3)
Burst data rate	800 Mb/s FC 1200 Mb/s SAS	800 Mb/s FC	800 Mb/s FC	800 Mb/s FC 600 Mb/s SAS	800 Mb/s FC 600 Mb/s SAS
Nominal load-to-ready time	17 seconds	15 seconds	15 seconds	12 seconds	12 seconds
-Initialized tape	17 seconds	NA	NA	NA	NA
-Uninitialized tape ¹	40-120 minutes	NA	NA	NA	NA
Nominal unload time	30 seconds	24 seconds	20 seconds	17 seconds	17 seconds
Average space record time from load point	45 seconds	59 seconds	56 seconds	62 seconds	60 seconds
Average rewind time (REWIND command)	55 seconds	59 seconds	60 seconds	NA	NA
Average rewind time (part of UNLOAD command, dependent on mount activity)					
Less than 5 Gb of contiguous data transferred	55 seconds	59 seconds	60 seconds	NA	NA
5 Gb to 50 Gb of contiguous data transferred	110 seconds	59 seconds	60 seconds	NA	NA
All other types of mount activity	165 seconds	59 seconds	60 seconds	NA	NA
¹ Cartridge initialization time can vary. See Media optimization for more information.					
Remember:					
<ul style="list-style-type: none"> • All sustained data rates depend on the capabilities of the interconnect. • Drive performance varies with media generation and drive interface (SAS/FC). 					

Performance specifications for 3592 tape drives

Performance data for 3592 tape drives.

Table 1. Performance specifications for 3592 tape drives

Performance parameter	TS1160 tape drive	TS1155 tape drive	TS1150 tape drive	TS1140 tape drive
Sustained data rate (native) ¹	400 MB/s (60F format) ³ 360 MB/s (55F format) ² 360 MB/s (E08 format) 250 MB/s (E07 format)	360 MB/s (55F format) ² 360 MB/s (E08 format) 250 MB/s (E07 format)	360 MB/s (E08 format) 250 MB/s (E07 format)	250 MB/s (E07 format)

Performance parameter	TS1160 tape drive	TS1155 tape drive	TS1150 tape drive	TS1140 tape drive
Compressed sustained data rate (at maximum compression)	900 MB/s (60F format) ³	750 MB/s (55F format) ²	750 MB/s (E08 format)	650 MB/s (E07 format)
	750 MB/s (55F format) ²	750 MB/s (E08 format)	650 MB/s (E07 format)	
	750 MB/s (E08 format)	650 MB/s (E07 format)		
	650 MB/s (E07 format)			
Burst data rate for Fibre Channel devices	1,600 MB/s	800 MB/s	800 MB/s	800 MB/s
Load-to-ready time				
- Initialized tape	12 seconds	12 seconds	12 seconds	15 seconds
- Uninitialized tape	210 seconds	210 seconds	210 seconds	26 seconds
Unload time: JE/JV/JM cartridge type				
- Tape not moved away from BOT during this mount	31 seconds	N/A	N/A	N/A
- Tape has been moved away from BOT during this mount	107 to 172 ⁴ seconds	N/A	N/A	N/A
Unload time: JD/JZ/JL cartridge type				
- Tape not moved away from BOT during this mount	31 seconds	31 seconds	31 seconds	N/A
- Tape has been moved away from BOT during this mount	102 to 171 ⁴ seconds	102 to 171 ⁴ seconds	102 to 171 ⁴ seconds	N/A
Unload time: JC/JY/JK cartridge type				
- With no encryption delay	36 seconds	36 seconds	36 seconds	36 seconds
- With delay to write wrapped key	44 seconds	44 seconds	44 seconds	44 seconds
Unload time: JB/JX cartridge type				
- With no encryption delay	N/A	N/A	N/A	24 seconds
- With delay to write wrapped key	N/A	N/A	N/A	31 seconds
Notes:				
<ol style="list-style-type: none"> All sustained data rates are dependent on the entire data path (from data source to host system to tape drive). By using the built-in data-compression capability of the tape drives, you can achieve greater data rates than the native data transfer rate. However, the actual throughput is a function of many components, such as the host system processor, disk data rate, block size, data compression ratio, interconnect, and system or application software. The 55F format is the native format for the 3592 Model 55F and 55E. The 60F format is the native format for the 3592 Model 60F, 60E, and 60S. The amount of time added depends on the characteristics of how the tape has been used during the current mount. Prior to D3I5_44F and D3I4_916 the unload time was 284 seconds, even if the tape had not moved away from BOT. 				

Rewind times for 3592 tape drives

Rewind times for 3592 tape drives.

Table 1. Rewind times for 3592 tape drives

Cartridge type	Rewind time	Capacity setting	TS1160 tape drive	TS1155 tape drive	TS1150 tape drive	TS1140 tape drive
JB/JX	Maximum	Full, unscaled capacity (100%)	N/A	N/A	N/A	72 seconds
		Scaled capacity with 0x35 setting (20%)	N/A	N/A	N/A	24 seconds
	Average	Full, unscaled capacity (100%)	N/A	N/A	N/A	38 seconds
		Scaled capacity with 0x35 setting (20%)	N/A	N/A	N/A	15 seconds
JC/JY	Maximum	Full, unscaled capacity (100%)	76 seconds	76 seconds	76 seconds	76 seconds
		Scaled capacity with 0x35 setting (20%)	26 seconds	26 seconds	26 seconds	26 seconds
	Average	Full, unscaled capacity (100%)	42 seconds	42 seconds	42 seconds	42 seconds
		Scaled capacity with 0x35 setting (20%)	17 seconds	17 seconds	17 seconds	17 seconds
JD/JZ	Maximum	Full, unscaled capacity (100%)	94 seconds	94 seconds	94 seconds	N/A
		Scaled capacity with 0x35 setting (20%)	34 seconds	34 seconds	34 seconds	N/A
	Average	Full, unscaled capacity (100%)	50 seconds	50 seconds	50 seconds	N/A
		Scaled capacity with 0x35 setting (20%)	20 seconds	20 seconds	20 seconds	N/A
JE/JV	Maximum	Full, unscaled capacity (100%)	94 seconds	N/A	N/A	N/A
		Scaled capacity with 0x35 setting (20%)	34 seconds	N/A	N/A	N/A
	Average	Full, unscaled capacity (100%)	50 seconds	N/A	N/A	N/A
		Scaled capacity with 0x35 setting (20%)	20 seconds	N/A	N/A	N/A
JK	Maximum	Advanced Type C economy, short length	18 seconds	18 seconds	18 seconds	18 seconds
	Average	Advanced Type C economy, short length	11 seconds	11 seconds	11 seconds	11 seconds
JL	Maximum	Advanced Type D economy, short length	34 seconds	34 seconds	34 seconds	N/A
	Average	Advanced Type D economy, short length	20 seconds	20 seconds	20 seconds	N/A
JM	Maximum	Advanced Type E economy, short length	34 seconds	N/A	N/A	N/A
	Average	Advanced Type E economy, short length	20 seconds	N/A	N/A	N/A

Average block locate time from load point for 3592 tape drives

Average block locate time from load point for 3592 tape drives

Table 1. Average block locate time from load point for a 3592 tape cartridge in a 3592 tape drive

Cartridge	Setting	Average block locate time from load point ¹
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Cartridge	Setting	TS1160 tape drive	TS1155 tape drive	TS1150 tape drive	TS1140 tape drive
		TS1160 tape drive	TS1155 tape drive	TS1150 tape drive	TS1140 tape drive
JB	Full, unscaled capacity (100%)	N/A	N/A	N/A	37 seconds
	Scaled capacity with 0x35 setting (20%)	N/A	N/A	N/A	15 seconds
JC	Full, unscaled capacity (100%)	40 seconds	40 seconds	40 seconds	40 seconds
	Scaled capacity with 0x35 setting (20%)	12 seconds	12 seconds	12 seconds	12 seconds
JD	Full, unscaled capacity (100%)	45 seconds	45 seconds	45 seconds	N/A
	Scaled capacity with 0x35 setting (20%)	13 seconds	13 seconds	13 seconds	N/A
JE	Full, unscaled capacity (100%)	45 seconds	N/A	N/A	N/A
	Scaled capacity with 0x35 setting (20%)	13 seconds	N/A	N/A	N/A
JK	Advanced Type C economy	11 seconds	11 seconds	11 seconds	11 seconds
JL	Advanced Type D economy	13 seconds	13 seconds	13 seconds	N/A
JM	Advanced Type E economy	13 seconds	N/A	N/A	N/A
JV	Full, unscaled capacity (100%)	45 seconds	N/A	N/A	N/A
JX	Full, unscaled capacity (100%)	N/A	N/A	N/A	37 seconds
JY	Full, unscaled capacity (100%)	40 seconds	40 seconds	40 seconds	40 seconds
JZ	Full, unscaled capacity (100%)	45 seconds	45 seconds	45 seconds	N/A

Notes:

- For an encrypted format, an additional 5 seconds might be required to obtain an encryption key to read the first block accessed on the cartridge.

For further information about data types supported by 3592 tape drives, see [Table 1](#). For further information about the capacity of each type of 3592 tape cartridge, see [Table 1](#).

Drive addresses

Tape drives are assigned two addresses – a physical address that indicates the drive's location in the library and a logical address that indicates the drive's location to the SCSI interface.

- **Physical addresses**
The TS4500 tape library assigns each tape drive a unique address to indicate its physical location.
- **Logical addresses**
The tape library assigns each drive a SCSI element address that defines a logical location in the library to the SCSI interface.

Physical addresses

The TS4500 tape library assigns each tape drive a unique address to indicate its physical location.

The physical address of each drive is displayed in the Location column of the Drives table in the management GUI. This column is displayed by default.

The physical address consists of three values:

Frame number

Represented as **Fx**, where **F** equals the frame and **x** equals its number. The leftmost frame in the library is always F1, regardless of whether it is a base frame or not. The frame numbers increment by one for each frame to the right of frame 1.

Column number

Represented as **Cy**, where **C** equals the column and **y** equals its number. Columns 1 - 4 are available for drives.

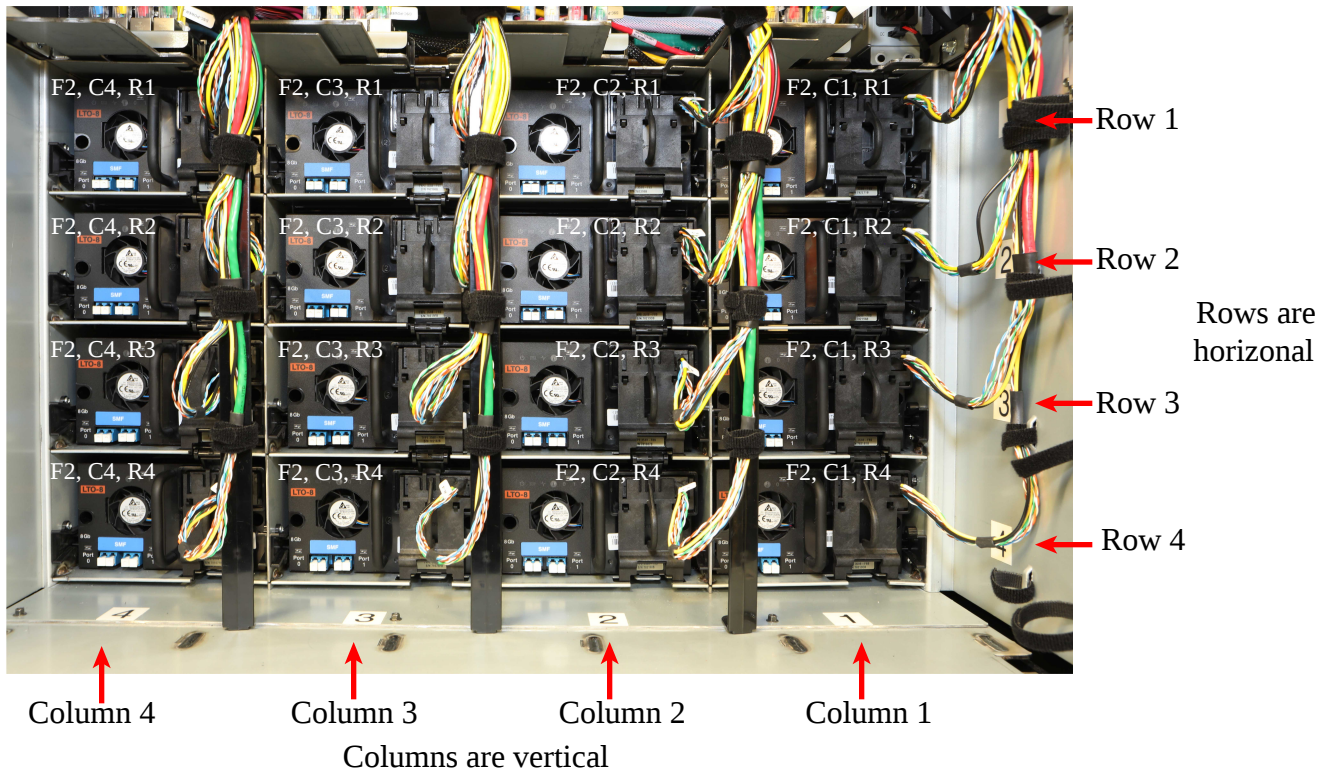
Exceptions: If the frame is in position 1 (the leftmost frame of a single accessor library), only columns 2 - 4 are available for drives.

If the frame is in position 1 of a dual accessor library, only column 4 is available for drives. In addition, only columns 1, and 2 in the rightmost frame of a dual accessor library are available for drives.

Row number

Represented as **Rz**, where **R** equals the row and **z** equals its number. Rows 1 - 4 are available for drives. Regardless of whether drives are installed, the row numbering is the same for every frame.

The example below shows the physical addressing for the drives in Frame 2 (F2).



Related information

- [Drives](#)

Logical addresses

The tape library assigns each drive a SCSI element address that defines a logical location in the library to the SCSI interface.

The logical address of each drive is displayed in the Element Address column of the Drives table in the management GUI. This column is hidden by default.

The logical address is represented 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 location of the drive; it does not vary based on other drives in the library.

Control path drives

A control path is the path for SCSI Medium Changer commands sent by a server to control a specific logical library. The TS4500 tape library has no direct SCSI connection to a server. When a server communicates with the library, it sends the communication by way of an LTO or 3592 tape drive. The tape drive is designated as a control path.

Methods of cleaning drives

Automatic cleaning of tape drives is enabled by default. However, it is also possible to initiate manual or host cleaning.

Notes:

- It is the operator's responsibility to monitor cleaning cartridge usage.
- Automatic cleaning is always enabled with the Advanced Library Management System (ALMS).

The head of every tape drive in the tape library must be kept clean to prevent errors that are caused by contamination. To help you keep the drives clean, IBM provides a cleaning cartridge with the library. Whenever a drive determines that it needs to be cleaned, it alerts you with a message on the library's display or host console. The library uses the cleaning cartridge to clean the drive with whatever cleaning method that you choose. In all methods, cleaning is performed after the data cartridge is unloaded from the drive and before the next load.

It is the operator's responsibility to monitor cleaning cartridge usage and replace cleaning cartridges as necessary. The tape library provides multiple ways to monitor and manage cleaning cartridges. If SNMP traps are enabled, a trap is generated when a cleaning cartridge expires. It is also possible to use the TS4500 management GUI to monitor the cleaning cycles that remain on a cleaning cartridge and to enable a setting that automatically ejects expired cleaning cartridges.

Three methods of cleaning are available:

Automatic cleaning

Automatic cleaning enables the library to automatically respond to any tape drive's request for cleaning and to begin the cleaning process. The cleaning process is transparent to any host application that uses the library. Automatic cleaning is required and cannot be disabled.

Manual cleaning

Manual cleaning requires that you select a menu option from the TS4500 management GUI to clean one or more of the tape drives. Manual cleaning is always supported.

Host cleaning

Host cleaning enables the backup application to define and control the cleaning process. Automatic and manual cleaning utilize the CLNxxx VOLSER. Host-based cleaning uses a cartridge defined within the backup application, which can have a non-CLNxxx VOLSER, to clean drives. For more information, see the section about cleaning in your application software's documentation.

Mixed drives in a logical library

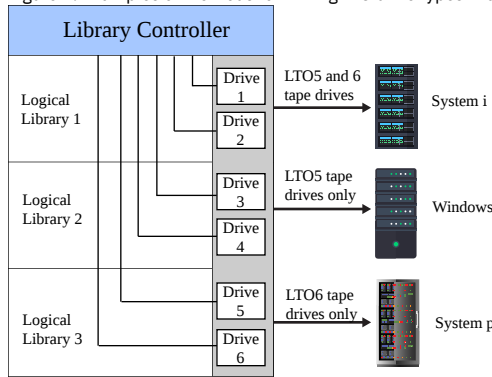
The TS4500 tape library supports several combinations of drives, with certain limitations.

The TS4500 tape library supports a mixture of LTO drive types in a logical library. However, the tape library does not support a mixture of LTO and 3592 tape drives in a logical library. Some independent software vendors (ISVs) support mixed drive types within logical libraries; others do not. Some ISVs that support mixed drive types do so with restrictions. For details, contact your ISV.

If the ISV support does not exist or does not meet your requirements, the TS4500 tape library provides another option to protect your investment by partitioning the tape drives into separate logical libraries. You can customize the partition to any number of slots by using menus.

[Figure 1](#) shows examples of methods for mixing LTO drive types in a logical library.

Figure 1. Examples of methods for mixing LTO drive types in a logical library



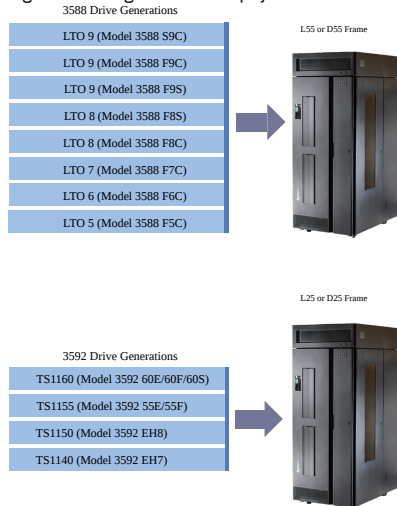
Mixed drives in frames

You can mix drive models within a drive type in a TS4500 tape library frame. Different drive types such as, LTO and JAG cannot be mixed.

[Figure 1](#) summarizes compatible drive combinations

Note: No drives are installed in the storage-only frames (models S25 and S55).

Figure 1. Mixing drives in the physical frames of the TS4500 tape library



Mixed media in drives

Not all cartridges that are supported by the TS4500 tape library are compatible with all drives. LTO cartridges are not supported by 3592 tape drives, and 3592 tape cartridges are not supported by LTO drives.

When labeled according to IBM bar code label specifications, the last character of the volume serial (VOLSER) number of an LTO cartridge indicates the first drive generation that supports the media. For example:

- 000764L9 is an LTO 9 cartridge
- 000764L8 is an LTO 8 cartridge
- 000764M8 is an LTO M8 cartridge
- 000764L7 is an LTO 7 cartridge
- 000764L6 is an LTO 6 cartridge
- 000764L5 is an LTO 5 cartridge

On a 3592 tape cartridge, the IBM® product label represents whether it is a read/write (R/W) cartridge or a write-once-read-many (WORM) cartridge. In addition, the last 2 characters of the VOLSER indicate the media type.

Note: Each bar code must be unique across the entire physical library.

- [Cartridges that are compatible with LTO tape drives](#)
- [Cartridges that are compatible with 3592 tape drives](#)

Cartridges that are compatible with LTO tape drives

[Table 1](#) summarizes the cartridges that are compatible with the LTO tape drives that are supported by the tape library.

Table 1. Cartridges that are compatible with LTO tape drives

Cartridge type	Drive type ¹				
	LTO 9	LTO 8	LTO 7	LTO 6	LTO 5
18 TB LTO 9 Data Cartridge (xxxxxL9)	R/W	Not compatible	Not compatible	Not compatible	Not compatible
18 TB LTO 9 Data Cartridge (xxxxxLZ)	R/W	Not compatible	Not compatible	Not compatible	Not compatible
12 TB LTO 8 Data Cartridge (xxxxxL8)	R/W	R/W	Not compatible	Not compatible	Not compatible
12 TB LTO 8 WORM Cartridge (xxxxxLY)	R/W	R/W	Not compatible	Not compatible	Not compatible
9 TB LTO M8 Data Cartridge (xxxxxxM8) ²	Not compatible	R/W	Not compatible	Not compatible	Not compatible
6 TB LTO 7 Data Cartridge (xxxxxL7)	Not compatible	R/W	R/W	Not compatible	Not compatible
6 TB LTO 7 WORM Cartridge (xxxxxLX)	Not compatible	R/W	R/W	Not compatible	Not compatible
2.5 TB LTO 6 Data Cartridge (xxxxxL6)	Not compatible	Not compatible	R/W	R/W	Not compatible
2.5 TB LTO 6 WORM Cartridge (xxxxxLW)	Not compatible	Not compatible	R/W	R/W	Not compatible
1.5 TB LTO 5 Data Cartridge (xxxxxL5)	Not compatible	Not compatible	Read only	R/W	R/W
1.5 TB LTO 5 WORM Cartridge (xxxxxLV)	Not compatible	Not compatible	Read only	R/W	R/W
800 GB LTO 4 Data Cartridge (xxxxxL4)	Not compatible	Not compatible	Not compatible	Read only	R/W
800 GB LTO 4 WORM Cartridge (xxxxxLU)	Not compatible	Not compatible	Not compatible	Read only	R/W
400 GB LTO 3 Data Cartridge (xxxxxL3)	Not compatible	Not compatible	Not compatible	Not compatible	Read only
400 GB LTO 3 WORM Cartridge (xxxxxLT)	Not compatible	Not compatible	Not compatible	Not compatible	Read only

Notes:

1. The drive rejects any command to load unsupported media and returns a sense key of 3 and an extra sense code/additional sense code qualifier of 30/01.
2. Uninitialized M8 media and preinitialized M8 media are both supported with a minimum LTO 8 tape drive firmware level of HB82 and a minimum library firmware level 1.4.1.2. The usage of M8 media with prior firmware levels may result in a permanent reduction in the capacity of the M8 media from 9 TB to 6 TB (native).

Cartridges that are compatible with 3592 tape drives

[Table 1](#) summarizes the cartridges that are compatible with the 3592 tape drives that are supported by the tape library.

- (-) Not supported
- (RW) Read Write
- (RO) Read Only

Table 1. Cartridges that are compatible with 3592 tape drives

Media	Recording format	TS1160 tape drive		TS1155 tape drive		TS1150 tape drive		TS1140 tape drive	
		Encryption enabled	Encryption not enabled	Encryption enabled	Encryption not enabled	Encryption enabled	Encryption not enabled	Encryption enabled	Encryption not enabled
JE, JM, JV ¹	Encrypted 60F	RW	Reformat	-	-	-	-	-	-
	60F	RW	RW	-	-	-	-	-	-
JD, JL, JZ ¹	Encrypted 55F	RW	Reformat	RW	Reformat	-	-	-	-
	55F	RW	RW	RW	RW	-	-	-	-
	Encrypted E08	RW	Reformat	RW	Reformat	RW	Reformat	-	-
	E08	RW	RW	RW	RW	RW	RW	-	-
JC, JK, JY ¹	Encrypted E08	RW	Reformat	RW	Reformat	RW	Reformat	-	-
	E08	RW	RW	RW	RW	RW	RW	-	-
	Encrypted E07	RO	Reformat	RO	Reformat	RW	Reformat	RW	Reformat

Media	Recording format	TS1160 tape drive		TS1155 tape drive		TS1150 tape drive		TS1140 tape drive	
		Encryption enabled	Encryption not enabled	Encryption enabled	Encryption not enabled	Encryption enabled	Encryption not enabled	Encryption enabled	Encryption not enabled
	E07	RO	RO	RO	RO	RW	RW	RW	RW
JB, JX ¹	Encrypted E07	-	-	-	-	-	-	RW	Reform
	E07	-	-	-	-	-	-	RW	RW
	Encrypted E06	-	-	-	-	-	-	RW	Reform
	E06	-	-	-	-	-	-	RW	RW
	Encrypted E05	-	-	-	-	-	-	RO	Reform
	E05	-	-	-	-	-	-	RO	RO
JA	Encrypted E06	-	-	-	-	-	-	RO	Reform
	E06	-	-	-	-	-	-	RO	RO
	Encrypted E05	-	-	-	-	-	-	RO	Reform
	E05	-	-	-	-	-	-	RO	RO
	J1A	-	-	-	-	-	-	RO	RO

Notes:

1. WORM tapes can be reformatted only if they are initialized and labeled. If data exists on the tape, reformatting is not allowed.

Tape cartridges

Libraries that are installed with LTO tape drives use LTO tape cartridges. Libraries that are installed with 3592 tape drives use 3592 tape cartridges.

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

Mixed media configurations are supported, meaning that a tape library can contain a mix of 3592 and LTO tape cartridges. Certain restrictions apply to the use of tape cartridges with drives. For more information about media and drive compatibility, refer to the topic *Mixing media in drives* in the **Related information** section.

- [Tape cartridge types](#)
The TS4500 tape library supports data or scratch cartridges, cleaning cartridges, and diagnostic/CE cartridges.
- [Capacity of supported LTO tape cartridges](#)
Libraries that are installed with LTO tape drives use LTO tape cartridges.
- [Capacity of supported 3592 tape cartridges](#)
Libraries that are installed with 3592 tape drives use 3592 tape cartridges.
- [Automatic media verification](#)
The TS4500 tape library supports policy-based automatic media verification to verify that your tape cartridges are readable.

Related information

- [Mixed media in drives](#)
- [Overview of LTO tape drive media](#)
- [Overview of 3592 tape drive media](#)

Tape cartridge types

The TS4500 tape library supports data or scratch cartridges, cleaning cartridges, and diagnostic/CE cartridges.

Data or scratch cartridge

A tape cartridge that is designed to receive information that is recorded to it by a tape drive. A scratch cartridge is a data cartridge whose tape no longer contains useful information and can be overwritten. To ensure that your tape library conforms to IBM®'s specifications for reliability, use only IBM LTO data cartridges in LTO tape drives and IBM 3592 tape cartridge in 3592 tape drives. You can use other LTO- or 3592-certified media, but they might not meet the standards of reliability that are established by IBM. If you are using mixed drive types, place only LTO tape cartridges into LTO frames; similarly, place 3592 tape cartridges into 3592 frames.

Cleaning cartridge

A tape cartridge that is used by the library to clean the heads of its tape drives. Use only the IBM LTO cleaning cartridge or an IBM-approved cleaning cartridge to clean an LTO tape drive. Use only the IBM 3592 cleaning cartridge or an IBM-approved cleaning cartridge to clean a 3592 tape drive. After you insert cleaning cartridges, they remain unassigned. You cannot assign them to a particular logical library, since they belong to the entire library.

Cleaning cartridges are identified by a volume serial (VOLSER) number that begins with a prefix of **CLN** for LTO and 3592 cleaning cartridges.

LTO diagnostic or 3592 CE cartridge

A tape cartridge used by an IBM Service Representative to service the tape library. The cartridge is installed when the library is installed – one for each type of drive used in the library (LTO and/or 3592).

Capacity of supported LTO tape cartridges

Libraries that are installed with LTO tape drives use LTO tape cartridges.

[Table 1](#) shows the capacity of supported LTO tape cartridges.

Table 1. Capacity of supported LTO tape cartridges

Supported tape cartridges	Native capacity	Compressed capacity ^{1, 2}
18 TB LTO 9 Data Cartridge (xxxxxxL9)	18 TB (16.37 TiB)	45 TB (40.92 TiB)
18 TB LTO 9 Data WORM Cartridge (xxxxxxLZ)	18 TB (16.37 TiB)	45 TB (40.92 TiB)
12 TB LTO 8 Data Cartridge (xxxxxxL8)	12 TB (10.91 TiB)	30 TB (27.93 TiB)
12 TB LTO 8 WORM Cartridge (xxxxxxLY)	12 TB (10.91 TiB)	30 TB (27.93 TiB)
9 TB LTO M8 Data Cartridge (xxxxxxM8) ³	9 TB (8.18 TiB)	22.5 TB (20.46 TiB)
6 TB LTO 7 Data Cartridge (xxxxxxL7)	6 TB (5.45 TiB)	15 TB (13.32 TiB)
6 TB LTO 7 WORM Cartridge (xxxxxxLX)	6 TB (5.45 TiB)	15 TB (13.32 TiB)
2.5 TB LTO 6 Data Cartridge (xxxxxxL6)	2.5 TB (2.27 TiB)	6.25 TB (5.68 TiB)
2.5 TB LTO 6 WORM Cartridge (xxxxxxLW)	2.5 TB (2.27 TiB)	6.25 TB (5.68 TiB)
1.5 TB LTO 5 Data Cartridge (xxxxxxL5)	1.5 TB (1.36 TiB)	3 TB (2.73 TiB)
1.5 TB LTO 5 WORM Cartridge (xxxxxxLV)	1.5 TB (1.36 TiB)	3 TB (2.73 TiB)
800 GB LTO 4 Data Cartridge (xxxxxxL4)	800 GB (745.06 GiB)	1600 GB (1490.12 GiB)
800 GB LTO 4 WORM Cartridge (xxxxxxLU)	800 GB (745.06 GiB)	1600 GB (1490.12 GiB)
400 GB LTO 3 Data Cartridge (xxxxxxL3)	400 GB (372.53 GiB)	800 GB (745.06 GiB)
400 GB LTO 3 WORM Cartridge (xxxxxxLT)	400 GB (372.53 GiB)	800 GB (745.06 GiB)

Notes:

1. The compressed capacity for the LTO 6, LTO 7, LTO 8, and LTO 9 cartridges uses a 2.5:1 compression ratio.
2. The compressed capacity for the LTO 3, LTO 4, and LTO 5 cartridges use a 2:1 compression ratio.
3. Uninitialized M8 media and preinitialized M8 media are both supported with a minimum LTO 8 tape drive firmware level of HB82 and a minimum library firmware level 1.4.1.2. The usage of M8 media with prior firmware levels may result in a permanent reduction in the capacity of the M8 media from 9 TB to 6 TB (native).

Related information

- [Mixed media in drives](#)
- [Overview of LTO tape drive media](#)

Capacity of supported 3592 tape cartridges

Libraries that are installed with 3592 tape drives use 3592 tape cartridges.

[Table 1](#) shows the capacity of supported 3592 tape cartridges.

Table 1. Capacity of supported 3592 tape cartridges

3592 tape cartridge	Cartridge type	Native capacity	Compressed capacity (compression ratio 3:1)
60F tape drive format	JE, JV ¹	20 TB (18.19 TiB)	60 TB (54.57 TiB)
	JM	5 TB (4.55 TiB)	15 TB (13.64 TiB)
	JD, JZ ¹	15 TB (13.64 TiB)	45 TB (40.2 TiB)
	JL	3 TB (2.72 TiB)	9 TB (8.18 TiB)
	JC, JY ¹	7 TB (6.37 TiB)	21 TB (19.1 TiB)
	JK	1.3 TB (1.18 TiB)	3.9 TB (3.54 TiB)
55F tape drive format	JD, JZ ¹	15 TB (13.64 TiB)	45 TB (40.93 TiB)
	JL	3 TB (2.73 TiB)	9 TB (8.19 TiB)
	JC, JY ¹	7 TB (6.37 TiB)	21 TB (19.1 TiB)
	JK	900 GB (838.19 GiB)	2.7 TB (2.46 TiB)
E08 tape drive format	JD, JZ ¹	10 TB (9.1 TiB)	30 TB (27.3 TiB)
	JL	2 TB (1.82 TiB)	6 TB (5.46 TiB)
	JC, JY ¹	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	JC, JY ¹	4 TB (3.64 TiB)	12 TB (10.91 TiB)
	JB, JX ¹	1.6 TB (1.46 TiB)	4.8 TB (4.37 TiB)
	JK	500 GB (465.66 GiB)	1.5 TB (1.36 TiB)

Notes:

1. Write-once-read-many (WORM) cartridge type.

Related information

- [Mixed media in drives](#)
- [Overview of 3592 tape drive media](#)

Automatic media verification

The TS4500 tape library supports policy-based automatic media verification to verify that your tape cartridges are readable.

The verification process is controlled at the logical library level. Media verification is set up to run automatically on a set date, but you can verify individual cartridges before the set date. Logical libraries that use AME or SME encryption cannot use media verification.

You can set the recurring schedule for media verification by day, months, or years. Cartridges that are in the process of verification are still available for media access. If the library receives a request for information on a cartridge that is being verified, the verification is suspended and the cartridge is released to fill the request. When the cartridge is no longer needed, verification is resumed.

The move and eject actions are disabled for cartridges in the verification process. You have to first stop the verification process before you can move or eject a cartridge that is being verified.

Enabling Media Verification

The first step to using media verification is selecting at least one tape drive in your library as a media verification drive. You should have at least two drives to ensure that there are no false positives due to a faulty tape drive. Tapes that fail verification are retried on the second drive, if available, before they are reported as faulty.

Once you selected the verification drives, go to the Cartridges by Logical Libraries page in the management GUI. Right-click on the logical library to enable media verification and set the verification schedule.

When media verification is enabled on a logical library for the first time, all the cartridges become due for verification on the same date. The initial queue for media verification might take up to several months to be established. This depends on the number of cartridges, how full they are, and the number of media verification drives. Once a cartridge is verified, the next verification date is based on the time period set in the verification policy.

Related information

- [Table 6](#)

Elastic capacity

In a dual-accessor configuration, the TS4500 tape library contains limited access columns that you can use for special situations. You can use these columns to store least recently used data cartridges, or as a temporary overflow area. The use of the limited access columns (Elastic Capacity) allows dual-accessor customers to achieve the same storage capacity as if the library was single accessor.

Elastic Capacity Settings

Go to Settings > Library > Advanced in the TS4500 tape library GUI to modify the Elastic Capacity settings. Choose one of the three options for Elastic Capacity.

Use for maximum capacity

Use this setting to store media cartridges in the limited access (Elastic Capacity) columns. When the dual-access area (the cartridge slots that both A and B accessors can reach) exceeds the usage threshold, the least recently used cartridges are move into the Elastic Capacity area. The default usage threshold is 98%.

Use for temporary overflow

Use this setting to temporarily store media cartridges in the limited access (Elastic Capacity) columns. When the dual-access area is 100% full, new cartridges that are imported from the I/O stations are moved to the Elastic Capacity areas.

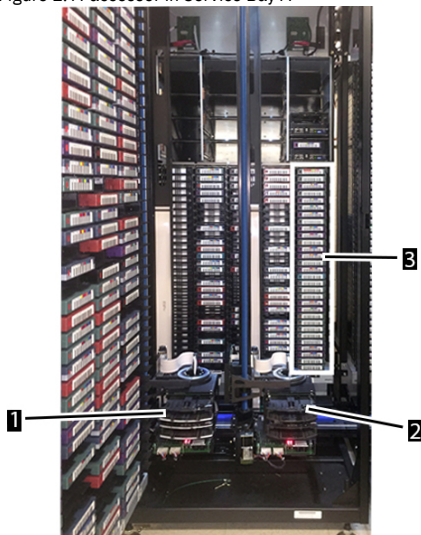
Do not use

Choose this setting if you do not want any media cartridges stored in the Elastic Capacity areas.

Limited Access

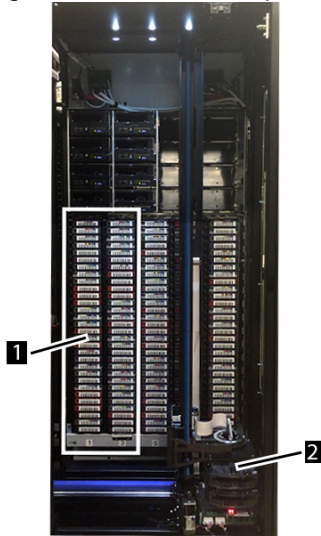
The Elastic Capacity slots are limited access when an accessor is placed in service. When the A accessor is in the Integrated Service Bay A (see 1 in [Figure 1](#)), the B accessor cannot reach columns 3-8 in that frame. The only cartridges the B accessor can access are in column 9 (see 3 in [Figure 1](#)) and column 10 on the door-side.

Figure 1. A-accessor in Service Bay A



When the B accessor is in the Integrated Service Bay B (See 2 in [Figure 2](#)), the A accessor cannot reach columns 5-10 in that frame. The only cartridges the A accessor can reach are in columns 1, 3 1 and door-side columns 2 and 4.

Figure 2. B-accessor in Service Bay B



Cartridge Movement

The movement of cartridges into the Elastic Capacity area is automated by the library firmware. The movement of cartridges from the Elastic Capacity area is not automated by the library firmware - that movement occurs when requested by the application, GUI, or CLI.

TS7700 backend switch support

A TS4500 tape library can be connected to a TS7700 system using two 16 Gb fibre channel switches. The switches can be installed in the bottom of the TS4500 frame, or in a TR1 rack mounted above the TS4500.

Supported device drivers

IBM® provides device driver support for the LTO and 3592 tape drives, and the robotics in the TS4500 tape library.

IBM maintains the current levels of device drivers and driver documentation on [Fix Central](#). Follow these steps to access this material.

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

Refer to the [IBM Tape Device Drivers Installation and User's Guide](#) for more information.

- **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.

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 TS4500 tape libraries as a single library image.
 - The libraries can be separate (at SAN distances)
- 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 TS4500 tape library.

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

Compatible servers and software

The TS4500 tape library is supported by a wide variety of servers, operating systems, and adapters. There are several ways to determine the servers and software that support the TS4500 tape library.

These attachments can change throughout the lifecycle of the product. To determine the current list of compatibility components, perform one of the following actions:

- Visit the web:
 - For a list of compatible software, operating systems, and servers for LTO and 3592 tape drives, download the [Independent Software Vendor \(ISV\) Matrix](#) from the [TS4500 Tape Library](#) web page.
 - For complete IBM® storage interoperability information for the TS4500 tape library in a storage area network (SAN) configuration, refer to the [IBM System Storage Interoperation Center \(SSIC\)](#). The SSIC has details on supported operating systems, servers, switches, and adapters.
- Contact your IBM sales representative.

Notes:

1. IBM does not provide application software with the TS4500 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, contact your software vendor for a matrix of compatible hardware, software, firmware revisions, and adapter cards.

Attachment interfaces

The TS4500 tape library uses the Fibre Channel interface for data transmission with attached tape drives and the Gigabit Ethernet interface for library communications.

The TS4500 tape library supports the Fibre Channel interface and the following device types:

- SCSI Medium Changer Device (tape library)
- SCSI Sequential Access Device (tape drive)

The Gigabit Ethernet interface is supported in either auto negotiation or fixed modes of 10 Mbps, 100 Mbps, and 1 Gbps using half or full duplex. The following TCP/IP protocols are supported:

IPv4 and IPv6 support

The TS4500 tape library supports internet protocol (IP) addresses in both IPv4 and IPv6 format. Both the TS4500 integrated management console (IMC) and the TS4500 management GUI 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.

Simple Network Management Protocol (SNMP)

SNMP traps are supported for drive and library events. SNMP management query functionality is supported by using a standard Management Information Base (MIB).

Hyper Text Transfer Protocol (HTTP)

An embedded web server provides a web user interface for library management and query capabilities.

Secure Socket Layer (SSL)

The TS4500 tape library supports SSL, a protocol for transmitting private documents through the internet.

Proprietary command set for communicating with the IBM® Encryption Key Manager or IBM Security Lifecycle Key Manager (formerly the Tivoli® Key Lifecycle Manager)

Simple Mail Transfer Protocol (SMTP)

The TS4500 tape library supports SMTP for sending email alerts.

Network Time Protocol (NTP)

The TS4500 tape library supports NTP for external time-and-date synchronization.

Lightweight Directory Access Protocol (LDAP)

The TS4500 tape library supports LDAP for centralized authentication.

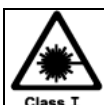
Domain Name System (DNS)

The TS4500 tape library supports DNS for flexible IP addressing.

- [Fibre Channel interface](#)
Several information resources are available to help users of drives that use a Fibre Channel interface.

Fibre Channel interface

Several information resources are available to help users of drives that use a Fibre Channel interface.



Attention: This product contains an assembly that complies with the performance standards set by the United States Food and Drug Administration for a Class One Laser Product. This laser assembly is registered with the Department of Health and Human Services and is in compliance with IEC825.

For drives that use a Fibre Channel interface, the following information is available:

- For a list of compatible software, operating systems, and servers for LTO and 3592 tape drives, download the [Independent Software Vendor \(ISV\) Matrix](#) from the [TS4500 Tape Library](#) web page.
- For complete IBM® storage interoperability information for the TS4500 tape library in a storage area network (SAN) configuration, refer to the [IBM System Storage Interoperation Center \(SSIC\)](#). The SSIC has details on supported operating systems, servers, switches, and adapters.

Fibre Channel technology combines the best features of traditional input/output interfaces with the best features of networking interfaces. The technology offers a transport mechanism for delivering commands, and provides high performance by allowing processing to be done in the hardware.

You can establish Fibre Channel connections between Fibre Channel ports that are in the tape library, one or more servers, and the connecting network. The network can consist of such elements as switches, hubs, bridges, and repeaters.

Library sharing

The tape library can be configured into one or more logical libraries that can be shared by multiple applications.

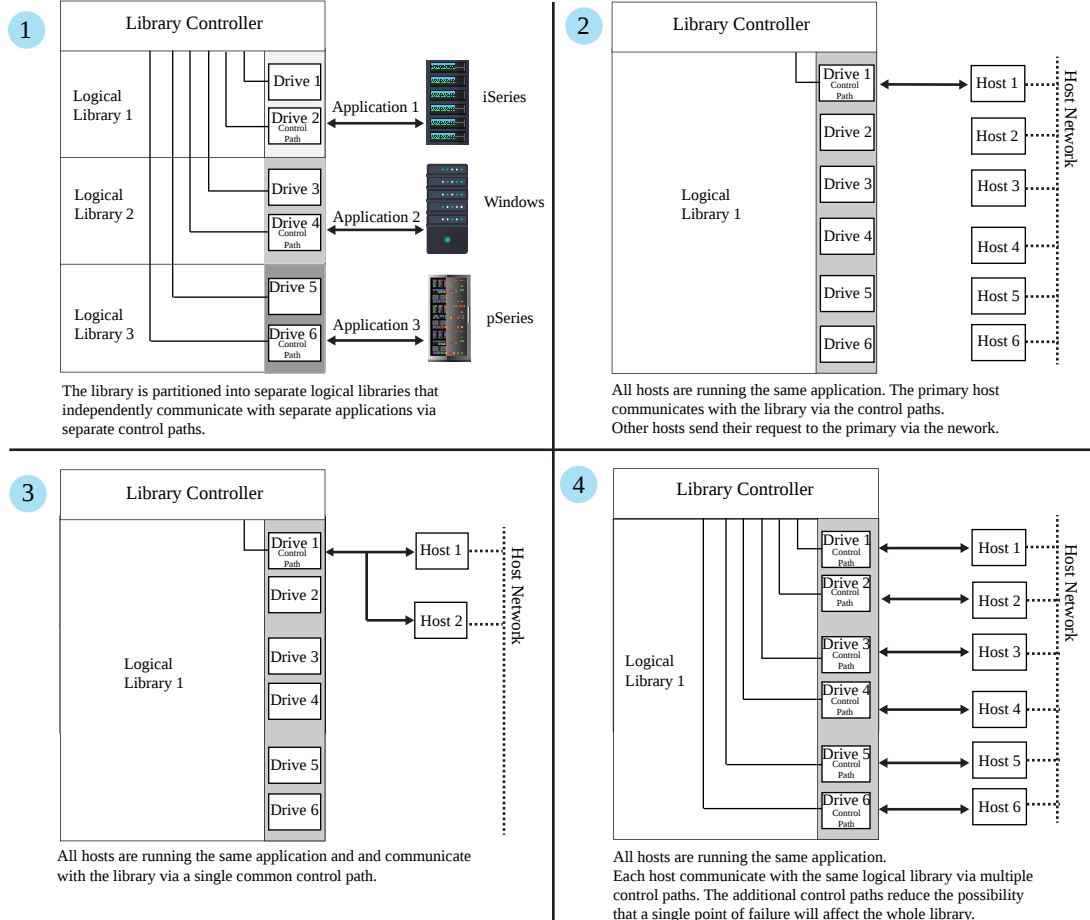
The guided setup for the tape library allows a single application to operate the library. Often, however, it is advantageous to be able to share a single library between heterogeneous or homogeneous applications. Some applications (and some servers) do not allow for sharing a library between systems. With the tape library, however, you can create configurations that enable the library to process commands from multiple heterogeneous applications (such as an IBM® System p application and a Windows application) and multiple homogeneous applications (for example, the same application run by several System p servers).

Use the management GUI to perform the following actions:

- Configure the library so that it is partitioned into separate logical libraries that independently communicate with separate applications through separate control paths. This configuration (see example 1 in [Figure 1](#)) requires no special capabilities from the server or application.
- Configure any single logical library (including the entire physical library) so that it is shared by two or more servers that are running the same application. Depending on the capabilities of the server and application, there are several ways to set up this type of configuration. Three typical ways include:
 - Configuring one server (mainframe host) to communicate with the library through a single control path; all other servers send requests to that server through a network (see example 2 in [Figure 1](#)). This configuration is used by Tivoli® Storage Manager (TSM).
 - Configuring all of the servers to communicate with the library through a single, common control path (see example 3 in [Figure 1](#)). This configuration is used in high-availability environments such as High-Availability Cluster Multi-Processing (HACMP) from IBM and Systems Management Server and Clustered Server Environments from Microsoft. Multi-initiator configurations are only supported by certain adapters and independent software vendors (ISVs). Check with your ISV.
 - Configuring a single logical library to communicate with multiple servers through multiple control paths. This configuration (see example 4 in [Figure 1](#)) requires that you add control paths. It is used by Backup, Recovery, and Media Services.

Your library configuration is not limited to the examples shown in [Figure 1](#). Many configurations are possible, and you can design them according to your business needs.

Figure 1. Examples of configurations for sharing the tape library. Lines from one or more drives to the library controller represent control paths.



- [Multipath architecture](#)
The multipath architecture feature of the tape library allows Open Systems applications to share the robotics of the library.
- [Multiple logical libraries](#)
The TS4500 tape library supports multiple libraries to share the physical library between applications, or to support mixed drive types for any application.
- [Multiple control paths](#)
A logical library can have multiple control paths. This enables additional library-sharing configurations and options.

Multipath architecture

The multipath architecture feature of the tape library allows Open Systems applications to share the robotics of the library.

The tape library features storage area network (SAN) ready multipath architecture. This architecture allows homogeneous or heterogeneous Open Systems applications to share the library's robotics without middleware or a dedicated server (host) acting as a library manager. The SAN-ready multipath architecture makes sharing possible by partitioning the library's storage slots and tape drives into logical libraries. Servers can then run separate applications for each logical library. This partitioning capability extends the potential centralization of storage that the SAN enables. Partitioning also provides investment protection if your application does not support the mixing of drive generations and media in the same logical library.

The multipath architecture of the tape library is designed to provide the capability to share the library robotics. The sharing is accomplished first by partitioning the library into as many as 128 logical libraries (up to the number of drives installed). Then, each logical library is assigned its own separate and distinct drives, storage slots, and control paths. Input/output (I/O) slots are shared on a first-come-first-serve basis. This type of partitioning is designed to allow heterogeneous applications to share the library robotics independent of each other. Cartridges under library control are not shared between logical libraries, nor are they allowed to be moved between logical libraries. An example of heterogeneous sharing is a Microsoft Windows application that is using the drive and storage slots of one logical library, while a UNIX application uses the drive and slots of another logical library. Logical libraries can also be used for separating LTO 5 tape drives and cartridges from later LTO or 3592 tape drives and cartridges, for applications that do not support mixing the drives in the same logical library.

Whether partitioned or not, the tape library is certified for SAN solutions (such as LAN-free backup).

The multipath architecture allows for more than one control path to be configured for any one logical library. A control path is a logical path into the library through which a server sends standard SCSI Medium Changer commands to control the logical library. Multiple control paths reduce the possibility of a failure in one control path to cause the entire library to become unavailable. Use of the control path failover feature further reduces that possibility.

Multiple logical libraries

The TS4500 tape library supports multiple libraries to share the physical library between applications, or to support mixed drive types for any application.

You can create multiple logical libraries by partitioning the library's tape drives and tape cartridges into two or more logical libraries. Each logical library consists of:

- Tape drives
- Tape cartridges in storage slots
- Tape cartridges in input/output (I/O) slots

Each logical library has its own control path. A control path is a logical path into the library through which a server sends standard SCSI Medium Changer commands to control the logical library. For frames that contain LTO tape drives and frames that contain 3592 tape drive, each logical library control path is available to servers through logical unit number (LUN) 1 of the first drive that is defined within that logical library. A LUN is a number that is used by a server to identify a drive.

In a TS4500 tape library, a logical library shares empty storage slots, empty I/O slots, and the cartridge accessor on a first-come, first-served basis.

Note: When you are naming logical libraries, developing an enterprise-wide library naming convention leads to easier management of the libraries. With automatic cleaning, cleaning cartridges are shared between logical libraries, so any appropriate cleaning cartridge is used to clean a drive in any configured logical library.

- [Share libraries by using multiple logical libraries](#)
Partition a tape library into multiple logical libraries to enable simultaneous data backup and restore tasks from different applications.
- [Multiple logical libraries for mixed drive types](#)
For applications that do not support mixed drive types and media within the same logical library, the TS4500 tape library can partition the applications.

Share libraries by using multiple logical libraries

Partition a tape library into multiple logical libraries to enable simultaneous data backup and restore tasks from different applications.

You can partition the library so that it processes:

- Commands from Application 1 (about Department A) in Logical Library 1
- Commands from Application 2 (about Department B) in Logical Library 2
- Commands from Application 3 (about Department C) in Logical Library 3

In this configuration, the tape drives and cartridges of each logical library are dedicated to that library and are not shared among other libraries. Commands that are issued by the applications travel to the library through three unique control paths. So, the data processing for Department A is confined to the tape drives and cartridges of Logical Library 1. Processing for Department B is confined to the tape drives and cartridges of Logical Library 2, and so forth.

Multiple logical libraries for mixed drive types

For applications that do not support mixed drive types and media within the same logical library, the TS4500 tape library can partition the applications.

The TS4500 tape library places the applications into multiple logical libraries to keep them separate.

Multiple control paths

A logical library can have multiple control paths. This enables additional library-sharing configurations and options.

Access to the logical library is on a first-come, first-served basis. Each control path for a logical library can accept commands while the library is in use by another control path.

To enable or disable control path drives, use the Drives page of the management GUI.

- [Multiple control paths for IBM i attachment](#)

The use of control paths for IBM® Power Systems running IBM i and the System i®, iSeries, and AS/400 servers is unique. In general, every IBM i, System i, and iSeries input/output processor (IOP) based adapter must "see" the control path that is associated with the drives to which it is connected.

- [Multiple control paths for control path failover](#)

The TS4500 tape library offers an optional control path failover feature.

Multiple control paths for IBM i attachment

The use of control paths for IBM® Power Systems running IBM i and the System i®, iSeries, and AS/400 servers is unique. In general, every IBM i, System i, and iSeries input/output processor (IOP) based adapter must "see" the control path that is associated with the drives to which it is connected.

The following list presents possible scenarios for IOP adapters that recognize the control paths with which they are associated.

- OS/400® V5R1 supports only one drive per IOP-based adapter and every drive requires a control path.
- For OS/400 V5R2 and later, the IOP-based adapter supports multiple drives per adapter, so that only one control path for the group of drives is required.
- For V6R1 and Power® 6 hardware using the IOP-less (Smart IOA), the adapter has two Fibre Channel ports and supports multiple devices per port. At least one control path is required per IOA and per set of drives within a library partition.
- For V7R1 and Power 6 or Power 7 hardware using the IOP-less (Smart IOA), the adapter has two Fibre Channel ports and supports multiple devices per port. At least one control path is required per IOA port and per set of drives within a library partition.

Multiple control paths for control path failover

The TS4500 tape library offers an optional control path failover feature.

The control path failover feature (feature code 1682) enables the host device driver to resend a command to a different control path for the same logical library.

Related information

- [Control path failover, data path failover, and load balancing](#)
- [Feature codes for the TS4500](#)

Advanced Library Management System

The Advanced Library Management System (ALMS) allows the locations of cartridges in the tape library to be virtualized.

ALMS is an extension of IBM's patented Multi-Path Architecture. With ALMS, the TS4500 tape library can virtualize locations of cartridges (called SCSI element addresses) while it maintains the native SAN attachment for the tape drives. ALMS enables logical libraries to consist of unique drives and ranges of volume serial (VOLSER) numbers, instead of fixed locations.

The TS4500 tape library comes with ALMS, so you can immediately start assigning tape drives to any logical library by using the TS4500 management GUI. Logical libraries can also be added, deleted, or easily changed without disruption. Storage capacity can be changed without impact to host applications.

ALMS offers dynamic management of cartridges, cartridge storage slots, tape drives, and logical libraries. It enables the tape library to achieve unprecedented levels of integration for functionality through dynamic partitioning, storage slot pooling, and flexible drive assignment. ALMS eliminates downtime when you add Capacity On Demand (CoD) or High Density Capacity on Demand (HD CoD) storage, add or remove logical libraries, or change logical library storage allocation. ALMS also reduces downtime when you add expansion frames, add or remove tape drives, or change logical drive allocation.

ALMS provides the following capabilities:

- Dynamic partitioning (storage slot pooling and flexible drive assignment)
- The ability to add or remove storage capacity to any host application
- The ability to configure drives or to configure storage capacity without taking the library offline
- Virtual I/O slots (always enabled) to automatically manage the movement of cartridges between I/O slots and storage slots

The sections that follow describe the capabilities of ALMS.

- [Storage slot pooling](#)

Storage slots are a shared resource in the TS4500 tape library.

- [Transparent addition or removal of storage capacity](#)
The addition or removal of logical library capacity in the tape library is transparent to any host application.
- [Configuration of storage capacity without disruption](#)
With the Advanced Library Management System (ALMS), the capacity expansion features can be enabled to increase storage capacity without disrupting library operations.
- [Virtual I/O slots](#)
Virtual I/O slots enhance the import and export capabilities of the library.

Related information

- [Multipath architecture](#)
- [Multiple logical libraries](#)

Storage slot pooling

Storage slots are a shared resource in the TS4500 tape library.

The Advanced Library Management System (ALMS) allows logical libraries to be added or deleted without disrupting operation. All storage slots are pooled (available on a first-come, first-served basis) to each logical library based on cartridge insert operations. They are a shared resource such that changes to the capacity allocation for each logical library can occur without downtime or administrator involvement. The minimum logical library has a name and can be thought of as a file folder that has no contents. Drives are assigned to the logical library from the Drives page of the TS4500 management GUI. Cartridges are assigned to the logical library based on their volume serial (VOLSER) numbers and by using one of the following methods, which are listed in priority order:

- VOLSER ranges
- Software application move from the I/O station (based on the source application that issued the command)
- Manual assignment by an operator by using the TS4500 management GUI

The primary and backup copies of VOLSER assignment and physical location of cartridges are stored in nonvolatile random access memory (NVRAM).

Transparent addition or removal of storage capacity

The addition or removal of logical library capacity in the tape library is transparent to any host application.

With the Advanced Library Management System (ALMS), you can change the quantity of storage slots accessible to all logical libraries by adding licensed capacity or by adding physical capacity. The change is transparent to each host application because the value in the

Maximum Number of Cartridges

field on the management GUI is not impacted by changes to the quantity of storage slots. The additional storage slots are new candidates for cartridges to be moved to upon insertion. This behavior allows the following two tasks to be performed independently and in either order:

- An administrator or service task to change the licensed or physical capacity of the library
- An administrator task to prepare the application to have access to more cartridges in their respective logical libraries by increasing the **Maximum Number of Cartridges** on the management GUI. Then, rediscovering the logical library at the application (for example, by restarting the application).

To modify the maximum number of cartridges for a logical library, access the management GUI and select Library > Logical Libraries.

Configuration of storage capacity without disruption

With the Advanced Library Management System (ALMS), the capacity expansion features can be enabled to increase storage capacity without disrupting library operations.

No downtime is required when you enable the base or intermediate capacity-on-demand features for models L25 and L55.

Also, no downtime is required when you enable the high-density capacity-on-demand features for models Lx5, Dx5, and Sx5.

Virtual I/O slots

Virtual I/O slots enhance the import and export capabilities of the library.

Virtual I/O slots are always enabled 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.

The TS4500 tape library has I/O stations with cartridge magazines that can be used to import and export up to 144 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. This enhances the import and export performance, while also decoupling physical cartridge movement from the application. As a result, operator efficiency is increased.

With virtual I/O slots, the library has various mechanisms for selecting the best storage slot location for each inserted cartridge, and the best I/O station for each ejected cartridge. These mechanisms vary depending on the configuration of your library.

Power structure of the TS4500 tape library

This section introduces the power structure that is provided by the TS4500 tape library.

Frame control assembly (FCA)

What is included in the FCA?

For models L25, D25, L55, and D55, the library offers the TS4500 frame control assembly power structure, which combines drive power, library power, and AC power cord capabilities. Each Lx5 and Dx5 frame comes with two Back Plane Cards (BPCs) and two power supplies. Model Sx5 frames do not have their own power supply. They share power with either an Lx5 or Dx5 frame.

Redundancy provided by two or more frames with an FCA (control system)

For two or more frames that have an FCA control system, failure or repair of a particular part does not cause the entire system to fail. Nor does it require scheduled downtime for maintenance. For example, the replacement of any single failed power supply can be accomplished without affecting the operation of the library. The two redundant power supplies are fed directly by independent AC power cords that support only 220 V AC (110 V AC is not supported).

Note: AC power cords do not come standard with models L25, D25, L55, and D55. You must specify what type of AC power cord is to be shipped with the frame control assembly.

Control path failover, data path failover, and load balancing

The path failover feature of the TS4500 tape library ensures the use of a redundant communication path when the primary path fails.

Command failures and time outs are costly. You want your library to run smoothly and efficiently. To ensure continued processing, libraries that are equipped with Fibre Channel LTO and 3592 tape drive offer path failover and load balancing capabilities. These capabilities allow the IBM® device driver to resend a command to an alternate path. The alternate path can include another host bus adapter (HBA), Storage Area Network (SAN), or library control path drive. The device driver initiates error recovery and continues the operation on the alternate path without interrupting the application. Path failover and load balancing are built-in features that are enabled by using a purchased license key.

Two types of path failover capabilities exist: *control path failover (CPF)* and *data path failover (DPF)*. *Control* refers to the command set that controls the library (the SCSI Medium Changer command set on LUN 1 of the tape drives). *Data* refers to the command set that carries the customer data to and from the tape drives (the SCSI-3 Stream Commands (SSC) device on LUN 0 of the tape drives). Path failover means the same thing in both. Path failover is where there is redundancy in the path from the application to the intended target (the library accessor or the drive mechanism, respectively), the device driver transparently fails over to another path in response to a break in the active path.

Both types of failover include host-side failover when configured with multiple HBA ports into a switch. But CPF includes target-side failover through the control paths that are enabled on more than one tape drive. DPF includes target-side failover for the dual-ported tape drives that are supported by the TS4500 tape library.

DPF includes load balancing of the HBAs because the channel is a data-intensive path (the control path carries very little data, so load balancing is not an issue). The dynamic load balancing support optimizes resources for devices that have physical connections to multiple HBAs in the same machine. When an application opens a device that has multiple HBA paths configured, the device driver determines which path has the HBA with the lowest usage and assigns that path to the application. When another application opens a different device with multiple HBA paths, the device driver again determines the path with the lowest HBA usage and assigns that path to the second application. The device driver updates the usage on the HBA assigned to the application when the device is closed. Dynamic load balancing uses all HBAs whenever possible and balances the load between them to optimize the resources in the machine.

Both CPF and DPF require the use of the IBM device driver. They are supported exclusively with products that bear the IBM logo on the operating systems that is indicated in [Table 1](#). [Table 1](#) summarizes the differences between CPF, DPF, and load balancing.

Table 1. Differences between CPF and DPF

Characteristic	CPF	DPF and Load Balancing for LTO tape drives	DPF and Load Balancing for 3592 tape drives
Device type	SMC ¹	SSC ²	SSC
LUN ³	LUN 1	LUN 0	LUN 0
Host-side failover	Yes	Yes	Yes
Target-side failover	Yes	Yes	Yes
IBM device driver required	Yes	Yes	Yes
Operating systems supported	AIX®, SuSE Linux®, Red Hat Enterprise Linux, Windows	AIX, SuSE Linux, Red Hat Enterprise Linux, Windows ⁴ (DPF only)	AIX, SuSE Linux, Red Hat Enterprise Linux, Windows ⁴ (DPF only)
Order feature to obtain license key	Yes	Yes ⁵	No

Notes:

1. SMC = SCSI-3 Medium Changer Specification (library)
2. SSC = SCSI-3 Stream Commands (drive)
3. LUN = logical unit number
4. Load balancing is not supported on Windows
5. LTO 4 and later tape drives do not require license keys at the host when you are configuring Data Path Failover.

The path failover feature can be ordered from the factory, or you can order it as a field upgrade. The path failover feature (FC 1682) is activated with a license key that you enter on the TS4500 management GUI. To order features, contact your IBM Sales Representative.

For more information about using these features, see the [IBM Tape Device Drivers Installation and User's Guide](#).

Related information

- [Feature codes for the TS4500](#)

Library Control Card failover

The TS4500 tape library allows for automatic Library Control Card (LCC) failover.

The main control center of the TS4500 tape library is the LCC. In addition to the base L-frame, each D-frame with a Frame Control Assembly has an LCC. For libraries with multiple LCCs, the library firmware performs automatic LCC failover.

When the TS4500 tape library powers up, one LCC is chosen to be the primary control card. Any other LCCs that are present in the library are used as cache LCCs. Should the primary LCC become degraded, the library firmware will automatically choose one of the cache LCCs to assume the primary role without interrupting library operations.

VOLSER ranges

Volume serial (VOLSER) ranges are used to assign cartridges to specific logical libraries in the tape library.

Tape cartridges are identified by the VOLSER number on the bar code label that is affixed to each cartridge. The tape library uses VOLSER ranges to assign cartridges to one or more logical libraries. When you insert a cartridge into the library and its VOLSER is within a logical library's range, the cartridge is assigned to that logical library. For example, you create a logical library that is called LogicalLibrary1 for VOLSERs that range from ABC000 to ABC999 (a library of LTO drives). When you insert a cartridge with VOLSER ABC123, the library recognizes that VOLSER as belonging to the range and assigns it to LogicalLibrary1.

When the library detects a new, unassigned cartridge, the library reads the VOLSER and assigns the cartridge to the correct logical library. If the VOLSER does not match any of the VOLSER ranges, the cartridge is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge.

Within a physical tape library, a maximum of 600 VOLSER ranges can be created between all logical libraries.

VOLSER ranges are created during the initial library configuration. However, you can assign new, or modify existing, ranges from the Logical Libraries page of the management GUI.

Increasing capacity

Install capacity on demand (CoD) features to increase the cartridge capacity of frames in the TS4500 tape library.

In the TS4500 tape library, the physical capacity, or total storage slots, is composed of licensed and unlicensed capacity. When the number of assigned cartridges reaches the licensed capacity, more cartridges cannot be assigned to a logical library until one of the following actions occurs:

- A cartridge is removed
- A CoD feature is purchased
- More slots or frames are added to the library

The Intermediate, Base, and High-Density Capacity-on-Demand features provide license keys so that you can enable more storage slots in the frames of the TS4500 tape library.

Monitor the capacity utilization of frames and the library from the TS4500 management GUI.

- [Intermediate and Base Capacity on Demand](#)
Use the Intermediate and Base Capacity on Demand (CoD) features to increase the initial (entry) capacity of the base frames (models L25 and L55) of the TS4500 tape library.
- [High-Density Capacity on Demand](#)
Use the High Density (HD) Capacity on Demand (CoD) license key to enable the full high-density capacity of the Lx5, Dx5, and Sx5 frames in the TS4500 tape library. Enabling the CoD on the TS4500 is a non-disruptive process.

Related information

- [Feature codes for the TS4500](#)
- [Frame capacity](#)

Intermediate and Base Capacity on Demand

Use the Intermediate and Base Capacity on Demand (CoD) features to increase the initial (entry) capacity of the base frames (models L25 and L55) of the TS4500 tape library.

The initial (entry) capacity of the L25 and L55 frames is 100 storage slots. You can purchase CoD features to increase the amount of available licensed capacity.

The Intermediate CoD feature (FC 1643) adds 100 slots, increasing the usable capacity of the L25 and L55 frames to 200 slots. The Base CoD feature (FC 1644) adds 200 slots, increasing the usable capacity of the L25 and L55 frames to 400 slots. FC 1644 is referred to as Full CoD with the TS4500 tape library.

Related information

- [Feature codes for the TS4500](#)
- [Frame capacity](#)

High-Density Capacity on Demand

Use the High Density (HD) Capacity on Demand (CoD) license key to enable the full high-density capacity of the Lx5, Dx5, and Sx5 frames in the TS4500 tape library. Enabling the CoD on the TS4500 is a non-disruptive process.

The initial (entry) capacity of the Lx5 frames is 100 slots. The Intermediate and Base CoD features can increase the usable capacity up to 400 slots. The HD CoD features add anywhere from 150 to more than 450 more slots, depending on frame position and configuration. The Base CoD feature (FC 1644) is a prerequisite for installing an HD CoD feature on an Lx5 frame.

The initial (entry) capacity of the Dx5 frames is 500 slots. The initial (entry) capacity of the S25 frame is 600 slots and of the S55 frame is 660 slots. The HD CoD features can add anywhere 50 - 660 more slots, depending on frame position and configuration.

[Table 1](#) shows potential capacities by frame model.

Table 1. HD CoD capacity

Frame model	Frame position	
	Position 1 (leftmost frame)	Position 2+
L25	+150 slots	+260 slots
L55	+330 slots	+482 slots
D25	+90 slots	+240 slots
D25 with I/O stations	+50 slots	+160 slots
D55	+274 slots	+470 slots
D55 with I/O stations	+230 slots	+382 slots
S25	+198 slots	+400 slots
S55	+394 slots	+660 slots

Related information

- [High-density technology](#)
- [Feature codes for the TS4500](#)
- [Frame capacity](#)

Command-line interface

Use the command-line interface (CLI) program to access tape library functions outside of the GUI interface.

For detailed information about each CLI command, refer to the CLI commands reference section.

Related information

- [Tape CLI commands](#)

Remote support

Remote support for the TS4500 tape library involves the use of a Call Home feature to detect and solve problems. Also, remote support requires several important security functions.

Optional remote support is available for the TS4500 tape library through its Call Home capability. The Call Home feature uses the integrated management console (IMC) to report failures that are detected by the library or a tape drive. When a failure is detected, Call Home sends detailed error information to IBM (home). The IBM service representative can then prepare an action plan to handle the problem before hand. The library might also periodically send support information (such as configuration, library and drive code versions, and error logs) to IBM.

The Call Home feature has three different, but related, capabilities: Problem Call Home, Heartbeat Call Home, and Test Call Home. The tape library sends data files that might be helpful to Support Center personnel for all three types of Call Home. These data files include library error logs and configuration information, such as the Machine Reported Product Data (MRPD) log. The MRPD file contains the following information about the machine (library):

- The number of frames and drives
- The model and serial number of each frame
- The type and serial number of each drive
- The code version of the library and each drive
- Any machine-detectable features such as additional I/O stations, capacity expansion

If a Problem Call Home is initiated, the library also sends the tape library logs and drive logs that are related to the problem.

Problem Call Home

The tape library or one of its drives detects a problem and the library initiates a Call Home operation. This Call Home operation creates a Problem Management Record (PMR) in the IBM Remote Technical Assistance Information Network (RETAIN). This is a single page of text data. It helps the support center or service representative determine an action plan and a list of parts (called field replaceable units or FRUs).

Heartbeat Call Home

The tape library sends the Heartbeat Call Home on a scheduled basis to ensure proper Call Home function. By default, the Heartbeat Call Home is sent once per week, 1 hour after a power cycle, and 1 hour after a code update is complete.

Test Call Home

When servicing the library, the service representative can issue a Test Call Home operation to RETAIN from the TS4500 management GUI. The library allows the service representative to include drive dumps in the Test Call Home for analysis. In this way, a drive dump can be accessed by Support Center personnel through the Call Home database.

- [Remote support through a system console](#)
A system console is a service tool through which the TS4500 tape library provides remote support.
- [Remote support security](#)
This topic is currently under review.

Remote support through a system console

A system console is a service tool through which the TS4500 tape library provides remote support.

The integrated management console (IMC) can be used as a service console with the TS4500 tape library. Similar in function to the TSSC, the IMC comes installed with a set of software tools that helps both local service and remote support of the attached TS4500 tape library. [Table 1](#) lists the system console features that can be ordered for the library.

Table 1. System console and remote support features

Feature Code	Supported Models	Customer-Setup Unit (CSU)	Description
This is a standard feature.	L25, L55	No	Integrated Management Console (IMC)
2704	L25, L55	No	Console Expansion 26 Port Enet Switch/Rackmount
2715	L25, L55	No	TS3000 system console (TSSC) Attachment

The method that is used by the library for Call Home support is a broadband connection that uses the Electronic Customer Care (ECC) Call Home function through the system console.

To perform an ECC Call Home operation through a system console, the TS4500 tape library sends Call Home information across a private Ethernet connection to the system console. The system console then performs the ECC Call Home operation and sends the information to the IBM Remote Technical Assistance Information Network (RETAIN) through the system console's Ethernet (broadband) connection.

For remote support through a system console, the TS4500 tape library needs a minimum of two Ethernet ports: one attached to your network for use by your administrator and one attached to the private system console network for remote support.

The IMC is preconfigured for remote support with the TS4500 tape library. The IMC also comes equipped with an RJ45 port that can be used to connect an external network cable for remote support.

[Table 2](#) presents the capabilities of remote support with a system console.

Note: All of the listed capabilities do not apply to every product type. For example, the TS4500 tape library does not use wellness checking, daily log file storage, or code image broadcast.

Table 2. Remote support capabilities

Location	Event	Support
Customer site	Call Home events	<ul style="list-style-type: none"> • Error initiated • Heartbeat (regular interval) • Test
	System console support capability	<ul style="list-style-type: none"> • Error-initiated problem reporting for up to 43 subsystems • Staged, error-specific data gathering • Subsystem and system console heartbeat reporting • Wellness checking • Log file storage (daily) • Code image and documentation repository (from media and RETAIN Fix Distribution Library)
	System console and remote support service tools	<ul style="list-style-type: none"> • Code image broadcast • Call home event log review • End-of-call completion report
IBM support	System console remote access	<ul style="list-style-type: none"> • Authenticated, secure remote access • Simultaneous call in and call home • Data transmission (TCP/IP) supported
	IBM call home database	<ul style="list-style-type: none"> • 24/7 access by IBM support staff • Error analysis and search capability

Remote support security

This topic is currently under review.

- [Security concerns when you use the TS4500 management GUI](#)

The TS4500 tape library has remote support security through a system console when you use the management GUI.

Security concerns when you use the TS4500 management GUI

The TS4500 tape library has remote support security through a system console when you use the management GUI.

The management GUI does not allow any access to customer data, and it does not allow FTP or TELNET type operations. It provides those functions that are allowed coded in the library firmware. The only files that it can offload are library logs, drive logs, and certain usage and error statistics files. It cannot be used to read or write a customer cartridge or otherwise access customer data.

You can use the management GUI to set up an administrator password. No-one without the password can use the management GUI to do anything to the library. The management GUI also provides several levels of access through various preset roles.

The following list presents potential security concerns when you are using the management GUI:

- A Management GUI user might move a cartridge from one location to another within the library. This change in position might confuse a host application, or make the cartridge unavailable by moving it to a different partition.
- A user might reconfigure the library and possibly cause problems at the hosts because of changes in partitioning or device IDs.
- A remote user might update the library or drive firmware. However, since the library and drives ignore any firmware they do not recognize, the only exposure is to loading older firmware.

These security concerns can be addressed by using the password, user role, and authentication features that are provided by the management GUI, and also by enabling SNMP audit logging. When SNMP audit logging is enabled, the library sends notifications when certain events occur in the library.

Library monitoring and querying

The TS4500 tape library provides several way to monitor library status and query the library for operating details.

- [TapeAlert support](#)
The TS4500 tape library is compatible with TapeAlert technology, which provides error and diagnostic information about the drives and the library to the host application.
- [SNMP requests](#)
The TS4500 tape library allows requests from an SNMP manager running systems management software, such as Netview®.
- [SNMP messaging](#)
The Simple Network Management Protocol (SNMP) enables the tape library to exchange information over a TCP/IP local area network with an SNMP manager running systems management software, such as NetView®.
- [SNMP audit logging](#)
SNMP audit logging provides logging information about specific TS4500 tape library user actions.

TapeAlert support

The TS4500 tape library is compatible with TapeAlert technology, which provides error and diagnostic information about the drives and the library to the host application.

The library provides this error and diagnostic information as TapeAlert flags that are reported to the application by the SCSI LOG SENSE command.

For a list of the TapeAlert flags for the drives and the library, refer to [TapeAlert Flags](#) in the TS4500 KC.

SNMP requests

The TS4500 tape library allows requests from an SNMP manager running systems management software, such as Netview®.

IBM maintains a management information base (MIB) that contains configuration data for all IBM tape libraries. This allows you to gather configuration data for all IBM tape libraries being managed – local or remote, regardless of model – in a single operation.

The **Get**, **GetNext**, and **GetBulk** SNMP requests are supported. **Set** requests are not supported.

The following configuration data can be queried:

- Frame or system configuration (frame or module)
- Logical libraries
- Drive configuration
- Library configuration
- VPD note card
- Call home configuration
- SNMP
- Key manager
- Drive encryption
- SMTP configuration
- Time configuration
- User roles
- Role access level

- LDAP configuration
- Ethernet configuration

SNMP messaging

The Simple Network Management Protocol (SNMP) enables the tape library to exchange information over a TCP/IP local area network with an SNMP manager running systems management software, such as NetView®.

SNMP allows alerts (called traps) to be sent to an SNMP manager. Using the information that is supplied in each SNMP trap, the monitoring software can alert operations staff of possible problems or operator interventions that occur. Monitoring programs (such as NetView) can be used to send email or pager notifications when they receive an SNMP trap. For more information, see your NetView documentation or the manual for your network management application.

Occasionally, the tape library might encounter situations that you want to know about. These situations can be conditions that affect library performance, such as an open door that causes the library to stop. You might also want to log user actions, such as a cartridge move or export that is initiated from the TS4500 management GUI. SNMP messages can alert you of these conditions.

The monitoring server must be loaded with systems management software that can receive and process the trap. SNMP supports a get and get-response mechanism for an operator to gather more information about a problem or query the library about its status. Through an SNMP manager, the operator issues a "get" to request information about the library. A get-response is the information that is provided in response to the get. This type of support generally requires an up-to-date library Management Information Base (MIB). The library's MIB contains units of information that specifically describe an aspect of a system, such as the system name, hardware number, or communications configuration.

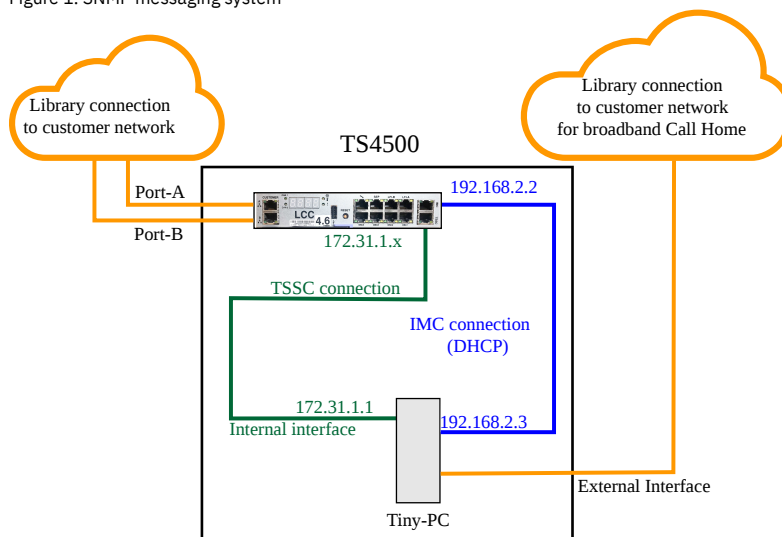
IBM provides the MIBs that are supported by the library. They include:

- IBM 3584 MIB for Version 2c traps
- Storage Networking Industry Association (SNIA) Storage Media Library (SML) MIB Version 1.12

Library settings cannot be changed with SNMP. Settings are changed by using the TS4500 management GUI.

[Figure 1](#) shows the flow of SNMP communication from the library over the Ethernet LAN to an SNMP monitoring server.

Figure 1. SNMP messaging system



Additional information is available in the [Implementing IBM Tape in Linux and Windows Redbook](#). Also, see the [Implementing IBM Tape in Unix Systems Redbook](#).

SNMP audit logging

SNMP audit logging provides logging information about specific TS4500 tape library user actions.

The tape library provides various interfaces that allow a user to configure different library or drive settings, move cartridges within or out of the library, and other actions. In addition, the tape library provides notifications, in the form of SNMP traps, that provide a log of when certain activities take place. With SNMP traps, you have more capabilities for monitoring these activities and the physical security of the library.

SNMP audit logging sends the log information over a TCP/IP local area network to an SNMP manager, just as SNMP traps are sent for library alerts.

The following events are logged:

- Login attempts, whether granted or denied
- Logouts (timeout, logout, or force logout)
- Any configuration change
- Any data or cleaning cartridge move that is initiated from a library user interface
- Any code load operation (library or drive) initiated from a library user interface and not associated with an FRU replacement
- Any prepare or finish service procedure that is initiated from a library user interface, including set storage slot offline or online
- Any drive serial number change not associated with an FRU replacement
- Any drive power cycle that is initiated from a library user interface

- Any node card reset that is initiated from a library user interface
- Door open events

The following information is provided in the logs for each of these events:

- Machine type, model, and serial number of the reporting machine
- The user name that initiated the event
- Level of severity
- Trap ID
- Description of the event

Secure Socket Layer (SSL) functions

The TS4500 tape library supports secure socket layer (SSL), which is a protocol for transmitting private documents across the Internet.

To enable or disable SSL, go to the management GUI and select Settings > Security and click the HTTPS tab.

Related information

- [Secure Communications](#)

Remote authentication

The TS4500 tape library supports remote authentication of user credentials using LDAP (with optional RACF authentication) or Kerberos.

When remote authentication is enabled, the tape library passes user authentication requests to the remote authentication server. The authentication server authenticates the user's ID and password. If they are valid, the tape library assigns the user a role based on the user's group membership on the authentication server.

When remote authentication is enabled, you can perform the following security tasks on multiple systems from a single interface:

- Add and remove users
- Reset or change passwords
- Assign, change, or delete user group assignments
- Respond to new security requirements. For instance, password rules can be changed in one location without reconfiguring multiple systems. By comparison, when you use local authentication, each individual system maintains an internal database of user IDs, with corresponding passwords and roles.

Related information

- [Managing remote users](#)
- [Roles](#)
- [Remote authentication](#)

IPv6 functionality

The TS4500 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. The TS4500 management GUI allows 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.

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 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

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 format 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 TS4500 management GUI for segments that are zero, or those that have leading zeros.

The following are 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)

An IPv6 (dual) address combines an IPv6 and an IPv4 address and has the following format: 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 are 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.

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 will attempt to find that address on the local link. If the system is on a different network, the packet is sent to a gateway which will then route the packet to the correct IP address. This 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 with the 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 4 octets like it is in IPv4, it is expressed as an integer between 1-128. 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 to **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 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 and 128. For example, a prefix-length of /64 specified as 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 1](#) shows the resulting network ranges for prefix lengths of IPv6 addresses.

Table 1. 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::0/64	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:FFFF:FFFF:FFFF:FFF F

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::0/80	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:FFFF:FFFF:FFF
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::0/96	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:0000:FFFF:FFF
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::0/112	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:0000:0000:FFF
2001:0DB8:ABCD:0012:0000:0000:0000:0000	2001:DB8:ABCD:12::	2001:db8:abcd:0012::0/128	2001:0DB8:ABCD:0012:0000:0000:0000:0000 - 2001:0DB8:ABCD:0012:0000:0000:0000:0000

Planning

The TS4500 tape library requires an environment able to accommodate the appropriate height, weight, and width in addition to other physical specifications. Use the **Planning** section as a reference for the on-site requirements for optimum operation of the TS4500 tape library. The TS4500 tape library is installed by an IBM® service representative.

- Frame model physical specifications**
 The physical specifications by frame model provide detailed information about the height and weight of frames in various configurations. Use this information when designing your tape library and planning for delivery and installation.
- Library placement**
 To ensure optimal performance, the tape library must be placed in a location that meets certain requirements and environmental specifications.
- Floor requirements**
 The TS4500 tape library must be placed on floor space that meets the following specifications. Use the list of allowable variances for floor stability, unevenness, and point load bearing qualities to determine where the TS4500 tape library is placed.
- Delivery route**
 The TS4500 tape library must be delivered using a planned route. Check the delivery route that the library must travel from your loading dock to the installation location. Ensure that the library will fit through all doors, hallways, and elevators.
- Security**
 The equipment must be located so that access to the equipment can be controlled and monitored. Consider all of these recommended security measures when you are determining where to locate your TS4500 tape library.
- Move restraints**
 The TS4500 tape library has several move restraints (adjustable points) that you can use to restrain the unit from potential movement (such as an earthquake). Use the diagram as a guide to help you locate the move restraints.
- Additional library grounding (bonding)**
 You can attach additional grounding (bonding) wires to the TS4500 tape library frame.
- Clearance specifications for the library**
 Clearances are required around the tape library to enable access for you or IBM service representatives to use or work on the library. Use this information when you are determining the location and position of your library.
- Cable routing**
 Normally, cables are routed through the rear openings at the bottom of the frame. If the library is being installed on a solid (non-raised) floor, your IBM Service Representative can route the Fibre Channel, Ethernet, and power cables through openings in the frame at the top of the library.
- Network connections**
 Customers can attach an independent network to the tape library for remote viewing and management. The network connects to a Library Control Card (LCC) in a D frame, either port A or port B, and to the Tiny PC for remote support (Call Home).
- Web cameras**
 A customer-supplied web camera can be mounted in a TS4500 tape library to visually monitor the location of the library's robotics. The mounting hardware must be installed by an IBM service representative.
- Fire suppression**
 Each Dx5, Lx5, S25 frame in the TS4500 tape library has areas on the top where you can cut opening to install pipes, conduits, or other fire suppression parts.
- Environmental specifications**
 Refer to these environmental specifications to determine where to place the tape library.
- Acoustical specifications**
 Several conditions must be in place to accommodate the acoustical specifications of the TS4500 tape library. This topic provides a general statement about the acoustical specifications.
- Air flow**
 The TS4500 tape library draws cool air in through the perforated holes in the front door and bottom front of the frame. Hot air vents through perforated holes in the back door and top back of the frame. The Sx5 frames do not have any perforated holes in the back door. However, the cool air inlet in the front and hot air outlet in the top back of the frame are the same as the other frames.
- Powering the components within the frame**
 The TS4500 tape library connects to AC power in multiple ways. The library is powered by two AC to DC power supplies in the Lx5 frame. You can also have power supplies that are installed in a Dx5 frame.
- Power consumption and cooling requirements**
 The power and cooling requirements for a frame depend on the frame model type, feature codes, and number and type of tape drives installed. Generally, the greater the number of tape drives in a frame, the more heat the frame generates. The cooling requirements increase in direct proportion to the amount of heat that is generated.
- Power cords and receptacles**
 Each frame receives single-phase (200–240 V ac) power on its own power cord from a customer-supplied outlet or from an optional power distribution unit (PDU).

- [Feature codes for the TS4500](#)
Order feature codes to install components in library frames or to enhance the capacity or capabilities of the library.
- [Frame capacity](#)
The cartridge capacity of the frames of the TS4500 tape library varies depending on whether the frame has I/O stations, tape drives, or any of the available capacity on demand features that increase the amount of licensed capacity of the frame.
- [Tape encryption overview](#)
The tape drives that are supported by the TS4500 tape library can encrypt data as it is written to a tape cartridge.
- [Using LTO tape drive media](#)
The section provides information about using LTO tape drive media.
- [Using 3592 tape drive media](#)
The tape library automates the storage and movement of IBM 3592 tape cartridges.

Frame model physical specifications

The physical specifications by frame model provide detailed information about the height and weight of frames in various configurations. Use this information when designing your tape library and planning for delivery and installation.

- [Frame height](#)
- [Physical specifications for frame models L25 and D25](#)
- [Physical specifications for frame models L55 and D55](#)
- [Physical specifications for frame model S25](#)
- [Physical specifications for frame model S55](#)

Frame height

Each library frame has a set of casters and four leveling jack screws that are used during installation to level the frame and set the final frame height.

- The nominal height from the bottom of the jack screws to the top of the frame is 1840 mm (72.4 in.). This height can vary by ± 40 mm (± 1.6 in.).
- The shipping height of the library (on its casters and with jack screws raised and not including the pallet) is 1800 mm (70.9 in.).
- The height of a frame with a TR1 top rack is 2320 mm (91.34 in.).
- The height of a frame with a TR2 top rack is 2066.6 mm (81.4 in.).

For detailed information about the physical specifications of each library frame, refer to [Frame model physical specifications](#). To calculate the length of your fully configured library, refer to [Clearance specifications for the library](#).

Physical specifications for frame models L25 and D25

Table 1. Physical characteristics of frame models L25 and D25

Physical characteristic	Measurement	
Height of L25 and D25 frames (on casters)	1800 mm (70.9 in)	
Height of L25 and D25 frames with TR1 top rack	2320 mm (91.34 in)	
Height of L25 and D25 frames with TR2 top rack	2066.6 mm (81.4 in)	
Width of L25 frame with covers	782 mm (30.8 in)	
Width of L25 or D25 frame without covers ²	725 mm (28.5 in)	
Depth of L25 or D25 frame (including front and rear doors)	1212 mm (47.72 in)	
	Position 1 (Leftmost frame)	Position 2+
Minimum weight of frame (with no tape drives or cartridges) ^{5, 6}	L25: 407.8 kg (899 lb) D25: 310.7 kg (685 lb)	L25: 407.8 kg (899 lb) D25: 310.7 kg (685 lb)
Maximum weight of frame (with maximum tape drives and cartridges) ^{3, 4, 5, 6}	L25: 586.5 kg (1 293 lb) D25: 500 kg (1 103 lb)	L25: 630.5 kg (1 390 lb) D25: 552.5 kg (1 218 lb)
Weight of the TR1 top rack (empty) ¹	24.5 kg (54 lb)	
Weight of the TR2 top rack (empty) ⁶	17.5 kg (38.5 lbs)	
Weight of the TR2 top rack with the Project Olympus Rack Configuration, 2 Side-Panels, Front and Rear Doors.	32.43 kg (71.5 lb)	
Notes:		
<ol style="list-style-type: none"> 1. A TR1 can optionally be installed on any HD2 frame. Side panels and PDUs are also optional. Each side panel adds 6.8 kg (15 lb). Each PDU adds 4.5 kg (10 lb). 2. Frame width only. Extra inter-frame spacing of 30 mm (1.2 in) is required. 3. The weight with drives and cartridges assumes a weight of 3.97 kg (8.75 lb) for a 3592 EH7 or 3592 EH8 tape drive and 0.24 kg (0.5 lb) for a standard 3592 tape cartridge. The actual weight of the frame varies, depending on the configuration and cartridge capacity. Listed weights are plus or minus 2.3 kg (5 lb). 4. Frames in position 1 (the leftmost frame in a library string) can have a maximum of 12 tape drives and 550 (L25) or 590 (D25) cartridges. Frames in positions 2+ can accommodate 16 tape drives and 660 (L25) or 740 (D25) cartridges. 5. Weights listed for the Lx5 frames include the accessor, IMC, side doors and side panels. After the initial library installation, these parts can be moved to other frames within the library string, which shifts some of the weight to other frames. 6. Side panels, front and rear doors, and PDUs are also optional. Each side panel adds 3.6 kg (8 lb). Each PDU adds 4.08 kg (9lb), Each door adds 3.2 kg (7 lb) 		

Physical specifications for frame models L55 and D55

Table 1. Physical characteristics of frame models L55 and D55

Physical Characteristic	Measurement	
Height of L55 and D55 frames (on casters)	1 800 mm (70.9 in)	
Height of L55 and D55 frames with TR1 top rack	2 320 mm (91.34 in)	
Height of L55 and D55 frames with TR2 top rack	2066.6 mm (81.4 in)	
Width of L55 frame with covers	782 mm (30.8 in)	
Width of L55 or D55 frame without covers ²	725 mm (28.5 in)	
Depth of L55 or D55 frame (including front and rear doors)	1 212 mm (47.72 in)	
	Position 1 (Leftmost frame)	Position 2+
Minimum weight of frame (with no tape drives or cartridges) ^{5, 6}	L55: 410 kg (904 lb)	L55: 410 kg (904 lb)
	D55: 316 kg (697 lb)	D55: 316 kg (697 lb)
Maximum weight of frame (with maximum tape drives and cartridges) ^{3, 4, 5, 6}	L55: 592 kg (1 305 lb)	L55: 637 kg (1 404 lb)
	D55: 503.5 kg (1 110 lb)	D55: 557 kg (1 228 lb)
Weight of TR1 top rack (empty) ¹	24.5 kg (54 lb)	
Weight of the TR2 top rack (empty) ⁶	17.5 kg (38.5 lbs)	
Weight of the TR2 top rack with the Project Olympus Rack Configuration, 2 Side-Panels, Front and Rear Doors.	32.43 kg (71.5 lb)	
Notes:		
1. A top rack can optionally be installed on any frame. Side panels and PDUs are also optional. Each side panel adds 6.8 kg (15 lb). Each PDU adds 4.5 kg (10 lb).		
2. Frame width only. Additional inter frame spacing of 30 mm (1.2 in) is required.		
3. The weight with drives and cartridges assumes a weight of 3.29 kg (7.25 lb) for an LTO tape drive and 0.2 kg (0.44 lb) for a standard LTO tape cartridge. The actual weight of the frame varies, depending on the configuration and cartridge capacity. Listed weights are plus or minus 2.3 kg (5 lb).		
4. Frames in position 1 (the leftmost frame in a library string) can have a maximum of 12 tape drives and 730 (L55) or 774 (D55) cartridges. Frames in positions 2+ can accommodate 16 tape drives and 882 (L55) or 970 (D55) cartridges.		
5. Weights listed for the Lx5 frames include the accessor, IMC, side doors and side panels. After the initial library installation, these parts can be moved to other frames within the library string, which shifts some of the weight to other frames.		
6. Side panels, front and rear doors, and PDUs are also optional. Each side panel adds 3.6 kg (8 lb). Each PDU adds 4.08 kg (9lb), Each door adds 3.2 kg (7 lb).		

Physical specifications for frame model S25

Table 1. Physical characteristics of frame model S25

Physical Characteristic	Measurement	
Height of S25 frame (on casters)	1 800 mm (70.9 in)	
Height of S25 with TR1 top rack	2 320 mm (91.34 in)	
Height of S25 with TR2 top rack	2066.6 mm (81.4 in)	
Width of S25 frame with covers	782 mm (30.8 in)	
Width of S25 frame without covers ¹	725 mm (28.5 in)	
Depth of S25 frame (including front and rear doors)	1 212 mm (47.7 in)	
	Position 1 (Leftmost frame)	Position 2+
Minimum weight of frame (0 cartridges)	299 kg (660 lb)	299 kg (660 lb)
Maximum weight of frame (with 0 drives and maximum cartridges) ^{3, 4}	491.2 kg (1 083 lb)	540.2 kg (1 191 lb)
Weight of TR1 top rack (empty) ²	24.5 kg (54 lb)	
Weight of the TR2 top rack (empty) ⁵	17.5 kg (38.5 lbs)	
Weight of the TR2 top rack with the Project Olympus Rack Configuration, 2 Side-Panels, Front and Rear Doors.	32.43 kg (71.5 lb)	
Notes:		
1. Frame width only. Additional inter frame spacing of 30 mm (1.2 in) is required.		
2. A top rack can optionally be installed on any HD2 frame. Side panels and PDUs are also optional. Each side panel adds 6.8 kg (15 lb). Each PDU adds 4.5 kg (10 lb).		
3. The weight with cartridges assumes a weight of .24 kg (0.5 lb) for a standard 3592 tape cartridge. The actual weight of the frame varies, depending on the configuration and cartridge capacity. Listed weights are plus or minus 2.3 kg (5 lb).		
4. Frames in position 1 (the leftmost frame in a library string) can have a maximum of 798 cartridges. Frames in positions 2+ can accommodate 1 000 cartridges.		
5. Side panels, front and rear doors, and PDUs are also optional. Each side panel adds 3.6 kg (8 lb). Each PDU adds 4.08 kg (9lb), Each door adds 3.2 kg (7 lb).		

Physical specifications for frame model S55

Table 1. Physical characteristics of frame model S55

Physical Characteristic	Measurement
Height of S55 frame (on casters)	1 800 mm (70.9 in)
Height of S55 with TR1 top rack	2 320 mm (91.34 in)

Physical Characteristic	Measurement	
Height of S25 with TR2 top rack	2066.6 mm (81.4 in)	
Width of frame with covers	782 mm (30.8 in)	
Width of frame without covers ¹	725 mm (28.5 in)	
Depth of S55 frame (including front and rear doors)	1 212 mm (47.7 in)	
	Position 1 (Leftmost frame)	Position 2+
Minimum weight of frame (with 0 cartridges)	304 kg (670 lb)	304 kg (670 lb)
Maximum weight of frame (with 0 drives and maximum cartridges) ^{3, 4}	509.4 kg (1 123 lb)	564 kg (1 244 lb)
Weight of TR1 top rack (empty) ²	24.5 kg (54 lb)	
Weight of the TR2 top rack (empty) ⁵	17.5 kg (38.5 lbs)	
Weight of the TR2 top rack with the Project Olympus Rack Configuration, 2 Side-Panels, Front and Rear Doors.	32.43 kg (71.5 lb)	
Notes:		
<ol style="list-style-type: none"> 1. Frame width only. Additional interframe spacing of 30 mm (1.2 in) is required. 2. A top rack can optionally be installed on any HD2 frame. Side panels and PDUs are also optional. Each side panel adds 6.8 kg (15 lb). Each PDU adds 4.5 kg (10 lb). 3. The weight with cartridges assumes a weight of .2 kg (0.44 lb) for a standard LTO tape cartridge. The actual weight of the frame varies, depending on the configuration and cartridge capacity. Listed weights are plus or minus 2.3 kg (5 lb). 4. Frames in position 1 (the leftmost frame in a library string) can have a maximum of 1 054 cartridges. Frames in positions 2+ can accommodate 1 320 cartridges. 5. Side panels, front and rear doors, and PDUs are also optional. Each side panel adds 3.6 kg (8 lb). Each PDU adds 4.08 kg (9lb), Each door adds 3.2 kg (7 lb). 		

Library placement

To ensure optimal performance, the tape library must be placed in a location that meets certain requirements and environmental specifications.

To avoid damage to the library, tape drives, and tape media, place the tape library away from equipment that produces any of the following pollutants (such as laser printers, ultrasonic humidifiers, and ionizers):

- Airborne dust
- Particulate pollution
- Corrosive fumes

Refer to [Environmental specifications](#) for detailed information about gaseous and particulate contamination.

Floor requirements

The TS4500 tape library must be placed on floor space that meets the following specifications. Use the list of allowable variances for floor stability, unevenness, and point load bearing qualities to determine where the TS4500 tape library is placed.

Install the library on a raised or solid floor. The floor must have a smooth surface and, if raised, must not have ventilation panels beneath the leveling jack screws. If carpeted, ensure that the carpet is approved for computer-room applications.

To accommodate unevenness in the floor, you can raise or lower the leveling jack-screws to the following specifications:

- Maximum allowable variance must not exceed 7 mm (.27 inches) per 76 mm (3 inches).
- Maximum out-of-level condition must not exceed 40 mm (1.6 inches) over the entire length and width of the library.

The floor on which the TS4500 tape library is installed must be able to support:

- Up to 5.0 kilograms per square centimeter (71.5 pounds per square inch) of point loads that are exerted by the leveling jack-screws.
- Up to 370 kilograms per square meter (75.8 pounds per square foot) of overall floor loading.

Note: The Top Rack (TR1) and the components in the Top Rack are not included in the floor loading requirements.

The number of point loads that is exerted depends on the number of frames that make up the library. The locations of the four point loads per frame are at the corners of each frame.

Delivery route

The TS4500 tape library must be delivered using a planned route. Check the delivery route that the library must travel from your loading dock to the installation location. Ensure that the library will fit through all doors, hallways, and elevators.

You must remove the library from the pallet and place it at the final location before you call your IBM Service Representative to arrange for the installation. Refer to the instructions on the shipping carton for correct unpacking procedures.

Because of the size and weight of this product, the transportation of this equipment must be performed by professional movers or riggers who are trained to handle large heavy objects. The IBM-authorized service provider will only perform minimal frame repositioning within the computer room, as needed, to perform required service actions.

Security

The equipment must be located so that access to the equipment can be controlled and monitored. Consider all of these recommended security measures when you are determining where to locate your TS4500 tape library.

Library location

You are responsible for the security of the TS4500 tape library, the cartridges that are contained within the library, and shelf-resident cartridges. To prevent unauthorized access to data, IBM recommends locating the TS4500 tape library and all shelf-resident cartridges in an area where access is controlled.

Locking mechanisms

The I/O stations have locking mechanisms that prevent you from opening an I/O station door when the accessor is manipulating cartridges in a station. The library's front door has a key lock. The key-lock is the same for every front door, and the keys are shipped with the library. The side doors of the base frames (Lx5) also have a key lock, which is the same key lock that is used for the front door. The library's rear door has a different key lock. The key lock is the same for every rear door and the keys are shipped with the library.

Onsite security measures

You are also responsible for evaluating, selecting, and implementing security features, administrative procedures, and appropriate controls in application systems and communication facilities.

Data security

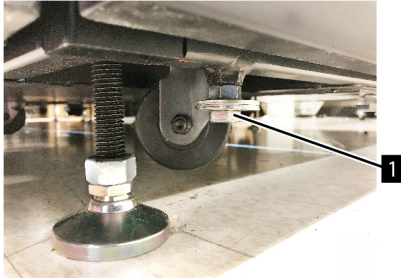
Data security is accomplished through the TS4500 management GUI. For more information about data security, see [Access](#) and [Security](#).

Move restraints

The TS4500 tape library has several move restraints (adjustable points) that you can use to restrain the unit from potential movement (such as an earthquake). Use the diagram as a guide to help you locate the move restraints.

Restraining points are at the bottom of the unit (see 1 in [Figure 1](#)). There are four restraining points at the bottom four corners of each frame. Affix restraints to each of the four points (two on each long side) and secure the library as needed. The restraint points provide threaded holes, thread size M10.

Figure 1. Location of restraining points. Two restraining points are on each long side of the library.



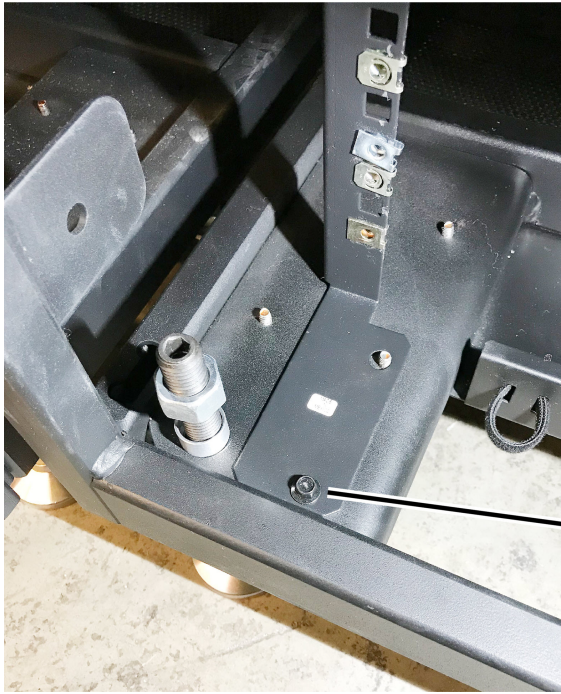
Additional library grounding (bonding)

You can attach additional grounding (bonding) wires to the TS4500 tape library frame.

The library is grounded to the grounding conductor of the AC power distribution of the building through the library power cords. However, you can provide additional grounding (bonding) of the library frames to the building. A grounding (bonding) conductor may be attached to any library frame at one of the 2 threaded holes (M6) at the bottom, back corners of the library frame. See 1 and 2 in [Figure 1](#).

The library frames are electrically bonded together by the accessor rail and the frame to frame mechanical connections. It is not necessary to bond every frame individually.

Figure 1. Location of grounding/bonding points



To install your additional grounding (bonding) wires:

1. If there is a mounting bracket installed in the frame (See 1 in [Figure 1](#)). Remove the M6 screw and connect the grounding (bonding) wire.
2. If there is not a mounting bracket installed (See 2 in [Figure 1](#)). Use an M6 screw to connect the bonding wire to the threaded M6 hole.

Clearance specifications for the library

Clearances are required around the tape library to enable access for you or IBM® service representatives to use or work on the library. Use this information when you are determining the location and position of your library.

Plan for appropriate clearances around your tape library. For a single accessor library, you need a service clearance of a minimum of 762 mm (30 in) on the front and back of each frame, in addition to the side where the Integrated Management Console (IMC) is installed.

For a dual accessor library, you need a minimum of 762 mm (30 in) clearance on the front and back of each frame, in addition to both ends of the library string.

Ensure that service clearance space does not overlap into high-traffic walkways where service activity might impede pedestrian traffic. As you plan clearances, consider leaving extra room on either end of the library for future expansion.

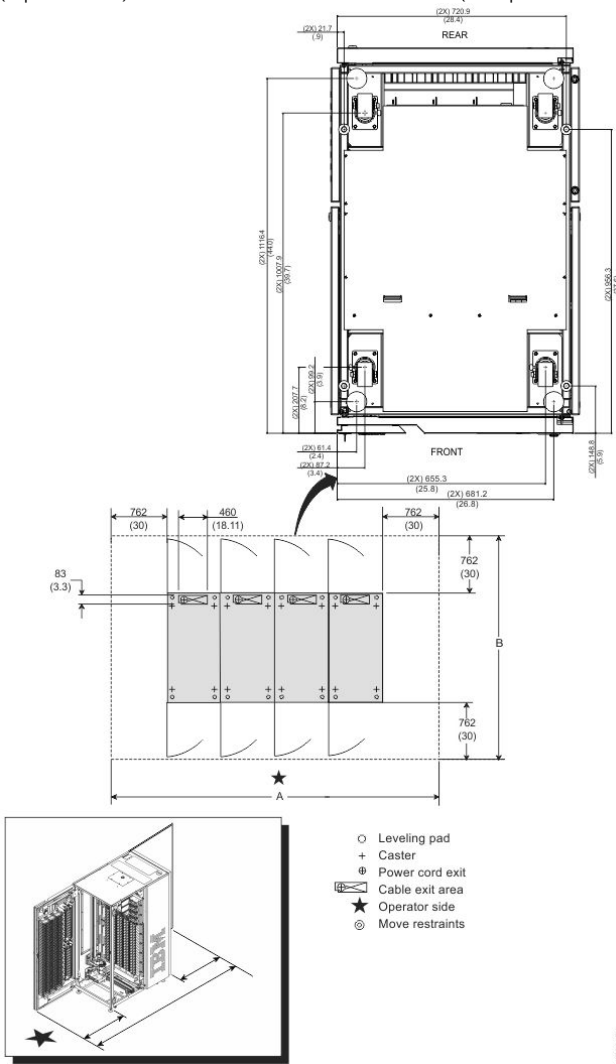
Table 1. TS4500 tape library footprint including service clearance

Number of Frames	Minimum Length of A in Figure 1 (Single Accessor) (see Note 1)	Minimum Length of A in Figure 1 (Dual Accessor)	Minimum Length of B in Figure 1
1	1 544 mm (60.8 in.)	n/a	2 737 mm (107.8 in.)
2	2 298 mm (90.5 in.)	3 061 mm (120.5 in.)	2 737 mm (107.8 in.)
3	3 053 mm (120.2 in.)	3 815 mm (150.2 in.)	2 737 mm (107.8 in.)
4	3 808 mm (149.9 in.)	4 570 mm (179.9 in.)	2 737 mm (107.8 in.)
5	4 562 mm (179.6 in.)	5 324 mm (209.6 in.)	2 737 mm (107.8 in.)
6	5 317 mm (209.3 in.)	6 079 mm (239.3 in.)	2 737 mm (107.8 in.)
7	6 072 mm (239.0 in.)	6 834 mm (269 in.)	2 737 mm (107.8 in.)
8	6 826 mm (268.7 in.)	7 588 mm (298.7 in.)	2 737 mm (107.8 in.)
9	7 581 mm (298.5 in.)	8 343 mm (328.5 in.)	2 737 mm (107.8 in.)
10	8 335 mm (328.2 in.)	9 097 mm (358.2 in.)	2 737 mm (107.8 in.)
11	9 090 mm (357.9 in.)	9 852 mm (387.9 in.)	2 737 mm (107.8 in.)
12	9 845 mm (387.6 in.)	10 607 mm (417.6 in.)	2 737 mm (107.8 in.)
13	10 599 mm (417.3 in.)	11 361 mm (447.3 in.)	2 737 mm (107.8 in.)
14	11 354 mm (447.0 in.)	12 116 mm (477.0 in.)	2 737 mm (107.8 in.)
15	12 108 mm (476.7 in.)	12 870 mm (506.7 in.)	2 737 mm (107.8 in.)
16	12 863 mm (506.4 in.)	13 625 mm (536.4 in.)	2 737 mm (107.8 in.)
17	13 618 mm (536.1 in.)	14 380 mm (566.1 in.)	2 737 mm (107.8 in.)
18	14 372 mm (565.8 in.)	15 134 mm (595.8 in.)	2 737 mm (107.8 in.)

Note:

1. For libraries with service clearance on the right end only (as you face the front door): Visual access is required on the left end as determined by the local service team. This visual access allows an IBM service representative to see the two-character display on the left side of the cartridge accessor.

Figure 1. Size of operator and service clearances for IBM TS4500 tape library models. The top measurements are in millimeters; the bottom measurements (in parentheses) are in inches. The service clearance area (and operator clearance area at the front of both frames) is denoted by dotted lines.



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Cable routing

Normally, cables are routed through the rear openings at the bottom of the frame. If the library is being installed on a solid (non-raised) floor, your IBM Service Representative can route the Fibre Channel, Ethernet, and power cables through openings in the frame at the top of the library.

Fibre Channel cables and Ethernet cables are routed through the frame opening shown in [Figure 1](#). Power cables are routed through the frame opening shown in [Figure 2](#). This illustration also shows the cable restraint assembly used to hold the power cables in place.

Figure 1. Access panel for Fibre Channel and Ethernet cable routing

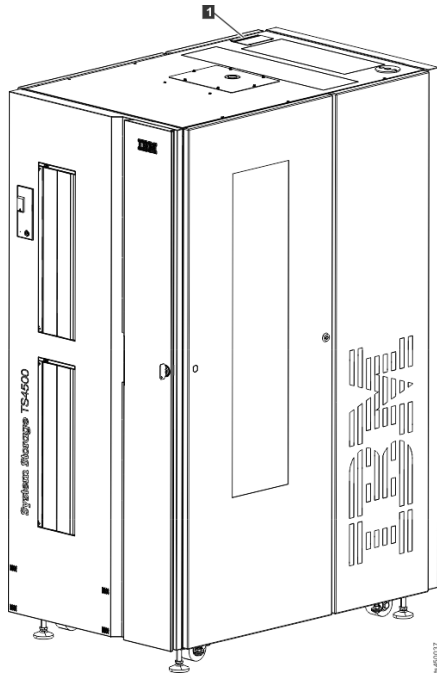
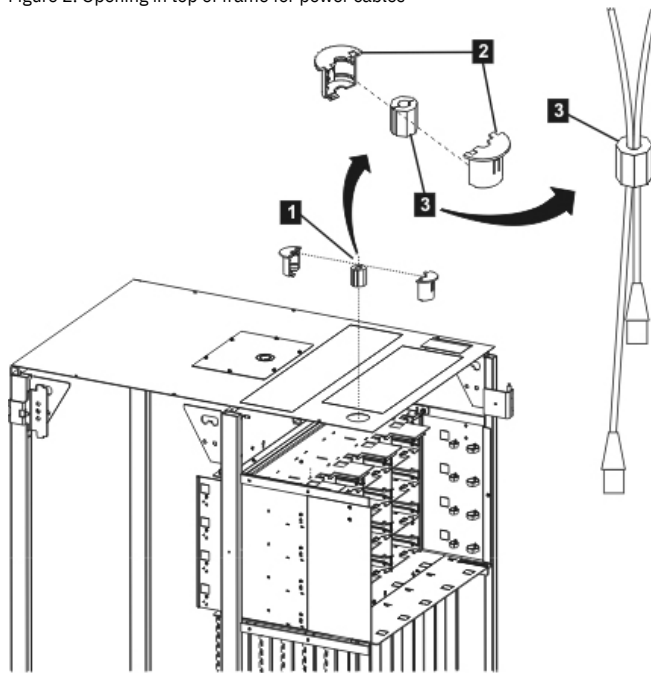


Figure 2. Opening in top of frame for power cables



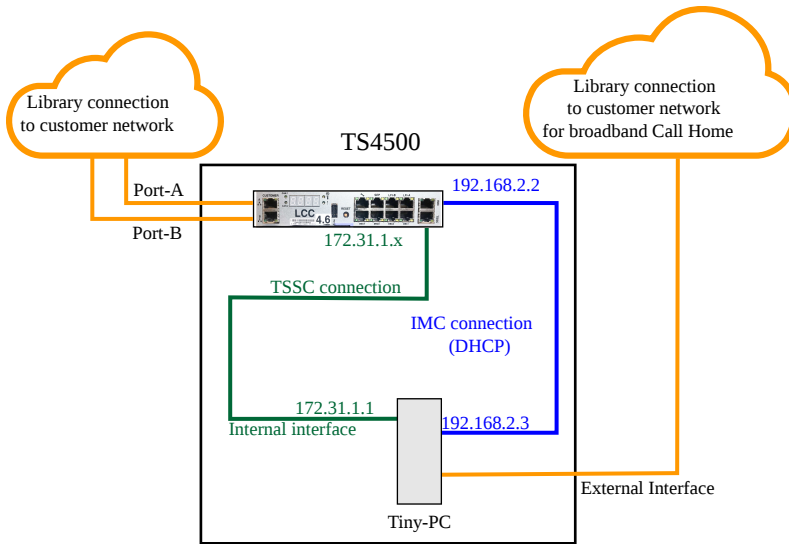
Network connections

Customers can attach an independent network to the tape library for remote viewing and management. The network connects to a Library Control Card (LCC) in a D frame, either port A or port B, and to the Tiny PC for remote support (Call Home).

The customer network Ethernet cables can be routed either up through the access hole in the bottom of the frame or through the access panel in the top of the frame. See [Figure 1](#).

If a top rack is going to be installed, the cables are routed through the access panel in the top of the frame and then through the top rack. The cables can also route through the access hole in the bottom of the frame. It is the customer's responsibility to provide the proper length Ethernet cables for this connectivity.

Figure 1. Customer network connections



Web cameras

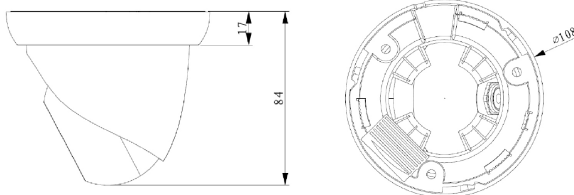
A customer-supplied web camera can be mounted in a TS4500 tape library to visually monitor the location of the library's robotics. The mounting hardware must be installed by an IBM® service representative.

Feature code 1530, web camera mounting hardware, is required in order to install a web camera. The camera must meet the specifications below. IBM does not recommend any specific camera make or model. However, the camera that was tested was the Amcrest IP4M-1055EB.

Camera Specifications

You must purchase a camera with the following specifications:

- Certified to IEC or UL 60950-1, IEC/UL 60065, or IEC/UL 62368-1 by an accredited safety agency.
- Rated for flammability UL 94 V-1 or better.
- Camera dimensions (in millimeters) :



- A DVR/NVR that supports the chosen cameras and is certified to IEC or UL 60950-1, IEC/UL 60065, or IEC/UL 62368-1 by an accredited safety agency.
- Cables of sufficient length to connect the DVR/NVR to the cameras. The cables should have an accredited safety agency mark such as UL, CSA, VDE, etc... printed on the cable jacket or have a UL VW-1 flammability rating printed on the jacket.

Camera Placement

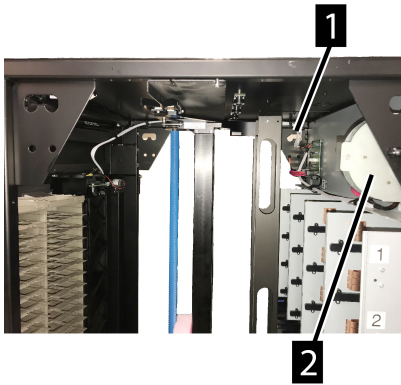
In a single-frame library, you can install the camera in locations 1, and 2.

In a multi-frame library, you can only install the cameras in the end frames.

1. In the leftmost frame, you can only install the camera in location 1,
2. In the rightmost frame, you can only install the camera in location 2.

In this example, the camera/mounting bracket is installed in location 2.

Figure 1. The options for installing the video camera



Fire suppression

Each Dx5, Lx5, S25 frame in the TS4500 tape library has areas on the top where you can cut opening to install pipes, conduits, or other fire suppression parts.

A fire-suppression system is the responsibility of the customer

Attention: For advice about selecting a fire-suppression system that provides the correct level of coverage and protection, consult your insurance underwriter, and local fire marshal (or local building inspector).

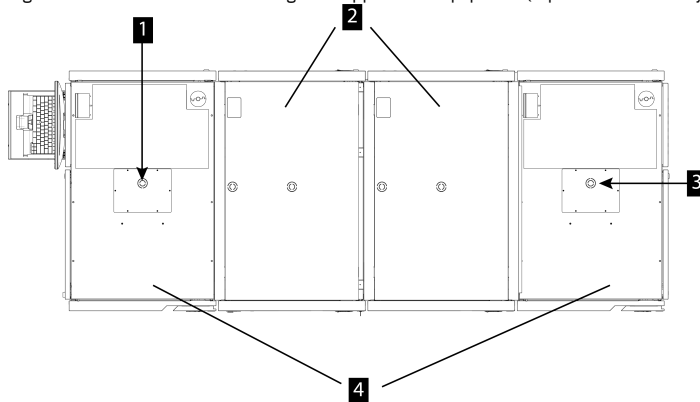
IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire-suppression systems, IBM does not make compatibility claims of any kind nor does IBM provide recommendations on fire-suppression systems. The TS4500 tape library is constructed to allow third-party installation of fire-suppression equipment. When you are deciding whether to implement fire-suppression equipment, refer to local and national standards and regulations.

In a TS4500 tape library with Integrated Cooling, the top of the L25 and D25 frames are covered by the TR1 and the air conditioner. However, you can apply fire suppression piping through the top of the S25 frames. [Figure 1](#) shows the knockouts you can use to route your fire suppression piping into the frames.

See [Attachment of cables, wiring, and pipes between frames](#) for how to route the fire suppression piping inside the library.

All water systems must be external to the library's frame, with mechanical support provided for piping.

Figure 1. Allowable areas for routing fire-suppression equipment (top view of the library frames)



Note:

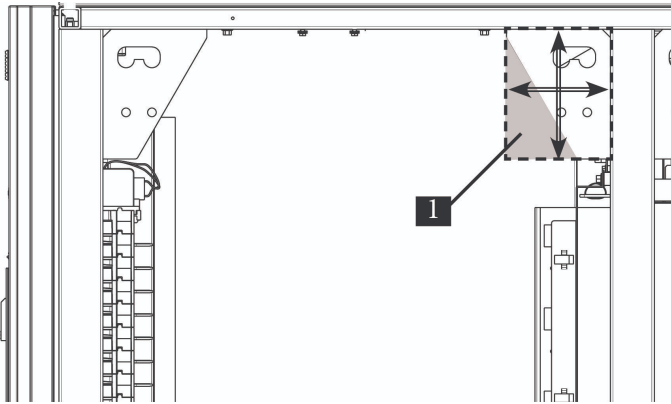
- 1 Fire Suppression knockout
- 2 TR1
- 3 Fire Suppression knockout
- 4 S25 Frames

Attachment of cables, wiring, and pipes between frames

A side view of the area available to run cables, wiring, and pipes between frames of the TS4500 tape library is shown in [Figure 2](#). The area is a triangular section that is 81 mm (3.2 inches) wide by 140 mm (5.5 inches) long (see 1 in [Figure 2](#)). All of the fire suppression tubing and equipment that routes between frames **must stay** within the area of the triangle section 1.

Inside a frame, all the fire suppression equipment **must stay** within the upper back portion of the frame. [Figure 2](#) illustrates this area with the four directional arrows and dotted line.

Figure 2. Location for routing fire-suppression equipment between frames



Route gaseous system piping with discharge nozzles inside the frames just below the top of the frame. Gas cylinders and control equipment must be external to the library. IBM does not supply heat or smoke detectors.

Environmental specifications

Refer to these environmental specifications to determine where to place the tape library.

[Table 1](#) lists the recommended environmental specifications for the tape library when operating and when powered off. [Figure 1](#) is a psychrometric chart showing the allowable and recommended operating environments. [Table 2](#) provides guidelines for gas and particulate exposure.



Attention: The environments in [Table 1](#) refer to the hardware of the tape library and may lead to temperatures greater than allowable for the cartridges and media stored in the library. Refer to the following topics and adjust the operating environment for the library accordingly.

- [Environmental and shipping specifications for LTO tape cartridges](#)
- [Environmental and shipping specifications for IBM 3592 tape cartridges](#)

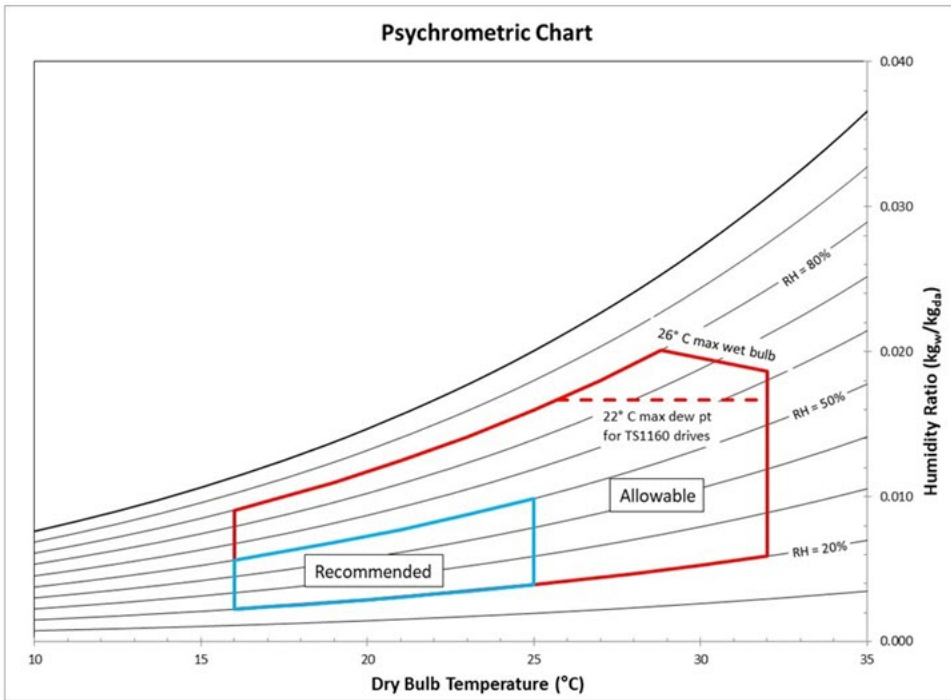
Table 1. Equipment environment specifications for the tape library

Product operation (equipment is powered on)									
Dry-bulb temperature			Humidity range, non-condensing			Maximum wet-bulb temperature ⁵	Maximum dew point temperature ⁶	Maximum elevation	Dry-bulb temperature
Allowable ²	Recommended ³	Maximum rate of change	Allowable	Recommended	Maximum rate of change				
16 to 32°C (60 to 90°F)	16 to 25°C (60 to 77°F)	5°C/hour (9°F/hour)	20% to 80% RH	20% to 50% RH	5% RH/hour ⁴ with no condensation	26°C (79°F)	22°C (72°F)	3050 m (10,000 feet)	5 to 41°C (40 to 106°F)

Notes:

1. Product equipment is removed from the original shipping container and installed but not in use - for example, during repair, maintenance, or upgrade.
2. Derate maximum dry-bulb temperature 1°C/300 m above 900 m (1.8°F/1,000 feet above 3,000 feet).
3. Derate maximum recommended dry-bulb temperature 1°C/300 m above 1,800 m (1.8°F/1,000 feet above 6,000 feet).
4. For 3592 media, changes of up to 40% RH in 5 minutes are allowed as long as the 20% to 80% absolute limits are not exceeded.
5. Applies to LTO drive generations 1 through 8 and to legacy 3592 drives (TS1155 and prior generations).
6. Applies to TS1160 and LTO 9 drives.

Figure 1. Psychrometric chart showing recommended and allowable operating environments for the tape library



Notes:

- The chart is shown in SI (metric) units and a barometric pressure of 101.325 kPa (sea level).
- The recommended operating environment specifies a long-term operating environment that can result in the greatest reliability and energy efficiency.
- The allowable operating environment represents where the equipment has been tested to verify functionality. Due to the stresses that operating in the allowable envelope can place on the equipment, these envelopes should be used for short-term operation, not continuous operation (for example, in the case of a cooling failure).

Table 2. Gas and particulate exposure

Contaminate	Requirement
Gaseous contamination	Severity level G1 as per ANSI/ISA 71.04-1985, ¹ which states that the reactivity rate of copper coupons shall be less than 300 Angstroms per month ($\text{\AA}/\text{month}$, $\approx 0.0039 \mu\text{g}/\text{cm}^2$ - hour weight gain). ² In addition, the reactivity rate of silver coupons shall be less than 300 $\text{\AA}/\text{month}$ ($\approx 0.0035 \mu\text{g}/\text{cm}^2$ - hour weight gain). ³ The reactive monitoring of gaseous corrosivity should be conducted approximately 5 cm (2 inches) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.
Particulate contamination	Data centers must meet the cleanliness level of ISO 14644-1 class 8. For data centers without airside economizer, the ISO 14644-1 class 8 cleanliness might be met simply by the choice of the following filtration: <ul style="list-style-type: none"> • The room air might be continuously filtered with MERV 8 filters. • Air entering a data center might be filtered with MERV 11 or preferably MERV 13 filters. For data centers with airside economizers, the choice of filters to achieve ISO class 8 cleanliness depends on the specific conditions present at that data center. The deliquescent relative humidity of the particulate contamination should be more than 60% RH. ⁴ Data centers must be free of zinc whiskers. ⁵

Notes:

1. ANSI/ISA-S71.04. 1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*, Instrument Society of America, Research Triangle Park, NC, 1985.
2. The derivation of the equivalence between the rate of copper corrosion product thickness growth in $\text{\AA}/\text{month}$ and the rate of weight gain assumes that Cu_2S and Cu_2O grow in equal proportions.
3. The derivation of the equivalence between the rate of silver corrosion product thickness growth in $\text{\AA}/\text{month}$ and the rate of weight gain assumes that Ag_2S is the only corrosion product.
4. The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.
5. Surface debris is randomly collected from 10 areas of the data center on a 1.5 cm (0.6 inch) diameter disk of sticky electrically conductive tape on a metal stub. If examination of the sticky tape in a scanning electron microscope reveals no zinc whiskers, the data center is considered free of zinc whiskers.

Acoustical specifications

Several conditions must be in place to accommodate the acoustical specifications of the TS4500 tape library. This topic provides a general statement about the acoustical specifications.

When the TS4500 tape library is both operating and idling, the following conditions apply:

- Power is on.
- All air-moving devices are operating.

- Tape cartridges are loaded in all drives.

When the library is operating the cartridge accessor loads, unloads, or moves tape cartridges. When the library is idling the accessor does not move.

The TS4500 tape library is a Category 1 product as defined in C-S 1-1710-006.

- [Acoustical specifications for models L25, D25, L55, and D55](#)
Use this table to view the acoustical specifications and noise emission values for Models L25, D25, L55, and D55 of the TS4500 tape library .

Acoustical specifications for models L25, D25, L55, and D55

Use this table to view the acoustical specifications and noise emission values for Models L25, D25, L55, and D55 of the TS4500 tape library .

Table 1. Noise emission values for the TS4500 tape library models L25, D25, L55, and D55

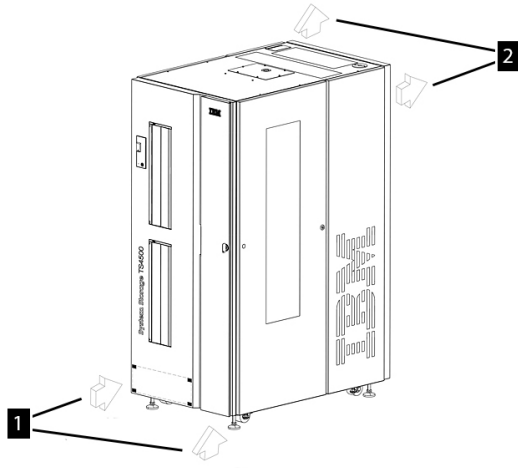
Declared Sound Power Level $L_{WA,d}$		Mean A-weighted Sound Pressure Level at the 1 m (Bystander) Positions $\langle L_{pA} \rangle_m$	
Operating (bels)	Idling (bels)	Operating (dB)	Idling (dB)
7.5 B	7.4 B	54 dB	51 dB
All measurements are in accordance with ANSI S12.10, and conform with ISO 9296.			

Air flow

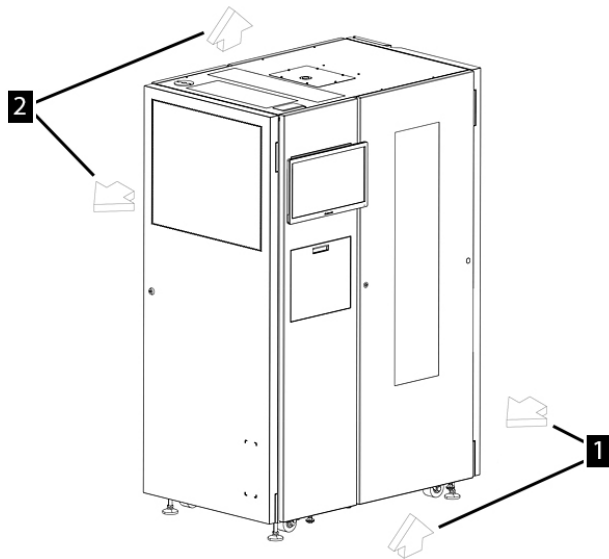
The TS4500 tape library draws cool air in through the perforated holes in the front door and bottom front of the frame. Hot air vents through perforated holes in the back door and top back of the frame. The Sx5 frames do not have any perforated holes in the back door. However, the cool air inlet in the front and hot air outlet in the top back of the frame are the same as the other frames.

Refer to [Air Flow - Front Isometric](#) and [Air Flow - Rear Isometric view](#). Cold air 1 enters the library from the front and hot air 2 exits out the back.

Air Flow - Front Isometric



Air Flow - Rear Isometric view



The FCA and tape drives have their own cooling as part of their packages, but air must be allowed to flow freely from the top of the library. With the top rack installed, air flows from the top of the library through a 2-inch gap in the bottom of the top rack. Internal components in the top rack must be mounted so that they do not interfere with the air flow through the 2-inch gap in the bottom of the top rack. The rear door of the top rack is perforated to allow the hot air to exit.

Note: For air to flow freely from the top of the library, do not stack cartridges, books, or other materials on the top of the library.

Note: For sizing total library air flow requirements, use 10 cubic feet per minute (cfm) per tape drive canister. For example, a library with a total of 16 tape drive canisters will draw 16 x 10 cfm = 160 cfm through the front, top, and bottom library openings and exhaust that air through the perforated vents in the back of the frame(s) that contain the tape drives.

Powering the components within the frame

The TS4500 tape library connects to AC power in multiple ways. The library is powered by two AC to DC power supplies in the Lx5 frame. You can also have power supplies that are installed in a Dx5 frame.

Powering the components within the frame

The Frame Control Assembly (FCA) includes power supplies for the tape drives that are installed in the frame. All Lx5 frames ship with an FCA. For Dx5 models, FC 1450 provides an FCA. If you have tape drives in a Dx5 frame, then FC1450 is required in that frame. The frame power supply provides power to the drives and control cards within that frame. A single power supply is adequate to power the frame, but two power supplies are present for redundancy. Any of the AC to DC power supplies can supply power to components shared between frames, such as the frame lighting and cartridge accessors.

You can power TS4500 tape library in three basic ways (1) Standard Configuration, (2) Using Power Distribution Unit (PDU) Feature Code 1951/1952, (3) Using Feature code 1751/1752 with a Top Rack.

- **Standard power configuration**
The standard TS4500 tape library power configuration requires the customer to supply two 20-amp power outlets per powered frame.
- **Using Power Distribution Unit (PDU) Feature Code 1951/1952 Do we need this one?**
Feature Code 1951/1952 provides 2 PDUs to power the TS4500 tape library.
- **Using Feature code 1751/1752 with a Top Rack**
Feature Code 1751/1752 provides 1 PDU that is installed in a Top Rack, to power the TS4500.

Standard power configuration

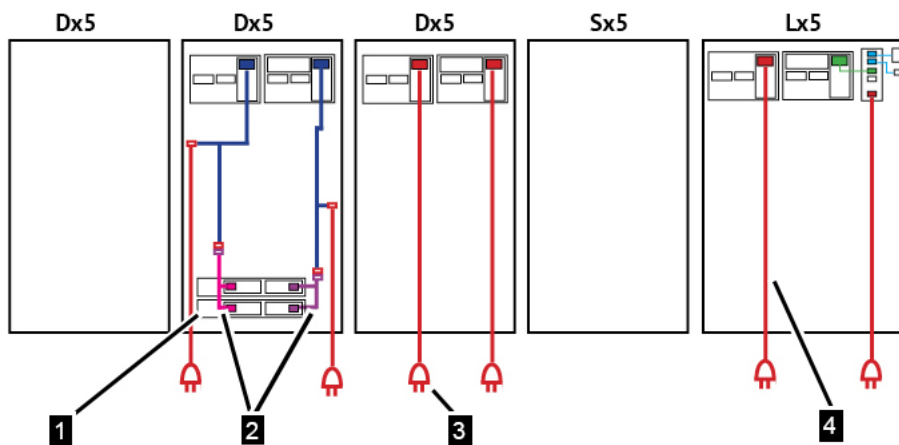
The standard TS4500 tape library power configuration requires the customer to supply two 20-amp power outlets per powered frame.

[Figure 1](#) shows a five frame library with the standard power configuration. In this example, the customer would provide six outlets.

Referring to [4](#), two power cords are shipped with each powered frame. The customer must specify the feature codes for the proper power cord type for their geographic location. The power cord feature codes for the standard configuration are FC99xx (Excluding FC9954 through 9959, and 9966).

The example also shows how two fiber channel switches [1](#) (FC 4880) are powered in this configuration. Two bifurcated power cords [2](#) and two bifurcated extensions (shown in blue) are shipped with the mounting kit FC 4879.

Figure 1. Standard power configuration (rear view of the library)



Using Power Distribution Unit (PDU) Feature Code 1951/1952 Do we need this one?

Feature Code 1951/1952 provides 2 PDUs to power the TS4500 tape library.

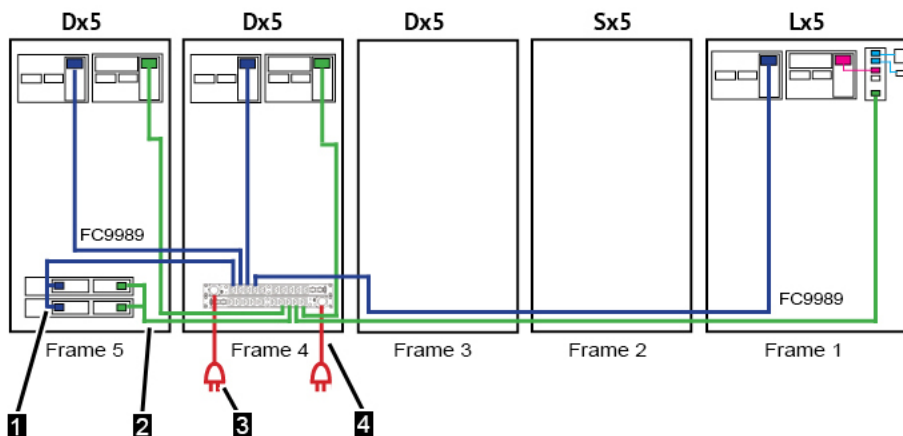
[Figure 1](#) shows a five frame library that is powered by using 2 PDUs (each FC 1951/1952 includes 2 PDUs, for redundancy) which are installed at the bottom of Frame 4. FC 1951/1952 can provide power for up to a total of three frames that are no more than three frames away from the PDUs. In this example, Frame 1 is three frames away from the PDUs in Frame 4.

The PDU requires two 200-240 vac power receptacles and a 30 amp circuit breaker. In this example, the customer only needs to provide two 30 amp rated outlets (one for each PDU in the FC 1951/1952) to power the entire library. The specific type of outlet that is required is determined by the specific power cord feature (FC 9954 through 9959, and 9966) that was ordered with the FC 1951 or (FC 9954 through 9958, and 9948) for FC 1952 (See 3 , and 4 in [Figure 1](#)). The FC1951/1952 includes two internal power cords that power the frame where the PDUs are installed (Frame 4). The customer must order FC9989 (two 4.3-m power cords) for each powered frame that attaches to the PDUs. In this example, FC9989 would be ordered for Frame1, and Frame 5.

The fiber channel switches that are installed (In this example, Frame 5) plug directly into the PDU in the adjacent frame. Two of the power supply cables from the switches 1 plug into one PDU, and the other power cables 2 plug into the other PDU for redundancy. With this example of the switches plugged directly into the PDUs, the switches and PDUs must be in adjacent frames. For configurations that require the switches and PDUs to be 2 or 3 frames away from each other, the bifurcated power cords extensions must be used.

Referring to 4 , the customer must specify the feature codes for the proper power cord type for their geographic location. The power cord feature codes that are used with FC1951 are FC9954 through 9959, and 9966. The power cord feature codes that are used with FC1952 are FC9954 through 9958, and 9948.

Figure 1. Power configuration with Feature Code 1951/1952 (rear view of the library)



Using Feature code 1751/1752 with a Top Rack

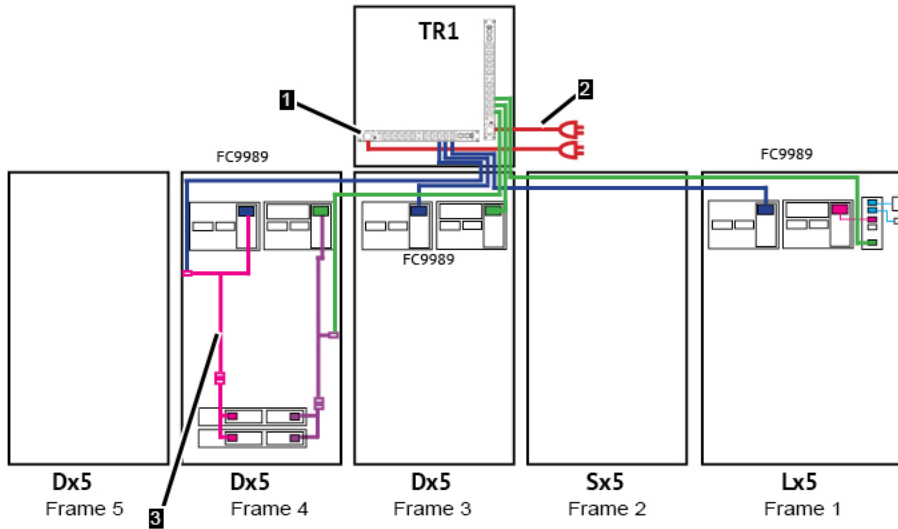
Feature Code 1751/1752 provides 1 PDU that is installed in a Top Rack, to power the TS4500.

[Figure 1](#) shows a five frame library that is powered with FC 1751. FC 1752 installs in the same way. This feature code provides one PDU. If the customer wants redundant power, then a second PDU (an extra FC1751/1752) must be ordered. In this example, two FC1751 would need to be ordered.

The customer must order FC9989 (Two 4.3-m power cords) for all the powered frames that attach to the PDU. In this example, FC9989 would be ordered for Frame 1, Frame 3, and Frame 4.

The customer must specify the feature codes for the proper power cord type 2 for their geographic location. The power cord feature codes that are used with FC1751 are FC9954 through 9959, and 9966. The power cord feature codes that are used with FC1752 are FC9954 through 9958, and 9948.

Figure 1. Power configuration with Feature Code 1751/1752 and Top Rack (rear view of the library)



Power consumption and cooling requirements

The power and cooling requirements for a frame depend on the frame model type, feature codes, and number and type of tape drives installed. Generally, the greater the number of tape drives in a frame, the more heat the frame generates. The cooling requirements increase in direct proportion to the amount of heat that is generated.

[Table 1](#) shows the power consumption and cooling requirements for frames, common feature codes, and tape drives. [Table 2](#) provides an example of how to calculate these values.

Table 1. Power consumption and cooling requirements for frame models

Description	Power consumption (watts)			Cooling requirements (Btu/hr, max. continuous) ²
	Off ¹	Idle	Max. continuous (not peak)	
FRAME MODELS				
L25, L55 ^{3,4}	11	95	130	443
D25, D55, S25, S55 ^{3,5}	0	11	11	38
FEATURE CODES				
FC 1442 HA kit with second accessor	0	24	85	290
FC 1450 (TS4500 FCA) including one LCC and two AC/DC power supplies	11	38	38	130
FC 1460 (redundant accessor power/network)	0	5	5	17
FC 1521, 1522, 1523, 1524 (quad drive mounting kits)	0	3	3	10
FC 1531, 1532, 1533, 1534 (quad drive mounting kits)	0	3	3	10
FC 1751 PDU (for TR1 top rack)	9	9	9	31
FC 1752 PDU	17	17	17	58
FC 1951 PDU	17	17	17	58
FC 1952 PDU	34	34	34	116
TAPE DRIVES (3592)				
TS1140 drive (3592 EH7) ⁶	0	28	50	171
TS1150 drive (3592 EH8) ⁶	0	23	48	164
TS1155 drive (3592 55F) ⁶	0	23	48	164
TS1155 drive (3592 55E) ⁶	0	50	63	215
TS1160 drive (3592 60F) ⁶	0	39	63	215
TS1160 drive (3592 60E) ⁶	0	38	62	211
TS1160 drive (3592 60S) ⁶	0	38	62	211
TAPE DRIVES (LTO)				
LTO 5 drive (3588 F5C) ⁶	0	16	32	109
LTO 6 drive (3588 F6C) ⁶	0	13	36	123

Description	Power consumption (watts)			Cooling requirements (Btu/hr, max. continuous) ²
	Off ¹	Idle	Max. continuous (not peak)	
LTO 7 drive (3588 F7C) ⁶	0	15	31	106
LTO 8 drive (3588 F8S and F8C) ⁶	0	18	40	136
LTO 9 drive (3588 F9S, F9C, and S9C) ⁶	0	18	37	126

Notes:

- "Off" refers to power consumed when the library is connected to an AC power source and the library on/off switch is set to off.
- To calculate the total cooling required by the library in Btu/hr, multiply the total power in watts by 3.41. To convert Btu/hr to kBtu/hr, divide your result by 1000.
- Lx5 models and models with FC 1450 or FC1951 come equipped with dual AC power cords. The figures in the table show the total power that is consumed, including power that is consumed by redundant power supplies. Each power cord supplies approximately half of the power.
- Lx5 frame power includes all frame loads, cartridge accessor, IMC, and display.
- For base models that do not include FC 1450 (TS4500 FCA), the power consumption values indicate power that is provided by other frames. These values include power consumption for the lighting and two LFIs.
- Idle power is consumed when the drive has no tape cartridge loaded. Maximum continuous power is consumed when the drive is actively reading and writing to the tape. These power consumption values includes the power that is required for the cooling fan at normal speed. In ambient environments that are hotter than the recommended range, the cooling fan might speed up and draw more power.

Table 2. Sample calculation of total library power consumption and cooling requirements

Frame model, feature codes, and drives	Quantity	Power (watts)			Cooling (kBtu/hr) ¹
		Off	Idle	Max. continuous	Max. continuous
L25	1	11	95	130	0.4
FC 1460 (redundant accessor power/network)	1	0	5	5	0.0
FC 1531, 1532, 1533, and 1534 (one of each FC per frame)	4	0	12	12	0.0
TS1160 drives	12	0	468	756	2.6
D25	3	0	33	33	0.1
FC 1450 (TS4500 FCA including one LCC and two ac/dc power supplies)	3	33	114	114	0.4
FC 1531, 1532, 1533, and 1534 (one of each FC per frame)	12	0	36	36	0.1
TS1160 drives	48	0	1872	3024	10.3
S25	4	0	44	44	0.2
FC 1442 (HA kit with second accessor; for Dx5 or Sx5)	1	0	24	85	0.3
Total library power consumption (watts)	--	44	2703	4239	14.5
Total cooling requirement (kBtu/hr)¹	--	0.2	9.2	14.5	--

Notes:

- To calculate the total cooling required by the library in Btu/hr, multiply the total power in watts by 3.41. To convert Btu/hr to kBtu/hr, divide your result by 1000.

Power cords and receptacles

Each frame receives single-phase (200–240 V ac) power on its own power cord from a customer-supplied outlet or from an optional power distribution unit (PDU).

Power cords

Refer to [Figure 1](#) and match the number that is beside each receptacle to the receptacle number listed in the table.

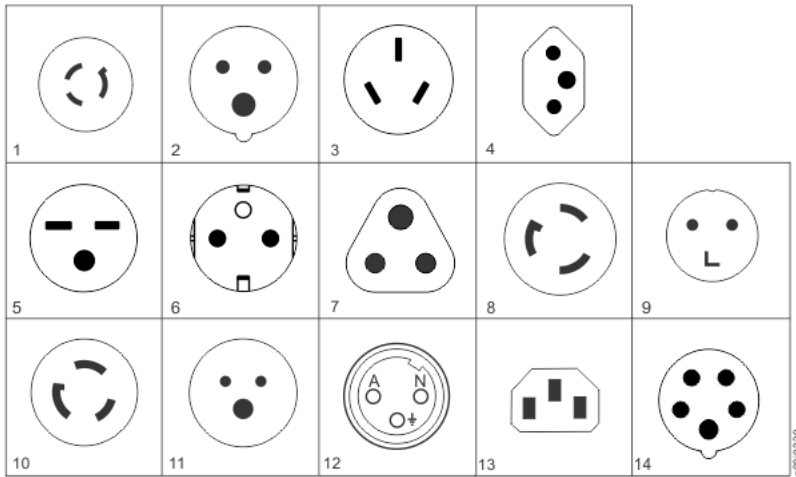
Table 1. Specifications for power cords used with xx5 frame models

Length and type of power cord	Part number and feature code*	Type of service receptacle
Dual 4.3 m (14 ft.) watertight, international 250 V ac, 16 A single phase. This power cord is for countries other than the United States, Canada, and Mexico.	45E2699 / 9970	IEC-309 2P +GND 16 A Uses receptacle #2
Dual 4.3 m (14 ft.) watertight, 250 V ac, 20 A single phase. This power cord is for the United States, Canada, and Mexico.	23R9540 / 9970	Hubbell HBL320R6W, IEC-309 2P +GND 20 A Uses receptacle #2
Dual 4.3 m (14 ft.) non-watertight, twistlock 250 V ac, 15 A. This power cord is for the United States and Canada.	39M5114 / 9972	NEMA L6-15R Uses receptacle #1
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 10 A, IRAM 2073. This power cord is for Argentina.	39M5066 / 9976	Uses receptacle #3
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 15 A, Earth Pin InMetro NBR 14136. This power cord is for Brazil.	02WN892 / 9977	Uses receptacle #4
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 10 A, AS/NZS 3112/2000. This power cord is for Australia and New Zealand.	39M5100 / 9978	Uses receptacle #3
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 15 A, JIS C8303, C8306. This power cord is for Japan.	39M5184 / 9979	Uses receptacle #5
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 10 A, GB 2099.1, 1002. This power cord is for China.	39M5204 / 9980	Uses receptacle #3
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 15 A, with earth pin KS C8305, K60884-1. This power cord is for Korea.	39M5217 / 9981	Uses receptacle #6
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 10 A, CNS 10917-3. This power cord is for Taiwan.	39M5252 / 9982	Uses receptacle #5
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 16 A, SANS 164-1. This power cord is for South Africa.	39M5142 / 9983	Uses receptacle #7
Dual 4.3 m (14 ft.) 250 V ac, 15A, single phase power cord, non-watertight twistlock 20A receptacles. This power cord is for US and Canada.	23R9760 / 9984	NEMA L6-20R Uses receptacle #8

Length and type of power cord	Part number and feature code*	Type of service receptacle
Dual 4.3 m (14 ft.) 250 V ac, 15A, single phase power cord, watertight 15A plugs. This power cord is for US and Canada.	12X4116 / 9985	Russellstoll 3743U2 or 9R23U2W receptacles, or Russellstoll 3913U2 or 9C23U2 connectors Uses receptacle #9
Dual 4.3 m (14 ft.) non-watertight, 250 V ac, 10A, single phase power cord with IEC 60320 C14 connector. This power cord can be used worldwide to connect to spare outlets on FC 1751, 1752, 1951, or 1952 PDUs. It can be used in an adjacent library frame or to a customer-provided PDU that is mounted external to the library frames.	46X7337 / 9989	IEC 60320 C13 Uses receptacle #13
Dual† 4.3 m (14 ft.) power cords with IEC-309 3p+n+g 32A plug, 240-415V ac 3 phase (WYE). This power cord is used in Europe, the Middle East, and Africa. It may be used in US and Canada where permitted by local authority having jurisdiction (AHJ).	39M5413 / 9948 (Used with FC 1752 or 1952 only; not compatible with FC 1751 or 1951)	IEC-309 3p+n+g 32A Uses receptacle #14
Single 2.8 m (9.2 ft.) non-watertight, 250 V ac, 10A single phase power cord with IEC 60320 C20 connector. This power cord can be used worldwide to connect internal library loads with C14 inlet connectors to spare C19 outlets on FC 1752 or 1952 PDUs. Any connected load must not exceed 10A.	39M5392 / 9949 (Used with FC 1752 or 1952 only; not compatible with FC 1751 or 1951)	IEC 60320 C19 (provided on FC 1752 or 1952 PDU)
Dual† 4.3 m (14 ft.) power cords with NEMA L6-30P non-watertight 30A plug, 200–240 V ac, 30 Amps, single phase. This power cord is for US, Canada, Latin America, and Japan.	39M5416 / 9954 (Used with FC 1751, 1752, 1951, or 1952 only)	NEMA L6-30R Uses receptacle #10
Dual† 4.3 m (14 ft.) power cords with watertight Russellstoll 3750DP 30A plug, 200–240 V ac, 30 Amps, single phase. This power cord is used in US, Chicago, Canada, Latin America, and Japan.	39M5418 / 9955 (Used with FC 1751, 1752, 1951, or 1952 only)	Russellstoll 3753 or 9R33UOW receptacle, or a Russellstoll 3933 or 9C33UO connector Uses receptacle #11
Dual† 4.3 m (14 ft.) power cords with IEC-309 p+n+g 30A plug, 200–240 V ac single phase. This power cord is used in US, Canada, and Mexico.	03JJ281 / 9956 (Used with FC 1751, 1752, 1951, or 1952 only)	IEC-309 p+n+g 30A/32A Uses 30A/32A version of receptacle #2
Dual† 4.3 m (14 ft.) power cords with IEC-309 p+n+g 32A plug, 200–240 V ac single phase. This power cord is used for countries other than US, Canada, and Mexico.	39M5414 / 9956 (Used with FC 1751, 1752, 1951, or 1952 only)	IEC-309 p+n+g 32A Uses 32A version of receptacle #2
Dual† 4.3 m (14 ft.) power cords with PDL 56P332 32A plug, 200–240 V ac single phase, 32 Amps. This power cord is used in Australia and New Zealand.	39M5419 / 9957 (Used with FC 1751, 1752, 1951, or 1952 only)	1-gang, 3-pin 32A socket, PDL 56S0332 or equivalent Uses receptacle #12
Dual† 4.3 m (14 ft.) non-watertight power cords with 30A plug type Shin Ju SJ-3302, 200–240 V ac, 30 Amps. This power cord is used in North and South Korea.	39M5420 / 9958 (Used with FC 1751, 1752, 1951, or 1952 only)	200–250 V ac single phase Uses receptacle #3
Dual† 4.3 m (14 ft.) power cords, unterminated (without a power plug), 200–240 V ac single phase, 30 Amps maximum, with IRAM and BSMI agency certifications. Wire size 4 mm ² . This is the recommended cord for Argentina, Taiwan, Europe, the Middle East, and Africa if an unterminated power cord is preferred.	23R7324 / 9959 (Used with FC 1751 or 1951 only; not compatible with FC 1752 or 1952)	Not specified (no plug supplied)
Dual† 4.3 m (14 ft.) power cords, unterminated (without a power plug), 200–240 V ac single phase, 30 Amps maximum, with CCC certification. This is the recommended power cord for China.	23R9543 / 9966 (Used with FC 1751 or 1951 only; not compatible with FC 1752 or 1952)	Not specified (no plug supplied)
Notes: * Except where noted, each feature code ships two power cords so that dual power is supported. † Only a single 99xx power cord is shipped with each 99xx feature ordered for installation into model TR1 (for use with PDU features 1751 or 1752).		

Power receptacles

Figure 1. Types of receptacles



Note: For more information about FC 9989, refer to *Powering adjacent frames*.

Electrical characteristics

[Table 2](#) lists the electrical characteristics for each frame model.

Table 2. Nameplate electrical limits ¹

Models Lx5, Dx5	Models xx5 with FC 1951	Models xx5 with FC 1952 and single phase power cord	Models xx5 with FC 1952 and 3-phase power cord FC 9948
200 - 240 V AC, 8 A, 50 - 60 Hz, 1.6 kVA, single phase	200 - 240 V AC, 24 A, 50 - 60 Hz, 4.8 kVA, single phase ²	200 - 240 V AC, 24 A, 50 - 60 Hz, 4.8 kVA, single phase ²	380 - 415 V AC, 20 A, 50 - 60 Hz, 4.8 kVA, 3-phase wye ²
Notes:			
1. Maximum electrical limits for a single frame. Do not use nameplate limits to calculate product power or cooling requirements.			
2. Electrical limits increase for frames with PDU FC 1951 or 1952 because the PDUs may supply power to adjacent frames.			

Recommended customer circuit breakers

[Table 3](#) lists the electrical characteristics for each frame model.

Table 3. Recommended customer circuit breakers

Maximum rating	Minimum rating
20 A (32 A if FC 1751, 1752, 1951, or 1952 is installed)	10 A (20 A if FC 1751, 1752, 1951, or 1952 is installed)

Feature codes for the TS4500

Order feature codes to install components in library frames or to enhance the capacity or capabilities of the library.

A customer-setup unit (CSU) is a feature that you, as the customer, can install when the feature is ordered as a field upgrade. If you choose not to install a CSU, IBM® can install it for an extra charge. However, detailed installation instructions are included for most features when you order and receive these features. To access the instructions for installing a CSU online, go to the [Support Portal for the TS4500 Tape Library](#), and choose Plan and install documentation.

Table 1. FCs for the frame models of the TS4500 tape library

FC	Model	CSU	Description
1404	L25, L55	No	TS1140 and TS1150 tape drive support This triggers the shipment of a JK diagnostic cartridge. When model L25 is ordered or when FC 9080 (Mixed Media) is ordered for model L55, a minimum of one of FC 1404 or 1406 is required but any may be selected.
1405	L25, L55	No	LTO5 and LTO6 tape drive support This triggers the shipment of an L5 diagnostic cartridge. When model L55 is ordered, a minimum of one of FC 1405 or 1407 is required but both can be selected. When FC 9080 (Mixed Media) is ordered for model L25, a minimum of one of FC 1405 or 1407 is required but both can be selected.
1406	L25, L55	Both	TS1150, TS1155, or TS1160 tape drive support This feature provides a JL diagnostic cartridge. When model L25 is ordered or when FC 9080 (Mixed Media) is ordered for model L55, a minimum of one of FC 1404 or 1406 is required but any may be selected.
1407	L25, L55	No	LTO6 and LTO7 tape drive support This triggers the shipment of an L6 CE cartridge. When model L55 is ordered, a minimum of one of FC 1405 or 1407 is required but both can be selected. When FC 9080 (Mixed Media) is ordered for model L25, a minimum of one of FC 1405 or 1407 is required but both can be selected.
1408	L25, L55	No	LTO7 and LTO8 tape drive support This triggers the shipment of an L7 CE cartridge. When model L55 is ordered, a minimum of one of FC 1407 or 1408 is required but both can be selected. When FC 9080 (Mixed Media) is ordered for model L25, a minimum of one of FC 1407 or 1408 is required but both can be selected.

FC	Model	CSU	Description
1409	L25, L55	No	<p>LT08 and LT09 tape drive support This triggers the shipment of an L8 CE cartridge. Only one L8 CE cartridge feature #1409 is required in a TS4500 Library.</p> <p>Prerequisite: One of either feature #1408 or #1409 is a prerequisite for the first TS1080 (3588 Model F8x) tape drive ordered. Feature #1409 is a prerequisite for the first TS1090 (3588 Model F9x or S9C) Tape drive ordered.</p>
1412	L25, L55	No	<p>SAS tape drive support This feature provides a mini SAS HD wrap tool. Only one tool is required for the library. The wrap tool is used to isolate drive sled problems</p>
1442	HA Kit w/Second Accessor	No	<p>Dual Accessors This triggers the shipment of</p> <ul style="list-style-type: none"> • Four CE/diagnostic cartridges (two of latest generation for both LTO and 3592) • Service Bay Stop-A and Service Bay Stop-B related parts • TS4500 Accessor B including scanner, enhanced grippers, and enhanced node cards <p>There is a maximum of one HA kit (FC 1442) per library.</p>
1450	D25, D55	No	<p>TS4500 frame control assembly (FCA) Includes 1x LCC and 2x power supplies.</p>
1460	L25, L55	No	<p>Redundant Accessor Power/Network This provides power and internal network redundancy for the L25/L55 frame. This is a prerequisite to FC 9002.</p>
1530	D25, D55, L25, L55, S25, S55	No	<p>Web camera mounting hardware Provides mounting hardware only.</p>
1531	D25, D55, L25, L55	No	<p>First quad drive mounting kit This feature provides signal and power cabling for a column of 4 adjacent drives. Fiber cables can be ordered via one of the following:</p> <ul style="list-style-type: none"> • FC 1536, MMF Quad Drive-to-Patch Panel cables • FC 1537, SMF Quad Drive-to-Patch Panel cables • FC 9713, No Patch Panel Cables <p>Prerequisite:</p> <ul style="list-style-type: none"> • Models L25/D25: One FC 1536 or 9713 is required • Models L55/D55: One FC 1536 or 1537 or 9713 is required. • Models D25/D55: FC 1450 is required.
1532	D25, D55, L25, L55	No	<p>Second quad drive mounting kit This feature provides signal and power cabling for a column of 4 adjacent drives. Fiber cables can be ordered via one of the following:</p> <ul style="list-style-type: none"> • FC 1536, MMF Quad Drive-to-Patch Panel cables • FC 1537, SMF Quad Drive-to-Patch Panel cables • FC 9713, No Patch Panel Cables <p>This feature is not supported in the leftmost frame of a dual accessor library.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> • Models L25/D25: One FC 1536 or 9713 is required. • Models L55/D55: One FC 1536 or 1537 or 9713 is required. • FC 1521 or 1531 is required.
1533	D25, D55, L25, L55	No	<p>Third quad drive mounting kit This feature provides signal and power cabling for a column of 4 adjacent drives. Fiber cables can be ordered via one of the following:</p> <ul style="list-style-type: none"> • FC 1536, MMF Quad Drive-to-Patch Panel cables • FC 1537, SMF Quad Drive-to-Patch Panel cables • FC 9713, No Patch Panel Cables <p>This feature is not supported in the leftmost or rightmost frame of a dual accessor library.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> • Models L25/D25: One FC 1536 or 9713 is required. • Models L55/D55: One FC 1536 or 1537 or 9713 is required. • FC 1522 or 1532 is required.

FC	Model	CSU	Description
1534	D25, D55, L25, L55	Both	<p>Fourth quad drive mounting kit</p> <p>This feature provides signal and power cabling for a column of 4 adjacent drives. Fiber cables can be ordered via one of the following:</p> <ul style="list-style-type: none"> FC 1536, MMF Quad Drive-to-Patch Panel cables FC 1537, SMF Quad Drive-to-Patch Panel cables FC 9713, No Patch Panel Cables <p>This feature is not supported in the leftmost frame of a single accessor library.</p> <p>This feature is not supported in the leftmost or rightmost frame of a dual accessor library.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> Models L25/D25: One FC 1536 or 9713 is required. Models L55/D55: One FC 1536 or 1537 or 9713 is required. FC 1523 or 1533 is required.
1536	D25, D55, L25, L55	Both	<p>MMF Quad Drive-to-Patch Panel Cables (all drive models)</p> <p>This feature includes all fiber cables required for a column of 4 drives, 8x LC-LC Multimode Fiber (MMF) Drive-to-Patch Panel cables.</p> <p>Prerequisite: One FC 1536 or 1537 or 9713 per each FC 1531, 1532, 1533, and 1534.</p>
1537	D55, L55	Both	<p>SMF Quad Drive-to-Patch Panel Cables (LTO8)</p> <p>This feature includes all fiber cables required for a column of 4 drives, 8x LC-LC Single Mode Fiber (SMF) Drive-to-Patch Panel cables.</p> <p>Prerequisite: One FC 1536 or 1537 or 9713 per each FC 1531, 1532, 1533, and 1534.</p>
1604	L25, L55	Yes	<p>Transparent LTO encryption</p> <p>Provides license keys to enable transparent LTO encryption.</p>
1628	L55	Yes	<p>Additional LTO Cartridge Magazines</p> <p>Provides magazine and cover for transport or storage of up to 18 cartridges.</p>
1629	L25	Yes	<p>Additional 3592 Cartridge Magazine</p> <p>Provides magazine and cover for transport or storage of up to 16 cartridges.</p>
1643	L25, L55	Yes	<p>Intermediate capacity on demand</p> <p>Provides license key to increase storage from entry capacity to intermediate capacity.</p>
1644	L25, L55	Yes	<p>Base capacity on demand</p> <p>Provides license key to increase storage from intermediate capacity to base capacity.</p> <p>This feature code is a prerequisite for FC 9002 or Model Lx5 HD CoD FC 164x.</p> <p>Prerequisite: FC 1643</p>
1645	S25	Yes	<p>High density capacity on demand</p>
1646	S55	Yes	<p>High density capacity on demand</p>
1647	L25	Yes	<p>High density capacity on demand</p> <p>Prerequisite: FC 1644</p>
1648	L55	Yes	<p>High density capacity on demand</p> <p>Prerequisite: FC 1644</p>
1649	D25	Yes	<p>High density capacity on demand</p>
1650	D55	Yes	<p>High density capacity on demand</p>
1652	D25, D55	No	<p>Two additional I/O stations</p> <p>This feature code adds either 36 (LTO) or 32 (3592) I/O slots.</p>
1663	D25, D55, L25, L55	No	<p>Drive removal</p>
1682	L25, L55	Yes	<p>Path failover</p>
1742	Sx4	No	<p>TS4500 Control - Upgrade</p> <p>This includes 1x top panel and 2x Ethernet cables, card cages, ASCs, BPCs, and LFIs.</p>
1750	TR1, TR2	No	<p>Side covers</p> <p>This feature provides left-and right-side end covers. This feature is required only for the first top rack ordered (if multiple top racks are installed on adjacent frames).</p>
1751	TR1	No	<p>Power distribution unit</p> <p>Provides one PDU to be mounted in the top rack. The first PDU in a top rack does not consume any of the 10U of rack space. The second PDU in a top rack consumes 1U of rack space.</p> <p>Note:</p> <ul style="list-style-type: none"> A maximum of two FC 1751s can be ordered. FC 1751 cannot be installed in the same rack as an FC 1752 PDU. <p>Each PDU has 10 C13 outlets divided into 2 groups of 5 outlets. Each group is protected by a 15 amp circuit breaker. In addition, there is a master 25 amp circuit breaker for the entire PDU. All of the circuit breakers are rated at 5 kAIC. Each PDU has a control input that can be used to turn all of the outlets on or off by an external switch or relay contact (not provided). The control input is defaulted to ON by a jumper plug included with the PDU.</p> <p>Prerequisite: For each FC 1751 ordered, one power cord (FC 9954 through 9959 or 9966) must also be ordered.</p> <p>Limitation: Mutually exclusive with 1752</p>

FC	Model	CSU	Description
1752	TR1, TR2	Yes	<p>Enhanced PDU Provides one PDU with 3-phase (wye) or single phase input power, to be mounted in top rack (max of two may be ordered). Each PDU ordered in a top rack consumes 1U of rack space.</p> <p>Each PDU has 9 outlets divided into three groups. Within each group there are two C-13 outlets and one C-19 outlet. Each group is protected by 20amp circuit breakers rated at 10 kAIC. Note that, if required, loads installed in the TR1 with C14 inlets can be connected to the PDU C19 outlets by use of C20 to C13 power cord FC 9949.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> For single phase input power, for each PDU ordered must order one power cord FC 9954 through 9958. For 3-phase (wye) input power, for each PDU ordered must order one power cord FC 9948. <p>Limitation: Mutually exclusive with FC 1751</p>
1753	TR2	No	<p>Olympus Rack Configuration This feature code specifies the configuration of the TR2 rack to be in conformance with the Open Compute Project Olympus Rack Specification.</p> <p>This provides 5U of 19 inch rack space with 3 sets of EIA rails with a spacing from the front face of the front EIA rail to the rear face of the middle EIA rail being 745 mm and the spacing from the front face of the front EIA rail to the rear face of the rear EIA rail to be 1020 mm.</p> <p>It includes a top cover that allows top access cables to be routed into the TR2. This also includes side air blocks that prevent airflow between the EIA rails and the side covers per the Open Compute Olympus Rack Specification</p>
1754	TR2	No	<p>Standard 19 inch Rack Configuration This feature code specifies the configuration of the TR2 rack to be in conformance with industry standard 19 inch racks.</p> <p>This provides 5U of 19 inch rack space with 2 sets of EIA rails with a spacing from the front face of the front EIA rail to the rear face of the rear EIA rail being 719 mm.</p> <p>It includes a top cover that allows top access cables to be routed into the TR2.</p>
1755	TR2	Yes	<p>Front Door This feature provides the front door for the TR2</p>
1756	TR2	Yes	<p>Rear Door This feature provides the rear door for the TR2</p>
1802	L25, L55	No	<p>1- to 2-frame X-track cable Non-HA 1 to 2 Frame Track Cable</p>
1806	L25, L55	No	<p>3- to 6-frame X-track cable Non-HA 3 to 6 Frame Track Cable</p>
1814	L25, L55	No	<p>7- to 14-frame X- track cable Non-HA 7 to 14 Frame Track Cable. See 3584 X Track Cable Features/Specify codes for more details.</p> <p>Limitation: Not supported with FC 2071 or FC 9071.</p>
1818	L25, L55	No	<p>9- to 18-frame X- track cable Non-HA 9 to 18 Frame Track Cable. See 3584 X Track Cable Features/Specify codes for more details.</p> <p>Limitation: Not supported with FC 2071 or FC 9071.</p>
1909	L25, L55, D25, D55	No	<p>Single power source bifurcated cable Allows attachment of a powered frame to a single outlet while also maintaining drive redundant power.</p>
1951	D25, D55, L25, L55, S25, S55	No	<p>Power distribution units Provides two PCAs, mounting hardware including rack brackets, and internal power cables.</p> <p>Supports any combination of up to 3 pairs of power cords for FC 4875 on the same frame and FC 9989 on adjacent frames.</p> <p>Each PDU has 10 C13 outlets divided into 2 groups of 5 outlets. Each group is protected by a 15 amp circuit breaker. In addition, there is a master 25 amp circuit breaker for the entire PDU. All of the circuit breakers are rated at 5 kAIC. Each PDU has a control input that can be used to turn all of the outlets on or off by an external switch or relay contact (not provided). The control input is defaulted to ON by a jumper plug included with the PDU.</p> <p>Corequisite: One power cord feature (FC 9954 through 9959 or 9966)</p> <p>Limitation: FC 1951 cannot be installed in the same rack as an FC 1952 PDU.</p>

FC	Model	CSU	Description
1952	D25, D55, L25, L55, S25, S55	No	<p>Enhanced PDUs Provides two PDUs with 3-phase (wye) or single phase input power, mounting hardware including rack brackets, and internal power cables to provide power to the local frame control assembly.</p> <p>These line cord features may require different customer facility outlets than frames without FC 1952. Can be used for adjacent frame AC power cord aggregation, or for unique facility AC socket requirements. Supports any combination of up to 3 pairs of power cords for FC 9989 on adjacent frames.</p> <p>Each PDU has 9 outlets divided into three groups. Within each group there are two C-13 outlets and one C-19 outlet. Each group is protected by 20amp circuit breakers rated at 10 kAIC. Note that, if required, loads installed in the TR1 with C14 inlets can be connected to the PDU C19 outlets by use of C20 to C13 power cord FC 9949.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> For single phase input power, must order one power cord FC 9954 through 9958. For 3-phase (wye) input power, must order one power cord FC 9948. <p>Limitation:</p> <ul style="list-style-type: none"> Mutually exclusive with legacy PDU FC 1951, Fibre Channel switch mounting FC 4879, and Ethernet switch FC 2704. Mutually exclusive with FC 4879 or 2704.
2002	L25, L55	No	1-2 Frame Flex Track A Cable
2006	L25, L55	No	3-6 Frame Flex Track A Cable
2014	L25, L55	No	7-14 Frame Flex Track A Cable
2018	L25, L55	No	9-18 Frame Flex Track A Cable
2071	L25, L55	No	<p>Flex Track Guide This includes AXY, AXY plate, ASC to Flex track cable, and new end stops.</p>
2072	D25, D55, S25, S55, Sx4	No	Flex Track Guide for Expansion Frame
2309	xx5	No	<p>TS4500 Accessor Refresh Provides a complete accessor assembly with HD grippers to Lxx models or models with FC 1442.</p> <p>Prerequisite: FC 2071, 2072, or 9071, 9072.</p>
2402	L25, L55	No	1-2 Frame Flex Track B Cable
2406	L25, L55	No	3-6 Frame Flex Track B Cable
2414	L25, L55	No	7-14 Frame Flex Track B Cable
2418	L25, L55	No	9-18 Frame Flex Track B Cable
2704	L25, L55	No	<p>Console expansion 26-port Ethernet switch/rack mount Provides a 26-port Ethernet switch and attachment cable for connection to an IMC as a centralized system console.</p> <p>Up to 24 extra connections of FC 2715 are provided by this feature. This feature is supported on Lx5 models to allow other products to share the IMC.</p>
2715	L25, L55	No	<p>TSSC attachment cable FC 2715 is a cable to attach a unit to the Ethernet switch provided by the TSSC.</p> <p>Note: A maximum of 43 of FC 2715 can be included in a single TSSC facility. Note: FC 2704 is supported on Lx5 models if you are connecting the frame to an existing TSSC.</p>
2735	L25, L55	No	<p>USB Optical Drive Required for all new plant orders. Provides a USB optical drive for use with the Integrated Management Console (IMC). The optical drive is required for IMC code.</p>
2737	S25, S55	No	<p>IMC Separate Power Source This feature allows longer distances between the IMC end panel and an FCA by supplying 2 Ethernet cables that are longer than normal. For both plant and field, instructions are also provided for moving the IMC PDU from another frame into this frame.</p> <p>Prerequisite: One of the FC 9970-9985, 9989 power cords.</p>
4879	L25, D25, TR1, TR2	No	<p>TS7700 BE Switch Mounting Hardware Provides 2x Fibre channel switch mounting hardware, including rack brackets and power cords.</p> <p>Prerequisite: FC 4880</p>
4880	L25, D25, TR1, TR2	No	<p>TS7700 BE 16 Gb Switch Provides 1x Fibre channel switch (16 Gb).</p> <p>Limitation: There is a maximum of 2x FC 4880 per model x25.</p>
4890	L25		<p>Preloaded Media Enablement Kit This feature provides the brackets and accessories for a system integrator to pre-load media.</p> <p>Prerequisite: FC 9074</p>
4892	D25, D55, L25, L55, S25, S55	No	<p>Rear Door Sensor This feature provides rear door sensor components for notifying of rear door open/close events.</p> <p>Prerequisite: FC 9074</p>
6013	D25, D55, L25, L55	Yes	LC to LC Fibre Channel cable - 13m (43 ft)

FC	Model	CSU	Description
6025	D25, D55, L25, L55	Yes	LC to LC Fibre Channel Cable - 25m (82 ft)
6061	D25, D55, L25, L55	Yes	LC to LC Fibre Channel Cable - 61m (200 ft)
8750	D55, L55	No	LTO cleaning cartridge Universal cleaning cartridge.
8802	D25, L25	No	3592 cleaning cartridge
9001	D25, D55, L25, L55	No	Driveless frame
9002	L25, L55	No	First expansion frame attachment Used as a part of the process to add any Dxx or Sxx frame. Prerequisites: <ul style="list-style-type: none"> FC 1460 and 1644. FC 9001 for Lxx models.
9003	L25, L55	No	Additional expansion frame attachment Used as a part of the process to add any Dxx or Sxx frame.
9040	High Availability Library	Lx5	Prerequisites: One Flex-track A and B cable of the same length. Flex-Track A cable: FC 2002, 2006, 2014, or 2018. Flex-Track B Cable: FC 2402, 2406, 2414, or 2418.
9071	L25, L55	No	Flex Track Guide Base Includes AXI, AXI plate, ASC to Flex track cable, and new end stops.
9072	D25, D55, S25, S55, Sx4	No	Flex Track Guide for Expansion Frame
9073	D25, D55, L25, L55, S25, S55	No	Gen-2 Frame This feature indicates that the frame is capable of supporting Enhanced PDUs and their associated power cords. FC 9073 is a prerequisite for ordering FC 1952.
9074	D25, D55, L25, L55, S25, S55	No	Gen-3 Frame This feature indicates the frame includes third generation modifications to support future enhancements.
9080	L25, L55	No	Mixed Media Library Prerequisite: Library must contain a mix of LTO and 3592 frames. <ul style="list-style-type: none"> For model L25, FC 1628 (LTO Magazine) and a minimum of one of FC 1405 or 1407 (LTO CE cartridge). For model L55, FC 1629 (3592 Magazine) and FC 1404 (3592 CE cartridge). Limitation: Mixed media not supported for Lx2/Lx3.
9210	L25, L55	No	Attached to HP-UX system
9211	L25, L55	No	Attached to Solaris system
9212	L25, L55	No	Attached to Windows system
9213	L25, L55	No	Attached to other non-IBM system
9215	L25, L55	No	Attached to Linux® system
9217	L25, L55	No	Attached to LM/TS7700
9218	L25, L55	No	Attached to HPSS
9400	L25, L55	No	Attached to i5/OS or OS/400 system
9600	L25, L55	No	Attached to AIX system
9607	D55, L55	No	3588 F7A/F7C tape drive - plant install This feature informs the plant to install one LTO 7 Tape Drive Model F7A/ F7C (3588 Model F7A or F7C) into a Tape Library Model D55, or L55 coming from the plant. Prerequisites: <ul style="list-style-type: none"> L55/D55 Models – FC 1521 or 1531 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than zero. L55/D55 Models – FC 1522 or 1532 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than four. L55/D55 Models – FC 1523 or 1533 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than eight. L55/D55 Models – FC 1524 or 1534 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than twelve.

FC	Model	CSU	Description
9609	D55, L55	No	<p>3588 F8A/F8C tape drive - plant install This feature informs the plant to install one LTO 8 Tape Drive Model F8A/F8C (3588 Model F8A or F8C) into a Tape Library Model D55, or L55 coming from the plant.</p> <p>Installation of a 3588 Tape Drive canister requires that a Quad Drive Mounting Kit feature (FC 1521, 1522, 1523, 1524 or 1531, 1532, 1533, 1534) be installed in the TS4500 frame to contain the canister.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> L55/D55 Models – FC 1521 or 1531 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than zero. L55/D55 Models – FC 1522 or 1532 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than four. L55/D55 Models – FC 1523 or 1533 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than eight. L55/D55 Models – FC 1524 or 1534 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than twelve. <p>Note: One FC 1408 is required per Tape Library if this is the first LTO 8 (3588 Model F8A, F8C, or F8S) tape drive ordered.</p>
9611	D55, L55	No	<p>3588 F8S tape drive - plant install This feature informs the plant to install one LTO 8 Tape Drive Model F8S (3588 Model F8S) into a Tape Library Model D55 or L55 coming from the plant.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> L55/D55 Models – FC 1521 or 1531 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than zero. L55/D55 Models – FC 1522 or 1532 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than four. L55/D55 Models – FC 1523 or 1533 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than eight. L55/D55 Models – FC 1524 or 1534 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than twelve. <p>Note: One FC 1408 is required per Tape Library if this is the first LTO 8 (3588 Model F8A, F8C, or F8S) tape drive ordered.</p>
9613	D55, L55	No	<p>3588 F9C Drive Plant Install This feature informs the plant to install one TS1090 Tape Drive Model F9C (3588 Model F9C) into a new TS4500 Tape Library Model D55 or L55 coming from the plant.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> L55/D55 Models – FC 1521 or 1531 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than zero. L55/D55 Models – FC 1522 or 1532 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than four. L55/D55 Models – FC 1523 or 1533 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than eight. L55/D55 Models – FC 1524 or 1534 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than twelve. <p>Note: One feature #1409 is required per Tape Library if this is the first TS1090 (3588 Model F9S, F9C or S9C) tape drive ordered.</p>
9615	D55, L55	No	<p>3588 F9S Drive Plant Install This feature informs the plant to install one TS1090 Tape Drive Model F9S (3588 Model F9S) into a new TS4500 Tape Library Model D55 or L55 coming from the plant.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> L55/D55 Models – FC 1521 or 1531 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than zero. L55/D55 Models – FC 1522 or 1532 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than four. L55/D55 Models – FC 1523 or 1533 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than eight. L55/D55 Models – FC 1524 or 1534 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than twelve. <p>Note: One feature #1409 is required per Tape Library if this is the first TS1090 (3588 Model F9S, F9C or S9C) tape drive ordered.</p>

FC	Model	CSU	Description
9617	D55, L55	No	<p>3588 S9C Drive Plant Install This feature informs the plant to install one TS1090 Tape Drive Model S9C (3588 Model S9C) into a new TS4500 Tape Library Model D55 or L55 coming from the plant.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> L55/D55 Models – FC 1521 or 1531 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than zero. L55/D55 Models – FC 1522 or 1532 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than four. L55/D55 Models – FC 1523 or 1533 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than eight. L55/D55 Models – FC 1524 or 1534 when tape drive FCs 9690, 9695, 9697, 9607, 9609, 9611, #9613, #9615, #9617 are greater than twelve. <p>Note: One feature #1409 is required per Tape Library if this is the first TS1090 (3588 Model F9S, F9C or S9C) tape drive ordered.</p>
9677	D25, L25	No	<p>Plant Install 3592 in a 3584 Frame This specify code notifies the plant to factory install a new 3592 Tape Drive into a new 3584 Tape Library Frame coming from the plant.</p> <p>This code must appear on the tape drive order and also the Plant Install 3592 E05 in a 3584 feature (FC 9680) or Plant Install 3592 E06 in a 3584 feature (FC 9683) or Plant Install 3592 E07/EH7 in a 3584 feature (FC 9692) or Plant Install 3592 E08/EH8 in a 3584 feature (FC 9699) or Plant Install 3592 55E in a 3584 feature (FC 9704) or Plant Install 3592 55F/55G in a 3584 feature (FC 9705) or Plant Install 3592 60F in a 3584 feature (FC 9706) or Plant Install 3592 60E in a 3584 feature (FC 9707) or Plant Install 3592 60S in a 3584 feature (FC9708) must appear on the 3584 Frame order.</p>
9689	D25, L25	Yes	<p>Field Install 3592 in a 3584 Frame This feature notifies the plant to ship one 3592 Tape Drive, which will be field installed in a 3584 Tape Library Frame.</p> <p>This code must appear on the tape drive order and also the Field Merge 3592 Tape Drive (FC 1674) or (FC 1675) or (FC 1676) for a 3592 E07/E08/55G/60G, (FC 9690) for a 3592 EH7/EH8/55E/55F or (FC 9726) for a 3592 60E/60F/60S must appear on the 3584 Tape Library Frame order.</p>
9690	D25, D55, L25, L55	Both	<p>LTO, TS1140, TS115x - field install drive in 3584 This feature field installs one 3592 Model EH7, EH8, 55E or 55F. Or one 3588 Model F5C, F6C, F7C, F8C, F8S Tape Drive into an installed 3584 Model D25 or L25, or D55 or L55. This feature is also required to field merge a 3592 Model EH7, EH8, 55E, 55F, or 3588 Model F5C, F6C, F7C, F8C, F8S Tape Drive into a 3584 frame coming from the plant. The Tape Drive requires a Quad Drive mounting kit to contain the drive.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> FC 1521 or 1531 when tape drive FCs 9690, 9692, 9699, 9695, 9697, 9607, 9704, 9705, 9706, 9707, 9708, 9726, 9611, 9609, #9613, #9615, #9617 are greater than zero. FC 1522 or 1532 when tape drive FCs 9690, 9692, 9699, 9695, 9697, 9607, 9704, 9705, 9706, 9707, 9708, 9726, 9611, 9609, #9613, #9615, #9617 are greater than four. FC 1523 or 1533 when tape drive FCs 9690, 9692, 9699, 9695, 9697, 9607, 9704, 9705, 9706, 9707, 9708, 9726, 9611, 9609, #9613, #9615, #9617 are greater than eight. FC 1524 or 1534 when tape drive FCs 9690, 9692, 9699, 9695, 9697, 9607, 9704, 9705, 9706, 9707, 9708, 9726, 9611, 9609, #9613, #9615, #9617 are greater than twelve.
9692	L25, L55	No	<p>3592 E07/EH7 tape drive - plant install in 3584 FC 9692 is a manufacturing routing code.</p> <p>Prerequisite: FC 152x (drive mounting kit). Each FC 152x supports up to 4 of FC 969x.</p>
9695	L25, L55	No	<p>3588 F5A/F5C tape drive - plant install in 3584 FC 9695 is a manufacturing routing code.</p> <p>Prerequisite: FC 152x/153x (drive mounting kit). Each FC 152x/153x supports up to 4 of FC 969x.</p>
9697	D55, L55	No	<p>3588 F6A/F6C tape drive - plant install FC 9697 is a manufacturing routing code.</p> <p>Prerequisite: FC 152x/153x (drive mounting kit). Each FC 152x/153x supports up to 4 of FC 969x.</p>
9699	D25, L25	No	<p>3592 E08/EH8 tape drive - plant install in 3584 FC 9699 is a manufacturing routing code.</p> <p>Prerequisite: FC 152x (drive mounting kit). Each FC 152x supports up to 4 of FC 969x.</p>
9700	D25, D55, L25, L55	No	No host attach cables - from plant
9704	D25, L25	No	3592 55E tape drive - Plant Install in 3584
9705	D25, L25	No	3592 55F tape drive - Plant Install in 3584
9706	D25, L25	No	<p>3592 60F tape drive - Plant Install in 3584 This feature tells the plant to install one 3592 Tape Drive Model 60F into a 3584 Model D25 or Model L25 coming from the plant.</p> <p>Prerequisite: Installation of the 3592 Model 60F Tape Drive requires a Quad Drive mounting kit to contain the drive. Mounting Kit feature (FC 1515) or (FC 1535).</p>

FC	Model	CSU	Description
9707	D25, L25	No	<p>3592 60E tape drive - Plant Install in 3584</p> <p>This feature tells the plant to install one 3592 Tape Drive Model 60E into a 3584 Model D25 or Model L25 coming from the plant.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> Installation of the 3592 Model 60E Tape Drive requires a Quad Drive mounting kit to contain the drive: FC 1531 or 1532 or 1533 or 1534 One FC 1406 is required per Tape Library if this is the first TS1160 60E tape drive ordered.
9708	D25, L25	No	<p>3592 60S tape drive - Plant Install in 3584</p> <p>This feature tells the plant to install one 3592 Tape Drive Model 60S into a 3584 Model D25 or Model L25 coming from the plant.</p> <p>Note: TS1160 Tape Drive Model 60S must be separately ordered and FC 9677 must be specified on that drive</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> Installation of the 3592 Model 60S tape drive requires a Quad Drive mounting kit to contain the drive: FC 1531, 1532, 1533, or 1534. One FC 1406 is required per library if this is the first TS1160 60S tape drive ordered. One FC 1412 is also required per library if this is the first TS1160 60S tape drive ordered.
9713	D25, D55, L25, L55	Both	<p>No Patch Panel Cables</p> <p>This feature should be specified if you do not want the factory to ship any Fiber Channel cable FC 1536 "MMF Quad Drive-to-Patch Panel cables" or FC 1537 "SMF Quad Drive-to-Patch Panel cables".</p>
9726	L25, D25	Both	<p>TS1160 tape drive - Field Install Drive in 3584</p> <p>This feature field installs one 3592 Model 60E or 60F or 60S Tape Drive into an installed 3584 Model D25 or L25. This feature is also required to field merge a 3592 Model 60E or 60F Tape Drive into a 3584 frame coming from the plant.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> Installation of the 3592 Model 60E/60F/60S Tape Drive requires a Quad Drive mounting kit to contain the drive: FC 1531 or 1532 or 1533 or 1534 One FC 1406 is required per Tape Library if this is the first TS1160 60E/60F tape drive ordered.
9735	L25, L55	No	<p>IMC broadband Call Home</p> <p>This feature originally indicated that the customer would allow broadband Call Home; however, the feature code is no longer utilized.</p>
9948	D25, D55, L25, L55, S25, S55, TR1, TR2	Both	<p>3 Phase Power Cord</p> <p>This feature provides a 4.3 meter (14 foot) long power cord with an IEC 309 3P+N+G 32A plug, rated for 230 Vac, 24 Amps. This power cord supports 3 phase (wye) power. To be used with Enhanced PDU FC 1752 or 1952.</p>
9949	D25, D55, L25, L55, S25, S55, TR1, TR2	Both	<p>C20-C13 Power Cord for spare outlets in the Enhanced PDU</p> <p>This feature provides a 2.8 meter long C20-C13 Power Cord to be used between computer equipment and the Enhanced PDU FC 1752 or 1952 or customer-supplied PDU with C19 outlets. C13 connects to the male C14 inlet or power cord plug and the C20 mates with the C19 receptacle on the Enhanced PDU. This power cord is intended to be used on PDUs with C19 outlets.</p>
9954	D25, D55, L25, L55, S25, S55, TR1, TR2	No	<p>NEMA L6-30 Power Cord</p> <p>FC 9954 is used with PDU FCs 1751 and 1752 (in model TR1) or 1951 and 1952 (in model xx5). FC 9954 provides 1x power cord when ordered on a model TR1 and 2x power cords when ordered on a model xx5.</p>
9955	D25, D55, L25, L55, S25, S55, TR1, TR2	No	<p>RS 3750DP power cord</p> <p>FC 9955 is used with PDU FC 1751 and 1752 (in model TR1) or 1951 and 1952 (in model xx5). FC 9955 provides 1x power cord when ordered on a model TR1 and 2x power cords when ordered on a model xx5.</p>
9956	D25, D55, L25, L55, S25, S55, TR1, TR2	No	<p>IEC 309 power cord</p> <p>FC 9956 is used with PDU FC 1751 and 1752 (in model TR1) or 1951 and 1952 (in model xx5). FC 9956 provides 1x power cord when ordered on a model TR1 and 2x power cords when ordered on a model xx5.</p>
9957	D25, D55, L25, L55, S25, S55, TR1, TR2	No	<p>PDL 4.3m power cord (Australia/NZ)</p> <p>FC 9957 is used with PDU FC 1751 and 1752 (in model TR1) or 1951 and 1952 (in model xx5). FC 9957 provides 1x power cord when ordered on a model TR1 and 2x power cords when ordered on a model xx5.</p>
9958	D25, D55, L25, L55, S25, S55, TR1, TR2	No	<p>4.3m power cord (Korea)</p> <p>FC 9958 is used with PDU FC 1751 and 1752 (in model TR1) or 1951 and 1952 (in model xx5). FC 9958 provides 1x power cord when ordered on a model TR1 and 2x power cords when ordered on a model xx5.</p>
9959	D25, D55, L25, L55, S25, S55	No	<p>Unterminated power cord</p> <p>FC 9959 is used with PDU FC 1751 (in model TR1) or 1951 (in model xx5). FC 9959 provides 1x power cord when ordered on a model TR1 and 2x power cords when ordered on a model xx5.</p> <p>Limitation: Not supported with FC 1752 or 1952.</p>
9966	D25, D55, L25, L55, S25, S55	No	<p>Unterminated power cords (China CCC cert)</p> <p>FC 9966 is used with PDU FC 1751 (in model TR1) or 1951 (in model xx5). FC 9966 provides 1x power cord when ordered on a model TR1 and 2x power cords when ordered on a model xx5.</p> <p>Limitation: Not supported with FC 1752 or FC 1952.</p>

FC	Model	CSU	Description
9970	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cord (international, 250 VAC 16A single phase, watertight connector, IEC-309) FC 9970 includes model-dependent contents. For countries other than the United States and Canada, the connector is rated at 16A (plug type Hubbell HBL316P6W or equivalent) for connection to Hubbell type HBL316R6W or equivalent receptacles.</p> <p>In the United States and Canada, the connector is rated at 20A (plug type Hubbell HBL320P6W) for connection to Hubbell type HBL320R6W or equivalent receptacles. This is the default power cord for all countries other than those specified for FC 9972 and FCs 9976 through 9983.</p> <p>This power cord can be used for all countries except:</p> <ul style="list-style-type: none"> • Japan • Korea • Philippines • Taiwan • Argentina • Brazil • Australia • New Zealand • China • South Africa <p>Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9972	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords, 250 VAC 15, non-watertight twist lock connector, Nema L6-15P mates with L6-15R FC 9972 includes model-dependent contents. It is the default power cord for US, Canada, Japan, Korea, Philippines, and Taiwan.</p> <p>Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9976	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 10 Amp/250 Vac, non watertight IRAM 2073 plug (Argentina) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9977	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 15 Amp/250 Vac with earth pin InMetro NBR 14136 plug (Brazil) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9978	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 10 Amp/250 Vac Aust/NZS 3112/2000 plug (Australia and New Zealand) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9979	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 15 Amp/250 Vac JIS C8303, C8306 plug (Japan) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9980	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 10 Amp/250 Vac, GB 2099.1, 1002 plug (China) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9981	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 15 Amp/250 Vac with earth pin KS C8305, K60884-1 plug (Korea) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9982	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 10 Amp/250 Vac CNS 10917-3 plug (Taiwan) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9983	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 10 Amp/250 Vac SANS 164-1 plug (South Africa) Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9984	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 15 Amp/250V single phase power cord assemblies, NEMA L6-20P non-watertight twistlock 20A plug FC 9984 is 2x power cords which are UL / CSA certified for use in US and Canada. These power cords mate with customer-supplied NEMA L6-20R receptacles.</p> <p>Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9985	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 15 Amp/250V single phase power cord assemblies with watertight 15A Russellstoll plug FC 9985 is 2x power cords which are UL/CSA certified for use in US and Canada. These power cords mate with customer-supplied Russellstoll 3743U2 or 9R23U2W receptacles.</p> <p>Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
9989	D25, D55, L25, L55, S25, S55	No	<p>Dual 4.3m power cords with 10Amp/250V with IEC 309 C14 plug FC 9989 is for use with adjacent frame PDUs (FC 1951) or external (customer-supplied) PDUs.</p> <p>Note: Only 1 power cord is shipped for an S25 and S55 to be used in conjunction with FC 2737.</p>
AGKA	D25, D55, L25, L55	Yes	<p>3m Mini-SAS HD/Mini-SAS HD Cable 3meters Mini-SAS HD to Mini-SAS HD cable for attachment of up to four Tape Drives in the same column.</p> <p>Prerequisite:</p> <ul style="list-style-type: none"> • First AGKA - FC 1531 • Third AGKA - FC 1532 • Fifth AGKA - FC 1533 • Seventh AGKA - FC 1534
AGK1	D25, D55, L25, L55	Yes	<p>10 Meter OM3 Fiber Cable (LC)</p> <p>Provides a 10m fiber cable to connect a drive to a switch that is external to the tape library. This cable can also be used to connect to a TS7700 back-end fiber switch that is 2 to 3 frames away. Order the number of this feature code for each drive to be connected.</p>

FC	Model	CSU	Description
AGK2	D25, D55, L25, L55	Yes	25 Meter OM3 Fiber Cable (LC) Provides a 25m fiber cable to connect drives to a fiber switch that is external to the tape library. Order the number of this feature code for each drive to be connected.
AGK3	D25, D55, L25, L55	Yes	80 Meter OM3 Fiber Cable (LC) Provides an 80m fiber cable to connect drives to a fiber switch that is external to the tape library. Order the number of this feature code for each drive to be connected.
AGKQ	D25, D55, L25, L55	Yes	3 Meter OM3 Fiber Quad Cables (LC) Provides 2 space-efficient 3m bundles (of four cables each) to connect four drives to a fiber switch in the same or one frame away, or in a Top Rack. To attach tape drives in the same frame or 1 frame away from a model x25 frame containing TS7700 BE switches, order one of this feature code for each quad-drive mounting kit to be connected. For xx5 models, each FC AGKQ has a prerequisite of an associated FC 152x or 153x.

Frame capacity

The cartridge capacity of the frames of the TS4500 tape library varies depending on whether the frame has I/O stations, tape drives, or any of the available capacity on demand features that increase the amount of licensed capacity of the frame.

- **Capacity of L25, D25, and S25 frames**
The total available capacity of the L25, D25, and S25 frames is affected by the position and configuration of the frame and the installation of capacity on demand (CoD) features.
- **Capacity of L55, D55, and S55 frames**
The total available capacity of the L55, D55, and S55 frames is affected by the position and configuration of the frame and the installation of capacity on demand (CoD) features.

Capacity of L25, D25, and S25 frames

The total available capacity of the L25, D25, and S25 frames is affected by the position and configuration of the frame and the installation of capacity on demand (CoD) features.

[Table 1](#) shows available storage capacity based on frame position and configuration. [Table 2](#) lists the quantity of accessible slots in each frame model based on frame position and quantity of I/O slots.

Table 1. Available storage capacity in L25, D25, and S25 frames

Frame model	Licensed feature(s)	Frame position	Quantity of drives	Quantity of I/O slots	Available storage capacity
L25	Entry	1	1 to 12	32	100
	Intermediate CoD	1	1 to 12	32	200
	Base CoD	1	0 to 12	32	400
	Base CoD	2+	0 to 16	32	400
	HD CoD	1	0 to 12	32	550
	HD CoD	2+	0 to 16	32	660
D25	Base	1	0 to 12	0 or 32	500
	Base	2+	0 to 16	0 or 32	500
	HD CoD	1	0 to 12	32	550
	HD CoD	1	0 to 12	0	590
	HD CoD	2+	0 to 16	32	660
	HD CoD	2+	0 to 16	0	740
S25	Base	Any	0	0	600
	HD CoD	1	0	0	798
	HD CoD	2+	0	0	1000

Table 2. Quantity of accessible slots in L25, D25, and S25 frames

Frame model	Frame position	Quantity of I/O slots	Quantity of accessible slots per tier (tier 0)	Quantity of accessible slots per tier (tiers 1 - 4)
L25	1	32	120	108
	2+	32	120	135
D25	1	32	120	108
	1	0	160	108
	2+	32	120	135
	2+	0	200	135
S25	1	0	160	160
	2+	0	200	200

Capacity of L55, D55, and S55 frames

The total available capacity of the L55, D55, and S55 frames is affected by the position and configuration of the frame and the installation of capacity on demand (CoD) features.

[Table 1](#) shows available storage capacity based on frame position and configuration. [Table 2](#) lists the quantity of accessible slots in each frame model based on frame position and quantity of I/O slots.

Table 1. Available storage capacity in L55, D55, and S55 frames

Frame model	Licensed feature(s)	Frame position	Quantity of drives	Quantity of I/O slots	Available storage capacity
L55	Entry	1	1 to 12	36	100
	Intermediate	1	1 to 12	36	200
	Base	1	0 to 12	36	400
	Base	2+	0 to 16	36	400
	HD CoD	1	0 to 12	36	730
	HD CoD	2+	0 to 16	36	882
D55	Base	1	0 to 12	0 or 36	500
	Base	2+	0 to 16	0 or 36	500
	HD CoD	1	0 to 12	36	730
	HD CoD	1	0 to 12	0	774
	HD CoD	2+	0 to 16	36	882
	HD CoD	2+	0 to 16	0	970
S55	Base	Any	0	0	660
	HD CoD	1	0	0	1054
	HD CoD	2+	0	0	1320

Table 2. Quantity of accessible slots in L55, D55, and S55 frames

Frame model	Frame position	Quantity of I/O slots	Quantity of accessible slots per tier (tier 0)	Quantity of accessible slots per tier (tiers 1 - 5)
L55	1	32	132	120
	2+	32	132	150
D55	1	32	132	120
	1	0	176	120
	2+	32	132	150
	2+	0	220	150
S55	1	0	176	176
	2+	0	220	220

Tape encryption overview

The tape drives that are supported by the TS4500 tape library can encrypt data as it is written to a tape cartridge.

Encryption is performed at full line speed in the tape drive after compression. (Data is compressed more efficiently before it is encrypted.) This capability adds a strong measure of security to stored data without any processing usage and performance degradation.

The following three major elements comprise the tape drive encryption solution:

The encryption-enabled tape drive

All of the tape drives that are supported by the TS4500 tape library are encryption capable. Encryption capability means that they are functionally capable of performing hardware encryption, but this capability is not yet activated. To perform hardware encryption, the tape drives must be encryption-enabled. Encryption can be enabled through the TS4500 management GUI.

Note: FC 1604, Transparent LTO Encryption, is required for library-managed encryption on LTO tape drives. It is not required for application-managed encryption.

Encryption key management

Encryption involves the use of several kinds of keys in successive layers. How these keys are generated, maintained, controlled, and transmitted depends upon the operating environment where the encrypting tape drive is installed. Some data management applications, such as Tivoli® Storage Manager, can perform key management. For environments without such applications, or environments where application-independent encryption is necessary, IBM® provides a key manager to perform all necessary key management tasks. Provided key managers include:

- The IBM Encryption Key Manager component for the Java™ platform
- The IBM Security Key Lifecycle Manager (formerly the Tivoli Key Lifecycle Manager)

The [Managing encryption](#) topic provides more information.

Encryption policy

This is the method that is used to implement encryption. It includes the rules that govern which volumes are encrypted and the mechanism for key selection. How and where these rules are set up depends on the operating environment. See [Managing encryption](#) for more information about each of the available methods. Encryption policy is managed at the logical library level. The Logical Libraries GUI page is used to enable encryption for a logical library and modify the encryption method that is being used. The Security GUI page is used to manage key servers and key labels.

Note: In the tape storage environment, the encryption function on tape drives (desktop, stand-alone, and within libraries) is configured and managed by the customer. It is not configured and managed by the IBM System Services Representative (SSR). In some instances, SSRs are 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 with the support line contract.

• [Managing encryption](#)

A key manager is a software program that assists IBM encryption-enabled tape drives in generating, protecting, storing, and maintaining encryption keys. The encryption keys encrypt information that is being written to tape media (tape and cartridge formats), and decrypt information that is being read from tape media.

• [Prerequisites for using encryption](#)

Certain hardware and software prerequisites must be met before using encryption with the TS4500 tape library.

Related information

- [Choosing or modifying an encryption method](#)
- [Encryption Key Servers](#)
- [Encryption Internal Label \(3592 or LTO\)](#)

Managing encryption

A key manager is a software program that assists IBM® encryption-enabled tape drives in generating, protecting, storing, and maintaining encryption keys. The encryption keys encrypt information that is being written to tape media (tape and cartridge formats), and decrypt information that is being read from tape media.

IBM currently supports the IBM Security Key Lifecycle Manager (formerly Tivoli® Key Lifecycle Manager) with the TS4500 tape library.

The key manager operates on z/OS®, i5/OS, AIX®, Linux®, HP-UX, Sun Solaris, and Windows. It is a shared resource that is deployed in several locations within an Enterprise. It can serve numerous IBM encrypting tape drives, regardless of where those drives are installed (for example, in tape library subsystems, connected to mainframe systems through various types of channel connections, or installed in other computing systems).

The key manager uses a key store to hold the certificates and keys (or pointers to the certificates and keys) required for all encryption tasks. Refer to the appropriate documentation for detailed information about the key manager and the key stores it supports.

The following encryption methods are supported:

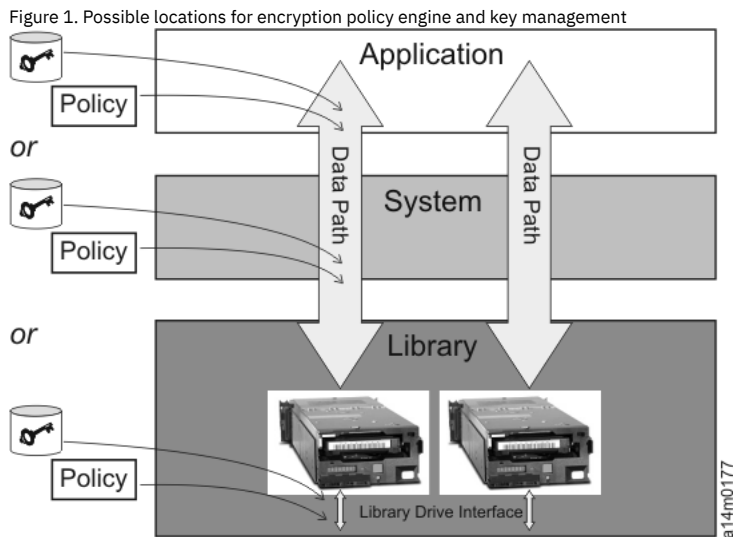
- Application-managed encryption (AME)
- System-managed encryption (SME)
- Library-managed encryption (LME)

These methods differ in three ways:

- Where the encryption policy engine resides
- Where key management occurs for your encryption solution
- How the key manager is connected to the drive

Your operating environment determines which method is the best for you.

Key management and the encryption policy engine can be in any of the environment layers shown in [Figure 1](#)



Application layer

Initiates data transfer for tape storage; for example, Tivoli Storage Manager.

System layer

Everything between the application and the tape drives; for example, z/OS DFSMS and FICON®/ESCON controllers.

Library layer

The TS4500 tape library, which contains an internal interface to each tape drive installed in the library.

- [Planning for application-managed encryption](#)
Application-managed encryption (AME) is useful in operating environments that run an application that is already capable of generating and managing encryption policies and keys, such as Tivoli Storage Manager.
- [Planning for system-managed encryption](#)
System-managed encryption (SME) is useful in System z® operating environments.
- [Planning for library-managed encryption](#)
Library-managed encryption (LME) is useful for encryption-enabled tape drives in an open-attached IBM tape library.

Planning for application-managed encryption

Application-managed encryption (AME) is useful in operating environments that run an application that is already capable of generating and managing encryption policies and keys, such as Tivoli® Storage Manager.

With AME, policies that specify when encryption is to be used are defined through the application interface. The policies and keys pass through the data path between the application layer and the encrypting tape drives.

Encryption is the result of interaction between the application and the encryption-enabled tape drive, and does not require any changes to the system and library layers. Because the application manages the encryption keys, data volumes that are written and encrypted using the application-managed encryption method can be read only by the same software application that wrote them. A key manager is not required by, or used with, application-managed tape encryption.

Note: The capability to use AME is not pre-set. The logical library must be set to use AME.

Application-managed tape encryption can use either of two encryption command sets:

- The IBM® encryption command set developed for the key manager
- The T10 command set defined by the InterNational Committee for Information Technology Standards (INCITS)

For more information about setting up application-managed encryption for Tivoli Storage Manager, visit the [IBM Tivoli Storage Manager](#) page.

Planning for system-managed encryption

System-managed encryption (SME) is useful in System z® operating environments.

Note: The capability to use SME is not pre-set. The logical library must be set to use SME. SME is not available for LTO drives. It is available only on 3592 drives.

Encryption policies that specify when to use encryption are set up in z/OS® DFSMS (Data Facility Storage Management Subsystem). Additional software products such as IBM® Integrated Cryptographic Service Facility (ICSF) and IBM Resource Access Control Facility (RACF®) can also be used. Key generation and management are performed by the key manager that is running on the host or externally on another host. Policy controls and keys pass through the data path between the system layer and the encrypting tape drives. Encryption is transparent to the applications.

Planning for library-managed encryption

Library-managed encryption (LME) is useful for encryption-enabled tape drives in an open-attached IBM tape library.

Note: The capability to use LME is not pre-set. The logical library must be set to use LME.

Bar code encryption policies, which are set up through the management GUI, can be used to specify when to use encryption. In such cases, policies are based on cartridge volume serial numbers. Library-managed encryption also allows other options, such as encryption of all volumes in a library, independent of bar codes. Key generation and management are performed by the key manager. Policy control and keys pass through the library-to-drive interface, therefore encryption is not apparent to the applications.

Library-managed encryption, when used with certain applications such as Symantec Netbackup or the EMC Legato NetWorker, includes support for an internal label option. When the internal label option is configured, the encryption-enabled tape drive automatically derives the encryption policy and key information from the metadata that is written on the tape volume by the application.

Notes:

- If you use LME and IBM® device drivers that run on Open Systems platforms (AIX®, Linux®, Solaris, Windows), information for bulk rekey is available in the [IBM Tape Device Drivers Installation and User's Guide](#).
- When you use LME, an extra Ethernet cable must be attached, preferably to a different network switch. The extra cable is for redundancy and better backup job reliability.
- When you use LME with LTO tape drives, the IBM Security Key Lifecycle Manager (formerly the Tivoli® Key Lifecycle Manager) is required as the key manager.

The following components are required to use encryption:

- Encryption-enabled tape drive
- Keystore
- Key manager

Prerequisites for using encryption

Certain hardware and software prerequisites must be met before using encryption with the TS4500 tape library.

With the TS4500 tape library, encryption is managed at the logical library level. All encryption-enabled drives that are assigned to a logical library use the same method of encryption.

The rules for setting up encryption differ based on whether the library is installed with 3592 or LTO tape drives, and whether you use Library-Managed Encryption (LME) or Application-Managed Encryption (AME).

If the library contains 3592 tape drives, the following prerequisites apply:

- IBM® Security Key Lifecycle Manager (SKLM), formerly the Tivoli® Key Lifecycle Manager, must be attached to the TS4500 and configured for LME.
- Tape drives must be enabled for encryption from the Logical Libraries page of the TS4500 management GUI.

If the library contains LTO tape drives, the following prerequisites apply:

- Tape drives must be enabled for encryption from the Logical Libraries page of the TS4500 management GUI.
- Feature code 1604, Transparent LTO Encryption, is required for LTO tape drives if using LME.
- SKLM is required as the key manager when using LME with LTO.

Using LTO tape drive media

The section provides information about using LTO tape drive media.

The tape library automates the storage and movement of IBM® LTO tape cartridges.

- [Overview of LTO tape drive media](#)
Subject to certain restrictions, the supported LTO tape drives use the following cartridge types.
- [WORM functionality for LTO 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.
- [Compatibility among LTO tape drives and cartridges](#)
This section defines compatibility among generations of LTO tape drives and cartridges.
- [LTO Type M cartridge \(M8\)](#)
The LTO program introduced a new capability with LTO 8 tape drives: the ability to write 9 TB (native) on a brand new LTO Ultrium 7 cartridge instead of 6 TB (native) as specified by the LTO 7 format. Such a cartridge is called an LTO Ultrium 7 cartridge initialized as Type M media (M8). These cartridges are identifiable by using an automation barcode label ending with the characters **M8**.
- [LTO data cartridge](#)
This section describes the construction, operation, and components of the IBM LTO data cartridge.
- [LTO cleaning cartridge](#)
The IBM LTO cleaning cartridge is used to clean LTO tape drives.
- [LTO diagnostic cartridge](#)
An IBM service representative uses the LTO diagnostic cartridge to ensure that the LTO tape drives run correctly and to specification.
- [LTO bar code labels](#)
Each LTO data, cleaning, and diagnostic cartridge that is processed by the tape library must bear a bar code label.
- [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.
- [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 to ensure the continued high reliability of your IBM LTO tape drives, handle them properly as described in the following topics.
- [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.
- [Environmental and shipping specifications for LTO tape cartridges](#)
Specific storage and shipping environmental conditions apply to LTO tape cartridges.
- [Disposing of LTO tape cartridges](#)
Dispose of LTO tape cartridges according to federal and other regulations.
- [Ordering LTO cartridges and media supplies](#)
Order LTO tape cartridges and other media supplies as described in this topic.

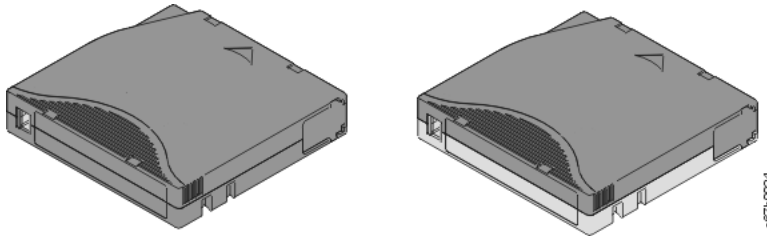
Overview of LTO tape drive media

Subject to certain restrictions, the supported LTO tape drives use the following cartridge types.

- 18 TB LTO 9 Data Cartridge (LTO 9 cartridge)
- 18 TB LTO 9 WORM Data Cartridge (LTO 9 cartridge)
- 12 TB LTO 8 Data Cartridge (LTO 8 cartridge)
- 12 TB LTO 8 WORM Data Cartridge (LTO 8 cartridge)
- 9 TB LTO M8 Data Cartridge (LTO M8 cartridge)
- 6 TB LTO 7 Data Cartridge (LTO 7 cartridge)
- 6 TB LTO 7 WORM Data Cartridge (LTO 7 cartridge)
- 2.5 TB LTO 6 Data Cartridge (LTO 6 cartridge)
- 2.5 TB LTO 6 WORM Data Cartridge (LTO 6 cartridge)
- 1.5 TB LTO 5 Data Cartridge (LTO 5 cartridge)
- 1.5 TB LTO 5 WORM Data Cartridge (LTO 5 cartridge)
- 800 GB LTO 4 Data Cartridge (LTO 4 cartridge)
- 800 GB LTO 4 WORM Data Cartridge (LTO 4 cartridge)
- 400 GB LTO 3 Data Cartridge (LTO 3 cartridge)
- 400 GB LTO 3 WORM Data Cartridge (LTO 3 cartridge)
- 200 GB LTO 2 Data Cartridge (LTO 2 cartridge)
- 100 GB LTO 1 Data Cartridge (LTO 1 cartridge)
- Universal LTO Cleaning Cartridge
- LTO Cleaning Cartridge
- Diagnostic cartridge

[Figure 1](#) shows IBM® LTO data and WORM cartridges.

Figure 1. IBM LTO data and WORM tape cartridges



WORM functionality for LTO 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.

The supported LTO tape drives include the WORM feature, which is supported by the LTO WORM data cartridges.

The following WORM media traits 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 same capacities as the equivalent LTO data cartridges.

Compatibility among LTO tape drives and cartridges

This section defines compatibility among generations of LTO tape drives and cartridges.

[Mixed media in drives](#) shows the compatibility among the LTO drives and cartridges.

Note: Only LTO 5 and later tape drives are supported with the TS4500 tape library.

LTO Type M cartridge (M8)

The LTO program introduced a new capability with LTO 8 tape drives: the ability to write 9 TB (native) on a brand new LTO Ultrium 7 cartridge instead of 6 TB (native) as specified by the LTO 7 format. Such a cartridge is called an LTO Ultrium 7 cartridge initialized as Type M media (M8). These cartridges are identifiable by using an automation barcode label ending with the characters **M8**.

Table 1. LTO 7 and LTO 8 cartridge types

Cartridge/density type	Barcode label	Cartridge packaging/silkscreen labeling	Native capacity	Tape drive compatibility
L8	xxxxxxL8	LTO Ultrium 8	12 TB	LTO 8
M8	xxxxxxM8	LTO Ultrium 7	9 TB	LTO 8
L7	xxxxxxL7	LTO Ultrium 7	6 TB	LTO 7, LTO 8

Hereafter, these cartridges will be referred to as L8, M8, and L7, respectively.

Only new, unused LTO Ultrium 7 cartridges can be initialized as M8 cartridges. Once a cartridge is initialized as M8, it cannot be changed back to L7. Initialized M8 cartridges can only be written and read in an LTO 8 tape drive; LTO 7 tape drives cannot read initialized M8 cartridges.

M8 cartridges can be purchased as either pre-initialized (also referred to as "labeled and initialized") M8 data cartridges or un-initialized M8 data cartridges (M8 WORM cartridges are not supported). For either option, the barcode label is included; however, the un-initialized M8 data cartridge must first be initialized in tape libraries that support the automatic initialization of un-initialized M8 cartridges while under the control of ISV applications that recognize the **M8** barcode label.

A tape cartridge is initialized when it is first loaded into a compatible tape drive and data is written by the ISV application at the beginning of tape (sometimes referred to as "labeling a tape" or "writing from BOT"). The tape drive establishes the density of the media at that time.

If an un-initialized M8 cartridge is not initialized in a tape library that supports un-initialized M8 cartridges, then the cartridge may inadvertently and silently be initialized at the L7 density (i.e., at a 6 TB native capacity) even if the barcode label states **M8**. This could occur with the usage of non-TS4500 tape libraries, stand-alone LTO 7 tape drives, stand-alone LTO 8 tape drives, down-level LTO 8 tape drive firmware, down-level TS4500 tape library firmware, or down-level ISV software that does not recognize that M8 cartridges should only be mounted in LTO 8 tape drives. M8 cartridges that are inadvertently initialized at the L7 density can continue to be read and written in LTO 7 and LTO 8 tape drives; however, they will remain limited to the 6 TB native capacity.

TS4500 tape library firmware version 1.4.1.2 added support for un-initialized M8 cartridges in addition to support for pre-initialized M8 cartridges. The TS3500 tape library only supports pre-initialized M8 cartridges. In any tape product with M8 cartridges, the minimum LTO 8 tape drive firmware version is HB82.

LTO data cartridge

This section describes the construction, operation, and components of the IBM® LTO data cartridge.

The IBM LTO 9 cartridge is green with a silk screen label on top that specifies "Ultrium 9 – 18000 GB". The IBM LTO 8 cartridge is burgundy with a silk screen label on top that specifies "Ultrium 8 - 12 TB." The IBM LTO 7 cartridge is purple with a silk screen label on top that specifies "Ultrium 7 - 6 TB." The IBM LTO 6 cartridge is black with a

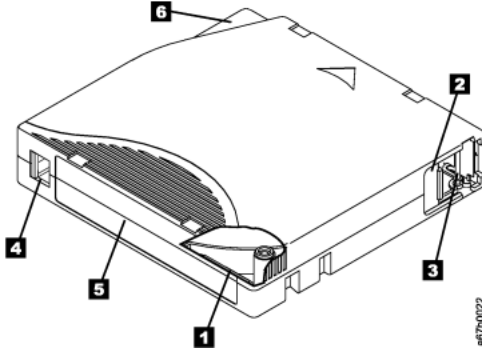
silk screen label on top that specifies "Ultrium 6 - 2.5 TB." The IBM LTO 5 cartridge is burgundy with a silk screen label on the top that specifies "Ultrium 5 - 1.5 TB." The IBM LTO 4 cartridge is green with a silk screen label on the top that specifies "Ultrium 4 - 800 GB." The IBM LTO 3 cartridge 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.

When processing tape in the cartridges, the LTO tape drives use a linear, serpentine recording format. LTO 9 drives read and write data on 8960 tracks, LTO 8 drives read and write data on 6656 tracks, LTO 7 drives read and write data on 3584 tracks, LTO 6 drives read and write data on 2176 tracks, and LTO 5 drives read and write data on 1280 tracks. LTO 9, 8, and 7 drives read and write 32 tracks at a time. LTO 6 and LTO 5 drives read and write 16 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 compatibility, refer to the topic about LTO tape drives.

Figure 1 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 1. 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 1) 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 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 TS4500 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.

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. Thus if the tape library contains frames with both LTO and 3592 tape drives, IBM supplies one LTO cleaning cartridge and one 3592 cleaning cartridge regardless of how many frames of each type are in the library. Each drive determines when it needs to be cleaned and alerts the library. The TS4500 tape library automatically cleans drives as needed; however, you can also use the TS4500 management GUI to initiate a manual cleaning if necessary.

Note: The volume serial (VOLSER) number on the cleaning cartridge's bar code label must begin with **CLN** or the library treats the cleaning cartridge as a data cartridge during an inventory.

The LTO Cleaning Cartridge is compatible with all LTO tape drives.

Before a drive can be cleaned, ensure that a cleaning cartridge is loaded in the library. You can load multiple cleaning cartridges and store them in any cartridge storage slots.

The tape library monitors the use of all cleaning cartridges. The IBM cleaning cartridges are valid for 50 uses. When a cleaning cartridge is almost expired, a warning icon displays on the TS4500 management GUI. When a cleaning cartridge has expired, an error icon displays. You can also enable automatic eject of expired cleaning cartridges through the TS4500 management GUI 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.

Related information

- [Methods of cleaning drives](#)
- [TS4500 management GUI Cartridges page help](#)

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. The diagnostic cartridge can be stored in any frame door slot. Depending on the mixture of LTO drives that are installed in the library, more than one LTO diagnostic cartridge might be required.

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.

Note: Only LTO 5 and later LTO tape drives are supported in the TS4500 tape library.

Table 1. Compatibility of diagnostic cartridges with LTO tape drives

Cartridge generation (y)	LTO tape drives				
	LTO 9	LTO 8	LTO 7	LTO 6	LTO 5
8	Yes	Yes	No	No	No
7	No	Yes	Yes	No	No
6	No	No	Yes	Yes	No
5	No	No	Yes	Yes	Yes
4	No	No	No	Yes	Yes
3	No	No	No	No	Yes
2	No	No	No	No	No
1	No	No	No	No	No

LTO bar code labels

Each LTO data, cleaning, and diagnostic cartridge that is processed by the 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, 8, 9, T, U, V, W, X, Y, or Z) or **M8**.

- **L** or **M** identifies the cartridge as an LTO cartridge.
- **1** indicates that the cartridge is the first generation of its type. **2, 3, 4, 5, 6, 7, 8,** or **9** indicates that the cartridge is the second, third, fourth, fifth, sixth, seventh, eighth, or ninth generation of its type.
- **T** indicates that the cartridge is a generation 3 WORM cartridge, **U** indicates that the cartridge is a 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, **Y** indicates that the cartridge is a generation 8 WORM cartridge, and **Z** indicates that the cartridge is a generation 9 WORM cartridge.

Note: Only LTO 5 and later LTO tape drives and their supported media are supported by the TS4500 tape library.

You can use the `modifyVolserReporting` CLI command 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.

Note: If you suspect that the library is having problems reading bar code labels, an IBM® service representative can slow scanner speed as part of problem determination.

- [Guidelines for using LTO bar code labels](#)
The guidelines listed in this topic must be followed when using LTO bar code labels.
- [Bar code label specifications](#)

Related information

- [modifyVolserReporting CLI command](#)
- [Ordering bar code labels for tape cartridges](#)

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.
- 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.

- 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.
- 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 tape library from reading the label.

Bar code label specifications

You can order tape cartridges with the labels included, or you can order custom labels. The bar code labels must meet predefined specifications. They include (but are not limited to):


- Eight uppercase alphanumeric characters, where the last 2 characters must be **L1**, **L2**, **L3**, **L4**, **L5**, **L6**, **L7**, **L8**, **L9**, **LT**, **LU**, **LV**, **LW**, **LX**, **LY**, **M8**, or **LZ**.
- 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, go to the [IBM LTO Ultrium Cartridge Label Specification](#) web page and download the PDF file of the specification, *IBM LTO Ultrium Cartridge Label Specification*. You can also contact your IBM® Sales Representative for this specification.

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.

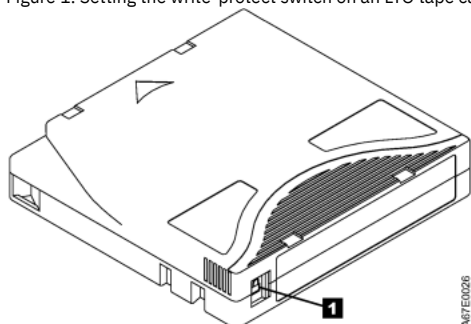
The position of the write-protect switch on an LTO tape cartridge (see 1 in [Figure 1](#)) determines whether you can write to the tape:

- 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 1. 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 to ensure the continued high reliability of your IBM LTO tape drives, handle them properly as described in the following topics.



Attention: Do not insert a damaged tape cartridge into your 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.
- [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.
- [Provide proper acclimation and environmental conditions for LTO tape cartridges](#)
Certain conditions are required to ensure the safety and quality of LTO tape 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.
- [Handle the LTO tape cartridge carefully](#)
Handle the LTO tape cartridges carefully to ensure they do not get damaged.
- [Examples of cartridge problems](#)
If you encounter a problem with an LTO tape cartridge, try to resolve the problem and avoid any data loss.

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 1](#)). They are available at <http://www.turtlecase.com>.

Figure 1. 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 2](#)).

Figure 2. 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.

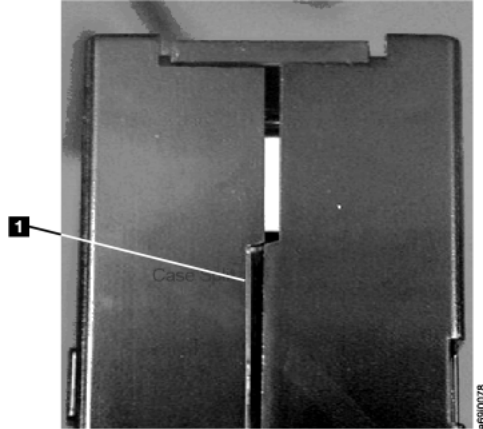
Perform a thorough inspection of LTO tape cartridges

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 1](#). If there are gaps in the seam, the leader pin may be dislodged and may need to be repositioned.)

Figure 1. 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 cartridge problems

If you encounter a problem with an LTO tape cartridge, try to resolve the problem and avoid any data loss.

Example: Split cartridge case

The cartridge 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.

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**

Reposition a leader pin in an LTO tape cartridge if it is improperly positioned.

- **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.

Repositioning a leader pin in an LTO tape cartridge

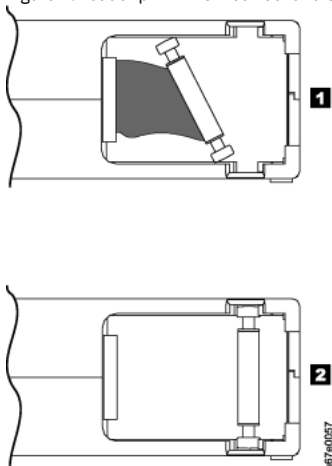
Reposition a leader pin in an LTO tape cartridge if it is improperly positioned.

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)

A leader pin that is improperly positioned inside an LTO tape cartridge can interfere with the operation of the drive. [Figure 1](#) shows a leader pin in the incorrect 1 and correct 2 positions.

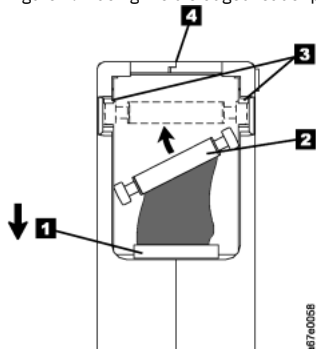
Figure 1. Leader pin in the incorrect and correct positions in an LTO tape cartridge. The cartridge door is open and the leader pin is visible inside the cartridge.



Complete the following steps to reposition a leader pin:

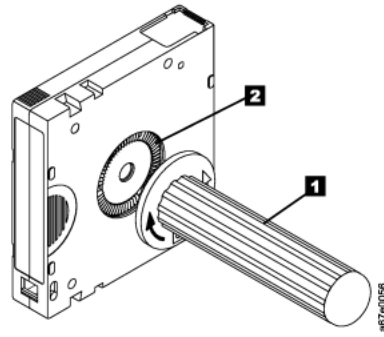
1. Slide open the cartridge door (1 in [Figure 2](#)) and locate the leader pin 2 . You may need to shake the cartridge gently to roll the pin toward the door.
2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips 3 .
3. Press the leader pin gently 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 2. 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 3](#)) into the cartridge's hub (2) and turn it clockwise until the tape becomes taut.

Figure 3. 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.

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.**

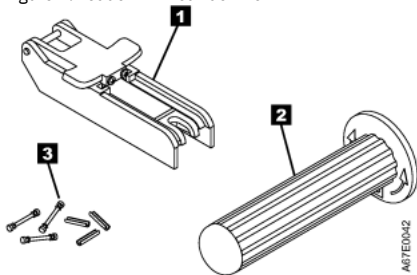
The Leader Pin Reattachment Kit contains three parts:

- **Leader pin attach tool** (see 1 in [Figure 1](#)). A plastic brace that holds the cartridge door open.
- **Cartridge manual rewind tool** (see 2 in [Figure 1](#)). 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 1](#)). 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.

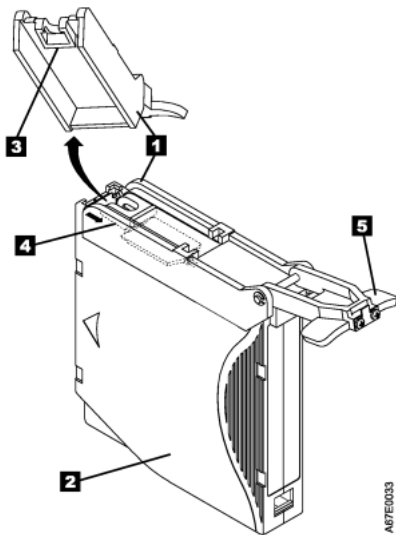
Figure 1. Leader Pin Reattachment Kit



To reattach a leader pin by using the IBM Leader Pin Reattachment Kit, perform the following steps:

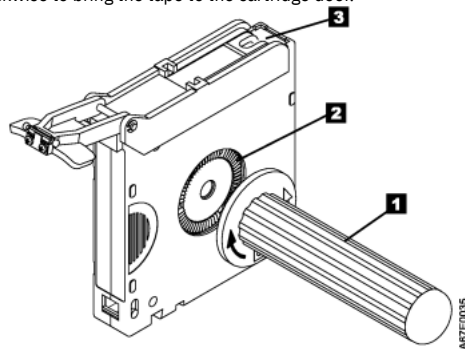
1. Attach the leader pin attach tool (1 in [Figure 2](#)) to the cartridge 2 so that the tool's hook 3 latches into the cartridge's door 4. Pull the tool back to hold the door open, then slide the tool onto the cartridge. Open the tool's pivot arm 5.

Figure 2. 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.



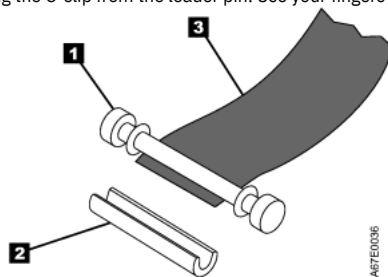
2. To find the end of the tape inside the cartridge, attach the cartridge manual rewind tool (1 in [Figure 3](#)) to the cartridge's hub 2 by fitting the tool's teeth between the teeth of the hub. Turn the tool clockwise until you see the end of the tape inside the cartridge. Then, slowly turn the rewind 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 3. 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.



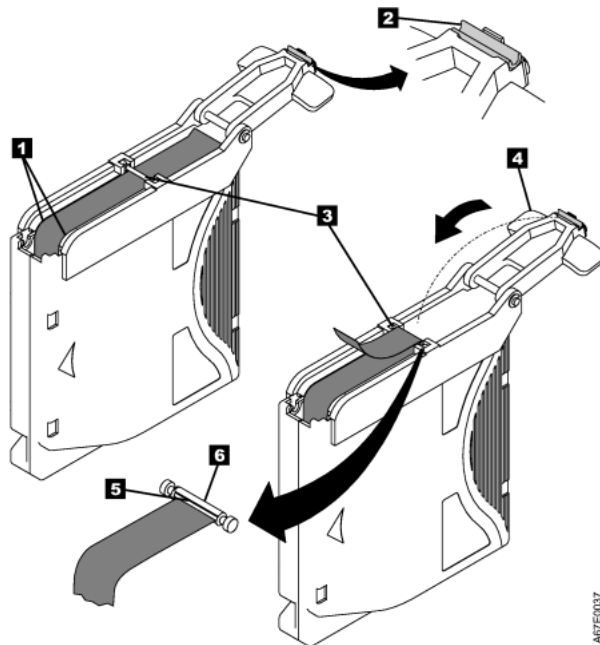
5. On the leader pin (1 in [Figure 4](#)), locate the open side of the C-clip 2 . The C-clip is a small black part that secures the tape 3 to the pin.
6. Remove the C-clip from the leader pin by using your fingers to push the clip away from the pin. Set the pin aside and discard the clip.

Figure 4. 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 5](#)).
 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 5](#)).
- 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 5. 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

Specific storage and shipping environmental conditions apply to 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 a frame, 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 1](#) gives the environment for storing and shipping LTO tape cartridges.

Table 1. Environment for storage and shipping the LTO tape cartridges

Environmental Specifications			
Environmental Factor	Allowable Storage	Recommended Storage	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%
Maximum wet bulb 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).		

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 LTO cartridges and media supplies

Order LTO tape cartridges and other media supplies as described in this topic.

You can order the cartridges and media supplies listed in [Table 1](#) from:

- An IBM Media Authorized Distributor (find the closest distributor at [IBM Storage Media](#)).
- Your IBM® Sales Representative or any authorized IBM Business Partner.

Notes:

- For cartridges with preapplied bar code labels, specify the volume serial (VOLSER) characters that you want. To order cartridges with radio frequency identification (RFID) labels, also specify the feature code from the table below.
- Only LTO 5 and later LTO tape drives and their supported media are supported.

Table 1. Ordering LTO cartridges and media supplies

Supply Item	Method of Ordering	Part numbers available from media distributors
18 TB Ultrium 9 Data Cartridge 20 Pk With labeling services	Specify Machine Type 3589 Model 553 and FC 5503.	02XW568L
18 TB Ultrium 9 Data Cartridges 20 Pk Without labeling services	Specify Machine Type 3589 Model 653 and FC 6503.	02XW568
18 TB Ultrium 9 Data Cartridges 5 Pk Without labeling services	Specify Machine Type 3589 Model 653 and FC 6507.	02XW568
12 TB Ultrium 8 Data Cartridge 20Pk Bar code labels are per-applied to cartridges.	Specify Machine Type 3589 Model 552 and FC 5502 and the VOLSER characters that you want.	01PL041L
12 TB Ultrium 8 Data Cartridge 20Pk Order VOLSER labels separately.	Specify Machine Type 3589 Model 652 and FC 6502.	01PL041
12 TB Ultrium 8 Data Cartridge 5Pk Order VOLSER labels separately.	Specify Machine Type 3589 Model 652 and FC 6506.	01PL041
12 TB Ultrium 8 WORM Data Cartridges Bar code labels are per-applied to cartridges.	Available from media distributors.	01PL042L
12 TB Ultrium 8 WORM Data Cartridges	Available from media distributors.	01PL042
12 TB Ultrium 8 RFID Cartridges	Available from media distributors.	01PL041RF
9 TB Ultrium 7 Uninitialized Tape Cartridge 20Pk M8 Labeled Bar code labels are pre-assigned to cartridges.	Available from media distributors.	38L7302L-M8
9 TB Ultrium 7 Initialized Tape Cartridge 20Pk M8 Labeled Bar code labels are pre-assigned to cartridges.	Available from media distributors.	38L7302LI-M8
6 TB Ultrium 7 Data Cartridge 20Pk Bar code labels are pre-assigned to cartridges.	Specify Machine Type 3589 Model 551 and FC 5501 and the VOLSER characters that you want.	38L7302L
6 TB Ultrium 7 Data Cartridge 20Pk Order VOLSER labels separately.	Specify Machine Type 3589 Model 651 and FC 6501.	38L7302
6 TB Ultrium 7 WORM Data Cartridge 20Pk Bar code labels are pre-assigned to cartridges.	Available from media distributors.	38L7303L
6 TB Ultrium 7 WORM Data Cartridge 20Pk	Available from media distributors.	38L7303
6 TB Ultrium 7 RFID Cartridges	Available from media distributors.	38L7302RF
6 TB Ultrium 7 Data Cartridge 5Pk No labeling	Specify Machine Type 3589 Model 651 and FC 6505	38L7302
2.5 TB Ultrium 6 Data Cartridge Bar code labels are pre-assigned to cartridges.	Specify Machine Type 3589 Model 550 and FC 5500 and the VOLSER characters that you want.	00V7590L
2.5 TB Ultrium 6 Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 650 and FC 6500.	00V7590
2.5 TB Ultrium 6 WORM Data Cartridge Bar code labels are pre-assigned to cartridges.	Available from media distributors.	00V7591L
2.5 TB Ultrium 6 WORM Data Cartridge Order VOLSER labels separately.	Available from media distributors.	00V7591
2.5 TB Ultrium 6 RFID Cartridges	Available from media distributors.	29201
1.5 TB Ultrium 5 Data Cartridge Bar code labels are pre-assigned to cartridges.	Specify Machine Type 3589 Model 014 and FC 1420 and the VOLSER characters that you want.	46X6666
1.5 TB Ultrium 5 Data Cartridge Order VOLSER labels separately.	Specify Machine Type 3589 Model 015 and FC 1520.	46X1290
1.5 TB Ultrium 5 WORM Data Cartridge Bar code labels are pre-assigned to cartridges.	Available from media distributors.	46X4444
1.5 TB Ultrium 5 WORM Data Cartridge Order VOLSER labels separately.	Available from media distributors.	46X1292
1.5 TB Ultrium 5 RFID Cartridges	Available from media distributors.	27879
Ultrium Cleaning Cartridge 5-pack (universal cleaning cartridge for use with all Ultrium tape drives) VOLSER labels are included.	Specify Machine Type 3589 Model 004 and FC 4005 and the VOLSER characters that you want.	35L2087

Supply Item	Method of Ordering	Part numbers available from media distributors
Ultrium Cleaning Cartridge (universal cleaning cartridge for use with all Ultrium tape drives) Order VOLSER labels separately.	Available from media distributors.	35L2086
Leader Pin Reattachment Kit	Order as part number 08L9129.	08L9129

- [Ordering bar code labels for tape cartridges](#)
Each tape cartridge must have a bar code label with a unique volume serial (VOLSER) number. You can order these labels separately from IBM data cartridges and cleaning cartridges.

Ordering bar code labels for tape cartridges

Each tape cartridge must have a bar code label with a unique volume serial (VOLSER) number. You can order these labels separately from IBM® data cartridges and cleaning cartridges.

Bar code labels must meet the following specifications:

- [IBM LTO Ultrium Cartridge Label Specification](#)
- [Label Specification for IBM 3592 Cartridges when used in IBM Libraries](#)

Table 1. Authorized suppliers of custom bar code labels¹

In the Americas	In Europe and Asia
EDP/Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U.S.A. Telephone: 888-438-8362 or 303-464-3547 Fax: 888-438-8363 or 303-666-2166 http://www.tri-optic.com	
Netc, L.L.C. ² 100 Corporate Drive Trumbull, CT 06611 U.S.A. Telephone: 203-372-6382 Fax: 203-372-0676 http://www.netclabels.com	Netc Europe Telephone.: +49-2151-970-900 Fax: +49-2151-970-908 Email: Vertrieb@netclabels.de http://www.netclabels.de
	Netc Asia Pacific Pty. Ltd. 7 Cordwood Drive Cooroy QLD 4563 Australia Telephone: +61 (0)7 5442 6263 Fax: +61 (0)7 5442 6522 http://www.netclabels.com.au
Notes:	
<ol style="list-style-type: none"> 1. These 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 users only and is not an endorsement or recommendation of such providers. IBM is not responsible for the quality of bar code labels that are procured from sources other than IBM. This information is applicable to bar code labels that are printed by the listed companies. IBM does not review the quality of any labels that are produced by software or services that are offered by such companies that allow users to print labels on their own printing equipment. 2. Netc is the only authorized supplier of radio frequency identification (RFID) labels. Orders for RFID labels must be placed through the U.S. office. Orders are shipped worldwide. 	

Using 3592 tape drive media

The tape library automates the storage and movement of IBM® 3592 tape cartridges.

- [Overview of 3592 tape drive media](#)
The 3592 tape drive uses ten different data cartridge types, plus a cleaning cartridge and a diagnostic (CE) cartridge.
- [WORM functionality for 3592 tape drive 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.
- [Capacity scaling and segmentation](#)
The 3592 tape drive use capacity scaling and segmentation to place data in a designated section of tape to speed access and manage efficient capacity.
- [3592 data cartridge](#)
This section describes the capacity, construction, operation, and components of the IBM 3592 Enterprise Tape Cartridge.
- [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.
- [3592 diagnostic cartridge](#)
This section gives information about the appearance and usage of the 3592 diagnostic cartridge.
- [3592 bar code label](#)
Each 3592 data, cleaning, and diagnostic cartridge that is processed by the TS4500 tape library must bear a bar code label.

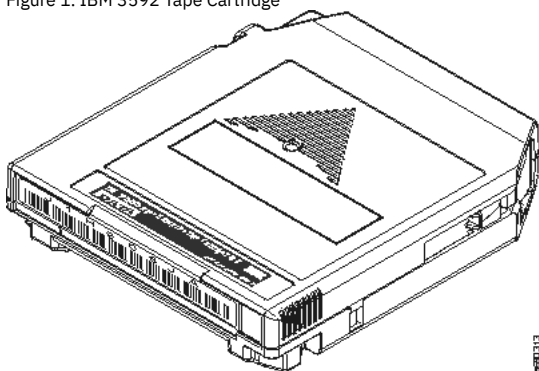
- [Setting the write-protect switch on a 3592 cartridge](#)
Use the write-protect switch to prevent data from being written to a 3592 tape cartridge.
- [Handling 3592 tape cartridges](#)
Incorrect handling or an inhospitable environment can damage IBM 3592 tape cartridges or their magnetic tape. To avoid 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.
- [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.
- [Environmental and shipping specifications for IBM 3592 tape cartridges](#)
Specific storage and shipping environmental conditions apply to IBM 3592 tape cartridges.
- [Disposing of 3592 cartridges](#)
Dispose of 3592 tape cartridges according to federal and other 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.
- [Ordering 3592 cartridges and media supplies](#)
You can order 3592 tape cartridges and related media supplies by part number or, for larger quantities, using the 3599 model number with feature codes to specify the cartridge type.

Overview of 3592 tape drive media

The 3592 tape drive uses ten different data cartridge types, plus a cleaning cartridge and a diagnostic (CE) cartridge.

[Figure 1](#) shows an IBM® 3592 Tape Cartridge.

Figure 1. IBM 3592 Tape Cartridge



Note: Each 3592 tape drive model has a unique firmware version that will not work for any other 3592 tape drive model. 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 TS4500 management GUI. Cartridges can be identified by the text on the product label and by the color of the cartridge label, door, and write-protect switch. [Table 1](#) describes the appearance of each cartridge type.

Table 1. Visual differences between 3592 tape cartridges

Text on product label	Cartridge type ¹	Case color	Label, door, and write-protect switch color	Part number
Data	JA	Black	Dark blue	18P7534
Extended data	JB	Black	Dark green	23R9830
Advanced Type C data	JC	Black	Dark purple	46X7452
Advanced Type D read/write	JD	Black	Burnt orange	2727263
Advanced Type E read/write	JE	Black	Brick red	02CE960
Advanced Type C economy	JK	Black	Light purple	46X7453
Advanced Type D economy	JL	Black	Apricot	2727264
Advanced Type E economy	JM	Black	Red	02CE961
Extended WORM	JX	Platinum (silvery gray)	Dark green	23R9831
Advanced Type C WORM	JY	Platinum (silvery gray)	Dark purple	46X7454
Advanced Type D WORM	JZ	Platinum (silvery gray)	Burnt orange	2727265
Advanced Type E WORM	JV	Platinum (silvery gray)	Brick red	02FJ980
Notes:				
1. This designation appears as the last two characters on standard bar code labels.				

The 3592 tape drive also supports cleaning and diagnostic cartridges:

- Cleaning cartridges have a black case with a white label. Instead of a write-protect switch, there is a non-moveable light gray block. The cartridge door is also light gray. The label for this cartridge says **CLEANING**. If you order cleaning cartridges with pre-attached labels, the first three characters on the label are **CLN** followed by three digits and then the characters **JA** (for example, **CLN 123JA**).
- Diagnostic cartridges – also called CE (Customer Engineer) cartridges – are used by IBM service representatives. The label for this cartridge is **CE xxxJy**, where **xxx** is three digits and **Jy** is the cartridge type (such as JJ or JK).

Related information

- [Tape cartridges](#)
- [Updating drive firmware](#)

WORM functionality for 3592 tape drive 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.

A 3592 tape drive with the appropriate microcode version installed is capable of reading and writing WORM cartridges. The TS1120 and later 3592 tape drive support WORM behaviors and format attributes. These tape drives support the following WORM media types:

JR (short length)

Supported by the J1A, TS1120, and TS1130 tape drives.
TS1130 in read-only mode.

JV (advanced)

Supported by the TS1160 tape drive.

JW (full length)

Supported by the J1A, TS1120, and TS1130 tape drives.
TS1130 in read-only mode.

JX (extended)

Supported by the TS1120, TS1130, and TS1140 tape drives.

JY (advanced)

Supported by the TS1140, TS1150, TS1155, and TS1160 tape drives.

JZ (advanced)

Supported by the TS1150, TS1155, and TS1160 tape drives.

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 by 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; this 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 provides an interface and control mechanisms that allow an application or system to manage as needed. The related control and status mechanisms 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 drive allows append operations to data already on WORM cartridges, and allows overwrite of file marks and other non-data attributes to provide application transparency. However, they do not allow data-overwrite 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.

Related information

- [Tape cartridges](#)

Capacity scaling and segmentation

The 3592 tape drive use capacity scaling and segmentation to place data in a designated section of tape to speed access and manage efficient capacity.

The 3592 tape drive supports capacity scaling for tape cartridges of media types JA, JB, JC, JD, and JE over a broad range of capacities. The effect of capacity scaling is to contain data in a specified fraction of the tape, which yields faster locate and read times. Alternatively, you can purchase economy tapes (the JJ, JK, JL, or JM 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) fast access, and another 200 GB (186.26 GiB) segment for more capacity. You can purchase 300 GB (279.39 GiB) data tapes that are pre-formatted with these segments, or you can segment and capacity scale them later. Segmentation is only available within a specified range of settings for capacity scaling. 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 at [Fix Central](#).

For more technical information about WORM, capacity scaling, and segmentation, see also the [IBM 3592 Tape Drive SCSI Reference](#).

All TS1120 and later tape drives also support multiple format options, such as scaling and segmentation modes that 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 that is 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 drive, 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](#).

Scaling support in drive

Capacity scaling in the TS1120 and later tape drives is controlled by the host program that performs a Scaling operation. The Scaling operation uses the Capacity Scaling byte and the Capacity Scaling Valid control bit in Mode page X'23'. These tape drives do not change their current cartridge scaling, except for a special condition. The drives change scaling when 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 that is 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. (Not applicable for JE cartridge types or 60F format cartridges.)
- 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 flushes 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 reached the real physical end of the tape.

Capacity scaling is not offered on any of the short length (economy) cartridge types (JJ, JK, JL, or JM), or on the WORM cartridges (JR, JV, JW, JX, JY, and JZ). Capacity scaling is only offered on the JA, JB, JC, and JD cartridge types (not JE).

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 (not supported on JE cartridges or 60F format). 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 rescaling, 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.

Related information

- [Tape cartridges](#)

3592 data cartridge

This section describes the capacity, construction, operation, and components of the IBM® 3592 Enterprise Tape Cartridge.

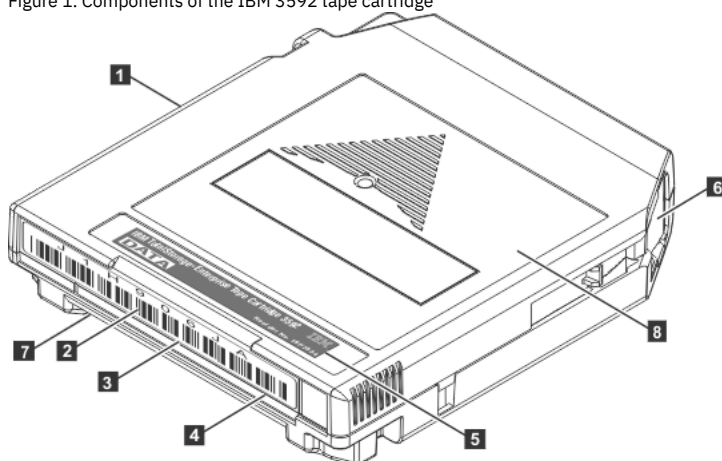
The 3592 tape drive has a bidirectional read/write head with an Enterprise Tape 3592 format. The TS1140, TS1150, TS1155, and TS1160 tape drives write or read 32 tracks at a time. The capacity of 3592 data cartridges varies by drive model and recording format. See the 3592 tape cartridges in [Tape cartridges](#) for these details.

Encryption-enabled tape drives encrypt the data after compression.

[Figure 1](#) 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 1. Components of the IBM 3592 tape cartridge



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Through its vision system, the TS4500 tape library identifies the types of cartridges it contains during an inventory operation. The bar code reader reads the VOLSER (see 3 in [Figure 1](#)) 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).

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.

IBM supplies a specially labeled IBM 3592 cleaning cartridge with the first 3592 tape drive in the tape library. This cleaning cartridge may be used in every 3592 tape drive.



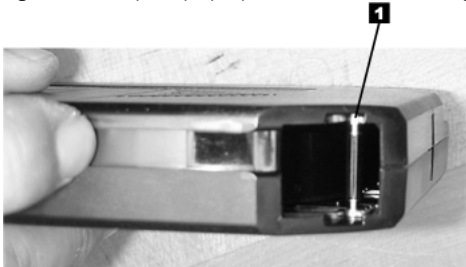
Attention: Insert only clean and undamaged cleaning cartridges into a tape system. Before you insert a cartridge into a drive or storage slot, inspect the cartridge for damage or debris. **Damaged or dirty cartridges can reduce system reliability and cause the loss of recorded data.** If debris appears 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 1](#)) 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.

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 TS4500 management GUI 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 1](#)) before you load the cartridge.

Figure 1. 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 2](#)). 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 3](#)) is also light gray.

#	Component
1	Non-moveable light gray block
2	Sample label for cleaning cartridge

Figure 2. Characteristics that identify the 3592 cleaning cartridge



Figure 3. 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. To determine whether one or more cleaning cartridges are loaded, go to the Cartridges page of the TS4500 management GUI.

Related information

- [TS4500 management GUI Cartridges page help](#)

3592 diagnostic cartridge

This section gives 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. The diagnostic cartridge is stored in a tier 0 cartridge storage slot. 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 **CE xxxJy**, where **xxx** is three digits and **Jy** is the cartridge type (such as JJ or JK).

A new diagnostic cartridge comes with the L25 frame.

3592 bar code label

Each 3592 data, cleaning, and diagnostic cartridge that is processed by the TS4500 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**), advanced type E data (**JE**), economy (**JJ**), advanced type C economy (**JK**), advanced type D economy (**JL**), advanced type E economy (**JM**), economy WORM (**JR**), WORM (**JW**), extended WORM (**JX**), advanced type C WORM (**JY**), advanced type D WORM (**JZ**), advanced type E WORM (**JV**), cleaning, or diagnostic cartridge. [Figure 1](#) 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**, **JE**, **JJ**, **JK**, **JL**, **JM**, **JR**, **JV**, **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, go to [Barcode Label Specification for use with 3592 Tape Media](#) and download the PDF file of the specification, *Label Specification for IBM 3592 Cartridges when used in IBM Libraries*. You can also contact your IBM sales representative for this specification.

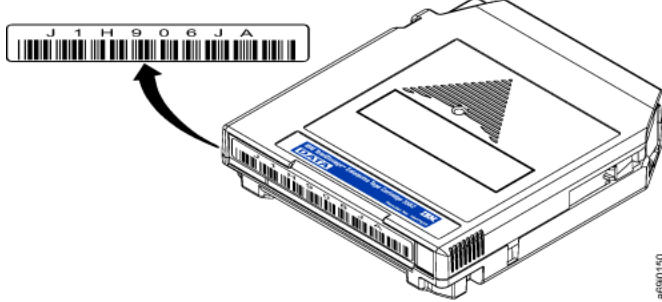
When attaching a bar code label to a tape cartridge, place the label only in the recessed bar code label area (see [Figure 1](#)). A label that extends outside of the recessed area can cause loading problems in the drive or the library.

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 tape library from reading the label. 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 using the modifyVolserReporting CLI command.

Note: If you suspect that the library is having problems reading the bar code labels, an IBM service representative can use the TS4500 management GUI to slow the scanner speed as part of problem determination.

To order bar code labels, see [Ordering bar code labels for tape cartridges](#).

Figure 1. 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](#)
This topic provides guidelines for using 3592 bar code labels.

Guidelines for using 3592 bar code labels

This topic provides 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.

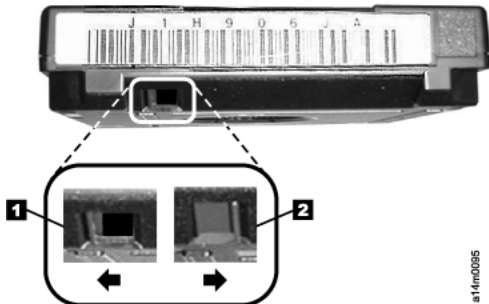
Setting the write-protect switch on a 3592 cartridge

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 1](#)) 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 1. 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.

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.
- **[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.
- **[Provide proper acclimation and environmental conditions for 3592 tape cartridges](#)**
Certain conditions ensure the safety and quality of 3592 tape cartridges.
- **[Perform a thorough inspection of 3592 tape cartridges](#)**
This topic offers guidelines for inspecting tape cartridges.
- **[Handle the 3592 tape cartridge carefully](#)**
Handle 3592 tape cartridges carefully to ensure they do not get damaged.

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.

It is recommended that you adhere to the following packaging and shipping guidelines to avoid damage to 3592 tape cartridges:

- 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 at www.turtlecase.com. The 3592 tape cartridges support racks and storage containers 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 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; 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 ensure the safety and quality of 3592 tape cartridges.

- Before you use a cartridge, allow it acclimate to the normal operating environment for a minimum of 24 hours. If you see condensation on the cartridge, wait an extra hour.
- Ensure that all surfaces of a cartridge are dry before you insert it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to magnetic fields of greater than 50 Oersteds (4000 ampere/meter). Devices that can produce strong magnetic fields are terminals, motors, video equipment, X-ray equipment, 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 transporting the cartridges.

Perform a thorough inspection of 3592 tape cartridges

This topic offers guidelines for inspecting 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.



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.

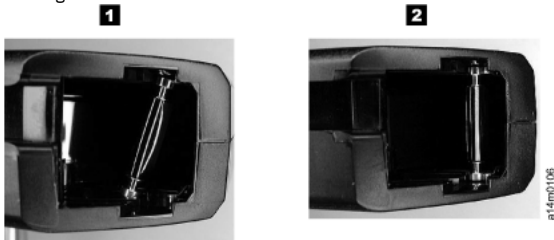
If the leader pin in your 3592 tape cartridge becomes dislodged from its pin-retaining spring clips, you must use the IBM® Leader Pin Reattachment Kit (part number 18P8887) to reposition it.

A leader pin that is improperly seated inside a cartridge can interfere with the operation of the drive. [Figure 1](#) 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)

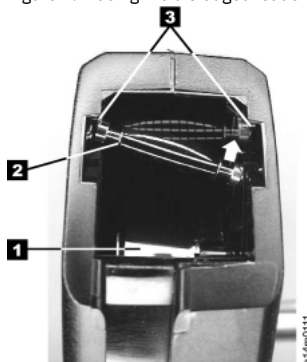
Figure 1. Leader pin in the incorrect and correct positions in a 3592 tape cartridge. The cartridge door is open and the leader pin is visible inside the cartridge.



To reposition the leader pin, perform the following steps.

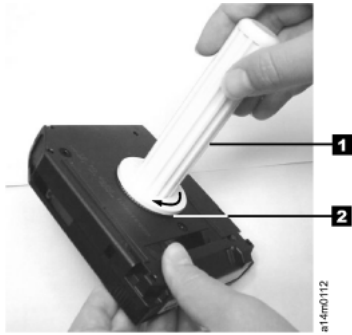
1. Slide open the cartridge door (see 1 in [Figure 2](#)) and locate the leader pin 2 (you may need to shake the cartridge gently to roll the pin toward the door).
2. With plastic or blunt-end tweezers, grasp the leader pin and position it in the pin-retaining spring clips 3.
3. Press the leader pin gently into the clips until it snaps into place and is firmly seated.
4. Close the cartridge door.

Figure 2. 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 3](#)) into the cartridge's hub 2 and turn it clockwise until the tape becomes taut.

Figure 3. Rewinding the tape into the cartridge



6. Remove the rewind tool by pulling it away from the cartridge.

Environmental and shipping specifications for IBM 3592 tape cartridges

Specific storage and shipping environmental conditions apply to IBM 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 1](#) lists the environmental conditions for storing and shipping IBM 3592 tape cartridges.

Table 1. Environment for storage and shipping the IBM 3592 tape cartridge

Environmental specifications			
Environmental factor	Allowable storage	Recommended storage	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%
Maximum wet bulb temperature (does not apply to 3592 JE tape cartridges)	26°C (79°F)	26°C (79°F)	26°C (79°F)
Maximum dew point temperature (applies only to 3592 JE tape cartridges)	22°C (72°F)	22°C (72°F)	22°C (72°F)
Magnetic field	Stray magnetic field at any point on tape not to exceed 50 oersteds (4000 ampere/meter).		

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 tape library helps to keep IBM magnetic tape cartridge systems operating in a reliable and efficient manner.

Ordering 3592 cartridges and media supplies

You can order 3592 tape cartridges and related media supplies by part number or, for larger quantities, using the 3599 model number with feature codes to specify the cartridge type.

- **Ordering 3592 cartridges and media supplies by part number**
Supported 3592 data cartridges and media supplies can be ordered by part number.
- **Ordering 3592 cartridges and media supplies using the 3599 model number**
Large quantities of 3592 data cartridges can be ordered using the 3599 model number to specify the cartridge type and a combination of feature codes to specify quantities, labeling, and initialization options. You can also order cleaning cartridges in this way.
- **Ordering supplies for repairs**
The Leader Pin Reattachment Kit is required for repairs to a 3592 tape cartridge.
- **Ordering bar code labels for tape cartridges**
Each tape cartridge must have a bar code label with a unique volume serial (VOLSER) number. You can order these labels separately from IBM data cartridges and cleaning cartridges.

Ordering 3592 cartridges and media supplies by part number

Supported 3592 data cartridges and media supplies can be ordered by part number.

The tape cartridges and media supplies listed in [Table 1](#) can be ordered from:

- An IBM Media Authorized Distributor (find the closest distributor at [IBM Storage Media](#)).
- Your IBM® Sales Representative or any authorized IBM Business Partner.

Table 1. Part numbers for 3592 tape cartridges and media supplies

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	60F format: 7 TB (6.37 TiB) 55F format: 7 TB (6.37 TiB) E08 format: 7 TB (6.37 TiB) E07 format: 4 TB (3.64 TiB)	46X7452
IBM Enterprise	3592 Advanced Type D data	JD	60F format: 15 TB (13.64 TiB) 55F format: 15 TB (13.64 TiB) E08 format: 10 TB (9.1 TiB)	2727263
IBM Enterprise	3592 Advanced Type E data	JE	60F format: 20 TB (18.19 TiB)	02CE960
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	60F format: 900 GB (838.19 GiB) 55F format: 900 GB (838.19 GiB) E08 format: 900 GB (838.19 GiB) E07 format: 500 GB (465.66 GiB)	46X7453
IBM Enterprise	3592 Advanced Type D economy	JL	60F format: 3 TB (2.73 TiB) 55F format: 3 TB (2.73 TiB) E08 format: 2 TB (1.82 TiB)	2727264
IBM Enterprise	3592 Advanced Type E economy	JM	60F format: 5 TB (4.55 TiB)	02CE961
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: 1600 GB (1490.12 GiB) E06 format: 1000 GB (931.32 GiB) E05 format: 700 GB (651.93 GiB)	23R9831
IBM Enterprise	3592 Advanced Type C WORM	JY	60F format: 7 TB (6.37 TiB) 55F format: 7 TB (6.37 TiB) E08 format: 7 TB (6.37 TiB) E07 format: 4 TB (3.64 TiB)	46X7454
IBM Enterprise	3592 Advanced Type D WORM	JZ	60F format: 15 TB (13.64 TiB) 55F format: 15 TB (13.64 TiB) E08 format: 10 TB (9.1 TiB)	2727265
IBM Enterprise	3592 Advanced Type E WORM	JV	60F format: 20 TB (18.19 TiB)	02FJ980
IBM Enterprise	3592 Cleaning		Cleaning, 50 uses	18P7535

Brand name	Tape cartridge ¹	Type	Capacity ²	Part number
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 1 for more detailed information.				

Related information

- [Tape cartridges](#)

Ordering 3592 cartridges and media supplies using the 3599 model number

Large quantities of 3592 data cartridges can be ordered using the 3599 model number to specify the cartridge type and a combination of feature codes to specify quantities, labeling, and initialization options. You can also order cleaning cartridges in this way.

[Table 1](#) lists cartridges that can be ordered using the 3599 model number. It includes examples of ordering options for each cartridge type. Note that additional feature codes are required to completely specify all cartridge characteristics.

You can order the model numbers listed in [Table 1](#) from:

- An IBM Media Authorized Distributor (find the closest distributor at [IBM Storage Media](#)).
- Your IBM® Sales Representative or any authorized IBM Business Partner.

Table 1. Model 3599 tape cartridge ordering options

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity ^{2, 5}	Description
		Regular	RFID ¹			
011 ⁴	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 ⁴	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 ⁴	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 ⁴	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 ⁴	JB/9032	5020	5021	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended Data cartridges, labeled, not initialized
016 ⁴	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
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
426	JE/9037	4262	N/A	9087	20 TB (18.19 TiB)	20-Pack 3592 Data Cartridges - Type E, labeled and initialized
526	JE/9037	5262	N/A	N/A	20 TB (18.19 TiB)	20-Pack 3592 Data Cartridges - Type E, labeled, not initialized
E11 ⁴	JJ/9050	1120	1121	9082	128 GB (119.21 GiB)	20-pack 3592 Economy cartridges, labeled and initialized
				9081	100 GB (93.13 GiB)	

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity ^{2, 5}	Description
		Regular	RFID ¹			
				9080	60 GB (58.88 GiB)	
E12 ⁴	JJ/9050	1220	1221	N/A	60 GB (58.88 GiB)	20-pack 3592 Economy cartridges, labeled, not initialized
E13 ⁴	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
436	JM/9037	4362	N/A	9087	5 TB (4.55 TiB)	20-Pack 3592 Economy Data Cartridges - Type E, labeled and initialized
536	JM/9037	5362	N/A	N/A	5 TB (4.55 TiB)	20-Pack 3592 Economy Data Cartridges - Type E, labeled, not initialized
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)	
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 ⁴	JY/9046	4400	4410	9084	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, labeled and initialized
540 ⁴	JY/9046	5400	5410	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, labeled, not initialized
640 ⁴	JY/9046	6400	N/A	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, not labeled and not initialized
445 ⁴	JZ/9049	4455	4465	9085	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D WORM cartridges, labeled and initialized
545 ⁴	JZ/9049	5451	5461	N/A	10 TB (9.1 TiB)	20-pack 3592 Advanced Type D WORM cartridges, labeled, not initialized
645 ⁴	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

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity ^{2, 5}	Description
		Regular	RFID ¹			
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:

- Radio frequency identification labels
- For more details about individual cartridge capacities, see [Table 1](#).
- N/A = Not applicable
- This product is no longer available for order by this method. Refer to [Ordering 3592 cartridges and media supplies by part number](#) to order this media type.
- For cartridges that are not initialized, the actual cartridge capacity is dependent on the format used to write the cartridge.

Related information

- [Tape cartridges](#)

Ordering supplies for repairs

The Leader Pin Reattachment Kit is required for repairs to a 3592 tape cartridge.

This kit contains the tools required 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, contact an IBM Media Authorized Distributor. You can find the closest distributor at [IBM Storage Media](#). Order as IBM® part number 18P8887.

Ordering bar code labels for tape cartridges

Each tape cartridge must have a bar code label with a unique volume serial (VOLSER) number. You can order these labels separately from IBM® data cartridges and cleaning cartridges.

Bar code labels must meet the following specifications:

- [IBM LTO Ultrium Cartridge Label Specification](#)
- [Label Specification for IBM 3592 Cartridges when used in IBM Libraries](#)

Table 1. Authorized suppliers of custom bar code labels¹

In the Americas	In Europe and Asia
EDP/Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 U.S.A. Telephone: 888-438-8362 or 303-464-3547 Fax: 888-438-8363 or 303-666-2166 http://www.tri-optic.com	
Netc, L.L.C. ² 100 Corporate Drive Trumbull, CT 06611 U.S.A. Telephone: 203-372-6382 Fax: 203-372-0676 http://www.netclabels.com	Netc Europe Telephone.: +49-2151-970-900 Fax: +49-2151-970-908 Email: Vertrieb@netclabels.de http://www.netclabels.de Netc Asia Pacific Pty. Ltd. 7 Cordwood Drive Cooroy QLD 4563 Australia Telephone: +61 (0)7 5442 6263 Fax: +61 (0)7 5442 6522 http://www.netclabels.com.au

Notes:

- These 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 users only and is not an endorsement or recommendation of such providers. IBM is not responsible for the quality of bar code labels that are procured from sources other than IBM. This information is applicable to bar code labels that are printed by the listed companies. IBM does not review the quality of any labels that are produced by software or services that are offered by such companies that allow users to print labels on their own printing equipment.
- Netc is the only authorized supplier of radio frequency identification (RFID) labels. Orders for RFID labels must be placed through the U.S. office. Orders are shipped worldwide.

Managing

Manage the data and components of your TS4500 tape library.

- [Locating the TS4500 tape library management functions](#)
The TS4500 includes basic management functions. These functions are found in the Management GUI.
- [Powering on the TS4500 tape library](#)
Power on the TS4500 tape library to begin the library initialization sequence and bring the library to a ready state.
- [Connecting to the TS4500 management GUI](#)
Connect to the IBM® TS4500 management graphical user interface (GUI) to remotely view and manage the library.
- [Saving and restoring the library configuration](#)
Your library's configuration information is stored in a database on an LCC. If there is an issue with your library's LCC or internal compact flash memory, the library configuration can be restored from a saved configuration file. Otherwise, the library may need to be completely reconfigured.
- [Updating the library and drive firmware](#)
The TS4500 tape library provides multiple options for updating the library and drive firmware.
- [Powering off the TS4500 tape library](#)
Use this procedure to power off the TS4500 tape library after normal operation, and not during an emergency.
- [Inserting tape cartridges](#)
There are several ways to insert tape cartridges in the TS4500 tape library.
- [Removing tape cartridges](#)
There are several ways to move data, scratch, or cleaning cartridges from the library into an I/O station.
- [Changing your password](#)
Modify or reset your password by using the management GUI.

Locating the TS4500 tape library management functions

The TS4500 includes basic management functions. These functions are found in the Management GUI.

Refer to the following sections:

- Managing the library [Table 1](#)
- Managing logical libraries [Table 2](#)
- Managing cartridges [Table 3](#)
- Managing drives [Table 4](#)
- Managing security [Table 5](#)
- Managing automatic media verification [Table 6](#)

Table 1. Managing the library

Task to Accomplish		From the management GUI	CLI Command
Inventory the library or a frame		Monitoring >> System Actions Inventory	No
Manage encryption	Choosing a method	Library >> Logical Libraries	No
	Managing encryption key servers	Settings >> Security >> Encryption Key Servers	No
	Modifying advanced settings	No	Yes
Manage licensed features		Settings >> Library >> Licensed Functions	No
Manage logical libraries	Create logical libraries	Library >> Logical Libraries	No
	Assign cartridges	Library >> Logical Libraries	Yes
	Assign drives	Library >> Logical Libraries	No
	Choose or modify method of encryption	Library >> Logical Libraries	No
	Specifying how many characters in each VOLSER number are reported (first 6, first 8, all, or last 8)	No	Yes
	Modify the maximum number of cartridges	Library >> Logical Libraries	No
	Modify the maximum number of VIO slots	No	Yes
Managing ports		Settings >> Network	No
Monitoring capacity utilization		Monitoring >> System	No
Monitoring I/O station status		Monitoring >> System	No
Monitoring system health		Monitoring >> System	Yes
Obtaining library logs		Monitor >> System	Yes
Reporting 6- or 8-character VOLSERS		No	Yes
Resetting the library and node cards		Monitoring >> System	Yes
Setting the date and time		Settings >> Library >> System Date and Time	No
Updating library firmware		Monitoring >> System	Yes
Using SNMP		Settings >> Notifications	No

Table 2. Managing logical libraries

Task	From the management GUI	From the CLI
Create logical libraries	Library >> Logical Libraries	No
Create VOLSER ranges	Cartridges >> VOLSER Ranges	Yes
Manage encryption settings	Library >> Logical Libraries	Yes
Set the maximum VIO	No	Yes
View queued exports	Cartridges >> Cartridges	Yes
View logical libraries	Library >> Logical Libraries	Yes
View VOLSER ranges	Cartridges >> VOLSER Ranges	Yes

Table 3. Managing cartridges

Task	From the management GUI	From the CLI
Assign cartridges	Cartridges > VOLSER Ranges	Yes
Enable automatic eject of expired cleaning cartridges	Settings > Library > Cleaning Cartridges	No
Monitor cleaning cartridges	Cartridges > Cartridges	Yes
Mount or demount cartridges	Cartridges > Cartridges	Yes
Move cartridges	Cartridges > Cartridges	Yes
Prestage or destage cartridges	No	Yes
View cartridge accessor status	Monitoring > System	Yes
View mount history	Drives > Drives	No

Table 4. Managing drives

Task	From the management GUI	From the CLI
Assign drives	Drives > Drives by Logical Library	No
Clean drives	Drives > Drives	No
Enable or disable a control path	Drives > Drives	No
Enable encryption	Library > Logical Libraries	No
Obtain drive logs	Drives > Drives	Yes
Reset a drive	Drives > Drives	Yes
Update drive firmware	Drives > Drives	Yes
View drive information	Drives > Drives	Yes
View encryption method	Drives > Drives by Logical Library	No
View Fibre Channel settings	Drives > Drives	Yes

Table 5. Managing security

Task	From the management GUI	From the CLI
Changing passwords	TS4500 management GUI banner	No
Enabling or disabling remote authentication	Settings > Security > Authentication	No
Enabling or disabling SSL	Settings > Security > HTTPS	No
Managing encryption	Settings > Security	Yes
Managing roles	Access > Roles	No
Managing users	Access > Users	No

Table 6. Managing automatic media verification

Task	From the management GUI	From the CLI
Reserve a verification drive	Drives > Use for Media Verification	No
Assign verification drive to a logical library	Drives > Assign	No
Remove verification drive designation	Drives > Use for Media Access	No
Check if a verification drive is verifying media	Drives (Check the drive state column).	No
Remove last verification drive out of a logical library	Drives by Logical Library > Reassign	No
Add a cartridge to the priority verification queue	Cartridges by Logical Library > Select for Priority Verification	No
Remove a cartridge from the priority verification queue	Cartridges by Logical Library > Deselect for Priority Verification	No
Enable automatic media verification on an existing logical library	Cartridges by Logical Library > Modify Media Verification	No
View media verification for a logical library	Cartridges by Logical Library > Properties (Logical Library properties)	No
View properties for verification drive	Drives > Properties	No
View last time cartridges were verified	Cartridges by Logical Library > Last Verification (Right-click on header and choose Last Verification column.)	No
	Cartridges by Logical Library (Right-click on header and choose Verification Results column.)	No
	Cartridges (Right-click on header and choose Last Verification column.)	No
	Cartridges (Right-click on header and choose Verification Results column.)	No
View which cartridges are currently in the verification process	Cartridges by Logical Library > Last Verification (Right-click on header and choose Last Verification column.)	No
Cancel media verification action	Tasks > Cancel (Right-click on media verification row.)	No

Powering on the TS4500 tape library

Power on the TS4500 tape library to begin the library initialization sequence and bring the library to a ready state.

Complete the following steps to power on the library:

1. Go to the display panel on the base frame of the library and slide the plastic cover that protects the power button up to uncover it.
2. Press the power button and wait to see the green power indicator turn on and stay on.
If the power indicator light fails to turn on, contact your IBM® service representative.

When you power the library on, it runs an initialization sequence for about 2 minutes. During that time, the TS4500 management GUI is not available. After the initialization sequence, the library does an inventory of the tape cartridges.

Related information

- [Display panel](#)

Connecting to the TS4500 management GUI

Connect to the IBM® TS4500 management graphical user interface (GUI) to remotely view and manage the library.

Before you connect to the TS4500 management GUI, the TS4500 tape library must first be installed and configured. In addition, you must use one of the supported web browsers that are listed in [Table 1](#) to access the management GUI. To ensure that all the functions of the management GUI are usable, enable cookies and JavaScript in your browser and disable the browser's function of blocking pop-up windows. The recommended browser resolution is 1000 x 600.

Table 1. Supported web browsers

Browser	Minimum versions supported
Mozilla Firefox	38
Microsoft Internet Explorer	11
Google Chrome	43

Note: IBM supports higher versions of the browsers as long as the vendors do not remove or disable functionality that the product relies upon. For browser levels higher than the versions that are certified with the product, customer support accepts usage-related and defect-related service requests. As with operating system and virtualization environments, if IBM support cannot re-create the issue in our lab, we might ask the client to re-create the problem on a certified browser version to determine whether a product defect exists. Defects are not accepted for cosmetic differences between browsers or browser versions that do not affect the functional behavior of the product. If a problem is identified in the product, defects are accepted. If a problem is identified with the browser, IBM might investigate potential solutions or work-around that the client can implement until a permanent solution becomes available.

Complete the following steps to connect to the management GUI:

1. Open one of the supported web browsers.
2. Type the Ethernet IP address of the frame you are connecting to on the URL line of the browser and press Enter.
The TS4500 management GUI login window displays.
Note: The IP address was set during the initial installation by the IBM service representative.
3. Enter your user name and password and click Log in.

Saving and restoring the library configuration

Your library's configuration information is stored in a database on an LCC. If there is an issue with your library's LCC or internal compact flash memory, the library configuration can be restored from a saved configuration file. Otherwise, the library may need to be completely reconfigured.

It is recommended to save the library configuration after initial installation and whenever the library configuration changes

Note: This task can only be accomplished by a user with a service role.

Command line interface (CLI) commands are used to create and restore the configuration file. For information on installing the CLI tool and running commands, refer to [Tape CLI commands](#).

- To save the configuration, use the [saveConfiguration CLI command](#).

The configuration information is saved to a file named `TS4500_library-serial-number_<firmware-level>_SAVECONF_<time-stamp>.dbz` in the directory where the CLI tool is stored.

- To restore a configuration, use the [restoreConfiguration CLI command](#).

Updating the library and drive firmware

The TS4500 tape library provides multiple options for updating the library and drive firmware.

[Table 1](#) lists various scenarios and the responsible party. Contact your IBM® Service representative with any questions about a specific scenario, who is responsible for the update, and if there is a charge.

Table 1. Library and drive firmware update scenarios

Update scenario	Responsible party	
	Not TS7700 Attached	TS7700 Attached
Installation of a chargeable feature	IBM Service Representative	TS7700 Service
Installation of nonchargeable feature	Customer ¹	TS7700 Service
Fixing a field issue	IBM Remote Code Load ²	TS7700 Service
Recommendation from an IBM Service representative	IBM Remote Code Load ²	TS7700 Service
Customer initiative to upgrade firmware level	Customer ¹	TS7700 Service

Note:

1. Customers can contract with their local service team. This is a billable activity.
2. If customers cannot allow Remote Code Load, they can contact their local service team to initiate an onsite exception process.

GUI Instructions:

- Go to [Updating library firmware](#) for steps on updating the library firmware.
- Go to [Updating drive firmware](#) for steps on updating the drive firmware.

Powering off the TS4500 tape library

Use this procedure to power off the TS4500 tape library after normal operation, and not during an emergency.

Complete the following steps to power off the library:

1. Ensure that the host application removed cartridges from all drives and that the library is varied offline from the host (if the host is attached).
2. Pause the library by pressing the pause button on the display panel on any frame that has an I/O station.
This action causes the library to move the cartridge accessor to its home location and pause operations for 60 seconds or as long as a frame door is open. The pause light next to the pause button stops flashing and illuminates solid to indicate that the library is paused. The health status pod on the System page of the management GUI also shows when the library is paused.
Note: Always pause the library before you power it off. If you power off before you pause the library, it might take longer to go online after the next power-on.
3. From the display panel on the base frame, slide the plastic cover that protects the power button and press the button. Wait until the green power indicator light turns off.

Related information

- [Display panel](#)

Inserting tape cartridges

There are several ways to insert tape cartridges in the TS4500 tape library.

The number of cartridges that you can add to the tape library is equal to the maximum number of available storage slots. Before inserting data or scratch cartridges, make sure that you have enough available slots in the library. View the number of available storage slots from the System page of the TS4500 management GUI. For more information, see the topic about frame capacity in the related links section.

Certain conditions apply when you mix drives and media. For more information, see the topic about supported drive and media configurations in the related links section.

- [Using I/O stations to insert cartridges](#)
Use the cartridge magazine to insert data, scratch, or cleaning cartridges into the I/O station and then into the library.
- [Bulk loading cartridges into high-density frames](#)
Bulk load cartridges into storage slots in high density (HD) frames of the TS4500 tape library during the initial cartridge insertion.

Related information

- [Frame capacity](#)
- [TS4500 management GUI System page help](#)
- [Tape drives](#)

Using I/O stations to insert cartridges

Use the cartridge magazine to insert data, scratch, or cleaning cartridges into the I/O station and then into the library.

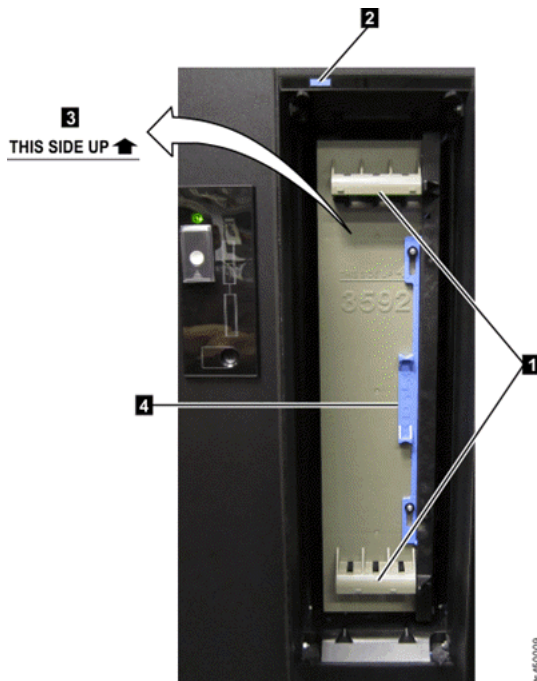
Important: Review the video on how to properly handle the I/O station <http://www.ibm.com/support/docview.wss?uid=ibm10728851>

Use the eject button (2 in [Figure 1](#)) or the TS4500 management GUI only to open and close the I/O station doors. Do not attempt to open the doors manually.

Complete the following steps to insert cartridges into the library by using the cartridge magazine and I/O station:

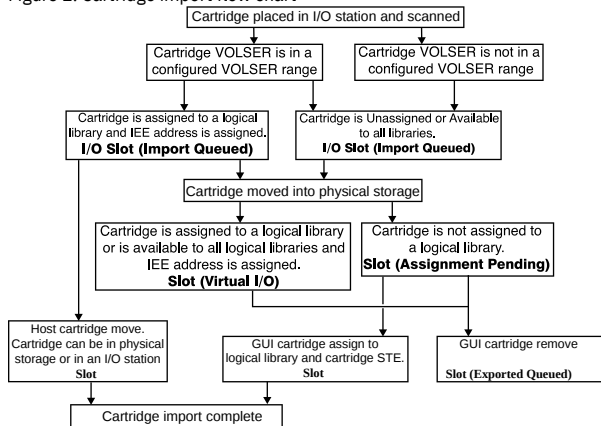
1. View the status of the I/O stations on the display panel on the base frame of the library.
The lock icon indicates that the station is locked. The open lock icon indicates that the station is unlocked.
2. Press the eject button (2 in [Figure 1](#)) or use the management GUI to open the I/O station doors.
After the eject button is pressed, the lock light flashes and the I/O station doors open after a slight delay.
3. Engage the magazine safety lock (4 in [Figure 1](#)) by sliding the mechanism down into the locked position. Then, remove the cartridge magazine by grabbing the handles at the top and bottom of the magazine (1 in [Figure 1](#)) and pulling straight out to remove the magazine completely from the station.
The magazine safety lock prevents cartridges from falling out of the magazine while it is being carried.
4. Place the cartridge magazine on an accessible surface and disengage the magazine safety lock by sliding the mechanism into the unlocked position.
Important: Do not attempt to insert cartridges when the magazine safety lock is engaged.
5. Insert one or more cartridges into the magazine so that the bar code label faces the interior of the library and the write-protect switch is on the right.
Note: An engraving on the cartridge magazine (3 in [Figure 1](#)) shows which end of the magazine is up. The cartridges cannot be fully inserted into the magazine if they are upside down. The cartridges must be fully seated for the magazine to fit into the I/O station.
6. Engage the magazine safety lock by sliding the mechanism into the locked position before you carry the cartridge magazine.
7. Replace the cartridge magazine into the I/O station and disengage the magazine safety lock by sliding the mechanism into the unlocked position. Review the cartridge magazine and I/O station video : <http://www.ibm.com/support/docview.wss?uid=ibm10728851>.
Note: The magazine safety lock must be in the unlock position for the accessor to retrieve cartridges.
8. Press the eject button (2 in [Figure 1](#)) or use the management GUI to close the I/O station doors. Do not manually force the doors closed. Doing so can damage the I/O station.
After the eject button is pressed, the lock light flashes and the I/O station doors close after a slight delay.
Note: If the I/O station doors do not close properly due to an obstruction, improperly seated cartridges, or a locked magazine, the doors automatically reopen. If this scenario occurs, clear any visible obstruction and check to ensure that all cartridges are seated in the cartridge magazine properly. Then, check that the cartridge magazine is seated properly in the I/O station and that the magazine is unlocked. Then, try to close the doors again by using the eject button or the management GUI.

Figure 1. I/O station and cartridge magazine handles



After you close the I/O station doors, the library automatically moves the cartridges into storage slots. How each cartridge is assigned to a logical library depends on the configured VOLSER ranges. For more information, see [Figure 2](#). The state of the cartridge is shown in bold text.

Figure 2. Cartridge import flow chart



View the state of inserted cartridges from the System or Cartridge page of the TS4500 management GUI.

Related information

- [Display panel](#)
- [I/O stations](#)
- [Cartridge magazine](#)
- [VOLSER ranges](#)
- [TS4500 management GUI System page help](#)
- [TS4500 management GUI Cartridges page help](#)

Bulk loading cartridges into high-density frames

Bulk load cartridges into storage slots in high density (HD) frames of the TS4500 tape library during the initial cartridge insertion.

After cartridges are inserted into storage slots and the library frame door is closed, the cartridges are assigned to logical libraries based on their volume serial (VOLSER) number. If the VOLSER of a cartridge does not match any of the existing VOLSER ranges, the cartridge remains unassigned. (VOLSER ranges are created and assigned to logical libraries during the initial library setup.)

Complete the following steps to bulk load cartridges into an HD frame:

1. Press the pause button on the display panel of the base frame of your TS4500 tape library to pause the library.
This action causes the library to move the cartridge accessor to its home location and pause operations for 60 seconds or as long as a frame door is open. The pause light next to the pause button stops flashing and illuminates solid to indicate that the library is paused. The health status pod on the System page of the management GUI also shows when the library is paused.
2. Within 60 seconds, unlock and open the front door on any HD frame.

3. 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 the front of the cartridge or until the slot accepts no more cartridges because it is full. LTO slots accept five cartridges; 3592 slots accept four cartridges.

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.
- For the initial bulk load on a newly installed frame, insert cartridges into the deep slots, but leave the top row empty. The slots in the top row 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.
- Only place cartridges in the frame that has the front door open. Do not insert cartridges into slots in an adjacent frame.
- 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 bar code label is visible (see [Figure 1](#) and [Figure 2](#)). The orientation differs from the orientation in an I/O slot.

Figure 1. Proper orientation of LTO tape cartridges in HD slots. The cartridge retention latch (1) and write-protect switch (2) are shown.

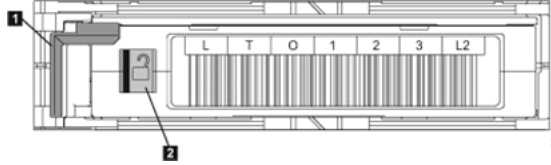
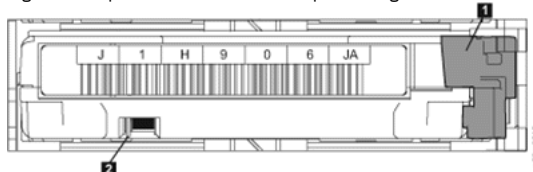


Figure 2. Proper orientation of 3592 tape cartridges in HD slots. The cartridge retention latch (1) and write-protect switch (2) are shown.



4. Gently close and lock the front door.
5. After approximately 15 seconds, the TS4500 tape library automatically inventories the frame of the door that you opened. During the inventory, the pause indicator on the display remains illuminated and a message displays on the health status pod on the System page of the management GUI. The inventory in an HD frame after a full bulk load takes approximately 45 minutes.

IBM recommends that you do not insert cartridges into an adjacent frame. However, if you inserted cartridges into an adjacent frame, you must also do an inventory of that frame or of the entire library.

Related information

- [Display panel](#)
- [TS4500 management GUI System page help](#)

Removing tape cartridges

There are several ways to move data, scratch, or cleaning cartridges from the library into an I/O station.

- From the host software, issue a **Move** command from the Storage element to the Import/Export element.
- From the management GUI, select Cartridges > Move > To I/O Slot.
- From the CLI, use the [removeDataCartridges CLI command](#).

You can also remove cartridges manually from tape drives or storage slots if necessary.

Notes:

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

Cartridges that are queued for export will display one of the following states on the Cartridges page of the management GUI:

Slot (Export Queued)

The cartridge is queued to be moved to an I/O station.

I/O Slot

The cartridge was moved to an 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.

You can use the [showQueuedExports CLI command](#) to specify whether exported cartridges remain assigned to a logical library or are unassigned upon export.

When a cartridge is exported from the host to an I/O station, removed from the I/O station, and reinserted into the I/O station in a different slot, it can become a new importable cartridge. Then, it can be automatically moved back into the physical library. This action 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 management GUI to remove the cartridge to the I/O station.

- [Using the TS4500 management GUI to remove cartridges](#)
Use the management GUI to move data, scratch, or cleaning cartridges from storage slots to an I/O station for removal from the library.
- [Removing a data cartridge from a drive in the library](#)
In a rare situation, you might need to remove a cartridge directly from a drive in the TS4500 tape library without transferring it to an I/O station.
- [Removing data cartridges from an HD slot in the library](#)
You can manually remove data cartridges directly from HD slots if the cartridge accessor is not working.

Related information

- [Cartridges](#)
- [Virtual I/O slots](#)
- [removeDataCartridges CLI command](#)
- [showQueuedExports CLI command](#)

Using the TS4500 management GUI to remove cartridges

Use the management GUI to move data, scratch, or cleaning cartridges from storage slots to an I/O station for removal from the library.

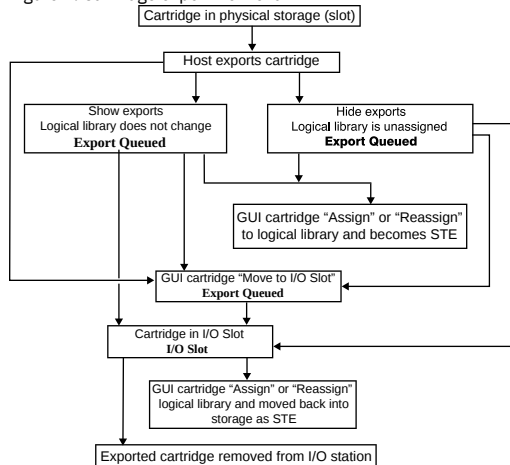
When initiated from the management GUI, the Move To I/O Slot operation has a higher priority than any other server export commands.

Complete the following steps to remove cartridges from the library:

1. From the TS4500 management GUI, select Cartridges > Cartridges to view a table that displays all cartridges in the library. Select Cartridges > Cartridges by Logical Library to view a table that displays all cartridges in the library by their assigned logical library.
2. Filter the table to locate the cartridge or cartridges to be removed.
3. Highlight the cartridge or cartridges to be removed and select Actions > Move > To I/O Slot.
4. Monitor the state of the cartridges that are being removed in the State column on the Cartridges or Cartridges by Logical Library page of the management GUI.
5. If the I/O station that you intend to use is locked, use the management GUI or your application software to unlock the station.
6. Press the eject button above the I/O station (2 in [Figure 1](#)) or use the management GUI to open the I/O station doors.
After the eject button is pressed, the lock light flashes and the I/O station doors open after a slight delay.
Note: Use the eject button or the management GUI to open and close the I/O station doors. Never attempt to open the doors manually.
7. Engage the magazine safety lock (4 in [Figure 1](#)) by sliding the mechanism into the locked position.
The lock prevents cartridges from falling out of the magazine while it is carried.
8. Remove the cartridge magazine by grabbing the handles at the top and bottom of the magazine (1 in [Figure 1](#)) and pulling straight out to remove the magazine completely from the station.
9. Place the cartridge magazine on an accessible surface, disengage the magazine safety lock, and remove any cartridges.
Important: Do not attempt to remove cartridges when the magazine safety lock is engaged.
10. If any cartridges remain in the magazine, engage the safety lock before you carry the magazine.
11. Replace the cartridge magazine into the I/O station and ensure that the safety lock is disengaged and in the unlock position.
Note: Do not leave the I/O station without a cartridge magazine, even if the magazine is empty.
12. Press the eject button above the I/O station or use the management GUI to close the I/O station doors.
After the eject button is pressed, the lock light flashes and the I/O station doors close after a slight delay.
Note: If the I/O station doors do not close properly due to an obstruction, improperly seated cartridges, or a locked magazine, the doors automatically reopen. If this situation occurs, clear any visible obstruction, check to ensure that all cartridges are seated in the cartridge magazine properly, and that the cartridge magazine is seated properly in the I/O station. Then, try to close the doors again by using the eject button or the management GUI.

[Figure 1](#) shows the movement and status of cartridges that are being exported. The state of the cartridge is shown in bold text. Refer to the management GUI Cartridges page help topic for descriptions of each cartridge state.

Figure 1. Cartridge export flow chart



Related information

- [Cartridge magazine](#)
- [TS4500 management GUI Cartridges page help](#)

Removing a data cartridge from a drive in the library

In a rare situation, you might need to remove a cartridge directly from a drive in the TS4500 tape library without transferring it to an I/O station.

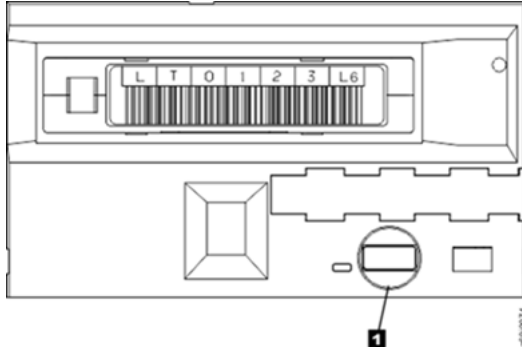
Note: If you encounter a stuck tape cartridge (that is, a cartridge that will not unload after it receives an Unload command from the host), follow this procedure. If after you complete these steps the cartridge still does not unload, contact your IBM® service representative.

1. Pause the library by pressing the pause button on the display panel on any frame that has an I/O station.
This action causes the library to move the cartridge accessor to its home location and pause operations for 60 seconds or as long as a frame door is open. The pause light next to the pause button stops flashing and illuminates solid to indicate that the library is paused. The health status pod on the System page of the

- management GUI also shows when the library is paused.
2. Within 60 seconds, unlock and open the front door of the frame that contains the drive with the cartridge that is to be removed.
 3. Remove the cartridge from the drive by following the correct steps for the type of drive:

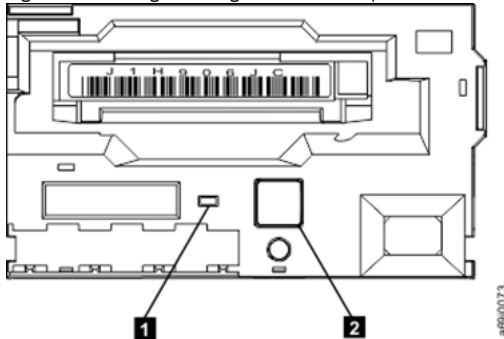
- To remove a cartridge from an LTO tape drive, perform the following steps:
 - Press and release the unload button (1 in [Figure 1](#)).
 - Wait for the cartridge to rewind and eject.
 - Note: A typical tape cartridge rewind and eject time can take as long as 5 minutes, although some conditions can extend this time to as long as 1 hour.
 - Remove the cartridge from the drive.

Figure 1. Removing a cartridge from an LTO tape drive



- To remove a cartridge from a 3592 tape drive, perform the following steps:
 - Ensure that the green power indicator light is on (see 1 in [Figure 2](#)).
 - Press and release the unload button (see 2 in [Figure 2](#)).
 - Wait for the cartridge to rewind and eject.
 - Note: A typical tape cartridge rewind and eject time can take as long as 5 minutes, although some conditions can extend this time to as long as 1 hour.
 - Remove the cartridge from the drive.

Figure 2. Removing a cartridge from a 3592 tape drive



4. Gently close and lock the front door.
5. After approximately 15 seconds, the TS4500 tape library automatically inventories the frame of the door that you opened and closed. During the inventory, the task pod on the System page of the management GUI shows that an inventory is in progress.

Removing data cartridges from an HD slot in the library

You can manually remove data cartridges directly from HD slots if the cartridge accessor is not working.

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

Complete the following steps to manually remove data cartridges directly from HD slots:

1. Pause the library by pressing the pause button on the display panel on any frame that has an I/O station. This action causes the library to move the cartridge accessor to its home location and pause operations for 60 seconds or as long as a frame door is open. The pause light next to the pause button stops flashing and illuminates solid to indicate that the library is paused. The health status pod on the System page of the management GUI also shows when the library is paused.
2. Unlock and open the front door of the frame that contains the cartridges that are to be removed within 60 seconds. If you do not open the door within 60 seconds, library operations resume automatically. Note: Remove cartridges only from a frame whose front door is open. Do not add or remove cartridges from an adjacent frame.
3. Locate the HD slot that contains the cartridges that you want to remove and perform one of the following procedures. The procedure that you use depends on the type of frame.

CAUTION:

HD slots have a constant force spring for pushing cartridges forward when a cartridge is being removed from the slot.

 - **For HD slots in an LTO frame:**
 - See [Figure 1](#). 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 2](#).

Figure 1. LTO HD slot gate release



Figure 2. LTO cartridge removal from an HD slot



Figure 3. 3592 HD slot gate release

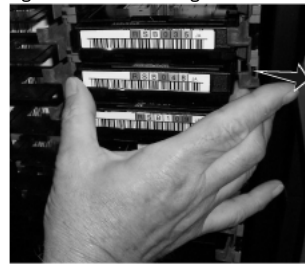


Figure 4. 3592 cartridge removal from an HD slot



- Use the same method to remove other data cartridges from the storage slot.
- For HD slots in a 3592 frame:
 - See [Figure 3](#). 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 4](#).

- Use the same method to remove other data cartridges from the storage slot.

4. Gently close and lock the front door of the frame.

5. After approximately 15 seconds, the TS4500 tape library automatically inventories the frame of the door that you opened.

During the inventory, the pause light next to the pause button remains illuminated and the health status pod on the System page of the management GUI indicates that an inventory is in progress.

- 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, see the section about inserting tape cartridges.

Related information

- [TS4500 management GUI System page help](#)
- [Inventory times](#)
- [Inserting tape cartridges](#)

Changing your password

Modify or reset your password by using the management GUI.

This action is only available when remote authentication is disabled.

Contact your administrator if you lost or forgot your password.

Complete the following steps to reset your password:

1. Log in to the management GUI with your user name and password.
2. Click your user name on the right end of the toolbar at the top of the page and then select Modify Password. The Modify Password window displays.
3. Enter your current password and your new password and click Modify.

Troubleshooting and support

The topics in this section provide information about diagnosing symptoms and resolving possible problems with the IBM® TS4500 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.

- [Library log files](#)
Use the TS4500 management GUI to download library logs for problem analysis if necessary.
- [Error codes](#)
This topic describes the tape library error codes.
- [Using SNMP to monitor and query a library](#)
The Simple Network Management Protocol (SNMP) enables the tape library to exchange information over a TCP/IP network with an SNMP manager running systems management software, such as Netview®.
- [TapeAlert flags](#)
This section lists the TapeAlert flags for Ultrium tape drives, 3592 tape drives, and the TS4500 tape library.
- [Initial troubleshooting checklist](#)
[Table 1](#) lists symptoms or errors that might occur with the TS4500 tape library and provides the required corrective actions.
- [Unlocking the administrator password](#)
Use the Access Recovery button to unlock the administrator password.
- [Resolving library errors](#)
- [Resolving fibre channel errors](#)
- [Resolving tape drive errors](#)
- [Resolving encryption-related errors](#)

Library log files

Use the TS4500 management GUI to download library logs for problem analysis if necessary.

Complete the following steps to download library logs:

1. Log in to the TS4500 management GUI and go to Monitoring > System.
2. Click the save icon on the System page toolbar (in the top left corner of the System page), and select Export Library Logs. Wait while the system gathers information.
3. When the "Open file" window appears, select Save to browse to a directory to save the library log .zip file.

Error codes

This topic describes the tape library error codes.

[Table 1](#) lists the severity, the SNMP trap ID, and the URC for each error code.

Table 1. Library events

Error code	Description	Severity	SNMP trap ID	URC
0001	Cartridge {VOLSER} could not be read.	Warning	201	C001
0002	Cartridge {VOLSER} could not be written to.	Warning	202	C002
0003	Cartridge {VOLSER} had a read, write, or positioning error.	Warning	203	NA
0004	Cartridge {VOLSER} had a read, write, or positioning error because of faulty media.	Warning	204	NA
0005	Cartridge {VOLSER} could not be read from because of faulty media or a faulty drive.	Warning	205	0xC005
0006	Cartridge {VOLSER} could not be written to or there was a positioning error because of faulty media or a faulty drive.	Warning	206	NA
0007	Cartridge {VOLSER} reached its end of life.	Warning	207	NA
0008	Cartridge {VOLSER} is not suitable for long term data storage.	Warning	208	NA
0009	A write command failed because cartridge {VOLSER} is write-protected.	Informational	209	NA
000A	A drive unload was attempted while media removal was prevented.	Informational	210	NA
000B	A cleaning tape was loaded into a drive.	Informational	211	NA
000C	Cartridge {VOLSER} is not supported by the drive.	Informational	212	NA
000D	Cartridge {VOLSER} had a mechanical failure. The cartridge was unloaded.	Warning	213	NA
000E	Cartridge {VOLSER} had a mechanical failure. The cartridge was not unloaded.	Error	214	0xC00E
000F	A drive detected the cartridge memory in cartridge {VOLSER} failed.	Warning	215	NA
0010	Cartridge {VOLSER} was manually removed from a drive with a read or write in process.	Informational	216	NA
0011	A drive rejected a write attempt to a read-only cartridge {VOLSER}.	Informational	217	NA
0012	At load time, a drive detected a corrupted directory for cartridge {VOLSER}.	Warning	218	NA

Error code	Description	Severity	SNMP trap ID	URC
0013	Cartridge {VOLSER} was nearing its end of life If you encounter this error, perform the following steps from the host: 1. Copy the data from the expiring cartridge to a different cartridge. 2. Eject the expiring cartridge and remove it from the library.	Warning	219	N/A
0014	A drive requested a cleaning.	Informational	220	NA
0015	A drive requested a routine cleaning.	Informational	221	NA
0016	A drive detected an expired cleaning cartridge {VOLSER}.	Informational	222	NA
0017	A drive detected an invalid cleaning cartridge {VOLSER}.	Warning	223	NA
0018	A drive reported TapeAlert flag 24.	Informational	224	NA
0019	Drive Fibre channel interface failed.	Error	225	0xC020
001A	Drive cooling fan failed.	Error	226	0xC01A
001B	Drive power supply failed.	Error	227	0xC01B
001C	A drive reported TapeAlert flag 28.	Informational	228	NA
001D	A drive reported a condition that requires drive diagnostics.	Warning	229	N/A
001E	A drive failed. A drive reset is required.	Error	230	0xC01E
001F	Drive power-on self-tests failed. A drive hard reset is required.	Error	231	0xC01F
0020	Drive Fibre channel interface failed.	Error	232	0xC020
0021	A failure occurred that requires cartridge {VOLSER} to be demounted from the drive and retried.	Warning	233	NA
0022	A drive firmware update process failed..	Informational	234	NA
0023	A drive detected that the humidity is outside the specified operational limits.	Warning	235	NA
0024	A drive detected that the temperature is outside the specified operational limits.	Warning	236	NA
0025	Drive power-supply voltages are outside the specified operational limits.	Error	237	0xC025
0026	A drive reported a condition that requires drive diagnostics.	Warning	238	0xC026
0027	A drive reported a condition that requires drive diagnostics.	Error	239	0xC027
0028	A drive reported TapeAlert flag 40.	Informational	240	NA
0029	A drive reported TapeAlert flag 41.	Informational	241	NA
002A	A drive reported TapeAlert flag 42.	Informational	242	NA
002B	A drive reported TapeAlert flag 43.	Informational	243	NA
002C	A drive reported TapeAlert flag 44.	Informational	244	NA
002D	A drive reported TapeAlert flag 45.	Informational	245	NA
002E	A drive reported TapeAlert flag 46.	Informational	246	NA
002F	A drive reported TapeAlert flag 47.	Informational	247	NA
0030	A drive reported TapeAlert flag 48.	Informational	248	NA
0031	Cartridge {VOLSER} was initialized as partitioned or capacity-scaled.	Informational	249	NA
0032	Cartridge {VOLSER} usage statistics were lost. No action required.	Informational	250	N/A
0033	At unload time, a drive detected a corrupted directory for cartridge {VOLSER}.	Warning	251	0xC033
0034	Cartridge {VOLSER} system area could not be written to.	Warning	252	0xC034
0035	Cartridge {VOLSER} system area could not be read.	Warning	253	0xC035
0036	Cartridge {VOLSER} does not have a valid start of data.	Warning	254	0xC036
0037	Cartridge {VOLSER} could not be loaded and threaded.	Warning	255	0xC037
0038	Cartridge {VOLSER} could not be unloaded.	Error	256	0xC038
0039	A drive library interface failed. A drive reset is recommended.	Warning	257	NA
003A	A drive performed a self-reset.	Informational	258	N/A
003B	WORM cartridge {VOLSER} has suspect data.	Warning	259	0xC03B
003C	An overwrite command failed for WORM cartridge {VOLSER}.	Informational	260	NA
003D	A drive is configured to require encryption, but encryption is not enabled.	Warning	261	N/A
003E	A drive reported TapeAlert flag 62.	Informational	262	NA
003F	A drive reported TapeAlert flag 63.	Informational	263	NA
0040	A drive reported TapeAlert flag 64.	Informational	264	NA
0200	I/O station full.	Informational	401	NA
0201	The I/O station has been open for five or more minutes.	Warning	405	NA
0202	An I/O station was opened.	Informational	483	NA
0203	An I/O station was closed.	Informational	484	NA
0210	The library ran out of LTO cleaning cartridges.	Warning	403	NA
0211	The library ran out of 3592 cleaning cartridges.	Warning	409	NA
0212	LTO cleaning cartridge {VOLSER} expired	Warning	406	NA
0213	3592 cleaning cartridge {VOLSER} expired	Warning	410	NA
0214	The library was almost out of licensed LTO storage slots	Warning	424	NA
0215	The library was almost out of licensed 3592 storage slots	Warning	425	NA
0216	The library ran out of licensed 3592 storage slots.	Warning	426	NA
0217	The library ran out of licensed LTO storage slots	Warning	427	NA
0218	The logical library {LOG_LIB} was almost full	Warning	416	NA
0219	The logical library {LOG_LIB} was full.	Warning	402	NA
021A	A shuffle operation failed because there were no open slots in the library	Warning	407	NA
021C	The library detected a new unassigned cartridge {VOLSER}.	Warning	421	NA
021E	Cartridge {VOLSER} could not be assigned to logical library {LOG_LIB} because VIO was full.	Warning	478	NA

Error code	Description	Severity	SNMP trap ID	URC
0220	A library front door was opened.	Warning	16	NA
0221	All library doors were closed	Informational	422	NA
0230	A frame inventory was started.	Informational	429	NA
0240	Call home started	Informational	431	NA
0241	Call home failed	Warning	415	NA
0242	Test call home started	Informational	432	NA
0243	Required LTO diagnostic cartridge was not found at the required location.	Informational	433	NA
0244	Required 3592 diagnostic cartridge was not found at the required location.	Informational	434	NA
0245	Call home finished	Informational	432	NA
0247	Service logs exported to IBM	Informational	482	N/A
0248	Library snapshot created.	Informational	0	NA
0249	System console not responding	Warning	495	N/A
0250	A cartridge that cannot be encrypted was loaded into a drive that is set to encrypt all cartridges	Warning	420	NA
0261	During a test, the encryption key manager address failed.	Warning	419	NA
0262	During a test, the encryption key manager path failed	Warning	419	NA
0263	During a test, the encryption key manager full path check failed	Warning	419	NA
0264	The security settings HTTPS certificate will expire in 30 days.	Warning	462	NA
0265	The security settings HTTPS certificate has expired.	Error	463	0xA763
0280	Accessor {ACCESSOR} could not read a barcode.	Warning	32	0xA4C5
0290	There is no Media Verification drive for cartridge {VOLSER} generation.	Warning	464	NA
0291	Media Verification failed for cartridge {VOLSER}	Error	465	0xA790
0292	There is only one Media Verification drive assigned to the logical library {LOG_LIB} and it failed	Error	466	0xA791
0293	Media Verification passed for cartridge {VOLSER}	Informational	0	NA
0295	Media Verification drive failed after multiple put errors.	Error	467	0xA792
02B1	A move failed because there was not a demount destination available.	Warning	407	N/A
02B2	A move failed because there was not a Tier0 destage destination available	Warning	407	N/A
02B3	A move failed because there was not an elastic destage destination available.	Warning	407	N/A
02B4	A move failed because there was not an import destination available.	Warning	407	N/A
02B5	A move failed because there was not an ERP destination available.	Warning	407	N/A
02C0	Cartridge {VOLSER} with an L7 density was unloaded.	Informational	0	NA
02C1	Cartridge {VOLSER} with an M8 density was unloaded.	Informational	0	NA
02D0	Accessor {ACCESSOR} could not read cartridge barcode label	Informational	491	NA
02D1	Cartridge CM Volser changed from {VOLSER} to {VOLSER}	Informational	492	NA
0300	An LCC was unable to communicate with an air conditioning unit.	Error	472	N/A
0302	An LCC was unable to communicate with a temperature and humidity sensor	Error	474	N/A
0303	An air conditioning compressor was off unexpectedly	Error	475	N/A
0304	An environmental LED state was changed to Red - Do Not Open Door	Informational	0	N/A
0305	An environmental LED state was changed to Yellow - Use Caution when Opening Door	Informational	0	N/A
0306	An environmental LED state was changed to Green - OK to Open Door	Informational	0	N/A
0307	Drives were set to environmental protection mode	Warning	476	N/A
0308	Ambient environment was out of specification at {TEMPERATURE}°C and {HUMIDITY}% RH.	Warning	477	N/A
0310	A request to open a door was made	Informational	0	N/A
0311	Library service was completed	Informational	0	N/A
0312	Library service exceeded 30 minutes	Error	479	N/A
0313	Library air conditioning normal operation was resumed	Informational	0	N/A
0320	Ship preparation started	Informational	0	N/A
0321	Ship preparation finished successfully	Informational	0	N/A
0322	Ship preparation failed	Error	0	N/A
0330	Accessor {ACCESSOR} column straightness check started	Informational	0	NA
0331	Accessor {ACCESSOR} column straightness check finished	Informational	0	NA
0332	Accessor {ACCESSOR} column straightness check failed.	Error	0	NA
0700	The state of the library changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0701	The state of drive {DRIVE} changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0702	The state of accessor {ACCESSOR} changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0703	The state of LCC node card {FRAME} changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0704	The state of ACC node card {ACCESSOR} changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0705	The state of MDA node card {ACCESSOR} changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0706	The state of Frame {FRAME} changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0707	The state of power supply {SIDE} in frame {FRAME} changed from {OLD_STATE} to {NEW_STATE}.	Informational	0	N/A
0800	A user logged in to the GUI from {IPADDRESS}	Informational	440	NA
0801	A user failed to login from {IPADDRESS}	Informational	441	NA
0802	A library setting was changed	Informational	443	NA
0803	A logical library {LOG_LIB} setting was changed	Informational	444	NA
0804	A tape drive setting was changed	Informational	445	NA
0805	A cartridge setting was changed	Informational	446	NA
0806	Library firmware update started.	Informational	447	NA

Error code	Description	Severity	SNMP trap ID	URC
0807	Library firmware update failed	Informational	455	NA
0808	A corrupted library firmware image was downloaded.	Informational	456	NA
0809	Drive firmware update failed.	Informational	457	NA
080A	ACC/MDA firmware update finished.	Informational	458	NA
080B	LCC firmware update finished.	Informational	458	NA
080C	Accessor {ACCESSOR} FRU replacement finished.	Informational	448	NA
080D	Drive FRU replacement finished	Informational	449	NA
080E	A drive serial number changed	Informational	450	NA
080F	A drive was reset	Informational	451	NA
0810	An administrator password was changed	Informational	453	NA
0811	An SNMP test trap was sent from the GUI	Informational	408	NA
0812	A user logged out of the GUI from {IPADDRESS}	Informational	442	NA
0813	Library security settings changed.	Informational	20	NA
0814	The library was set offline	Informational	21	NA
0815	A drive was offline	Informational	22	NA
0816	Accessor {ACCESSOR} MDA card was reset by a user.	Informational	452	NA
0817	Accessor {ACCESSOR} ACC card was reset by a user.	Informational	452	NA
0818	An LCC card was reset by user.	Informational	452	NA
0819	The library was reset by user.	Informational	452	NA
081A	The access recovery button was pressed.	Informational	460	NA
081B	User account locked	Informational	461	NA
081C	A service user logged in to the GUI from {IPADDRESS}	Informational	471	NA
081D	Accessor {ACCESSOR} MDA card was reset.	Informational	485	NA
081E	Accessor {ACCESSOR} ACC card was reset.	Informational	485	NA
0820	A drive beacon was turned on	Informational	487	NA
0821	A drive beacon was turned off	Informational	488	NA
0822	A drive was hard reset	Informational	489	NA
0823	User {USER} submitted feedback.	Informational	507	NA
0900	Calibrate frame with accessor {ACCESSOR} started.	Informational	0	NA
0901	Calibrate frame with accessor {ACCESSOR} finished.	Informational	0	NA
0902	Accessor {ACCESSOR} calibrate started.	Informational	0	NA
0903	Accessor {ACCESSOR} calibrate finished.	Informational	0	NA
0904	Calibrate I/O with accessor {ACCESSOR} started.	Informational	0	NA
0905	Calibrate I/O with accessor {ACCESSOR} finished.	Informational	0	NA
0906	Calibrate drive with accessor {ACCESSOR} started.	Informational	0	NA
0907	Calibrate drive with accessor {ACCESSOR} finished.	Informational	0	NA
090C	Drive firmware update started.	Informational	447	NA
090D	Drive firmware update finished.	Informational	459	NA
090E	Library firmware update started.	Informational	447	NA
090F	Library firmware update finished.	Informational	458	NA
0911	Inventory finished.	Informational	430	NA
0912	Inventory with audit started.	Informational	429	NA
0913	Inventory with audit finished.	Informational	430	NA
0914	Library verify started.	Informational	0	NA
0915	Library verify finished.	Informational	0	NA
0916	Library diagnostics started.	Informational	0	NA
0917	Library diagnostics finished.	Informational	0	NA
091A	Drive FRU replacement started.	Informational	0	NA
091C	Drive log download started.	Informational	0	NA
091D	Drive log download finished.	Informational	0	NA
091E	Discover hardware started.	Informational	0	NA
091F	Discover hardware finished.	Informational	0	NA
0920	VOLSER range update started.	Informational	0	NA
0921	VOLSER range update finished.	Informational	444	NA
0922	Accessor {ACCESSOR} FRU replacement started.	Informational	448	NA
0924	Calibrate library with accessor {ACCESSOR} started.	Informational	0	NA
0925	Calibrate library with accessor {ACCESSOR} finished.	Informational	0	NA
0926	Drive FRU replacement started	Informational	449	NA
0927	Drive FRU replacement finished	Informational	449	NA
0928	Drive test started.	Informational	0	NA
0929	Drive test finished.	Informational	0	NA
092A	The library was reset.	Informational	0	NA
2000	The pause button failed.	Error	2	NA
2001	The access recovery button failed.	Error	2	NA
2002	Library pause button was pressed	Informational	480	NA
2124	More than 8 LCC detected on library string	Warning	468	NA
2125	LCC card failed over	Warning	469	NA

Error code	Description	Severity	SNMP trap ID	URC
2127	An LCC communication with Accessor {ACCESSOR} MDA card timed out.	Warning	499	N/A
2128	An LCC communication with Accessor {ACCESSOR} ACC card timed out.	Warning	500	N/A
2129	An LCC communication with Accessor {ACCESSOR} ACC card failed.	Error	508	NA
2380	Accessor {ACCESSOR} ACC card failed.	Error	2	0xA413
2381	Accessor {ACCESSOR} ACC card CAN bus 1 failed.	Error	2	0xA413
2382	Accessor {ACCESSOR} ACC card CAN bus 2 failed.	Error	2	0xA413
2481	Accessor {ACCESSOR} MDA card CAN bus 1 failed.	Error	2	0xA414
2482	Accessor {ACCESSOR} MDA card CAN bus 2 failed.	Error	2	0xA414
2484	An LCC card was not responding over Ethernet	Warning	2	0xA427
2500	FPGA L Frame location was incorrect	Warning	481	N/A
3021	A library side door was opened.	Warning	16	NA
3024	A library side door was not detected	Error	2	0xA43B
3025	The service bay barrier was down when a side door was opened	Error	2	0xA43C
3026	The service bay barrier was up when a side door was closed	Error	2	0xA43C
3027	A library rear door was opened.	Informational	0	NA
3028	A library front door was closed.	Informational	0	NA
3029	A library side door was closed.	Informational	NA	0
302A	A library rear door was closed.	Informational	0	NA
3081	A frame was not found	Error	2	0xA431
3430	A 12V DC power supply would not turn on	Error	28	0xA514
34A1	A 12V DC power supply was not detected	Error	28	0xA457
3746	A drive was miscabled	Error	2	0xA624
3749	A BPC-G231-to-BPC cable was not connected correctly.	Error	2	0xA627
3750	An ASC to flex track cable was not plugged correctly	Error	2	0xA628
3752	An LCC to DSC communication failed	Warning	486	NA
3753	Library frame count in FPGA does not match configuration	Error	505	NA
3822	An LCC to drive communication failed	Warning	1	0xB80A
3833	An LCC card could not get a response from a drive	Error	1	0xB701
3834	Communication between an LCC card and a drive failed on Ethernet	Error	1	0xB702
3835	An LCC card could not communicate with a drive	Error	1	0xB703
3839	A drive or canister type did not match the configuration	Error	1	0xB707
383B	A drive diagnostic test returned an invalid status	Error	1	0xB709
383C	More than 128 Drives detected on library string	Warning	470	NA
4081	Gripper {GRIPPER} did not move.	Error	2	0xB401
4082	Gripper {GRIPPER} encountered an unexpected hard stop while extending.	Error	2	0xB402
4083	Gripper {GRIPPER} encountered an unexpected hard stop while retracting.	Error	2	0xB403
4084	Gripper {GRIPPER} encountered a high current condition while extending.	Error	2	0xB404
4085	Gripper {GRIPPER} encountered a high current condition while retracting.	Error	2	0xB405
4086	Gripper {GRIPPER} was unable to find a hard stop while extending	Error	2	0xB406
4087	Gripper {GRIPPER} was unable to find a hard stop while retracting	Error	2	0xB407
4088	Gripper {GRIPPER} was unable to get cartridge {VOLSER}	Error	2	0xB408
4089	Gripper {GRIPPER} was unable to put cartridge {VOLSER}	Error	2	0xB409
408A	Gripper {GRIPPER} lost power.	Error	2	0xB40A
408B	Gripper {GRIPPER} encountered a low current condition while retracting.	Error	2	0xB40B
408C	Gripper {GRIPPER} lost a cartridge.	Error	2	0xB40C
408D	Gripper {GRIPPER} is not aligned properly in the gripper cage.	Error	2	0xB40D
4181	Gripper {GRIPPER} sensor was blocked when it should not have been.	Error	2	0xB40E
4182	Gripper {GRIPPER} sensor was not blocked when it should have been.	Error	2	0xB40F
4183	Gripper {GRIPPER} sensor was in a degraded state.	Error	7	0xB40E
4184	Gripper {GRIPPER} sensor failed.	Error	2	0xB40E
4221	Accessor {ACCESSOR} X home sensor was blocked when it should not have been.	Error	2	0xA47A
4380	Accessor {ACCESSOR} X home sensor was not found during a re-zero.	Error	2	0xA471
4480	Accessor {ACCESSOR} Y home sensor was blocked when it should not have been.	Error	2	0xA480
4481	Accessor {ACCESSOR} Y home sensor was not found during rezero.	Error	2	0xA481
4580	Accessor {ACCESSOR} X motor did not move.	Error	2	0xA490
4581	Accessor {ACCESSOR} X motion could not find a hard stop while moving left.	Error	2	0xA491
4582	Accessor {ACCESSOR} X motion could not find a hard stop while moving right.	Error	2	0xA492
4583	Accessor {ACCESSOR} X motion encountered an unexpected hard stop while moving left.	Error	2	0xA493
4584	Accessor {ACCESSOR} X motion encountered an unexpected hard stop while moving right.	Error	2	0xA494
4585	Accessor {ACCESSOR} X motion required excessive force to move left.	Error	2	0xA495
4586	Accessor {ACCESSOR} X motion required excessive force to move right.	Error	2	0xA496
4587	Accessor {ACCESSOR} X motion failed due to loss of 40 V dc.	Error	2	0xA40A
4588	Accessor {ACCESSOR} X motion motor driver failed.	Error	2	0xA498
4589	Accessor {ACCESSOR} X motion position drift occurred.	Error	2	0xA499
4590	Accessor {ACCESSOR} X motion accessor rezero completed.	Informational	2	0xA475
4591	Accessor {ACCESSOR} rezero completed.	Informational	2	0xA476
4680	Accessor {ACCESSOR} Y motor did not move.	Error	2	0xA4A0

Error code	Description	Severity	SNMP trap ID	URC
4681	Accessor {ACCESSOR} Y motion could not find a hard stop while moving up.	Error	2	0xA4A1
4682	Accessor {ACCESSOR} Y motion could not find a hard stop while moving down.	Error	2	0xA4A2
4683	Accessor {ACCESSOR} Y motion encountered an unexpected hard stop while moving up.	Error	2	0xA4A3
4684	Accessor {ACCESSOR} Y motion encountered an unexpected hard stop while moving down.	Error	2	0xA4A4
4685	Accessor {ACCESSOR} Y motion required excessive force to move up.	Error	2	0xA4A5
4686	Accessor {ACCESSOR} Y motion required excessive force required to move down.	Error	2	0xA4A6
4687	Accessor {ACCESSOR} Y motion failed because of a loss of 40V DC power.	Error	2	0xA40B
4688	Accessor {ACCESSOR} Y motion failed.	Error	2	0xA4A8
4689	Accessor {ACCESSOR} Y motion failed because of drift.	Error	2	0xA4A9
4690	Accessor {ACCESSOR} Y motion accessor rezero completed.	Informational	2	0xA485
4691	Accessor {ACCESSOR} Y motion drift was suspected.	Informational	2	0xA486
4780	Accessor {ACCESSOR} pivot motor could not move.	Error	2	0xA5B0
4781	Accessor {ACCESSOR} pivot motion could not find a hard stop.	Error	2	0xA5B1
4782	Accessor {ACCESSOR} pivot motion could not find a hard stop.	Error	2	0xA5B2
4783	Accessor {ACCESSOR} pivot motion encountered an unexpected hard stop.	Error	2	0xA5B3
4784	Accessor {ACCESSOR} pivot motion encountered an unexpected hard stop.	Error	2	0xA5B4
4785	Accessor {ACCESSOR} pivot motion required excessive force to pivot.	Error	2	0xA5B5
4786	Accessor {ACCESSOR} pivot motion required excessive force to pivot.	Error	2	0xA5B6
4787	Accessor {ACCESSOR} pivot motion failed because of a power loss.	Error	2	0xA4B8
4840	Accessor {ACCESSOR} XY positioning could not be determined.	Error	2	0xA4B9
4880	Accessor {ACCESSOR} failover occurred.	Error	2	0xA4BA
4890	Accessor {ACCESSOR} XY impact was detected	Error	2	0xA4BB
4891	Accessor {ACCESSOR} detected a cartridge in the accessor or gripper's path.	Error	2	0xA4BB
48A0	Accessor {ACCESSOR} detected an obstacle in the accessor or gripper's path	Error	2	0xA4BB
48B0	Accessor {ACCESSOR} re-zero failed.	Error	2	0xA4BC
4900	The number of cartridges in the library needs to be 4 times the number of frames for multi-frame verification testing	Error	0	N/A
4901	Multi-frame verification test failed	Error	0	N/A
4902	Multi-frame verification test completed successfully	Informational	0	N/A
4903	Multi-frame verification test has started	Informational	0	N/A
5B22	Accessor {ACCESSOR} barcode scanner cannot be triggered.	Error	2	0xA4C3
5B23	Accessor {ACCESSOR} barcode scanner cannot be triggered.	Error	2	0xA4C4
5B24	Accessor {ACCESSOR} barcode scanner with invalid VPD was detected.	Error	2	0xA4C5
5B82	Accessor {ACCESSOR} barcode scanner loopback test failed.	Error	2	0xA4C2
5B86	Accessor {ACCESSOR} could not read a frame barcode label.	Error	2	0xA4CE
5B89	Accessor {ACCESSOR} could not read an I/O station barcode label.	Informational	2	0xA4C9
5B8A	Accessor {ACCESSOR} barcode scanner communication failed	Informational	490	NA
9080	Accessor {ACCESSOR} found an empty source element.	Error	24	0xA4D0
9180	Accessor {ACCESSOR} inventory with audit failed	Error	2	0xA4D5
9181	Accessor {ACCESSOR} inventory failed	Error	2	0xA4D5
9250	Accessor {ACCESSOR} had only one usable gripper for operation.	Error	2	0xA4D2
9251	Accessor {ACCESSOR} had no usable grippers for operation.	Error	2	0xA4D2
9480	Accessor {ACCESSOR} found a destination element unexpectedly full.	Error	24	0xA4D1
A010	Cartridge {VOLSER} was not detected from the previous inventory.	Error	24	0xA950
A012	An inventory self-correction started.	Informational	24	0xA952
A080	Accessor {ACCESSOR} had no grippers installed.	Error	2	0xB420
A08C	A drive type that was incompatible with the original drive type was detected.	Error	2	0xB32C
B061	Could not lock I/O station door	Error	17	0xB091
B062	Could not unlock I/O station door	Error	17	0xB092
B063	Could not open I/O station door	Error	17	0xB093
B064	Could not close I/O station door	Error	17	0xB094
B066	A magazine type incompatible with the library was detected in an I/O Station	Warning	17	N/A
B220	Gripper {GRIPPER} could not get cartridge {VOLSER} from I/O station.	Error	17	0xB320
B221	Gripper {GRIPPER} could not put cartridge {VOLSER} in I/O station.	Error	17	0xB321
B382	Gripper {GRIPPER} could not get cartridge {VOLSER} from slot.	Error	2	0xB150
B383	Gripper {GRIPPER} could not get cartridge {VOLSER} out of slot.	Error	2	0xB152
B384	Gripper {GRIPPER} found cartridge {VOLSER} stuck in the slot	Error	2	0xB153
B388	Gripper {GRIPPER} could not put cartridge {VOLSER} in slot.	Error	2	0xB151
B480	Accessor {ACCESSOR} X or Y motion command exceeded the limits of the library	Error	4	0xAACA
B481	Accessor {ACCESSOR} asymmetrical motor limits were detected	Error	4	0xAACB
B500	Accessor {ACCESSOR} calibration failed.	Error	2	0xB190
B501	Library calibration with accessor {ACCESSOR} failed.	Error	2	0xB190
B502	Frame calibration with accessor {ACCESSOR} failed.	Error	2	0xB190
B503	I/O station calibration with accessor {ACCESSOR} failed.	Error	2	0xB190
B504	Drive calibration with accessor {ACCESSOR} failed.	Error	2	0xB190
B580	Accessor {ACCESSOR} could not find a column fiducial.	Error	2	0xB361
B581	Accessor {ACCESSOR} encountered a column tilt outside the specified operational limits	Error	493	N/A

Error code	Description	Severity	SNMP trap ID	URC
B582	Accessor {ACCESSOR} found a column fiducial calibration value is outside the operational limits against stored value	Warning	496	N/A
B583	Accessor {ACCESSOR} found a column calibration value out of range from adjacent column	Warning	498	N/A
B584	Accessor {ACCESSOR} encountered a column tilt close to the operational limits.	Warning	506	N/A
B681	Accessor {ACCESSOR} could not find a drive fiducial.	Error	2	0xC020
B682	Accessor {ACCESSOR} found a drive fiducial calibration value is outside the operational limits against stored value	Warning	497	N/A
B790	Accessor {ACCESSOR} could not find an I/O station fiducial.	Error	2	0xB370
B791	Accessor {ACCESSOR} could not find an I/O station fiducial.	Error	2	0xB170
B792	Accessor {ACCESSOR} detected an un-calibrated frame.	Error	2	0xB171
B793	Accessor {ACCESSOR} encountered an I/O station tilt outside the specified operational limits	Error	494	N/A
B891	A drive did not release the cartridge. This failure could be caused by a cartridge gate not opening due to a gate mechanical problem.	Error	2	0xC031
B893	A drive did not load the cartridge	Error	2	0xC033
CCCA	A memory allocation or stack error occurred.	Informational	4	0xACCC
CCCC	A library firmware error occurred.	Informational	4	0xACCC
CCCF	X authorization failed.	Error	4	0xACCF

Using SNMP to monitor and query a library

The Simple Network Management Protocol (SNMP) enables the tape library to exchange information over a TCP/IP network with an SNMP manager running systems management software, such as Netview®.

Trap monitoring

The tape library sends alerts (called "traps") to the SNMP manager when specific conditions or events occur.

After a trap is received, it must be interpreted. Traps can be interpreted manually or by using an SNMP compiler with a management information base (MIB) to format the trap information in human-readable form.

Traps are grouped by severity level (informational, error, or warning). The trap IDs are defined in [Error codes](#).

Library queries

The tape library responds to requests from the SNMP manager for information, such as the library configuration, installed drives, and cartridges.

- [Managing SNMP traps](#)
SNMP traps are sent automatically from the tape library to every existing SNMP destination. SNMP traps cannot be disabled.
- [Managing SNMP requests](#)
SNMP allows the tape library to respond to requests from an SNMP manager for specific information about the library, such as its configuration and details about drives and cartridges.
- [Interpreting SNMP traps](#)
SNMP traps can be interpreted either by using an SNMP compiler in conjunction with a management information base (MIB) or by manually translating the object identifiers (OIDs) in the traps.
- [Management information base \(MIB\) files](#)
A MIB (management information base) is a database that describes the properties of each component in a networked device, such as a tape library. MIBs are stored in the SNMP manager. When data is sent from the device to an SNMP manager, the MIB is used by the manager's compiler to translate the data into a human-readable format.
- [SNMP object identifiers \(status\)](#)
These object identifiers can be used to monitor drive status, obtain a list of all cartridges in the library, and view trap or TapeAlert messages.
- [SNMP object identifiers \(configuration\)](#)
These object identifiers (OIDs) can be used to obtain configuration information about the library using the IBM_AUTOMATION_QUERY MIB. The information is grouped into major components.

Managing SNMP traps

SNMP traps are sent automatically from the tape library to every existing SNMP destination. SNMP traps cannot be disabled.

To add or modify an SNMP destination, open the management GUI and go to Settings > SNMP Traps. From this page you can create or remove an SNMP destination, change the trap severity level (error, warning, and/or info), and send a test trap to the SNMP destination.

Related information

- [SNMP Traps](#)

Managing SNMP requests

SNMP allows the tape library to respond to requests from an SNMP manager for specific information about the library, such as its configuration and details about drives and cartridges.

- [Enabling and disabling SNMP requests](#)
SNMP requests are disabled by default. Use the TS4500 management GUI to enable SNMP requests.
- [Supported SNMP requests](#)
The following SNMP requests are supported.
- [Library information that can be queried](#)
Different categories of information can be queried depending on the management information base (MIB) files that are installed in your SNMP manager.

Enabling and disabling SNMP requests

SNMP requests are disabled by default. Use the TS4500 management GUI to enable SNMP requests.

1. Go to Settings > SNMP Traps and define an SNMP destination.
2. Go to Settings > SNMP Requests and change the setting for SNMP Requests to Allowed.

Related information

- [SNMP Traps](#)
- [SNMP Requests](#)

Supported SNMP requests

The following SNMP requests are supported.

- **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** requests are not supported. Instead, use the TS4500 management GUI to configure your SNMP and library settings.

Library information that can be queried

Different categories of information can be queried depending on the management information base (MIB) files that are installed in your SNMP manager.

[Table 1](#) summarizes these categories and lists the required MIBs.

Table 1. Library information that can be queried through SNMP

Category of information	Required MIB(s)	Object identifier descriptions
The last trap or TapeAlert message that was sent by the library	IBM 3584 MIB	SNMP object identifiers (status)
The status of each drive in the library; a list of all cartridges in the library	SNIA SML MIB	Refer to the MIB for object definitions.
Library configuration	IBM_AUTOMATION_QUERY	SNMP object identifiers (configuration)

Related information

- [Management information base \(MIB\) files](#)

Interpreting SNMP traps

SNMP traps can be interpreted either by using an SNMP compiler in conjunction with a management information base (MIB) or by manually translating the object identifiers (OIDs) in the traps.

- [Interpreting a trap with an SNMP compiler](#)
If your SNMP management software includes an SNMP compiler, you'll need the library's management information base (MIB) to interpret the traps. When the SNMP manager receives an SNMP trap, the compiler uses the information in the MIB to convert the trap into human-readable form.
- [Manually interpreting an SNMP trap](#)
if your SNMP manager doesn't have an SNMP compiler, you will need to manually interpret the SNMP traps.

Interpreting a trap with an SNMP compiler

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Related information

- [Management information base \(MIB\) files](#)

Manually interpreting an SNMP trap

if your SNMP manager doesn't have an SNMP compiler, you will need to manually interpret the SNMP traps.

1. Observe the trap when it is received by systems management software and identify its components.

[Figure 1](#) 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 **254** in the OID indicate that the device is a TS4500 tape library. The OID fields contain values that help you to determine the nature of the problem.

Note: Not every trap contains every field.

Figure 1. Sample SNMP trap

```
1.3.6.1.4.1.2.6.254.1.2.11.1.0=3584 L55 1312345
1.3.6.1.4.1.2.6.254.1.2.21.1.0=04 44 00
1.3.6.1.4.1.2.6.254.1.2.31.1.0=90 80
1.3.6.1.4.1.2.6.254.1.2.41.1.0=A4D0
1.3.6.1.4.1.2.6.254.1.2.51.1.0=The library has detected an error in its inventory
1.3.6.1.4.1.2.6.254.1.2.61.1.0=12762L5
1.3.6.1.4.1.2.6.254.1.2.71.1.0=LogicalLibraryA
1.3.6.1.4.1.2.6.254.1.2.81.1.0=500507630F070641
1.3.6.1.4.1.2.6.254.1.2.91.1.0=10680005807
1.3.6.1.4.1.2.6.254.1.2.101.1.0=(1) warning
1.3.6.1.4.1.2.6.254.1.2.111.1.0=JSmith
1.3.6.1.4.1.2.6.254.1.2.121.1.0=Frame 1, Column 2, Row 3
```

2. Refer to [Table 1](#) 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 1](#).

Table 1. Fields in an SNMP trap

Object Identifier (OID) and Variable Name	Description of OID Field	Maximum Characters	Sample Value in Field
1.3.6.1.4.1.2.6.254.1.2.11.1.0 MTMNLSN	Machine type	4	3584
	Blank character	1	
	Model number	3	L55
	Blank character	1	
	Serial number	7	1312345
1.3.6.1.4.1.2.6.254.1.2.21.1.0 SKASCASCQ	Sense key	2	04
	Additional sense code (ASC)	1	
	Additional sense code qualifier (ASCQ)	2	00
1.3.6.1.4.1.2.6.254.1.2.31.1.0 HECHECQ	Hardware error code (HEC)	2	90
	Hardware error code qualifier (HECQ)	2	80
1.3.6.1.4.1.2.6.254.1.2.41.1.0 URC	Unit reference code (URC)	4	A4D0
1.3.6.1.4.1.2.6.254.1.2.51.1.0 TD	Text description	255	The library detected an error in its inventory
1.3.6.1.4.1.2.6.254.1.2.61.1.0 VOLSER	Cartridge volume serial number	8	12762L5
1.3.6.1.4.1.2.6.254.1.2.71.1.0 LL	Logical library name	255	LogicalLibraryA
1.3.6.1.4.1.2.6.254.1.2.81.1.0 WWNN	World Wide Node Name	16	500507630F070641
1.3.6.1.4.1.2.6.254.1.2.91.1.0 DrvSN	Drive serial number	12	10680005807
1.3.6.1.4.1.2.6.254.1.2.101.1.0 SV	Severity code	15	(1) warning
1.3.6.1.4.1.2.6.254.1.2.111.1.0 UserID	User ID	49	JSmith
1.3.6.1.4.1.2.6.254.1.2.121.1.0 Location	Location	255	Frame 1, Row 2, Column 3

To determine the meaning of each OID field, use the following sources:

- For the SCSI sense key, ASC, and ASCQ, see [SCSI Reference](#).

In general, the library generates SNMP traps when it detects error conditions, but also for some exception conditions. These traps are also assigned a unique OID in the MIB. The following list presents some of the exception conditions that can generate traps. For a complete list, refer to the MIB.

- 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.
- There are no LTO or 3592 cleaning cartridges in the library.
- An LTO or 3592 cleaning cartridge expired (the number of cleanings that remain on the cartridge decreased to 0).
- The LTO or 3592 cartridge slots are approaching full capacity.
- All physical tape slots are allocated to a cartridge. No more cartridges can be added.
- The library had a problem while it was reading the barcode of a cartridge.
- The library attempted to call home but was unsuccessful.
- All library doors are closed.
- A cartridge that cannot be encrypted is loaded into a drive that is set for encryption.

- A new cartridge is inserted in the library and is unassigned.
- An SNMP audit logging event occurred .
- An encryption key manager communication failure occurred.

Management information base (MIB) files

A MIB (management information base) is a database that describes the properties of each component in a networked device, such as a tape library. MIBs are stored in the SNMP manager. When data is sent from the device to an SNMP manager, the MIB is used by the manager's compiler to translate the data into a human-readable format.

[Table 1](#) lists the MIBs that are supported by the TS4500 tape library.

Table 1. Supported MIBs

MIB	Description	Where to obtain
IBM® 3584 MIB for Version 2c traps	Defines the SNMP traps that are supported by the TS4500 tape library.	TS4500 management GUI
IBM_AUTOMATION_QUERY MIB (also called the configuration MIB)	A shared MIB for all IBM tape library types. It supports SNMP requests for library configuration data. Using the same community name for all libraries makes it easy to gather data across all IBM library types (see SNMP Requests).	IBM Fix Central
SNIA SML MIB Version 1.20b	The Storage Networking Industry Association MIB for Storage Media Libraries based on CIM (Common Information Model) version 2.8. This MIB is useful if you are supporting other types of libraries or libraries from other manufacturers.	Available online
SNMP MIB-II	The second version of the MIB (MIB-II) for use with network management protocols in TCP/IP-based networks.	Comes with your management software and is also available at https://www.ietf.org/rfc/rfc1213.txt

- [Downloading the IBM 3584 MIB](#)
The IBM 3584 MIB provides the SNMP trap definitions for the tape library. It is downloaded from the tape library management GUI. Follow these steps.
- [Downloading the IBM_AUTOMATION_QUERY configuration MIB](#)
The IBM_AUTOMATION_QUERY MIB (also called the configuration MIB) is downloaded from Fix Central.

Downloading the IBM 3584 MIB

The IBM 3584 MIB provides the SNMP trap definitions for the tape library. It is downloaded from the tape library management GUI. Follow these steps.

Follow these steps:

1. From the System page of the TS4500 management GUI, click Settings, > Notifications, > SNMP Traps.
2. From the SNMP Traps page, select Actions, > Download SNMP MIB file and save the file.
3. Move the MIB to the MIB storage area in your SNMP manager.

Downloading the IBM_AUTOMATION_QUERY configuration MIB

The IBM_AUTOMATION_QUERY MIB (also called the configuration MIB) is downloaded from Fix Central.

Follow these steps:

1. Go to [Fix Central](#) and select **Select Product**.
2. Select **System Storage** from 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 **TS4500 Tape Library** from the Tape auto loaders 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 user ID and password to view available MIBs for download. You will also need the library serial number.

Related information

- [SNMP Traps](#)

SNMP object identifiers (status)

These object identifiers can be used to monitor drive status, obtain a list of all cartridges in the library, and view trap or TapeAlert messages.

Table 1. SNMP object identifiers (status)

Object identifier	Data returned
numberOfMediaAccessDevices . 0	The number of drives in the library.

Object identifier	Data returned
<code>mediaAccessDevice-Availability.1</code> through <code>mediaAccessDevice-Availability.n</code> , where <code>n</code> is the number returned by <code>numberOfMediaAccessDevices.0</code>	The status of all drives in the library, ordered by element address.
<code>numberOfPhysicalMedias.0</code>	The number of cartridges in the library.
<code>physicalMedia-PhysicalLabel.1</code> through <code>physicalMedia-PhysicalLabel.n</code> , where <code>n</code> is the number returned by <code>numberOfPhysicalMedias.0</code>	The label for each cartridge in the library, ordered by physical location.
<code>ibm3584MIBObjectsMTMNLISN.0</code> <code>ibm3584MIBObjectsSKASCASCQ.0</code> <code>ibm3584MIBObjectsHECHECKQ.0</code> <code>ibm3584MIBObjectsTA.0</code> <code>ibm3584MIBObjectsURC.0</code> <code>ibm3584MIBObjectsTD.0</code> <code>ibm3584MIBObjectsFSC.0</code> <code>ibm3584MIBObjectsSCD.0</code> <code>ibm3584MIBObjectsVOLSER.0</code> <code>ibm3584MIBObjectsLL.0</code>	The last trap or TapeAlert that was sent by the library. Note: If a value is not valid for a specific TapeAlert, the library returns an asterisk (*) in each defined character position.

SNMP object identifiers (configuration)

These object identifiers (OIDs) can be used to obtain configuration information about the library using the IBM_AUTOMATION_QUERY MIB. The information is grouped into major components.

Note: The three-digit number in each OID (such as 257 in the following configuration files) refers to a specific model of tape library. This number may be different for your tape library.

- [Library configuration](#)
The following fields are supported for the library configuration table:
- [Frame or system configuration \(frame or module or chassis\)](#)
The following fields are supported for frame or system configuration data:
- [Logical library configuration](#)
The following fields are supported for logical library configuration data:
- [Media access device configuration](#)
The following fields are supported for media access device configuration data:
- [User configuration](#)
The following fields are supported for user configuration data:

Library configuration

The following fields are supported for the library configuration table:

Table 1. 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
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

Name	Type	OID	Access	Supported by	Description
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..'7ffffff'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..'7ffffff'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..'7ffffff'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..'7ffffff'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..'7ffffff'h)	.1.3.6.1.4.1.2.6.257.1.2.2.1.28	Read-only	All	Password minimum Length
libraryConfiguration-PwdMinUpperCase	INTEGER (0..'7ffffff'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..'7ffffff'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..'7ffffff'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..'7ffffff'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..'7ffffff'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..'7ffffff'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..'7ffffff'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 1. Frame or System Configuration

Name	Type	OID	Access	Supported by	Description
chassis -Index	INTEGER (0..'7ffffff'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..'7ffffff'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

Name	Type	OID	Access	Supported by	Description
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
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 1. 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

Name	Type	OID	Access	Supported by	Description
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	OctetString	.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-EncryptionSSEnabled	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	OctetString	.1.3.6.1.4.1.2.6.257.1.4.2.1.16	Read-only	All	Encryption Method
loglibrary-EncryptionEKMIP-1	OctetString	.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
loglibrary-EncryptionEKMIP-2	OctetString	.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	OctetString	.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	OctetString	.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 1. 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
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

Name	Type	OID	Access	Supported by	Description
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.
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-Unknown)	.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.
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 Not Applicable. 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	OctetString	.1.3.6.1.4.1.2.6.257.1.5.2.1.23	Read-only	All	Firmware Version
mediaAccessDevice – Port0_WWNN	OctetString	.1.3.6.1.4.1.2.6.257.1.5.2.1.24	Read-only	All	Port 0 WWNN
mediaAccessDevice – Port1_WWNN	OctetString	.1.3.6.1.4.1.2.6.257.1.5.2.1.25	Read-only	All	Port 1 WWNN
mediaAccessDevice - AssignedWWNN	OctetString	.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 1. User configuration

Name	Type	OID	Access	Supported by	Description
Users-Index	INTEGER (0..7ffffff'h)	.1.3.6.1.4.1.2.6.257.1.6.2.1.1	Read-only	All	Index
Users-Username	OctetString	.1.3.6.1.4.1.2.6.257.1.6.2.1.2	Read-only	All	User Name
Users-UsernameRole	OctetString	.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

TapeAlert flags

This section lists the TapeAlert flags for Ultrium tape drives, 3592 tape drives, and the TS4500 tape library.

- [TapeAlert flags supported by the library](#)

This section lists the TapeAlert flags that are supported by the TS4500 tape library.

- [TapeAlert flags supported by 3592 tape drives](#)
TapeAlert flags supported by 3592 tape drives.
- [TapeAlert flags supported by LTO tape drives](#)
This section lists the TapeAlert Flags that are supported by LTO tape drives.

TapeAlert flags supported by the library

This section lists the TapeAlert flags that are supported by the TS4500 tape library.

Table 1. TapeAlert flags that are supported by the TS4500 tape library

TapeAlert Flags Supported by the TS4500 tape library					
Flag Number and Name	Description	Action Required	SNMP Trap	Call Home	
1	Library hardware A	The library has trouble while it is 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 2 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
23	Library scan retry	The operation to scan the bar code on a cartridge had to perform an excessive number of retries before it succeeds. 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 occurred in the shuttle mechanism while it attempted to transfer a cartridge between two library strings.	1. Restart the operation. 2. If the problem persists, call your IBM service representative.	Yes	Yes
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, 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

TapeAlert flags supported by 3592 tape drives

Table 1. TapeAlert flags supported by 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 a problem reading data. No data is lost, but there is a reduction in the performance of the tape.	Isolate the fault between drive and tape by following these steps: <ul style="list-style-type: none"> 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. 	201 (Warning)	No
2	Write warning	02h	Set when the tape drive is having a problem while data is being written. No data is lost, but there is a reduction in the capacity of the tape.	Isolate the fault between drive and tape by following these steps: <ul style="list-style-type: none"> 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. 	202 (Warning)	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 along with flags 4, 5, or 6).	Determine whether 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
5	Read failure	05h	Set for any unrecoverable read error where the isolation is uncertain and the failure might be faulty media or drive hardware. The flag is cleared when the cartridge is removed from the drive.	Isolate the fault between drive and tape by following these steps: <ul style="list-style-type: none"> 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. 	205 (Warning)	No
6	Write failure	06h	Set for any unrecoverable write or positioning error where isolation is uncertain and failure might be faulty media or drive hardware. The flag is cleared when the cartridge is removed from the drive.	Isolate the fault between drive and tape by following these steps: <ul style="list-style-type: none"> 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. 	206 (Warning)	No
7	Media life	07h	Set when the tape cartridge reached its end of life (EOL).	<ol style="list-style-type: none"> Copy the data to another tape cartridge. 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 you are 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 drive sees a write command. The flag is cleared when the cartridge is removed from the drive.	Set the cartridge write-protect switch to OFF. Ensure that the cartridge is not logically protected. If the problem persists, contact your IBM Service Representative.	N/A	No

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
10	No removal	0Ah	Set when an unload operation 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
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
13	Recoverable mechanical cartridge failure	0Dh	The drive has detected a mechanical volume failure and the volume is able to be unloaded. This is normally a broken tape detected during midtape recovery, and is normally a high usage tape that has broken tape at the leader pin.	Quarantine the tape cartridge and contact your IBM Service Representative.		No
14	Unrecoverable mechanical cartridge failure	0Eh	The drive has detected a mechanical cartridge failure and the cartridge is not able to be unloaded. Normally set when the tape split apart.	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 it was 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 cartridge. The flag is cleared when the cartridge is ejected.	None. Status only.	N/A	No
18	Tape directory is corrupted on load	12h	Set when the tape drive detects that the directory is corrupted and results in longer file-search times. The flag is cleared when the cartridge is removed from the drive.	Operator action optional. The drive automatically rebuilds 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
19	Nearing media life	13h	The media is nearing its specified usage life	Schedule a time to migrate the data to another tape cartridge	219 (Warning)	No
20	Clean now	14h	Set when the tape drive detects that it needs cleaning.	Clean the tape drive.	N/A	No
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 must clean it soon.	N/A	No
22	Expired cleaning media	16h	Set when the tape drive detects a cleaning cartridge that is expired. It is cleared when a valid cleaning cartridge is loaded.	Replace the cleaning cartridge.	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 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
29	Drive preventative maintenance required	1Dh	Set when drive maintenance is required.		229 (Informational)	No
30	Hardware A	1Eh	Set when a hardware failure occurs 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. Also, 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 by using 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
35	Drive humidity	23h	Set when the drive humidity sensor indicates the humidity is out of range.			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)	No
39	Diagnostics required	27h	Set when a condition occurs that requires diagnostics.		239 (Error)	Yes
49	Diminished native capacity	31h	The media is either partitioned or shortened and is not configured to use full native capacity.	If using partitioning, this is normal. If not, then determine why there is a partitioned cartridge present and unpartition the cartridge.	249 (Informational)	No
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. The drive automatically rebuilds 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.	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
54	No start of data	36h	Set when the start of data cannot be found on the tape.	Try another tape.	254 (Warning)	No
55	Load failure	37h	A load failure occurred because the media could not 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	An unload failure occurred because the media could not be unloaded.	Contact your IBM Service Representative.	256 (Error)	Yes
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
58	Microcode failure	3Ah	A drive panic occurred.			No
59	WORM Medium - Integrity Check Failed	3Bh	The drive determined that data on the 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 be appended to WORM media only. 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
61	Encryption policy violation	3Dh	The drive is configured to require encryption, but encryption is not enabled.	Contact your IBM Service Representative.		No

TapeAlert flags supported by LTO tape drives

This section lists the TapeAlert Flags that are supported by LTO tape drives.

[Table 1](#) lists the TapeAlert flags supported by LTO tape drives.

Table 1. TapeAlert Flags supported by LTO 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 a problem reading data. No data is lost, but there is a reduction in the performance of the tape.	Isolate the fault between drive and tape by following these steps: <ul style="list-style-type: none"> 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. 	201 (Warning)	No
2	Write warning	02h	Set when the tape drive is having a problem while data is being written. No data is lost, but there is a reduction in the capacity of the tape.	Isolate the fault between drive and tape by following these steps: <ul style="list-style-type: none"> 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. 	202 (Warning)	No
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 6 in Resolving LTO tape drive errors .	205 (Warning)	No
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. 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 LTO tape drive errors .	206 (Warning)	No
7	Media life	07h	Set when the tape cartridge reached its end of life (EOL).	<ol style="list-style-type: none"> Copy the data to another tape cartridge. Discard the old (EOL) tape cartridge. 	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 .	N/A	No
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 a cleaning tape is loaded into the drive.	None. Status 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
13	Recoverable mechanical cartridge failure	0Dh	The drive has detected a mechanical volume failure and the volume is able to be unloaded. This is normally a broken tape detected during midtape recovery, and is normally a high usage tape that has broken tape at the leader pin.	Quarantine the tape cartridge and contact your IBM Service Representative.		No
14	Unrecoverable mechanical cartridge failure	0Eh	The drive has detected a mechanical cartridge failure and the cartridge is not able to be unloaded. Normally 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

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
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 Resolving LTO tape drive errors .	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.	None. Status only.	N/A	No
18	Tape directory is 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
19	Nearing media life	13h	The media is nearing its specified usage life	Schedule a time to migrate the data to another tape cartridge	219 (Warning)	No
20	Clean now	14h	Set when the tape drive detects that it needs cleaning.	Clean the tape drive. See Methods of cleaning drives .	N/A	No
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 must clean it soon.	N/A	No
22	Expired clean	16h	Set when the tape drive detects an expired cleaning cartridge.	Replace the cleaning cartridge.	222 (Warning)	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	Interface	19h	Set when the tape drive detects a problem with the Fibre Channel interface.	See Error Code 8 or 9 in Resolving LTO tape drive errors .	225 (Error)	Yes
26	Cooling fan failure	1Ah	Set when a tape drive fan failed.	Contact your IBM Service Representative.	226 (Error)	Yes
30	Hardware A	1Eh	Set when a hardware failure occurs that requires a drive reset to recover.	If resetting the drive does not recover the error, note the error code on the single-character display and refer to Resolving LTO tape drive errors .	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 refer to Resolving LTO tape drive errors .	231 (Error)	Yes
32	Interface	20h	Set when the tape drive detects a problem with the Fibre Channel interface.	See Error Code 8 or 9 in Resolving LTO tape drive errors .	232 (Error)	Yes
33	Eject media	21h	Set when a failure occurs that requires the tape cartridge to be ejected from the drive and retried.	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
35	Drive humidity	23h	Set when the drive humidity sensor indicates the humidity is out of range.			No
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 LTO tape drive errors .	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 Error Code 2 in Resolving LTO tape drive errors .	237 (Error)	No
38	Predictive failure	26h	The drive has predicted a potential failure.	Run drive diagnostics	238 (Error)	Yes
39	Diagnostics required	27h	A failure occurred that requires drive diagnostics to be run.	Run drive diagnostics	239 (Error)	Yes
49	Diminished native capacity	31h	The media is either partitioned or shortened and is not configured to use full native capacity.	If using partitioning, this is normal. If not, then determine why there is a partitioned cartridge present and unpartition the cartridge.	249 (Informational)	No

Flag Number and Name		Hex code	Description	Action Required	SNMP Trap ID	Call Home
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	A load failure occurred because the media could not 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	An unload failure occurred because the media could not be unloaded.	Contact your IBM Service Representative.	256 (Error)	Yes
58	Microcode failure	3Ah	A drive panic occurred.	Send drive dumps to your IBM Service Representative.		No
59	WORM Medium - Integrity Check Failed	3Bh	The drive determined that data on the tape is suspect, from a WORM point of view.	<ol style="list-style-type: none"> Copy the data to another WORM tape cartridge. 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 be appended to WORM media only. 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
61	Encryption policy violation	3Dh	The drive is configured to require encryption, but encryption is not enabled.	Contact your IBM Service Representative.		No

Initial troubleshooting checklist

[Table 1](#) lists symptoms or errors that might occur with the TS4500 tape library and provides the required corrective actions.

Table 1. Resolving errors with the TS4500 tape library

Symptom or Error	Action
<p>The library is powered off. All of the following conditions are true:</p> <ul style="list-style-type: none"> The power-on indicator is not lit. The library and all of the drives do not respond to host commands. 	<ol style="list-style-type: none"> Ensure that the library is powered on (the power indicator on the display panel on the base frame is illuminated). Ensure that the power cord for the library is plugged into the wall receptacle. Note: Each frame might have a separate power cord. 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). If the problem still exists, call your IBM® service representative.
A message displays on the TS4500 management GUI and indicates that a front door is open.	<ol style="list-style-type: none"> Ensure that all front doors are closed and properly latched. If the problem still exists, open and close each front door. If the problem still exists, call your IBM service representative.
A message displays on the TS4500 management GUI 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.	<ol style="list-style-type: none"> If the message indicates that the door of the I/O station is open, close the door. 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. If the problem still exists, call your IBM service representative.
A message displays on the TS4500 management GUI and indicates that a cleaning cartridge expired.	<p>Usage of the cleaning cartridge exceeded a specified threshold. The procedure to remove and replace a cleaning cartridge is the same as the procedure to remove and replace a data cartridge. Refer to the following procedures to remove and replace the cleaning cartridge:</p> <ul style="list-style-type: none"> Removing a data cartridge from a drive in the library Inserting tape cartridges Ordering LTO cartridges and media supplies Ordering 3592 cartridges and media supplies To enable automatic ejects of expired cleaning cartridges, see Advanced.
A message displays on the TS4500 management GUI and indicates that a drive needs to be cleaned.	<ol style="list-style-type: none"> Ensure that a cleaning cartridge is present in the library inventory. If no cleaning cartridge is present, see Inserting tape cartridges. 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. If the problem still exists, initiate a manual cleaning from the Drives page of the TS4500 management GUI.

Symptom or Error	Action
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 .
The host application software indicates that a cartridge is write protected.	<ol style="list-style-type: none"> 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. (Refer to the section about Using the TS4500 management GUI to remove cartridges.) 4. Set the cartridge write-protect switch to enable writing. 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.
The host application software indicates that there is a problem with the cartridge.	<ol style="list-style-type: none"> 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. 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.	<ol style="list-style-type: none"> 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 or Guidelines for using 3592 bar code labels). 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 a drive failed.	<ol style="list-style-type: none"> 1. Record the error message and any error codes. 2. Retry the job (if possible, use a different cartridge; many problems that are reported as drive failures are caused by media defects). <ul style="list-style-type: none"> • 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 tape cartridges). • If the retry with a different cartridge fails, call your IBM service representative.
The host application software indicates that the library failed.	<ol style="list-style-type: none"> 1. Record the error message and any error codes. 2. Check the TS4500 management GUI 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 and connected to the IMC but the IMC monitor is blurry, unreadable, or blank.	Call your IBM service representative.
The monitor on the IMC is readable, but the keyboard keys do not work.	Call your IBM service representative.
You cannot insert a 3592 tape cartridge into the library.	<ol style="list-style-type: none"> 1. Ensure that you have the correct cartridge type and that it is oriented correctly (see Inserting tape cartridges). 2. Inspect the cartridge for damage (see Perform a thorough inspection of LTO tape cartridges or Perform a thorough inspection of 3592 tape cartridges). 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 tape cartridges). 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: <ul style="list-style-type: none"> • 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 Go to the section about FID messages.
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.
The 3592 tape drive is not ready at load point.	<ol style="list-style-type: none"> 1. Verify that the 3592 tape drive is powered on (the power indicator on the display panel on the base frame is illuminated, see 4 in Figure 1). 2. If the cartridge is not inserted correctly, remove the cartridge and insert it again (see Inserting tape cartridges). 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 or Perform a thorough inspection of 3592 tape cartridges. 3. If an FID or ATTN message appears on the message display, record the code, press the unload button (see 3 in Figure 1), and try the operation again. <ul style="list-style-type: none"> • 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 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.

Symptom or Error	Action
A power failure occurred and the 3592 tape cartridge failed to eject.	<p>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).</p> <ul style="list-style-type: none"> • 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. 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 tape cartridge fails to unload from the 3592 tape drive.	<p>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 to remove the cartridge manually. If the cartridge still does not unload, refer to the following steps:</p> <ol style="list-style-type: none"> 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. 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.	<ol style="list-style-type: none"> 1. Ensure that the library is powered on (the power indicator on the display panel on the base frame is illuminated) (see 4 in Figure 1). <ul style="list-style-type: none"> • 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 tape cartridges). 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 .
The host application software or tape hardware indicates an encryption-related error, or a backup/restore task to encryption hardware fails.	Check for any errors that are related to encryption. See Encryption-related ASC/ASCQ codes , and Errors reported by the encryption key manager .
The host application software or tape hardware indicates a connection problem with the encryption key manager.	<p>Perform the following checks:</p> <ul style="list-style-type: none"> • If you are using library-managed encryption, run diagnostics on all network attached devices (see Encryption Key Servers). <ul style="list-style-type: none"> ◦ If a test fails, a problem might exist with the IP address, the Ethernet cable, or the switches. Perform the following checks: <ol style="list-style-type: none"> 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.
A power outage occurred and the system does not allow a cartridge to be ejected with Tivoli Storage Manager or the TS4500 management GUI.	<ol style="list-style-type: none"> 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 TS4500 management GUI. 4. Manually remove the cartridge, and reinsert it.

Related information

- [Using the TS4500 management GUI to remove cartridges](#)

Unlocking the administrator password

Use the Access Recovery button to unlock the administrator password.

When you press the Access Recovery button, you have 15 minutes to log into the library and reset the administrator password with a temporary password. You must enter a new administrator password when you log out and back in again.

Perform the following steps:

1. Press the Access Recovery button (See [Display panel](#)).
2. Log into the GUI by using "admin" for the user name and password.
3. Go to Access_>Roles and then highlight the "admin" role.
4. Go to Actions_>Reset Password .

Resolving library errors

- [Resetting the library](#)
You can reset the TS4500 Tape Library if it is unresponsive or experiencing intermittent and unusual problems.
- [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.

Resetting the library

You can reset the TS4500 Tape Library if it is unresponsive or experiencing intermittent and unusual problems.

Resetting the library logs all users out of the library. Host applications are not affected. When you reset the library, you might lose logs that are necessary for analyzing the problem.

Perform the following steps to reset the library:

1. From the System page of the management GUI, select **Actions** > **Reset Library**.
2. Click **Yes** when the Reset Library warning dialog displays to continue with the library reset.

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 that detected 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 TS4500 management GUI. 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. Your IBM® service representative can set this detection capability.

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 might have falsely sensed an obstruction. The action of opening the door resets the NMA state and allows the library to continue operations when the door is closed.

If no obvious obstructions are found, the problem might be related to other causes, which your IBM service representative can determine. If the root cause is not corrected, the library might again enter an NMA state, which generates a Call Home.

Resolving fibre channel errors

- [Resolving errors with Fibre Channel communications](#)
Refer to a list of actions to identify and resolve communication errors with Fibre Channel devices.

Resolving errors with Fibre Channel communications

Refer to a list of actions to identify and resolve communication errors with Fibre Channel devices.

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 or more Fibre Channel devices in the library.

1. Ensure that all Fibre Channel cables from the host to the library are securely connected at both ends. Also, check that the fibers are not crossed, and that there is light present out the end of the fiber.
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.
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.
5. Some Fibre Channel devices 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.

6. Ensure that the host is configured with the correct World Wide Node Name or worldwide port name.
7. 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 the [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.
8. 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.
9. 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. No light 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. The Fibre Channel wrap plug might be installed or the drive might be offline (in maintenance mode).
10. 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. No light 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 is not established.
 - **Green**: Fibre Channel connections are good and communication is established.

Resolving tape drive errors

- [Resolving LTO tape drive errors](#)
LTO tape drives have a single-character display (SCD) that displays a code indicating drive status, including error conditions.
- [Distinguishing EH7 and EH8 tape drives](#)
The EH7 and EH8 tape drives are nearly identical. The stickers on the backs of the tape drives specify whether the drive is a 3592 EH7 tape drive or 3592 EH8 tape drive. The stickers on the front sides of the tape drives specify TS1140 or TS1150.
- [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 TS4500 tape library is due to faulty media or faulty hardware.
- [Using FID messages generated by 3592 tape drives](#)
Failure ID (FID) messages are short codes that can be used by service technicians to isolate problems with the 3592 tape drive.

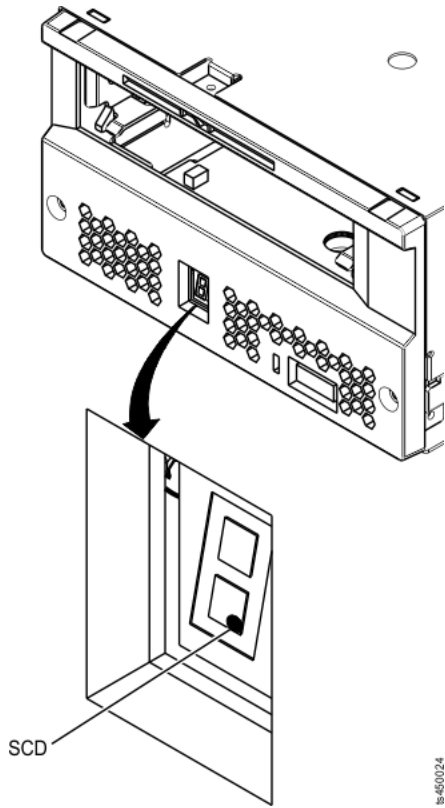
Resolving LTO tape drive errors

LTO tape drives have a single-character display (SCD) that displays a code indicating drive status, including error conditions.

It can be difficult to see the SCD when the tape library is active 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 from the Monitoring > System page of the TS4500 management GUI.

[Figure 1](#) shows the location of the SCD.

Figure 1. Front view of the LTO tape drive



#	Component	#	Component
1	LED indicator for power	4	LED indicator for info, such as error messages
2	LED indicator for drive status	5	LED indicator for port 0 Fiber Channel activity
3	LED indicator for library communications	6	LED indicator for port 1 Fiber Channel activity

Figure 2. Rear view of the LTO tape drive

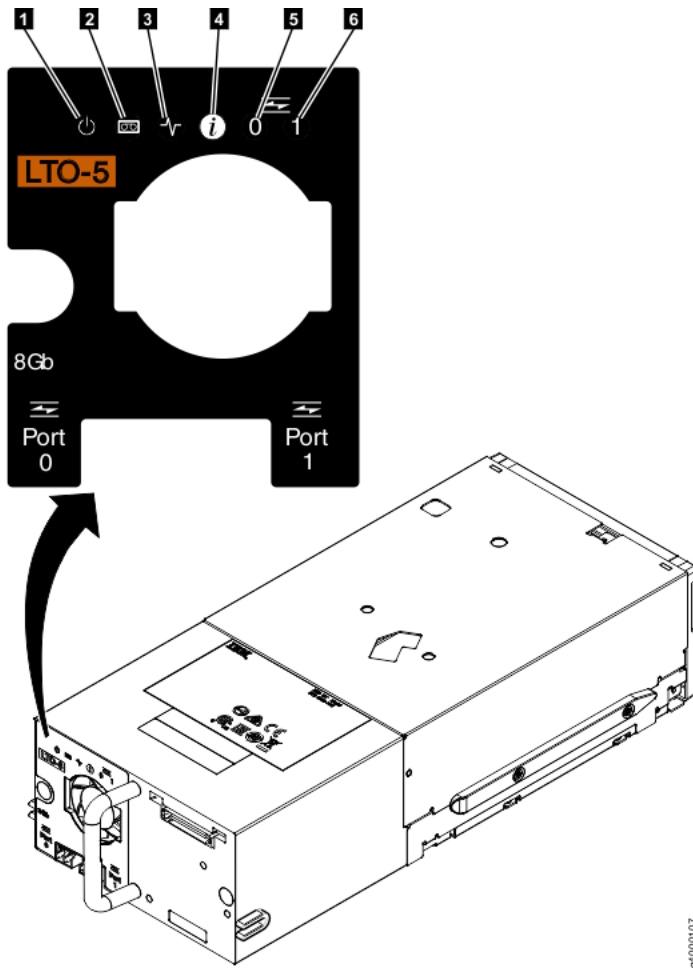


Table 1 lists the SCD error codes for LTO tape drives. Use this table only if no sense data is available. Whenever possible, use sense data or a drive's Fault Symptom Code (FSC) instead of the SCD code. For information about sense data, see the *IBM LTO Tape Drive SCSI Reference*.

Table 1. 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.
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.

Distinguishing EH7 and EH8 tape drives

The EH7 and EH8 tape drives are nearly identical. The stickers on the backs of the tape drives specify whether the drive is a 3592 EH7 tape drive or 3592 EH8 tape drive. The stickers on the front sides of the tape drives specify TS1140 or TS1150.

Figure 1 shows the front view of both the EH7 and the EH8 tape drives. Figure 2 shows the rear view of the EH7 and EH8 tape drives. Use these figures to resolve errors listed in [Using FID messages generated by 3592 tape drives](#).

Figure 1. Front view of the EH7 or EH8 tape drive

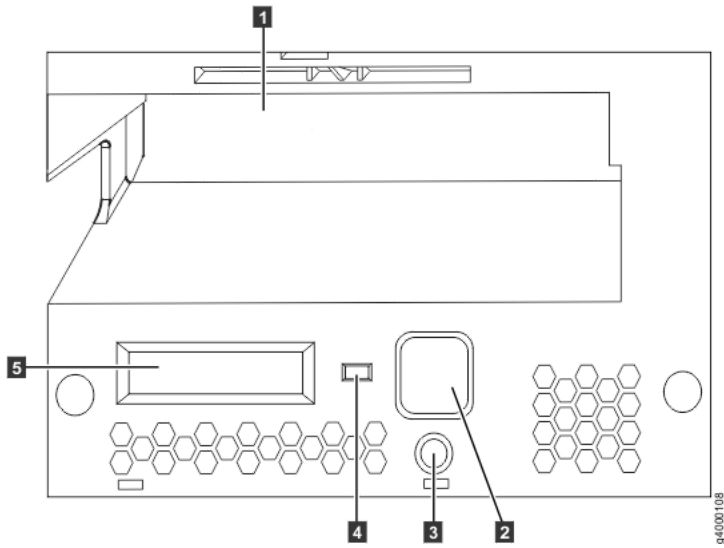
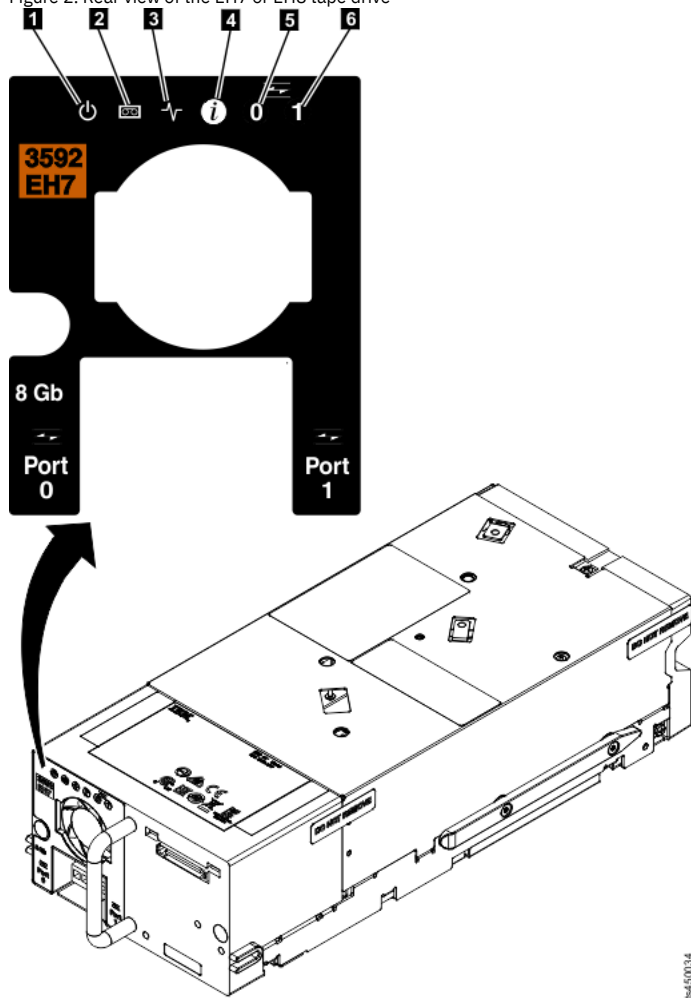


Figure 2. Rear view of the EH7 or EH8 tape drive



#	Component	#	Component
1	LED indicator for power	4	LED indicator for info, such as error messages
2	LED indicator for drive status	5	LED indicator for port 0 Fibre Channel activity
3	LED indicator for library communications	6	LED indicator for port 1 Fibre Channel activity

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 TS4500 tape library is due to faulty media or faulty hardware.

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.

1. Ensure that the cartridge maximum usage of 50 cleanings is not exceeded.
 - Ensure that a cleaning cartridge is installed in the 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. Open the door to observe if the pin is properly seated, and examine the cartridge for cracks. If damaged, repair or replace the cartridge.
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.

Using FID messages generated by 3592 tape drives

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 you contact 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 and provide it 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.

The FID can also be obtained from host software or error logs.

[Table 1](#) describes FID messages and the actions that you must take.

Table 1. FID messages

FID	Description	Action
50	Drive canister problem	The encryption configuration that was installed during manufacturing is incorrect. Replace the drive canister. Call for service.
51	Drive canister problem	The encryption hardware's power-on self-test failed. Replace the drive canister. Call for service.
52	Hardware or firmware problem	The encryption firmware's power-on self-test failed. Call for service.
53	Hardware or firmware problem	An invoked encryption self-test failed. Call for service.
54	Encryption diagnostic failure	An automatically invoked encryption diagnostic test 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.

FID	Description	Action
86, F2	Hardware or media problem	<ol style="list-style-type: none"> 1. Isolate between media and hardware . 2. This failure might be caused by a damaged cartridge. Inspect the cartridge that was being used when the error occurred for physical defects. 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	<ol style="list-style-type: none"> 1. Isolate between media and hardware . 2. Call for service if the problem remains.

Resolving encryption-related errors

- [Errors reported by the encryption key manager](#)
The encryption key manager returns error messages related to encryption-enabled tape drives.
- [Encryption-related ASC/ASCQ codes](#)
[Table 1](#) provides sense codes (ASCs) and sense code qualifier (ASCQ) for encryption-related messages.

Errors reported by the encryption key manager

The encryption key manager returns error messages related to encryption-enabled tape drives.

Table 1. 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 that was 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 that was 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 that was 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). Enable debug tracing on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.
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). 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 cannot 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). 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). 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 <code>listdrives</code> command to check whether the drive is in the list. If not, configure the drive manually by using the <code>addrdrive</code> command with the correct drive information or turn "auto-fill" ON by setting drive.acceptUnknownDrives to true using the <code>modconfig</code> command. Enable debug tracing and try the operation again. If the problem persists, contact IBM Support.

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 <code>listdrives -drivename <drivename></code> 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). 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 <code>listdrives -drivename <drivename></code> 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). 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). Enable debug on the key manager. Try to re-create the problem and gather debug logs. If the problem persists, contact IBM Support.

Encryption-related ASC/ASCQ codes

[Table 1](#) provides sense codes (ASCs) and sense code qualifier (ASCQ) for encryption-related messages.

Table 1. 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 is required - feature is not enabled (license needed).
5	EE 02	Encryption - Key Service Not Available	N/A	The tape drive is not configured with an encryption method (application- 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. An ACK was received from the library, but it 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 code 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. EF 10 is reported when the tape drive is configured for a system managed encryption key path.	If this sense code is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed). Also, verify that the encryption proxy server is configured correctly. If this sense code is NOT associated with a job failure, ignore this condition.
5	EE 10	Encryption - Key Required	N/A	This code 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. 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 code.	If this sense code is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed). Also, verify that the encryption proxy server is configured correctly. If this sense code is not associated with a job failure, ignore this condition.

Sense Key	ASC ASCQ	Description	Impact	Explanation ¹	Action
7	EF 11	Encryption - Key Generation	Key manager	This code 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 is a key-generation request instead of a request for an existing key.	If this sense code is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed). Also, verify that the encryption proxy server is configured correctly. If this sense code 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 changed.	No action required. Key change detected (notification only) re-drive command.
7	EF 13	Encryption - Key Translate	Key manager	This code 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 code is associated with a job failure, verify that the tape drive is set for the correct encryption method (application-, system-, or library-managed). Also, verify that the encryption proxy server is configured correctly. If this sense code is not associated with a job failure, ignore this condition.
0	EF 13	Encryption - Key Translate	Key manager	This code 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 is required. Key translation is requested (in-band).
6	EE 18	Encryption - Changed (Read)	N/A	Information only - SCSI Unit Attention - encryption characteristics (for example: key, method, etc.) were changed prior to a read operation.	No action is required. Retry the command if necessary.
6	EE 19	Encryption - Changed (Write)	N/A	Information only - SCSI Unit Attention - encryption characteristics (for example: key, method, etc.) were changed prior to a write operation.	No action is required. Retry the command if necessary.
5	EE 23	Encryption - Key Conflict	Key manager	An attempt was made to reuse a previously used Data Key Index (Dki). Also known as a <i>key collision</i> . Note: This sense code is expected to be a rare occurrence. It is only used in a multi-key environment.	Retry the command 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 a key manager code bug or incompatible code versions on the drive and key manager. Note: This sense code is expected to be a rare occurrence.	Retry the command 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 code might indicate an authorized attempt to access data.	This sense code might be reported after Service replaces a tape drive. If so, then it might be automatically corrected to support the new tape drive. If the problem persists, ensure that the Drive Authentication Keys are correct.
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 code might indicate an unauthorized attempt to access data.	Retry the command if necessary. This sense code might be reported after Service replaces a tape drive. If so, then it might 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 code might indicate an unauthorized attempt to access data. Note: A private key is needed for External Authentication.	Retry the command 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 code might indicate an unauthorized attempt to access data.	Retry the command 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 an unsupported format. Note: This code is expected to be a rare occurrence.	Ensure that the encryption keys are correct, then retry the command. 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.

Sense Key	ASC ASCQ	Description	Impact	Explanation ¹	Action
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 that is used to wrap a key or keys to send them to the tape drive. It is typically reported with ASC/ASCQ EE 0F, so this sense code 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.
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 a key manager code bug or incompatible code versions on the drive and key manager. Note: This code is expected to be a rare occurrence.	Retry the command 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 might 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 are met. As an example, before you run 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.	Retry the command 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 code combination is typically not produced by the tape drive. Note: This code is expected in test environments only, 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.
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 code might also be caused by a failure in the tape drive's encryption hardware.	Retry the command 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 you read 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 might need to be accessed with the old key or with the new key. This tape must 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 is not yet complete, 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). Also, verify that the encryption proxy server is configured correctly.
3	EE F1	Encryption - Encryption Fenced (Write)	N/A	The key manager set an encryption fence condition that prevents further writing. This fence condition is cleared when the cartridge is demounted. Note: This code occurs with the library-managed encryption method only. 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.

Reference

The topics in this section provide additional information related to the IBM® TS4500.

- [TS4500 management GUI help](#)
This section contains the help files that provide user assistance for the IBM TS4500 management graphical user interface (GUI).
- [Tape CLI commands](#)
Command line interface (CLI) commands are used to perform library management procedures. Many of these procedures cannot be run from the management GUI.
- [REST over SCSI API reference](#)
- [SCSI Reference](#)
This section describes how SCSI is implemented for the tape library.
- [Library card information](#)
This section provides information about the printed circuit cards that control the operation of the tape library.
- [Notices](#)
This section provides legal and regulatory information, such as electromagnetic compatibility notices, safety notices, and electronic emissions notices.
- [Additional information](#)
This section contains miscellaneous reference information, such as a discussion of the units used to express data storage values. This section also provides a list of additional publications and a glossary.

TS4500 management GUI help

This section contains the help files that provide user assistance for the IBM® TS4500 management graphical user interface (GUI).

- [Monitoring](#)
The TS4500 management GUI pages under the Monitoring icon can help you monitor the system and events.
- [Library](#)
The management GUI page under the Library icon enables you to view or manage the logical libraries.
- [Drives menu](#)
The TS4500 management GUI pages under the drives icon enable you to view all drives in the library, view drives by logical library, and perform tasks such as assigning drives and enabling control paths.
- [Cartridges](#)
The TS4500 management GUI pages under the Cartridges icon enable you to view cartridges at large, view cartridges by logical library, assign and move cartridges, and modify logical libraries.
- [Access](#)
The TS4500 management GUI pages under the Access icon enable you to view, create, and assign users and their roles.
- [Settings](#)
Use the TS4500 management GUI pages under the Settings icon to manage system notifications, and network, encryption, and date settings.

Monitoring

The TS4500 management GUI pages under the Monitoring icon can help you monitor the system and events.

- [System](#)
The System page displays the physical configuration of your TS4500 tape library and is the starting place for identifying health and status issues with the library and library components.
- [Events](#)
Events are information notices or warning and error alerts that provide details about the library and library components. Use the Events page to view these events and monitor their status.
- [Tasks](#)
The Tasks page displays long-running actions, such as inventory and reset, that run in the background while the library is performing other operations. Use this page to monitor the progress of tasks and view task properties.

System

The System page displays the physical configuration of your TS4500 tape library and is the starting place for identifying health and status issues with the library and library components.

- [Viewing component status](#)
The System page displays the status of the library frames, storage slots, tape drives, I/O stations, and cartridge accessor(s).
- [Page actions and remote management of the library](#)
Use the Actions menu on the top left corner of the page, or right-click a frame or I/O station. The menu of available actions changes depending on whether the entire library, a specific frame, or an I/O station is selected.
- [What do the icons mean?](#)
The System page shows a graphical representation of your library. The icons provide basic status and event information. Hover over error and warning icons to view the amount of time since the event was generated and a short description of the event.
- [Running an inventory](#)
An inventory operation includes a check to determine whether each cartridge storage slot in the library is empty or full, and a scan of the bar code labels. You can run an inventory on a single library frame or on an entire library.
- [What are the status pods?](#)
Pods at the bottom of the System page show a quick view of capacity, drive utilization, and library health status.

- [Accessor states](#)
The state indicates the operating status of the accessor. To view the current state, hover your mouse over the accessor in the library graphic on the Monitoring System GUI page.
- [Resetting the library](#)
You can reset the control system if the library experiences a hang state. This action resets the node cards in the library.
- [Updating library firmware](#)
- [Using the beacon LED](#)
Each frame with an I/O station has a beacon light-emitting diode (LED) that can be turned on or off. You can use the beacon LED to identify a frame that is in service or needs service, or to identify a frame for other reasons to someone at the library.
- [Session timeout settings](#)
A user is automatically logged out if there is no activity for a set amount of time.
- [Exporting system information](#)
Click the Save icon on the toolbar to view the export options.

Viewing component status

The System page displays the status of the library frames, storage slots, tape drives, I/O stations, and cartridge accessor(s).

Hover over the top of a frame, or over an I/O station, to view its state and contents. If there is a problem with any of the components, a warning or error icon is displayed. Hover over the icon to see a message about the affected component that includes the amount of time that has passed since the event occurred and a short description of the event.

Library frame

An error or warning icon at the base of a library frame indicates a problem with the frame door, I/O station (if applicable), or with any of the slots, cartridges, or drives in that frame.

Cartridge accessor

An error or warning icon on an cartridge accessor indicates a degraded state of operation for the accessor or an issue with any of the accessor components (gripper, scanner, or calibration sensor).

I/O station

Click an I/O station to view I/O station properties, including the state of the station. Possible states are empty, cartridges in I/O for 60 minutes or more, or the magazine is missing for 60 minutes or more. Icons on the door of the library frame also indicate I/O station status.

Related concepts

- [I/O stations](#)

Related information

- [Event categories](#)
- [What do the icons mean?](#)

Page actions and remote management of the library

Use the Actions menu on the top left corner of the page, or right-click a frame or I/O station. The menu of available actions changes depending on whether the entire library, a specific frame, or an I/O station is selected.

You can perform some remote physical actions on the library from the System page. For example, you can open and close I/O station doors from the I/O station action menu. You can also turn the beacon LED on or off from the action menu of any frame with an I/O station. The beacon LED, which can be set remotely, signals to operators which frame requires attention or which I/O station contains a specific cartridge.

Related concepts

- [I/O stations](#)



Related information










- [Using the beacon LED](#)

What do the icons mean?

The System page shows a graphical representation of your library. The icons provide basic status and event information. Hover over error and warning icons to view the amount of time since the event was generated and a short description of the event.

Table 1. System view icons

Icon	Description
	There is an error with a frame, tape drive, cartridge, or accessor. Hover on the icon to see a list of the most important issues that cause this state. Click any issue to open the events page and see more information.
	There is a warning with a frame, tape drive, cartridge, or accessor. Hover on the icon to see a list of the most important issues that cause this state. Click any issue to open the events page and see more information.

Icon	Description
	The task icon displays if there are running or paused tasks.
	The event icon displays if there are active events.
	The I/O station is full.
	The I/O station has been full for 60 minutes or more. This scenario might occur with input operations if there is a shortage of storage slots. This scenario might occur with output operations if the I/O station is unattended. View the state of the cartridges, I/O slot (import queued) or I/O slot, on the Cartridges page.
	The I/O station is partially full.
	The I/O station has been partially full for 60 minutes or more. This scenario might occur with input operations if there is a shortage of storage slots. This scenario might occur with output operations if the I/O station is unattended. View the state of the cartridges, I/O slot (import queued) or I/O slot, on the Cartridges page.
	The I/O station is empty.
	The cartridge magazine is missing.
	The cartridge magazine has been missing for 60 minutes or more.

Related information

- [Cartridge states](#)

Running an inventory

An inventory operation includes a check to determine whether each cartridge storage slot in the library is empty or full, and a scan of the bar code labels. You can run an inventory on a single library frame or on an entire library.

The TS4500 tape library automatically inventories the library, however certain conditions necessitate that you manually initiate an inventory. For example, if an automatic inventory of the media was inconsistent, you might need to run an inventory to reconcile an inconsistency. Similarly, you might need to start a manual inventory if the host application software indicates that there is a problem with the library inventory.

The TS4500 tape library provides the following two inventory options:

Scan tier 0 and tier 1

Use this option when a faster inventory is preferred. This option only scans other tiers if a discrepancy is found.

Scan all tiers

Use this option when a full library inventory is required. This option is concurrent and can take many hours depending on the number of cartridges in the library.

When no frame is selected, you can select Inventory from the Actions menu to start an inventory of the library. When a frame is selected, the Inventory option inventories only that frame. Right-click any frame and select Inventory from the frame action menu to inventory only that frame.

You can inventory a single frame by selecting it and then clicking Actions > Inventory. If you don't select any frame, all frames are inventoried.

Refer to the topic about inventory time for more information about library inventories. Refer to the topic about high-density technology for more information about the tiered architecture of high-density frames.

Related concepts

- [High-density technology](#)

Related reference

- [Inventory times](#)

What are the status pods?

Pods at the bottom of the System page show a quick view of capacity, drive utilization, and library health status.

Physical capacity status pod

The physical capacity pod displays how many licensed slots are filled by cartridges and the percentage of slots that are filled – for example, 3402 of 3938 licensed slots (86%).

The pod is green when the number of cartridges in the library is less than the cartridge capacity utilization threshold. The default threshold setting is 99.0%. Use the `setUtilThreshold` CLI command to set this threshold and the `viewUtilThreshold` command to view the current setting.

The pod is yellow when the number of cartridges exceeds the capacity utilization threshold. If this scenario occurs, you can remove cartridges, increase the capacity threshold, or purchase more capacity.

The pod is red when the number of cartridges exceeds the number of licensed slots. If this scenario occurs, you must remove cartridges or purchase more capacity.

Drive utilization status pod

The drive utilization pod displays the status of drives across the library. Click the status pod to go to the Drives by Logical Libraries page.

The blue pod fills in as the number of drives in use out of the total number of drives in the library increases.

If there are multiple logical libraries, a warning icon displays if all of the drives in any logical library are being used.

Health status pod

The color of the Health Status pod indicates the current state of the library by severity. Click the pod if it is yellow or red to go to the appropriate page for understanding and troubleshooting the warning or error. If a library is in more than one state, the higher priority state is shown.

Related reference

- [setUtilThreshold CLI command](#)
- [viewUtilThreshold CLI command](#)

Accessor states

The state indicates the operating status of the accessor. To view the current state, hover your mouse over the accessor in the library graphic on the Monitoring >> System GUI page.

State	Description
inServiceMode	The accessor is being serviced and is not able to move cartridges.
noMovementAllowed	The accessor is in a state where movement is not allowed due to some failure or internal process that is not related to library/accessor initialization. If dual accessors are configured, the other accessor might still be operational in this state. Access to certain drives and cartridges might be restricted if the accessor is not in the Service Bay.
bothGrippersFailed	Both grippers within this accessor have failed, and the accessor is no longer usable. It may or might not have a cartridge in it.
gripper1Failed/ gripper2Failed	A gripper within this accessor has failed, but the accessor is still usable. It may or might not have a cartridge in it.
noMotorPower	Power is removed from the accessor by the library. This is normally done in response to a user opening a door of the library.
onlineStandby	The accessor is parked in the Service Bay. If the other accessor goes down, then this accessor becomes active. In this option, the preferred zone for the other accessor includes the entire library except for the area for the Service Bay for this accessor.
onlineActive	The accessor is operational and can fulfill requests for media.

Resetting the library

You can reset the control system if the library experiences a hang state. This action resets the node cards in the library.

A reset can take up to 3 minutes and might require that you reconnect to the web server once the reset is complete.

Updating library firmware

Complete the following steps to update the TS4500 tape library firmware:

1. Obtain the library firmware package from IBM® Support and install it on your workstation.
2. From the System page of the TS4500 management GUI, select Actions >> Firmware Update.
3. Browse to the library firmware image and click Open.
The Apply Library Firmware window displays.
Note: The library firmware image file is named TS4500_WXYZ.afwz, where W, X, Y, and Z are different numbers depending on the firmware version.
4. Click Yes to continue.
5. The task pod at the lower left of the System page indicates that the firmware update task is in progress. Monitor the status of the update from the Tasks page by selecting Monitor >> Tasks.

If the library firmware update hangs, reset the library from the System page by selecting Actions >> Reset Library and then try the firmware update again.

Related tasks

- [Resetting the library](#)

Related information

- [Monitoring tasks](#)

Using the beacon LED

Each frame with an I/O station has a beacon light-emitting diode (LED) that can be turned on or off. You can use the beacon LED to identify a frame that is in service or needs service, or to identify a frame for other reasons to someone at the library.

Select a frame with an I/O station and then select Actions >> Turn on beacon or Actions >> Turn off beacon.

Session timeout settings

A user is automatically logged out if there is no activity for a set amount of time.

You can modify the amount of time that is allowed before a management GUI session times out by selecting **Settings > Library** and clicking the **GUI Preferences** tab.

Exporting system information

Click the **Save** icon on the toolbar to view the export options.

Export library logs

Creates a file named `TS4500_LOG_<library-serial-number>_<date-time>.zip` that contains event logs, servo logs, NVRAM event logs, Fatal Exception logs, etc.

Export library logs to IBM

Creates the same .zip file and uses **Call Home** to transmit the file to IBM service.

An event is created so you can track the status on the **Events** page. The event status initially displays `Calling home`, then changes to either `Call home initiated` (to indicate that the transmission was successful) or `Call home failed` (if **Call Home** is not correctly configured).

Export usage statistics

Creates a file named `<library-name>_usage_statistics_<date>.csv` that contains the usage statistics of important library components.

Export system summary

Creates a file named `<library-name>_systemsummary_<date>.csv` that lists the library properties and configuration settings. It is helpful to download this file periodically to compare the library configuration over time or for audit purposes.

You can also download this file using the **downloadResources** CLI command.


Related reference

- [downloadResources CLI command](#)
-

Events

Events are information notices or warning and error alerts that provide details about the library and library components. Use the **Events** page to view these events and monitor their status.

- **Event categories**
Tape library events are categorized by severity.
- **Monitoring events**
The events displayed on the **Events** page are sorted first by severity and second by time. Specify a time range – 1 day, 1 week (the default), or All – from the menu bar at the top of the **Events** table.
- **Events at a glance**

If there are any active events, the event pod  displays in the bottom-right corner of the **System** page. The number next to the pod indicates the total number of active events (both errors and warnings). The color indicates the highest level of the active events. If it is red, at least one of the indicated events is an error. If it is yellow, the most severe active event is a warning.

- **Exporting event information**
Click the **Save** icon on the toolbar to view the export options.
-

Event categories

Tape library events are categorized by severity.



Error

Error events are the highest priority events and require immediate intervention. They are identified by the error icon (a red circle containing a white X) in the **Events** table. Errors indicate a hardware or communication failure that can impair library operations or cause damage to the system.



Warning

Warning events are the second highest priority events and require attention when time allows. They are identified by the warning icon (a yellow triangle containing an exclamation mark) in the **Events** table. Warnings indicate a problem that does not pose an immediate threat, but does require resolution to ensure library operations continue smoothly.



Information

Information events are the lowest priority events and do not require corrective action. They are identified by the information icon (a blue balloon containing a lowercase letter i) in the **Events** table. Information events provide information about the library or library operations, such as user logins and tape moves.


Monitoring events

The events displayed on the Events page are sorted first by severity and second by time. Specify a time range – 1 day, 1 week (the default), or All – from the menu bar at the top of the Events table.

Note: Use the **downloadEvents** CLI command to export the event listing to a CSV file.

The Events table displays the most recent 10,000 events. If the Events table is full and a new event is generated, the oldest inactive events are deleted first. Active events, displayed in color in the Events table, are events that have not yet been fixed. Inactive events, displayed in gray in the Events table, are events that are being addressed or that have been fixed. Only errors and warnings can be marked inactive. Information messages are not alerts and therefore cannot be marked as inactive.

To manually mark an event as inactive, either:

- Use the **Mark Inactive** action to mark a specific event or range of events as inactive.
- Click the **Mark All Inactive** icon  to mark all events as inactive.

Events can also be marked inactive by an IBM® service representative.

To view details about an event, select the event and select **Actions > Properties**. The Event Properties include a complete history of the event. If there is an action that can be performed to resolve an error or warning event, a fix procedure is also provided.

View the status of each event in the State column. For events that require service, the State column shows when a Call Home is generated, when the Call Home is complete, and when the service action is complete.

Event notifications can be distributed and saved as follows:

- If SNMP traps are enabled, notification messages are also sent to the SNMP server based on the subscription level (error, warning, or information). SNMP trap IDs are listed and defined in *Resolving error codes*.
- If the email (SMTP) server is enabled, messages are sent by email to the specified recipients.
- If the library is configured to send syslog (system log) notifications, it sends a notification of each event to the syslog server. The syslog server keeps its own log of system events.

Related concepts

- [SNMP messaging](#)
- [SNMP audit logging](#)


Related reference

- [Error codes](#)
- [downloadEvents CLI command](#)

Related information

- [SNMP Traps](#)
- [SNMP Requests](#)
- [Email Server](#)
- [Email Recipients](#)
- [Syslog Server](#)

Events at a glance

If there are any active events, the event pod  displays in the bottom-right corner of the System page. The number next to the pod indicates the total number of active events (both errors and warnings). The color indicates the highest level of the active events. If it is red, at least one of the indicated events is an error. If it is yellow, the most severe active event is a warning.

Hover over the events pod to see the location of the event, the relative time since the event occurred in minutes (m) or hours (h), and a short description of the event.

Related information

- [What do the icons mean?](#)

Exporting event information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Events page.


Tasks

The Tasks page displays long-running actions, such as inventory and reset, that run in the background while the library is performing other operations. Use this page to monitor the progress of tasks and view task properties.

- [Monitoring tasks](#)

The Tasks table displays all active tasks. They are sorted first by state and second by time. Tasks are removed from the table when they expire after a certain amount of time.

- [Tasks at a glance](#)

The task pod  displays in the lower-left corner of the System page when there are running or paused tasks. The number next to the pod indicates the number of tasks. A blue icon indicates that there are no paused tasks. If there is at least one paused task, the icon turns red. If no icon is displayed, there are no active tasks.

- [Exporting task information](#)

Click the Save icon on the toolbar to view the export options.

Monitoring tasks

The Tasks table displays all active tasks. They are sorted first by state and second by time. Tasks are removed from the table when they expire after a certain amount of time.

Highlight a task in the table and select Actions_>Monitor to view the status of the task.


Highlight a task in the table and select Actions_>Properties to view a complete description of the task and the task history.

In the event that a long-running task hangs, or appears to take more time than it should, you can reset the library and then start the task again. Non-disruptively reset the library by selecting Actions_>Reset Library from the System page.

Related information

- [Resetting the library](#)

Tasks at a glance

The task pod  displays in the lower-left corner of the System page when there are running or paused tasks. The number next to the pod indicates the number of tasks. A blue icon indicates that there are no paused tasks. If there is at least one paused task, the icon turns red. If no icon is displayed, there are no active tasks.

Hover over the task pod to see the three oldest running tasks that are sorted by the time that they were created.

Related information

- [What do the icons mean?](#)

Exporting task information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Tasks page.

Library

The management GUI page under the Library icon enables you to view or manage the logical libraries.

- [Logical Libraries](#)

Use this page to manage logical libraries and to perform other actions, such as modifying the method of encryption that is used.

- [Node Cards](#)

The Library_>Node Cards page allows you to view and perform actions on library node cards. This page is only visible to service users and users with Administrator privileges.

Logical Libraries

Use this page to manage logical libraries and to perform other actions, such as modifying the method of encryption that is used.

- [Using multiple logical libraries](#)

You can create multiple logical libraries by partitioning the physical library's tape drives and tape cartridges into two or more logical libraries. Each logical library can contain only one media type.

- [Assigning tape drives and cartridges to a logical library](#)

Each logical library requires at least one drive as a control path drive. Assign additional tape drives as needed to improve performance. Enable or disable control path drives on the Drives page.

- [Assigning cartridges to a logical library by VOLSER range](#)
You can assign specific cartridges to each logical library based on their volume serial (VOLSER) numbers. With the TS3500 tape library, this was known as the Cartridge Assignment Policy.
- [Applying VOLSER ranges](#)
Use the Apply VOLSER Ranges option to scan all cartridges and reassign all cartridges based on VOLSER ranges.
- [Modifying the maximum cartridges for a logical library](#)
You can modify the maximum number of cartridges for a logical library to ensure that your library does not exceed the licensed capacity or use the system default.
- [Creating logical libraries](#)
Create logical libraries using presets that have the preferred drive and encryption configurations for their specific use.
- [Choosing or modifying an encryption method](#)
Encryption is managed at the logical library level. All encryption-enabled drives that are assigned to a logical library use the same method of encryption. Enable encryption, or modify the method that is being used, on the Logical Libraries page.
- [Exporting library information](#)
Click the Save icon on the toolbar to view the export options.
- [Performing other logical library tasks from the CLI](#)
The following logical library tasks can only be performed from the command-line interface (CLI):

Using multiple logical libraries

You can create multiple logical libraries by partitioning the physical library's tape drives and tape cartridges into two or more logical libraries. Each logical library can contain only one media type.

Create multiple logical libraries for the following scenarios:

Share the library for multiple backup applications

You can partition your library so that it processes commands from Application 1 (about Department A) in Logical Library 1, commands from Application 2 (about Department B) in Logical Library 2, and commands from Application 3 (about Department C) in Logical Library 3. In this configuration, the tape drives and tape cartridges in each logical library are dedicated to that library and are not shared among other libraries. Commands issued by the applications travel to the library through three unique control paths. Thus, the data processing for Department A is confined to the tape drives and tape cartridges in Logical Library 1, processing for Department B is confined to the tape drives and tape cartridges in Logical Library 2, and so forth.

Share the library to support mixed drive types for any application

You can use multiple logical libraries for applications that do not support mixed drive types and media in the same logical library by partitioning the physical tape library to keep them separate. For example, you can partition LTO 6 and LTO 5 tape drives and their media into two separate logical libraries.

Tip: When naming logical libraries, developing an enterprise-wide library naming convention leads to easier management of the libraries.

Assigning tape drives and cartridges to a logical library

Each logical library requires at least one drive as a control path drive. Assign additional tape drives as needed to improve performance. Enable or disable control path drives on the Drives page.

Drives are assigned to logical libraries when the logical libraries are created. You can modify the drives that are assigned to a logical library on the Drives by Logical Library page.

Note: A tape drive can be used only by the logical library it is assigned to. Drives cannot be shared between logical libraries.

Cartridges are assigned to logical libraries based on the VOLSER range that is assigned to the logical library when it is created. You can modify what cartridges are assigned to a logical library by modifying the VOLSER range from the VOLSER Ranges by Logical Library page.

Note: Cleaning cartridges are shared between the logical libraries. You can view the cleaning cartridges on the Cartridges page.

Related information

- [Using control path drives](#)
- [Assigning and unassigning tape drives to a logical library](#)
- [Assigning cartridges to a logical library by VOLSER range](#)
- [Creating, modifying, or deleting VOLSER ranges](#)
- [Cartridges](#)

Assigning cartridges to a logical library by VOLSER range

You can assign specific cartridges to each logical library based on their volume serial (VOLSER) numbers. With the TS3500 tape library, this was known as the Cartridge Assignment Policy.

All cartridge assignments are displayed on the VOLSER range bar. As you create logical libraries and assign VOLSER ranges, any cartridges that are not part of those ranges remain unassigned. View or assign unassigned cartridges on the Cartridges page.

When you insert a cartridge into the library and its VOLSER is within a range that is assigned to a certain logical library, the cartridge is assigned to that logical library. The cartridge must be of the same media type as that logical library. For example, if you create Logical Library 1 for VOLSERs that range from ABC000 to ABC999 (a library of LTO 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.

If you insert a cartridge that is outside of any VOLSER ranges, it is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge.

You can view all of the VOLSER ranges by selecting View VOLSER ranges from the Actions menu. You can also view all VOLSER ranges that are assigned to each logical library on the VOLSER Ranges by Logical Library page.

Related information

- [Cartridges](#)
- [VOLSER Ranges by Logical Library](#)

Applying VOLSER ranges

Use the Apply VOLSER Ranges option to scan all cartridges and reassign all cartridges based on VOLSER ranges.

This action can be useful in the following scenarios:

- If there are cartridges in the library with old policies that do not match the current assignments
- If a VOLSER range was moved to a different logical library, or the range was resized and the option to reassign cartridges was not selected
- If a cartridge was manually assigned outside of a VOLSER range

Cartridges will be reassigned to existing logical libraries. If the maximum number of cartridges is met for a logical library, any additional cartridges that would have been assigned to that logical library will be unassigned.

Modifying the maximum cartridges for a logical library

You can modify the maximum number of cartridges for a logical library to ensure that your library does not exceed the licensed capacity or use the system default.

If the maximum number of cartridges is met, you can increase the maximum number allowed for the logical library by selecting Actions_>_Modify Maximum Cartridges, or go to the Cartridges page to reassign some cartridges.

Related concepts

- [Transparent addition or removal of storage capacity](#)

Related information

- [Assigning or unassigning cartridges](#)

Creating logical libraries

Create logical libraries using presets that have the preferred drive and encryption configurations for their specific use.

Spectrum Protect

Use this option to create a logical library for Spectrum Protect using all unassigned tape drives. When you select this option, two of the drives that are assigned to the logical library are designated as control path drives. When possible, drives are assigned as control paths in two separate frames.

Spectrum Archive

Use this option to create a logical library for Spectrum Archive using all unassigned tape drives. When you select this option, two of the drives that are assigned to the logical library are designated as control path drives. When possible, drives are assigned as control paths in two separate frames.

TS7700

Use this option to create a logical library for TS7700 using all unassigned 3592 tape drives. When you select this option, up to four of the drives that are assigned to the logical library are designated as control path drives. When possible, drives are assigned as control paths in two separate frames.

General Use

Use this option if you use an application other than those listed to manage your tape library. When you select this option, one of the drives assigned to the logical library is designated as a control path drive.

Advanced

Use this option for complete customization when creating a logical library if the presets do not fit your requirements.

Choosing or modifying an encryption method

Encryption is managed at the logical library level. All encryption-enabled drives that are assigned to a logical library use the same method of encryption. Enable encryption, or modify the method that is being used, on the Logical Libraries page.

To enable encryption, or modify the method that is being used, select a logical library on the Logical Libraries page. Then select Actions_>_Modify Encryption Method. Choose a method from the Encryption menu on the Modify Encryption Method Window and click Modify.

The following methods can be used for encryption:

System-managed encryption (SME)

Select this method encryption if the library is attached to a TS7700.

Application-managed encryption (AME)

Use this method if the application generates and manages encryption policies and keys. Applications such as Tivoli® Storage Manager can manage encryption.

Library-managed encryption (LME) by bar code

Use this method to use the default key that is specified by the key manager for all VOLSER ranges. The encryption policy is specified based on cartridge volume serial numbers.

Note: To modify the behavior for different VOLSER ranges, use the **modifyVolserRanges** CLI command.

Library-managed encryption (LME) by internal label selective encryption

Use this method if you use Symantec NetBackup or the EMC Legato NetWorker. This encryption method encrypts cartridges with pool identifiers from 1500 - 9999 (inclusive), using keys specific to each pool. Labels for these keys are generated by the tape drive based on the pool identifier. For instance, key label **INTERNAL_LABEL_NBU_1505_A** would be generated for a cartridge in pool 1505. Go to Settings > Security and click on the Key Label Mapping tab to map these generated labels to the wanted key-encrypting key labels in the keystore of the encryption key manager. All other cartridges remain unencrypted.

Click Ping on the Modify Encryption Method window to test the connection to the encryption key servers if using LME.

To set up or modify the encryption key servers, go to Settings > Security and click the Encryption Key Servers tab.

Related concepts

- [Tape encryption overview](#)

Related reference

- [modifyVolserRanges CLI command](#)

Related information

- [Encryption Key Servers](#)

Exporting library information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Logical Library page.

Export library statistics

Downloads the library statistics report.

- [Library statistics report](#)

The library statistics report is saved to a file named <library-name>_library_statistics_<date>.csv.

Related reference

- [downloadResources CLI command](#)

Library statistics report

The library statistics report is saved to a file named <library-name>_library_statistics_<date>.csv.

The report contains the following information:

Date and Time

The date and time that the cartridge was unmounted from the drive, in the format `yyyy mm dd hh:nn:ss`.

LogLib

The volume serial number of the cartridge (also known as the VOLSER). The VOLSER is a unique identifier.

Residency Max

The maximum amount of time, in seconds, that a volume was mounted on a drive during the last hour.

Residency Avg

The average amount of time, in seconds, that a volume was mounted on a drive during the last hour.

Mounts Total

The total number of mounts during the last hour.

Mounts Max

The maximum amount of time, in seconds, required to perform any single mount operation during the last hour.

Mounts Avg

The average amount of time, in seconds, required to perform any single mount operation during the last hour.

Ejects Total

The total number of ejects during the last hour.

Ejects Max

The maximum amount of time, in seconds, required to perform any single eject operation during the last hour.

Ejects Avg

The average amount of time, in seconds, required to perform any single eject operation during the last hour.

Inserts Total

The number of insert stores during the last hour. This number is the number of volumes that were moved from an I/O station to a location within the library.

Shuttle Ejects Total

Shuttle Ejects Max

Shuttle Ejects Avg

Shuttle Insert Total

Performing other logical library tasks from the CLI

The following logical library tasks can only be performed from the command-line interface (CLI):

- Modify the number of VOLSER characters that are reported (first 6, first 8, all, or last 8) (`modifyVolserReporting` command)
- Modify the maximum number of virtual I/O slots for the logical library (`setMaximumVIOCartridges` command)

Related reference

- [modifyVolserReporting CLI command](#)
- [setMaximumVIOCartridges CLI command](#)

Node Cards

The Library_>Node Cards page allows you to view and perform actions on library node cards. This page is only visible to service users and users with Administrator privileges.

- **Node card properties**
The Library_>Node Cards page displays a list of properties for each node card.
- **Node card states**
The state indicates the current operating status of the card.
- **Resetting a node card**
If a library is unresponsive or if a task fails to finish normally, you may be able to resolve the issue by resetting a node card (LCC, MDA, or ACC) instead of performing a power-off reset.
- **Viewing node card properties**
To view a list of all card properties, click the row for the card in the Node Cards GUI page and select Actions_>Properties. A new window opens to display the properties. This can be useful if the Node Cards page is configured to only display a subset of properties and you need to see a property that isn't displayed.
- **Exporting node card data**
To export the data currently displayed in the Node Card window, click the Save icon on the toolbar and select Export to CSV. The data is saved to a file named `export.csv`.

Node card properties

The Library_>Node Cards page displays a list of properties for each node card.

Property	Description
Card	The type of card (LCC, MDA, or ACC).
State	The current operating status of the card. See Node card states for more information.
Location	The location of the card (frame or accessor).
Part number	The part number of the card.
Serial number	The serial number of the card.
Firmware version	The firmware version currently installed on the card (LCC only).

Node card states

The state indicates the current operating status of the card.

State	Description/user action
<code>inServiceMode</code>	The accessor the MDA or ACC card is on is in service. To end this state, use the completeAccessorService task on the accessor on which this node card is located.
<code>unreachable</code>	The node card is not answering network ping by the library via Ethernet or CAN. Any resource managed by this LCC will no longer have its state updated while the LCC is in this state. Try to reset the node card . If the issue persists, service will need to check cables.

State	Description/user action
noEthernet	The LCC is not communicating with the reporting LCC card on the internal LCC-to-LCC Ethernet network. Any resource managed by this LCC will no longer have its state updated while the LCC is in this state. Try to reset the node card . Try to reset the node card . If the issue persists, service will need to check cables.
noCAN	The node card is not communicating with the reporting LCC on CAN. Try to reset the node card . If the issue persists, service will need to check cables. Try to reset the node card . If the issue persists, service will need to check cables.
online	The node card is in a running state.
restarting	Node card library-controlled reset, such as firmware update or manual reset, is in progress.

Resetting a node card

If a library is unresponsive or if a task fails to finish normally, you may be able to resolve the issue by resetting a node card (LCC, MDA, or ACC) instead of performing a power-off reset.

The effect of a card reset on library operations will depend on the library configuration:

- With a multi-frame, dual-accessor library, you can reset any node card and still have a fully functional library.
- Resetting an LCC may disrupt host operations for the frame. Some drive communication may be affected. If the frame has an I/O station, that operation may be affected.
- In a library with one LCC, resetting the LCC will cycle power to the accessor. The IMC and any remote customer port will have to re-establish their web interface to the library.
- In a single-frame library, or a multi-frame library with a single accessor, resetting any of the node cards will make the library unavailable for cartridge requests, moves, mounts, and unmounts. Host operations (reads and writes to the drives) will continue.

To reset a node card, click the row for the card in the Library > Node Cards GUI page, then select Actions > Reset. Alternatively, you can right-click on the row and select Reset from the context menu.

Viewing node card properties

To view a list of all card properties, click the row for the card in the Node Cards GUI page and select Actions > Properties. A new window opens to display the properties. This can be useful if the Node Cards page is configured to only display a subset of properties and you need to see a property that isn't displayed.

Alternatively, you can right-click on the card row, then select Properties from the context menu.

Exporting node card data

To export the data currently displayed in the Node Card window, click the Save icon on the toolbar and select Export to CSV. The data is saved to a file named export.csv.

Drives menu

The TS4500 management GUI pages under the drives icon enable you to view all drives in the library, view drives by logical library, and perform tasks such as assigning drives and enabling control paths.

- **Drives**
Use the Drives page to view the location and state of all drives in the library, enable or disable control paths, eject cartridges, reset or clean drives, update drive firmware, and export drive data.
- **Drives by Logical Library**
Use the Drives by Logical Library page to view drive assignment and usage among all logical libraries, view cleaning cartridge status, assign drives, and manage the logical libraries and their settings.
- **Fibre Channel Ports**
Use the Drives > Fibre Channel Ports page to modify the port speed and topology for a drive.
- **SAS Ports**
Use the Drives > SAS Ports page to view SAS (Serial Attached SCSI) drive properties.
- **Ethernet Ports**
Use the Drives > Ethernet Ports page to view the settings for Ethernet drive ports and export the table data.

Drives

Use the Drives page to view the location and state of all drives in the library, enable or disable control paths, eject cartridges, reset or clean drives, update drive firmware, and export drive data.

- [Drive properties](#)
The Drives, > Drives page lists the properties for each drive in the library.
- [Assigning and unassigning tape drives to a logical library](#)
When a tape drive is installed in the library, by default it is unassigned. All unassigned drives are assigned when a logical library is created using the logical library presets. Any newly added drives can be assigned to an existing logical library individually by first selecting the unassigned drive and then selecting Actions, > Assign.
- [Using control path drives](#)
One or more drives can be designated as control path drives.
- [Resetting a tape drive](#)
If a tape drive becomes unresponsive or fails to eject a tape, resetting the drive may resolve the problem. You can reset a drive from the TS4500 management GUI by selecting Actions, > Reset from the Drives page.
- [Cleaning tape drives](#)
- [Updating drive firmware](#)
Complete this task to update tape drive firmware using the TS4500 management GUI.
- [Exporting drive information](#)
Click the Save icon on the toolbar to view the export options.
- [Performing other drive tasks from the CLI](#)
Several drive tasks can only be performed from the TS4500 command-line interface (CLI).
- [Ethernet drive initial setup](#)
Follow these steps to prepare an Ethernet drive for use after installation:
- [Ethernet drive network configuration](#)
Use the Modify iSCSI action from the Drives page to configure an Ethernet drive's network settings and optionally assign a new name or alias to the drive.

Related concepts

- [Drive addresses](#)

Drive properties

The Drives, > Drives page lists the properties for each drive in the library.

Property	Description
Drive use	How the drive is currently configured: <ul style="list-style-type: none"> • For media access • For media access and as a control path to a logical library • For media verification
Location	The location of the drive in Fx, Cx, Rx (frame, column, row) format. For example, F1 , C4 , R2 .
Port state	The state of the port. A green icon indicates that communication has been established between the drive and the library. A gray icon indicates that no light was detected on that port.
State	The current state of the drive. For example, online, unloading, cleaning, or unreachable.
Type	The drive type (either 3592 or LTO/3588) and model. For example, 3592-55F or 3588-F7C .
S/N	The serial number of the drive.
Firmware	The firmware version installed on the drive.
Encryption	Enabled or disabled.
WWNN	A unique identifier assigned by the library to each drive slot.
Logical library	The logical library to which the drive is assigned.
Interface	The interface that the drive uses to communicate with the library - fibre channel, Ethernet, or SAS (serial attached SCSI).
iSCSI name	(Ethernet drives only) See Ethernet drive network configuration .
iSCSI alias	(Ethernet drives only) See Ethernet drive network configuration .
Element address	The unique logical SCSI address of the drive.
Contents	The VOLSER of the cartridge currently mounted in the drive.

Assigning and unassigning tape drives to a logical library

When a tape drive is installed in the library, by default it is unassigned. All unassigned drives are assigned when a logical library is created using the logical library presets. Any newly added drives can be assigned to an existing logical library individually by first selecting the unassigned drive and then selecting Actions, > Assign.

A drive must be assigned to a logical library of the same media type. In addition, all drives within a logical library must be managed the same way; either library managed or application managed.

To reassign a drive from one logical library to another, use the Actions, > Reassign option. The drive is automatically unassigned from its current logical library. It is possible to reassign multiple drives simultaneously if they are currently assigned to the same logical library.

To remove a drive from a logical library, first make sure the drive is empty (Actions, > Eject Cartridge) and then select the Actions, > Unassign option. If the drive being unassigned is a control path drive, a different drive must be designated as a control path drive before the original control path drive is unassigned.

Related information

- [Creating logical libraries](#)

Using control path drives

One or more drives can be designated as control path drives.

Select Enable Control Path from the Actions menu to designate a control path drive. Drives that are enabled as control paths are identified with the icon shown in [Figure 1](#). Note that it is possible for a logical library to have no control path drives.

Figure 1. Control path drive icon



Using multiple control paths for any single, configured logical library provides the following benefits:

- Allows access to the logical library by multiple servers
 - Provides communication failover so that if one control path fails, host communication for the entire library is not lost
- Note: Use the Path Failover feature (feature code 1682) to enable the host device driver to resend a command to an alternate control path for the same logical library.

Access to the logical library is on a first-come, first-served basis. Each control path for a logical library can accept commands while the library is in use by another control path.

Control path drives should not be removed from a logical library that is performing jobs. If the logical library is not actively being used, control path drives can be removed from a logical library only after all non-control path drives have been removed or a different control path drive has been assigned.

Resetting a tape drive

If a tape drive becomes unresponsive or fails to eject a tape, resetting the drive may resolve the problem. You can reset a drive from the TS4500 management GUI by selecting Actions, > Reset from the Drives page.

A drive reset takes approximately two minutes. If the drive is a control path, it will be unavailable to the host until the reset completes.

If the problem continues after the reset, refer to the appropriate troubleshooting procedure.

Cleaning tape drives

The TS4500 tape library automatically cleans tape drives as needed; however it is also possible to initiate a manual cleaning from the Drives page by selecting Actions, > Clean.

A valid cleaning cartridge is required for cleaning drives. Monitor cleaning cartridge usage from the Cartridges page.

Related concepts

- [Methods of cleaning drives](#)

Related information

- [Cartridges](#)

Updating drive firmware

Complete this task to update tape drive firmware using the TS4500 management GUI.

It is possible to update drive firmware on one drive, or multiple drives, at a time. Any drives that are selected on the Drives page are updated with the firmware level that was uploaded. It is possible to install firmware levels that are earlier than the version that the drive is running.

To avoid disrupting the host, control path drives are updated when they are reset. All other drives are updated when the drive is unloaded. Control path drives must be manually reset in order to begin using the uploaded firmware level.

To update drive firmware, complete the following steps:

1. Obtain the drive firmware package on your workstation.
2. From the Drives page of the TS4500 management GUI, select one or more drives and then click Actions, > Update Drive Firmware.
3. Browse to the drive firmware image and click **Open**.

The firmware image files are named as follows, where xxxx is the firmware level.

- LTO 5 drives – LTO5_xxxx.fcp_fh.ro
- LTO 6 drives – LTO6_xxxx.fcp_fh.fmrz
- LTO 7 drives – LTO7_xxxx.fcp_fh.fmrz
- LTO 8 drives – LTO8_xxxx.fcp_fh.fmrz

- LTO 9 (FC) drives – LTO9_XXXX.fcp_fh.fmrz
 - LTO 9 (SAS) drives – LTO9_XXXX.ssp_fh.fmrz
 - TS1140 drives – D3I3_XXX.fcp_fj.fmrz
 - TS1150 drives – D3I4_XXX.fcp_fj.fmrz
 - TS1155 drives:
 - Model 55F – D3I5_XXX.fcp_fj.fmrz
 - Model 55E – D3I5_XXX.ena_fj_D.fmrz
 - TS1160F drives:
 - Model 60F – D3I5_XXX.fca_fj_D.fmrz
 - Model 60E – D3I5_XXX.ena_fj_D.fmrz
4. Monitor the status of the update in the State and Firmware columns of the Drives table.
 5. Select the control path drives that have a state of “Reset Required” and reset them by selecting Actions > Reset.

Exporting drive information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Drive page.

Export service logs

Creates a file named TS4500_DriveLogs_<drive>_<date-time>.zip that contains drive service logs for the selected drive.

Export service logs to IBM

Creates the same .zip file and uses Call Home to transmit the file to IBM service.

An event is created so you can track the status on the Events page. The event status initially displays `Calling home`, then changes to either `Call home initiated` (to indicate that the transmission was successful) or `Call home failed` (if Call Home is not correctly configured).

Export usage statistics

Creates a file named <library-name>_drive_statistics_<date>.csv that contains the WWNN ID, model, and serial number for each drive and read/write error information for each drive.

Performing other drive tasks from the CLI

Several drive tasks can only be performed from the TS4500 command-line interface (CLI).

- Customized firmware update that enables you to select specific drives to be updated (`driveCodeUpdate` command)
- View and modify port speeds and topology (`modifyFibreChannelSettings` command)
- Modify loop IDs (`setDrivePortsId` command)

Related reference

- [driveCodeUpdate CLI command](#)
- [modifyFibreChannelSettings CLI command](#)
- [setDrivePortsID CLI command](#)

Ethernet drive initial setup

Follow these steps to prepare an Ethernet drive for use after installation:

1. Specify the network configuration settings for the drive. (Drives > Drives page, Modify iSCSI action)
2. Specify authentication settings for the drive. (Settings > Networking > iSCSI page)
3. Assign the drive to a logical library. This can be done before or after configuring the drive. (Drives > Drives by Logical Library page)

Related information

- [Ethernet drive network configuration](#)
- [iSCSI](#)

Ethernet drive network configuration

Use the Modify iSCSI action from the Drives page to configure an Ethernet drive's network settings and optionally assign a new name or alias to the drive.

Ethernet drives have the following properties:

iSCSI name

Each drive is automatically assigned a default name in the format `naa.<WWNN>`, where `<WWNN>` is a unique identifier assigned by the library to each drive slot. For example, the drive in the slot with the WWNN name of `50:05:07:63:00:19:F2:00` has the iSCSI name `naa.500507630019F200`.

Drives can be renamed, but names must comply with the standards defined in the [Internet Small Computer System Interface \(iSCSI\) Protocol](#) (RFC 7143). Drive names can have a maximum length of 223 characters. All alphabetic characters must be lowercase.

iSCSI alias

Each drive is automatically assigned a default alias in the format Library <serial-number>, Drive F#,C#,R# (for example, Library 13FB002,Drive F2,C3,R1). Aliases can be changed or deleted. An alias has a maximum length of 255 characters.

DHCP

DHCP is enabled by default. When DHCP is enabled, the port 0/port 1 addresses, gateway, and subnet mask fields are blank since these settings are provided by DHCP.

If you disable DHCP, you will need to provide these settings using IPv4 format (for example, 9.1.2.3). You can apply these settings to an individual drive, or to a range of drives by selecting multiple drives from the Drives table.

Each port can be configured separately so that ports in the same drive can be attached to different subnets.

Port 0/Port 1 addresses

Port 0 is required; port 1 is optional.

If multiple drives are selected, enter the starting address for a port and the system will calculate and assign the ending address of the range based on the number of drives selected.

Gateway and subnet mask

Gateway is optional; subnet mask is required.

If multiple drives are selected and all of the selected drives have the same gateway and/or subnet mask, that address is displayed in the corresponding field. Otherwise, the field is blank and the value you enter is applied to all selected drives.

Related CLI commands

- Use the **setISCSI** command to configure a drive's network settings and assign a new name or alias to the drive. You can specify different network settings for each port in a drive with this command, whereas changes made through the GUI are always applied to both ports.
- Use the **setMacAddress** command to change Ethernet port MAC addresses. MAC addresses can only be changed from the CLI, not from the GUI.

Related reference

- [setISCSI CLI command](#)
- [setMacAddress CLI command](#)

Related information

- [Ethernet drive initial setup](#)
- [Ethernet Ports](#)

Drives by Logical Library

Use the Drives by Logical Library page to view drive assignment and usage among all logical libraries, view cleaning cartridge status, assign drives, and manage the logical libraries and their settings.

- [Monitoring drive usage by logical library](#)
The drive usage bar indicates the current drive usage for the logical library. The number on the right of the bar is the total number of drives assigned to the logical library. The bar fills as a percentage of the number of drives that are in use.
- [Monitoring logical library capacity](#)
- [Assigning and unassigning tape drives to a logical library](#)
When a tape drive is installed in the library, by default it is unassigned. All unassigned drives are assigned when a logical library is created using the logical library presets. Any newly added drives can be assigned to an existing logical library individually by first selecting the unassigned drive and then selecting Actions > Assign.
- [Using control path drives](#)
One or more drives can be designated as control path drives.
- [Exporting drive information by logical library](#)
Click the Save icon on the toolbar to view the export options.
- [Performing other drive tasks from the CLI](#)
Several drive tasks can only be performed from the TS4500 command-line interface (CLI).

Monitoring drive usage by logical library

The drive usage bar indicates the current drive usage for the logical library. The number on the right of the bar is the total number of drives assigned to the logical library. The bar fills as a percentage of the number of drives that are in use.

The bar turns red if all of the drives in the logical library are being used. If all of the drives are being used frequently, the logical library could be over-allocated and you should consider adding more drives to the logical library.

Monitoring logical library capacity

You can monitor the logical library capacity from the Cartridges by Logical Library page. If the logical library is near to or at the maximum capacity, either unassign some cartridges or increase the maximum number of cartridges allowed by selecting Actions > Modify Maximum Cartridges.

Related information

- [Cartridges by Logical Library](#)

Assigning and unassigning tape drives to a logical library

When a tape drive is installed in the library, by default it is unassigned. All unassigned drives are assigned when a logical library is created using the logical library presets. Any newly added drives can be assigned to an existing logical library individually by first selecting the unassigned drive and then selecting Actions, > Assign.

A drive must be assigned to a logical library of the same media type. In addition, all drives within a logical library must be managed the same way; either library managed or application managed.

To reassign a drive from one logical library to another, use the Actions, > Reassign option. The drive is automatically unassigned from its current logical library. It is possible to reassign multiple drives simultaneously if they are currently assigned to the same logical library.

To remove a drive from a logical library, first make sure the drive is empty (Actions, > Eject Cartridge) and then select the Actions, > Unassign option. If the drive being unassigned is a control path drive, a different drive must be designated as a control path drive before the original control path drive is unassigned.

Related information

- [Creating logical libraries](#)

Using control path drives

One or more drives can be designated as control path drives.

Select Enable Control Path from the Actions menu to designate a control path drive. Drives that are enabled as control paths are identified with the icon shown in [Figure 1](#). Note that it is possible for a logical library to have no control path drives.

Figure 1. Control path drive icon



Using multiple control paths for any single, configured logical library provides the following benefits:

- Allows access to the logical library by multiple servers
- Provides communication failover so that if one control path fails, host communication for the entire library is not lost
Note: Use the Path Failover feature (feature code 1682) to enable the host device driver to resend a command to an alternate control path for the same logical library.

Access to the logical library is on a first-come, first-served basis. Each control path for a logical library can accept commands while the library is in use by another control path.

Control path drives should not be removed from a logical library that is performing jobs. If the logical library is not actively being used, control path drives can be removed from a logical library only after all non-control path drives have been removed or a different control path drive has been assigned.

Exporting drive information by logical library

Click the Save icon on the toolbar to view the export options.

Export service logs

Creates a file named TS4500_DriveLogs_<drive>_<date-time>.zip that contains drive service logs for the selected drive.

Export usage statistics

Creates a file named <library-name>_drive_statistics_<date>.csv that contains the WWNN ID, model, and serial number for each drive and read/write error information for each drive.

Performing other drive tasks from the CLI

Several drive tasks can only be performed from the TS4500 command-line interface (CLI).

- Customized firmware update that enables you to select specific drives to be updated (driveCodeUpdate command)
- View and modify port speeds and topology (modifyFibreChannelSettings command)
- Modify loop IDs (setDrivePortsId command)

Related reference

- [driveCodeUpdate CLI command](#)
- [modifyFibreChannelSettings CLI command](#)
- [setDrivePortsID CLI command](#)

Fibre Channel Ports

Use the Drives, > Fibre Channel Ports page to modify the port speed and topology for a drive.

- [Fibre channel port properties](#)
The Drives, > Fibre Channel Ports page lists the port properties for each fibre channel drive in the library.
- [Exporting port information](#)
Click the Save icon on the toolbar to view the export options.
- [Performing port tasks from the CLI](#)
The following port tasks can be performed from the TS4500 command-line interface (CLI):

Fibre channel port properties

The Drives, > Fibre Channel Ports page lists the port properties for each fibre channel drive in the library.

Property	Description
Drive	The location of the drive in Fx, Cx, Rx (frame, column, row) format. For example, F1 , C4 , R2 .
Port	The port number (0 or 1).
State	The state of the port. A green icon indicates that communication has been established between the drive and the library. A gray icon indicates that no light was detected on that port.
WWPN	A unique identifier assigned by the library to each drive port.
Speed	The speed of data transmission over the port. Use the Actions, > Modify Speed option to change this setting. <ul style="list-style-type: none">• Auto (default) - Auto-negotiated by the drive and the fiber switch.• 1 Gb/s• 2 Gb/s• 4 Gb/s• 8 Gb/s• 16 Gb/s
Topology	Use the Actions, > Modify Topology option to change this setting. <ul style="list-style-type: none">• Auto-L (default) - Auto-negotiated; try the L port first.• Auto-N - Auto-negotiated; try the N port first.• L Port - Use the L port.• N Port - Use the N port.
Loop ID	A unique value that identifies the position of the drive in the tape library. See Default SCSI ID and Loop ID (AL_PA) Assignments for Drives for more information.

Exporting port information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Ports page.

Export connectivity report

Creates a file that contains information about the current connections between the tape library and the host.

- [Host connectivity report](#)
The host connectivity report is saved to a file named <library-name>_hostconnectivity_<date>.csv.

Host connectivity report

The host connectivity report is saved to a file named <library-name>_hostconnectivity_<date>.csv.

The report contains the following columns:

Drive S/N

The drive serial number shown in the S/N column of the Drives page in the library GUI.

Example: **YD1068012621**

Drive Location

The drive location shown in the Location column of the Drives page in the library GUI.

Example: **F1**, **C4**, **R3**

Last Access Time

Example: **11/15/2017 19:56:12**

The same date/time format is used in the Event CSV.

Drive Port

The port number shown in the Port column of the Fibre Channel Ports page in the library GUI.

One of the following:

- 0
- 1

Transport ID (WWPN / iSCSI Name / ISID)

Examples:

- 50:05:07:63:00:5a:57:ae
- iqn.2016-12.be.fibredev5:initiator,i,0x400001370000

Reservation

One of the following:

- None
- Persist Reserve - Write Exclusive
- Persist Reserve - Exclusive Access
- Persist Reserve - Write Exclusive - Registrants Only
- Persist Reserve - Exclusive Access - Registrants Only
- Persist Reserve - Write Exclusive - All Registrants
- Persist Reserve - Exclusive Access - All Registrants
- SPC-2 Reserve

Host Name

Example: dfrsptsm04.dzbank.vrnet

This field is often empty.

Device Special File Name (DSFN)

Example: IBMtape14

Operating System

Example: Linux

Operating System Version

Example: 2.6.32-642.6.2.el6.x86_64 x86_64

Device Driver Name

Example: lin_tape

Device Driver Version

Example: 3.0.13

Data path failover enabled

One of the following:

- true
- false

Process ID

Example: 0

Performing port tasks from the CLI

The following port tasks can be performed from the TS4500 command-line interface (CLI):

- Set the port IDs for a specified drive (setDrivePortsId)
- Set port speed and topology (modifyFibreChannelSettings)
- Show the Fibre Channel settings for both ports in each drive (viewFibreChannel)

Related reference

- [setDrivePortsID CLI command](#)
- [modifyFibreChannelSettings CLI command](#)
- [viewFibreChannel CLI command](#)

SAS Ports

Use the [Drives, SAS Ports](#) page to view SAS (Serial Attached SCSI) drive properties.

- [SAS port properties](#)
The [Drives, SAS Ports](#) page lists the port properties for each SAS drive in the library.

- [Exporting port information](#)
Click the Save icon on the toolbar to view the export options.

SAS port properties

The Drives, SAS Ports page lists the port properties for each SAS drive in the library.

Property	Description
Drive	The location of the drive in Fx, Cx, Rx (frame, column, row) format. For example, F1, C4, R2 .
Port	The port number (0 or 1).
State	The state of the port. A green icon indicates that communication has been established between the drive and the library over that port. A gray icon indicates that no light was detected on the port.
Address	A unique identifier for the port.
Speed	The speed of data transmission over the port. The speed is auto-negotiated to the highest available speed and cannot be changed. The supported options are: <ul style="list-style-type: none"> • 3 Gb/s • 6 Gb/s • 12 Gb/s
Hashed address	A short ("hashed") version of the port address.

Exporting port information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Ports page.

Export connectivity report

Creates a file that contains information about the current connections between the tape library and the host.

- [Host connectivity report](#)
The host connectivity report is saved to a file named <library-name>_hostconnectivity_<date>.csv.

Host connectivity report

The host connectivity report is saved to a file named <library-name>_hostconnectivity_<date>.csv.

The report contains the following columns:

Drive S/N

The drive serial number shown in the S/N column of the Drives page in the library GUI.

Example: **YD1068012621**

Drive Location

The drive location shown in the Location column of the Drives page in the library GUI.

Example: **F1, C4, R3**

Last Access Time

Example: **11/15/2017 19:56:12**

The same date/time format is used in the Event CSV.

Drive Port

The port number shown in the Port column of the Fibre Channel Ports page in the library GUI.

One of the following:

- 0
- 1

Transport ID (WWPN / iSCSI Name / ISID)

Examples:

- **50:05:07:63:00:5a:57:ae**
- **iqn.2016-12.be.fibredev5:initiator,i,0x400001370000**

Reservation

One of the following:

- **None**
- **Persist Reserve - Write Exclusive**

- **Persist Reserve - Exclusive Access**
- **Persist Reserve - Write Exclusive - Registrants Only**
- **Persist Reserve - Exclusive Access - Registrants Only**
- **Persist Reserve - Write Exclusive - All Registrants**
- **Persist Reserve - Exclusive Access - All Registrants**
- **SPC-2 Reserve**

Host Name

Example: `dfrsptsm04.dzbank.vrnet`

This field is often empty.

Device Special File Name (DSFN)

Example: `IBMtape14`

Operating System

Example: `Linux`

Operating System Version

Example: `2.6.32-642.6.2.el6.x86_64 x86_64`

Device Driver Name

Example: `lin_tape`

Device Driver Version

Example: `3.0.13`

Data path failover enabled

One of the following:

- `true`
- `false`

Process ID

Example: `0`

Ethernet Ports

Use the [Drives > Ethernet Ports](#) page to view the settings for Ethernet drive ports and export the table data.

- [Ethernet port properties](#)
The [Drives > Ethernet Ports](#) page lists the port properties for each Ethernet drive in the library.
- [Exporting port information](#)
Click the Save icon on the toolbar to view the export options.

Ethernet port properties

The [Drives > Ethernet Ports](#) page lists the port properties for each Ethernet drive in the library.

Property	Description
Drive	The location of the drive in Fx, Cx, Rx (frame, column, row) format. For example, <code>F1, C4, R2</code> .
Port	The port number (0 or 1).
State	The state of the port. A green icon indicates that communication has been established between the drive and the library. A gray icon indicates that no light was detected on that port.
IP address	The IP address for the drive.
iSCSI name	A unique network identifier for the drive. See Ethernet drive network configuration for more information.
iSCSI alias	A unique network identifier for the drive. See Ethernet drive network configuration for more information.
Gateway	The gateway network address.
Subnet	The subnet network address.
MAC address	A unique network identifier for the drive.
Speed	The speed of data transmission over the port.

Exporting port information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named `export.csv` that contains the information displayed in the Ports page.

Export connectivity report

Creates a file that contains information about the current connections between the tape library and the host.

- [Host connectivity report](#)

The host connectivity report is saved to a file named <library-name>_hostconnectivity_<date>.csv.

Host connectivity report

The host connectivity report is saved to a file named <library-name>_hostconnectivity_<date>.csv.

The report contains the following columns:

Drive S/N

The drive serial number shown in the S/N column of the Drives page in the library GUI.

Example: **YD1068012621**

Drive Location

The drive location shown in the Location column of the Drives page in the library GUI.

Example: **F1,C4,R3**

Last Access Time

Example: **11/15/2017 19:56:12**

The same date/time format is used in the Event CSV.

Drive Port

The port number shown in the Port column of the Fibre Channel Ports page in the library GUI.

One of the following:

- **0**
- **1**

Transport ID (WWPN / iSCSI Name / ISID)

Examples:

- **50:05:07:63:00:5a:57:ae**
- **iqn.2016-12.be.fibredev5:initiator,i,0x400001370000**

Reservation

One of the following:

- **None**
- **Persist Reserve - Write Exclusive**
- **Persist Reserve - Exclusive Access**
- **Persist Reserve - Write Exclusive - Registrants Only**
- **Persist Reserve - Exclusive Access - Registrants Only**
- **Persist Reserve - Write Exclusive - All Registrants**
- **Persist Reserve - Exclusive Access - All Registrants**
- **SPC-2 Reserve**

Host Name

Example: **dfrsptsm04.dzbank.vrnet**

This field is often empty.

Device Special File Name (DSFN)

Example: **IBMtape14**

Operating System

Example: **Linux**

Operating System Version

Example: **2.6.32-642.6.2.el6.x86_64 x86_64**

Device Driver Name

Example: **lin_tape**

Device Driver Version

Example: **3.0.13**

Data path failover enabled

One of the following:

- **true**
- **false**

Process ID

Example: **0**

Cartridges

The TS4500 management GUI pages under the Cartridges icon enable you to view cartridges at large, view cartridges by logical library, assign and move cartridges, and modify logical libraries.

- **Cartridges**
Use the Cartridges page to move cartridges to a different location, remove cartridges to an I/O station, assign or cartridges to a logical library, or unassign cartridges from a logical library.
- **Cartridges by Logical Library**
Use the Cartridges by Logical Library page to create and manage logical libraries, and assign, unassign, or move cartridges.
- **VOLSER Ranges**
Volume serial (VOLSER) ranges are used to assign cartridges to specific logical libraries. You can view a list of all VOLSER ranges in the library, search for VOLSERs, and create, modify, and delete VOLSER ranges on the VOLSER Ranges page.
- **VOLSER Ranges by Logical Library**
Volume serial (VOLSER) ranges are used to automatically assign cartridges to specific logical libraries. You can create the ranges when you create your logical libraries or you can create, modify, and reassign the ranges on the VOLSER Ranges by Logical Library page.

Cartridges

Use the Cartridges page to move cartridges to a different location, remove cartridges to an I/O station, assign or cartridges to a logical library, or unassign cartridges from a logical library.

- **Searching for cartridges**
Use either the Cartridges page or the Cartridges by Logical Library page to find specific cartridges.
- **Viewing cleaning cartridge status**
IBM® supplies a cleaning cartridge with the first frame of each media type in a library. The library uses the cleaning cartridge to automatically clean tape drives as needed to maintain the efficiency of the tape drives. Each cleaning cartridge can be used 50 times.
- **Cartridge states**
The State column in the Cartridges table lists the current state for each cartridge. The following states are possible:
- **Assigning or unassigning cartridges**
A bar code label with a volume serial (VOLSER) number is affixed to each cartridge. Cartridges are assigned to a logical library with VOLSER ranges that are defined when the logical library is created. If the VOLSER range that is assigned to a logical library matches the VOLSER of a cartridge, that cartridge is assigned to the logical library. If the VOLSER of a newly inserted cartridge does not match the VOLSER range of a logical library, the cartridge is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge. VOLSER ranges were called the Cartridge Assignment Policy with the TS3500 tape library.
- **Fixing a tape with an unknown VOLSER**
Many tape management applications use Standard Label tape processing. The VOLSER number on the bar code label must match the VOLSER written to the tape to maintain compatibility with this type of processing. If a tape's VOLSER is unknown, you are not able to use it until a VOLSER is established.
- **Moving cartridges**
At times, you might 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 actions on the Cartridges or Cartridges by Logical Library page to move one or more cartridges to continue the operation.
- **Exporting cartridge information**
Click the Save icon on the toolbar to view the export options.
- **Performing other cartridge tasks from the CLI**
The following cartridge tasks can be performed only from the TS4500 command-line interface (CLI):

Searching for cartridges

Use either the Cartridges page or the Cartridges by Logical Library page to find specific cartridges.

To search for specific cartridges, either:

- Use the Cartridges page to find the cartridges and view their state (slot, I/O slot, drive, or gripper). Sort the table to locate specific tape cartridges. You can sort by VOLSER, state, location, logical library, element address, or most recent use.
- Use the Cartridges by Logical Library page to see the cartridges displayed by their logical library. Sort the table to locate specific tape cartridges within a specific logical library. You can sort by VOLSER, state, location, element address, or most recent use.

Search for specific cartridges by using the filter. Click Filter and enter a value in the search field or click the Advanced Filter icon at the right end of the search field to enter extended search criteria. Enter substrings if the entire value is unknown. Wildcard characters are not supported. In place of wildcard characters, you can add more substrings to the search by clicking the + icon at the end of each criterion. Search values are not case-sensitive.

Viewing cleaning cartridge status

IBM® supplies a cleaning cartridge with the first frame of each media type in a library. The library uses the cleaning cartridge to automatically clean tape drives as needed to maintain the efficiency of the tape drives. Each cleaning cartridge can be used 50 times.

You can view how many cleans remain on a cleaning cartridge from:

- The Cartridges page, under the Cleans Remaining column. This column is hidden by default. Right-click the table header to add the column to the table.
- The Cartridges by Logical Library page, at the end of the list of logical libraries.

You can optionally have expired cleaning cartridges automatically ejected. To enable this feature, go to the Settings_>Library and click the Cleaning Cartridges tab.

Note: Cleaning cartridges are shared between logical libraries.

Cartridge states

The State column in the Cartridges table lists the current state for each cartridge. The following states are possible:

Drive

The cartridge is in a tape drive.

Gripper

The cartridge is in the gripper of a cartridge accessor.

I/O Slot (Import Queued)

The cartridge is in an I/O slot but is queued to be moved to a storage slot.

I/O Slot

The cartridge was moved to an I/O station. This state is cleared if the cartridge is moved by the operator to any other location, including a different I/O slot.

Slot

The cartridge is in a storage slot.

Slot (Assignment Pending)

The cartridge is in the Unassigned logical library because an empty import/export element (IEE) address is not currently available for assignment.

Slot (Export Queued)

The cartridge is queued to be moved from a slot to an I/O station.

Slot (Virtual I/O)

The cartridge was imported (physically moved) into the slot, but is still in the VIO element address space and has not been queued for export.

Assigning or unassigning cartridges

A bar code label with a volume serial (VOLSER) number is affixed to each cartridge. Cartridges are assigned to a logical library with VOLSER ranges that are defined when the logical library is created. If the VOLSER range that is assigned to a logical library matches the VOLSER of a cartridge, that cartridge is assigned to the logical library. If the VOLSER of a newly inserted cartridge does not match the VOLSER range of a logical library, the cartridge is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge. VOLSER ranges were called the Cartridge Assignment Policy with the TS3500 tape library.

You can modify what cartridges are assigned to a logical library by modifying the VOLSER range of the logical library from the VOLSER Ranges by Logical Library page.

If an individual cartridge is outside of a VOLSER range, it is possible to use the Assign action to assign that cartridge to a specific logical library. However, creating VOLSER ranges is the preferred method for assigning cartridges to logical libraries.

To assign or reassign cartridges to a logical library, highlight one or more cartridges from the same logical library and then select Actions_>Assign. You can bulk assign all available or unassigned cartridges from the Cartridges by Logical Library page by highlighting the Available or Unassigned cartridges rows and selecting Actions_>Assign All Cartridges.

The Use the VOLSER ranges of the logical library check box in the Assign Cartridges window is selected by default so that cartridges are automatically assigned to logical libraries based on their VOLSERs. Clear the check box to manually select a logical library for the cartridge or cartridges.

Note: If the new cartridge assignments exceed the maximum number of cartridges that are allowed by a logical library, any additional cartridges will be unassigned. Go to the Logical Libraries page to modify the maximum number of cartridges that are allowed, and then try the cartridge assignment again.

Select Actions_>Unassign to unassign one or more cartridges, however this action might result in synchronization problems with the application. To avoid this scenario, the preferred method is to use the application to eject cartridges.

Fixing a tape with an unknown VOLSER

Many tape management applications use Standard Label tape processing. The VOLSER number on the bar code label must match the VOLSER written to the tape to maintain compatibility with this type of processing. If a tape's VOLSER is unknown, you are not able to use it until a VOLSER is established.

If a tape has an unknown VOLSER, select Actions_>Fix Unknown VOLSER to apply a new VOLSER number to the tape. Enter the first 6 characters of the volume serial number and then add the last 2 characters that specify the cartridge type. [Table 1](#) shows the possible cartridge type values.

Table 1. Cartridge types

Media	Cartridge type
LTO media	L8, LY, L7, LX, L6, LW, L5, LV, L4, LU, L3, or LT
3592 media	JB, JC, JD, JE, JK, JL, JM, JV, JX, JY, or JZ

When you click Fix, the cartridge is automatically assigned to the logical library that includes the VOLSER range that contains the VOLSER of the fixed cartridge.

Note: This action might result in synchronization problems with the application. An audit type of action for your application might be required for your application.

Moving cartridges

At times, you might 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 actions on the Cartridges or Cartridges by Logical Library page to move one or more cartridges to continue the operation.

Select Actions_>Move_>To Drive, Actions_>Move_>To Slot, or Actions_>Move_>To I/O Slot depending on where you want to move the cartridge.

Note: Using the Cartridges or Cartridges by Logical Library page to move cartridges might result in synchronization problems with the application. To avoid this scenario, the preferred method is to use the application to move cartridges.

Exporting cartridge information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Cartridges page.

Export mount history

Creates the mount history report.

- [Mount history report](#)

The mount history report is saved to a file named <library-name>_mount_history_<date>.csv.

Mount history report

The mount history report is saved to a file named <library-name>_mount_history_<date>.csv.

The report contains the following information:

Date and Time

The date and time that the cartridge was mounted into the drive, in the format `yyyy mm dd hh:nn.ss`.

VolSer

The volume serial number of the cartridge (also known as the VOLSER). The VOLSER is a unique identifier. Ignore the underscore that precedes the VOLSER.

Frame

The number of the library frame from which the cartridge was demounted. Beginning with the base frame, frames are numbered 1 - 4, from left to right.

Drive

The number of the drive from which the cartridge was demounted. Drives are numbered 1 - 16.

LogLib

The name of the logical library to which the cartridge was assigned.

EAddr

The SCSI element address of the drive from which the cartridge was demounted.

Mount Media Write

The total amount of data, in MB, that is written by the drive on that mount.

Mount Media Read

The total amount of data, in MB, that is read by the drive on that mount.

Mount Host Write

The total amount of data, in MB, that is written through the host on that mount.

Mount Host Read

The total amount of data, in MB, that is read through the host on that mount.

Mount Drive Residency

The number of minutes the tape cartridge remained in the tape drive during the mount.

Mount Tape Alert Media

The TapeAlerts (if any) set during that mount.

A maximum of four TapeAlerts are reported in one string with no spaces. Single-digit TapeAlerts include a leading zero. For example, TapeAlerts 5, 12, 29, and 60 would be reported as `05122960`.

Life Mounts Media

The number of times the cartridge has been mounted to a drive since it was manufactured.

Life WRetries Media

During the life of the cartridge, the number of errors that occurred when drives retried write operations.

Life WPerms Media

During the life of the cartridge, the number of permanent, unrecoverable errors that occurred when drives performed write operations.

Life RRetries Media

During the life of the cartridge, the number of errors that occurred when drives retried read operations.

Life RPerms Media

During the life of the cartridge, the number of permanent, unrecoverable errors that occurred when drives performed read operations.

Mount Rating Drive

The overall measure of the condition of the drive. `X'00'` is unknown. The value ranges from `X'01'` (best) to `X'FF'` (worst). This is a rating of the efficiency of the drive.

Mount Rating Media

The overall measure of the condition of the cartridge that is mounted. `X'00'` is unknown. The value ranges from `X'01'` (best) to `X'FF'` (worst). This is a rating of the efficiency of the cartridge.

Mount Rating Ports

The overall measure of the condition of the interface to the host server. X'00' is unknown. The value ranges from X'01' (best) to X'FF' (worst). This is a rating of the efficiency of the interface.

Mount Rating Port0

The overall measure of the condition of the Port 0 interface to the host server. X'00' is unknown. The value ranges from X'01' (best) to X'FF' (worst). This is a rating of the efficiency of the Port 0 interface.

Mount Rating Port1

The overall measure of the condition of the Port 1 interface to the host server. X'00' is unknown. The value ranges from X'01' (best) to X'FF' (worst). This is a rating of the efficiency of the Port 1 interface.

Mount Rating Rsvd

Reserved for the library interface.

Mount Write Perf

The ratio of performance write commands with respect to all write-type commands. This is a measure of the efficiency of write performance. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Write ERPs

The measure of how the data rate performance impacts the error-recovery procedures (ERPs) on write operations. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Write Burst

For write operations, the measure of the comparison between the window tape buffer rate to the average rate. The window rate is the amount of data moved divided by the time when ready in the mode (when data could be moved, but is not). The average rate is the amount of data moved divided by the overall time in the mode (including setup, overhead, and so forth). The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Write Buffer

The average tape-buffer efficiency on write operations. This is streaming write efficiency. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Read Perf

The ratio of performance read commands with respect to all read-type commands. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Read ERPs

The measure of how the data rate performance impacts the error-recovery procedures (ERPs) on read operations. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Read Burst

For read operations, the measure of the comparison between the window tape buffer rate to the average rate. The window rate is the amount of data moved divided by the time when ready in the mode (when data could be moved, but is not). The average rate is the amount of data moved divided by the overall time in the mode (including setup, overhead, and so forth). The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Read Buffer

The average tape-buffer efficiency on read operations. This is streaming read efficiency. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Capacity Total

The measure of the efficiency of static capacity. This can be viewed as the percentage of recorded media that fits into the currently recorded area with respect to how much data can ideally fit in that area. The lower the percentage, the less capacity is available (due to recording error recovery, media defects, and so forth).

Mount Capacity Writes

The measure of the efficiency of active capacity on write commands. This can be viewed as the sum of efficiency for write operations on this mount. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Capacity Control

The measure of the efficiency of active capacity on all other operations. The value is given as a percentage. A high percentage is best; a low percentage is worst.

Mount Crypto Status

Whether a cartridge is encrypted. Values are 1 (the media contains encrypted data), 0 (the media does not contain encrypted data), or a blank space if the drive was unable to determine whether the media contains encrypted data.

Crypto Rekey

Whether a cartridge has been rekeyed. Values are 1 (the cartridge was rekeyed during the last mount) or 0 (the cartridge was not rekeyed during the last mount).

Performing other cartridge tasks from the CLI

The following cartridge tasks can be performed only from the TS4500 command-line interface (CLI):

- Prestage to cartridge cache (prestageDataCartridges command)
- Destage from cartridge cache (destageDataCartridges command)

Related reference

- [prestageDataCartridges CLI command](#)
- [destageDataCartridges CLI command](#)

Cartridges by Logical Library

Use the Cartridges by Logical Library page to create and manage logical libraries, and assign, unassign, or move cartridges.

- [Searching for cartridges](#)
Use either the Cartridges page or the Cartridges by Logical Library page to find specific cartridges.
- [Viewing cleaning cartridge status](#)
IBM® supplies a cleaning cartridge with the first frame of each media type in a library. The library uses the cleaning cartridge to automatically clean tape drives as needed to maintain the efficiency of the tape drives. Each cleaning cartridge can be used 50 times.
- [Assigning or unassigning cartridges](#)
A bar code label with a volume serial (VOLSER) number is affixed to each cartridge. Cartridges are assigned to a logical library with VOLSER ranges that are defined when the logical library is created. If the VOLSER range that is assigned to a logical library matches the VOLSER of a cartridge, that cartridge is assigned to the logical library. If the VOLSER of a newly inserted cartridge does not match the VOLSER range of a logical library, the cartridge is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge. VOLSER ranges were called the Cartridge Assignment Policy with the TS3500 tape library.
- [Moving cartridges](#)
At times, you might 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 actions on the Cartridges or Cartridges by Logical Library page to move one or more cartridges to continue the operation.
- [Exporting cartridge information](#)
Click the Save icon on the toolbar to view the export options.
- [Performing other cartridge tasks from the CLI](#)
The following cartridge tasks can be performed only from the TS4500 command-line interface (CLI):

Related information

- [Logical Libraries](#)

Searching for cartridges

Use either the Cartridges page or the Cartridges by Logical Library page to find specific cartridges.

To search for specific cartridges, either:

- Use the Cartridges page to find the cartridges and view their state (slot, I/O slot, drive, or gripper). Sort the table to locate specific tape cartridges. You can sort by VOLSER, state, location, logical library, element address, or most recent use.
- Use the Cartridges by Logical Library page to see the cartridges displayed by their logical library. Sort the table to locate specific tape cartridges within a specific logical library. You can sort by VOLSER, state, location, element address, or most recent use.

Search for specific cartridges by using the filter. Click Filter and enter a value in the search field or click the Advanced Filter icon at the right end of the search field to enter extended search criteria. Enter substrings if the entire value is unknown. Wildcard characters are not supported. In place of wildcard characters, you can add more substrings to the search by clicking the + icon at the end of each criterion. Search values are not case-sensitive.

Viewing cleaning cartridge status

IBM® supplies a cleaning cartridge with the first frame of each media type in a library. The library uses the cleaning cartridge to automatically clean tape drives as needed to maintain the efficiency of the tape drives. Each cleaning cartridge can be used 50 times.

You can view how many cleans remain on a cleaning cartridge from:

- The Cartridges page, under the Cleans Remaining column. This column is hidden by default. Right-click the table header to add the column to the table.
- The Cartridges by Logical Library page, at the end of the list of logical libraries.

You can optionally have expired cleaning cartridges automatically ejected. To enable this feature, go to the Settings_>Library and click the Cleaning Cartridges tab.

Note: Cleaning cartridges are shared between logical libraries.

Assigning or unassigning cartridges

A bar code label with a volume serial (VOLSER) number is affixed to each cartridge. Cartridges are assigned to a logical library with VOLSER ranges that are defined when the logical library is created. If the VOLSER range that is assigned to a logical library matches the VOLSER of a cartridge, that cartridge is assigned to the logical library. If the VOLSER of a newly inserted cartridge does not match the VOLSER range of a logical library, the cartridge is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge. VOLSER ranges were called the Cartridge Assignment Policy with the TS3500 tape library.

You can modify what cartridges are assigned to a logical library by modifying the VOLSER range of the logical library from the VOLSER Ranges by Logical Library page.

If an individual cartridge is outside of a VOLSER range, it is possible to use the Assign action to assign that cartridge to a specific logical library. However, creating VOLSER ranges is the preferred method for assigning cartridges to logical libraries.

To assign or reassign cartridges to a logical library, highlight one or more cartridges from the same logical library and then select Actions_>Assign. You can bulk assign all available or unassigned cartridges from the Cartridges by Logical Library page by highlighting the Available or Unassigned cartridges rows and selecting Actions_>Assign All Cartridges.

The Use the VOLSER ranges of the logical library check box in the Assign Cartridges window is selected by default so that cartridges are automatically assigned to logical libraries based on their VOLSERS. Clear the check box to manually select a logical library for the cartridge or cartridges.

Note: If the new cartridge assignments exceed the maximum number of cartridges that are allowed by a logical library, any additional cartridges will be unassigned. Go to the Logical Libraries page to modify the maximum number of cartridges that are allowed, and then try the cartridge assignment again.

Select Actions > Unassign to unassign one or more cartridges, however this action might result in synchronization problems with the application. To avoid this scenario, the preferred method is to use the application to eject cartridges.

Moving cartridges

At times, you might 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 actions on the Cartridges or Cartridges by Logical Library page to move one or more cartridges to continue the operation.

Select Actions > Move > To Drive, Actions > Move > To Slot, or Actions > Move > To I/O Slot depending on where you want to move the cartridge.

Note: Using the Cartridges or Cartridges by Logical Library page to move cartridges might result in synchronization problems with the application. To avoid this scenario, the preferred method is to use the application to move cartridges.

Exporting cartridge information

Click the Save icon on the toolbar to view the export options.

Export table data

Creates a file named export.csv that contains the information displayed in the Cartridges page.

Export mount history

Creates the mount history report.

- [Mount history report](#)

The mount history report is saved to a file named <library-name>_mount_history_<date>.csv.

Performing other cartridge tasks from the CLI

The following cartridge tasks can be performed only from the TS4500 command-line interface (CLI):

- Prestage to cartridge cache (prestageDataCartridges command)
- Destage from cartridge cache (destageDataCartridges command)

Related reference

- [prestageDataCartridges CLI command](#)
- [destageDataCartridges CLI command](#)

VOLSER Ranges

Volume serial (VOLSER) ranges are used to assign cartridges to specific logical libraries. You can view a list of all VOLSER ranges in the library, search for VOLSERS, and create, modify, and delete VOLSER ranges on the VOLSER Ranges page.

- [Using VOLSER ranges](#)

When you insert a cartridge into the library and its VOLSER is within a range that is assigned to a certain logical library, the cartridge is assigned to that logical library. The cartridge must be of the same media type as that logical library. For example, if you create a logical library that is called LogicalLibrary1 for VOLSERS that range from ABC000 to ABC999 (a library of LTO drives), and then you insert a cartridge with VOLSER ABC123, the library recognizes that VOLSER as belonging to the range and assigns it to LogicalLibrary1. If you insert a cartridge that is outside of any VOLSER ranges, it is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge.

- [Creating, modifying, or deleting VOLSER ranges](#)

To create or modify a VOLSER range, highlight a logical library and select Actions > Create VOLSER Range or Actions > Modify VOLSER Range. Enter the start and end VOLSERS for the range and click Create or Modify. Any cartridges that belong to that VOLSER range are automatically assigned, except for cartridges that are in the process of being exported. If the reassignment exceeds the maximum cartridge capacity of the new or modified logical library, any excess cartridges are automatically unassigned.

Related information

- [Logical Libraries](#)

Using VOLSER ranges

When you insert a cartridge into the library and its VOLSER is within a range that is assigned to a certain logical library, the cartridge is assigned to that logical library. The cartridge must be of the same media type as that logical library. For example, if you create a logical library that is called LogicalLibrary1 for VOLSERS that range from

ABC000 to ABC999 (a library of LTO drives), and then you insert a cartridge with VOLSER ABC123, the library recognizes that VOLSER as belonging to the range and assigns it to LogicalLibrary1. If you insert a cartridge that is outside of any VOLSER ranges, it is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge.

Within a physical TS4500 tape library, a maximum of 600 VOLSER ranges can be created between all logical libraries.

Creating, modifying, or deleting VOLSER ranges

To create or modify a VOLSER range, highlight a logical library and select **Actions > Create VOLSER Range** or **Actions > Modify VOLSER Range**. Enter the start and end VOLSERs for the range and click **Create** or **Modify**. Any cartridges that belong to that VOLSER range are automatically assigned, except for cartridges that are in the process of being exported. If the reassignment exceeds the maximum cartridge capacity of the new or modified logical library, any excess cartridges are automatically unassigned.

You can reassign a VOLSER range to a different logical library of the same media type by highlighting the range (or ranges) and selecting **Actions > Reassign VOLSER Range**. Any cartridges that belong to that VOLSER range are automatically reassigned. If the reassignment exceeds the maximum cartridge capacity of the new logical library, any excess cartridges are automatically unassigned.

To delete a VOLSER range, highlight the range and select **Actions > Delete VOLSER Range**. If any cartridges are assigned to the range, they are automatically unassigned.

Note: Any action that causes cartridge assignments to change can result in application synchronization problems. To avoid this scenario, first use the application to eject any cartridges that are assigned to the selected VOLSER range.

VOLSER Ranges by Logical Library

Volume serial (VOLSER) ranges are used to automatically assign cartridges to specific logical libraries. You can create the ranges when you create your logical libraries or you can create, modify, and reassign the ranges on the VOLSER Ranges by Logical Library page.

- [Using VOLSER ranges](#)

When you insert a cartridge into the library and its VOLSER is within a range that is assigned to a certain logical library, the cartridge is assigned to that logical library. The cartridge must be of the same media type as that logical library. For example, if you create a logical library that is called LogicalLibrary1 for VOLSERs that range from ABC000 to ABC999 (a library of LTO drives), and then you insert a cartridge with VOLSER ABC123, the library recognizes that VOLSER as belonging to the range and assigns it to LogicalLibrary1. If you insert a cartridge that is outside of any VOLSER ranges, it is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge.

- [Creating, modifying, or deleting VOLSER ranges](#)

To create or modify a VOLSER range, highlight a logical library and select **Actions > Create VOLSER Range** or **Actions > Modify VOLSER Range**. Enter the start and end VOLSERs for the range and click **Create** or **Modify**. Any cartridges that belong to that VOLSER range are automatically assigned, except for cartridges that are in the process of being exported. If the reassignment exceeds the maximum cartridge capacity of the new or modified logical library, any excess cartridges are automatically unassigned.

Related information

- [Cartridges](#)
- [Logical Libraries](#)

Using VOLSER ranges

When you insert a cartridge into the library and its VOLSER is within a range that is assigned to a certain logical library, the cartridge is assigned to that logical library. The cartridge must be of the same media type as that logical library. For example, if you create a logical library that is called LogicalLibrary1 for VOLSERs that range from ABC000 to ABC999 (a library of LTO drives), and then you insert a cartridge with VOLSER ABC123, the library recognizes that VOLSER as belonging to the range and assigns it to LogicalLibrary1. If you insert a cartridge that is outside of any VOLSER ranges, it is available to be imported into any logical library of the same media type. The assignment is then determined by the first application to import the cartridge.

Within a physical TS4500 tape library, a maximum of 600 VOLSER ranges can be created between all logical libraries.

Creating, modifying, or deleting VOLSER ranges

To create or modify a VOLSER range, highlight a logical library and select **Actions > Create VOLSER Range** or **Actions > Modify VOLSER Range**. Enter the start and end VOLSERs for the range and click **Create** or **Modify**. Any cartridges that belong to that VOLSER range are automatically assigned, except for cartridges that are in the process of being exported. If the reassignment exceeds the maximum cartridge capacity of the new or modified logical library, any excess cartridges are automatically unassigned.

You can reassign a VOLSER range to a different logical library of the same media type by highlighting the range (or ranges) and selecting **Actions > Reassign VOLSER Range**. Any cartridges that belong to that VOLSER range are automatically reassigned. If the reassignment exceeds the maximum cartridge capacity of the new logical library, any excess cartridges are automatically unassigned.

To delete a VOLSER range, highlight the range and select **Actions > Delete VOLSER Range**. If any cartridges are assigned to the range, they are automatically unassigned.

Note: Any action that causes cartridge assignments to change can result in application synchronization problems. To avoid this scenario, first use the application to eject any cartridges that are assigned to the selected VOLSER range.

Access

The TS4500 management GUI pages under the Access icon enable you to view, create, and assign users and their roles.

Note: The options and actions under the Access icon are available only to users with the administrator role.

- [Users](#)
Each person who accesses the library should have their own user account. Password protection is always enabled and all users are required to sign in with a user name and password.
- [Roles](#)
Roles define which management GUI pages users can view and what actions they can perform.

Users

Each person who accesses the library should have their own user account. Password protection is always enabled and all users are required to sign in with a user name and password.

Users can be managed and authenticated either locally (with accounts restricted to a specific tape library) or remotely (using a remote authentication server that allows you to manage user accounts across multiple systems).

- [Managing local users](#)
If remote authentication is not enabled, the library maintains a database of user names with corresponding passwords and roles. User accounts are stored on the tape library and are not shared with other systems.
- [Creating a local user account](#)
If remote authentication is not being used, each person who accesses the management GUI must have a local user account. Each user account is mapped to a role that defines what pages the user can view and what actions they can perform.
- [Managing remote users](#)
When remote authentication is enabled, user accounts are created and managed on a remote authentication server (LDAP or Kerberos) and then mapped to a predefined library role that determines the user's access level. Authentication requests are passed to the remote authentication server.
- [IMC access by a local user](#)
In some environments, it is possible to rely on the physical security of the data center as the default operating mode. In this scenario, the TS4500 tape library allows a local user to access the TS4500 integrated management console (IMC) without logging in, enabling quick access to the System Summary view of the TS4500 management GUI.
- [Modifying your own or resetting a user's password](#)
Any user can modify their own password by clicking their user name at the upper right corner of the page and selecting Modify Password.
- [What if I get locked out?](#)
If you get locked out of the management GUI, you can revert to the default administrator user name and password by selecting the Access Recovery button at the front of the server.

Managing local users

If remote authentication is not enabled, the library maintains a database of user names with corresponding passwords and roles. User accounts are stored on the tape library and are not shared with other systems.

A tape library can have up to 80 local users.

To create and manage local user accounts, use the Access_>Users page from the management GUI. From this page you can:

- View all local users and their properties, including their state (**Connected** or **Disconnected**), their role, their email address, and the date and time of their last login. The page also indicates if the user is locked out because of too many invalid login attempts.
- Create a new local user account. (You can't create a local user from the GUI if remote authentication is enabled, but you can using the `createUser` CLI command.)
- Change a user's email address
- Change a user's role
- Reset a user's password
- Disconnect a user
- Delete a user
- View a user's IP address (Actions_>Connections)

You can also use CLI commands to manage users:

- Create a local user (`createUser` command).
- Delete a local user (`deleteUsers` command).
- View all remote or local users (`viewUsers`). This command returns the same information as the GUI Users page.

Related concepts

- [Creating a local user account](#)

Related reference

- [createUser CLI command](#)
- [deleteUser CLI command](#)
- [viewUsers CLI command](#)

Creating a local user account

If remote authentication is not being used, each person who accesses the management GUI must have a local user account. Each user account is mapped to a role that defines what pages the user can view and what actions they can perform.

If remote authentication is enabled, users must be added on the remote authentication server.

Note: You can use the **createUser** CLI command to create local users when remote authentication is enabled. Follow these steps to add a local user from the management GUI:

1. Select **Access > Users**. The Users page displays.
2. Click **Create User**. The Create User window displays.
3. Enter a name for the user and specify a role.
4. Enter the user's email address (optional). If you specify an email address, it can be used for password resets and email notifications.
5. Assign a temporary password for the user. Users are prompted to specify a new password the first time they log in.
 - To have a system-generated password emailed to the user, specify an email address and check the **Send password to this email check box**.
 - To create the password yourself, uncheck the **Send password to this email check box** and enter the password in the provided fields.
6. Click **Create**.

Related information

- [Role descriptions](#)

Managing remote users

When remote authentication is enabled, user accounts are created and managed on a remote authentication server (LDAP or Kerberos) and then mapped to a predefined library role that determines the user's access level. Authentication requests are passed to the remote authentication server.

When remote authentication is enabled, the **Access > Users** page displays users who are defined on the remote authentication server and currently connected to the library. From this page you can:

- View remote users and their properties, including their state (only users with a **Connected** state are displayed), their role, their email address, and the date and time of their last login. You cannot view local users.
- Disconnect a user.
- View a user's IP address (**Actions > Connections**).

You can use CLI commands to perform functions that cannot be performed from the GUI when remote authentication is enabled:

- Create a local user (**createUser** command).
- Delete a local user (**deleteUser** command).
- View all users who are currently connected to the library, either remote or local depending on command options (**viewUsers** command).

Related reference

- [createUser CLI command](#)
- [deleteUser CLI command](#)
- [viewUsers CLI command](#)

Related information

- [Remote authentication](#)

IMC access by a local user

In some environments, it is possible to rely on the physical security of the data center as the default operating mode. In this scenario, the TS4500 tape library allows a local user to access the TS4500 integrated management console (IMC) without logging in, enabling quick access to the System Summary view of the TS4500 management GUI.

A preset local user called "localGUI," with the role of Monitor, is enabled by default. This is the only local user that is valid when remote authentication is enabled.

Note: If the "localGUI" user is deleted, all users will be required to log in at the IMC.

To disable this local user login function and show the login screen at the IMC, go to **Settings > Security > Password and Session Policy** and turn off the **Automatic IMC (local GUI) login at power on setting**.

Related information

- [Password and session policy](#)

Modifying your own or resetting a user's password

Any user can modify their own password by clicking their user name at the upper right corner of the page and selecting **Modify Password**.

Administrators can reset another user's password in the event a user lost or forgot their password. If the user has an email address in the system, a temporary password is automatically sent to them. If a user does not have an email address in the system, an administrator must create a temporary password for the user and contact the user

with the password information.

Related tasks

- [Changing your password](#)

What if I get locked out?

If you get locked out of the management GUI, you can revert to the default administrator user name and password by selecting the Access Recovery button at the front of the server.

This reset should be used for emergencies only, such as if the remote authentication server is down or if an administrator loses or forgets their password and no administrators can access the system.

Related concepts

- [Display panel](#)

Roles

Roles define which management GUI pages users can view and what actions they can perform.

- [Managing roles](#)
The library has four preset roles, each with different levels of access to the management GUI. You can create up to 16 new roles, each with a custom name and one of the preset access levels. All roles have access to all logical libraries.
- [Role descriptions](#)
The library has four preset roles, each with a different level of access to the management GUI. You can create additional custom roles based on one of the four preset roles.

Managing roles

The library has four preset roles, each with different levels of access to the management GUI. You can create up to 16 new roles, each with a custom name and one of the preset access levels. All roles have access to all logical libraries.

From the management GUI, use the Access > Roles page to manage roles. From this page you can:

- View the current roles and the number of users mapped to each role.
- View the properties of each role – specifically, a list of management GUI pages and whether users with that role can view or edit the information on that page. You cannot change a role's access levels from the management GUI, but you can do it from the CLI.
- Create a new role. You will be prompted to enter a name for the role and one of the four preset roles to determine the access level.
- Delete a role. You cannot delete a preset role, and you cannot delete a custom role that has users assigned to it.

You can use CLI commands to:

- View the current roles and the number of mapped users (**viewRoles**).
- View a role's access levels (**viewRolePermissions**).
- Change a role's access levels (**setRolePermissions**).

Related reference

- [setRolePermissions CLI command](#)
- [viewRolePermissions CLI command](#)
- [viewRoles CLI command](#)

Role descriptions

The library has four preset roles, each with a different level of access to the management GUI. You can create additional custom roles based on one of the four preset roles.

Monitor

Users mapped to this role can view all physical and library data, but cannot view user accounts or security settings. This role is useful for library operators.

Superuser

Users mapped to this role can view all pages and perform library tasks, but cannot manage users, modify security settings, or access service-related functions.

Administrator

Users mapped to this role can perform all library tasks, including managing access and security, but cannot access service-related functions.

Service

Users mapped to this role can view all pages that are available to a Monitor, in addition to performing service-related functions such as updating firmware, downloading logs, calibrating library components, and performing diagnostic tests. This role is useful for IBM® service representatives.

Users with this role are able to view pages and perform functions that are not available to users with other roles.

Custom

Users mapped to a role with a customized name can view all of the pages that are available to the selected preset permission level of the custom role. The permissions of a custom role with Service-level access cannot be modified.

Settings

Use the TS4500 management GUI pages under the Settings icon to manage system notifications, and network, encryption, and date settings.

- [Library](#)
Use the Library page to set the date and time of your library and to set whether to automatically eject expired cleaning cartridges.
- [Networking](#)
Use the Networking page to configure the ports on each library controller card (LCC). Each port can enable or disable a particular protocol. The LCC specified for each port is the LCC to which that network connects when local hardware communicates with remote hardware.
- [Notifications](#)
Use the Notifications page to configure the sender information, recipient information, and library information for the various TS4500 tape library notifications.
- [Security](#)
Use the Security page to disable, or enable and configure remote authentication, set access rules, enable or disable secure socket layer, and manage encryption.
- [GUI Preferences](#)
Use the GUI Preferences page to control the behavior of the navigation dock.

Library

Use the Library page to set the date and time of your library and to set whether to automatically eject expired cleaning cartridges.

- [Date and Time](#)
Use the Date and Time page to choose whether to synchronize with the NTP server or set the time and date manually.
- [Licensed Functions](#)
Licensed Functions enable extended library capabilities that are available only to users who upload a license key code for that particular capability.
- [Advanced](#)
Use the Advanced page to manage cleaning cartridges, manage accessor behavior in a dual-accessor library, and enable/disable REST over SCSI for the library.

Date and Time

Use the Date and Time page to choose whether to synchronize with the NTP server or set the time and date manually.

Synchronizing with the NTP server allows the system to better correlate logs across your entire data center. If you manually set the time and date, it is more difficult to ensure exact log correlation across the entire data center.

Licensed Functions

Licensed Functions enable extended library capabilities that are available only to users who upload a license key code for that particular capability.

Extended library capabilities

The following features are the extended library capabilities and become available when the license key is uploaded:

Path Failover

Creates redundancy in the path from the application to the intended target (the library accessor or the drive mechanism, respectively)

LTO Transparent Encryption

Required to enable encryption on LTO tape drives if using library-managed encryption (LME).

Intermediate Capacity on Demand (HD CoD)

Increases storage from entry capacity to intermediate capacity.

Base capacity on demand

Increases storage from intermediate capacity to base capacity.

High Density Capacity on Demand (HD CoD)

Increases storage to use all of the tiers of an HD frame. Actual capacity depends on frame type and position.

All of the available extended capabilities are listed in the table on the Licensed Functions page. A check mark displayed next to one of the extended capabilities means that your library already has that capability. The Advanced Library Management System (ALMS) is available without a license key. If a green check mark appears next to a feature in the table on the Licensed Functions page, the license key for that feature is already uploaded, and the feature is available.

The license key

The license key file is generated by manufacturing. It is a number generated based on the serial number of the library. The library will decode it, and enable the corresponding feature. The file name for the license key code has an extension of .flk. The typical contents of a license key might look something like this:

249-0316-41819

Advanced

Use the Advanced page to manage cleaning cartridges, manage accessor behavior in a dual-accessor library, and enable/disable REST over SCSI for the library.

Move expired cleaning cartridges to I/O station

If this option is checked, cleaning cartridges are automatically moved to an I/O station when they expire after 50 uses.

Elastic Capacity

In dual-accessor libraries, this option allows cartridges to be stored in accessor service areas during periods of peak activity. It may be necessary to disable this option temporarily if there is a service issue with one of the accessors, usually under the direction of IBM support.

Cartridges are moved to service areas when the number of cartridges in the non-service area exceeds the utilization threshold, set by default to 98%. Use the **setUtilThreshold** CLI command to change the utilization threshold setting and the **viewUtilThreshold** command to view the current setting.

The elastic capacity options are:

- Use for maximum capacity – The least recently used cartridges are moved to an accessor service area when the non-service area exceeds the utilization threshold.
- Use for temporary overflow – I/O station cartridges are imported to an accessor service area when the non-service area exceeds the utilization threshold.
- Do not use – Cartridges are never moved to an accessor service area.

Active accessor

Allows you to activate and inactivate accessors. You can also activate and inactivate accessors using the **setAccessorZones** CLI command.

Accessor preferred zone

This read-only graphic displays an indicator for each frame and shows the preferred zone (tape drives and I/O stations) for each accessor, including the accessor service areas if Elastic Capacity is enabled.

You can restrict accessor zones to specific frames with the **setAccessorZones** CLI command. The **viewAccessorZones** command displays the current zone setting for each accessor.

REST over SCSI

REST over SCSI (RoS) allows library administrators to obtain status information about library components by sending REST API commands and receiving HTTP responses using SCSI Write Buffer and Read Buffer commands, respectively. If enabled (the default setting), the library will accept and respond to commands. If disabled, commands are rejected.

Related reference

- [Cartridges](#)
- [setUtilThreshold CLI command](#)
- [viewUtilThreshold CLI command](#)
- [setAccessorZones CLI command](#)
- [viewAccessorZones CLI command](#)

Networking

Use the Networking page to configure the ports on each library controller card (LCC). Each port can enable or disable a particular protocol. The LCC specified for each port is the LCC to which that network connects when local hardware communicates with remote hardware.

- **Management Ethernet Ports**
Use the Management Ethernet Ports page to change the IP address you use to access the management GUI. Individual frames and ports can be configured to use IPv4, IPv6, or both types of IP (Internet Protocol) addresses.
- **iSCSI**
Use the Settings > Networking > iSCSI page to manage security settings for Ethernet drives.

Management Ethernet Ports

Use the Management Ethernet Ports page to change the IP address you use to access the management GUI. Individual frames and ports can be configured to use IPv4, IPv6, or both types of IP (Internet Protocol) addresses.

Important: Only IPs restricted are the 172.31.1.X, 192.168.1.2, and 192.168.2.2 these are reserved for IMC/TSSC usage. To add or modify port IP addresses, see the *Configuring ports* topic.

IPv6 addresses

IPv6 addresses can be static, DHCP, or stateless auto configured.

Static

Static (fixed) IP addresses are manually assigned to each system by an administrator.

DHCP (Dynamic Host Configuration Protocol)

A DHCP server maintains a database of available IP addresses and configuration information. When the DHCP server receives a request from a network-attached device, client, the DHCP server:

- Determines the network to which the DHCP client is connected
- Allocates an IP address or prefix
- Sends the appropriate configuration information to the device

Stateless auto configure

Stateless auto configure allows a host to generate its own addresses. It uses a combination of the *router prefix* (identifies the subnet that is associated with a link), and a host-generated *interface identifier* (uniquely identifies an interface on a subnet).

IPv6 link local

A link-local address is an IP address that is intended only for communications within the segment of a local network. The link local address is not configurable. IPv6 is enabled per interface, and the IPv6 link local address is assigned to the interface where IPv6 is enabled.

Related tasks

- [Configuring ports](#)

iSCSI

Use the Settings > Networking > iSCSI page to manage security settings for Ethernet drives.

Security for Ethernet drives is managed with CHAP (Challenge Handshake Authentication Protocol), a network login protocol.

There are two levels of CHAP authentication:

- Initiator (one-way) authentication – The target (the drive) authenticates the initiator. The initiator is required to provide a user name and password.
- Target (mutual) authentication – Provides additional security by authenticating both the initiator and the target. Both the initiator and the target must have user names and passwords.

Authentication is disabled by default. To change the security settings, select one of the following options from the Authentication menu:

- Disabled
- CHAP enabled
- CHAP and NONE enabled
- NONE enabled

You can specify security settings separately for discovery and for normal use.

Related information

- [Ethernet drive initial setup](#)
- [Ethernet drive network configuration](#)

Notifications

Use the Notifications page to configure the sender information, recipient information, and library information for the various TS4500 tape library notifications.

- **Library Information**
Use the Library Information page to view and change the name and location of the tape library and the customer contact information. This information is used in SNMP, email, syslog, and Call Home notifications.
- **Changing the system name and library information**
Modify the library information that is sent with the SNMP, email, syslog, and Call Home notifications. The system name appears in the breadcrumbs.
- **SNMP Requests**
Use the Settings > SNMP Requests page to configure how the tape library handles requests from an SNMP manager.
- **SNMP Traps**
Use the Settings > SNMP Traps page to view and add SNMP trap destinations. You can also specify trap severity preferences, send a test trap, and download the IBM 3584 management information base (MIB).
- **Email Server**
Email notifications are a way (other than SNMP traps) to send information to users who need information about events that occur on the network.
- **Email Recipients**
Use the Email Recipients page to add email addresses for recipients of the error notifications, warning notifications, and info notifications.
- **Syslog Server**
The tape library creates a log of system events as they occur. The tape library can be configured to send a notification of each event to a customer-provided syslog (system log) server.

Library Information

Use the Library Information page to view and change the name and location of the tape library and the customer contact information. This information is used in SNMP, email, syslog, and Call Home notifications.

- System name - This name is initially assigned during library configuration, but can be changed later.
- System location - The library's physical location.
- Company contact - The name and phone number of the customer office or department that maintains the tape library.

Attention: Customer contact information must be generic, and must not contain any personal information.

Related tasks

- [Changing the system name and library information](#)

Changing the system name and library information

Modify the library information that is sent with the SNMP, email, syslog, and Call Home notifications. The system name appears in the breadcrumbs.

1. From the System page of the management GUI, click Settings > Notifications > Library Information.
2. On the Library Information page, click Modify.
3. Modify the library information as appropriate.

Related information

- [Library Information](#)

SNMP Requests

Use the Settings > SNMP Requests page to configure how the tape library handles requests from an SNMP manager.

SNMP requests (allowed/not allowed)

If SNMP requests are allowed, the tape library will accept requests from an SNMP manager.

If SNMP requests are not allowed, the tape library will not accept requests from an SNMP manager, but will continue sending traps to the SNMP manager.

SNMP community

The SNMP community is the name of the class of users who have access to the statistics of network-attached devices. The community name is sent with a trap. For information about SNMP trap community names, see the documentation for your SNMP manager software.

By default, the SNMP community name is set to `public`. This name should be changed during initial library configuration because security scanning software will flag it as a vulnerability.

SNMP Traps

Use the Settings > SNMP Traps page to view and add SNMP trap destinations. You can also specify trap severity preferences, send a test trap, and download the IBM 3584 management information base (MIB).

Specifying a destination for SNMP traps

Up to five SNMP destinations can be specified.

To create a new SNMP destination, click Create Destination and enter the IP address and port number for the SNMP manager (the default port for SNMP traps is 162), then specify the trap severity level that you wish to send (error, warning, and/or info).

The Actions menu has the following options for each SNMP destination:

- Modify – Change the settings for the destination.
- Delete – Delete the destination.
- Send Test Trap – Send a test trap to the destination.

SNMP traps are sent automatically whenever there is a working connection to an SNMP destination. There is no way to disable traps. However, if no severity level is specified, no traps will be sent.

Downloading the IBM 3584 MIB

To download the IBM 3584 MIB, select Actions > Download SNMP MIB File and save the file, then move the MIB to the MIB storage area in your SNMP manager.

Email Server

Email notifications are a way (other than SNMP traps) to send information to users who need information about events that occur on the network.

To configure the SMTP email server, click Modify on the Email Server page and enter the server IP address and the "From" address (this is the email address that appears in the "From" field of all email notifications). If necessary, change the server port ID (the default is 25). Then click the Test button to test the network connection to the server. If successful, a green checkbox is displayed in the server address field. If not, an error message is displayed.

If your SMTP server requires authentication before it accepts email notifications, enable authentication on this page and specify a user name and password.

After the server is configured, proceed to Settings > Notifications > Email Recipients page to specify the message recipients.

Related information

- [Email Recipients](#)
- [Monitoring events](#)

Email Recipients

Use the Email Recipients page to add email addresses for recipients of the error notifications, warning notifications, and info notifications.

Email addresses and local user names

Specify the email address that you want to send the events to. You can optionally select a user if an email address was specified for that user when it was defined.

Related information

- [Email Server](#)
- [Monitoring events](#)
- [Users](#)

Syslog Server

The tape library creates a log of system events as they occur. The tape library can be configured to send a notification of each event to a customer-provided syslog (system log) server.

Events can be filtered by severity level (error, warning, and/or informational); see [Event categories](#) for details. Refer to [Error codes](#) for a complete list of events.

Use the Settings > Notifications > Syslog Server page to:

- Specify the IP address of the syslog server.
- Specify the server port ID (the default is 514).
- Specify the severity level of events that are to be sent to the syslog server.

Related information

- [Monitoring events](#)

Security

Use the Security page to disable, or enable and configure remote authentication, set access rules, enable or disable secure socket layer, and manage encryption.

- [Remote authentication](#)
The library provides a flexible and robust method of remote authentication. Security tasks are centralized and user management can be performed from a single interface, without logging in.
- [Password and session policy](#)
Use the Password and Session Policy page to specify password requirements and the amount of time before automatic logout.
- [Secure Communications](#)
The tape library is secured with a secure socket layer (SSL). SSL is a protocol for encrypted (secure) transmission through the Internet. The Secure Communications page enables you to configure the SSL settings.
- [Encryption Key Servers](#)
Use the Encryption Key Servers page to manage which key servers use an encryption key.
- [Encryption Internal Label \(3592 or LTO\)](#)
Use the Encryption Internal Label (3592 or LTO) page to create, change, or delete mappings from the cartridge key labels to the key-encrypting labels.

Remote authentication

The library provides a flexible and robust method of remote authentication. Security tasks are centralized and user management can be performed from a single interface, without logging in.

The following remote authentication protocols are supported:

- LDAP (with optional RACF authentication) – LDAP is an open protocol that uses TCP/IP to provide access to directories that support an X.500 model and that does not incur the resource requirements of the more complex X.500 Directory Access Protocol (DAP). For example, LDAP can be used to locate people, organizations, and other resources in an Internet or intranet directory.
- Kerberos – Kerberos is a network authentication protocol that is based on symmetric key cryptography. Kerberos assigns a unique key, called a ticket, to each user who logs on to the network. The ticket is embedded in messages that are sent over the network. The receiver of a message uses the ticket to authenticate the sender.
- [Enabling remote authentication](#)
Before you can enable remote authentication, you must define the groups and roles that users will be assigned to. You will also need information about the remote authentication server.
- [Configuring LDAP](#)
The TS4500 tape library supports LDAP with optional RACF (Resource Access Control Facility) authentication.
- [Configuring Kerberos](#)
The library supports Kerberos authentication.

Enabling remote authentication

Before you can enable remote authentication, you must define the groups and roles that users will be assigned to. You will also need information about the remote authentication server.

Follow these steps:

1. Create a group on the remote authentication server.
2. Assign at least one user to the group on the remote authentication server.
3. From the management GUI, select **Access > Roles > Create Role**.
4. Create a new role with the same name as the group that you created on the remote authentication server. This role determines the access level of users assigned to the group.
5. Gather the configuration settings required for the remote authentication server.
6. From the management GUI, go to the **Settings > Security > Remote Authentication** page.
7. Select **Enable Remote Authentication** from the Actions menu and enter the server configuration settings..

Note:

- The maximum number of active remote authentication sessions at a given time is 100 minus the number of local users (not including the three preset users).
- If a user is a member of multiple groups that correspond to library roles, the user inherits the access level of the first role match found in alphabetical order. For example, if a user belongs to two groups that have corresponding library custom roles – `tech_admin` with Administrator access and `tech_service` with Service access – the user will have Administrator level access.

Related information

- [Role descriptions](#)
- [Configuring LDAP](#)
- [Configuring Kerberos](#)
- [Managing remote users](#)

Configuring LDAP

The TS4500 tape library supports LDAP with optional RACF (Resource Access Control Facility) authentication.

[Table 1](#) provides the configuration settings for LDAP and RACF.

Table 1. LDAP configuration settings

Setting	LDAP configuration	RACF configuration*
LDAP repository URI	Required. The URI of the LDAP server. It must start with <code>ldap://</code> and end with a port number.	Required. Must be set to the RACF server IP address and port number. For example, <code>ldap://9.7.124.103:389</code> .
Secondary repository URI	Optional. Must be in the same format as the primary repository URI. If you do not have a Secondary Repository URI, leave this field blank.	Optional. Must be in the same format as the primary repository URI. If you do not have a Secondary Repository URI, leave this field blank.
LDAP StartTLS	Optional. Allows you to enable/disable transport layer security (TLS). The TLS certificate is purchased from a certifying entity. It is a plain text file that contains information about the web server and verifies that it is indeed what it claims to be. (In this case, the web server is the TS4500 tape library.) The TLS certificate that is stored on the tape library enables your web browser to access the tape library without challenging its validity.	Not supported.
LDAP TLS certificate	Required if LDAP StartTLS is enabled. This is where you specify the path and file name of the TLS certificate file.	Not supported.
Service Credentials: User Name and Password	If your LDAP server does not support anonymous access (meaning access without being authenticated to the LDAP server), you will need to provide login credentials for service users. You can either: <ul style="list-style-type: none"> • Specify the user name and password for the LDAP administrator account. For example, <code>CN=ServiceUser,OU=Users,DC=server,DC=ibm,DC=com</code> • Specify <code>{0}</code> for the user name in the DN and <code>{0}</code> for the password. These placeholders will be replaced by the user name and password of the user who is trying to log in. For example, <code>CN={0},OU=Users,DC=server,DC=ibm,DC=com</code> <code>Password={0}</code> 	Optional. If used, the user name must contain the full racfid. For example, <code>racfid=USER1,profiletype=USER,cn=RACF</code> Refer to the User name/Group name filters setting below for more information.
Simple lookup	Default. Group and user LDAP distinguished names are used for authentication look-up.	Not supported.
Advanced search	Optional. Enables the following options, which provide more flexible searching and better performance.	Required. Must be selected.
Base DN	Optional. Allows you to customize the base Distinguished Name (Base DN) with which to begin your LDAP search, which will begin the search deeper in your LDAP tree for better performance.	Required. Enter <code>cn=RACF</code> .
Group name attribute	Optional. Allows you to choose what attribute in your LDAP group accounts is used to associate with a TS4500 role.	Required. Enter <code>racfgroupid</code> .
User name attribute	Optional. Allows you to customize what attribute in your LDAP user account is used for user names.	Required. Enter <code>racfuserid</code> .
Group member attribute	Optional. Allows you to customize the link between your LDAP users and groups.	Required. Enter <code>racfgroupuserids</code> .

Setting	LDAP configuration	RACF configuration*
User name/Group name filters	Optional. Useful when you want to improve your LDAP search. For example, you can create a user attribute called <code>remote</code> and then allow remote access for all users that have <code>remote=TS4500</code> .	Optional. RACF does not support LDAP-like filtering. Instead, these filters can be used with RACF to specify the Distinguished Name (DN) pattern the tape library must use when determining which group(s) the user belongs to during log in. When the user/group DN patterns are used in the filter fields, service login credentials are not required. The option to set a DN pattern enables the tape library to support RACF servers, which do NOT allow searching for user information (for example, to get the groups the user belongs to). Examples of DN patterns in filter fields: User name filter: <code>racfid={0},profiletype=USER,cn=RACF</code> Group name filter: <code>racfid={0},profiletype=GROUP,cn=RACF</code>
*TS4500 code levels prior to version 1.4.1.0 do not support RACF. If the library is configured to use RACF and is then updated with library code older than version 1.4.1.0, you may lose user interface access to the library. To avoid this issue, disable remote authentication before loading the down-level code on the library. If you do lose access, follow the Access Recovery procedure to enable the admin user account to log into the library. Remote Authentication can then be disabled via the web user interface, which will allow local users to log into the library.		

RACF wildcard support

You can create local user accounts on the tape library that include the * wildcard in the name so they can be mapped to groups of users on the RACF server. This allows you to authenticate and assign a role to groups of users on the RACF server whose names follow the same naming convention.

When a user on the RACF server logs in, the tape library first searches the RACF server for a group that matches a role name in the library. If a match is found, the role for that group is assigned to the user. If a match is not found, the tape library then searches its list of local mapped users.

The following CLI commands are used to create and manage these users. Most of these options cannot be performed from the GUI.

- Use the **createUser** command to create a local user with a name containing the * wildcard. Requirements:
 - The user name must be enclosed in double quotes when you enter the command.
 - The * must be the last character in the user name.
- Use the **viewUsers** command to view a list of local users. This requires the use of the -local option. When you view users, the prefix `mapped_` is added to the user name containing the wildcard and any users that are mapped to that user account.
- Use the **deleteUser** command to delete local users.

RACF wildcard command examples

The following example creates a local user named `managers_*` with the Administrator role. All users on the LDAP server with a name starting with `managers_` will be mapped to this user account and will be authenticated and assigned the Administrator role.

```
createUser -name "managers_*" -role Administrator -sendToEmail no -tempPass L0gM3InN0w
```

```
User managers_* was created successfully.
```

The following example returns a list of all local users defined on the tape library, including the `managers_*` user and any mapped users from the RACF server who are currently connected. The user name for each mapped RACF user has a `mapped_` prefix.

```
viewUsers -local
```

Name	Locked	State	Role	Email	Last login
<code>mapped_managers_*</code>		Connected	Administrator		viernes, septiembre 28, 2018 11:22:33 AM CST
<code>mapped_managers_jecervan</code>		Connected	Administrator	xyz@mx1.ibm.com	viernes, septiembre 28, 2018 11:22:33 AM CST
<code>service</code>		Disconnected	Service	svc@service.com	
<code>temporal</code>		Disconnected	Administrator		lunes, noviembre 25, 2013, 09:40:22 AM CST

The following example deletes the `mapped_managers_*` user.

```
deleteUser "mapped_managers_*"
```

```
User mapped_managers_* was deleted successfully.
```

Related reference

- [createUser CLI command](#)

Configuring Kerberos

The library supports Kerberos authentication.

At user login, when Kerberos is enabled, the library obtains a ticket-granting ticket (TGT) from the key distribution center (configured in the Remote Authentication wizard) and uses the TGT to authenticate the user. Once the user is successfully authenticated, the tape library obtains the permissions information for the user from the LDAP repository or Kerberos server configuration in the LDAP settings.

[Table 1](#) provides the Kerberos configuration settings.

Note: The library Ethernet ports must be configured to use DNS before Kerberos can be enabled. DNS cannot be disabled if Kerberos is being used.

Table 1. Kerberos configuration

Setting	Kerberos configuration
Realm	Generally the same as your company's domain name. For example, if your company's domain name is <i>example.com</i> , then your Kerberos realm is <i>EXAMPLE.COM</i> .
KDC (Kerberos server)	The Key Distribution Center server. A KDC server generally has a prefix of kerberos followed by your Kerberos realm, a colon, and the port number of the Kerberos server. (The library port number for the Kerberos server is 88.) So, if your company's domain name is example.com , a conventional name for your KDC server is kerberos.example.com:88 .
Domain mapping	Optional

Password and session policy

Use the Password and Session Policy page to specify password requirements and the amount of time before automatic logout.

Enabling/disabling automatic login for the IMC

The tape library includes a predefined local user named localGUI with the role of Monitor. By default, localGUI users can access the integrated management console (IMC) without logging in. To disable automatic login, select Settings > Security > Password and Session Policy and change Automatic IMC (localGUI) login at power on to Disabled.

Secure Communications

The tape library is secured with a secure socket layer (SSL). SSL is a protocol for encrypted (secure) transmission through the Internet. The Secure Communications page enables you to configure the SSL settings.

SSL is a cryptographic security 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, URLs that require an SSL connection start with *https* instead of *http*.

Note: When you update certificate settings and/or enable or disable SSL, the web server will reset and you will be logged out.

Secure Communications On (SSL enabled)

When SSL is enabled, the data exchanged between the tape library and your browser is encrypted. You can use a system-defined encryption certificate or upload your own certificate.

System-defined certificate

The web server on the library uses the certificate that is installed with the library firmware. It is in PEM format and is a self-signed certificate.

User-defined certificate

If there is an existing certificate, its identifying information is displayed in the Certificate field. You can use this certificate, or click the folder icon to upload another certificate.

Note: If you modify a certificate that was already uploaded, you must re-select the PEM file by clicking the folder icon and specifying the file even if the name is still displayed in the Certificate field. If the certificate is encrypted, you must enter the password again.

Certificate requirements:

- RSA keys are recommended. No specific key size is required.
- Certificates must use AES encryption. DES is not supported.
- Certificates must be in PEM format. They may be self-signed or CA-signed, but must contain both the certificate and the private key. If the private key is encrypted, you must enter the password for the private key.
- Certificates with the SHA256 signature algorithm are supported. Certificates with SHA1 or MD5 hash signatures are not allowed.
- Both wildcard and multi-domain (SAN) certificates are supported. A wildcard certificate allows unlimited subdomains to be protected with a single certificate, while a SAN certificate allows for multiple domain names to be protected with a single certificate.

If you are using CA-signed certificates on a library configured with multiple IPs, it is strongly recommended to include each IP used for web GUI access in the certificate. If an IP address or DNS name is not specified in the certificate, the message "Your connection is not secure" is displayed after the web server restarts. Click "Add Exception" and then "Confirm Security Exception" to be able to use that certificate.

Secure Communications Off (SSL disabled)

When SSL is disabled, your browser will communicate with the library using unencrypted data transmissions.

- [Getting started with SSL certificates](#)

This topic provides a beginner-level description of the process for obtaining SSL certificates so you can implement secure communications (HTTPS) on your tape library.

Getting started with SSL certificates

This topic provides a beginner-level description of the process for obtaining SSL certificates so you can implement secure communications (HTTPS) on your tape library.

To summarize the process, you will:

1. Install OpenSSL, if it's not already installed.
2. Generate a private key. A private key is used to create a digital signature for the library web server. This file should be kept secure, as anyone with access to it may be able to gain access to the web server.

3. Generate a certificate. The certificate includes a public key that works together with your private key. Depending on your security requirements, you can generate either:
 - A certificate signing request (CSR), which is a certificate in a format that can be sent to a CA (certificate authority) for signing.
 - A self-signed certificate.
4. Create a certificate package.
5. Upload the certificate package to the tape library.

Examples of the most common OpenSSL command options are provided here. Refer to the [OpenSSL command help](#) for additional options.

- **Working with OpenSSL**

[OpenSSL](#) is an open-source software library that is widely used to generate and manage certificates. OpenSSL is recommended to ensure compatibility with development and support.

- **Generating a private key**

A private key file is a text file that can be opened with any text editor. The file must have a *.pem extension. It will look something like this (only much longer):

- **Generating a certificate signing request**

The **req** command is used to generate a CSR. The most basic form of this command specifies the name of the key file you created in the previous step and the name of the output file, which must have a *.csr extension.

- **Generating a self-signed certificate**

The **req** command is also used to generate a self-signed certificate. The output file should have a *.pem extension.

- **Creating the certificate package**

When you have the certificate, copy and paste the contents of the certificate file into the file containing the private key. It should look something like the following (only much longer). The file must have a *.pem extension.

- **Uploading the certificate package to the tape library**

To upload the certificate, log in to the management GUI and select Settings > Security > Secure Communications. From the Secure Communications page, select On and specify the PEM file containing the certificate.

- **Advanced command examples**

The following commands are used by development to generate certificates for testing. These commands use the **-newkey** option to generate both the private key and the certificate with a single command. Refer to the [OpenSSL command help](#) for information on the other options used here.

Working with OpenSSL

[OpenSSL](#) is an open-source software library that is widely used to generate and manage certificates. OpenSSL is recommended to ensure compatibility with development and support.

- **Installing OpenSSL**

The installation procedure depends on your operating system:

- **Configuring OpenSSL**

OpenSSL requires a master configuration file (openssl.cnf) to generate a certificate. If this file is not included in your installation, you will receive an error message that mentions openssl.cnf. Follow these steps to add the file:

- **Running OpenSSL**

OpenSSL is a command-line program, meaning that you enter text commands in a command window and status and error messages are displayed as the command executes. To run OpenSSL:

Installing OpenSSL

The installation procedure depends on your operating system:

- Windows users – There are several versions of OpenSSL for Windows. One such product is [Win32 OpenSSL](#). Additional options can be found in the [OpenSSL Binaries wiki](#). When installing, accept the default installation settings.
- Linux users – Refer to the [OpenSSL Downloads](#) page for the latest version.

Configuring OpenSSL

OpenSSL requires a master configuration file (openssl.cnf) to generate a certificate. If this file is not included in your installation, you will receive an error message that mentions openssl.cnf. Follow these steps to add the file:

1. Obtain a configuration file. If you don't have one locally, MIT (Massachusetts Institute of Technology) provides a [generic configuration file](#) that you can use. You don't need to make any changes to the file at this time. After you become more familiar with OpenSSL, you may want to customize some of the settings.
2. Save the file to your computer in the following directory:

```
Windows
  C:\Program Files (x86)\Common Files\SSL\
Linux
  /etc/pki/tls/
```

Running OpenSSL

OpenSSL is a command-line program, meaning that you enter text commands in a command window and status and error messages are displayed as the command executes. To run OpenSSL:

- Windows – If you accept the default installation options, the installer will create a directory for the program on your C:\ drive. For example:

C:\OpenSSL-Win32

To run the program, go to the C:\OpenSSL-Win32\bin directory and double-click the file openssl.exe. This opens a text window with an OpenSSL> prompt. Enter the commands described below at this prompt. The files you generate are placed in this same directory.

- Linux – Depends on your installation.

Generating a private key

A private key file is a text file that can be opened with any text editor. The file must have a *.pem extension. It will look something like this (only much longer):

```
-----BEGIN RSA PRIVATE KEY-----
Proc-Type: 4,ENCRYPTED
DEK-Info: AES-256-CBC,F6F1F37584D8189C97F23F9DCD431B42
qwabUGR9ag09wq1nDtsB3hSuXtJdOBhEn3Wok6qrIWqE8VL8Ss5N7U4MNIWA4G9A ...
-----END RSA PRIVATE KEY-----
```

The **genrsa** command is used to generate an RSA private key file.

The most basic form of the **genrsa** command specifies the name of the output file containing the key and specifies AES256 encryption (required).

- Windows
OpenSSL> **genrsa -out key-filename.pem -aes256**
- Linux
\$ **openssl genrsa -out key-filename.pem -aes256**

The **-pass** option adds password protection to the certificate. If specified, tape library users will be required to enter this password to log in to the GUI.

- Windows
OpenSSL> **genrsa -out key-filename.pem -aes256 -passout
pass:Passw0rd1**
- Linux
\$ **openssl genrsa -out key-filename.pem -aes256 -passout
pass:Passw0rd1**

If you do not specify a size for the private key, the **genrsa** command uses the default value of 512 bits. To specify a different key size, enter the value as shown in the following example (2048). The key size must be the last option in the command.

- Windows
OpenSSL> **genrsa -out key-filename.pem -aes256 -passout pass:Passw0rd1
2048**
- Linux
\$ **openssl genrsa -out key-filename.pem -aes256 -passout pass:Passw0rd1
2048**

Generating a certificate signing request

The **req** command is used to generate a CSR. The most basic form of this command specifies the name of the key file you created in the previous step and the name of the output file, which must have a *.csr extension.

The following example also includes the **-SHA256** option, which creates a certificate using the SHA256 signature algorithm.

- Windows
OpenSSL> **req -new -key key-filename.pem -out cert.csr
-SHA256**
- Linux
\$ **openssl req -new -key key-filename.pem -out cert.csr -SHA256**

When you enter the command, you will be prompted to provide the following information. This information is used to create a distinguishing name (DN) for the certificate.

- The two-letter code for your country, such as US or DE
- The full name of your state or province
- Your city or town
- The name of your organization
- The name of the unit within your organization
- Your name or the host name of the system
- Your email address
- A challenge password – This is not related to the password you assigned when creating the private key. Leave blank unless you understand when and how to use it.
- Company name – Optional

Generating a self-signed certificate

The **req** command is also used to generate a self-signed certificate. The output file should have a *.pem extension.

- Windows

```
Openssl> req -new -x509 -key key-filename.pem -out selfcert.pem
-SHA256
```

- Linux
\$ openssl req -new -x509 -key key-filename.pem -out selfcert.pem
-SHA256

Creating the certificate package

When you have the certificate, copy and paste the contents of the certificate file into the file containing the private key. It should look something like the following (only much longer). The file must have a *.pem extension.

```
-----BEGIN RSA PRIVATE KEY-----
Proc-Type: 4, ENCRYPTED
DEK-Info: AES-256-CBC, F6F1F37584D8189C97F23F9DCD431B42
qwabUGR9ag09wq1ndtsB3hSuXtJdOBhEn3Wok6qrIWqE8VL8Ss5N7U4MNIWA4G9A ...
-----END RSA PRIVATE KEY-----

-----BEGIN CERTIFICATE-----
MIID4zCCAsugAwIBAgIJALwLp6+xV13iMA0GCSqGSIb3DQEBBQUAMIGHMQswCQYD
VQQGEwJERTEKXMBUGA1UEBwwORnJhbmtmdXJ0L01haW4xEzARBgNVBAoMCKRaIEJB
OoD8y9uFwL24rdqR7lCAC5PdPY1f594yOwbUaIVfxBo46vnmzJO3 ...
-----END CERTIFICATE-----
```

Uploading the certificate package to the tape library

To upload the certificate, log in to the management GUI and select Settings > Security > Secure Communications. From the Secure Communications page, select On and specify the PEM file containing the certificate.

Advanced command examples

The following commands are used by development to generate certificates for testing. These commands use the `-newkey` option to generate both the private key and the certificate with a single command. Refer to the [OpenSSL command help](#) for information on the other options used here.

Self-signed certificate with private key encrypted; must enter passphrase

- Windows
Openssl> req -x509 -sha256 -newkey rsa:2048 -keyout key.pem -out cert.pem
-days 1460
- Linux
\$ openssl req -x509 -sha256 -newkey rsa:2048 -keyout key.pem -out cert.pem -days
1460

Self-signed certificate with private key not encrypted

- Windows
Openssl> req -x509 -sha256 -newkey rsa:2048 -keyout key.pem -out cert.pem
-days 3650 -nodes
- Linux
\$ openssl req -x509 -sha256 -newkey rsa:2048 -keyout key.pem -out cert.pem -days
3650 -nodes

Encryption Key Servers

Use the Encryption Key Servers page to manage which key servers use an encryption key.

Encryption is managed at the logical library level. All encryption-enabled drives that are assigned to a logical library use the same method of encryption.

Run Diagnostics

If you want to verify the functionality of all of the network-attached devices, run diagnostics on the devices. Select Settings > Security > Run Diagnostics. Highlight the IP address of the appropriate server, and select Actions > Run Diagnostics.

Note: If a warning icon appears in the Ethernet column using the Run Diagnostics function, it could be caused by having the ICMP (Internet Control Message Protocol) requests disabled.

Also Note: At least one key server IP address must be selected for the Run Diagnostics option to display on the Actions menu (or the right-click drop-down menu). If no key server IP address is added (or selected), the Run Diagnostics option does not display on the Actions menu.

ICMP Requests

ICMP is a messaging protocol (external to the TS4500 tape library) that sends error messages that a requested service is not available, or that one of the network-attached devices could not be reached. ICMP requests are disabled or enabled on the server where the encryption key manager is running.

The disabled status of ICMP requests could trigger a warning in the Ethernet column when the Run Diagnostics function is invoked. If ICMP requests are disabled, the server that is running the encryption key manager does not return a ping when running diagnostics. This scenario triggers a warning in the Ethernet column of the Run Diagnostics table. If a warning appears in the Ethernet column and not in the Key Server Path column, ignore the warning in the

Ethernet column. If a warning appears in the Ethernet column and the Key Server Path column, the failure could be on the machine or the network connections between the library and that machine.

Related information

- [Choosing or modifying an encryption method](#)

Encryption Internal Label (3592 or LTO)

Use the Encryption Internal Label (3592 or LTO) page to create, change, or delete mappings from the cartridge key labels to the key-encrypting labels.

When the Encryption Internal Label option is configured, the encryption-enabled tape drive automatically derives the encryption policy and key information from the metadata that is written on the tape volume by the TS4500 tape library. Mapping the cartridge key labels to the key-encrypting labels enables the TS4500 tape library to apply the same encryption policy for both types of labels. It is a way for the system to share encryption policies

GUI Preferences

Use the GUI Preferences page to control the behavior of the navigation dock.

- [Navigation](#)
Use the Navigation page to enable or disable animation of the navigation dock in the GUI.

Navigation

Use the Navigation page to enable or disable animation of the navigation dock in the GUI.

You may want to turn the animation off if the enlarged icons obscure any information on the screen. Also, turning off the navigation animation helps increase performance when you are remotely connecting to the library over a slow network connection.

Tape CLI commands

Command line interface (CLI) commands are used to perform library management procedures. Many of these procedures cannot be run from the management GUI.

- [Installing the CLI](#)
- [Command line syntax](#)
The following conventions are used to define command syntax:
- [Running CLI commands](#)
You can run CLI commands from any directory. It is simplest to run commands from the directory where the TS4500CLI.jar file is stored because you don't have to specify the path to the .jar file. If you do specify the path, it must be enclosed in quotes.
- [CLI commands listed alphabetically](#)
- [CLI commands listed by category](#)

Installing the CLI

To download and license the CLI, go to [Fix Central](#) and specify the TS4500 release you are running, then download the CLI from the CLI Tool section.

Note: The CLI is supported for Java 6, 7, and 8. Java 9 and 10 are not supported.

Command line syntax

The following conventions are used to define command syntax:

Notation	Description
Text without brackets or braces	Items that must be typed as shown.
< <i>Italic text in angle brackets</i> >	Variables; you must provide a value.
[Text in square brackets]	Optional items. Items not enclosed in brackets are required.
{Text in braces}	Set of required items; choose one.
Vertical bar ()	Separator for mutually exclusive items; choose one.
...	Items that can be repeated.

Running CLI commands

You can run CLI commands from any directory. It is simplest to run commands from the directory where the TS4500CLI.jar file is stored because you don't have to specify the path to the .jar file. If you do specify the path, it must be enclosed in quotes.

Syntax

```
java -jar <filename> -ip <LCC-IP> -u <username> -p <password> --<command-name>
```

where:

- -jar = the name of the CLI .jar file (normally TS4500CLI.jar).
- -ip <LCC-IP> = the IP address of the LCC node
- -u <username> = your username
- -p <password> = your password (use -ep if your password was encrypted with the **encrypt** command)
- --<command-name> = the command name and any associated parameters.

Example commands

The following example shows how to execute a command from the directory where TS4500CLI.jar is stored.

```
java -jar TS4500CLI.jar -ip 9.22.55.88 -u username -p pwd --viewNodeCards
```

The following example shows how to execute a command when TS4500CLI.jar is in a different directory. The quotes are required.

```
java -jar "C:\Program Files\IBM\TS4500CLI.jar" -ip 9.22.55.88 -u username -p pwd --viewNodeCards
```

CLI commands listed alphabetically

- [assignDataCartridges CLI command](#)
Use the **assignDataCartridges** command to assign or reassign individual data cartridges to one or more logical libraries.
- [assignDriveToLL CLI command](#)
Use the **assignDriveToLL** command to assign a drive to a logical library.
- [batch CLI command](#)
Use the **batch** command to run multiple commands specified in a file.
- [bulkAssignDataCartridges CLI command](#)
Use the **bulkAssignDataCartridges** command to bulk-assign cartridges to a single logical library. You can bulk-assign up to 100 cartridges. Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries.
- [bulkAssignDataCartridgesByLL CLI command](#)
Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries. To bulk-assign cartridges to a single logical library, use the **bulkAssignDataCartridges** command.
- [cleanDrive CLI command](#)
Use the **cleanDrive** command to clean a specific drive.
- [codeUpdate CLI command](#)
Use the **codeUpdate** command to update the library firmware. To update the firmware in a specific drive, use the **driveCodeUpdate** command, or use the TS4500 management GUI (Drives > Drives page).
- [completeDriveService CLI command](#)
Use the **completeDriveService** command to complete the drive replacement procedure.
- [continueCloseLibraryVerify CLI command](#)
Use the **continueCloseLibraryVerify** command to finish the library verification process for I/O stations. Before you run this command, you must run the **continueLibraryVerify** command and then close all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)
- [continueLibraryVerify CLI command](#)
Use the **continueLibraryVerify** command to perform the second step of the library verification process for I/O stations. Before you run this command, you must run the **startLibraryVerify** command and then open all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)
- [createBEP CLI command](#)
Use the **createBEP** command to create a bar code encryption policy. Before you run this command, run the **viewKeyLabelMapping** command to look up the key label mapping index number of the cartridges to have the encryption policy.
- [createKeyLabelMapping CLI command](#)
Use the **createKeyLabelMapping** command to create a key label mapping.
- [createLL CLI command](#)
Use the **createLL** command to create a new logical library.
- [createUser CLI command](#)
Use the **createUser** command to create a new local user. Remote authentication can be either enabled or disabled.
- [createVolserRanges CLI command](#)
Use the **createVolserRanges** command to create one or more new VOLSER ranges.
- [deleteBEP CLI command](#)
Use the **deleteBEP** command to delete a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **deleteBEP** command.
- [deleteKeyLabelMapping CLI command](#)
Use the **deleteKeyLabelMapping** command to delete a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number for a specific key label mapping.
- [deleteLL CLI command](#)
Use the **deleteLL** command to delete a logical library.
- [deleteUser CLI command](#)
Use the **deleteUser** command to delete local user accounts. Local user accounts cannot be deleted from the management GUI when Remote Authentication is enabled; they can only be deleted from the CLI.

- [**deleteVolserRanges CLI command**](#)
Use the **deleteVolserRanges** command to delete one or more VOLSER ranges. The command is applied immediately to all cartridges in the specified VOLSER ranges.
- [**destageDataCartridges CLI command**](#)
Use the **destageDataCartridges** command to move cartridges from their cartridge cache locations to a high-density slot. (This command is only for high-density libraries. All data cartridges that are being destaged must be in tier 0.)
- [**downloadDrivesLog CLI command**](#)
Use the **downloadDrivesLog** command to download a .zip file containing the logs from the specified (or all) drives. This command is useful for troubleshooting.
- [**downloadEvents CLI command**](#)
Use the **downloadEvents** command to export detailed information about all error, warning, and informational events saved in the library.
- [**downloadLog CLI command**](#)
The **downloadLog** command creates a set of log files describing recent library activity, including errors and failures. The default command creates encrypted files for use by IBM development; these files cannot be read by customers or SSRs. The **-csh** (control system health) option creates a smaller set of unencrypted log files that can be used by customers and SSRs to determine the status of the control system.
- [**downloadPropertiesFile CLI command**](#)
Use the **downloadPropertiesFile** command to download the properties file (TSSC file) if one exists in the card.
- [**downloadResources CLI command**](#)
Use the **downloadResources** command to export information about a library to a .csv file. You can specify all resources or a single resource, such as drives or users.
- [**downloadSnapshot CLI command**](#)
Use the **downloadSnapshot** command to download a snapshot from the library. First, run the **viewSnapshots** command to obtain the index number for the specific snapshot.
- [**driveCodeUpdate CLI command**](#)
Use the **driveCodeUpdate** command to update the firmware in a drive or list of drives.
- [**editKeyLabelMapping CLI command**](#)
Use the **editKeyLabelMapping** command to edit a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number of a specific key label mapping.
- [**encrypt CLI command**](#)
Use the **encrypt** command to create an encrypted password that can be used with any other CLI command. When using an encrypted password in a command, use **-ep** instead of **-p** before the password.
- [**getFWVersion CLI command**](#)
Use the **getFWVersion** command to view the current library firmware version.
- [**modifyAdvancedEncSettings CLI command**](#)
Use the **modifyAdvancedEncSettings** command to make the advanced encryption settings more or less restrictive for data that is stored in a library, or to return the advanced encryption settings to their default values.
- [**modifyBEP CLI command**](#)
Use the **modifyBEP** command to edit a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **modifyBEP** command.
- [**modifyFibreChannelSettings CLI command**](#)
Use the **modifyFibreChannelSettings** command to set port speed and topology for a specified drive. Speed and topology are the same for both ports in the drive.
- [**modifyVolserRanges CLI command**](#)
Use the **modifyVolserRanges** command to modify existing VOLSER ranges.
- [**modifyVolserReporting CLI command**](#)
Use the **modifyVolserReporting** command to specify the number of characters in each VOLSER number (first 6, first 8, all, or last 8) to report to the host for a specified logical library.
- [**moveFromAllDrives CLI command**](#)
Use the **moveFromAllDrives** command to eject all cartridges from all full drives and move them to the home storage location. If the home storage location is not available, the cartridges are moved to the first empty slot. (To eject a cartridge from a specific drive, use the **moveFromDrive** command.)
- [**moveFromDrive CLI command**](#)
Use the **moveFromDrive** command to eject a single cartridge from a drive and move it to the home storage location. If the home storage location is not available, the cartridge is moved to the first empty slot.
- [**moveToDrive CLI command**](#)
Use the **moveToDrive** command to move a cartridge from a storage location (specified by VOLSER number) to a specified drive location.
- [**prestageDataCartridges CLI command**](#)
Use the **prestageDataCartridges** command to move cartridges from high-density slots to cartridge cache locations specified by their VOLSER numbers. (This command is only for high-density libraries. All data cartridges that are being prestaged must be in tier 3 or higher.)
- [**removeDataCartridges CLI command**](#)
Use the **removeDataCartridges** command to remove a data cartridge from a storage location and move it to the I/O station. The cartridge is unassigned from its logical library and the state changes to I/O Slot.
- [**resetDrive CLI command**](#)
Use the **resetDrive** command to power cycle a specific drive.
- [**resetNodeCards CLI command**](#)
Use the **resetNodeCards** command to reset one or more node cards.
- [**restoreConfiguration CLI command**](#)
Use the **restoreConfiguration** command to restore a configuration database to the library. Use the **saveConfiguration** command to save the configuration database to a file. This requires a user with the Service role.
- [**saveConfiguration CLI command**](#)
Use the **saveConfiguration** command to save the configuration database to your computer. Use the **restoreConfiguration** command to restore a configuration database to the library. This requires a user with a Service role.
- [**setAccessorZones CLI command**](#)
(Dual-accessor libraries only.) Use the **setAccessorZones** command to specify which tape drives and I/O stations (within sets of frames) are served by which accessor. This command can also be used to inactivate an accessor.
- [**setAutoEjectCleaningCarts CLI command**](#)
Use the **setAutoEjectCleaningCarts** command to specify whether expired cleaning cartridges are automatically ejected from the library.
- [**setDrivePortsID CLI command**](#)
Use the **setDrivePortsID** command to set the port IDs for a specified drive (port 1 and port 2).
- [**setDriveUse CLI command**](#)
Use the **setDriveUse** command to configure the drive for media access, control path with media access, or media verification.
- [**setISCSI CLI command**](#)
Use the **setISCSI** command to update the network configuration settings for a single Ethernet drive and to optionally change the name and alias of the drive. Each port can be configured separately so that ports in the same drive can be attached to different subnets.

- [setLibraryTime CLI command](#)
Use the **setLibraryTime** command to set the library date and time to the same date, time, and time zone of the server on which the CLI is running.
- [setMacAddress CLI command](#)
Use the **setMacAddress** command to change the MAC address for an Ethernet port (or both ports). To look up a port's current MAC address, use the **viewMacAddress** command or refer to the Drives > Ethernet Ports GUI page.
- [setMaximumVIOCartridges CLI command](#)
Use the **setMaximumVIOCartridges** command to update the number of virtual I/O slots for the logical library.
- [setNMADetection CLI command](#)
Use the **setNMADetection** command to enable or disable NMA detection in the library.
- [setRolePermissions CLI command](#)
Use the **setRolePermissions** command to allow or restrict access to individual GUI pages for a specified role. Use the output from the **viewRolePermissions** command as input for this command.
- [setScannerSpeed CLI command](#)
Use the **setScannerSpeed** command to set the speed of the scanner.
- [setSlotOffline CLI command](#)
Use the **setSlotOffline** command to set a specified storage slot offline.
- [setSlotOnline CLI command](#)
Use the **setSlotOnline** command to set a specified storage slot online.
- [setSSL CLI command](#)
Use the **setSSL** command to enable or disable the use of HTTPS (HTTP over SSL). The HTTPS protocol provides secure communication over the network.
- [setUtilThreshold CLI command](#)
Use the **setUtilThreshold** command to change the cartridge capacity utilization threshold settings. Use the **viewUtilThreshold** command to view the current settings.
- [showQueuedExports CLI command](#)
Use the **showQueuedExports** command to specify whether cartridges that are queued for export remain assigned to the logical library or are unassigned from the logical library.
- [startCalibration CLI command](#)
Use the **startCalibration** command to calibrate a library component.
- [startDiscoverHW CLI command](#)
Use the **startDiscoverHW** command to start a discover hardware operation.
- [startDriveService CLI command](#)
Use the **startDriveService** command to start the drive replacement procedure.
- [startInventory CLI command](#)
Use the **startInventory** command to start an inventory operation.
- [startLibraryVerify CLI command](#)
Use the **startLibraryVerify** command to start the library verification process for I/O stations. When the command completes, you will be prompted to open all I/O station doors and then run the **continueLibraryVerify** command. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)
- [unassignDrive CLI command](#)
Use the **unassignDrive** command to unassign a specific drive from its current logical library.
- [version CLI command](#)
Use the **version** command to view the current version of the TS4500 CLI tool.
- [viewAccessor CLI command](#)
Use the **viewAccessor** command to show the accessor's status and usage statistics.
- [viewAccessorZones CLI command](#)
Use the **viewAccessorZones** command to view which tape drives and I/O stations (within sets of frames) are being served by which accessor. You can also view these settings in the TS4500 management GUI on the Settings > Library > Advanced page.
- [viewAdvancedEncryptionSettings CLI command](#)
Use the **viewAdvancedEncryptionSettings** command to display the advanced encryption settings for the specified logical library.
- [viewBEP CLI command](#)
Use the **viewBEP** command to display a list of all VOLSER ranges showing the BEP settings. In the command output, each VOLSER range has a corresponding index number that you will need to specify to run the **modifyBEP** and **deleteBEP** commands.
- [viewCleaningCartridges CLI command](#)
Use the **viewCleaningCartridges** command to view information for all cleaning cartridges in a library, including the number of remaining cleans.
- [viewDataCartridges CLI command](#)
Use the **viewDataCartridges** command to view high-level information for all data cartridges in a library, sorted by VOLSER number.
- [viewDriveDetails CLI command](#)
The **viewDriveDetails** command returns information about a specific drive that is useful for troubleshooting, including the contents of the drive, the name of the logical library, worldwide node numbers (WWNNs), and port ID information.
- [viewDriveEthernetPorts CLI command](#)
The **viewEthernetPorts** command returns a list of all the Ethernet drives in the library.
- [viewSasPorts CLI command](#)
The **viewSasPorts** command returns of all the SAS drives in the library.
- [viewDriveSummary CLI command](#)
Use the **viewDriveSummary** command to list all of the drives in the library. This summary information is useful to network administrators who are deciding where to mount a cartridge. To list detailed information about a specific drive, use the **viewDriveDetails** command.
- [viewDriveVPD CLI command](#)
Use the **viewDriveVPD** command to show vital product data (VPD) information for all drives in the library. This command is useful if an administrator or service engineer needs to see such information as a product model number, product release level, or other information specific to the device type.
- [viewDrivePod CLI command](#)
The **viewDrivePod** command provides basic monitoring capability to display system health and drives in use. The output is in JSON format for use with the IBM Storage Mobile Dashboard. This command provides the same information as the middle pod (drive utilization) on the System GUI page.
- [viewFibreChannel CLI command](#)
Use the **viewFibreChannel** command to show the Fibre Channel settings for both ports in each drive. The information is sorted by drive name. This command is useful to view the port configuration for the Fibre Channel switch and make sure that the configuration is compatible for the type of network in use.
- [viewIoStation CLI command](#)
Use the **viewIoStation** command to view a summary of information for all cartridges in the I/O station.
- [viewISCSI CLI command](#)
Use the **viewISCSI** command to view the configuration settings for a specific Ethernet drive.

- [viewKeyLabelMapping CLI command](#)
Use the **viewKeyLabelMapping** command to view the list of available key labels and to obtain the index number for each key label mapping for use with the **editKeyLabelMapping** and **deleteKeyLabelMapping** commands.
- [viewLibraryVPD CLI command](#)
Use the **viewLibraryVPD** command to show vital product data (VPD) for the library. This command is useful if an administrator or service engineer needs to see the model or serial number or other information specific to the library.
- [viewLogicalLibraries CLI command](#)
Use the **viewLogicalLibraries** command to list high-level information for all logical libraries. If you need detailed information for a specific library, use the **viewLogicalLibraryDetails** command.
- [viewLogicalLibraryDetails CLI command](#)
Use the **viewLogicalLibraryDetails** command to show the name, type, maximum cartridges, number of virtual I/O slot addresses, and number of drive addresses in a specified logical library. To show summary information for all logical libraries, use the **viewLogicalLibraries** command.
- [viewMacAddress CLI command](#)
Use the **viewMacAddress** command to look up the MAC addresses for a drive's Ethernet ports.
- [viewNodeCards CLI command](#)
Use the **viewNodeCards** command to view a summary of information about each node card in the library.
- [viewOfflineComponents CLI command](#)
Use the **viewOfflineComponents** command to display a list of all offline components in the library.
- [viewPasswordAndSessionPolicy CLI command](#)
The **viewPasswordAndSessionPolicy** command displays the current password security settings.
- [viewRolePermissions CLI command](#)
Use the **viewRolePermissions** command to display the access level for each GUI page for the specified role. You can send the command output to a text file that can be edited and used as input to the **setRolePermissions** command.
- [viewRoles CLI command](#)
Use the **viewRoles** command to display all of the defined roles in the library and the number of users with that role.
- [viewSnapshots CLI command](#)
Use the **viewSnapshots** command to display a list of all available snapshots in the library. The snapshots are listed chronologically, with the most recent file last. Each snapshot is assigned an index number. To download a snapshot, use the **downloadSnapshots** command and specify the index number returned by this command.
- [viewStorageCapacity CLI command](#)
The **viewStorageCapacity** command provides basic monitoring capability for capacity utilization and licensed slots. The output is in JSON format for use with the IBM Storage Mobile Dashboard.
- [viewSystemSummary CLI command](#)
Use the **viewSystemSummary** command to view a summary of library components. This command is useful for users who need to view information about each frame, or to see a summary of the total storage capacity. The information is listed in ascending order by frame number, followed by component totals for the whole library.
- [viewSystemSummaryDetails CLI command](#)
Use the **viewSystemSummaryDetails** command to view detailed information about a specific frame. If you need to view summary information about all frames in the library, use the **viewSystemSummary** command.
- [viewUsers CLI command](#)
Use the **viewUsers** command to display a list of users (either remote or local) and their properties, including state, role, email address, and date and time of last login.
- [viewUtilThreshold CLI command](#)
Use the **viewUtilThreshold** command to view the current cartridge capacity utilization threshold settings. Use the **setUtilThreshold** to change these settings.
- [viewVolserRanges CLI command](#)
Use the **viewVolserRanges** command to list all VOLSER ranges in the physical library, sorted by the starting VOLSER number in the range. To list the VOLSER ranges assigned for each logical library, use the **viewVolserRangesbyLL** command.
- [viewVolserRangesByLL CLI command](#)
Use the **viewVolserRangesByLL** command to list all of the VOLSER ranges for each logical library in the physical library. To list all of the VOLSER ranges for the physical library, use the **viewVolserRanges** command.

assignDataCartridges CLI command

Use the **assignDataCartridges** command to assign or reassign individual data cartridges to one or more logical libraries.

Syntax

```
assignDataCartridges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file listing the VOLSER number for each cartridge to be assigned and the name of the destination logical library.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
assignDataCartridges todays_assigns.txt
```

Example input file

```
UAA9RHL5, testto1ib
UBB9RHL5, 1ib2
```

Example output

```
The cartridges were assigned successfully
Done.
```

assignDriveToLL CLI command

Use the **assignDriveToLL** command to assign a drive to a logical library.

Syntax

```
assignDriveToLL <logical-library-name>,<-f# -c# -r#> -ssl
```

Parameters

<logical-library-name>
The name of the logical library.

<-f# -c# -r#>
(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
assignDriveToLL CLILib,F1C2R1
```

Example output

```
The drive was assigned successfully
```

batch CLI command

Use the **batch** command to run multiple commands specified in a file.

Syntax

```
batch <filename.txt> -ssl
```

Parameters

<filename.txt>
(Required.) A text file containing one or more commands, in the following format:

```
--commandName1 [commandParameters]
--commandName2 [commandParameters]
```

Note: Enter only the command name and any parameters in the input file. Do not enter the full java command or you will receive an error.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
batch todays_batch.txt
```

Example input file

```
--viewLogicalLibraries
--viewIoStation
--viewAccessor
--viewRoles
--viewUsers
```

Example output

Name	Type	Assigned Cartridges	Virtual I/O cartridges	Drives	Encryption Method	Queued Exports	VOLSER Reporting (6/8 characters)
GVGNFLOW	3592	0	0	0	No	Hide	6
Library1	3592	0	0	0	No	Show	6

Volume	Serial	Logical Library	Element Address	Media Type	Location (F,C,R)	Encryption
M000NTJL		Logical Library 1	1046	JAG	I/O Slot(F1,C5,R4,T1)	Not Encrypted
M001NTJL		Logical Library 1	1294	JAG	I/O Slot(F1,C6,R29,T0)	Not Encrypted

Availability

Accessor	Accessor A
Accessor	OK - Online
Gripper 1	OK - Online
Gripper 2	OK - Online

Usage Statistics

	Accessor A Component
Pivots	267
Gripper 1 gets	104
Gripper 1 puts	103
Gripper 2 gets	46
Gripper 2 puts	46
Bar code scans	5724
X travel (meters)	86
Y travel (meters)	114

Role	Mapped users
Administrator	12
Superuser	0
Service	1
Monitor	1

Name	Locked	State	Role	Email	Last login
jecervan		Disconnected	Administrator	jecervan@mx1.ibm.com	
service		Disconnected	Service	service@service.com	
temporal		Disconnected	Administrator		lunes, noviembre 25, 2013, 09:40:22 AM CST

bulkAssignDataCartridges CLI command

Use the **bulkAssignDataCartridges** command to bulk-assign cartridges to a single logical library. You can bulk-assign up to 100 cartridges. Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries.

Syntax

```
bulkAssignDataCartridges <filename.txt>,<destination-logical-library> -ssl
```

Parameters

- <filename.txt>**
(Required.) A text file listing the VOLSER number for each cartridge to be assigned.
- <destination-logical-library>**
(Required.) The name of the destination logical library.
- ssl**
Required if SSL (HTTPS) is enabled.

Example command

```
bulkAssignDataCartridges todays_bulk_assigns.txt,LibTest
```

Example input file

```
UAA9RHL5
UBB9RHL5
```

Example output

```
The cartridges were assigned successfully
Done.
```

bulkAssignDataCartridgesByLL CLI command

Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries. To bulk-assign cartridges to a single logical library, use the **bulkAssignDataCartridges** command.

Syntax

```
bulkAssignDataCartridgesByLL <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file listing the VOLSER number for each cartridge to be assigned and the name of the destination logical library.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
bulkAssignDataCartridgesByLL todays_bulk_assignsLL.txt
```

Example input file

```
UAA9RHL5, testtolib  
UBB9RHL5, lib2
```

Example output

```
The cartridges were assigned successfully  
Done.
```

cleanDrive CLI command

Use the **cleanDrive** command to clean a specific drive.

Syntax

```
cleanDrive <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
cleanDrive -f1 -c4 -r1
```

Example output

```
The drive was cleaned successfully
```

codeUpdate CLI command

Use the **codeUpdate** command to update the library firmware. To update the firmware in a specific drive, use the **driveCodeUpdate** command, or use the TS4500 management GUI (Drives > Drives page).

Syntax

```
codeUpdate <firmware_image_file> -ssl
```

Parameters

<firmware_image_file>

(Required.) The filename (and path, if necessary) of the firmware file.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
codeUpdate TS4500_1100-04Q.afwz
```

Example output

```
Name: TS4500_1100-04Q.afwz
>>>Uploading file..
.....
Done.
```

completeDriveService CLI command

Use the **completeDriveService** command to complete the drive replacement procedure.

Syntax

```
completeDriveService <-f# -c# -r#>
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
completeDriveService -f1 -c4 -r1
```

Example output

```
The drive service has completed.
```

continueCloseLibraryVerify CLI command

Use the **continueCloseLibraryVerify** command to finish the library verification process for I/O stations. Before you run this command, you must run the **continueLibraryVerify** command and then close all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)

Syntax

```
continueCloseLibraryVerify -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
continueCloseLibraryVerify
```

Example output

```
IO doors closed.
Library verify continues now...The test has been completed successfully
```

continueLibraryVerify CLI command

Use the **continueLibraryVerify** command to perform the second step of the library verification process for I/O stations. Before you run this command, you must run the **startLibraryVerify** command and then open all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)

Syntax

```
continueLibraryVerify -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
continueLibraryVerify
```

Example output

```
IO doors opened. Library verify continues now.....Done!  
Next step: CLOSE all IO doors, and then use "continueCloseLibraryVerify" command to continue the test.
```

createBEP CLI command

Use the **createBEP** command to create a bar code encryption policy. Before you run this command, run the **viewKeyLabelMapping** command to look up the key label mapping index number of the cartridges to have the encryption policy.

Syntax

```
createBEP <VOLSER_start>,<VOLSER_end>,<logical_library_name>,<media_type>,<klm_index_1>,<klm_index_2> -ssl
```

Parameters

<VOLSER_start>
(Required.) The volume serial number that starts the series of cartridges to have the encryption policy.

<VOLSER_end>
(Required.) The volume serial number that ends the series of cartridges to have the encryption policy.

<logical_library_name>
(Required.) The name of the logical library that contains the series of cartridges to have the encryption policy.

<media_type>
(Required.) The media type of the cartridges to have the encryption policy (LTO or 3592).

<klm_index_1>
(Required.) The key label mapping index number of the cartridges to have the encryption policy.

<klm_index_2>
(Required for 3592 drives. Optional for LTO.) A second range of labels for encryption.

-ssl
Required if SSL (HTTPS) is enabled.

Example command (3592 cartridges)

```
createBEP TTT200,TTT300,test1,3592,1,2
```

This command creates a bar code encryption policy for the VOLSER range TTT200 through TTT300 in the **test1** logical library for the 3592 cartridges that are referenced in indexes 1 and 2.

Example output

```
The bar code encryption policy was created successfully
```

createKeyLabelMapping CLI command

Use the **createKeyLabelMapping** command to create a key label mapping.

Syntax

```
createKeyLabelMapping <keyLabelFrom>, <keyModeFrom>, <keyLabelTo> -ssl
```

Parameters

<keyLabelFrom>

(Required.) A text string; maximum 50 characters. It cannot be repeated in the list of key labels.

<keyModeFrom>

(Required.) A parameter with the following possible values:

- Wrapped-Hash
- Wrapped-Default (Specifying this value for <keyModeFrom> disables <keyLabelTo>, so it is not necessary to specify a value for <keyLabelTo>.)
- Wrapped-Clear
- Direct-Default-Set
- Direct-Specific

<keyLabelTo>

(Required.) A text string; maximum 50 characters.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
createKeyLabelMapping START, Wrapped-Hash, END
```

This example instructs the system to create a mapping from the key label **START** to the key label **END** using the wrapped-hash key mode.

Example output

```
The Key Label Mapping was created successfully
```

createLL CLI command

Use the **createLL** command to create a new logical library.

Syntax

```
createLL <logical-library-name>, {LTO|JAG}
```

Parameters

<logical-library-name>

The name of the new logical library.

{LTO|JAG}

The type of drives in the logical library: LTO or JAG (3592).

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
createLL NewLib, JAG
```

Example output

```
The logical library was created successfully
```

createUser CLI command

Use the **createUser** command to create a new local user. Remote authentication can be either enabled or disabled.

Syntax

```
createUser -name "<name>" -role <role> -sendToEmail {yes -email <email> | no -tempPass <password>} -ssl
```

Parameters

-name "<name>"

(Required.) A name for the user. The double quotation marks are required.

-role <role>

(Required.) The user's role.
-sendToEmail
(Required.) The options are:

- **yes**
-email
<email>
- **no**
-tempPass
<password>

-ssl
Required if SSL (HTTPS) is enabled.

Example commands

The following example creates a local user account. The user's password (**L0gM3InN0w**) is defined in the command.

```
createUser -name "testUser" -role Service -sendToEmail no -tempPass L0gM3InN0w
```

The following example creates a local user account, with a system-generated password being sent to the user's email account.

```
createUser -name "testUser" -role Service -sendToEmail yes -email testUser@mycompany.com
```

Example output

```
User testUser was created successfully.
```

Related concepts

- [Creating a local user account](#)

Related reference

- [deleteUser CLI command](#)
- [viewUsers CLI command](#)

Related information

- [Managing local users](#)
- [Roles](#)

createVolserRanges CLI command

Use the **createVolserRanges** command to create one or more new VOLSER ranges.

Syntax

```
createVolserRanges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file defining the VOLSER ranges to be created. The file can contain any number of VOLSER ranges. The VOLSER ranges are defined as follows:

```
<startRange>, <endRange>, <LLName>, <mediaType>, {TRUE|FALSE}
```

where:

- <startRange> = the starting VOLSER in the range to be created
- <endRange> = the ending VOLSER in the range to be created
- <LLName> = the name of the logical library
- <mediaType> = LTO or 3592
- TRUE = The range is applied to new cartridges only.
- FALSE = The range is not limited to new cartridges. It is applied immediately to all cartridges in the library.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
createVolserRanges volser_ranges.txt
```

Example input file

```
UAA9RH,UBB9RH,Library1,3592,FALSE
TUU9RH,TXX9RH,Library2,LTO,TRUE
GGG9RH,HHH9RH,Library2,LTO,TRUE
```

Example output

```
The Volser Range was created successfully
The Volser Range was created successfully
The Volser Range was created successfully
Done.
```

deleteBEP CLI command

Use the **deleteBEP** command to delete a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **deleteBEP** command.

Syntax

```
deleteBEP <index> -ssl
```

Parameters

<index>

(Required.) The index number, obtained by running the **viewBEP** command, that corresponds to the BEP to delete.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
deleteBEP 1
```

This example deletes the BEP that corresponds to index 1.

Example output

```
The bar code encryption policy was deleted successfully
```

deleteKeyLabelMapping CLI command

Use the **deleteKeyLabelMapping** command to delete a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number for a specific key label mapping.

Syntax

```
deleteKeyLabelMapping <index> -ssl
```

Parameters

<index>

(Required.) The index number of a key label mapping. Run the **viewKeyLabelMapping** command to obtain the index number.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
deleteKeyLabelMapping 1
```

Example output

```
The Key Label Mapping was deleted successfully
```

deleteLL CLI command

Use the **deleteLL** command to delete a logical library.

Syntax

```
deleteLL <logical-library-name>
```

Parameters

<logical-library-name>

The name of the logical library.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
deleteLL NewLib
```

Example output

```
The logical library was deleted successfully
```

deleteUser CLI command

Use the **deleteUser** command to delete local user accounts. Local user accounts cannot be deleted from the management GUI when Remote Authentication is enabled; they can only be deleted from the CLI.

To view a list of local users from the CLI, use the **viewUsers** command with the **-local** option.

Only one user can be deleted at a time.

Syntax

```
deleteUser "<name>" -ssl
```

Parameters

"<name>"

(Required.) The name of the local user. The double quotation marks are required.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
deleteUser "testuser"
```

Example output

```
User testUser1 was removed successfully.
```

Related reference

- [createUser CLI command](#)
- [viewUsers CLI command](#)

Related information

- [Managing local users](#)

deleteVolserRanges CLI command

Use the **deleteVolserRanges** command to delete one or more VOLSER ranges. The command is applied immediately to all cartridges in the specified VOLSER ranges.

Syntax

```
deleteVolserRanges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file defining the VOLSER ranges to be deleted. The file can contain any number of VOLSER ranges. The VOLSER ranges are defined as follows:

<LLName>, <startRange>, <endRange>

where:

- <LLName> = the name of the logical library that contains the VOLSER to be deleted
- <startRange> = the starting VOLSER in the range to be deleted
- <endRange> = the ending VOLSER in the range to be deleted

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
deleteVolserRanges ranges_to_delete.txt
```

Example input file

```
Library1,UAA9RH,UBB9RH  
Library1,TUU9RH,TXX9RH  
Library1,GGG9RH,HHH9RH
```

Example output

```
The Volser Range was removed successfully  
The Volser Range was removed successfully  
The Volser Range was removed successfully  
Done.
```

destageDataCartridges CLI command

Use the **destageDataCartridges** command to move cartridges from their cartridge cache locations to a high-density slot. (This command is only for high-density libraries. All data cartridges that are being destaged must be in tier 0.)

Syntax

```
destageDataCartridges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file containing a list of VOLSER numbers corresponding to the cartridge cache locations.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
destageDataCartridges todays_destaging.txt
```

Example input file

```
UAA9RHL5  
UBB9RHL5
```

Example output

```
The cartridges were moved successfully  
Done.
```

downloadDrivesLog CLI command

Use the **downloadDrivesLog** command to download a .zip file containing the logs from the specified (or all) drives. This command is useful for troubleshooting.

Syntax

```
downloadDrivesLog {<F# C# R#>,<F# C# R#>,... | ALL} -ssl
```

Each drive location must be delimited by a comma.

Parameters

{<F# C# R#>,<F# C# R#>,... | ALL}

(Required.) A comma-delimited list of drive locations, where:

- F# = frame number of the drive
- C# = column number of the drive
- R# = row number of the drive
- ALL = all drives

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadDrivesLog F1C1R1,F1C2R2
```

Example output

```
Gathering logs...
Downloading...3638135/3638135 bytes
The drivelog file: TS4500_DRIVELOGS_2016-09-06_11.41.58.zip has been downloaded.
```

downloadEvents CLI command

Use the **downloadEvents** command to export detailed information about all error, warning, and informational events saved in the library.

The most recent 10,000 events are downloaded. Events are sorted by severity first and then by time. The information is saved to a CSV file with a filename in the format TS4500_Events_<date/time>.csv. The file is saved to the directory where the TS4500CLI.jar file is stored.

Refer to the Events topic for more information about events.

Syntax

```
downloadEvents -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadEvents
```

Example output

```
Downloading...45410004/45410004 bytes
The file: TS4500_Events_2018-02-26_10.49.11.csv has been downloaded.
```

Related information

- [Events](#)

downloadLog CLI command

The **downloadLog** command creates a set of log files describing recent library activity, including errors and failures. The default command creates encrypted files for use by IBM development; these files cannot be read by customers or SSRs. The -csh (control system health) option creates a smaller set of unencrypted log files that can be used by customers and SSRs to determine the status of the control system.

The default zip file is named TS4500_FWLOGS_[yyyy-MM-dd_hh.mm.ss].zip. It is saved in the directory where the TS4500CLI.jar file is stored.

Syntax

```
downloadLog [-csh] [-ssl]
```

Parameters

-csh

(Optional.) Creates a zip file named TS4500_CSHLOGS_[yyyy-MM-dd_hh.mm.ss].zip. It is saved in the directory where the TS4500CLI.jar file is stored. The zip file contains the following log files:

File name	Description
DHC.txt	This file is useful when running DHC and when completing service on an accessor.
Lib_Verify.txt	This file should be looked at if the library is failing Library Verify with either accessor.
LogCollection.log	This file indicates if a log collection is being executed or the last log collection that was executed on that local LCC card. It provides a highly detailed view of the log collection progress.
memsegData_1.csv	This file contains all of the calibration data for Accessor A. If there are failures, it can quickly point to the failing location. It can also help indicate if the calibration of any fiducial is re-trying. It can also be monitored while calibrating the library to have a real-time status of progress.
memsegData_2.csv	This file contains all of the calibration data for Accessor B. If there are failures, it can quickly point to the failing location. It can also help indicate if the calibration of any fiducial is re-trying. It can also be monitored while calibrating the library to have a real-time status of progress.
READY.txt	This file should be looked at if the library is stuck in initializing. It can point the service person to potential problems with the library trying to come ready.
scsi.txt	This file contains the SCSI commands that come from the host.
volserData_1.csv	This file contains all of the barcode data being scanned for Accessor A. This file is a running history of all the barcodes that have been scanned.
volserData_2.csv	This file contains all of the barcode data being scanned for Accessor B. This file is a running history of all the barcodes that have been scanned.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadLog
```

Example output

```
Downloading... [completed] / [totalSize] has been downloaded.
```

```
The log file: TS4500_FWLOGS_[yyyy-MM-dd_hh.mm.ss].zip has been downloaded.
```

Example output with -csh option

```
Downloading... [completed] / [totalSize] has been downloaded.
```

```
The log file: TS4500_CSHLOGS_[yyyy-MM-dd_hh.mm.ss].zip has been downloaded.
```

downloadPropertiesFile CLI command

Use the **downloadPropertiesFile** command to download the properties file (TSSC file) if one exists in the card.

Syntax

```
downloadPropertiesFile -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadPropertiesFile
```

Example output

```
Downloading... [completed] / [totalSize] has been downloaded.
```

```
The file: "LIBLG_01_VP_[yyyy-MM-dd_hh.mm.ss] has been downloaded.
```

downloadResources CLI command

Use the **downloadResources** command to export information about a library to a .csv file. You can specify all resources or a single resource, such as drives or users.

If you specify all resources, the output file is assigned a name in the format *<library-name>_LibrarySummary_<date-time>.csv*. This is the same as the System Summary file that is created by the Export System Summary option on the System GUI page.

If you specify a single resource, the output file is named *<library-name>_<library-serial-number>_<resource>_<date-time>.csv*.

The output file is saved in the directory where the TS4500CLI.jar file is stored.

Syntax

```
downloadResources {all|<resource>} -ssl
```

Parameters

{all|<resource>}

(Required.) Enter all to download the System Summary file, which contains information on all system resources. For information on a specific resource, enter one of the following resource names. The names are capitalized here for clarity, but the CLI is not case-sensitive.

- Accessors
- Cartridges
- Drives
- EmailRecipients
- EncryptionInternalLabels
- EncryptionKeyServers
- FibreChannelPorts
- Frames
- FunctionalSwitches
- Grippers
- IOStations
- iSCSIPorts
- Library
- LicensedFeatures
- LogicalLibraries
- ManagementEthernetPorts
- MountHistory
- PasswordPolicy
- Roles
- Slots
- SNMPDestinations
- SyslogServers
- SystemConsole
- Users
- VOLSERRanges

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadResources drives
```

Example output

```
Downloading...45410004/45410004 bytes  
The file: MTC001_13FA001_Drives_20170413T001012.csv has been downloaded.
```

Related information

- [Exporting system information](#)

downloadSnapshot CLI command

Use the **downloadSnapshot** command to download a snapshot from the library. First, run the **viewSnapshots** command to obtain the index number for the specific snapshot.

Syntax

```
downloadSnapshot <index> -ssl
```

The snapshot file is downloaded to the same directory where the CLI is running.

Parameters

<index>

(Required.) The index number of the snapshot that is to be downloaded. Run the **viewSnapshots** command to look up the index number.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadSnapshot 1
```


Example output

```
Downloading... [completed] / [totalSize] has been downloaded.
.
The snapshot file: "TS4500_Snapshot_01122013.zip has been downloaded.
```

driveCodeUpdate CLI command

Use the **driveCodeUpdate** command to update the firmware in a drive or list of drives.

Syntax

```
driveCodeUpdate <firmware-image-file> -l <F# C# R#>,<F# C# R#>,... --reset <resetOption> -ssl
```

Parameters

<firmware-image-file>

(Required.) The filename (and the path, if necessary) of the firmware file.

-l <F# C# R#>,<F# C# R#>,...

(Required.) A comma-delimited list of drives to update. The drive list must be preceded by -l (lowercase letter L, short for "location").

Drive locations are indicated as follows:

- F# = frame number
- C# = column number
- R# = row number

--reset <resetOption>

(Required.) Specifies when the drive will be reset after the code is updated. It has the following options:

- IMMEDIATE = The reset takes place immediately. The drive must be empty before the update. Before you perform an IMMEDIATE reset, run the **moveFromDrive** command to eject a cartridge from the drive.
- UNLOAD = The reset occurs after the drive is unloaded.
- MANUAL = A manual reset must be performed to activate the code.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
driveCodeUpdate LTO6_DAQM.fcp_fh.fmrz -l F1C4R2,F1C4R3 --reset IMMEDIATE
```

Example output

```
The code update has started
```

```
Name: LTO6_DAQM.fcp_fh.fmrz
```

```
>>>Uploading file..
```

```
.....
```

```
Done.
```

editKeyLabelMapping CLI command

Use the **editKeyLabelMapping** command to edit a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number of a specific key label mapping.

Syntax

```
editKeyLabelMapping <index>,<keyLabelFrom>,<keyModeFrom>,<keyLabelTo> -ssl
```

Parameters

<index>

(Required.) The index number of a key label mapping. Run the **viewKeyLabelMapping** command to obtain the index number.

<keyLabelFrom>

(Required.) A text string; maximum 50 characters. It cannot be repeated in the list of key labels.

<keyModeFrom>

(Required.) A parameter with the following possible values:

- Wrapped-Hash
- Wrapped-Default (Specifying this value for `<keyModeFrom>` disables `<keyLabelTo>`, so it is not necessary to specify a value for `<keyLabelTo>`.)
- Wrapped-Clear
- Direct-Default-Set
- Direct-Specific

`<keyLabelTo>`

(Required.) A text string; maximum 50 characters.

`-ssl`

Required if SSL (HTTPS) is enabled.

Example command

```
editKeyLabelMapping 1,START,Wrapped-Hash,END
```

This example edits the key label mapping for index 1. The revised mapping is from the key label **START** to the key label **END**, and the wrapped-hash key mode is used.

Example output

```
The Key Label Mapping was edited successfully
```

encrypt CLI command

Use the **encrypt** command to create an encrypted password that can be used with any other CLI command. When using an encrypted password in a command, use `-ep` instead of `-p` before the password.

Syntax

```
encrypt <PlainTextPassword> -ssl
```

Parameters

`<PlainTextPassword>`

(Required.) The plain text password that should be encrypted.

`-ssl`

Required if SSL (HTTPS) is enabled.

Example command

```
encrypt PlainTextPassword
```

Example output

```
0aR6IcjT
```

Example: Using the encrypted password

In the following example, the encrypted password (`0aR6IcjT`) is being used with the `-ep` parameter to run the **viewLogicalLibraries** command.

```
C:\IBM\Anaconda\CLI>java -jar TS4500CLI.jar -ip 9.22.95.48 -u Dev -ep 0aR6IcjT --viewLogicalLibraries
```

getFWVersion CLI command

Use the **getFWVersion** command to view the current library firmware version.

Syntax

```
getFWVersion
```

Parameters

`-ssl`

Required if SSL (HTTPS) is enabled.

Example command

```
getFWVersion
```

Example output

```
Firmware Version: 1.1.0.0-0AE.00
```

modifyAdvancedEncSettings CLI command

Use the **modifyAdvancedEncSettings** command to make the advanced encryption settings more or less restrictive for data that is stored in a library, or to return the advanced encryption settings to their default values.

Syntax

```
modifyAdvancedEncSettings <logical-library-name>,<advanced-method> {TRUE | FALSE},<advanced-policy>,<density-code>,<keypath> -ssl
```

Parameters

<logical-library-name>

(Required.) The name of the logical library.

<advanced-method> {TRUE | FALSE}

(Required.) The TRUE parameter is required to change any command values.

Use the FALSE parameter to return to the default settings. No other options are required.

<advanced-policy>

(Required.) The options are:

Advanced policy	Setting
No advanced setting	0
Don't encrypt if no policy	1
Encrypt if no policy	2
Policy required	3
Never encrypt (policy override)	4
Always encrypt (policy override)	5
Internal label – selective encryption	6
Internal label – encrypt all	7

<density-code>

(Required.) The options are:

Density code	Setting
No advanced setting	0
Show encryption	1
Mask encryption	2

<keypath>

(Required.) The options are:

Key path	Setting
No advanced setting	1

-ssl

Required if SSL (HTTPS) is enabled.

Example command, TRUE

```
modifyAdvancedEncSettings Library1,TRUE,2,2,1
```

This example modifies the encryption settings for **Library1** to use the advanced policy that the system should encrypt the data if the data does not already have an encryption policy attached to it. The density code of **2** instructs the system to mask the encryption. The key path of **1** the key path parameter cannot be modified by this command. Any value here is ignored.

Example command, FALSE

```
modifyAdvancedEncSettings Library1,FALSE
```

This example removes any advanced encryption settings for **Library1** and restores the default settings.

Example output

```
The advanced encryption settings for Logical Library Library1 were updated successfully
```

modifyBEP CLI command

Use the **modifyBEP** command to edit a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **modifyBEP** command.

Syntax

```
modifyBEP <index> -KLM1 <#> -BEP {true|false} -KLM2 <#> -ssl
```

Parameters

index

(Required.) The index number, obtained by running the **viewBEP** command, of the BEP to be edited.

-KLM1 <#>

(Required.) The index number of the key label mapping that contains the encryption policy to be edited. Use the [viewKeyLabelMapping CLI command](#) to look up the index number.

-BEP {true|false}

(Required.) A flag to enable (true) or disable (false) BEP.

-KLM2 <#>

An optional parameter to be used if you want to edit encryption policies for in a second key label mapping index.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
modifyBEP 1 -KLM1 3 -BEP false
```

This example updates the bar code encryption policy in BEP index 1, key label mapping index 3 with BEP disabled.

Example output

```
The bar code encryption policy was updated successfully
```

modifyFibreChannelSettings CLI command

Use the **modifyFibreChannelSettings** command to set port speed and topology for a specified drive. Speed and topology are the same for both ports in the drive.

Syntax

```
modifyFibreChannelSettings <speed>,<topology> <-f# -c# -r#> -ssl
```

Parameters

<speed>

(Required.) The options are:

- 1
- 2
- 4
- 8
- 16

<topology>

(Required.) The options are:

- Auto-L
- L
- N
- Auto-N

<-f# -c# -r#>

(Required.) The drive location, where:

- -f# = frame number of the drive that contains ports 1 and 2.
- -c# = column number of the drive that contains ports 1 and 2.
- -r# = row number of the drive that contains ports 1 and 2.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
modifyFibreChannelSettings 4,N -f1 -c1 -r1
```

This example sets the port speed to 4 and the topology to N for both ports in the drive at frame 1, column 1, row 1.

Example output

```
The Fibre channel settings were updated successfully
```

modifyVolserRanges CLI command

Use the **modifyVolserRanges** command to modify existing VOLSER ranges.

Syntax

```
modifyVolserRanges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file defining the VOLSER ranges to be modified. The file can contain any number of VOLSER ranges. The VOLSER ranges must be defined as follows:

```
<startRange>, <endRange>, <LLName>, <mediaType>, {TRUE | FALSE}
```

where:

- <startRange> = the starting VOLSER in the range to be modified.
- <endRange> = the ending VOLSER in the range to be modified.
- <LLName> = the name of the logical library that contains the VOLSER range to be modified.
- <mediaType> = LTO or 3592
- TRUE = The range is applied to new cartridges only.
- FALSE = The range is not limited to new cartridges. It is applied immediately to all cartridges in the library.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
modifyVolserRanges volser_ranges.txt
```

Example input file

```
UAA9RH, UBB9RH, Library1, 3592, FALSE  
TUU9RH, TXX9RH, Library2, LTO, TRUE  
GGG9RH, HHH9RH, Library2, LTO, TRUE
```

Example output

```
The Volser Range was modified successfully  
The Volser Range was modified successfully  
The Volser Range was modified successfully  
Done.
```

modifyVolserReporting CLI command

Use the **modifyVolserReporting** command to specify the number of characters in each VOLSER number (first 6, first 8, all, or last 8) to report to the host for a specified logical library.

Syntax

```
modifyVolserReporting "<logical-library-name>, {6|8|All|Last8}" -ssl
```

Parameters

<logical-library-name>

(Required.) The name of the logical library.

{6|8|All|Last8}

(Required.) The number of characters to report, where:

- 6 = the first 6 characters
- 8 = the first 8 characters
- All = all characters

- Last8 = the last 8 characters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
modifyVolserReporting "Library1,6"
```

The first 6 characters of each VOLSER number are reported for all cartridges in the Library1 logical library.

Example output

```
Volser Reporting flag was updated successfully
```

moveFromAllDrives CLI command

Use the **moveFromAllDrives** command to eject all cartridges from all full drives and move them to the home storage location. If the home storage location is not available, the cartridges are moved to the first empty slot. (To eject a cartridge from a specific drive, use the **moveFromDrive** command.)

Syntax

```
moveFromAllDrives -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
moveFromAllDrives
```

Example output

```
The drive [location] is empty now. Moving to next drive...
The drive [location] is empty now. Moving to next drive...
The drive [location] is empty now. Moving to next drive...
Done. All drives are empty.
```

moveFromDrive CLI command

Use the **moveFromDrive** command to eject a single cartridge from a drive and move it to the home storage location. If the home storage location is not available, the cartridge is moved to the first empty slot.

Syntax

```
moveFromDrive <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The current (moveFrom) location of the cartridge, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
moveFromDrive -f1 -c4 -r1
```

Example output

```
The cartridge was ejected successfully
```

moveToDrive CLI command

Use the **moveToDrive** command to move a cartridge from a storage location (specified by VOLSER number) to a specified drive location.

Syntax

```
moveToDrive <VOLSER> <-f# -c# -r#> -ssl
```

Parameters

<VOLSER>

(Required.) The VOLSER number for the current cartridge storage location.

<-f# -c# -r#>

(Required.) The destination for the cartridge, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
moveToDrive UAA9RHL5 -f1 -c4 -r1
```

Example output

```
The cartridge was mounted successfully
```

prestigeDataCartridges CLI command

Use the **prestigeDataCartridges** command to move cartridges from high-density slots to cartridge cache locations specified by their VOLSER numbers. (This command is only for high-density libraries. All data cartridges that are being prestaged must be in tier 3 or higher.)

Syntax

```
prestigeDataCartridges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file containing a list of VOLSER numbers corresponding to the cartridge cache locations.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
prestigeDataCartridges prestige.txt
```

Example input file

```
UAA9RHL5  
UBB9RHL5
```

Example output

```
The cartridges were moved successfully.  
Done.
```

removeDataCartridges CLI command

Use the **removeDataCartridges** command to remove a data cartridge from a storage location and move it to the I/O station. The cartridge is unassigned from its logical library and the state changes to I/O Slot.

If the I/O station is full, the cartridge is unassigned and the state changes to Slot (Export Queued).

Syntax

```
removeDataCartridges {<VOLSER>|<filename.txt>} -ssl
```

Parameters

{<VOLSER>|<filename.txt>}

(Required.) One of the following:

- The VOLSER number of a specific cartridge.
- A text file containing a list of VOLSER numbers.

-ssl

Required if SSL (HTTPS) is enabled.

Example command (single cartridge)

```
removeDataCartridges UAA9RHL5
```

Example command (with input file)

```
removeDataCartridges todays_removes.txt
```

Example input file

```
UAA9RHL5  
UBB9RHL5
```

Example output

```
The cartridges were removed successfully  
Done.
```

resetDrive CLI command

Use the **resetDrive** command to power cycle a specific drive.

Syntax

```
resetDrive <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
resetDrive -f1 -c4 -r1
```

Example output

```
The drive was reset successfully
```

resetNodeCards CLI command

Use the **resetNodeCards** command to reset one or more node cards.

Syntax

```
resetNodeCards <node_name_1>,<node_name_2>,...
```


Parameters

<node_name_1>,<node_name_2>,...

(Required.) A comma-separated list of node cards to be reset. The node names are as follows:

- ALL
- ALLLCA
- ALLACC
- ALLSMC
- ALLXYC
- ALLPLUS
- XYCPLUS
- ACCPLUS
- LCAPLUS
- XYA
- XYB
- OPC1
- SMC[2-16]
- ACCA
- ACCB
- LCA[1-31]
- LCAB[1-31]

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
resetNodeCards LCA1,LCAB3,ACCA
```

Example output

```
The command was executed successfully
```

restoreConfiguration CLI command

Use the **restoreConfiguration** command to restore a configuration database to the library. Use the **saveConfiguration** command to save the configuration database to a file. This requires a user with the Service role.

The configuration file has a name in the format TS4500_<firmware-level>_SAVECONF_<time-stamp>.dbz and is stored in the directory where the CLI is running.

Note: You can only restore configuration files that were saved at the same library firmware level that you are currently running.

Syntax

```
restoreConfiguration <configuration_file_name>.dbz -ssl
```

Parameters

<configuration_file_name>.dbz

(Required.) The name (and the path, if necessary) of the configuration file to upload.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
restoreConfiguration TS4500_1.4.1.3-D00.T3_SAVECONF_20180323160237.DBZ
```

Example output

```
Name: TS4500_1.4.1.3-D00.T3_SAVECONF_20180323160237.DBZ
>>>Uploading file...
Done.
.
.
The configuration database has been restored successfully.
```

saveConfiguration CLI command

Use the **saveConfiguration** command to save the configuration database to your computer. Use the **restoreConfiguration** command to restore a configuration database to the library. This requires a user with a Service role.

The output file is assigned a name in the following format:

- TS4500_library-serial-number_<firmware-level>_SAVECONF_<time-stamp>.dbz

For example:

- TS4500_FA054_1.4.1.3-D00.T3_SAVECONF_20180323160237.dbz

The file is saved to the directory where the CLI is running.

Syntax

```
saveConfiguration -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example

```
saveConfiguration
```

Example output

```
Done.....  
The library DB backup process has finished successfully.
```

setAccessorZones CLI command

(Dual-accessor libraries only.) Use the **setAccessorZones** command to specify which tape drives and I/O stations (within sets of frames) are served by which accessor. This command can also be used to inactivate an accessor.

Description

By default, each accessor is zoned to serve half of the frames in the library. For example, in a 12-frame library, Accessor A serves frames 1 through 6 and Accessor B serves frames 7 through 12.

You can view the current accessor zone settings with the **viewAccessorZones** command. You can also view these settings in the TS4500 management GUI on the Settings > Library > Advanced page. The Accessor Preferred Zones graphic is refreshed to reflect changes made both through the GUI and with the **setAccessorZones** command.

Elastic capacity settings made through the Advanced page are unaffected by zone changes made with the **viewAccessorZones** command.

Syntax

- Use the no parameter to specify a different zone setting for an accessor, or to inactivate an accessor. (Using this command to inactivate an accessor is the same as inactivating it in the Advanced GUI page.)

```
setAccessorZones no, {<frameNumber>|0|255}
```

where:

- no = Do not use the default zone setting. Instead, use the setting specified here.
 - <frameNumber> (1 – 18) = The last frame served by Accessor A. All remaining frames in the library will be served by Accessor B.
 - 0 = Inactivate Accessor A.
 - 255 = Inactivate Accessor B.
- Use the yes parameter to return both accessors to their default zone settings.

```
setAccessorZones yes
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example commands

The following example uses the `yes` parameter to return both accessors to their default zone settings.

```
setAccessorZones yes
```

The following example restricts Accessor A to frames 1, 2, and 3. Accessor B serves the rest of the frames in the library.

```
setAccessorZones No,3
```

The following example disables Accessor B.

```
setAccessorZones no,255
```

Example output

```
The accessor zone was updated successfully
```

setAutoEjectCleaningCarts CLI command

Use the `setAutoEjectCleaningCarts` command to specify whether expired cleaning cartridges are automatically ejected from the library.

Syntax

```
setAutoEjectCleaningCarts {enabled|disabled} -ssl
```

Parameters

{enabled|disabled}
(Required.) If `enabled` is specified, expired cleaning cartridges are automatically ejected. If `disabled` is specified, they are not.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
setAutoEjectCleaningCarts enabled
```

Example output

```
The auto eject cleaning cartridges flag was set successfully
```

setDrivePortsID CLI command

Use the `setDrivePortsID` command to set the port IDs for a specified drive (port 1 and port 2).

Syntax

```
setDrivePortsID <Port1ID>,<Port2ID> <-f# -c# -r#>
```

Parameters

<Port1ID>
(Required.) The ID number for port 1.

<Port2ID>
(Required.) The ID number for port 2.

<-f# -c# -r#>
(Required.) The drive location, where:

- `-f#` = frame number of the drive that contains ports 1 and 2.
- `-c#` = column number of the drive that contains ports 1 and 2.
- `-r#` = row number of the drive that contains ports 1 and 2.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
setDrivePortsID 18,21 -f1 -c1 -r1
```

Example output

The ports IDs were updated successfully

setDriveUse CLI command

Use the **setDriveUse** command to configure the drive for media access, control path with media access, or media verification.

Syntax

```
setDriveUse -use {access|controlPath|verification} <-f# -c# -r#>
```

Parameters

-use

(Required.) The intended use for the drive, where:

- access = Configures the drive for media access.
- controlPath = Configures the drive as a control path with media access.
- verification = Configures the drive for media verification.

<-f# -c# -r#>

(Required.) The drive location, where:

- -f# = frame number of the drive.
- -c# = column number of the drive.
- -r# = row number of the drive.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setDriveUse -use verification -f4 -c3 -r1
```

Example output

```
The drive was updated successfully.
```

setISCSI CLI command

Use the **setISCSI** command to update the network configuration settings for a single Ethernet drive and to optionally change the name and alias of the drive. Each port can be configured separately so that ports in the same drive can be attached to different subnets.

To look up a drive's current settings, use the **viewISCSI** command or refer to the [Drives, Ethernet Ports GUI page](#).

Syntax

```
setISCSI -portxAddress {DHCP|<ip-address>} -subnet <subnet-mask> -gateway <gateway-address> [-name {DEFAULT|<iSCSI-name>}] [-alias "<iSCSI-alias>"] <-f# -c# -r#> -ssl
```

Parameters

-portxAddress {DHCP|<ip-address>}

(Required.) The port to modify, where:

- -portxAddress is either -port0Address or -port1Address.
- DHCP enables DHCP.
- <ip-address> disables DHCP and assigns this value as the IP address for the specified port. (IPv4 format)

If you are specifying a different subnet mask and gateway for each port, you must enter a separate command for each port, as shown in the example commands. If both ports will be using the same subnet mask and gateway, you can enter the network settings in a single command.

-subnet <subnet-mask>

(Required if DHCP is being disabled.) The subnet mask for the specified port.

-gateway <gateway-address>

(Required if DHCP is being disabled.) The gateway for the specified port.

[-name {DEFAULT|<iSCSI-name>}]

(Optional.) The name for the drive, where:

- DEFAULT restores the drive name to the system-assigned name.
- <iSCSI-name> is the new name for the drive. See *Ethernet drive network configuration* for port name requirements.

A port ID is required when specifying this parameter, even though the name is applied to the drive. You can specify either port.

[-alias "<i>iSCSI-alias</i>"]

(Optional.) The new alias for the drive. See *Ethernet drive network configuration* for alias naming requirements. Quotes are required.

A port ID is required when specifying this parameter, even though the alias is applied to the drive. You can specify either port.

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example commands

The following command disables DHCP for port 0 of the drive in F1C4R1 and assigns the provided network settings to the port.

```
setISCSI -port0Address 9.1.2.4 -subnet 255.255.255.0 -gateway 9.1.0.100 -f1 -c4 -r1
```

The following command enables DHCP for port 0, disables DHCP for port 1 and assigns the provided network settings to the port, and changes the alias for the drive to **new-drive-alias**.

```
setISCSI -port0Address DHCP -port1Address 9.1.2.5 -subnet 255.255.255.1 -gateway 9.1.0.100 -alias "new-drive-alias" -f1 -c4 -r1
```

The following command assigns the address 9.1.2.4 to port 0, assigns the address 9.1.2.5 to port 1, and assigns the provided subnet mask and gateway to both ports.

```
setISCSI -port0Address 9.1.2.4 -port1Address 9.1.2.5 -subnet 255.255.255.1 -gateway 9.1.0.100 -f1 -c4 -r1
```

The following commands assign the provided network settings to each port in the specified drive when each port will be attached to a different subnet. (These commands must be entered separately. Combining them into one command will apply the last subnet mask and gateway entered to both ports.)

```
setISCSI -port0Address 9.1.2.3 -subnet 255.255.0.0 -gateway 9.7.0.1 -f1 -c4 -r1
setISCSI -port1Address 9.1.2.4 -subnet 255.255.0.1 -gateway 9.8.0.1 -f1 -c4 -r1
```

The following command enables DHCP for port 0 of the drive in F1C4R1 and renames the drive to **new-drive-name**.

```
setISCSI -port0Address DHCP -name new-drive-name -f1 -c4 -r1
```

Example output

```
The iSCSI Drive Settings were updated.
```

Related reference

- [viewISCSI CLI command](#)

Related information

- [Ethernet drive network configuration](#)

setLibraryTime CLI command

Use the **setLibraryTime** command to set the library date and time to the same date, time, and time zone of the server on which the CLI is running.

Syntax

```
setLibraryTime -ssl
```

Note: You must have the Administrator role to run this command.

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setLibraryTime
```

Example output

```
The library date and time were updated successfully to Thu Aug 25 14:08:13 MST 2016, time zone: America/Phoenix
```

setMacAddress CLI command

Use the **setMacAddress** command to change the MAC address for an Ethernet port (or both ports). To look up a port's current MAC address, use the **viewMacAddress** command or refer to the [Drives, Ethernet Ports GUI](#) page.

Syntax

```
setMacAddress -portxAddress {DEFAULT|<MAC-address>} [-portxAddress {DEFAULT|<MAC-address>}] <-f# -c# -r#> -ssl
```

Parameters

-portxAddress {DEFAULT|<MAC-address>}

(Required.) The port ID and the new MAC address, where:

- -portxAddress is either -port0Address or -port1Address.
- DEFAULT returns the MAC address to its default setting.
- <MAC-address> is the new MAC address, expressed as a 12-digit hexadecimal number. It can be entered either with or without colons (for example, 00:1a:64:eb:04:83 and 001a64eb0483 are both acceptable).

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setMacAddress -port0Address 00:1a:64:eb:04:83 -port1Address 001a64eb0484 -f1 -c4 -r1
```

Example output

```
MAC address(es) updated.
```

Related reference

- [viewMacAddress CLI command](#)

Related information

- [Ethernet drive network configuration](#)

setMaximumVIOCartridges CLI command

Use the **setMaximumVIOCartridges** command to update the number of virtual I/O slots for the logical library.

Syntax

```
setMaximumVIOCartridges "<logical-library-name>,<nn>" -ssl
```

Parameters

<logical-library-name>

(Required.) The name of the logical library.

<nn>

(Required.) The number of virtual I/O slots in the logical library.

This value cannot be less than the number of physical I/O slots. For example, if the library has two I/O magazines, each with 18 slots, this value must be at least 36.

This value cannot exceed 255.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setMaximumVIOCartridges "Library1,200"
```

Example output

```
The MAX VIO was updated successfully
```

setNMADetection CLI command

Use the **setNMADetection** command to enable or disable NMA detection in the library.

Syntax

```
setNMADetection {TRUE|FALSE} -ssl
```

Parameters

{TRUE|FALSE}

where:

- TRUE = NMA detection is on
- FALSE = NMA detection is off

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setNMADetection TRUE
```

Example output

```
The NMA detection flag was updated successfully
```

setRolePermissions CLI command

Use the **setRolePermissions** command to allow or restrict access to individual GUI pages for a specified role. Use the output from the **viewRolePermissions** command as input for this command.

Syntax

```
setRolePermissions <filename.txt> -role <role_name> -ssl
```

Parameters

<filename.txt>

(Required.) A text file containing the output from the **viewRolePermissions** command, edited as necessary to indicate the new access levels for each GUI page. You can delete lines that aren't changing.

The following access levels are supported:

- Read only = The user can view but cannot edit the page.
- Modify = The user can edit the page.
- No Access = The user cannot view the page.

-role <role_name>

(Required.) The name of the role.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setRolePermissions administrator_permissions.txt -role administrator
```

Example input file

```
      Action,      Access Level
      Cartridges,  No Access
Cartridges by Logical Library,  No Access
      Cleanning Cartridges,  No Access
      Drives,      No Access
      Drives by Logical Library,  No Access
      Email Notifications,  Read Only
      Email Recipients,  Read Only
```

Encryption Internal,	Read Only
Encryption Key Manager,	Read Only
Ethernet Ports,	No Access
Events,	No Access
Library Information,	No Access
Licensed Functions,	No Access
Logical Libraries,	Read Only
Management GUI Behavior,	No Access
Master Console,	No Access
Password Rules,	Read Only
Remote Authentication,	Read Only
Roles,	No Access
SNMP Requests,	Read Only
SNMP Traps,	Read Only
Scan Speed,	Modify
Secure Socket Layer,	Read Only
Service Port,	Modify
Syslogs Notifications,	Read Only
System,	Modify
System Date and Time,	Modify
Tasks,	Modify
Users,	No Access
VOLSER Ranges,	Read Only
VOLSER Ranges by Logical Library,	Read Only

Example output

```
The permissions were updated successfully
```

Related information

- [Roles](#)

setScannerSpeed CLI command

Use the **setScannerSpeed** command to set the speed of the scanner.

Syntax

```
setScannerSpeed <speed> -ssl
```

Parameters

<speed>

(Required.) Scanner speed has the following settings:

- 0 (nominal speed)
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setScannerSpeed 100
```

Example output

```
The scanner speed was updated successfully
```

setSlotOffline CLI command

Use the **setSlotOffline** command to set a specified storage slot offline.

Syntax

```
setSlotOffline <-f# -c# -r#> -ssl
```


Parameters

<-f# -c# -r#>

(Required.) The slot location, where:

- -f# = frame number
- -c# = column number
- -r# = row number

A row number of 0 takes all rows in the specified column offline.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setSlotOffline -f3 -c6 -r0
```

Example output

```
Storage Slot was set Offline
```

setSlotOnline CLI command

Use the **setSlotOnline** command to set a specified storage slot online.

Syntax

```
setSlotOnline <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The slot location, where:

- -f# = frame number
- -c# = column number
- -r# = row number

A row number of 0 takes all rows in the specified column online.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setSlotOnline -f3 -c6 -r0
```

Example output

```
Storage Slot was set Online
```

setSSL CLI command

Use the **setSSL** command to enable or disable the use of HTTPS (HTTP over SSL). The HTTPS protocol provides secure communication over the network.

Syntax

```
setSSL {enabled|disabled} -ssl
```

Parameters

{enabled|disabled}

(Required.) The SSL setting. The options are:

- enabled = enable HTTPS.
- disabled = disable HTTPS.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setSSL enabled
```

Example output

```
The SSL flag was updated successfully
```

setUtilThreshold CLI command

Use the **setUtilThreshold** command to change the cartridge capacity utilization threshold settings. Use the **viewUtilThreshold** command to view the current settings.

The command has the following options:

- The **-cut** (capacity utilization threshold) option controls the behavior of the physical capacity status pod in the bottom left corner of the management GUI System page. When the percentage of slots filled exceeds the **-cut** value (the default is 99%), the pod changes from green to yellow as a warning. When all licensed slots are filled, the pod turns red.
- The **-daut** (dual accessor utilization threshold) option is only applicable to dual-accessor libraries with elastic capacity enabled. It determines the threshold at which cartridges are moved to accessor service areas in the end frames. The default is 98%.

Either **-cut** or **-daut** must be specified. Both options can be specified in the same command.

Syntax

```
setUtilThreshold -cut <nn> -daut <nn> -ssl
```

Parameters

-cut <nn>

One of the following values. The default setting is 99.0.

- 50, 55, 60, 65, 70, 75, 80, 85, 90,
- 91, 92, 93, 94, 95, 96, 97, 98,
- 99.0, 99.1, 99.2, 99.3, 99.4, 99.5, 99.6, 99.7, 99.8, 99.9
-

-daut <nn>

A whole number (no decimals) between 90 and 100. The default setting is 98.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setUtilThreshold -cut 99.5 -daut 95
```

Example output

```
The specified utilization threshold(s) were updated.
```

Related reference

- [viewUtilThreshold CLI command](#)

Related information

- [What are the status pods?](#)
- [Advanced](#)

showQueuedExports CLI command

Use the **showQueuedExports** command to specify whether cartridges that are queued for export remain assigned to the logical library or are unassigned from the logical library.

Syntax

```
showQueuedExports "<logical-library-name>,{true|false}" -ssl
```

Parameters

<logical-library-name>

(Required.) The name of the logical library.

{true|false}

(Required.) The options are:

- true = cartridges that are queued for export remain assigned to the logical library after they are moved to an I/O slot. Also called "show" because the host can still see the cartridges. This is the default.
- false = cartridges that are queued for export are unassigned from the logical library when they are moved to an I/O slot. This allows an unlimited number of cartridges to be queued for export without exceeding the limit of 255 IEE addresses. Also called "hide" because the cartridges are no longer visible to the host.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
showQueuedExports "Library1,true"
```

Example output

```
Queued exports flag was updated successfully
```

startCalibration CLI command

Use the **startCalibration** command to calibrate a library component.

Options cannot be combined in a single command. Each command must be entered separately.

Syntax

```
startCalibration LIBRARY
startCalibration FRAME,<frame-number>
startCalibration DRIVE,<F#C#R#>
startCalibration IO,<frame-number>,<IO-number>
startCalibration ACCESSOR,<accessor-number>
```

Parameters

LIBRARY

Calibrates all library components.

FRAME,<frame-number>

Calibrates the specified frame.

DRIVE,<F#C#R#>

Calibrates the drive in the specified location.

IO,<frame-number>,<IO-number>

Calibrates the specified I/O station in the specified frame, where:

1 = upper I/O station

2 = lower I/O station

ACCESSOR,<accessor-number>

Calibrates the specified accessor, where:

1 = accessor A

2 = accessor B

-ssl

Required if SSL (HTTPS) is enabled.

Example commands

```
startCalibration LIBRARY
startCalibration FRAME,1
startCalibration DRIVE,F1C2R3
startCalibration IO,1,2
startCalibration ACCESSOR,2
```

Example output

```
Calibration has started
```

startDiscoverHW CLI command

Use the **startDiscoverHW** command to start a discover hardware operation.

Syntax

```
startDiscoverHW {OVERWRITE <frames>|<frames>}
```

Parameters

```
{OVERWRITE <frames>|<frames>}  
where:
```

- OVERWRITE <frames> deletes all existing configuration data for the specified frames and re-creates the data.
- <frames> saves the existing configuration data for the specified frames and adds information for any new hardware that is discovered.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
startDiscoverHW OVERWRITE,1,2,5,18  
startDiscoverHW 1,2,5,15,18
```

Example output

```
Discover HW has started
```

startDriveService CLI command

Use the **startDriveService** command to start the drive replacement procedure.

Syntax

```
startDriveService <-f# -c# -r#>
```

Parameters

```
<-f# -c# -r#>
```

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
startDriveService -f1 -c4 -r1
```

Example output

```
The drive was assigned successfully
```

startInventory CLI command

Use the **startInventory** command to start an inventory operation.

Syntax

```
startInventory -library {SINGLE|NO} -audit {FIRST|ALL} -frame {ALL|<frame-number>}
```

Parameters

```
-library {SINGLE|NO}  
(Required.)
```

- SINGLE = The whole library will be inventoried.
- NO = A specific frame, specified by the -frame option, will be inventoried.

```
-audit {FIRST|ALL}  
(Required.)
```

- FIRST = Inventory tier 0 and tier 1
- ALL = Inventory all tiers

-frame {ALL|<frame-number>}
(Required.)

- ALL = All frames (the whole library)
- <frame-number> = A specific frame, specified by its position in the library string.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
startInventory -library SINGLE -audit ALL -frame ALL
startInventory -library NO -audit FIRST -frame 5
```

Example output

```
Inventory has started
```

startLibraryVerify CLI command

Use the **startLibraryVerify** command to start the library verification process for I/O stations. When the command completes, you will be prompted to open all I/O station doors and then run the **continueLibraryVerify** command. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)

Syntax

```
startLibraryVerify -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
startLibraryVerify
```

Example output

```
..Library verify - IO stations - has started...Library verify in progress
.....Done!
Next step: OPEN all IO doors , and then use "continueLibraryVerify" command to continue the test.
```

unassignDrive CLI command

Use the **unassignDrive** command to unassign a specific drive from its current logical library.

Syntax

```
unassignDrive <drive-location>
```

Parameters

<drive-location>
(Required.) The location of the drive, in the format F#C#R#. (For example, F1C2R3.)

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
unassignDrive F1C2R3
```

Example output

```
The drive was unassigned successfully
```

version CLI command

Use the **version** command to view the current version of the TS4500 CLI tool.

Syntax

```
version -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
version
```

Example output

```
CLI GEN 4 Version: 1.28  
Build: 01/23/2016
```

viewAccessor CLI command

Use the **viewAccessor** command to show the accessor's status and usage statistics.

Syntax

```
viewAccessor -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewAccessor
```

Example output

```
Availability  
      , Accessor A  
  Accessor, OK - Online  
  Gripper 1, OK - Online  
  Gripper 2, OK - Online  
  
Usage Statistics  
      , Accessor A Component  
      Pivots, 267  
  Gripper 1 gets, 104  
  Gripper 1 puts, 103  
  Gripper 2 gets, 46  
  Gripper 2 puts, 46  
  Bar code scans, 5724  
  X travel (meters), 86  
  Y travel (meters), 114
```

viewAccessorZones CLI command

Use the **viewAccessorZones** command to view which tape drives and I/O stations (within sets of frames) are being served by which accessor. You can also view these settings in the TS4500 management GUI on the Settings > Library > Advanced page.

Syntax

```
viewAccessorZones -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewAccessorZones
```

Example output

```
Accessor A: 1 - 12  
Accessor B: 13 - 16
```

viewAdvancedEncryptionSettings CLI command

Use the **viewAdvancedEncryptionSettings** command to display the advanced encryption settings for the specified logical library.

Syntax

```
viewAdvancedEncryptionSettings "<logical-library-name>" -ssl > <output-filename.csv>
```

Parameters

- "<logical-library-name>"
(Required.) The name of the logical library.
- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewAdvancedEncryptionSettings "LogLib1"
```

Example output

```
Name:                LibLog1  
Advanced Method:     True  
Advanced Policy:     Encrypt if no policy  
Density Code:        Shows Encryption  
Key Path:            System
```

viewBEP CLI command

Use the **viewBEP** command to display a list of all VOLSER ranges showing the BEP settings. In the command output, each VOLSER range has a corresponding index number that you will need to specify to run the **modifyBEP** and **deleteBEP** commands.

Syntax

```
viewBEP -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewBEP
```

Example output

Index,	Volser Start,	Volser End,	Logical Library,	Media Type,	KLM1,	KLM2,	BEP
1,	TTT200,	TTT300,	test1,	3592,	1,	3,	0
2,	CCC000,	DDD000,	test1,	3592,	1,	3,	1
3,	TTT400,	TTT500,	test1,	3592,	1,	0,	1
5,	TTT000,	TTT100,	test1,	3592,	1,	3,	1

viewCleaningCartridges CLI command

Use the **viewCleaningCartridges** command to view information for all cleaning cartridges in a library, including the number of remaining cleans.

Syntax

```
viewCleaningCartridges -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewCleaningCartridges
```

Example output

Volume Serial,	Logical Library,	Element Address,	Media Type,	Location(F,C,R),	Cleans remaining,	Most Recent use
M000NTL5,	Logical Library 1,	1046,	JAG,	Slot (F1,C5,R4,T1),	50,	31 December 1969
06:00:00						
M001NTL5,	Logical Library 1,	1294,	JAG,	Slot (F1,C6,R29,T0),	50,	31 December 1969
06:00:00						

viewDataCartridges CLI command

Use the **viewDataCartridges** command to view high-level information for all data cartridges in a library, sorted by VOLSER number.

Syntax

```
viewDataCartridges -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDataCartridges
```

Example output

Volume Serial,	Logical Library,	Element Address,	Media Type,	Location(F,C,R),	Encryption,	Most Recent use
M000NTL5,	Logical Library 1,	1046,	JAG,	Slot (F1,C5,R4,T1),	Not Encrypted,	0
M001NTL5,	Logical Library 1,	1294,	JAG,	Slot (F1,C6,R29,T0),	Not Encrypted,	0

viewDriveDetails CLI command

The **viewDriveDetails** command returns information about a specific drive that is useful for troubleshooting, including the contents of the drive, the name of the logical library, worldwide node numbers (WWNNs), and port ID information.

Syntax

```
viewDriveDetails <-f# -c# -r#> -ssl > <output-filename.csv>
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDriveDetails -f1 -c1 -r3
```

Example output

```
Location (F,C,R)      F1,C1,R3
State                ONLINE
Type                 3592-55E
Logical Library      GVGNFLOW
Control path         Enabled
Contents             N408NTJL
Firmware             4068
WWNN                 5005076044143503
Element Address      257
Drive Display        ND
  Port 0
  Loop ID             20
  WWPN                5005076344443503
  Port 1
  Loop ID             84
  WWPN                5005076344843503
```

viewDriveEthernetPorts CLI command

The **viewEthernetPorts** command returns a list of all the Ethernet drives in the library.

Syntax

```
viewDriveEthernetPorts -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewDriveEthernetPorts -ssl
```

Example output

```
Subnet, Location, Port, State, IP Address, iSCSI Name, iSCSI Alias, IPV4 Gateway,
MAC Address, Speed
255.255.255.0, F1, C4, R2, 0, Disabled, 9.7.124.61, naa.500507630202e821, Library 13FA009, Drive F1, C4, R2 i2, 9.7.124.0,
00-1a-64-ea-62-65, 0 Gbps
255.255.255.0, F1, C4, R2, 1, Disabled, 9.7.124.62, naa.500507630202e821, Library 13FA009, Drive F1, C4, R2 i2, 9.7.124.0,
00-1a-64-ea-62-66, 0 Gbps
```

viewSasPorts CLI command

The **viewSasPorts** command returns of all the SAS drives in the library.

Syntax

```
viewSasPorts -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewSasPorts -ssl
```

Example output

```
Location(F,C,R),      Type,      Address,      Link Status,      Link Speed, Hashed Address
F1, C4, R1,          3592-60S,  50050760444000c, Light Detected,    Auto,          13
,                    ,           50050760448000c, No light,          Auto,          77
F2, C4, R3,          LTO 9,     50050760444001e, Light Detected,    Auto,          31
,                    ,           50050760448001e, No light,          Auto,          95
F1, C3, R4,          3592-60S,  50050760444000b, No light,          Auto,          12
,                    ,           50050760448000b, No light,          Auto,          76
F1, C4, R3,          3592-60S,  50050760444000e, No light,          Auto,          15
,                    ,           50050760448000e, No light,          Auto,          79
```

viewDriveSummary CLI command

Use the **viewDriveSummary** command to list all of the drives in the library. This summary information is useful to network administrators who are deciding where to mount a cartridge. To list detailed information about a specific drive, use the **viewDriveDetails** command.

Syntax

```
viewDriveSummary -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDriveSummary
```

Example output

```
Location(F,C,R), State, Type, Contents, Firmware, Serial, WWNN, Element Address, Logical Library
F1,C1,R3, Online, 3592, Empty, 0, 13A0001, , 257, GVGNFLOW
```

viewDriveVPD CLI command

Use the **viewDriveVPD** command to show vital product data (VPD) information for all drives in the library. This command is useful if an administrator or service engineer needs to see such information as a product model number, product release level, or other information specific to the device type.

Syntax

```
viewDriveVPD -ssl > <output-filename.csv>
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.
- > <output-filename.csv> (Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDriveVPD
```

Example output

Location(F,C,R)	Drive Type	Firmware Version	Machine Type	Serial Number
F1,C2,R1	LTO 5	C7R2	3588	00078AE1DD
F1,C1,R2	LTO 5	C7R2	3588	00078AE1F3
F4,C4,R1	3592E04	2693	3592	0007859653

viewDrivePod CLI command

The **viewDrivePod** command provides basic monitoring capability to display system health and drives in use. The output is in JSON format for use with the IBM Storage Mobile Dashboard. This command provides the same information as the middle pod (drive utilization) on the System GUI page.

Syntax

```
viewDrivePod
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.

Example command

```
viewDrivePod
```

Example output (in JSON format)

```
[{"clazz": "com.ibm.storage.anaconda.events.DriveStationEvent", "drivesInUse": 0, "libraryIdx": -1, "libraryName": "", "podStatus": "HEALTHY", "totalDrives": 1, "topic": "DRIVE_STATION", "id": 4996, "arguments": null, "timestamp": 1539385899616, "topic": "DRIVE_STATION"}]
```

viewFibreChannel CLI command

Use the **viewFibreChannel** command to show the Fibre Channel settings for both ports in each drive. The information is sorted by drive name. This command is useful to view the port configuration for the Fibre Channel switch and make sure that the configuration is compatible for the type of network in use.

Syntax

```
viewFibreChannel -ssl > <output-filename.csv>
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.
- > <output-filename.csv> (Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewFibreChannel
```

Example output

Drive	Location(F,C,R)	Logical Library	Type	Port	Link Status	Configured LinkSpeed	Configured Topology
30F000701,	F1,C1,R1,	Library1,	3592,	30F400701,	Light Detected,	4Gb/s,	L Port
30F000702,	F1,C2,R1,	Library2,	3592,	30F800701,	No Light,	Not Available,	Not Available
,	,	,	,	30F400702,	Light Detected,	4Gb/s,	L Port
,	,	,	,	30F800702,	No Light,	Not Available,	Not Available

viewIoStation CLI command

Use the **viewIoStation** command to view a summary of information for all cartridges in the I/O station.

Syntax

```
viewIoStation -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewIoStation
```

Example output

Volume Serial	Logical Library	Element Address	Media Type	Location(F,C,R)	Encryption
M000NTL5,	Logical Library 1,	1046,	JAG,	I/O Slot(F1,C5,R4,T1),	Not Encrypted
M001NTL5,	Logical Library 1,	1294,	JAG,	I/O Slot(F1,C6,R29,T0),	Not Encrypted

viewISCSI CLI command

Use the **viewISCSI** command to view the configuration settings for a specific Ethernet drive.

Syntax

```
viewISCSI <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number
-

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewISCSI -f4 -c3 -r1
```

Example output

```
iSCSI name:    naa.032165478954
iSCSI alias:  Drive05
DHCP:         Disabled
Port 0 address: 9.1.2.3
Gateway:      9.7.0.1
Subnet mask:  255.255.0.0
Port 1 address: 9.1.2.4
Gateway:      9.8.0.1
Subnet mask:  255.255.0.1
```

Related reference

- [setISCSI CLI command](#)

Related information

- [Ethernet drive network configuration](#)

viewKeyLabelMapping CLI command

Use the **viewKeyLabelMapping** command to view the list of available key labels and to obtain the index number for each key label mapping for use with the **editKeyLabelMapping** and **deleteKeyLabelMapping** commands.

Syntax

```
viewKeyLabelMapping -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewKeyLabelMapping
```

Example output

Index,	Map From Key Label,	Key Mode ,	Map To Key Label
1,	Aedea,	Wrapped-Default,	0
2,	Aedea2,	Wrapped-Default,	0
3,	Aedea3,	Wrapped-Hash,	Aedea5

viewLibraryVPD CLI command

Use the **viewLibraryVPD** command to show vital product data (VPD) for the library. This command is useful if an administrator or service engineer needs to see the model or serial number or other information specific to the library.

Syntax

```
viewLibraryVPD -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewLibraryVPD
```

Example output

Location,	Machine Type,	Model,	Serial Number,	Media Type
Frame 1,	3584,	L25,	13FA005,	3592

viewLogicalLibraries CLI command

Use the **viewLogicalLibraries** command to list high-level information for all logical libraries. If you need detailed information for a specific library, use the **viewLogicalLibraryDetails** command.

Note: Information about queued exports and VOLSER reporting is only available through this command, not through the TS4500 management GUI.

Syntax

```
viewLogicalLibraries -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewLogicalLibraries
```

Example output

Name, Type, Assigned Cartridges, Virtual I/O cartridges, Drives, Encryption Method, Queued Exports, VOLSER Reporting (6/8/All/Last8 characters)					
GvGNFLOW, 3592, All	0,	0,	0,	No,	Hide,
Library1, 3592, LAST8	0,	0,	0,	No,	Show,

viewLogicalLibraryDetails CLI command

Use the **viewLogicalLibraryDetails** command to show the name, type, maximum cartridges, number of virtual I/O slot addresses, and number of drive addresses in a specified logical library. To show summary information for all logical libraries, use the **viewLogicalLibraries** command.

Syntax

```
viewLogicalLibraryDetails "<logical-library-name>" -ssl > <output-filename.csv>
```

Parameters

<logical-library-name>
(Required.) The name of the logical library.

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewLogicalLibraryDetails "library1"
```

Example output

Name, Type, Max Cartridges, Virtual I/O slot addresses, Drive Addresses,				
Library1, 3592, 1000,	130 (768-897),	68 (257-321)		

viewMacAddress CLI command

Use the **viewMacAddress** command to look up the MAC addresses for a drive's Ethernet ports.

Syntax

```
viewMacAddress <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewMacAddress -f4 -c3 -r1
```

Example output

```
Port 0 MAC Address: 00:1a:64:eb:04:83
Port 1 MAC Address: 00:1a:64:eb:04:84
```

Related reference

- [setMacAddress CLI command](#)

Related information

- [Ethernet drive network configuration](#)

viewNodeCards CLI command

Use the **viewNodeCards** command to view a summary of information about each node card in the library.

Syntax

```
viewNodeCards -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewNodeCards
```

Example output

```
Card name, CardPass, Location, Part number, Serial number, Firmware version
LCA1, 0, Frame 1.Row 1, , , 1.1.0.0-00Q.00
```

viewOfflineComponents CLI command

Use the **viewOfflineComponents** command to display a list of all offline components in the library.

Syntax

```
viewOfflineComponents -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewOfflineComponents
```

Example output

```
Frame, Column, Row, Status
4, 9, 1, Offline
```

viewPasswordAndSessionPolicy CLI command

The **viewPasswordAndSessionPolicy** command displays the current password security settings.

Syntax

```
viewPasswordAndSessionPolicy
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewPasswordAndSessionPolicy
```

Example output

```
Automatic logout: Disabled
Password lock: 5 attempts
Automatic IMC (local GUI) login at power on: Disabled
Minimum number of characters: 8
Minimum number of upper case characters: 1
Minimum number of lower case characters: 1
Minimum number of numeric characters: 1
Minimum number of special characters: 0
Maximum identical, consecutive characters: 2
Maximum password age: 90 day(s)
Minimum password age: 1 day(s)
Number of unique passwords before reusing: 8
```

viewRolePermissions CLI command

Use the **viewRolePermissions** command to display the access level for each GUI page for the specified role. You can send the command output to a text file that can be edited and used as input to the **setRolePermissions** command.

Syntax

```
viewRolePermissions -role <roleName> > <filename.txt> > <output-filename.csv> -ssl
```

Note: You must have the Administrator role to run this command.

Parameters

-role <roleName>
(Required.) The name of the role for which the access levels will be output.

> <filename.txt>
(Optional.) Use this option to send the command output to a text file that can be edited and used as input for the **setRolePermissions** command. The file is stored in the same directory as the TS4500CLI.jar file. To save the file in a different directory, specify the path to that directory. If you don't specify a filename, the output is sent to your display.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.
Note: This file cannot be used with the **setRolePermissions** command.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewRolePermissions -role administrator > administrator_permissions.txt
```

Example output

Action,	Access Level
Cartridges,	No Access
Cartridges by Logical Library,	No Access
Cleanning Cartridges,	No Access
Drives,	No Access
Drives by Logical Library,	No Access
Email Notifications,	Read Only
Email Recipients,	Read Only
Encryption Internal,	Read Only
Encryption Key Manager,	Read Only
Ethernet Ports,	No Access
Events,	No Access
Library Information,	No Access
Licensed Functions,	No Access
Logical Libraries,	Read Only
Management GUI Behavior,	No Access
Master Console,	No Access
Password Rules,	Read Only
Remote Authentication,	Read Only
Roles,	No Access
SNMP Requests,	Read Only
SNMP Traps,	Read Only
Scan Speed,	Modify
Secure Socket Layer,	Read Only
Service Port,	Modify
Syslogs Notifications,	Read Only
System,	Modify
System Date and Time,	Modify
Tasks,	Modify
Users,	No Access
VOLSER Ranges,	Read Only
VOLSER Ranges by Logical Library,	Read Only

Related information

- [Roles](#)

viewRoles CLI command

Use the **viewRoles** command to display all of the defined roles in the library and the number of users with that role.

Syntax

```
viewRoles -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewRoles
```

Example output

Role,	Mapped users
Administrator,	12
Superuser,	0
Service,	1
Monitor,	1

Related information

- [Roles](#)

viewSnapshots CLI command

Use the **viewSnapshots** command to display a list of all available snapshots in the library. The snapshots are listed chronologically, with the most recent file last. Each snapshot is assigned an index number. To download a snapshot, use the **downloadSnapshots** command and specify the index number returned by this command.

Syntax

```
viewSnapshots -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewSnapshots
```

Example output

```
1 - TS4500_Snapshot_01122013.zip
2 - TS4500_Snapshot_01012014.zip
3 - TS4500_Snapshot_01022014.zip
```

viewStorageCapacity CLI command

The **viewStorageCapacity** command provides basic monitoring capability for capacity utilization and licensed slots. The output is in JSON format for use with the IBM Storage Mobile Dashboard.

Syntax

```
viewStorageCapacity
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewStorageCapacity
```

Example output (in JSON format)

```
[{"librarymediatype": "3", "licensed_jag_used": "5", "licensed_lto": "0",  
"licensed_jag": "100", "licensed_lto_used": "0"}]
```

viewSystemSummary CLI command

Use the **viewSystemSummary** command to view a summary of library components. This command is useful for users who need to view information about each frame, or to see a summary of the total storage capacity. The information is listed in ascending order by frame number, followed by component totals for the whole library.

Syntax

```
viewSystemSummary -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewSystemSummary
```

Example output

```
Frame: 1
State: Door closed
Media Type: 3592
Data Cartridges: 307
Storage Slots: 660
Drives: 10
Upper IO cartridges: 9
Upper IO door slots: 16
Upper IO door media type: 3592
Lower IO cartridges: 7
Lower IO door slots: 16
Lower IO door media type: 3592
MTM: 3584L25
S/N: FA002
-----
Frame: 2
Accessors: OK - Online
State: Door closed
Media Type: 3592
Data Cartridges: 332
Storage Slots: 883
Drives: 2
MTM: 3584D25
S/N: FA106
-----
Total storage slots: 1543
Total storage cartridges: 639
Total IO slots: 16
Total IO cartridges: 16
Total Drives: 12
Total Frames: 2
```

viewSystemSummaryDetails CLI command

Use the **viewSystemSummaryDetails** command to view detailed information about a specific frame. If you need to view summary information about all frames in the library, use the **viewSystemSummary** command.

Syntax

```
viewSystemSummaryDetails <frame#> -ssl > <output-filename.csv>
```

Note: No accessor information is returned if the specified frame does not have accessors.

Parameters

<frame#>

(Required.) The frame number.

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewSystemSummaryDetails 2
```

Example output

```
Frame: 2
Accessors: OK - Online
State: Door closed
Media Type: 3592
Data Cartridges: 332
Storage Slots: 883
Licensed slots: 200
```

LTO Capacity:
3590 capacity:
Drives: 2
MTM: 3584D25
S/N: FA106

viewUsers CLI command

Use the **viewUsers** command to display a list of users (either remote or local) and their properties, including state, role, email address, and date and time of last login.

If remote authentication is enabled, the command returns a list of all users defined on the remote authentication server who are currently connected to the library. If the **-local** option is specified, the command returns a list of all local users, connected and disconnected.

If remote authentication is not enabled, the command returns a list of all local users, connected and disconnected.

Syntax

```
viewUsers -local -ssl > <output-filename.csv>
```

Parameters

-local

(Optional.) If specified when remote authentication is enabled, the command returns a list of all local users. If remote authentication is not enabled, this option has no effect; the command still returns a list of local users.

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewUsers -local
```

Example output

Name,	Locked,	State,	Role,	Email,	Last login
jecervan,	,	Disconnected,	Administrator,	xyz@mx1.ibm.com,	
service,	,	Disconnected,	Service,	service@service.com,	
temporal,	,	Disconnected,	Administrator,	,	lunes, noviembre 25, 2013, 09:40:22 AM CST

Related reference

- [createUser CLI command](#)
- [deleteUser CLI command](#)

Related information

- [Managing local users](#)

viewUtilThreshold CLI command

Use the **viewUtilThreshold** command to view the current cartridge capacity utilization threshold settings. Use the **setUtilThreshold** to change these settings.

Syntax

```
viewUtilThreshold -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewUtilThreshold
```

Example output

```
Capacity Utilization Threshold: 99.5%
Dual Accessor Utilization Threshold: 95
```

Related reference

- [setUtilThreshold CLI command](#)

viewVolserRanges CLI command

Use the **viewVolserRanges** command to list all VOLSER ranges in the physical library, sorted by the starting VOLSER number in the range. To list the VOLSER ranges assigned for each logical library, use the **viewVolserRangesbyLL** command.

Syntax

```
viewVolserRanges -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewVolserRanges
```

Example output

Volser Start	Volser End	Logical Library	Media Type	Number of Cartridges
CCC9RH,	DDD9RH,	Library 1,	LTO,	40
EEE9RH,	FFF9RH,	Library 1,	LTO,	10
GGG9RH,	HHH9RH,	Library 1,	3592,	10
III9RH,	JJJ9RH,	Library 1,	3592,	10

viewVolserRangesByLL CLI command

Use the **viewVolserRangesByLL** command to list all of the VOLSER ranges for each logical library in the physical library. To list all of the VOLSER ranges for the physical library, use the **viewVolserRanges** command.

Syntax

```
viewVolserRangesByLL -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewVolserRangesByLL
```

Example output

Logical Library	Cartridges	Media Type
Tuco_Salamanca,	14,	LTO
SG0011 - SG1100,	14	

Typoon,	1,	LTO
B00000 - B00001,	0	
D00000 - D00030,	0	

CLI commands listed by category

- [Cleaning cartridge commands](#)
- [CLI commands](#)
- [Data cartridge commands](#)
- [Drive commands](#)
- [Encryption key manager/BEP commands](#)
- [Ethernet drive commands](#)
- [Key label mapping commands](#)
- [Logical library commands](#)
- [Mobile commands](#)
- [Security commands](#)
- [Service commands](#)
- [System commands](#)
- [User and role commands](#)
- [VOLSER commands](#)

Cleaning cartridge commands

- [setAutoEjectCleaningCarts CLI command](#)
Use the **setAutoEjectCleaningCarts** command to specify whether expired cleaning cartridges are automatically ejected from the library.
- [viewCleaningCartridges CLI command](#)
Use the **viewCleaningCartridges** command to view information for all cleaning cartridges in a library, including the number of remaining cleans.

setAutoEjectCleaningCarts CLI command

Use the **setAutoEjectCleaningCarts** command to specify whether expired cleaning cartridges are automatically ejected from the library.

Syntax

```
setAutoEjectCleaningCarts {enabled|disabled} -ssl
```

Parameters

{enabled|disabled}
(Required.) If enabled is specified, expired cleaning cartridges are automatically ejected. If disabled is specified, they are not.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
setAutoEjectCleaningCarts enabled
```

Example output

```
The auto eject cleaning cartridges flag was set successfully
```

viewCleaningCartridges CLI command

Use the **viewCleaningCartridges** command to view information for all cleaning cartridges in a library, including the number of remaining cleans.

Syntax

```
viewCleaningCartridges -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewCleaningCartridges
```

Example output

Volume Serial,	Logical Library,	Element Address,	Media Type,	Location(F,C,R),	Cleans remaining,	Most Recent use
M000NTL5,	Logical Library 1,	1046,	JAG,	Slot (F1,C5,R4,T1),	50,	31 December 1969
06:00:00						
M001NTL5,	Logical Library 1,	1294,	JAG,	Slot (F1,C6,R29,T0),	50,	31 December 1969
06:00:00						

CLI commands

- [batch CLI command](#)
Use the **batch** command to run multiple commands specified in a file.
- [encrypt CLI command](#)
Use the **encrypt** command to create an encrypted password that can be used with any other CLI command. When using an encrypted password in a command, use -ep instead of -p before the password.
- [version CLI command](#)
Use the **version** command to view the current version of the TS4500 CLI tool.

batch CLI command

Use the **batch** command to run multiple commands specified in a file.

Syntax

```
batch <filename.txt> -ssl
```

Parameters

<filename.txt>
(Required.) A text file containing one or more commands, in the following format:

```
--commandName1 [commandParameters]  
--commandName2 [commandParameters]
```

Note: Enter only the command name and any parameters in the input file. Do not enter the full java command or you will receive an error.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
batch todays_batch.txt
```

Example input file

```
--viewLogicalLibraries  
--viewIoStation  
--viewAccessor  
--viewRoles  
--viewUsers
```

Example output

Name,	Type,	Assigned Cartridges,	Virtual I/O cartridges,	Drives,	Encryption Method,	Queued Exports,	VOLSER Reporting
(6/8 characters)							
GVGNFLOW,	3592,	0,	0,	0,	No,	Hide,	
6							
Library1,	3592,	0,	0,	0,	No,	Show,	
6							
Volume Serial,	Logical Library,	Element Address,	Media Type,	Location(F,C,R),	Encryption		
M000NTJL,	Logical Library 1,	1046,	JAG,	I/O Slot(F1,C5,R4,T1),	Not Encrypted		
M001NTJL,	Logical Library 1,	1294,	JAG,	I/O Slot(F1,C6,R29,T0),	Not Encrypted		

Availability

```
      ,      Accessor A
  Accessor,   OK - Online
  Gripper 1,  OK - Online
  Gripper 2,  OK - Online
```

Usage Statistics

```
      ,      Accessor A Component
      Pivots, 267
  Gripper 1 gets, 104
  Gripper 1 puts, 103
  Gripper 2 gets, 46
  Gripper 2 puts, 46
  Bar code scans, 5724
  X travel (meters), 86
  Y travel (meters), 114
```

```
  Role,      Mapped users
Administrator, 12
  Superuser,  0
  Service,    1
  Monitor,    1
```

```
Name, Locked, State, Role, Email, Last login
jecervan, , Disconnected, Administrator, jecervan@mx1.ibm.com,
service, , Disconnected, Service, service@service.com,
temporal, , Disconnected, Administrator, , lunes, noviembre 25, 2013, 09:40:22 AM CST
```

encrypt CLI command

Use the **encrypt** command to create an encrypted password that can be used with any other CLI command. When using an encrypted password in a command, use **-ep** instead of **-p** before the password.

Syntax

```
encrypt <PlainTextPassword> -ssl
```

Parameters

<PlainTextPassword>
(Required.) The plain text password that should be encrypted.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
encrypt PlainTextPassword
```

Example output

```
0aR6IcjT
```

Example: Using the encrypted password

In the following example, the encrypted password (0aR6IcjT) is being used with the **-ep** parameter to run the **viewLogicalLibraries** command.

```
C:\IBM\Anaconda\CLI>java -jar TS4500CLI.jar -ip 9.22.95.48 -u Dev -ep 0aR6IcjT --viewLogicalLibraries
```

version CLI command

Use the **version** command to view the current version of the TS4500 CLI tool.

Syntax

```
version -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
version
```


Example output

```
CLI GEN 4 Version: 1.28
Build: 01/23/2016
```

Data cartridge commands

- [assignDataCartridges CLI command](#)
Use the **assignDataCartridges** command to assign or reassign individual data cartridges to one or more logical libraries.
- [bulkAssignDataCartridges CLI command](#)
Use the **bulkAssignDataCartridges** command to bulk-assign cartridges to a single logical library. You can bulk-assign up to 100 cartridges. Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries.
- [bulkAssignDataCartridgesByLL CLI command](#)
Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries. To bulk-assign cartridges to a single logical library, use the **bulkAssignDataCartridges** command.
- [destageDataCartridges CLI command](#)
Use the **destageDataCartridges** command to move cartridges from their cartridge cache locations to a high-density slot. (This command is only for high-density libraries. All data cartridges that are being destaged must be in tier 0.)
- [moveFromAllDrives CLI command](#)
Use the **moveFromAllDrives** command to eject all cartridges from all full drives and move them to the home storage location. If the home storage location is not available, the cartridges are moved to the first empty slot. (To eject a cartridge from a specific drive, use the **moveFromDrive** command.)
- [moveFromDrive CLI command](#)
Use the **moveFromDrive** command to eject a single cartridge from a drive and move it to the home storage location. If the home storage location is not available, the cartridge is moved to the first empty slot.
- [moveToDrive CLI command](#)
Use the **moveToDrive** command to move a cartridge from a storage location (specified by VOLSER number) to a specified drive location.
- [prestigeDataCartridges CLI command](#)
Use the **prestigeDataCartridges** command to move cartridges from high-density slots to cartridge cache locations specified by their VOLSER numbers. (This command is only for high-density libraries. All data cartridges that are being prestaged must be in tier 3 or higher.)
- [removeDataCartridges CLI command](#)
Use the **removeDataCartridges** command to remove a data cartridge from a storage location and move it to the I/O station. The cartridge is unassigned from its logical library and the state changes to I/O Slot.
- [viewDataCartridges CLI command](#)
Use the **viewDataCartridges** command to view high-level information for all data cartridges in a library, sorted by VOLSER number.

assignDataCartridges CLI command

Use the **assignDataCartridges** command to assign or reassign individual data cartridges to one or more logical libraries.

Syntax

```
assignDataCartridges <filename.txt> -ssl
```

Parameters

<filename.txt>
(Required.) A text file listing the VOLSER number for each cartridge to be assigned and the name of the destination logical library.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
assignDataCartridges todays_assigns.txt
```

Example input file

```
UAA9RHL5, testtolib
UBB9RHL5, lib2
```

Example output

```
The cartridges were assigned successfully
Done.
```

bulkAssignDataCartridges CLI command

Use the **bulkAssignDataCartridges** command to bulk-assign cartridges to a single logical library. You can bulk-assign up to 100 cartridges. Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries.

Syntax

```
bulkAssignDataCartridges <filename.txt>,<destination-logical-library> -ssl
```

Parameters

<filename.txt>
(Required.) A text file listing the VOLSER number for each cartridge to be assigned.

<destination-logical-library>
(Required.) The name of the destination logical library.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
bulkAssignDataCartridges todays_bulk_assigns.txt,LibTest
```

Example input file

```
UAA9RHL5  
UBB9RHL5
```

Example output

```
The cartridges were assigned successfully  
Done.
```

bulkAssignDataCartridgesByLL CLI command

Use the **bulkAssignDataCartridgesByLL** command to bulk-assign cartridges to multiple logical libraries. To bulk-assign cartridges to a single logical library, use the **bulkAssignDataCartridges** command.

Syntax

```
bulkAssignDataCartridgesByLL <filename.txt> -ssl
```

Parameters

<filename.txt>
(Required.) A text file listing the VOLSER number for each cartridge to be assigned and the name of the destination logical library.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
bulkAssignDataCartridgesByLL todays_bulk_assignsLL.txt
```

Example input file

```
UAA9RHL5, testtolib  
UBB9RHL5, lib2
```

Example output

```
The cartridges were assigned successfully  
Done.
```

destageDataCartridges CLI command

Use the **destageDataCartridges** command to move cartridges from their cartridge cache locations to a high-density slot. (This command is only for high-density libraries. All data cartridges that are being destaged must be in tier 0.)

Syntax

```
destageDataCartridges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file containing a list of VOLSER numbers corresponding to the cartridge cache locations.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
destageDataCartridges todays_destaging.txt
```

Example input file

```
UAA9RHL5  
UBB9RHL5
```

Example output

```
The cartridges were moved successfully  
Done.
```

moveFromAllDrives CLI command

Use the **moveFromAllDrives** command to eject all cartridges from all full drives and move them to the home storage location. If the home storage location is not available, the cartridges are moved to the first empty slot. (To eject a cartridge from a specific drive, use the **moveFromDrive** command.)

Syntax

```
moveFromAllDrives -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
moveFromAllDrives
```

Example output

```
The drive [location] is empty now. Moving to next drive...  
The drive [location] is empty now. Moving to next drive...  
The drive [location] is empty now. Moving to next drive...  
Done. All drives are empty.
```

moveFromDrive CLI command

Use the **moveFromDrive** command to eject a single cartridge from a drive and move it to the home storage location. If the home storage location is not available, the cartridge is moved to the first empty slot.

Syntax

```
moveFromDrive <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The current (moveFrom) location of the cartridge, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
moveFromDrive -f1 -c4 -r1
```

Example output

```
The cartridge was ejected successfully
```

moveToDrive CLI command

Use the **moveToDrive** command to move a cartridge from a storage location (specified by VOLSER number) to a specified drive location.

Syntax

```
moveToDrive <VOLSER> <-f# -c# -r#> -ssl
```

Parameters

<VOLSER>

(Required.) The VOLSER number for the current cartridge storage location.

<-f# -c# -r#>

(Required.) The destination for the cartridge, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
moveToDrive UAA9RHL5 -f1 -c4 -r1
```

Example output

```
The cartridge was mounted successfully
```

prestigeDataCartridges CLI command

Use the **prestigeDataCartridges** command to move cartridges from high-density slots to cartridge cache locations specified by their VOLSER numbers. (This command is only for high-density libraries. All data cartridges that are being prestaged must be in tier 3 or higher.)

Syntax

```
prestigeDataCartridges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file containing a list of VOLSER numbers corresponding to the cartridge cache locations.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
prestigeDataCartridges prestige.txt
```

Example input file

```
UAA9RHL5  
UBB9RHL5
```

Example output

```
The cartridges were moved successfully.  
Done.
```

removeDataCartridges CLI command

Use the **removeDataCartridges** command to remove a data cartridge from a storage location and move it to the I/O station. The cartridge is unassigned from its logical library and the state changes to I/O Slot.

If the I/O station is full, the cartridge is unassigned and the state changes to Slot (Export Queued).

Syntax

```
removeDataCartridges {<VOLSER>|<filename.txt>} -ssl
```

Parameters

{<VOLSER>|<filename.txt>}

(Required.) One of the following:

- The VOLSER number of a specific cartridge.
- A text file containing a list of VOLSER numbers.

-ssl

Required if SSL (HTTPS) is enabled.

Example command (single cartridge)

```
removeDataCartridges UAA9RHL5
```

Example command (with input file)

```
removeDataCartridges todays_removes.txt
```

Example input file

```
UAA9RHL5  
UBB9RHL5
```

Example output

```
The cartridges were removed successfully  
Done.
```

viewDataCartridges CLI command

Use the **viewDataCartridges** command to view high-level information for all data cartridges in a library, sorted by VOLSER number.

Syntax

```
viewDataCartridges -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDataCartridges
```

Example output

Volume Serial	Logical Library	Element Address	Media Type	Location (F,C,R)	Encryption	Most Recent use
M000NTL5	Logical Library 1	1046	JAG	Slot (F1,C5,R4,T1)	Not Encrypted	0
M001NTL5	Logical Library 1	1294	JAG	Slot (F1,C6,R29,T0)	Not Encrypted	0

Drive commands

- [cleanDrive CLI command](#)

Use the **cleanDrive** command to clean a specific drive.

- [modifyFibreChannelSettings CLI command](#)
Use the **modifyFibreChannelSettings** command to set port speed and topology for a specified drive. Speed and topology are the same for both ports in the drive.
- [resetDrive CLI command](#)
Use the **resetDrive** command to power cycle a specific drive.
- [setDrivePortsID CLI command](#)
Use the **setDrivePortsID** command to set the port IDs for a specified drive (port 1 and port 2).
- [setDriveUse CLI command](#)
Use the **setDriveUse** command to configure the drive for media access, control path with media access, or media verification.
- [unassignDrive CLI command](#)
Use the **unassignDrive** command to unassign a specific drive from its current logical library.
- [viewDriveDetails CLI command](#)
The **viewDriveDetails** command returns information about a specific drive that is useful for troubleshooting, including the contents of the drive, the name of the logical library, worldwide node numbers (WWNNs), and port ID information.
- [viewDriveEthernetPorts CLI command](#)
The **viewEthernetPorts** command returns a list of all the Ethernet drives in the library.
- [viewSasPorts CLI command](#)
The **viewSasPorts** command returns of all the SAS drives in the library.
- [viewDriveSummary CLI command](#)
Use the **viewDriveSummary** command to list all of the drives in the library. This summary information is useful to network administrators who are deciding where to mount a cartridge. To list detailed information about a specific drive, use the **viewDriveDetails** command.
- [viewDriveVPD CLI command](#)
Use the **viewDriveVPD** command to show vital product data (VPD) information for all drives in the library. This command is useful if an administrator or service engineer needs to see such information as a product model number, product release level, or other information specific to the device type.
- [viewFibreChannel CLI command](#)
Use the **viewFibreChannel** command to show the Fibre Channel settings for both ports in each drive. The information is sorted by drive name. This command is useful to view the port configuration for the Fibre Channel switch and make sure that the configuration is compatible for the type of network in use.

cleanDrive CLI command

Use the **cleanDrive** command to clean a specific drive.

Syntax

```
cleanDrive <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
cleanDrive -f1 -c4 -r1
```

Example output

```
The drive was cleaned successfully
```

modifyFibreChannelSettings CLI command

Use the **modifyFibreChannelSettings** command to set port speed and topology for a specified drive. Speed and topology are the same for both ports in the drive.

Syntax

```
modifyFibreChannelSettings <speed>, <topology> <-f# -c# -r#> -ssl
```

Parameters

<speed>

(Required.) The options are:

- 1
- 2
- 4

- 8
- 16

<topology>

(Required.) The options are:

- Auto-L
- L
- N
- Auto-N

<-f# -c# -r#>

(Required.) The drive location, where:

- **-f#** = frame number of the drive that contains ports 1 and 2.
- **-c#** = column number of the drive that contains ports 1 and 2.
- **-r#** = row number of the drive that contains ports 1 and 2.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
modifyFibreChannelSettings 4,N -f1 -c1 -r1
```

This example sets the port speed to **4** and the topology to **N** for both ports in the drive at frame 1, column 1, row 1.

Example output

```
The Fibre channel settings were updated successfully
```

resetDrive CLI command

Use the **resetDrive** command to power cycle a specific drive.

Syntax

```
resetDrive <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
resetDrive -f1 -c4 -r1
```

Example output

```
The drive was reset successfully
```

setDrivePortsID CLI command

Use the **setDrivePortsID** command to set the port IDs for a specified drive (port 1 and port 2).

Syntax

```
setDrivePortsID <Port1ID>, <Port2ID> <-f# -c# -r#>
```

Parameters

<Port1ID>

(Required.) The ID number for port 1.

<Port2ID>

(Required.) The ID number for port 2.

<-f# -c# -r#>

(Required.) The drive location, where:

- **-f#** = frame number of the drive that contains ports 1 and 2.
- **-c#** = column number of the drive that contains ports 1 and 2.
- **-r#** = row number of the drive that contains ports 1 and 2.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setDrivePortsID 18,21 -f1 -c1 -r1
```

Example output

```
The ports IDs were updated successfully
```

setDriveUse CLI command

Use the **setDriveUse** command to configure the drive for media access, control path with media access, or media verification.

Syntax

```
setDriveUse -use {access|controlPath|verification} <-f# -c# -r#>
```

Parameters

-use

(Required.) The intended use for the drive, where:

- **access** = Configures the drive for media access.
- **controlPath** = Configures the drive as a control path with media access.
- **verification** = Configures the drive for media verification.

<-f# -c# -r#>

(Required.) The drive location, where:

- **-f#** = frame number of the drive.
- **-c#** = column number of the drive.
- **-r#** = row number of the drive.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setDriveUse -use verification -f4 -c3 -r1
```

Example output

```
The drive was updated successfully.
```

unassignDrive CLI command

Use the **unassignDrive** command to unassign a specific drive from its current logical library.

Syntax

```
unassignDrive <drive-location>
```

Parameters

<drive-location>

(Required.) The location of the drive, in the format F#C#R#. (For example, F1C2R3.)

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
unassignDrive F1C2R3
```

Example output

```
The drive was unassigned successfully
```

viewDriveDetails CLI command

The **viewDriveDetails** command returns information about a specific drive that is useful for troubleshooting, including the contents of the drive, the name of the logical library, worldwide node numbers (WWNNs), and port ID information.

Syntax

```
viewDriveDetails <-f# -c# -r#> -ssl > <output-filename.csv>
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- **-f#** = frame number
- **-c#** = column number
- **-r#** = row number

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDriveDetails -f1 -c1 -r3
```

Example output

```
Location (F,C,R)      F1,C1,R3
State                ONLINE
Type                3592-55E
Logical Library      GVGNFLOW
Control path        Enabled
Contents            N408NTJL
Firmware            4068
WWNN                5005076044143503
Element Address      257
Drive Display        ND
Port 0
Loop ID              20
WWPN                5005076344443503
Port 1
Loop ID              84
WWPN                5005076344843503
```

viewDriveEthernetPorts CLI command

The **viewEthernetPorts** command returns a list of all the Ethernet drives in the library.

Syntax

```
viewDriveEthernetPorts -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewDriveEthernetPorts -ssl
```

Example output

```
Subnet, Location, Port, State, IP Address, iSCSI Name, iSCSI Alias, IPv4 Gateway,
MAC Address, Speed
255.255.255.0, F1, C4, R2, 0, Disabled, 9.7.124.61, naa.500507630202e821, Library 13FA009, Drive F1, C4, R2 i2, 9.7.124.0,
00-1a-64-ea-62-65, 0 Gbps
255.255.255.0, F1, C4, R2, 1, Disabled, 9.7.124.62, naa.500507630202e821, Library 13FA009, Drive F1, C4, R2 i2, 9.7.124.0,
00-1a-64-ea-62-66, 0 Gbps
```

viewSasPorts CLI command

The **viewSasPorts** command returns of all the SAS drives in the library.

Syntax

```
viewSasPorts -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewSasPorts -ssl
```

Example output

```
Location(F,C,R), Type, Address, Link Status, Link Speed, Hashed Address
F1, C4, R1, 3592-60S, 500507604440000c, Light Detected, Auto, 13
, , 500507604448000c, No light, Auto, 77
F2, C4, R3, LTO 9, 500507604440001e, Light Detected, Auto, 31
, , 500507604480001e, No light, Auto, 95
F1, C3, R4, 3592-60S, 500507604440000b, No light, Auto, 12
, , 500507604480000b, No light, Auto, 76
F1, C4, R3, 3592-60S, 500507604440000e, No light, Auto, 15
, , 500507604480000e, No light, Auto, 79
```

viewDriveSummary CLI command

Use the **viewDriveSummary** command to list all of the drives in the library. This summary information is useful to network administrators who are deciding where to mount a cartridge. To list detailed information about a specific drive, use the **viewDriveDetails** command.

Syntax

```
viewDriveSummary -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDriveSummary
```

Example output

```
Location(F,C,R), State, Type, Contents, Firmware, Serial, WWNN, Element Address, Logical Library
F1,C1,R3, Online, 3592, Empty, 0, 13A0001, , 257, GVGNFLOW
```

viewDriveVPD CLI command

Use the **viewDriveVPD** command to show vital product data (VPD) information for all drives in the library. This command is useful if an administrator or service engineer needs to see such information as a product model number, product release level, or other information specific to the device type.

Syntax

```
viewDriveVPD -ssl > <output-filename.csv>
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.
- > <output-filename.csv> (Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewDriveVPD
```

Example output

Location (F,C,R) ,	Drive Type,	Firmware Version,	Machine Type,	Serial Number
F1,C2,R1	LTO 5	C7R2	3588	00078AE1DD
F1,C1,R2	LTO 5	C7R2	3588	00078AE1F3
F4,C4,R1	3592E04	2693	3592	0007859653

viewFibreChannel CLI command

Use the **viewFibreChannel** command to show the Fibre Channel settings for both ports in each drive. The information is sorted by drive name. This command is useful to view the port configuration for the Fibre Channel switch and make sure that the configuration is compatible for the type of network in use.

Syntax

```
viewFibreChannel -ssl > <output-filename.csv>
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.
- > <output-filename.csv> (Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewFibreChannel
```

Example output

Drive,	Location (F,C,R) ,	Logical Library,	Type,	Port,	Link Status,	Configured LinkSpeed,	Configured Topology
30F000701,	F1,C1,R1,	Library1,	3592,	30F400701,	Light Detected,	4Gb/s,	L Port
,	,	,	,	30F800701,	No Light,	Not Available,	Not Available
30F000702,	F1,C2,R1,	Library2,	3592,	30F400702,	Light Detected,	4Gb/s,	L Port
,	,	,	,	30F800702,	No Light,	Not Available,	Not Available

Encryption key manager/BEP commands

- [createBEP CLI command](#)
Use the **createBEP** command to create a bar code encryption policy. Before you run this command, run the **viewKeyLabelMapping** command to look up the key label mapping index number of the cartridges to have the encryption policy.
- [deleteBEP CLI command](#)
Use the **deleteBEP** command to delete a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **deleteBEP** command.

- [modifyBEP CLI command](#)
Use the **modifyBEP** command to edit a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **modifyBEP** command.
- [viewBEP CLI command](#)
Use the **viewBEP** command to display a list of all VOLSER ranges showing the BEP settings. In the command output, each VOLSER range has a corresponding index number that you will need to specify to run the **modifyBEP** and **deleteBEP** commands.

createBEP CLI command

Use the **createBEP** command to create a bar code encryption policy. Before you run this command, run the **viewKeyLabelMapping** command to look up the key label mapping index number of the cartridges to have the encryption policy.

Syntax

```
createBEP <VOLSER_start>,<VOLSER_end>,<logical_library_name>,<media_type>,<klm_index_1>,<klm_index_2> -ssl
```

Parameters

- <VOLSER_start>
(Required.) The volume serial number that starts the series of cartridges to have the encryption policy.
- <VOLSER_end>
(Required.) The volume serial number that ends the series of cartridges to have the encryption policy.
- <logical_library_name>
(Required.) The name of the logical library that contains the series of cartridges to have the encryption policy.
- <media_type>
(Required.) The media type of the cartridges to have the encryption policy (LTO or 3592).
- <klm_index_1>
(Required.) The key label mapping index number of the cartridges to have the encryption policy.
- <klm_index_2>
(Required for 3592 drives. Optional for LTO.) A second range of labels for encryption.
- ssl
Required if SSL (HTTPS) is enabled.

Example command (3592 cartridges)

```
createBEP TTT200,TTT300,test1,3592,1,2
```

This command creates a bar code encryption policy for the VOLSER range TTT200 through TTT300 in the **test1** logical library for the 3592 cartridges that are referenced in indexes 1 and 2.

Example output

```
The bar code encryption policy was created successfully
```

deleteBEP CLI command

Use the **deleteBEP** command to delete a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **deleteBEP** command.

Syntax

```
deleteBEP <index> -ssl
```

Parameters

- <index>
(Required.) The index number, obtained by running the **viewBEP** command, that corresponds to the BEP to delete.
- ssl
Required if SSL (HTTPS) is enabled.

Example command

```
deleteBEP 1
```

This example deletes the BEP that corresponds to index 1.

Example output

```
The bar code encryption policy was deleted successfully
```

modifyBEP CLI command

Use the **modifyBEP** command to edit a bar code encryption policy (BEP). First, run the **viewBEP** command to obtain the index number for the BEP, then use the index number as input for the **modifyBEP** command.

Syntax

```
modifyBEP <index> -KLM1 <#> -BEP {true|false} -KLM2 <#> -ssl
```

Parameters

index

(Required.) The index number, obtained by running the **viewBEP** command, of the BEP to be edited.

-KLM1 <#>

(Required.) The index number of the key label mapping that contains the encryption policy to be edited. Use the [viewKeyLabelMapping CLI command](#) command to look up the index number.

-BEP {true|false}

(Required.) A flag to enable (true) or disable (false) BEP.

-KLM2 <#>

An optional parameter to be used if you want to edit encryption policies for in a second key label mapping index.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
modifyBEP 1 -KLM1 3 -BEP false
```

This example updates the bar code encryption policy in BEP index 1, key label mapping index 3 with BEP disabled.

Example output

```
The bar code encryption policy was updated successfully
```

viewBEP CLI command

Use the **viewBEP** command to display a list of all VOLSER ranges showing the BEP settings. In the command output, each VOLSER range has a corresponding index number that you will need to specify to run the **modifyBEP** and **deleteBEP** commands.

Syntax

```
viewBEP -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewBEP
```

Example output

Index,	Volser Start,	Volser End,	Logical Library,	Media Type,	KLM1,	KLM2,	BEP
1,	TTT200,	TTT300,	test1,	3592,	1,	3,	0
2,	CCC000,	DDD000,	test1,	3592,	1,	3,	1
3,	TTT400,	TTT500,	test1,	3592,	1,	0,	1
5,	TTT000,	TTT100,	test1,	3592,	1,	3,	1

Ethernet drive commands

- [setISCSI CLI command](#)
Use the **setISCSI** command to update the network configuration settings for a single Ethernet drive and to optionally change the name and alias of the drive. Each port can be configured separately so that ports in the same drive can be attached to different subnets.
- [setMacAddress CLI command](#)
Use the **setMacAddress** command to change the MAC address for an Ethernet port (or both ports). To look up a port's current MAC address, use the **viewMacAddress** command or refer to the Drives_> Ethernet Ports GUI page.
- [viewISCSI CLI command](#)
Use the **viewISCSI** command to view the configuration settings for a specific Ethernet drive.
- [viewMacAddress CLI command](#)
Use the **viewMacAddress** command to look up the MAC addresses for a drive's Ethernet ports.

setISCSI CLI command

Use the **setISCSI** command to update the network configuration settings for a single Ethernet drive and to optionally change the name and alias of the drive. Each port can be configured separately so that ports in the same drive can be attached to different subnets.

To look up a drive's current settings, use the **viewISCSI** command or refer to the Drives_> Ethernet Ports GUI page.

Syntax

```
setISCSI -portxAddress {DHCP|<ip-address>} -subnet <subnet-mask> -gateway <gateway-address> [-name {DEFAULT|<iSCSI-name>}] [-alias "<iSCSI-alias>"] <-f# -c# -r#> -ssl
```

Parameters

-portxAddress {DHCP|<ip-address>}

(Required.) The port to modify, where:

- -portxAddress is either -port0Address or -port1Address.
- DHCP enables DHCP.
- <ip-address> disables DHCP and assigns this value as the IP address for the specified port. (IPv4 format)

If you are specifying a different subnet mask and gateway for each port, you must enter a separate command for each port, as shown in the example commands. If both ports will be using the same subnet mask and gateway, you can enter the network settings in a single command.

-subnet <subnet-mask>

(Required if DHCP is being disabled.) The subnet mask for the specified port.

-gateway <gateway-address>

(Required if DHCP is being disabled.) The gateway for the specified port.

[-name {DEFAULT|<iSCSI-name>}]

(Optional.) The name for the drive, where:

- DEFAULT restores the drive name to the system-assigned name.
- <iSCSI-name> is the new name for the drive. See *Ethernet drive network configuration* for port name requirements.

A port ID is required when specifying this parameter, even though the name is applied to the drive. You can specify either port.

[-alias "<iSCSI-alias>"]

(Optional.) The new alias for the drive. See *Ethernet drive network configuration* for alias naming requirements. Quotes are required.

A port ID is required when specifying this parameter, even though the alias is applied to the drive. You can specify either port.

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example commands

The following command disables DHCP for port 0 of the drive in F1C4R1 and assigns the provided network settings to the port.

```
setISCSI -port0Address 9.1.2.4 -subnet 255.255.255.0 -gateway 9.1.0.100 -f1 -c4 -r1
```

The following command enables DHCP for port 0, disables DHCP for port 1 and assigns the provided network settings to the port, and changes the alias for the drive to **new-drive-alias**.

```
setISCSI -port0Address DHCP -port1Address 9.1.2.5 -subnet 255.255.255.1 -gateway 9.1.0.100 -alias "new-drive-alias" -f1 -c4 -r1
```

The following command assigns the address 9.1.2.4 to port 0, assigns the address 9.1.2.5 to port 1, and assigns the provided subnet mask and gateway to both ports.

```
setISCSI -port0Address 9.1.2.4 -port1Address 9.1.2.5 -subnet 255.255.255.1 -gateway 9.1.0.100 -f1 -c4 -r1
```

The following commands assign the provided network settings to each port in the specified drive when each port will be attached to a different subnet. (These commands must be entered separately. Combining them into one command will apply the last subnet mask and gateway entered to both ports.)

```
setISCSI -port0Address 9.1.2.3 -subnet 255.255.0.0 -gateway 9.7.0.1 -f1 -c4 -r1
setISCSI -port1Address 9.1.2.4 -subnet 255.255.0.1 -gateway 9.8.0.1 -f1 -c4 -r1
```

The following command enables DHCP for port 0 of the drive in F1C4R1 and renames the drive to `new-drive-name`.

```
setISCSI -port0Address DHCP -name new-drive-name -f1 -c4 -r1
```

Example output

```
The iSCSI Drive Settings were updated.
```

Related reference

- [viewISCSI CLI command](#)

Related information

- [Ethernet drive network configuration](#)

setMacAddress CLI command

Use the `setMacAddress` command to change the MAC address for an Ethernet port (or both ports). To look up a port's current MAC address, use the `viewMacAddress` command or refer to the `Drives > Ethernet Ports` GUI page.

Syntax

```
setMacAddress -portxAddress {DEFAULT|<MAC-address>} [-portxAddress {DEFAULT|<MAC-address>}] <-f# -c# -r#> -ssl
```

Parameters

`-portxAddress {DEFAULT|<MAC-address>}`

(Required.) The port ID and the new MAC address, where:

- `-portxAddress` is either `-port0Address` or `-port1Address`.
- `DEFAULT` returns the MAC address to its default setting.
- `<MAC-address>` is the new MAC address, expressed as a 12-digit hexadecimal number. It can be entered either with or without colons (for example, `00:1a:64:eb:04:83` and `001a64eb0483` are both acceptable).

`<-f# -c# -r#>`

(Required.) The location of the drive, where:

- `-f#` = frame number
- `-c#` = column number
- `-r#` = row number

`-ssl`

Required if SSL (HTTPS) is enabled.

Example command

```
setMacAddress -port0Address 00:1a:64:eb:04:83 -port1Address 001a64eb0484 -f1 -c4 -r1
```

Example output

```
MAC address(es) updated.
```

Related reference

- [viewMacAddress CLI command](#)

Related information

- [Ethernet drive network configuration](#)

viewISCSI CLI command

Use the **viewISCSI** command to view the configuration settings for a specific Ethernet drive.

Syntax

```
viewISCSI <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number
-

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewISCSI -f4 -c3 -r1
```

Example output

```
iSCSI name:      naa.032165478954
iSCSI alias:     Drive05
DHCP:            Disabled
Port 0 address:  9.1.2.3
Gateway:         9.7.0.1
Subnet mask:     255.255.0.0
Port 1 address:  9.1.2.4
Gateway:         9.8.0.1
Subnet mask:     255.255.0.1
```

Related reference

- [setISCSI CLI command](#)

Related information

- [Ethernet drive network configuration](#)

viewMacAddress CLI command

Use the **viewMacAddress** command to look up the MAC addresses for a drive's Ethernet ports.

Syntax

```
viewMacAddress <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
viewMacAddress -f4 -c3 -r1
```

Example output

```
Port 0 MAC Address: 00:1a:64:eb:04:83
Port 1 MAC Address: 00:1a:64:eb:04:84
```

Related reference

- [setMacAddress CLI command](#)

Related information

- [Ethernet drive network configuration](#)

Key label mapping commands

- [createKeyLabelMapping CLI command](#)
Use the **createKeyLabelMapping** command to create a key label mapping.
- [deleteKeyLabelMapping CLI command](#)
Use the **deleteKeyLabelMapping** command to delete a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number for a specific key label mapping.
- [editKeyLabelMapping CLI command](#)
Use the **editKeyLabelMapping** command to edit a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number of a specific key label mapping.
- [viewKeyLabelMapping CLI command](#)
Use the **viewKeyLabelMapping** command to view the list of available key labels and to obtain the index number for each key label mapping for use with the **editKeyLabelMapping** and **deleteKeyLabelMapping** commands.

createKeyLabelMapping CLI command

Use the **createKeyLabelMapping** command to create a key label mapping.

Syntax

```
createKeyLabelMapping <keyLabelFrom>, <keyModeFrom>, <keyLabelTo> -ssl
```

Parameters

<keyLabelFrom>

(Required.) A text string; maximum 50 characters. It cannot be repeated in the list of key labels.

<keyModeFrom>

(Required.) A parameter with the following possible values:

- Wrapped-Hash
- Wrapped-Default (Specifying this value for <keyModeFrom> disables <keyLabelTo>, so it is not necessary to specify a value for <keyLabelTo>.)
- Wrapped-Clear
- Direct-Default-Set
- Direct-Specific

<keyLabelTo>

(Required.) A text string; maximum 50 characters.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
createKeyLabelMapping START, Wrapped-Hash, END
```

This example instructs the system to create a mapping from the key label **START** to the key label **END** using the wrapped-hash key mode.

Example output

```
The Key Label Mapping was created successfully
```

deleteKeyLabelMapping CLI command

Use the **deleteKeyLabelMapping** command to delete a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number for a specific key label mapping.

Syntax

```
deleteKeyLabelMapping <index> -ssl
```

Parameters

<index>

(Required.) The index number of a key label mapping. Run the **viewKeyLabelMapping** command to obtain the index number.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
deleteKeyLabelMapping 1
```

Example output

```
The Key Label Mapping was deleted successfully
```

editKeyLabelMapping CLI command

Use the **editKeyLabelMapping** command to edit a key label mapping. First, run the **viewKeyLabelMapping** command to obtain the index number of a specific key label mapping.

Syntax

```
editKeyLabelMapping <index>, <keyLabelFrom>, <keyModeFrom>, <keyLabelTo> -ssl
```

Parameters

<index>

(Required.) The index number of a key label mapping. Run the **viewKeyLabelMapping** command to obtain the index number.

<keyLabelFrom>

(Required.) A text string; maximum 50 characters. It cannot be repeated in the list of key labels.

<keyModeFrom>

(Required.) A parameter with the following possible values:

- Wrapped-Hash
- Wrapped-Default (Specifying this value for <keyModeFrom> disables <keyLabelTo>, so it is not necessary to specify a value for <keyLabelTo>.)
- Wrapped-Clear
- Direct-Default-Set
- Direct-Specific

<keyLabelTo>

(Required.) A text string; maximum 50 characters.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
editKeyLabelMapping 1, START, Wrapped-Hash, END
```

This example edits the key label mapping for index 1. The revised mapping is from the key label **START** to the key label **END**, and the wrapped-hash key mode is used.

Example output

```
The Key Label Mapping was edited successfully
```

viewKeyLabelMapping CLI command

Use the **viewKeyLabelMapping** command to view the list of available key labels and to obtain the index number for each key label mapping for use with the **editKeyLabelMapping** and **deleteKeyLabelMapping** commands.

Syntax

```
viewKeyLabelMapping -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to

that directory.

Example command

```
viewKeyLabelMapping
```

Example output

Index,	Map From Key Label,	Key Mode ,	Map To Key Label
1,	Aedea,	Wrapped-Default,	0
2,	Aedea2,	Wrapped-Default,	0
3,	Aedea3,	Wrapped-Hash,	Aedea5

Logical library commands

- [assignDriveToLL CLI command](#)
Use the **assignDriveToLL** command to assign a drive to a logical library.
- [createLL CLI command](#)
Use the **createLL** command to create a new logical library.
- [deleteLL CLI command](#)
Use the **deleteLL** command to delete a logical library.
- [modifyAdvancedEncSettings CLI command](#)
Use the **modifyAdvancedEncSettings** command to make the advanced encryption settings more or less restrictive for data that is stored in a library, or to return the advanced encryption settings to their default values.
- [modifyVolserReporting CLI command](#)
Use the **modifyVolserReporting** command to specify the number of characters in each VOLSER number (first 6, first 8, all, or last 8) to report to the host for a specified logical library.
- [setMaximumVIOCartridges CLI command](#)
Use the **setMaximumVIOCartridges** command to update the number of virtual I/O slots for the logical library.
- [showQueuedExports CLI command](#)
Use the **showQueuedExports** command to specify whether cartridges that are queued for export remain assigned to the logical library or are unassigned from the logical library.
- [viewAdvancedEncryptionSettings CLI command](#)
Use the **viewAdvancedEncryptionSettings** command to display the advanced encryption settings for the specified logical library.
- [viewLogicalLibraries CLI command](#)
Use the **viewLogicalLibraries** command to list high-level information for all logical libraries. If you need detailed information for a specific library, use the **viewLogicalLibraryDetails** command.
- [viewLogicalLibraryDetails CLI command](#)
Use the **viewLogicalLibraryDetails** command to show the name, type, maximum cartridges, number of virtual I/O slot addresses, and number of drive addresses in a specified logical library. To show summary information for all logical libraries, use the **viewLogicalLibraries** command.

assignDriveToLL CLI command

Use the **assignDriveToLL** command to assign a drive to a logical library.

Syntax

```
assignDriveToLL <logical-library-name>,<-f# -c# -r#> -ssl
```

Parameters

<logical-library-name>

The name of the logical library.

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
assignDriveToLL CLILib,F1C2R1
```

Example output

```
The drive was assigned successfully
```

createLL CLI command

Use the **createLL** command to create a new logical library.

Syntax

```
createLL <logical-library-name>, {LTO|JAG}
```

Parameters

<logical-library-name>
The name of the new logical library.

{LTO|JAG}
The type of drives in the logical library: LTO or JAG (3592).

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
createLL NewLib,JAG
```

Example output

```
The logical library was created successfully
```

deleteLL CLI command

Use the **deleteLL** command to delete a logical library.

Syntax

```
deleteLL <logical-library-name>
```

Parameters

<logical-library-name>
The name of the logical library.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
deleteLL NewLib
```

Example output

```
The logical library was deleted successfully
```

modifyAdvancedEncSettings CLI command

Use the **modifyAdvancedEncSettings** command to make the advanced encryption settings more or less restrictive for data that is stored in a library, or to return the advanced encryption settings to their default values.

Syntax

```
modifyAdvancedEncSettings <logical-library-name>,<advanced-method> {TRUE | FALSE},<advanced-policy>,<density-code>,<keypath> -ssl
```

Parameters

<logical-library-name>
(Required.) The name of the logical library.

<advanced-method> {TRUE | FALSE}
(Required.) The TRUE parameter is required to change any command values.

Use the FALSE parameter to return to the default settings. No other options are required.

<advanced-policy>
(Required.) The options are:

Advanced policy	Setting
No advanced setting	0
Don't encrypt if no policy	1
Encrypt if no policy	2
Policy required	3
Never encrypt (policy override)	4
Always encrypt (policy override)	5
Internal label – selective encryption	6
Internal label – encrypt all	7

<density-code>
(Required.) The options are:

Density code	Setting
No advanced setting	0
Show encryption	1
Mask encryption	2

<keypath>
(Required.) The options are:

Key path	Setting
No advanced setting	1

-ssl
Required if SSL (HTTPS) is enabled.

Example command, TRUE

```
modifyAdvancedEncSettings Library1,TRUE,2,2,1
```

This example modifies the encryption settings for **Library1** to use the advanced policy that the system should encrypt the data if the data does not already have an encryption policy attached to it. The density code of **2** instructs the system to mask the encryption. The key path of **1** the key path parameter cannot be modified by this command. Any value here is ignored.

Example command, FALSE

```
modifyAdvancedEncSettings Library1,FALSE
```

This example removes any advanced encryption settings for **Library1** and restores the default settings.

Example output

```
The advanced encryption settings for Logical Library Library1 were updated successfully
```

modifyVolserReporting CLI command

Use the **modifyVolserReporting** command to specify the number of characters in each VOLSER number (first 6, first 8, all, or last 8) to report to the host for a specified logical library.

Syntax

```
modifyVolserReporting "<logical-library-name>,{6|8|All|Last8}" -ssl
```

Parameters

<logical-library-name>
(Required.) The name of the logical library.
{6|8|All|Last8}
(Required.) The number of characters to report, where:

- 6 = the first 6 characters
- 8 = the first 8 characters
- All = all characters
- Last8 = the last 8 characters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
modifyVolserReporting "Library1,6"
```

The first 6 characters of each VOLSER number are reported for all cartridges in the Library1 logical library.

Example output

```
Volser Reporting flag was updated successfully
```

setMaximumVIOCartridges CLI command

Use the **setMaximumVIOCartridges** command to update the number of virtual I/O slots for the logical library.

Syntax

```
setMaximumVIOCartridges "<logical-library-name>,<nn>" -ssl
```

Parameters

<logical-library-name>

(Required.) The name of the logical library.

<nn>

(Required.) The number of virtual I/O slots in the logical library.

This value cannot be less than the number of physical I/O slots. For example, if the library has two I/O magazines, each with 18 slots, this value must be at least 36.

This value cannot exceed 255.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setMaximumVIOCartridges "Library1,200"
```

Example output

```
The MAX VIO was updated successfully
```

showQueuedExports CLI command

Use the **showQueuedExports** command to specify whether cartridges that are queued for export remain assigned to the logical library or are unassigned from the logical library.

Syntax

```
showQueuedExports "<logical-library-name>,{true|false}" -ssl
```

Parameters

<logical-library-name>

(Required.) The name of the logical library.

{true|false}

(Required.) The options are:

- true = cartridges that are queued for export remain assigned to the logical library after they are moved to an I/O slot. Also called "show" because the host can still see the cartridges. This is the default.
- false = cartridges that are queued for export are unassigned from the logical library when they are moved to an I/O slot. This allows an unlimited number of cartridges to be queued for export without exceeding the limit of 255 IEE addresses. Also called "hide" because the cartridges are no longer visible to the host.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
showQueuedExports "Library1,true"
```

Example output

```
Queued exports flag was updated successfully
```

viewAdvancedEncryptionSettings CLI command

Use the **viewAdvancedEncryptionSettings** command to display the advanced encryption settings for the specified logical library.

Syntax

```
viewAdvancedEncryptionSettings "<logical-library-name>" -ssl > <output-filename.csv>
```

Parameters

"<logical-library-name>"

(Required.) The name of the logical library.

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewAdvancedEncryptionSettings "LogLib1"
```

Example output

```
Name:                LibLog1
Advanced Method:     True
Advanced Policy:     Encrypt if no policy
Density Code:        Shows Encryption
Key Path:            System
```

viewLogicalLibraries CLI command

Use the **viewLogicalLibraries** command to list high-level information for all logical libraries. If you need detailed information for a specific library, use the **viewLogicalLibraryDetails** command.

Note: Information about queued exports and VOLSER reporting is only available through this command, not through the TS4500 management GUI.

Syntax

```
viewLogicalLibraries -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewLogicalLibraries
```

Example output

Name, Type, Assigned Cartridges, Virtual I/O cartridges, Drives, Encryption Method, Queued Exports, VOLSER Reporting (6/8/All/Last8 characters)						
GVCNFLOW, 3592, All	0,	0,	0,	No,	Hide,	
Library1, 3592, LAST8	0,	0,	0,	No,	Show,	

viewLogicalLibraryDetails CLI command

Use the **viewLogicalLibraryDetails** command to show the name, type, maximum cartridges, number of virtual I/O slot addresses, and number of drive addresses in a specified logical library. To show summary information for all logical libraries, use the **viewLogicalLibraries** command.

Syntax

```
viewLogicalLibraryDetails "<logical-library-name>" -ssl > <output-filename.csv>
```

Parameters

<logical-library-name>
(Required.) The name of the logical library.

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewLogicalLibraryDetails "library1"
```

Example output

Name	Type	Max Cartridges	Virtual I/O slot addresses	Drive Addresses
Library1	3592	1000	130 (768-897)	68 (257-321)

Mobile commands

- [viewDrivePod CLI command](#)
The **viewDrivePod** command provides basic monitoring capability to display system health and drives in use. The output is in JSON format for use with the IBM Storage Mobile Dashboard. This command provides the same information as the middle pod (drive utilization) on the System GUI page.
- [viewStorageCapacity CLI command](#)
The **viewStorageCapacity** command provides basic monitoring capability for capacity utilization and licensed slots. The output is in JSON format for use with the IBM Storage Mobile Dashboard.

viewDrivePod CLI command

The **viewDrivePod** command provides basic monitoring capability to display system health and drives in use. The output is in JSON format for use with the IBM Storage Mobile Dashboard. This command provides the same information as the middle pod (drive utilization) on the System GUI page.

Syntax

```
viewDrivePod
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewDrivePod
```

Example output (in JSON format)

```
[{"clazz": "com.ibm.storage.anaconda.events.DriveStationEvent",  
  "drivesInUse": 0, "libraryIdx": -1, "libraryName": "", "podStatus": "HEALTHY",  
  "totalDrives": 1, "topic": "DRIVE_STATION", "id": 4996, "arguments": null,  
  "timestamp": 1539385899616, "topic": "DRIVE_STATION"}]
```

viewStorageCapacity CLI command

The **viewStorageCapacity** command provides basic monitoring capability for capacity utilization and licensed slots. The output is in JSON format for use with the IBM Storage Mobile Dashboard.

Syntax

```
viewStorageCapacity
```


Parameters

`-ssl`
Required if SSL (HTTPS) is enabled.

Example command

```
viewStorageCapacity
```

Example output (in JSON format)

```
[{"librarymediatype": "3", "licensed_jag_used": "5", "licensed_lto": "0",  
"licensed_jag": "100", "licensed_lto_used": "0"}]
```

Security commands

- [setSSL CLI command](#)
Use the **setSSL** command to enable or disable the use of HTTPS (HTTP over SSL). The HTTPS protocol provides secure communication over the network.

setSSL CLI command

Use the **setSSL** command to enable or disable the use of HTTPS (HTTP over SSL). The HTTPS protocol provides secure communication over the network.

Syntax

```
setSSL {enabled|disabled} -ssl
```

Parameters

{enabled|disabled}
(Required.) The SSL setting. The options are:

- enabled = enable HTTPS.
- disabled = disable HTTPS.

`-ssl`
Required if SSL (HTTPS) is enabled.

Example command

```
setSSL enabled
```

Example output

```
The SSL flag was updated successfully
```

Service commands

- [codeUpdate CLI command](#)
Use the **codeUpdate** command to update the library firmware. To update the firmware in a specific drive, use the **driveCodeUpdate** command, or use the TS4500 management GUI (Drives > Drives page).
- [completeDriveService CLI command](#)
Use the **completeDriveService** command to complete the drive replacement procedure.
- [continueCloseLibraryVerify CLI command](#)
Use the **continueCloseLibraryVerify** command to finish the library verification process for I/O stations. Before you run this command, you must run the **continueLibraryVerify** command and then close all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)
- [continueLibraryVerify CLI command](#)
Use the **continueLibraryVerify** command to perform the second step of the library verification process for I/O stations. Before you run this command, you must run the **startLibraryVerify** command and then open all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)
- [downloadDrivesLog CLI command](#)
Use the **downloadDrivesLog** command to download a .zip file containing the logs from the specified (or all) drives. This command is useful for troubleshooting.
- [downloadLog CLI command](#)
The **downloadLog** command creates a set of log files describing recent library activity, including errors and failures. The default command creates encrypted files for use by IBM development; these files cannot be read by customers or SSRs. The `-csh` (control system health) option creates a smaller set of unencrypted log files that can be used by customers and SSRs to determine the status of the control system.

- [downloadPropertiesFile CLI command](#)
Use the **downloadPropertiesFile** command to download the properties file (TSSC file) if one exists in the card.
- [downloadSnapshot CLI command](#)
Use the **downloadSnapshot** command to download a snapshot from the library. First, run the **viewSnapshots** command to obtain the index number for the specific snapshot.
- [driveCodeUpdate CLI command](#)
Use the **driveCodeUpdate** command to update the firmware in a drive or list of drives.
- [restoreConfiguration CLI command](#)
Use the **restoreConfiguration** command to restore a configuration database to the library. Use the **saveConfiguration** command to save the configuration database to a file. This requires a user with the Service role.
- [saveConfiguration CLI command](#)
Use the **saveConfiguration** command to save the configuration database to your computer. Use the **restoreConfiguration** command to restore a configuration database to the library. This requires a user with a Service role.
- [setScannerSpeed CLI command](#)
Use the **setScannerSpeed** command to set the speed of the scanner.
- [setSlotOffline CLI command](#)
Use the **setSlotOffline** command to set a specified storage slot offline.
- [setSlotOnline CLI command](#)
Use the **setSlotOnline** command to set a specified storage slot online.
- [startCalibration CLI command](#)
Use the **startCalibration** command to calibrate a library component.
- [startDiscoverHW CLI command](#)
Use the **startDiscoverHW** command to start a discover hardware operation.
- [startDriveService CLI command](#)
Use the **startDriveService** command to start the drive replacement procedure.
- [startInventory CLI command](#)
Use the **startInventory** command to start an inventory operation.
- [startLibraryVerify CLI command](#)
Use the **startLibraryVerify** command to start the library verification process for I/O stations. When the command completes, you will be prompted to open all I/O station doors and then run the **continueLibraryVerify** command. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)
- [viewSnapshots CLI command](#)
Use the **viewSnapshots** command to display a list of all available snapshots in the library. The snapshots are listed chronologically, with the most recent file last. Each snapshot is assigned an index number. To download a snapshot, use the **downloadSnapshots** command and specify the index number returned by this command.

codeUpdate CLI command

Use the **codeUpdate** command to update the library firmware. To update the firmware in a specific drive, use the **driveCodeUpdate** command, or use the TS4500 management GUI (Drives > Drives page).

Syntax

```
codeUpdate <firmware_image_file> -ssl
```

Parameters

<firmware_image_file>
(Required.) The filename (and path, if necessary) of the firmware file.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
codeUpdate TS4500_1100-04Q.afwz
```

Example output

```
Name: TS4500_1100-04Q.afwz
>>>Uploading file..
.....
Done.
```

completeDriveService CLI command

Use the **completeDriveService** command to complete the drive replacement procedure.

Syntax

```
completeDriveService <-f# -c# -r#>
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
completeDriveService -f1 -c4 -r1
```

Example output

```
The drive service has completed.
```

continueCloseLibraryVerify CLI command

Use the **continueCloseLibraryVerify** command to finish the library verification process for I/O stations. Before you run this command, you must run the **continueLibraryVerify** command and then close all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)

Syntax

```
continueCloseLibraryVerify -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
continueCloseLibraryVerify
```

Example output

```
IO doors closed.  
Library verify continues now...The test has been completed successfully
```

continueLibraryVerify CLI command

Use the **continueLibraryVerify** command to perform the second step of the library verification process for I/O stations. Before you run this command, you must run the **startLibraryVerify** command and then open all of the I/O station doors. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)

Syntax

```
continueLibraryVerify -ssl
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
continueLibraryVerify
```

Example output

```
IO doors opened. Library verify continues now.....Done!  
Next step: CLOSE all IO doors, and then use "continueCloseLibraryVerify" command to continue the test.
```

downloadDrivesLog CLI command

Use the **downloadDrivesLog** command to download a .zip file containing the logs from the specified (or all) drives. This command is useful for troubleshooting.

Syntax

```
downloadDrivesLog {<F# C# R#>,<F# C# R#>,... | ALL} -ssl
```

Each drive location must be delimited by a comma.

Parameters

{<F# C# R#>,<F# C# R#>,... | ALL}

(Required.) A comma-delimited list of drive locations, where:

- F# = frame number of the drive
- C# = column number of the drive
- R# = row number of the drive
- ALL = all drives

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadDrivesLog F1C1R1,F1C2R2
```

Example output

```
Gathering logs...
Downloading...3638135/3638135 bytes
The drivelog file: TS4500_DRIVELOGS_2016-09-06_11.41.58.zip has been downloaded.
```

downloadLog CLI command

The **downloadLog** command creates a set of log files describing recent library activity, including errors and failures. The default command creates encrypted files for use by IBM development; these files cannot be read by customers or SSRs. The -csh (control system health) option creates a smaller set of unencrypted log files that can be used by customers and SSRs to determine the status of the control system.

The default zip file is named TS4500_FWLOGS_[yyyy-MM-dd_hh.mm.ss].zip. It is saved in the directory where the TS4500CLI.jar file is stored.

Syntax

```
downloadLog [-csh] [-ssl]
```

Parameters

-csh

(Optional.) Creates a zip file named TS4500_CSHLOGS_[yyyy-MM-dd_hh.mm.ss].zip. It is saved in the directory where the TS4500CLI.jar file is stored. The zip file contains the following log files:

File name	Description
DHC.txt	This file is useful when running DHC and when completing service on an accessor.
Lib_Verify.txt	This file should be looked at if the library is failing Library Verify with either accessor.
LogCollection.log	This file indicates if a log collection is being executed or the last log collection that was executed on that local LCC card. It provides a highly detailed view of the log collection progress.
memsegData_1.csv	This file contains all of the calibration data for Accessor A. If there are failures, it can quickly point to the failing location. It can also help indicate if the calibration of any fiducial is re-trying. It can also be monitored while calibrating the library to have a real-time status of progress.
memsegData_2.csv	This file contains all of the calibration data for Accessor B. If there are failures, it can quickly point to the failing location. It can also help indicate if the calibration of any fiducial is re-trying. It can also be monitored while calibrating the library to have a real-time status of progress.
READY.txt	This file should be looked at if the library is stuck in initializing. It can point the service person to potential problems with the library trying to come ready.
scsi.txt	This file contains the SCSI commands that come from the host.
volserData_1.csv	This file contains all of the barcode data being scanned for Accessor A. This file is a running history of all the barcodes that have been scanned.
volserData_2.csv	This file contains all of the barcode data being scanned for Accessor B. This file is a running history of all the barcodes that have been scanned.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadLog
```

Example output

```
Downloading... [completed] / [totalSize] has been downloaded.  
The log file: TS4500_FWLOGS_[yyyy-MM-dd_hh.mm.ss].zip has been downloaded.
```

Example output with -csh option

```
Downloading... [completed] / [totalSize] has been downloaded.  
The log file: TS4500_CSHLOGS_[yyyy-MM-dd_hh.mm.ss].zip has been downloaded.
```

downloadPropertiesFile CLI command

Use the **downloadPropertiesFile** command to download the properties file (TSSC file) if one exists in the card.

Syntax

```
downloadPropertiesFile -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
downloadPropertiesFile
```

Example output

```
Downloading... [completed] / [totalSize] has been downloaded.  
The file: "LIBLG_01_VP_[yyyy-MM-dd_hh.mm.ss] has been downloaded.
```

downloadSnapshot CLI command

Use the **downloadSnapshot** command to download a snapshot from the library. First, run the **viewSnapshots** command to obtain the index number for the specific snapshot.

Syntax

```
downloadSnapshot <index> -ssl
```

The snapshot file is downloaded to the same directory where the CLI is running.

Parameters

<index>
(Required.) The index number of the snapshot that is to be downloaded. Run the **viewSnapshots** command to look up the index number.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
downloadSnapshot 1
```

Example output

```
Downloading... [completed] / [totalSize] has been downloaded.  
.  
The snapshot file: "TS4500_Snapshot_01122013.zip has been downloaded.
```

driveCodeUpdate CLI command

Use the **driveCodeUpdate** command to update the firmware in a drive or list of drives.

Syntax

```
driveCodeUpdate <firmware-image-file> -l <F# C# R#>,<F# C# R#>,... --reset <resetOption> -ssl
```

Parameters

<firmware-image-file>

(Required.) The filename (and the path, if necessary) of the firmware file.

-l <F# C# R#>,<F# C# R#>,...

(Required.) A comma-delimited list of drives to update. The drive list must be preceded by -l (lowercase letter L, short for "location").

Drive locations are indicated as follows:

- F# = frame number
- C# = column number
- R# = row number

--reset <resetOption>

(Required.) Specifies when the drive will be reset after the code is updated. It has the following options:

- IMMEDIATE = The reset takes place immediately. The drive must be empty before the update. Before you perform an IMMEDIATE reset, run the **moveFromDrive** command to eject a cartridge from the drive.
- UNLOAD = The reset occurs after the drive is unloaded.
- MANUAL = A manual reset must be performed to activate the code.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
driveCodeUpdate LTO6_DAQM.fcp_fh.fmrz -l F1C4R2,F1C4R3 --reset IMMEDIATE
```

Example output

```
The code update has started
```

```
Name: LTO6_DAQM.fcp_fh.fmrz
```

```
>>>Uploading file..
```

```
.....
```

```
Done.
```

restoreConfiguration CLI command

Use the **restoreConfiguration** command to restore a configuration database to the library. Use the **saveConfiguration** command to save the configuration database to a file. This requires a user with the Service role.

The configuration file has a name in the format TS4500_<firmware-level>_SAVECONF_<time-stamp>.dbz and is stored in the directory where the CLI is running.

Note: You can only restore configuration files that were saved at the same library firmware level that you are currently running.

Syntax

```
restoreConfiguration <configuration_file_name>.dbz -ssl
```

Parameters

<configuration_file_name>.dbz

(Required.) The name (and the path, if necessary) of the configuration file to upload.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
restoreConfiguration TS4500_1.4.1.3-D00.T3_SAVECONF_20180323160237.DBZ
```

Example output

```
Name: TS4500_1.4.1.3-D00.T3_SAVECONF_20180323160237.DBZ
>>>Uploading file...
Done.
.
The configuration database has been restored successfully.
```

saveConfiguration CLI command

Use the **saveConfiguration** command to save the configuration database to your computer. Use the **restoreConfiguration** command to restore a configuration database to the library. This requires a user with a Service role.

The output file is assigned a name in the following format:

- TS4500_library-serial-number_<firmware-level>_SAVECONF_<time-stamp>.dbz

For example:

- TS4500_FA054_1.4.1.3-D00.T3_SAVECONF_20180323160237.dbz

The file is saved to the directory where the CLI is running.

Syntax

```
saveConfiguration -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example

```
saveConfiguration
```

Example output

```
Done.....
The library DB backup process has finished successfully.
```

setScannerSpeed CLI command

Use the **setScannerSpeed** command to set the speed of the scanner.

Syntax

```
setScannerSpeed <speed> -ssl
```

Parameters

<speed>
(Required.) Scanner speed has the following settings:

- 0 (nominal speed)
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
setScannerSpeed 100
```

Example output

The scanner speed was updated successfully

setSlotOffline CLI command

Use the **setSlotOffline** command to set a specified storage slot offline.

Syntax

```
setSlotOffline <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The slot location, where:

- -f# = frame number
- -c# = column number
- -r# = row number

A row number of 0 takes all rows in the specified column offline.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setSlotOffline -f3 -c6 -r0
```

Example output

```
Storage Slot was set Offline
```

setSlotOnline CLI command

Use the **setSlotOnline** command to set a specified storage slot online.

Syntax

```
setSlotOnline <-f# -c# -r#> -ssl
```

Parameters

<-f# -c# -r#>

(Required.) The slot location, where:

- -f# = frame number
- -c# = column number
- -r# = row number

A row number of 0 takes all rows in the specified column online.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setSlotOnline -f3 -c6 -r0
```

Example output

```
Storage Slot was set Online
```

startCalibration CLI command

Use the **startCalibration** command to calibrate a library component.

Options cannot be combined in a single command. Each command must be entered separately.

Syntax

```
startCalibration LIBRARY
startCalibration FRAME, <frame-number>
startCalibration DRIVE, <F#C#R#>
startCalibration IO, <frame-number>, <IO-number>
startCalibration ACCESSOR, <accessor-number>
```

Parameters

LIBRARY
Calibrates all library components.

FRAME, <frame-number>
Calibrates the specified frame.

DRIVE, <F#C#R#>
Calibrates the drive in the specified location.

IO, <frame-number>, <IO-number>
Calibrates the specified I/O station in the specified frame, where:
1 = upper I/O station
2 = lower I/O station

ACCESSOR, <accessor-number>
Calibrates the specified accessor, where:
1 = accessor A
2 = accessor B

-ssl
Required if SSL (HTTPS) is enabled.

Example commands

```
startCalibration LIBRARY
startCalibration FRAME, 1
startCalibration DRIVE, F1C2R3
startCalibration IO, 1, 2
startCalibration ACCESSOR, 2
```

Example output

```
Calibration has started
```

startDiscoverHW CLI command

Use the **startDiscoverHW** command to start a discover hardware operation.

Syntax

```
startDiscoverHW {OVERWRITE <frames>|<frames>}
```

Parameters

{OVERWRITE <frames>|<frames>}
where:

- OVERWRITE <frames> deletes all existing configuration data for the specified frames and re-creates the data.
- <frames> saves the existing configuration data for the specified frames and adds information for any new hardware that is discovered.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
startDiscoverHW OVERWRITE, 1, 2, 5, 18
startDiscoverHW 1, 2, 5, 15, 18
```

Example output

```
Discover HW has started
```

startDriveService CLI command

Use the **startDriveService** command to start the drive replacement procedure.

Syntax

```
startDriveService <-f# -c# -r#>
```

Parameters

<-f# -c# -r#>

(Required.) The location of the drive, where:

- -f# = frame number
- -c# = column number
- -r# = row number

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
startDriveService -f1 -c4 -r1
```

Example output

```
The drive was assigned successfully
```

startInventory CLI command

Use the **startInventory** command to start an inventory operation.

Syntax

```
startInventory -library {SINGLE|NO} -audit {FIRST|ALL} -frame {ALL|<frame-number>}
```

Parameters

-library {SINGLE|NO}

(Required.)

- SINGLE = The whole library will be inventoried.
- NO = A specific frame, specified by the -frame option, will be inventoried.

-audit {FIRST|ALL}

(Required.)

- FIRST = Inventory tier 0 and tier 1
- ALL = Inventory all tiers

-frame {ALL|<frame-number>}

(Required.)

- ALL = All frames (the whole library)
- <frame-number> = A specific frame, specified by its position in the library string.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
startInventory -library SINGLE -audit ALL -frame ALL
startInventory -library NO -audit FIRST -frame 5
```

Example output

```
Inventory has started
```

startLibraryVerify CLI command

Use the **startLibraryVerify** command to start the library verification process for I/O stations. When the command completes, you will be prompted to open all I/O station doors and then run the **continueLibraryVerify** command. (Library verification is a three-step process in which the following commands must be run in this order: **startLibraryVerify**, **continueLibraryVerify**, and **continueCloseLibraryVerify**.)

Syntax

```
startLibraryVerify -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
startLibraryVerify
```

Example output

```
..Library verify - IO stations - has started...Library verify in progress  
.....Done!  
Next step: OPEN all IO doors , and then use "continueLibraryVerify" command to continue the test.
```

viewSnapshots CLI command

Use the **viewSnapshots** command to display a list of all available snapshots in the library. The snapshots are listed chronologically, with the most recent file last. Each snapshot is assigned an index number. To download a snapshot, use the **downloadSnapshots** command and specify the index number returned by this command.

Syntax

```
viewSnapshots -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewSnapshots
```

Example output

```
1 - TS4500_Snapshot_01122013.zip  
2 - TS4500_Snapshot_01012014.zip  
3 - TS4500_Snapshot_01022014.zip
```

System commands

- [downloadEvents CLI command](#)
Use the **downloadEvents** command to export detailed information about all error, warning, and informational events saved in the library.
- [downloadResources CLI command](#)
Use the **downloadResources** command to export information about a library to a .csv file. You can specify all resources or a single resource, such as drives or users.
- [getFWVersion CLI command](#)
Use the **getFWVersion** command to view the current library firmware version.
- [resetNodeCards CLI command](#)
Use the **resetNodeCards** command to reset one or more node cards.
- [setAccessorZones CLI command](#)
(Dual-accessor libraries only.) Use the **setAccessorZones** command to specify which tape drives and I/O stations (within sets of frames) are served by which accessor. This command can also be used to inactivate an accessor.
- [setLibraryTime CLI command](#)
Use the **setLibraryTime** command to set the library date and time to the same date, time, and time zone of the server on which the CLI is running.
- [setNMADetection CLI command](#)
Use the **setNMADetection** command to enable or disable NMA detection in the library.
- [setUtilThreshold CLI command](#)
Use the **setUtilThreshold** command to change the cartridge capacity utilization threshold settings. Use the **viewUtilThreshold** command to view the current settings.
- [viewAccessor CLI command](#)
Use the **viewAccessor** command to show the accessor's status and usage statistics.
- [viewAccessorZones CLI command](#)
Use the **viewAccessorZones** command to view which tape drives and I/O stations (within sets of frames) are being served by which accessor. You can also view these settings in the TS4500 management GUI on the Settings > Library > Advanced page.

- [viewIoStation CLI command](#)
Use the **viewIoStation** command to view a summary of information for all cartridges in the I/O station.
- [viewLibraryVPD CLI command](#)
Use the **viewLibraryVPD** command to show vital product data (VPD) for the library. This command is useful if an administrator or service engineer needs to see the model or serial number or other information specific to the library.
- [viewNodeCards CLI command](#)
Use the **viewNodeCards** command to view a summary of information about each node card in the library.
- [viewOfflineComponents CLI command](#)
Use the **viewOfflineComponents** command to display a list of all offline components in the library.
- [viewSystemSummary CLI command](#)
Use the **viewSystemSummary** command to view a summary of library components. This command is useful for users who need to view information about each frame, or to see a summary of the total storage capacity. The information is listed in ascending order by frame number, followed by component totals for the whole library.
- [viewSystemSummaryDetails CLI command](#)
Use the **viewSystemSummaryDetails** command to view detailed information about a specific frame. If you need to view summary information about all frames in the library, use the **viewSystemSummary** command.
- [viewUtilThreshold CLI command](#)
Use the **viewUtilThreshold** command to view the current cartridge capacity utilization threshold settings. Use the **setUtilThreshold** to change these settings.

downloadEvents CLI command

Use the **downloadEvents** command to export detailed information about all error, warning, and informational events saved in the library.

The most recent 10,000 events are downloaded. Events are sorted by severity first and then by time. The information is saved to a CSV file with a filename in the format TS4500_Events_<date/time>.csv. The file is saved to the directory where the TS4500CLI.jar file is stored.

Refer to the Events topic for more information about events.

Syntax

```
downloadEvents -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
downloadEvents
```

Example output

```
Downloading...45410004/45410004 bytes  
The file: TS4500_Events_2018-02-26_10.49.11.csv has been downloaded.
```

Related information

- [Events](#)

downloadResources CLI command

Use the **downloadResources** command to export information about a library to a .csv file. You can specify all resources or a single resource, such as drives or users.

If you specify all resources, the output file is assigned a name in the format <library-name>_LibrarySummary_<date-time>.csv. This is the same as the System Summary file that is created by the Export System Summary option on the System GUI page.

If you specify a single resource, the output file is named <library-name>_<library-serial-number>_<resource>_<date-time>.csv.

The output file is saved in the directory where the TS4500CLI.jar file is stored.

Syntax

```
downloadResources {all|<resource>} -ssl
```

Parameters

{all|<resource>}
(Required.) Enter all to download the System Summary file, which contains information on all system resources. For information on a specific resource, enter one of the following resource names. The names are capitalized here for clarity, but the CLI is not case-sensitive.

- Accessors

- Cartridges
- Drives
- EmailRecipients
- EncryptionInternalLabels
- EncryptionKeyServers
- FibreChannelPorts
- Frames
- FunctionalSwitches
- Grippers
- IOStations
- iSCSIPorts
- Library
- LicensedFeatures
- LogicalLibraries
- ManagementEthernetPorts
- MountHistory
- PasswordPolicy
- Roles
- Slots
- SNMPDestinations
- SyslogServers
- SystemConsole
- Users
- VOLSERRanges

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
downloadResources drives
```

Example output

```
Downloading...45410004/45410004 bytes  
The file: MTC001_13FA001_Drives_20170413T001012.csv has been downloaded.
```

Related information

- [Exporting system information](#)

getFWVersion CLI command

Use the **getFWVersion** command to view the current library firmware version.

Syntax

```
getFWVersion
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
getFWVersion
```

Example output

```
Firmware Version: 1.1.0.0-0AE.00
```

resetNodeCards CLI command

Use the **resetNodeCards** command to reset one or more node cards.

Syntax

```
resetNodeCards <node_name_1>,<node_name_2>,...
```

Parameters

<node_name_1>,<node_name_2>,...

(Required.) A comma-separated list of node cards to be reset. The node names are as follows:

- ALL
- ALLLCA
- ALLACC
- ALLSMC
- ALLXYC
- ALLPLUS
- XYCPLUS
- ACCPLUS
- LCAPLUS
- XYA
- XYB
- OPC1
- SMC[2-16]
- ACCA
- ACCB
- LCA[1-31]
- LCAB[1-31]

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
resetNodeCards LCA1,LCAB3,ACCA
```

Example output

```
The command was executed successfully
```

setAccessorZones CLI command

(Dual-accessor libraries only.) Use the **setAccessorZones** command to specify which tape drives and I/O stations (within sets of frames) are served by which accessor. This command can also be used to inactivate an accessor.

Description

By default, each accessor is zoned to serve half of the frames in the library. For example, in a 12-frame library, Accessor A serves frames 1 through 6 and Accessor B serves frames 7 through 12.

You can view the current accessor zone settings with the **viewAccessorZones** command. You can also view these settings in the TS4500 management GUI on the Settings > Library > Advanced page. The Accessor Preferred Zones graphic is refreshed to reflect changes made both through the GUI and with the **setAccessorZones** command.

Elastic capacity settings made through the Advanced page are unaffected by zone changes made with the **viewAccessorZones** command.

Syntax

- Use the no parameter to specify a different zone setting for an accessor, or to inactivate an accessor. (Using this command to inactivate an accessor is the same as inactivating it in the Advanced GUI page.)

```
setAccessorZones no, {<frameNumber>|0|255}
```

where:

- no = Do not use the default zone setting. Instead, use the setting specified here.
 - <frameNumber> (1 – 18) = The last frame served by Accessor A. All remaining frames in the library will be served by Accessor B.
 - 0 = Inactivate Accessor A.
 - 255 = Inactivate Accessor B.
- Use the yes parameter to return both accessors to their default zone settings.

```
setAccessorZones yes
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

Example commands

The following example uses the `yes` parameter to return both accessors to their default zone settings.

```
setAccessorZones yes
```

The following example restricts Accessor A to frames 1, 2, and 3. Accessor B serves the rest of the frames in the library.

```
setAccessorZones No,3
```

The following example disables Accessor B.

```
setAccessorZones no,255
```

Example output

```
The accessor zone was updated successfully
```

setLibraryTime CLI command

Use the `setLibraryTime` command to set the library date and time to the same date, time, and time zone of the server on which the CLI is running.

Syntax

```
setLibraryTime -ssl
```

Note: You must have the Administrator role to run this command.

Parameters

`-ssl`
Required if SSL (HTTPS) is enabled.

Example command

```
setLibraryTime
```

Example output

```
The library date and time were updated successfully to Thu Aug 25 14:08:13 MST 2016, time zone: America/Phoenix
```

setNMADetection CLI command

Use the `setNMADetection` command to enable or disable NMA detection in the library.

Syntax

```
setNMADetection {TRUE|FALSE} -ssl
```

Parameters

`{TRUE|FALSE}`
where:

- TRUE = NMA detection is on
- FALSE = NMA detection is off

`-ssl`
Required if SSL (HTTPS) is enabled.

Example command

```
setNMADetection TRUE
```

Example output

```
The NMA detection flag was updated successfully
```

setUtilThreshold CLI command

Use the **setUtilThreshold** command to change the cartridge capacity utilization threshold settings. Use the **viewUtilThreshold** command to view the current settings.

The command has the following options:

- The **-cut** (capacity utilization threshold) option controls the behavior of the physical capacity status pod in the bottom left corner of the management GUI System page. When the percentage of slots filled exceeds the **-cut** value (the default is 99%), the pod changes from green to yellow as a warning. When all licensed slots are filled, the pod turns red.
- The **-daut** (dual accessor utilization threshold) option is only applicable to dual-accessor libraries with elastic capacity enabled. It determines the threshold at which cartridges are moved to accessor service areas in the end frames. The default is 98%.

Either **-cut** or **-daut** must be specified. Both options can be specified in the same command.

Syntax

```
setUtilThreshold -cut <nn> -daut <nn> -ssl
```

Parameters

-cut <nn>

One of the following values. The default setting is 99.0.

- 50, 55, 60, 65, 70, 75, 80, 85, 90,
- 91, 92, 93, 94, 95, 96, 97, 98,
- 99.0, 99.1, 99.2, 99.3, 99.4, 99.5, 99.6, 99.7, 99.8, 99.9
-

-daut <nn>

A whole number (no decimals) between 90 and 100. The default setting is 98.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
setUtilThreshold -cut 99.5 -daut 95
```

Example output

```
The specified utilization threshold(s) were updated.
```

Related reference

- [viewUtilThreshold CLI command](#)

Related information

- [What are the status pods?](#)
- [Advanced](#)

viewAccessor CLI command

Use the **viewAccessor** command to show the accessor's status and usage statistics.

Syntax

```
viewAccessor -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewAccessor
```

Example output

Availability		Accessor A
Accessor,		OK - Online
Gripper 1,		OK - Online
Gripper 2,		OK - Online

Usage Statistics		Accessor A Component
Pivots,		267
Gripper 1 gets,		104
Gripper 1 puts,		103
Gripper 2 gets,		46
Gripper 2 puts,		46
Bar code scans,		5724
X travel (meters),		86
Y travel (meters),		114

viewAccessorZones CLI command

Use the **viewAccessorZones** command to view which tape drives and I/O stations (within sets of frames) are being served by which accessor. You can also view these settings in the TS4500 management GUI on the Settings > Library > Advanced page.

Syntax

```
viewAccessorZones -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewAccessorZones
```

Example output

```
Accessor A: 1 - 12
Accessor B: 13 - 16
```

viewIoStation CLI command

Use the **viewIoStation** command to view a summary of information for all cartridges in the I/O station.

Syntax

```
viewIoStation -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewIoStation
```

Example output

Volume Serial	Logical Library	Element Address	Media Type	Location (F,C,R)	Encryption
M000NTL5	Logical Library 1	1046	JAG	I/O Slot (F1,C5,R4,T1)	Not Encrypted
M001NTL5	Logical Library 1	1294	JAG	I/O Slot (F1,C6,R29,T0)	Not Encrypted

viewLibraryVPD CLI command

Use the **viewLibraryVPD** command to show vital product data (VPD) for the library. This command is useful if an administrator or service engineer needs to see the model or serial number or other information specific to the library.

Syntax

```
viewLibraryVPD -ssl > <output-filename.csv>
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.
- > <output-filename.csv> (Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewLibraryVPD
```

Example output

```
Location, Machine Type, Model, Serial Number, Media Type  
Frame 1, 3584, L25, 13FA005, 3592
```

viewNodeCards CLI command

Use the **viewNodeCards** command to view a summary of information about each node card in the library.

Syntax

```
viewNodeCards -ssl > <output-filename.csv>
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.
- > <output-filename.csv> (Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewNodeCards
```

Example output

```
Card name, CardPass, Location, Part number, Serial number, Firmware version  
LCA1, 0, Frame 1.Row 1, , , 1.1.0.0-00Q.00
```

viewOfflineComponents CLI command

Use the **viewOfflineComponents** command to display a list of all offline components in the library.

Syntax

```
viewOfflineComponents -ssl > <output-filename.csv>
```

Parameters

- ssl Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewOfflineComponents
```

Example output

Frame,	Column,	Row,	Status
4,	9,	1,	Offline

viewSystemSummary CLI command

Use the **viewSystemSummary** command to view a summary of library components. This command is useful for users who need to view information about each frame, or to see a summary of the total storage capacity. The information is listed in ascending order by frame number, followed by component totals for the whole library.

Syntax

```
viewSystemSummary -ssl > <output-filename.csv>
```

Parameters

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewSystemSummary
```

Example output

```
Frame: 1
State: Door closed
Media Type: 3592
Data Cartridges: 307
Storage Slots: 660
Drives: 10
Upper IO cartridges: 9
Upper IO door slots: 16
Upper IO door media type: 3592
Lower IO cartridges: 7
Lower IO door slots: 16
Lower IO door media type: 3592
MTM: 3584L25
S/N: FA002
-----
Frame: 2
Accessors: OK - Online
State: Door closed
Media Type: 3592
Data Cartridges: 332
Storage Slots: 883
Drives: 2
MTM: 3584D25
S/N: FA106
-----
Total storage slots: 1543
Total storage cartridges: 639
Total IO slots: 16
Total IO cartridges: 16
Total Drives: 12
Total Frames: 2
```

viewSystemSummaryDetails CLI command

Use the **viewSystemSummaryDetails** command to view detailed information about a specific frame. If you need to view summary information about all frames in the library, use the **viewSystemSummary** command.

Syntax

```
viewSystemSummaryDetails <frame#> -ssl > <output-filename.csv>
```

Note: No accessor information is returned if the specified frame does not have accessors.

Parameters

<frame#>
(Required.) The frame number.

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewSystemSummaryDetails 2
```

Example output

```
Frame: 2  
Accessors: OK - Online  
State: Door closed  
Media Type: 3592  
Data Cartridges: 332  
Storage Slots: 883  
Licensed slots: 200  
LTO Capacity:  
3590 capacity:  
Drives: 2  
MTM: 3584D25  
S/N: FA106
```

viewUtilThreshold CLI command

Use the **viewUtilThreshold** command to view the current cartridge capacity utilization threshold settings. Use the **setUtilThreshold** to change these settings.

Syntax

```
viewUtilThreshold -ssl
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewUtilThreshold
```

Example output

```
Capacity Utilization Threshold: 99.5%  
Dual Accessor Utilization Threshold: 95
```

Related reference

- [setUtilThreshold CLI command](#)

User and role commands

- [createUser CLI command](#)
Use the **createUser** command to create a new local user. Remote authentication can be either enabled or disabled.
- [deleteUser CLI command](#)
Use the **deleteUser** command to delete local user accounts. Local user accounts cannot be deleted from the management GUI when Remote Authentication is enabled; they can only be deleted from the CLI.

- [setRolePermissions CLI command](#)
Use the **setRolePermissions** command to allow or restrict access to individual GUI pages for a specified role. Use the output from the **viewRolePermissions** command as input for this command.
- [viewRolePermissions CLI command](#)
Use the **viewRolePermissions** command to display the access level for each GUI page for the specified role. You can send the command output to a text file that can be edited and used as input to the **setRolePermissions** command.
- [viewPasswordAndSessionPolicy CLI command](#)
The **viewPasswordAndSessionPolicy** command displays the current password security settings.
- [viewRoles CLI command](#)
Use the **viewRoles** command to display all of the defined roles in the library and the number of users with that role.
- [viewUsers CLI command](#)
Use the **viewUsers** command to display a list of users (either remote or local) and their properties, including state, role, email address, and date and time of last login.

createUser CLI command

Use the **createUser** command to create a new local user. Remote authentication can be either enabled or disabled.

Syntax

```
createUser -name "<name>" -role <role> -sendToEmail {yes -email <email> | no -tempPass <password>} -ssl
```

Parameters

- name "<name>"
(Required.) A name for the user. The double quotation marks are required.
- role <role>
(Required.) The user's role.
- sendToEmail
(Required.) The options are:
 - **yes**
-email
 <email>
 - **no**
-tempPass
 <password>
- ssl
Required if SSL (HTTPS) is enabled.

Example commands

The following example creates a local user account. The user's password (**L0gM3InN0w**) is defined in the command.

```
createUser -name "testUser" -role Service -sendToEmail no -tempPass L0gM3InN0w
```

The following example creates a local user account, with a system-generated password being sent to the user's email account.

```
createUser -name "testUser" -role Service -sendToEmail yes -email testUser@mycompany.com
```

Example output

```
User testUser was created successfully.
```

Related concepts

- [Creating a local user account](#)

Related reference

- [deleteUser CLI command](#)
- [viewUsers CLI command](#)

Related information

- [Managing local users](#)
- [Roles](#)

deleteUser CLI command

Use the **deleteUser** command to delete local user accounts. Local user accounts cannot be deleted from the management GUI when Remote Authentication is enabled; they can only be deleted from the CLI.

To view a list of local users from the CLI, use the **viewUsers** command with the **-local** option.

Only one user can be deleted at a time.

Syntax

```
deleteUser "<name>" -ssl
```

Parameters

"<name>"
(Required.) The name of the local user. The double quotation marks are required.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
deleteUser "testuser"
```

Example output

```
User testUser1 was removed successfully.
```

Related reference

- [createUser CLI command](#)
- [viewUsers CLI command](#)

Related information

- [Managing local users](#)

setRolePermissions CLI command

Use the **setRolePermissions** command to allow or restrict access to individual GUI pages for a specified role. Use the output from the **viewRolePermissions** command as input for this command.

Syntax

```
setRolePermissions <filename.txt> -role <role_name> -ssl
```

Parameters

<filename.txt>
(Required.) A text file containing the output from the **viewRolePermissions** command, edited as necessary to indicate the new access levels for each GUI page. You can delete lines that aren't changing.

The following access levels are supported:

- Read only = The user can view but cannot edit the page.
- Modify = The user can edit the page.
- No Access = The user cannot view the page.

-role <role_name>
(Required.) The name of the role.

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
setRolePermissions administrator_permissions.txt -role administrator
```

Example input file

```
        Action,           Access Level
        Cartridges,       No Access
Cartridges by Logical Library, No Access
        Cleaning Cartridges, No Access
        Drives,           No Access
```

Drives by Logical Library,	No Access
Email Notifications,	Read Only
Email Recipients,	Read Only
Encryption Internal,	Read Only
Encryption Key Manager,	Read Only
Ethernet Ports,	No Access
Events,	No Access
Library Information,	No Access
Licensed Functions,	No Access
Logical Libraries,	Read Only
Management GUI Behavior,	No Access
Master Console,	No Access
Password Rules,	Read Only
Remote Authentication,	Read Only
Roles,	No Access
SNMP Requests,	Read Only
SNMP Traps,	Read Only
Scan Speed,	Modify
Secure Socket Layer,	Read Only
Service Port,	Modify
Syslogs Notifications,	Read Only
System,	Modify
System Date and Time,	Modify
Tasks,	Modify
Users,	No Access
VOLSER Ranges,	Read Only
VOLSER Ranges by Logical Library,	Read Only

Example output

The permissions were updated successfully

Related information

- [Roles](#)

viewRolePermissions CLI command

Use the **viewRolePermissions** command to display the access level for each GUI page for the specified role. You can send the command output to a text file that can be edited and used as input to the **setRolePermissions** command.

Syntax

```
viewRolePermissions -role <roleName> > <filename.txt> > <output-filename.csv> -ssl
```

Note: You must have the Administrator role to run this command.

Parameters

- role <roleName>
(Required.) The name of the role for which the access levels will be output.
- > <filename.txt>
(Optional.) Use this option to send the command output to a text file that can be edited and used as input for the **setRolePermissions** command. The file is stored in the same directory as the TS4500CLI.jar file. To save the file in a different directory, specify the path to that directory. If you don't specify a filename, the output is sent to your display.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.
Note: This file cannot be used with the **setRolePermissions** command.
- ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewRolePermissions -role administrator > administrator_permissions.txt
```

Example output

Action,	Access Level
Cartridges,	No Access
Cartridges by Logical Library,	No Access
Cleanning Cartridges,	No Access
Drives,	No Access
Drives by Logical Library,	No Access
Email Notifications,	Read Only
Email Recipients,	Read Only

Encryption Internal,	Read Only
Encryption Key Manager,	Read Only
Ethernet Ports,	No Access
Events,	No Access
Library Information,	No Access
Licensed Functions,	No Access
Logical Libraries,	Read Only
Management GUI Behavior,	No Access
Master Console,	No Access
Password Rules,	Read Only
Remote Authentication,	Read Only
Roles,	No Access
SNMP Requests,	Read Only
SNMP Traps,	Read Only
Scan Speed,	Modify
Secure Socket Layer,	Read Only
Service Port,	Modify
Syslogs Notifications,	Read Only
System,	Modify
System Date and Time,	Modify
Tasks,	Modify
Users,	No Access
VOLSER Ranges,	Read Only
VOLSER Ranges by Logical Library,	Read Only

Related information

- [Roles](#)

viewPasswordAndSessionPolicy CLI command

The **viewPasswordAndSessionPolicy** command displays the current password security settings.

Syntax

```
viewPasswordAndSessionPolicy
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

Example command

```
viewPasswordAndSessionPolicy
```

Example output

```
Automatic logout: Disabled
Password lock: 5 attempts
Automatic IMC (local GUI) login at power on: Disabled
Minimum number of characters: 8
Minimum number of upper case characters: 1
Minimum number of lower case characters: 1
Minimum number of numeric characters: 1
Minimum number of special characters: 0
Maximum identical, consecutive characters: 2
Maximum password age: 90 day(s)
Minimum password age: 1 day(s)
Number of unique passwords before reusing: 8
```

viewRoles CLI command

Use the **viewRoles** command to display all of the defined roles in the library and the number of users with that role.

Syntax

```
viewRoles -ssl > <output-filename.csv>
```

Parameters

-ssl
Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewRoles
```

Example output

Role,	Mapped users
Administrator,	12
Superuser,	0
Service,	1
Monitor,	1

Related information

- [Roles](#)

viewUsers CLI command

Use the **viewUsers** command to display a list of users (either remote or local) and their properties, including state, role, email address, and date and time of last login.

If remote authentication is enabled, the command returns a list of all users defined on the remote authentication server who are currently connected to the library. If the **-local** option is specified, the command returns a list of all local users, connected and disconnected.

If remote authentication is not enabled, the command returns a list of all local users, connected and disconnected.

Syntax

```
viewUsers -local -ssl > <output-filename.csv>
```

Parameters

-local

(Optional.) If specified when remote authentication is enabled, the command returns a list of all local users. If remote authentication is not enabled, this option has no effect; the command still returns a list of local users.

-ssl

Required if SSL (HTTPS) is enabled.

> <output-filename.csv>

(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewUsers -local
```

Example output

Name,	Locked,	State,	Role,	Email,	Last login
jecervan,	,	Disconnected,	Administrator,	xyz@mx1.ibm.com,	
service,	,	Disconnected,	Service,	service@service.com,	
temporal,	,	Disconnected,	Administrator,	,	lunes, noviembre 25, 2013, 09:40:22 AM CST

Related reference

- [createUser CLI command](#)
- [deleteUser CLI command](#)

Related information

- [Managing local users](#)

VOLSER commands

- [createVolserRanges CLI command](#)
Use the **createVolserRanges** command to create one or more new VOLSER ranges.
- [deleteVolserRanges CLI command](#)
Use the **deleteVolserRanges** command to delete one or more VOLSER ranges. The command is applied immediately to all cartridges in the specified VOLSER ranges.
- [modifyVolserRanges CLI command](#)
Use the **modifyVolserRanges** command to modify existing VOLSER ranges.
- [viewVolserRanges CLI command](#)
Use the **viewVolserRanges** command to list all VOLSER ranges in the physical library, sorted by the starting VOLSER number in the range. To list the VOLSER ranges assigned for each logical library, use the **viewVolserRangesbyLL** command.
- [viewVolserRangesByLL CLI command](#)
Use the **viewVolserRangesByLL** command to list all of the VOLSER ranges for each logical library in the physical library. To list all of the VOLSER ranges for the physical library, use the **viewVolserRanges** command.

createVolserRanges CLI command

Use the **createVolserRanges** command to create one or more new VOLSER ranges.

Syntax

```
createVolserRanges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file defining the VOLSER ranges to be created. The file can contain any number of VOLSER ranges. The VOLSER ranges are defined as follows:

```
<startRange>, <endRange>, <LLName>, <mediaType>, {TRUE | FALSE}
```

where:

- <startRange> = the starting VOLSER in the range to be created
- <endRange> = the ending VOLSER in the range to be created
- <LLName> = the name of the logical library
- <mediaType> = LTO or 3592
- TRUE = The range is applied to new cartridges only.
- FALSE = The range is not limited to new cartridges. It is applied immediately to all cartridges in the library.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
createVolserRanges volser_ranges.txt
```

Example input file

```
UAA9RH, UBB9RH, Library1, 3592, FALSE
TUU9RH, TXX9RH, Library2, LTO, TRUE
GGG9RH, HHH9RH, Library2, LTO, TRUE
```

Example output

```
The Volser Range was created successfully
The Volser Range was created successfully
The Volser Range was created successfully
Done.
```

deleteVolserRanges CLI command

Use the **deleteVolserRanges** command to delete one or more VOLSER ranges. The command is applied immediately to all cartridges in the specified VOLSER ranges.

Syntax

```
deleteVolserRanges <filename.txt> -ssl
```

Parameters

<filename.txt>

(Required.) A text file defining the VOLSER ranges to be deleted. The file can contain any number of VOLSER ranges. The VOLSER ranges are defined as follows:

`<LLName>, <startRange>, <endRange>`

where:

- `<LLName>` = the name of the logical library that contains the VOLSER to be deleted
- `<startRange>` = the starting VOLSER in the range to be deleted
- `<endRange>` = the ending VOLSER in the range to be deleted

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
deleteVolserRanges ranges_to_delete.txt
```

Example input file

```
Library1,UAA9RH,UBB9RH  
Library1,TUU9RH,TXX9RH  
Library1,GGG9RH,HHH9RH
```

Example output

```
The Volser Range was removed successfully  
The Volser Range was removed successfully  
The Volser Range was removed successfully  
Done.
```

modifyVolserRanges CLI command

Use the **modifyVolserRanges** command to modify existing VOLSER ranges.

Syntax

```
modifyVolserRanges <filename.txt> -ssl
```

Parameters

`<filename.txt>`

(Required.) A text file defining the VOLSER ranges to be modified. The file can contain any number of VOLSER ranges. The VOLSER ranges must be defined as follows:

```
<startRange>, <endRange>, <LLName>, <mediaType>, { TRUE | FALSE }
```

where:

- `<startRange>` = the starting VOLSER in the range to be modified.
- `<endRange>` = the ending VOLSER in the range to be modified.
- `<LLName>` = the name of the logical library that contains the VOLSER range to be modified.
- `<mediaType>` = LTO or 3592
- TRUE = The range is applied to new cartridges only.
- FALSE = The range is not limited to new cartridges. It is applied immediately to all cartridges in the library.

-ssl

Required if SSL (HTTPS) is enabled.

Example command

```
modifyVolserRanges volser_ranges.txt
```

Example input file

```
UAA9RH,UBB9RH,Library1,3592,FALSE  
TUU9RH,TXX9RH,Library2,LTO,TRUE  
GGG9RH,HHH9RH,Library2,LTO,TRUE
```

Example output

```
The Volser Range was modified successfully  
The Volser Range was modified successfully  
The Volser Range was modified successfully  
Done.
```

viewVolserRanges CLI command

Use the **viewVolserRanges** command to list all VOLSER ranges in the physical library, sorted by the starting VOLSER number in the range. To list the VOLSER ranges assigned for each logical library, use the **viewVolserRangesbyLL** command.

Syntax

```
viewVolserRanges -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewVolserRanges
```

Example output

Volser Start,	Volser End,	Logical Library,	Media Type,	Number of Cartridges
CCC9RH,	DDD9RH,	Library 1,	LTO,	40
EEE9RH,	FFF9RH,	Library 1,	LTO,	10
GGG9RH,	HHH9RH,	Library 1,	3592,	10
III9RH,	JJJ9RH,	Library 1,	3592,	10

viewVolserRangesByLL CLI command

Use the **viewVolserRangesByLL** command to list all of the VOLSER ranges for each logical library in the physical library. To list all of the VOLSER ranges for the physical library, use the **viewVolserRanges** command.

Syntax

```
viewVolserRangesByLL -ssl > <output-filename.csv>
```

Parameters

- ssl
Required if SSL (HTTPS) is enabled.
- > <output-filename.csv>
(Optional.) Instead of sending the command output to your display, this option sends the output to a .csv (comma-separated variable) file that can be opened and saved in a spreadsheet. By default, the file is saved in the directory where the TS4500CLI.jar file is stored. To save the file in a different directory, specify the path to that directory.

Example command

```
viewVolserRangesByLL
```

Example output

Logical Library,	Cartridges,	Media Type
Tuco Salamanca,	14,	LTO
SG0011 - SG1100,	14	
Typoon,	1,	LTO
B00000 - B00001,	0	
D00000 - D00030,	0	

REST over SCSI API reference

- [API Overview](#)

The Tape REST API provides a set of functions that allow tape library administrators to send requests and receive responses using the GET, POST, and PATCH HTTP

protocols. REST API commands are sent and responses are received using SCSI Write Buffer and Read Buffer commands, respectively. This method is called REST over SCSI, or RoS for short.

- [Location attributes](#)
- [URL endpoints](#)
- [REST resources](#)
- [Error responses](#)
- [ITDT support for RoS](#)

The IBM Tape Diagnostic Tool (ITDT) Standard Edition provides convenient command-line support for the tape library RoS functions. ITDT is a cross-platform, device-driver-independent utility that can be obtained at no charge from IBM [Fix Central](#).

- [Deprecated REST endpoints](#)

API Overview

The Tape REST API provides a set of functions that allow tape library administrators to send requests and receive responses using the GET, POST, and PATCH HTTP protocols. REST API commands are sent and responses are received using SCSI Write Buffer and Read Buffer commands, respectively. This method is called REST over SCSI, or RoS for short.

- [Query and task flow](#)
- [Examples of POST/GET commands](#)

Query and task flow

Query flow

- SCSI Write Buffer (GET query)
- SCSI Read Buffer (HTTP response to GET query)

Query flow for large data transfers

- SCSI Write Buffer (GET query)
- SCSI Read Buffer (first portion of the HTTP response to GET query)
- ...
- SCSI Read Buffer (final portion of the HTTP response to GET query)

Task flow

Start task:

- SCSI Write Buffer (POST task)
- SCSI Read Buffer (HTTP response to POST task)

Poll for completion:

- SCSI Write Buffer (GET task)
- SCSI Read Buffer (HTTP response to GET task)

Notes

1. The Buffer ID for each REST API command is X'10'.
2. The Buffer ID for the HTTP response to the most recent REST API command is X'11' — i.e., the HTTP response should be retrieved before sending a new REST API command.
3. The Buffer Mode is 2 for all RoS commands.
4. The Buffer Offset field for all RoS commands is vendor-specific and equates to an offset of 1 MiB (X'100000') for each unit of Buffer Offset.
5. Each Read Buffer response has a maximum Transfer Length of 1 MiB. In order to determine the remaining length of an HTTP response that has been truncated to 1 MiB, use the value returned for the Content-Length: field in the header of the HTTP response (at Buffer Offset of 0).
6. RoS buffers are volatile (not stored in the LCC database) and are maintained separately for each control path in the library.
7. Memory is allocated by control path upon first usage of that control path for REST over SCSI. To limit the cumulative memory consumed by REST over SCSI, a maximum of 4 control paths per LCC may be used for REST over SCSI (the cumulative usage is cleared with each reset of the LCC).
8. RoS commands are allowed during SCSI Not Ready conditions such as door open. For the POST of a task, the task will be created but will report a state of **failed** if the library is in a SCSI Not Ready condition at any time during the execution of that task. For additional details on SCSI Not Ready conditions, see [Supported SCSI commands](#) and [Sense Key 2 \(Not Ready\)](#).
9. There is a limit of one task in progress at a time.

Examples of POST/GET commands

- [Start Inventory Tier 0 and 1](#)
- [Get Inventory Tier 0 and 1 task progress](#)
- [Get Events \(with response greater than 1 MiB\)](#)

Start Inventory Tier 0 and 1

SCSI Write Buffer Command

Mode of 2, Buffer ID of X'10', Buffer Offset of X'000000'. Buffer data contains the http POST command:

```
POST /v1/tasks
Accept: application/json
Content-Type: application/json
Content-Length: 50
```

```
{"type": "inventoryTier0and1", "location": "library"}
```

SCSI Write Buffer Response

The response from SCSI is **command complete**.

SCSI Read Buffer Command

Mode of 2, Buffer ID of X'11', Buffer Offset of X'000000', Allocation Length of X'100000'

SCSI Read Buffer Response

Buffer data contains the minimum http response:

```
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 20
```

```
{"ID": "1098711043"}
```

Get Inventory Tier 0 and 1 task progress

SCSI Write Buffer Command

Mode of 2, Buffer ID of X'10', Buffer Offset of X'000000'. Buffer data contains the http POST command:

```
GET /v1/tasks/1098711043
```

SCSI Write Buffer Response

The response from SCSI is **command complete**.

SCSI Read Buffer Command

Mode of 2, Buffer ID of X'11', Buffer Offset of X'000000', Allocation Length of X'100000'

SCSI Read Buffer Response

Buffer data contains the http response:

```
HTTP/1.1 200 OK Content-Type: application/json Content-Length: 275 {"ID": "1098711043", "type": "inventoryTier0and1",
"location": "library", "state": "inProgress", "startTime": "2018-09-17T23:02:00-0700", "lastUpdateTime": "2018-09-17T23:02:10-
0700", "percentComplete": 68, "duration": 60000, "user": "admin", "description": "", "volser": ""}
```

Get Events (with response greater than 1 MiB)

SCSI Write Buffer Command

Mode of 2, Buffer ID of X'10', Buffer Offset of X'000000'. Buffer data contains the http POST command:

```
GET /v1/events
```

SCSI Write Buffer Response

The response from SCSI is **command complete**.

SCSI Read Buffer Command

Mode of 2, Buffer ID of X'11', Buffer Offset of X'000000', Allocation Length of X'100000'

SCSI Read Buffer Response

Buffer data contains the http response including the Content-Length field for determining the total length of data to be transferred (after the Content-Length value). Response is truncated to 1 MiB:

```
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 2753246

[{"ID": "2522", "severity": "information", "time": "2019-07-23T13:39:57-0700", "type": "audit", "location": null, "user": "FWService", "description": "A service user logged in to the GUI from 9.108.42.124", "state": null, "errorCode": "081C"},
. . .
{"ID": "1521", "severity": "information", "time": "2019-07-23T13:39:27-0700", "type": "library", "location": null, "user": "System", "description": "The state of the library
```

SCSI Read Buffer Command

Mode of 2, Buffer ID of X'11', Buffer Offset of X'000001', Allocation Length of X'100000'

SCSI Read Buffer Response

Buffer data contains the next portion of the http response (truncated to 1 MiB):

```
changed from restarting to nodeCardDegraded.", "state": null, "errorCode": "0700"} , {"ID": "1520", "severity": "information", "time": "2019-07-23T13:39:11-0700", "type": "library", "location": "frameSide_F19Sb", "user": "System", "description": "An LCC card was not responding over Ethernet", "state": null, "errorCode": "2384"},
. . .
{"ID": "519", "severity": "information", "ti
```

SCSI Read Buffer Command

Mode of 2, Buffer ID of X'11', Buffer Offset of X'000002', Allocation Length of X'100000'

SCSI Read Buffer Response

Buffer data contains the last portion of the http response:

```
me": "2019-07-23T13:38:34-0700", "type": "library", "location": null, "user": "System", "description": "The state of the library changed from nodeCardDegraded to restarting.", "state": null, "errorCode": "0700"},
. . .
{"ID": "218", "severity": "information", "time": "2019-07-23T13:36:33-0700", "type": "audit", "location": null, "user": "FWService", "description": "A user logged out of the GUI from 9.108.42.124", "state": null, "errorCode": "0812"} , {"ID": "217", "severity": "information", "time": "2019-07-23T13:20:08-0700", "type": "library", "location": null, "user": "System", "description": "System console not responding", "state": null, "errorCode": "0249"}
```

Location attributes

[Table 1](#) summarizes the conventions used to describe the location of each library component.

Abbreviations

A = accessor (a or b)
C = column (column number)
F = frame (frame number)
G = gripper (1 or 2)
IO = I/O station (upper or lower)
L = fiducial location (top or bottom)
P (Ethernet) = port location (a, b, imc, tssc, or service)
P (fibre channel and iSCSI) = port number (1 or 2)
R = row (row number)
S = frame side (a or b)
T = tier

Table 1. REST resource location attributes

Resource	Attribute format	Example	Human-readable example
ACC node card	nodeCardACC_A<a b>	nodeCardACC_Ab	ACC Node Card Accessor B
Accessor	accessor_A<a b>	accessor_Ab	Accessor B
Column	column_F<f>C<c>	column_F1C3	Column F1, C3
Drive	drive_F<f>C<c>R<r>	drive_F16C10R44	Drive F16, C10, R44
Fiducial	fiducial_F<f>C<c>L<t b>	fiducial_F1C3Lt	Fiducial F1 C3 Lower
Fiducial (I/O station)	fiducial_F<f>IO<u l>L<t b>	fiducial_F1IOuLb	
Frame	frame_F<f>	frame_F1	Frame 1
Frame side	frameSide_F<f>S<a b>	frameSide_F1Sa	Side F1, Side A
Gripper	gripper_A<a b>G<1 2>	gripper_AbG1	Gripper B1
I/O station	ioStation_F<f>IO<u l>	ioStation_F2IOu	I/O Station F2, Upper

Resource	Attribute format	Example	Human-readable example
I/O slot	ioSlot_F<f>IO<u l>R<r>	ioSlot_F2IOuR4	I/O Slot F2, Upper, R4
LCC node card	nodeCardLCC_F<f>	nodeCardLCC_F1	LCC Node Card F1
Library	library		Library
MDA node card	nodeCardMDA_A<a b>	nodeCardMDA_Ab	MDA Node Card Accessor B
Port (Ethernet)	ethernetPort_F<f>P<p>	ethernetPort_F2Pa	Ethernet Port F2, Port A
Port (fibre channel)	fcPort_F<f>C<c>R<r>P<p>	fcPort_F1C4R2P1	FC Port F1, C4, R2, Port 1
Port (iSCSI)	iSCSIPort_F<f>C<c>R<r>P<p>	iSCSIPort_F1C4R2P2	iSCSI Port F1, C4, R2, Port 2
Port (SAS)	SASPort_F<f>C<c>R<r>P<p>	SASPort_F1C4R2P2	SAS Port F1, C4, R2, Port 2
Position (general position within the library, only used in events and tasks)	position_F<f>C<c>R<r>	frameSide_F1C5R7	
Power supply	powerSupply_F<f>PS<power supply A or B>	powerSupply_F1PSa	Power supply F1, PSA
Slot	slot_F<f>C<c>R<r>T<t>	slot_F1C3R23T0	Slot F1, C3, R23, T0

URL endpoints

Accessors

[GET](#)

[/v1/accessors](#)

Retrieves information about all accessors in the tape library.

[GET](#)

[/v1/accessors/<location>](#)

Retrieves information about the accessor in the specified location.

[PATCH](#)

[/v1/accessors/<location> {"velocityScalingXY": <value>, "velocityScalingPivot": <value>}](#)

Adjusts the maximum speed at which an accessor can move.

[POST](#)

[/v1/tasks \[{"type": "calibrateAccessor", "location": "accessor_A<a|b>"}\]](#)

Executes the calibration task on the given accessor. This starts a long-running task in the library that is visible from the GUI.

Cleaning cartridges

[GET](#)

[/v1/cleaningCartridges](#)

Retrieves information about all cleaning cartridges in the tape library.

[GET](#)

[/v1/cleaningCartridges/<internalAddress>](#)

Retrieves information about the cleaning cartridge with the specified `internalAddress`.

[GET](#)

[/v1/cleaningCartridges/<volser>](#)

Retrieves information about the cleaning cartridge with the specified VOLSER number.

Data cartridges

[GET](#)

[/v1/dataCartridges](#)

Retrieves information about all host-accessible or unassigned data cartridges in the tape library. If a data cartridge is removed from the library or missing during an inventory scan, it does not appear in this list.

[GET](#)

[/v1/dataCartridges/<internalAddress>](#)

Retrieves information about the data cartridge with the specified `internalAddress`.

[GET](#)

[/v1/dataCartridges/<volser>](#)

Retrieves information about the data cartridge with the specified VOLSER number.

Diagnostic cartridges

[GET](#)

[/v1/diagnosticCartridges](#)

Retrieves information about all diagnostic cartridges in the tape library.

[GET](#)

[/v1/diagnosticCartridges/<internalAddress>](#)

Retrieves information about the diagnostic cartridge with the specified `internalAddress`.

[GET](#)

[/v1/diagnosticCartridges/<volser>](#)

Retrieves information about the diagnostic cartridge with the specified VOLSER number.

Drives

[GET](#)

[/v1/drives](#)

Retrieves information about all drives in the tape library.

[GET](#)

[/v1/drives/<location>](#)

Retrieves information about the drive in the specified location.

[GET](#)

[/v1/drives/<sn>](#)

Retrieves information about the drive with the specified serial number.

[POST](#)

[/v1/drives/<location>/clean](#)

Initiates a cleaning operation for the drive in the specified location.

[POST](#)

[/v1/drives/<sn>/clean](#)

Initiates a cleaning operation for the drive with the specified serial number.

[PATCH](#)

[/v1/drives/<location> {"use": <"access" | "controlPath" | "verification">}](#)

Modifies the use of the drive in the specified location (data access, control path, or verification).

[PATCH](#)

[/v1/drives/<sn> {"use": <"access" | "controlPath" | "verification">}](#)

Modifies the use of the drive with the specified serial number (data access, control path, or verification).

[POST](#)

[/v1/drives/<location>/reset {"mode": <"normal" | "hard">}](#)

Resets the drive in the specified location.

[POST](#)

[/v1/drives/<sn>/reset {"mode": <"normal" | "hard">}](#)

Resets the drive with the specified serial number.

[PATCH](#)

[/v1/drives/<location> {"beacon": <"enabled" | "disabled">}](#)

Turns the beacon on/off.

[PATCH](#)

[/v1/drives/<sn> {"beacon": <"enabled" | "disabled">}](#)

Turns beacon on/off for the drive with the specified serial number for the drive at the specified location.

Ethernet ports

[GET](#)

[/v1/ethernetPorts](#)

Retrieves information about all Ethernet ports in the tape library.

[GET](#)

[/v1/ethernetPorts/<location>](#)

Retrieves information about the Ethernet port in the specified location.

Events

[GET](#)

[/v1/events](#)

Retrieves a list of all events. Events can be filtered by date/time range and by a specific library component.

[GET](#)

[/v1/events/<ID>](#)

Retrieves information about the error with the specified ID number.

Frames

[GET](#)

[/v1/frames](#)

Retrieves information about all frames in the tape library.

[GET](#)

[/v1/frames/<location>](#)

Retrieves information about the frame in the specified location.

POST [/v1/tasks](#)
{`"type": "calibrateFrame", "location": "frame_F<F>", "accessor": "accessor_A<a|b>"`}

Executes the calibration task on the given frame. This starts a long-running task in the library that is visible from the GUI.

Library

GET
[/v1/library](#)

Retrieves information about the library and its settings.

POST
[/v1/library/reset](#)

Resets the library.

GET
[/v1/library/saveConfig](#)

Saves the library configuration to a file external to the library. This file can be used with the [restoreConfiguration](#) CLI command to restore the library configuration back to what it was before.

PATCH
[/v1/library {"time":<time>}](#)

Sets the library time, date, and time zone.

POST
[/v1/tasks {"type": "calibrateLibrary", "accessor": "accessor_A<a|b>"}](#)

Executes the calibration task on the library. This starts a long-running task in the library that is visible from the GUI.

Logs

POST
[/v1/logs](#)

Initiates the creation of a log file. This immediately returns the filename of the log file.

GET
[/v1/logs](#)

Retrieves a list of existing log files.

GET
[/v1/logs/<filename>/export](#)

Exports the log file with the specified name.

Node cards

GET
[/v1/nodeCards](#)

Retrieves information about all node cards in the tape library.

GET
[/v1/nodeCards/<ID>](#)

Retrieves information about the specified node card.

POST
[/v1/nodeCards/<ID>/reset](#)

Resets the specified node card.

Reports

GET
[/v1/reports/drives](#)

Retrieves all reports for the last week.

GET
[/v1/reports/drives?after=<YYYY-MM-DDThh:mm:ss>&before=<YYYY-MM-DDThh:mm:ss>](#)

Retrieves all reports created within the specified time interval.

GET
[/v1/reports/drives/{sn}](#)

Retrieves all reports for the drive with the specified serial number.

GET
[/v1/reports/library](#)

Retrieves all reports for the last week.

GET
[/v1/reports/library?after=<YYYY-MM-DDThh:mm:ss>&before=<YYYY-MM-DDThh:mm:ss>](#)

Retrieves all reports created within the specified time interval.

GET
[/v1/reports/accessors](#)

Retrieves all reports for the last week.

[GET](#)

[/vl/reports/accessors?after=<YYYY-MM-DDThh:mm:ss>&before=<YYYY-MM-DDThh:mm:ss>](#)

Retrieves all reports created within the specified time interval.

Slots

[GET](#)

[/vl/slots](#)

Retrieves information about all storage slots in the tape library. Default sorting is by location in numerical order based on Frame, Column, and then Row in order.

[GET](#)

[/vl/slots/<location>](#)

Retrieves information about the storage slot in the specified location.

Tasks

[GET](#)

[/vl/tasks](#)

Retrieves information about all currently running tasks.

[GET](#)

[/vl/tasks/<ID>](#)

Retrieves information about the task with the specified ID number.

[POST](#)

[/vl/tasks \[{"type": "inventoryTier0and1", "location": "<library> | "frame_F<f>">}\]](#)

Executes an inventory scan on tiers 0 and 1 of the library or the specified frame. This starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "inventoryAllTiers", "location": "<library> | "frame_F<f>">}\]](#)

Executes an inventory scan on all tiers of the library or the specified frame. This starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks {"type": "calibrateLibrary", "accessor": "accessor_A<a|b>"}](#)

Executes the calibration task on the library. This starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "startDriveService", "location": "drive_F<f>C<c>R<r>"}\]](#)

Initiates a service action on the specified drive. This puts the drive in the **in service** state and starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "startDriveService", "sn": "serialNumber"}\]](#)

Initiates a service action on the drive with the specified serial number. This puts the drive in the **in service** state and starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "completeDriveService", "location": "drive_F<f>C<c>R<r>"}\]](#)

Completes a service action on the specified drive. This takes the drive out of the **in service** state and starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "completeDriveService", "sn": "serialNumber"}\]](#)

Completes a service action on the drive with the specified serial number. This takes the drive out of the **in service** state and starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "calibrateAccessor", "location": "accessor_A<a|b>"}\]](#)

Executes the calibration task on the given accessor. This starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "startAccessorService", "location": "accessor_A<a|b>"}\]](#)

Initiates a service action on the specified accessor. This puts the accessor in the **in service** state and starts a long-running task in the library that is visible from the GUI.

[POST](#)

[/vl/tasks \[{"type": "completeAccessorService", "location": "accessor_A<a|b>"}\]](#)

Completes a service action on the specified accessor. This takes the accessor out of the **in service** state and starts a long-running task in the library that is visible from the GUI.

[POST /vl/tasks](#)

[\[{"type": "testDrive", "location": "drive_F<f>C<c>R<r>"}\]](#)

Starts a test drive operation using a diagnostic cartridge. This starts a long-running task in the library that is visible from the GUI.

[POST /vl/tasks](#)

[\[{"type": "testDrive", "sn": "serialNumber"}\]](#)

Starts a test operation using a diagnostic cartridge on the drive with the specified serial number. This starts a long-running task in the library that is visible from the GUI.

[POST /vl/tasks](#)

[{"type": "calibrateFrame", "location": "frame_F<f>", "accessor": "accessor_A<a|b>"}](#)

Executes the calibration task on the given frame. This starts a long-running task in the library that is visible from the GUI.

Work items

```

POST
/vl/workItems [{"type": "moveToDrive", "cartridge":
<volser>,"sourceInternalAddress":
<internalAddress>,"destinationLocation": <location>,"destinationSN":
< serialNumber
>,"destinationInternalAddress": <internalAddress>}],

```

Moves a cartridge to the specified drive.

```

POST
/vl/workItems [{"type": "moveToSlot", "cartridge":
<volser>,"sourceInternalAddress":
<internalAddress>,"destinationLocation":
<location>,"destinationInternalAddress":
<internalAddress>}],

```

Moves a cartridge to a slot chosen by the library.

```

POST
/vl/workItems [{"type": "moveToIOStation", "cartridge": <volser>,"
sourceInternalAddress": <internalAddress>,"
destinationLocation": <location>,"
destinationInternalAddress": <internalAddress>}],

```

Moves a cartridge to an I/O station chosen by the library.

Deprecated URL endpoints

[POST /vl/cleaningCartridges/<internalAddress>/moveToIOStation](#)
 Moves the specified cleaning cartridge to the I/O station.

[POST /vl/dataCartridges/<internalAddress>/moveToIOStation](#)
 Moves the specified data cartridge to the I/O station.

[POST /vl/diagnosticCartridges/<internalAddress>/moveToIOStation](#)
 Moves the specified diagnostic cartridge to the I/O station.

REST resources

- [Accessors](#)
Accessors are the physical devices that move tape cartridges within the library.
- [Cleaning cartridges](#)
Cleaning cartridges are used periodically to clean drives. They have a limited number of uses; this resource tracks the most recent use for each cleaning cartridge and the number of cleans remaining.
- [Data cartridges](#)
Data cartridges are the main cartridges in the library. They are used to store host data and are largely controlled by the library manager.
- [Diagnostic cartridges](#)
Diagnostic cartridges are used periodically to test drive performance and troubleshoot problems.
- [Drives](#)
A tape drive reads data from and writes data to a cartridge mounted in the drive. It communicates over the SCSI interface to the host system. Control path drives handle library actions from the host system. All drives communicate with the library/LCC node card.
- [Ethernet ports](#)
Ethernet ports manage non-data access control to the tape library.
- [Events](#)
Library events are used to track all resource state changes within the library.
- [Frames](#)
- [Library](#)
- [Power supplies](#)
Power supplies connect the library to alternating current (AC) power. The library is powered by two AC to direct current (DC) power supplies in the L-frame. Power supplies are also installed in the D-frame.
- [Logs](#)
- [Node cards](#)
Physical node cards within the library control all aspects of the library's operation. Node card types include the motor driver assembly (MDA), the accessor control card (ACC), and the library control card (LCC).
- [Reports](#)
The reports contain usage history and other data for resources in the library.
- [Slots](#)
- [Tasks](#)
- [Work items](#)

Accessors

Accessors are the physical devices that move tape cartridges within the library.

- [Get accessor information](#)
- [Adjust accessor velocity](#)

Get accessor information

[Request syntax](#)
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Request syntax

GET
[/v1/accessors](#)

Retrieves information about all accessors in the tape library.

GET
[/v1/accessors/<location>](#)

Retrieves information about the accessor in the specified location.

Path parameters

location

A string that describes the unique identifier for the accessor with a value of `accessor_Aa` or `accessor_Ab`.

cURL example

```
> GET /v1/accessors/accessor_Aa
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 439
[
  {
    "location": "accessor_Aa",
    "state": "onlineActive",
    "stateReferenceEvent": 435,
    "driveAccess": "normal",
    "cartridgeAccess": "normal",
    "pivots": 151321,
    "barCodeScans": 92742,
    "velocityScalingXY": 100,
    "velocityScalingPivot": 100,
    "travelX": 38056,
    "travelY": 65039,
    "getsGripper1": 63614,
    "putsGripper1": 63595,
    "getsGripper2": 63338,
    "putsGripper2": 63310
  }
]
```

Attribute summary

Name	Schema
<code>location</code>	String (location)
<code>state</code>	String (accessor state)
<code>stateReferenceEvent</code>	Integer (event ID)
<code>driveAccess</code>	String (normal, limited)
<code>cartridgeAccess</code>	String (normal, limited)
<code>pivots</code>	Integer (#pivots)
<code>barCodeScans</code>	Integer (#scans)
<code>velocityScalingXY</code>	Integer (%)
<code>velocityScalingPivot</code>	Integer (%)
<code>travelX</code>	Integer (meters)
<code>travelY</code>	Integer (meters)
<code>getsGripper1</code>	Integer (#gets)
<code>putsGripper1</code>	Integer (#puts)
<code>getsGripper2</code>	Integer (#gets)
<code>putsGripper2</code>	Integer (#puts)

Attribute descriptions

location

A string that describes the unique identifier for the accessor with a value of `accessor_Aa` or `accessor_Ab`.

pivots

An integer count of the number of pivots this accessor has performed in its lifetime.

state

A string representing the current state of the accessor. Values include the following in priority order:

State	Description
<code>inServiceMode</code>	The accessor is being serviced and is not able to move cartridges. To end this state, use the completeAccessorService task.
<code>noMovementAllowed</code>	The accessor is in a state where movement is not allowed due to some failure or internal process that is not related to library/accessor initialization. If dual accessors are configured, the other accessor might still be operational in this state. Access to certain drives and cartridges might be restricted if the accessor is not in the Service Bay.
<code>bothGrippersFailed</code>	Both grippers within this accessor have failed, and the accessor is no longer usable. It may or might not have a cartridge in it.
<code>gripper1Failed/ gripper2Failed</code>	A gripper within this accessor has failed, but the accessor is still usable. It may or might not have a cartridge in it.
<code>scannerFailed</code>	One or more scanners are either not communicating with the library or require service.
<code>noMotorPower</code>	Power is removed from the accessor by the library. This is normally done in response to a user opening a door of the library.
<code>calibrating</code>	Accessor is in the process of initializing and orienting itself within the library and is not able to move cartridges.
<code>onlineStandby</code>	The accessor is parked in the Service Bay. If the other accessor goes down, then this accessor becomes active. In this option, the preferred zone for the other accessor includes the entire library except for the area for the Service Bay for this accessor.
<code>onlineActive</code>	The accessor is operational and can fulfill requests for media.

stateReferenceEvent

If state is not a warning or error state this will be null. Otherwise, it may be the event ID for the event which caused the state to change.

driveAccess

In the case of a single-accessor library, this attribute is `normal` when the accessor is in a state that allows it to access the drives of the library. Otherwise, `limited` is reported.

In the case of a dual-accessor library, this attribute also depends on the state of the other accessor. If the other accessor is in the `noMovementAllowed` state and in a position that blocks this accessor from reaching drives, a value of `limited` is reported.

cartridgeAccess

In the case of a single-accessor library, this attribute is `normal` when the accessor is in a state that allows it to access the cartridges of the library. Otherwise, `limited` is reported. In the case of a dual-accessor library, this attribute also depends on the state of the other accessor. If the other accessor is in the `noMovementAllowed` state and in a position that blocks this accessor from reaching cartridges that it can normally, access given the `LibraryElasticCapacity` setting, a value of `limited` is reported.

barCodeScans

An integer count of the number of bar code scans this accessor has performed in its lifetime.

velocityScalingXY

An integer that defines the amount by which the maximum velocity of the accessor is scaled in the X and Y directions.

velocityScalingPivot

An integer that defines the amount by which the maximum velocity of the accessor is scaled for the Pivot movement.

travelX

An integer count of the number of meters this accessor has traveled in the X direction (horizontally) in its lifetime.

travelY

An integer count of the number of meters this accessor has traveled in the Y direction (vertically) in its lifetime.

getsGripper1

An integer count of the number of times gripper 1 on this accessor has engaged to retrieve a cartridge into the accessor in its lifetime.

putsGripper1

An integer count of the number of times gripper 1 on this accessor has engaged to place a cartridge out of the accessor in its lifetime.

getsGripper2

An integer count of the number of times gripper 2 on this accessor has engaged to retrieve a cartridge into the accessor in its lifetime.

putsGripper2

An integer count of the number of times gripper 2 on this accessor has engaged to place a cartridge out of the accessor in its lifetime.

Adjust accessor velocity

[Request syntax](#)

[Path parameters](#)

[Request body parameters](#)

[cURL example](#)

Request syntax

[PATCH](#)

`/v1/accessors/<location> {"velocityScalingXY": <value>, "velocityScalingPivot": <value>}`

Adjusts the maximum speed at which an accessor can move.

Path parameters

location

A string that describes the unique identifier for the accessor with a value of `accessor_Aa` or `accessor_Ab`.

Request body parameters

velocityScalingXY

An integer that defines the amount by which the maximum velocity of the accessor is scaled in the X and Y directions. A value of 100 is default and means no scaling. A smaller value reduces the maximum velocity by the scaled amount. For example, a value of 80 reduces it to 80% of the original value. If the value entered is below the system's minimum value of 20, the command will be rejected.

velocityScalingPivot

An integer that defines the amount by which the maximum velocity of the accessor is scaled for the Pivot movement. A value of 100 is default and means no scaling. A smaller value reduces the maximum velocity by the scaled amount. For example, a value of 80 reduces it to 80% of the original value. The value must be an increment of 10. If the value entered is not an increment of 10 or is below the system's minimum value of 20, the command will be rejected.

cURL example

```
> PATCH /v1/accessors/accessor_Ab {"velocityScalingXY": 80}
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 0
```

Cleaning cartridges

Cleaning cartridges are used periodically to clean drives. They have a limited number of uses; this resource tracks the most recent use for each cleaning cartridge and the number of cleans remaining.

- [Get cleaning cartridge information](#)

Get cleaning cartridge information

[Request syntax](#)

[Path parameters](#)

[cURL example](#)

[Attribute summary](#)

[Attribute descriptions](#)

Request syntax

[GET](#)

`/v1/cleaningCartridges`

Retrieves information about all cleaning cartridges in the tape library.

[GET](#)

`/v1/cleaningCartridges/<internalAddress>`

Retrieves information about the cleaning cartridge with the specified `internalAddress`.

[GET](#)

`/v1/cleaningCartridges/<volser>`

Retrieves information about the cleaning cartridge with the specified VOLSER number.

Path parameters

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERS. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

volser

A string that represents the volume serial number or bar code that identifies the cartridge to the host. For example, `SG1122L2` for a data cartridge, `CLNU28L1` for a cleaning cartridge, or `DG I01L6` for a diagnostic cartridge. If there are duplicate VOLSERS in the library, a query of this VOLSER returns more than one cartridge.

cURL example

```
> GET /v1/cleaningCartridges
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 330
```

```
[
  {
    "volser": "CLNI01L1",
    "state": "normal",
    "accessible": "normal",
    "cleansRemaining": 45,
    "location": "slot_F1C6R13T0",
    "mediaType": "LTO",
    "mostRecentUsage": "2019-03-25T13:33:58-0700"
  }, {
    "volser": "CLNI01L1",
    "state": "normal",
    "accessible": "normal",
    "cleansRemaining": 44,
    "location": "slot_F1C10R4T0",
    "mediaType": "LTO",
    "mostRecentUsage": "2019-03-25T13:34:17-0700"
  }
]
```

Attribute summary

Name	Schema
volser	String (VOLSER)
state	String (cartridge state)
accessible	String (normal, limited, no)
cleansRemaining	Integer
location	String (location)
mediaType	String (media type)
mostRecentUsage	String (date/time)
internalAddress	String (hex string)
mediaSN	String

Attribute descriptions

volser

A string that represents the volume serial number or bar code that identifies the cartridge to the host. For example, **SG1122L2** for a data cartridge, **CLNU28L1** for a cleaning cartridge, **DG I01L6** for a diagnostic cartridge, or *null* if the VOLSER is unknown.

state

A string that represents the current state of the cartridge. The following values are included in order of priority :

Table 1.

State	Description
failedVerification	The cartridge failed last verification. You may need to migrate the data to another cartridge.
assignmentRequired	The cartridge is in a slot but is unassigned to a logical library because an empty import/export element (IEE) address is not currently available for assignment. The cartridge must be manually assigned to the logical library or removed from the library.
exportQueued	The cartridge is queued to be moved to an I/O station.
verifying	Verification in a media verification drive in progress.
normal	The cartridge status is normal.

accessible

A string that indicates whether the cartridge is accessible by all accessors or not. Values include *normal* when all installed accessors have normal access to the cartridge as defined by the elastic capacity library setting, *limited* when one accessor in a dual-accessor library is unable to reach the cartridge due to errors, and *no* when none of the installed accessors can reach the drive due to errors.

cleansRemaining

An integer that represents the number of clean operations that remain for this cleaning cartridge.

location

A string that describes the current location of the cartridge. Note that the gripper location is only shown as part of a failure scenario if the cartridge is stuck in the gripper or as part of a tier 2 mount. Otherwise, a cartridge that is in transit from one location to another maintains its source location until after the move is completed. The format depends on the location of the cartridge, as follows:

- gripper_A<a|b>G<1|2> (for example, gripper_AbG1)
- drive_F<f>C<c>R<r> (for example, drive_F16C10R44)
- slot_F<f>C<c>R<r>T<t> (for example, slot_F1C3R23T0)
- ioSlot_F<f>IO<u|l>R<r> (for example, ioSlot_F2IOuR4)

mediaType

A string that represents the media type supported by the tape drive. Supported values include **3592** and **LTO**.

mostRecentUsage

A string that represents the last date and time this cartridge was mounted into a drive, or *null* if this is unknown or the cartridge is not yet mounted. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**.

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERS. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

mediaSN

A 32-character string representing the media serial number of the cartridge. This value is permanently stored in the medium auxiliary memory of the cartridge during manufacture. If the cartridge is not yet mounted by the library, **mediaSN** is *null* as its value has not been read yet.

Data cartridges

Data cartridges are the main cartridges in the library. They are used to store host data and are largely controlled by the library manager.

- [Get data cartridge information](#)

Get data cartridge information

Note: Data cartridge commands are supported in library firmware version 1.7.0.0 and higher.

[Request syntax](#)

[Path parameters](#)

[cURL example](#)

[Attribute summary](#)

[Attribute descriptions](#)

Request syntax

GET

[/v1/dataCartridges](#)

Retrieves information about all host-accessible or unassigned data cartridges in the tape library. If a data cartridge is removed from the library or missing during an inventory scan, it does not appear in this list.

GET

[/v1/dataCartridges/<internalAddress>](#)

Retrieves information about the data cartridge with the specified **internalAddress**.

GET

[/v1/dataCartridges/<volser>](#)

Retrieves information about the data cartridge with the specified VOLSER number.

Path parameters

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERS. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

volser

A string that represents the volume serial number or bar code that identifies the cartridge to the host. For example, **SG1122L2** for a data cartridge, **CLNU28L1** for a cleaning cartridge, or **DG I01L6** for a diagnostic cartridge. If there are duplicate VOLSERS in the library, a query of this VOLSER returns more than one cartridge.

cURL example

```
> GET /v1/dataCartridges
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 33330
```

```
[
  {
    "volser": "SG1122L2",
    "state": "normal",
    "accessible": "normal",
    "location": "slot_F1C6R13T0",
    "mediaType": "LTO",
    "encrypted": "yes",
    "mostRecentVerification": "2019-03-01T03:44:07-0700",
    "mostRecentUsage": "2019-03-25T13:33:58-0700",
    "logicalLibrary": "myLL2",
    "elementAddress": 1025
    "internalAddress": "030403"
  }, {
    . . .
  }
]
```

Attribute summary

Name	Schema
volser	String (VOLSER)

Name	Schema
state	String (cartridge state)
accessible	String (normal, limited, no)
location	String (location)
mediaType	String (media type)
encrypted	String (yes, no, null)
mostRecentVerification	String (date/time)
mostRecentUsage	String (date/time)
logicalLibrary	String (LL name)
elementAddress	Integer
internalAddress	String (hex string)
mediaSN	String

Attribute descriptions

volser

A string that represents the volume serial number or bar code that identifies the cartridge to the host. For example, **SG1122L2** for a data cartridge, **CLNU28L1** for a cleaning cartridge, **DG I01L6** for a diagnostic cartridge, or *null* if the VOLSER is unknown.

state

A string that represents the current state of the cartridge. The following values are included in order of priority :

Table 1.

State	Description
failedVerification	The cartridge failed last verification. You may need to migrate the data to another cartridge.
assignmentRequired	The cartridge is in a slot but is unassigned to a logical library because an empty import/export element (IEE) address is not currently available for assignment. The cartridge must be manually assigned to the logical library or removed from the library.
uncertainBarcode	Possible mismatch between a scanned bar code label and the copy of the bar code stored on cartridge memory. The library will try to resolve on the next mount/demount cycle of this cartridge. If issue persists, contact IBM Support.
exportQueued	The cartridge is queued to be moved to an I/O station.
verifying	Verification in a media verification drive in progress.
normal	The cartridge status is normal.

accessible

A string that indicates whether the cartridge is accessible by all accessors or not. Values include *normal* when all installed accessors have normal access to the cartridge as defined by the elastic capacity library setting, *limited* when one accessor in a dual-accessor library is unable to reach the cartridge due to errors, and *no* when none of the installed accessors can reach the drive due to errors.

location

A string that describes the current location of the cartridge. Note that the gripper location is only shown as part of a failure scenario if the cartridge is stuck in the gripper or as part of a tier 2 mount. Otherwise, a cartridge that is in transit from one location to another maintains its source location until after the move is completed. The format depends on the location of the cartridge, as follows:

- **gripper_A<a|b>G<1|2>** (for example, **gripper_AbG1**)
- **drive_F<f>C<c>R<r>** (for example, **drive_F16C10R44**)
- **slot_F<f>C<c>R<r>T<t>** (for example, **slot_F1C3R23T0**)
- **ioSlot_F<f>IO<u|l>R<r>** (for example, **ioSlot_F2IOuR4**)

mediaType

A string that represents the media type supported by the tape drive. Supported values include **3592** and **LTO**.

encrypted

A string that represents the state of encryption on the cartridge. If **yes**, the data on the cartridge was encrypted by the tape drive. If **no**, the data on the cartridge was not encrypted by the tape drive. If *null*, the cartridge has not yet been mounted.

mostRecentVerification

A string that represents the last date and time this cartridge was verified by using media verification in a drive, which was assigned as a media verification drive. If media verification is not run on this cartridge, it returns *null*.

mostRecentUsage

A string that represents the last date and time this cartridge was mounted into a drive, or *null* if this is unknown or the cartridge is not yet mounted. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**.

logicalLibrary

A string that represents the name of the logical library this cartridge is assigned to currently. If it is not assigned to a logical library, this is *null*. If the cartridge does not belong to a bar code range, it is available to all logical libraries. In this case, the state that is reported is **importing** and this value returns *null*.

elementAddress

An integer that represents the element address of the cartridge drive. This value is reported to hosts via the Read Element Status SCSI command. This is *null* if not yet reported to the host.

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERS. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

mediaSN

A 32-character string that represents the media serial number of the cartridge. This value is permanently stored in the medium auxiliary memory of the cartridge during manufacture. If the cartridge is not yet mounted by the library, `mediaSN` is *null* as its value has not been read yet.

Diagnostic cartridges

Diagnostic cartridges are used periodically to test drive performance and troubleshoot problems.

- [Get diagnostic cartridge information](#)

Get diagnostic cartridge information

[Request syntax](#)

[Path parameters](#)

[cURL example](#)

[Attribute summary](#)

[Attribute descriptions](#)

Request syntax

GET

`/v1/diagnosticCartridges`

Retrieves information about all diagnostic cartridges in the tape library.

GET

`/v1/diagnosticCartridges/<internalAddress>`

Retrieves information about the diagnostic cartridge with the specified `internalAddress`.

GET

`/v1/diagnosticCartridges/<volser>`

Retrieves information about the diagnostic cartridge with the specified VOLSER number.

Path parameters

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERS. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

volser

A string that represents the volume serial number or bar code that identifies the cartridge to the host. For example, `SG1122L2` for a data cartridge, `CLNU28L1` for a cleaning cartridge, or `DG I01L6` for a diagnostic cartridge. If there are duplicate VOLSERS in the library, a query of this VOLSER returns more than one cartridge.

cURL example

```
> GET /v1/diagnosticCartridges
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 560
```

```
[
  {
    "volser": "DG 011L2",
    "state": "normal",
    "accessible": "normal",
    "location": "slot_F1C10R7T0",
    "mediaType": "LTO",
    "mostRecentUsage": "2019-03-29T11:12:04-0700",
    "internalAddress": "FF0402"
  }, {
    "volser": "DG 419L4",
    "state": "normal",
    "location": "slot_F1C10R5T0",
    "mediaType": "LTO",
    "mostRecentUsage": "2019-03-29T11:12:04-0700",
    "internalAddress": "FF0403"
  }, {
    . . .
  }
]
```

Attribute summary

Name	Schema
<code>volser</code>	String (VOLSER)
<code>state</code>	String (Cartridge state)
<code>accessible</code>	String (normal, limited, no)

Name	Schema
location	String (location)
mediaType	String (media type)
mostRecentUsage	String (date/time)
internalAddress	String (hex string)
mediaSN	String

Attribute descriptions

volser

A string that represents the volume serial number or bar code that identifies the cartridge to the host. For example, **SG1122L2** for a data cartridge, **CLNU28L1** for a cleaning cartridge, **DG I01L6** for a diagnostic cartridge, or *null* if the VOLSER is unknown.

state

A string that represents the current state of the cartridge. The following values are included in order of priority :

Table 1.

State	Description
failedVerification	The cartridge failed last verification. You may need to migrate the data to another cartridge.
assignmentRequired	The cartridge is in a slot but is unassigned to a logical library because an empty import/export element (IEE) address is not currently available for assignment. The cartridge must be manually assigned to the logical library or removed from the library.
exportQueued	The cartridge is queued to be moved to an I/O station.
verifying	Verification in a media verification drive in progress.
normal	The cartridge status is normal.

accessible

A string that indicates whether the cartridge is accessible by all accessors or not. Values include *normal* when all installed accessors have normal access to the cartridge as defined by the elastic capacity library setting, *limited* when one accessor in a dual-accessor library is unable to reach the cartridge due to errors, and *no* when none of the installed accessors can reach the drive due to errors.

location

A string that describes the current location of the cartridge. Note that the gripper location is only shown as part of a failure scenario if the cartridge is stuck in the gripper or as part of a tier 2 mount. Otherwise, a cartridge that is in transit from one location to another maintains its source location until after the move is completed. The format depends on the location of the cartridge, as follows:

- **gripper_A<a|b>G<1|2>** (for example, **gripper_AbG1**)
- **drive_F<f>C<c>R<r>** (for example, **drive_F16C10R44**)
- **slot_F<f>C<c>R<r>T<t>** (for example, **slot_F1C3R23T0**)
- **ioSlot_F<f>IO<u|l>R<r>** (for example, **ioSlot_F2IOuR4**)

mediaType

A string that represents the media type supported by the tape drive. Supported values include **3592** and **LTO**.

mostRecentUsage

A string that represents the last date and time this cartridge was mounted into a drive, or *null* if this is unknown or the cartridge is not yet mounted. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**.

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERs. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

mediaSN

A 32-character string that represents the media serial number of the cartridge. This value is permanently stored in the medium auxiliary memory of the cartridge during manufacture. If the cartridge is not yet mounted by the library, **mediaSN** is *null* as its value has not been read yet.

Drives

A tape drive reads data from and writes data to a cartridge mounted in the drive. It communicates over the SCSI interface to the host system. Control path drives handle library actions from the host system. All drives communicate with the library/LCC node card.

- [Get drive information](#)
- [Clean drive](#)
- [Modify drive use](#)
- [Reset drive](#)
- [Turn drive beacon on/off](#)

Get drive information

[Request syntax](#)
[Path parameters](#)
[cURL example](#)

[Attribute summary](#)
[Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/drives](#)

Retrieves information about all drives in the tape library.

[GET](#)
[/v1/drives/<location>](#)

Retrieves information about the drive in the specified location.

[GET](#)
[/v1/drives/<sn>](#)

Retrieves information about the drive with the specified serial number.

Path parameters

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is `drive_F<f>C<c>R<r>`, where `<f>` is the frame, `<c>` is the column, and `<r>` is the row the drive is installed in. For example, `drive_F16C10R44`.

sn

A string representing the serial number of the drive. This can also be used as a unique identifier for the tape drive.

cURL example

```
> GET /v1/drives
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1907

[
  {
    "location": "drive_F2C4R2",
    "sn": "YD1097000039",
    "mediaType": "3592",
    "state": "online",
    "operation": "loading",
    "accessible": "normal",
    "mtm": "3592-EH7",
    "barcode": "11S00VJ876Y81013000124",
    "interface": "fibreChannel",
    "interfaceMode": "multi-mode",
    "logicalLibrary": "JAGTEST",
    "use": "controlPath",
    "firmware": "3A88",
    "encryption": "disabled",
    "wwnn": "50050760441355fd",
    "elementAddress": 257,
    "beacon": "disabled",
    "volser": "SG1353L2",
  }, {
    "location": "drive_F3C2R1",
    "sn": "00078A3444",
    "mediaType": "LTO",
    "state": "online",
    "operation": "unloading",
    "accessible": "normal",
    "barcode": "11S00VJ876Y81013000125",
    "mtm": "3588-F5C",
    "interface": "fibreChannel",
    "interfaceMode": "multi-mode",
    "logicalLibrary": "LTOGU",
    "use": "verification",
    "firmware": "H8AF",
    "encryption": "enabled",
    "wwnn": "5005076044135504",
    "elementAddress": 448,
    "beacon": "disabled",
    "volser": null,
  }, {
    . . .
  }
]
```

Attribute summary

Name	Schema
location	String (location)
sn	String
mediaType	String (media type)
state	String (drive state)
operation	String

Name	Schema
accessible	String (normal, limited, no)
mtm	String
barcode	String
interface	String
interfaceMode	String
logicalLibrary	String (LL name)
use	String
firmware	String
encryption	String (enabled disabled)
wwnn	String (WWNN)
elementAddress	Integer
beacon	String (enabled disabled)
volser	String (VOLSER)

Attribute descriptions

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is **drive_F<f>C<c>R<r>**, where <f> is the frame, <c> is the column, and <r> is the row the drive is installed in. For example, **drive_F16C10R44**.

sn

A string representing the serial number of the drive. This can also be used as a unique identifier for the tape drive.

mediaType

A string that represents the media type supported by the tape drive. Supported values include **3592** and **LTO**.

state

A string representing the current state of the tape drive. Values include the following in priority order:

State	Description
inServiceMode	The drive is offline for service. The drive is not online to the SCSI interface for data path or control path commands. Any commands for mounting a data cartridge to this drive coming through a different control path will also be rejected.
restarting	A library-controlled reset is in progress, such as a firmware update or manual reset, is in progress.
initializing	The drive has answered network ping from the library but is not fully logged into the library yet. This includes drive reset scenarios not initiated by the library.
unreachable	The drive has not answered network ping from library. May be responding to SCSI commands, not reachable by the library but is still eligible for mount/unmount activity. A power cycle reset (POST /v1/drives/<location>/reset (mode:hard)) is recommended for this drive if the drive is also not responding to SCSI commands.
resetRequired	The control path drive firmware was updated. A drive reset (POST /v1/drives/<location>/reset (mode:normal)) is now required to activate the new firmware level. This state is not displayed for non-control path drives as they are reset automatically after firmware update.
updating	The drive is online and drive firmware is being updated.
cleaning	Cleaning is in progress.
online	The drive is communicating with the library and reporting that it is responding to SCSI commands. See the operation attribute for details about the operation being performed while in this state.

operation

A string representing the current operation the tape drive is performing. If the tape drive is not in the *online* state, this will be *null*. Values include the following in order of priority:

Operation	Description
loading	Drive is online and in the process of loading a cartridge.
unloading	Drive is online, unloading, and writing to the currently loaded cartridge.
empty	Drive is online and empty.
ready	Drive is online, shows no activity, and has a cartridge mounted. This will normally match the drive's SCSI ready condition but not always.
unloaded	Drive is online, shows no activity, and has no cartridge mounted.

accessible

A string that indicates whether the cartridge is accessible by all accessors or not. Values include *normal* when all installed accessors have normal access to the cartridge as defined by the elastic capacity library setting, *limited* when one accessor in a dual-accessor library is unable to reach the cartridge due to errors, and *no* when none of the installed accessors can reach the drive due to errors.

mtm

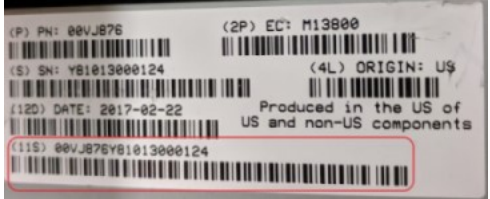
A string representing the machine type and model of the tape drive (e.g. **3588-F6C**). For a full list of supported drives, refer to [Supported tape drives](#).

barcode

A string representing the 11S barcode label found on the tape drive. This is a 22-character string with the following format:

11S-Y Bar-code - Common Cross Brand Header Format

ID			IBM Part Number							ID	Loc & Type	EC	Vendor Code	Serial Number							
1	1	S	p	p	p	p	p	p	p	Y	x	x	h	h	s	s	s	s	s	s	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22



interface

A string representing the type of ports this tape drive includes. Values include **fibreChannel** and **iSCSI**.

interfaceMode

A string representing the interface mode supported by the ports this tape drive includes. Values include **single-mode** for single-mode fiber and **multi-mode** for multi-mode fiber. The value is *null* if the ports included have an iSCSI interface.

logicalLibrary

A string representing the name of the logical library this tape drive has been assigned to or *null* if the tape drive is currently unassigned.

use

A string representing the assigned use this tape drive has been given within the logical library. Values include:

Use	Description
access	Data access drives
controlPath	Data access and control path drives
verification	Media verification drives

firmware

A string representing the firmware version currently installed on the tape drive.

encryption

The state of encryption on this tape drive. Values include **enabled** and **disabled**.

wwnn

A 16-character hex string representing the world-wide node name of the tape drive.

elementAddress

An integer representing the element address of the tape drive. This value is reported to hosts via the Read Element Status SCSI command. This will be *null* if unassigned to a logical library.

beacon

A string indicating the current state of the drive beacon LED. This beacon can be seen from the rear of the drive. Values include **enabled** (LED is flashing) and **disabled** (LED is off).

The **PATCH beacon** command does not verify that a drive is present in the specified drive location. If an empty drive location is specified, the command output will still indicate that the beacon is enabled for that drive location. The **GET drives** command can be used to verify the presence of a drive in a specific drive location.

If the drive is replaced while this is enabled, the state of the physical LED may not match this attribute. In this case, the beacon should be disabled.

volser

A string representing the volume serial number or barcode that uniquely identifies the cartridge that is currently mounted in the tape drive. For example, **SG1122L2** or *null* if the tape drive does not have a cartridge mounted or the currently loaded cartridge's VOLSER is unknown.

Clean drive

[Request syntax](#)

[Path parameters](#)

[cURL example](#)

Request syntax

POST

[/vl/drives/<location>/clean](#)

Initiates a cleaning operation for the drive in the specified location.

POST

[/vl/drives/<sn>/clean](#)

Initiates a cleaning operation for the drive with the specified serial number.

Path parameters

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is **drive_F<f>C<c>R<r>**, where <f> is the frame, <c> is the column, and <r> is the row the drive is installed in. For example, **drive_F16C10R44**.

sn

The globally unique serial number of the drive.

cURL example

```
> POST /v1/drives/drive_F3C2R1/clean
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0

> POST /v1/drives/YG1013000616/clean
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0
```

Modify drive use

[Request syntax](#)
[Path parameters](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

PATCH
`/v1/drives/<location> {"use": <"access" | "controlPath" | "verification">}`
Modifies the use of the drive in the specified location (data access, control path, or verification).

PATCH
`/v1/drives/<sn> {"use": <"access" | "controlPath" | "verification">}`
Modifies the use of the drive with the specified serial number (data access, control path, or verification).

Path parameters

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is `drive_F<f>C<c>R<r>`, where <f> is the frame, <c> is the column, and <r> is the row the drive is installed in. For example, `drive_F16C10R44`.

sn

The globally unique serial number of the drive.

Request body parameters

use

A string representing the assigned use this tape drive has been given within the logical library. Values include:

Use	Description
access	Data access drives
controlPath	Data access and control path drives
verification	Media verification drives

cURL example

```
> PATCH /v1/drives/drive_F3C2R1 {"use": "access"}
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 0

> PATCH /v1/drives/YG1013000616 {"use": "access"}
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 0
```

Reset drive

Note: Reset drive commands are supported in library firmware version 1.7.0.0 and higher.

[Request syntax](#)
[Path parameters](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST

[/v1/drives/<location>/reset {"mode": <"normal" | "hard">}](#)

Resets the drive in the specified location.

POST

[/v1/drives/<sn>/reset {"mode": <"normal" | "hard">}](#)

Resets the drive with the specified serial number.

CAUTION:

Usage of the hard reset option on a tape drive that is currently moving tape between reels has a small risk of damaging that tape. Ensure the tape is not moving when using this hard reset option. If the drive state cannot be determined from the host (e.g. an apparent drive hang), then the hard reset should follow this sequence.

- Using LUN 1 of any control path drive other than the drive to be reset:
 - GET /v1/drives/ once every minute until the drive state has been "unreachable" for a minimum of 6 minutes (this ensures any residual tape movement has stopped), and then
 - POST /v1/drives//reset {"mode": "hard"} command with a programmatic copy of the [location] used in the GET command (this reduces the risk of resetting the wrong drive).
- Using LUN 0 of the drive that was reset:
 - Poll the tape drive for ready status, and then,
 - Gather a drive dump to be sent to IBM support.

Path parameters

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is **drive_F<f>C<c>R<r>**, where <f> is the frame, <c> is the column, and <r> is the row the drive is installed in. For example, **drive_F16C10R44**.

sn

The globally unique serial number of the drive.

Request body parameters

mode

An optional string representing the type of reset to perform on the drive. If not provided, **normal** is used. Possible values include:

Mode	Description
normal	A communication is sent to the drive indicating it should reboot itself.
hard	The library removes power to the drive temporarily to force a reset.

cURL example

```
> POST /v1/drives/drive_F3C2R1/reset {"mode": "hard"}
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0

> POST /v1/drives/YG1013000616/reset {"mode": "hard"}
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0
```

Turn drive beacon on/off

[Request syntax](#)

[Path parameters](#)

[Request body parameters](#)

[cURL example](#)

Request syntax

PATCH

[/v1/drives/<location> {"beacon": <"enabled" | "disabled">}](#)

Turns the beacon on/off.

PATCH

[/v1/drives/<sn> {"beacon": <"enabled" | "disabled">}](#)

Turns beacon on/off for the drive with the specified serial number for the drive at the specified location.

Path parameters

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is **drive_F<f>C<c>R<r>**, where <f> is the frame, <c> is the column, and <r> is the row the drive is installed in. For example, **drive_F16C10R44**.

sn

The globally unique serial number of the drive.

Request body parameters

beacon

A string indicating the current state of the drive beacon LED. This beacon can be seen from the rear of the drive. Values include **enabled** (LED is flashing) and **disabled** (LED is off).

The [PATCH beacon](#) command does not verify that a drive is present in the specified drive location. If an empty drive location is specified, the command output will still indicate that the beacon is enabled for that drive location. The [GET drives](#) command can be used to verify the presence of a drive in a specific drive location.

If the drive is replaced while this is enabled, the state of the physical LED may not match this attribute. In this case, the beacon should be disabled.

cURL example

```
> PATCH /v1/drives/drive_F3C2R1 {"beacon": "enabled"}
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 0

> PATCH /v1/drives/YG1013000616 {"beacon": "enabled"}
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 0
```

Ethernet ports

Ethernet ports manage non-data access control to the tape library.

- [Get Ethernet port information](#)

Get Ethernet port information

[Request syntax](#)
[Path parameters](#)
[cURL example](#)
[Attribute summary](#)
[Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/ethernetPorts](#)
Retrieves information about all Ethernet ports in the tape library.

[GET](#)
[/v1/ethernetPorts/<location>](#)
Retrieves information about the Ethernet port in the specified location.

Path parameters

location
A string representing the unique location of this port. The format of this field is **ethernetPort_F<f>P<p>** with possible values for <p> of **a, b, imc, tssc**, or **service**.

cURL example

```
> GET /v1/ethernetPorts/ethernetPort_F1Pa
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1736
```

```
[
  {
    "location": "ethernetPort_F1Pa",
    "macAddress": "40:F2:E9:52:36:E3",
    "ipv4Address": "disabled",
    "ipv4Subnet": "disabled",
    "ipv4Gateway": "disabled",
    "ipv4Assignment": "disabled",
    "ipv4Primary": "disabled",
    "ipv4Secondary": "disabled",
    "ipv6Address": "disabled",
    "ipv6PrefixLength": "disabled",
    "ipv6Gateway": "disabled",
    "ipv6Primary": "disabled",
    "ipv6Secondary": "disabled",
    "ipv6Link": "disabled",
    "ipv6DHCP": "disabled",
    "ipv6StatelessConfig": "disabled",
    "ipv6Static": "disabled"
  }
]
```

Attribute summary

Name	Schema
location	String (location)
macAddress	String
ipv4Address	String
ipv4Subnet	String
ipv4Gateway	String
ipv4Assignment	String
ipv4Primary	String
ipv4Secondary	String
ipv6Address	String
ipv6PrefixLength	String
ipv6Gateway	String
ipv6Primary	String
ipv6Secondary	String
ipv6Link	String
ipv6DHCP	String
ipv6StatelessConfig	String
ipv6Static	String

Attribute descriptions

location

A string representing the unique location of this port. The format of this field is `ethernetPort_F<f>P<p>` with possible values for `<p>` of `a`, `b`, `imc`, `tssc`, or `service`.

macAddress

The media access control (MAC) address of this Ethernet port.

ipv4Address

The IPv4 address of this Ethernet port.

ipv4Subnet

The IPv4 subnet mask of this Ethernet port.

ipv4Gateway

The IPv4 gateway address of this Ethernet port.

ipv4Assignment

The IPv4 address of this Ethernet port. Values include `static` and `dynamic`.

ipv4Primary

The IPv4 primary DNS address of this Ethernet port. If the `ipv4Assignment` is `Static`, this is `null`.

ipv4Secondary

The IPv4 secondary DNS address of this Ethernet port. If the `ipv4Assignment` is `Static`, this is `null`.

Ipv6Address

The IPv6 address of this Ethernet port.

ipv6PrefixLength

The IPv6 prefix length of this Ethernet port.

ipv6Gateway

The IPv6 gateway address of this Ethernet port.

ipv6Primary

The IPv6 primary DNS address of this Ethernet port.

Events

Library events are used to track all resource state changes within the library.

- [Get event information](#)
- [Get Event Fix Procedure](#)

Get event information

[Request syntax](#)
[Path parameters](#)
[Query parameters](#)
[cURL example](#)
[Attribute summary](#)
[Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/events](#)

Retrieves a list of all events. Events can be filtered by date/time range and by a specific library component.

[GET](#)
[/v1/events/<ID>](#)

Retrieves information about the error with the specified ID number.

Path parameters

ID

A decimal integer that is the unique identifier of the event in the library.

Query parameters

after

(Optional) A string representing the time after which events should be viewed. Any event with a time matching or prior to this will not be returned. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**. If the time zone is omitted, the system's current time zone is used.

before

(Optional) A string representing the time before which events should be viewed. Any event with a time matching or after this will not be returned. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**. If the time zone is omitted, the system's current time zone is used.

location

(Optional) A string representing the hardware component where the event originated. Hardware components include:

- **accessor_A<a|b>** (for example, **accessor_Ab**)
- **column_F<f>C<c>** (for example, **column_F1C3**)
- **drive_F<f>C<c>R<r>** (for example, **drive_F16C10R44**)
- **ethernetPort_F<f>P<p>** (for example, **ethernetPort_F2Pa**)
- **fiducial_F<f>C<c>L<t|b>** (for example, **fiducial_F1C3Lt**)
- **fiducial_F<f>IO<u|l>L<t|b>** (for example, **fiducial_F1IOuLb**)
- **frame_F<f>** (for example, **frame_F1**)
- **frameSide_F<f>S<a|b>** (for example, **frameSide_F1Sa**)
- **gripper_A<a|b>G<1|2>** (for example, **gripper_AbG1**)
- **ioStation_F<f>IO<u|l>** (for example, **ioStation_F2IOu**)
- **position_F<f>C<c>R<r>** (for example, **frameSide_F1C5R7**)
- **slot_F<f>C<c>R<r>T<t>** (for example, **slot_F1C3R23T0**)

cURL example

```
> GET /v1/events
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 45992
```

```
[
  {
    "ID": 1649,
    "severity": "information",
    "time": "2019-04-03T11:13:44-0700",
    "location": null,
    "user": "System",
    "description": "The library ran out of licensed LTO storage slots",
    "state": null,
    "errorCode": "0217"
  }, {
    "ID": 1645,
    "severity": "error",
    "time": "2019-04-03T11:11:15-0700",
    "location": "position_F1C0R0",
    "user": "System",
    "description": "Accessor detected an un-calibrated frame.",
    "state": "Call home initiated",
    "errorCode": "B792"
  }, {
    "ID": 1644,
    "severity": "information",
    "time": "2019-04-03T11:07:22-0700",
    "location": null,
    "user": "devService",
    "description": "A user logged out of the GUI from 9.108.42.123",
    "state": null,
  }
```

```

    "errorCode": "0812"
  }, {
    . . .
  }
]

```

Attribute summary

Name	Schema
ID	Integer
severity	String (event severity)
time	String (date/time)
location	String (location code)
user	String (user name)
description	String
state	String
errorCode	String (4-digit hex)

Attribute descriptions

ID

A decimal integer that is the unique identifier of the event in the library.

severity

A string representing the severity of the event which indicates the urgency that should be given to it. Values include:

- **error**
- **warning**
- **inactiveError**
- **inactiveWarning**
- **information**

time

The time the event occurred. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**.

location

A string representing the hardware component where the event originated. This can be *null* if no hardware was associated with this event. Hardware components include:

- **accessor_A<a|b>** (for example, **accessor_Ab**)
- **column_F<f>C<c>** (for example, **column_F1C3**)
- **drive_F<f>C<c>R<r>** (for example, **drive_F16C10R44**)
- **ethernetPort_F<f>P<p>** (for example, **ethernetPort_F2Pa**)
- **fiducial_F<f>C<c>L<t|b>** (for example, **fiducial_F1C3Lt**)
- **fiducial_F<f>IO<u|l>L<t|b>** (for example, **fiducial_F1IOuLb**)
- **frame_F<f>** (for example, **frame_F1**)
- **frameSide_F<f>S<a|b>** (for example, **frameSide_F1Sa**)
- **gripper_A<a|b>G<1|2>** (for example, **gripper_AbG1**)
- **ioStation_F<f>IO<u|l>** (for example, **ioStation_F2IOu**)
- **position_F<f>C<c>R<r>** (for example, **position_F1C5R7**)
- **slot_F<f>C<c>R<r>T<t>** (for example, **slot_F1C3R23T0**)

user

A string showing the user name of the user that issued the action that caused this event. This can be *null* if this event did not occur as a result of a user action.

description

A string describing the event that gives more information on exactly what it represents.

state

A string representing the current state of the event regarding its call home status. This can be *null* if no call home has occurred yet. Values include:

- **Detected error <error code>**
- **Command failed with error code <error code>**
- **Calling home**
- **Call home initiated**
- **Call home failed**

- Call home not attempted because not configured
- Assigned PMR <PMR number>. Service action required
- Service action complete by <description>

errorCode

A 4-digit hex string that represents the internal error code used to represent this type of event.

Get Event Fix Procedure

- [Request syntax](#)
- [Request body parameters](#)
- [cURL example](#)
- [Attribute summary](#)
- [Attribute descriptions](#)

Request syntax

GET
[/v1/events/{ID}/fixprocedure](#)

Retrieves fix procedure for the given error or warning level event. For information level events, this will return "No Fix procedure action needed, this is an informational event".

Request body parameters

ID

A number that is the unique identifier for the event in the library.

cURL example

```
> GET /v1/events/{ID}/fixprocedure
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 123
{
  "ID": 1645,
  "errorCode": "0019",
  "fixProcedure": "Failure isolation procedure:\n1. Before you attempt to
resolve, get library logs and the drive log for the drive involved.\n2.
Followthe "Fibre Channel Wrap Test - LTO and 3592 drives" from the
KC.\n3. If test failed, replace the drive."
}
```

Attribute summary

Name	Schema
ID	Number
errorCode	String
fixProcedure	String

Attribute descriptions

ID

The unique identifier for the event in the library.

errorCode

The 4-digit hex error code that represents the type of event surfaced.

fixProcedure

A short description of what needs to be fixed for warning or error level events. Null if this is an information level event.

Frames

- [Get frame information](#)

Get frame information

Note: Frame commands are supported in library firmware version 1.7.0.0 and higher.

- [Request syntax](#)
- [Path parameters](#)

Request syntax

```

GET
/v1/frames

```

Retrieves information about all frames in the tape library.

```

GET
/v1/frames/<location>

```

Retrieves information about the frame in the specified location.

Path parameters

location

A string that represents the unique location of the frame in the library. The format is `frame_F<f>`, where `f` is the frame position.

cURL example

```

> GET /v1/frames
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 45992

[
  {
    "location": "frame_F1",
    "state": "normal",
    "type": "Storage-only expansion frame",
    "mtm": "3584-S24",
    "sn": "13FA050",
    "mediaType": "LTO",
    "frontDoor": "closed",
    "frontDoorLastChanged": "2018-09-17T23:02:00",
    "rearDoor": "closed",
    "rearDoorLastChanged": "2018-09-16T23:04:00",
    "sideDoor": "closed",
    "sideDoorLastChanged": "2018-09-16T23:04:30",
    "slots": 990,
    "cartridges": 983,
    "drives": 3,
    "ioStations": 2
  }, {
    . . .
  }
]

```

Attribute summary

Name	Schema
<code>location</code>	String (location)
<code>state</code>	String (frame state)
<code>type</code>	String
<code>mtm</code>	String
<code>sn</code>	String
<code>mediaType</code>	String (media type)

Name	Schema
frontDoor	String (open, closed)
frontDoorLastChanged	String (time/date)
rearDoor	String (open, closed)
rearDoorLastChanged	String (time/date)
sideDoor	String (open, closed)
sideDoorLastChanged	String (time/date)
slots	Integer
cartridges	Integer
drives	Integer
ioStations	Integer

Attribute descriptions

location

A string that represents the unique location of the frame in the library. The format is `frame_F<f>`, where `f` is the frame position.

state

A string that represents the current state of the frame. The following values are included in order of priority:

State	Description
<code>frontDoorOpenWhileNotAllowed</code>	The front door was opened while the AC light indicated it is not safe.
<code>acUnreachable</code>	The AC unit is not communicating with the library.
<code>calibrationRequired</code>	When the library determines that the calibration status of this frame is in question, this state is surfaced.
<code>inventoryPending</code>	The inventory of this frame is in question. After a door is closed on this frame or the system is restarted, the library queues an inventory of this frame. If the library is unable to complete the inventory action, service might be required.
<code>normal</code>	The frame has no reported errors.

type

A string describing the type of frame. Values include the following:

- `Base frame`
- `Expansion frame`
- `Storage-only expansion frame`

mtm

A string representing the machine type and model of this frame.

Frame MTM	Type	Media type	Capacity		Other
			Frame 1	Frame 2+	
3584-L25	Base frame	3592	Up to 12 drives and 550 slots	Up to 16 drives and 660 slots	Equipped with two 16-slot I/O stations Optionally equipped with top rack (Model TR1)
3584-L55	Base frame	LTO	Up to 12 drives and 730 slots	Up to 16 drives and 882 slots	Equipped with two 18-slot I/O stations Optionally equipped with top rack (Model TR1)

Frame MTM	Type	Media type	Capacity		Other
			Frame 1	Frame 2+	
3584-D25	Expansion frame	3592	Up to 12 drives and 590 slots	Up to 16 drives and 740 slots	Optionally equipped with two 16-slot I/O stations Optionally equipped with top rack (Model TR1) Limited to any combination of seven D25 and D55 frames
3584-D55	Expansion frame	LTO	Up to 12 drives and 774 slots	Up to 16 drives and 970 slots	Optionally equipped with two 18-slot I/O stations Optionally equipped with top rack (Model TR1) Limited to any combination of seven D25 and D55 frames
3584-S25	Storage-only expansion frame	3592	798 slots	1000 slots	Optionally equipped with top rack (Model TR1)
3584-S55	Storage-only expansion frame	LTO	1054 slots	1320 slots	Optionally equipped with top rack (Model TR1)
3584-S24	Storage-only expansion frame	3592	<i>Unsupported</i>	1000 slots	Requires a TS4500 control upgrade Cannot be installed to the left of an Lx5 frame Cannot be installed as the rightmost frame in a dual accessor tape library
3584-S54	Storage-only expansion frame	LTO	<i>Unsupported</i>	1320 slots	Requires a TS4500 control upgrade Cannot be installed to the left of an Lx5 frame Cannot be installed as the rightmost frame in a dual accessor tape library

sn

A string that represents the unique serial number of the frame.

mediaType

A string that represents the media type that is supported by the tape drive. Supported values include

3592

and

LTO

frontDoor

A string that represents the state of the front door of the frame. The values that are returned are either "open" or "closed".

frontDoorLastChanged

A string that represents the last time the front door of the frame was either opened or closed. This is *null* before any state change. The time format is in ISO 8601 format of

YYYY-MM-DDThh:mm:ss+-hhmm

or

YYYY-MM-DDThh:mm:ss

. For example,

2018-09-17T23:02:00

rearDoor

A string that represents the state of the rear door of the frame. The values that are returned are either "open" or "closed". In libraries, where rear door sensors are not installed, *null* is returned.

rearDoorLastChanged

A string that represents the last time the rear door of the frame was either opened or closed. In libraries, where rear door sensors are not installed, *null* is returned. This value is also *null* before any state change. The time format is in ISO 8601 format of

YYYY-MM-DDThh:mm:ss+-hhmm

or

YYYY-MM-DDThh:mm:ss

. For example,

2018-09-17T23:02:00

sideDoor

A string that represents the state of the side door of the frame, if it is installed. The values that are returned are either "open" or "closed". If there is no side door, *null* is returned.

sideDoorLastChanged

A string that represents the last time the side door of the frame was either opened or closed. If there is no side door, *null* is returned. The value is also *null* before any state change. The time format is in ISO 8601 format of

YYYY-MM-DDThh:mm:ss+-hhmm

or
YYYY-MM-DDThh:mm:ss

. For example,
2018-09-17T23:02:00

slots

An integer that represents the number of available physical slots in this frame. This value might be different for a given frame type depending on if that frame is installed in position 1 or not.

cartridges

An integer that represents the number of cartridges currently in slots or drives in this frame.

ltoDrives

An integer that represents the number of LTO drives installed in this frame.

3595Drives

An integer that represents the number of 3592 drives that are installed in this frame.

ioStations

An integer that represents the number of I/O stations that are installed in this frame.

Library

- [Get library information](#)
- [Reset library](#)
- [Save library configuration](#)
- [Set library time, date, and time zone](#)

Get library information

[Request syntax](#)

[cURL example](#)

[Attribute summary](#)

[Attribute descriptions](#)

Request syntax

[GET](#)

[/v1/library](#)

Retrieves information about the library and its settings.

cURL example

```
> GET /v1/library
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 693
```

```
[
  {
    "name": "RASFW_LIB",
    "status": "online",
    "totalCapacity": 2978,
    "licensedCapacity": 100,
    "totalCartridges": 342,
    "assignedCartridges": 100,
    "firmware": "1.5.0.3-30E.L4",
    "sn": "78BA497",
    "time": "2019-04-03T11:33:37-0700",
    "location": "Firmware Lab",
    "address": "9000 S Rita Rd",
    "city": "Tucson",
    "state": "AZ",
    "country": "USA",
    "contact": "Kevin Elliott",
    "telephone": "222-333-3333",
    "secondaryTelephone": "222-333-3333",
    "secureCommunications": "enabled",
    "autoEjectCleaningCartridges": "enabled",
    "elasticCapacity": "disabled",
    "activeAccessors": "Dual active",
```

```

"vioStatus": "enabled",
"nmaDetection": "enabled",
"capacityUtilThresh": 99,
"dualAccessorUtilThresh": 98
}
]

```

Attribute summary

Name	Schema
name	String
status	String (library state)
totalCapacity	Integer (#cartridges)
licensedCapacity	Integer (#cartridges)
totalCartridges	Integer (#cartridges)
assignedCartridges	Integer (#cartridges)
firmware	String
sn	String
time	String (date/time)
location	String
address	String
city	String
state	String
country	String
contact	String
telephone	String (phone number)
secondaryTelephone	String (phone number)
secureCommunications	String (enabled disabled)
autoEjectCleaningCartridges	String (enabled disabled)
elasticCapacity	String
activeAccessors	String
vioStatus	String (enabled disabled)
nmaDetection	String (enabled disabled)
capacityUtilThresh	Integer (percentage)
dualAccessorUtilThresh	Integer (percentage)

Attribute descriptions

name

A string representing the name the tape library was given.

status

A string representing the overall health status of the library. Values include:

Table 1.

State	Description
doorOpenWhileNotAllowed	A library door is open while the cooling light indicated that this is dangerous to do so. This may cause condensation on the cartridges or drive. Close all the library doors. See frame state frontdoorOpenWhileNotAllowed .
notConfigured	The library is not configured. The initial setup wizard on the IMC should be run.
doorOpen	A library front door is open. No cartridge movement is allowed, and all accessors are powered down. This is not applicable to a side door that was opened for dual accessor service. See accessor state inServiceMode .
pausing	The Pause button was pressed so the library can be gracefully shut down before opening doors or powering off the library. The library will process current queued cartridge movement operations and then move the accessors to the home position.
paused	The library is paused for 60 seconds or until a door is opened, or the library is powered down. The accessors have been moved to the home position, and the library doors are ready to be opened or the library powered down. New cartridge movement requests will be queued in case the 60 second timer expires.
restarting	The library is restarting. This does not affect drive read or write activity, but no cartridge movement will be processed.
inServiceMode	The library is offline for service. This does not affect drive read/write activity, but no cartridge movement will be processed.
accessorsUnavailable	All accessors within the library are unavailable to move cartridges within the library. See accessor states inServiceMode , noMovementAllowed , and bothGrippersFailed . Note: Accessors being offline due to door open is handled by the doorOpen library state above.
accessorDegraded	One or more accessors are degraded and cartridge movement within the library will be slower as a result. See accessor state scannerFailed , gripperXfailed , and all unavailable states where one accessor is not able to move cartridges in dual accessor environment.
nodeCardDegraded	One or more node cards are having issues communicating with other node cards or managing the library. See node card states, unreachable , noEthernet inServiceMode , and noCAN .

State	Description
<code>driveDegraded</code>	One or more drives are detecting errors, causing issues with communication or cartridge read/write operations. See drive state inServiceMode .
<code>fcPortUnavailable</code>	One or more Fibre Channel drive ports are not available.
<code>cartridgeDegraded</code>	One or more cartridges have been shown to have issues which may affect its ability to store data. See cartridge state <code>cartridgeFailedMove</code> , <code>errorThresholdExceeded</code> , failedVerification .
<code>updating</code>	The library is in the process of updating firmware.
<code>scanningInventory</code>	A library inventory is in progress.
<code>online</code>	The library status is normal.

totalCapacity

An integer representing the total physical cartridge capacity of the library.

licensedCapacity

An integer representing the total licensed cartridge capacity of the library.

totalCartridges

An integer representing the total number of cartridges currently in the library slots, I/O stations, drives, and accessors.

assignedCartridges

An integer representing the total number of cartridges assigned to logical libraries in the library.

firmware

A string representing the firmware level installed on the library.

sn

A string representing the serial number of the library.

time

A string representing the current date and time set on the library. All dates and times returned by the library are in relation to this time. Time format is in ISO 8601 format of `YYYY-MM-DDThh:mm:ss+hhmm` or `YYYY-MM-DDThh:mm:ss`. For example, `2018-09-17T23:02:00`.

location

A string showing the user-entered physical location of the library. For example, `Building 9062`. If not provided, this is `null`.

address

A string representing the physical address of the library. If not provided, this is `null`.

city

A string representing the city in which the library is located. If not provided, this is `null`.

state

A string representing the two-character state in which the library is located. For example, `AZ` for Arizona. If not provided, this is `null`.

country

A string representing the country in which the library is located. If not provided, this is `null`.

contact

A string representing the name of the primary contact for the tape library. This is used by IBM Support during repair and service. If not provided, this is `null`.

telephone

A string representing the primary telephone number for the primary contact. This is used by IBM Support during repair and service. If not provided, this is `null`.

secondaryTelephone

A string representing the secondary telephone number for the primary contact. This is used by IBM Support during repair and service. If not provided, this is `null`.

secureCommunications

A string representing the current setting for secure communications. If `enabled`, the user is required to log into the GUI using a secure HTTPS connection. If `disabled`, an unsecured HTTP connection is allowed.

autoEjectCleaningCartridges

A string representing the current setting for automatically ejecting cleaning cartridges to the I/O station. If `enabled`, cleaning cartridges are auto-ejected from the library when they have no cleans remaining. If `disabled`, they must be ejected manually.

elasticCapacity

A string representing the current setting for elastic capacity. Values include:

- `maxCapacity`
- `tempOverflow`
- `doNotUse`

activeAccessors

A string representing which accessors are currently active. Values include:

- `dualActive`
- `accessorAOnly`
- `accessorBOnly`

vioStatus

A string representing the current setting for Virtual I/O (VIO). This is `enabled` or `disabled`.

nmaDetection

A string representing the current setting for NMA detection. This is **enabled** or **disabled**.

capacityUtilThresh

A percentage value accurate to one decimal place.

dualAccessorUtilThresh

A percentage value accurate to one decimal place.

Reset library

[Request syntax](#)

[cURL example](#)

Request syntax

POST

[/v1/library/reset](#)

Resets the library.

While a REST API response will always be created, the SCSI Read Buffer method of querying for that response will not necessarily occur before the library reset has begun. After resetting the library, status should be monitored until online.

cURL example

```
> POST /v1/library/reset
<The command will not return a response as the library is reset>
```

Save library configuration

[Request syntax](#)

Request syntax

GET

[/v1/library/saveConfig](#)

Saves the library configuration to a file external to the library. This file can be used with the [restoreConfiguration](#) CLI command to restore the library configuration back to what it was before.

The output file is assigned a name in the following format:

```
TS4500_<library-serial-number>_<firmware-level>_SAVECONF_<date-time>.dbz
```

Set library time, date, and time zone

[Request syntax](#)

[Request body parameters](#)

[cURL example](#)

Request syntax

PATCH

[/v1/library_{"time":<time>}](#)

Sets the library time, date, and time zone.

Request body parameters

time

The current date and time set on the library. All dates and times returned by the library are in relation to this time. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**.

cURL example

```
> PATCH /v1/library {"time": "2018-09-17T23:02:00-0700"}
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0
```

Power supplies

Power supplies connect the library to alternating current (AC) power. The library is powered by two AC to direct current (DC) power supplies in the L-frame. Power supplies are also installed in the D-frame.

- [Get power supply information](#)

Get power supply information

[Request syntax](#)
[Path parameters](#)
[cURL example](#)
[Attribute summary](#)
[Attribute descriptions](#)
[Responses](#)

Request syntax

[GET](#)
[/v1/powerSupplies](#)

Retrieves information about all power supplies in the tape library.

[GET](#)
[/v1/powerSupplies/<location>](#)

Retrieves information about the power supplies in the specified location.

Path parameters

location

A string that represents the location of the power supply in the library.

Query parameters

None.

cURL example

```
> GET /v1/powerSupplies/powerSupply_F1PSa
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1903
[
  {
    "location": "powerSupply_F1PSa",
    "state": "online"
  }, {
    . . .
  }
]
```

Attribute summary

Name	Schema
location	String (location)
state	String (frame state)

Attribute descriptions

location

A string that represents the location of the power supply in the library.

state

The overall health status of the power supply last read by the LCC node card. The value might be obsolete if the LCC node card is unreachable. The following values are included in order of priority:

State	Description/user action
failed	The power supply is showing a failure or is unreachable. Verify that the power supply is plugged in and cabled correctly from the rear of the frame. If issue persists, contact IBM Support.
online	The power supply is plugged in and supplying power to the library.

Responses

Returns 200 OK on success.

Logs

A library log file is a ZIP file that contains records of library activity, such as event logs, servo logs, NVRAM event logs, and fatal exception logs. Each log file is assigned a name in the format `TS4500_LOG_<library-serial-number>_<date-time>.zip`. Up to five log files can be stored on the library. If an additional log file is created, the oldest file is deleted.

To view a list of existing log files and their attributes, use the [GET /v1/logs](#) command.

To view the attributes of a specific log file, use the [GET /v1/logs/<filename>](#) command.

To create a new log file, use the [POST /v1/logs](#) command.

To download a log file, use the [GET /v1/logs/<filename>/export](#) command.

- [Create a log file](#)
- [Get information about existing log files](#)
- [Export a log file](#)

Create a log file

[Request syntax](#)
[cURL example](#)

Request syntax

[POST](#)
[/v1/logs](#)

Initiates the creation of a log file. This immediately returns the filename of the log file.

It can take 20 minutes or longer to create the file. Progress can be monitored with the [GET /v1/logs](#) or [GET /v1/logs/<filename>](#) command. File creation is complete when the `state` attribute changes from `inProgress` to `Complete`.

cURL example

```
> POST /v1/logs
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0

{"filename": "TS4500_LOG_FB058_20190404101855.zip"}
```

Get information about existing log files

[Request syntax](#)
[cURL example](#)
[Attribute summary](#)
[Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/logs](#)

Retrieves a list of existing log files.

[GET](#)
[/v1/logs/<filename>](#)

Retrieves information about the log file with the specified file name.

If a log file is still being created, task progress can be monitored with the `state` and `percentComplete` attributes.

cURL example

```
> GET /v1/logs
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 45992

[
  {
    "filename": "TS4500_LOG_FB058_20190404101855.zip",
    "state": "inProgress",
    "startTime": "2019-04-04T10:18:55-0700",
    "lastUpdateTime": "2019-04-04T10:23:55-0700",
    "percentComplete": 61
  }, {
    "filename": "TS4500_LOG_FB058_20190403111344.zip",
    "state": "complete",
    "startTime": "2019-04-03T11:13:44-0700",
    "lastUpdateTime": "2019-04-03T11:25:55-0700",
    "percentComplete": 100
  }, {
```

```
}  
]  
]
```

Attribute summary

Name	Schema
filename	String
state	State
startTime	String (date/time)
lastUpdateTime	String (date/time)
percentComplete	Integer (percentage)

Attribute descriptions

filename

The name of the file, in the format TS4500_LOG_<library-serial-number>_<date-time>.zip.

state

A string showing the completion status of the event. Values include:

State	Description
inProgress	The task is in progress. The percentComplete attribute shows how far along the task is.
completed	The task completed successfully. The file can be downloaded using the GET /v1/logs/<filename>/export command.
failed	The task failed. Retry the operation. If it continues to fail, contact IBM Support.

startTime

The time at which the log creation task was started. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, 2018-09-17T23:02:00.

lastUpdatedTime

The time this task's state was last updated. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, 2018-09-17T23:02:00.

percentComplete

A percentage value accurate to one decimal place showing how close the task is to being complete. This is an estimate of the time the task will take, not a guarantee.

Export a log file

[Request syntax](#)

[cURL example](#)

Request syntax

GET

[/v1/logs/<filename>/export](#)

Exports the log file with the specified name.

cURL example

```
> GET /v1/logs/TS4500_LOG_BA784_20190815181114.zip/export  
HTTP/1.1 200 OK  
Content-Type: application/zip  
Content-Length: 202719595  
  
<zip file list starts here>
```

Node cards

Physical node cards within the library control all aspects of the library's operation. Node card types include the motor driver assembly (MDA), the accessor control card (ACC), and the library control card (LCC).

- [Get node card information](#)
- [Reset node card](#)

Get node card information

[Request syntax](#)

[Path parameters](#)

[cURL example](#)
[Attribute summary](#)
[Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/nodeCards](#)

Retrieves information about all node cards in the tape library.

[GET](#)
[/v1/nodeCards/<ID>](#)

Retrieves information about the specified node card.

Path parameters

ID

A decimal integer that is the unique identifier of the node card in the library.

cURL example

```
> GET /v1/nodeCards
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1059

[
  {
    "ID": 17,
    "type": "MDA",
    "location": "accessor_Aa",
    "state": "online",
    "partNum": "38L7590",
    "sn": "Y010MY83W62Y",
    "barcode": "11S38L7590Y010MY83W62Y",
    "ec": 0,
    "firmware": "0066",
    "cfBarcode": null,
    "cfPartNum": null,
    "cfVendor": null,
    "reportingLCC": null,
    "primaryLCC": null
  }, {
    "ID": 49,
    "type": "ACC",
    "location": "accessor_Aa",
    "state": "online",
    "partNum": "38L7353",
    "sn": "Y010MY773848",
    "barcode": "11S38L7353Y010MY773848",
    "ec": 0,
    "firmware": "0066",
    "cfBarcode": null,
    "cfPartNum": null,
    "cfVendor": null,
    "reportingLCC": null,
    "primaryLCC": null
  }, {
    "ID": 65,
    "type": "LCC",
    "location": "frame_F1",
    "state": "online",
    "partNum": "38L6415",
    "sn": "Y1Y01063W00J",
    "barcode": "11S38L6415Y1Y01063W00J",
    "ec": 0,
    "firmware": "1.5.0.3-40B.A4",
    "cfBarcode": "P1T0100387520308040",
    "cfPartNum": "VTDCFAPC016G-1A1",
    "cfVendor": "Virtium",
    "reportingLCC": "yes",
    "primaryLCC": "yes"
  }
]
```

Attribute summary

Name	Schema
ID	Integer
type	String
location	String (location)
state	State
partNum	String
sn	String
barcode	String
ec	

	Integer
firmware	String
cfBarcode	String
cfPartNum	String
cfVendor	String
reportingLCC	String
primaryLCC	String

Attribute descriptions

ID

A decimal integer that is the unique identifier of the node card in the library.

type

A string representing the physical type of the node card. Values include:

- **MDA** (motor driver assembly)
- **ACC** (accessor control card)
- **LCC** (library control card)

location

A string representing the hardware component where this node card is physically located. For the MDA card and ACC, this identifies the accessor in the format **accessor_A<a>**. For the LCC card, this identifies the frame in the format **frame_F<f>**.

state

A string representing the current state of the node card. Values include:

State	Description
inServiceMode	The accessor the MDA or ACC card is on is in service. To end this state, use the completeAccessorService task on the accessor on which this node card is located.
unreachable	The node card is not answering network ping by the library via Ethernet or CAN. Any resource managed by this LCC will no longer have its state updated while the LCC is in this state. Try to reset the node card . If the issue persists, service will need to check cables.
noEthernet	The LCC is not communicating with the reporting LCC card on the internal LCC-to-LCC Ethernet network. Any resource managed by this LCC will no longer have its state updated while the LCC is in this state. Try to reset the node card . If the issue persists, service will need to check cables.
noCAN	The node card is not communicating with the reporting LCC on CAN. Try to reset the node card . If the issue persists, service will need to check cables.
online	The node card is in a running state.
restarting	Node card library-controlled reset, such as firmware update or manual reset, is in progress.

partNum

restarting

A string representing the part number of the node card.

sn

A string representing the serial number of the node card.

barcode

A string representing the exact barcode label found on the node card. This is a 22-character string with the following format:

11S-Y Bar-code - Common Cross Brand Header Format

ID	IBM Part Number								ID	Loc & Type	EC	Vendor Code	Serial Number								
1	1	S	p	p	p	p	p	p	p	Y	x	x	h	h	h	s	s	s	s	s	s
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

ec

An integer representing the EC number of the node card.

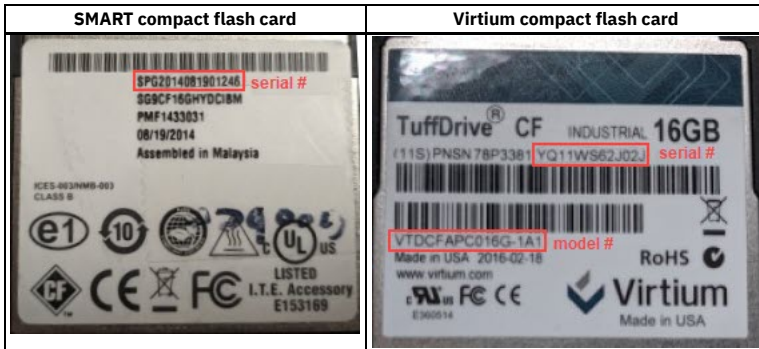
firmware

A string representing the current firmware level of the node card.

cfBarcode

A string representing the value read from the serial number barcode of the compact flash card installed on the LCC. If this is not an LCC card, this value is *null*. The format of the barcode matches that read off of the compact flash card itself.

SMART compact flash card	Virtium compact flash card
---------------------------------	-----------------------------------



cfPartNum

A string representing the part number of the compact flash card installed on the LCC. If this is not an LCC, or the CF card does not support reporting this, the value is *null*.

cfVendor

A string representing the name of the vendor of the compact flash card installed on the LCC. If this is not an LCC card, this value is *null*. The other two supported values are **SMART** and **Virtium**.

reportingLCC

A string representing whether or not this LCC is reporting the information for this **GET** command. This returns **yes** if this LCC is reporting the status, **no** if this LCC's status is being reported by another LCC, or *null* if this is not an LCC card.

primaryLCC

A string representing whether or not this LCC is acting as the primary LCC or the secondary LCC. This returns **yes** if this LCC is the primary, **no** if this LCC is the secondary, or *null* if this is not an LCC card.

Reset node card

[Request syntax](#)

[Path parameters](#) [cURL example](#)

Request syntax

POST

[/v1/nodeCards/<ID>/reset](#)

Resets the specified node card.

If the LCC is the node card executing this command, a REST API response will always be created; however the SCSI Read Buffer method of querying for that response will not necessarily occur before the node card reset has begun. However, the buffer will be non-volatile and query-able after the reset is complete.

Path parameters

ID

A decimal integer that is the unique identifier of the node card in the library.

cURL example

```
> POST /v1/nodeCards/2/reset
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0
```

Reports

The reports contain usage history and other data for resources in the library.

- [Get drive report](#)
- [Get library report](#)
- [Get accessor report](#)

Get drive report

Note: Report commands are supported in library firmware version 1.7.0.0 and higher.

The drive report contains the usage history for each drive, including mounts, cleans, host I/O, compression rate, error rates, and environmental data.

These reports are taken at intervals of 1 hour and kept for 1 year. However, you can only offload 1 week of data at a time per GET command to ensure the query response size does not get too large. If you do not include query parameters to limit the time frame, all reports for the last week will be returned.

- [Request syntax](#)
- [Query parameters](#)
- [cURL example](#)
- [Attribute summary](#)
- [Attribute descriptions](#)

Request syntax

[GET](#)

[/v1/reports/drives](#)

Retrieves all reports for the last week.

[GET](#)

[/v1/reports/drives?after=<YYYY-MM-DDThh:mm:ss>&before=<YYYY-MM-DDThh:mm:ss>](#)

Retrieves all reports created within the specified time interval.

[GET](#)

[/v1/reports/drives/{sn}](#)

Retrieves all reports for the drive with the specified serial number.

Query parameters

after

(Optional) A string representing the time after which reports should be viewed. Any report with a time matching or prior to this will not be returned. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**. If the time zone is omitted, the system's current time zone is used.

before

(Optional) A string representing the time before which reports should be viewed. Any report with a time matching or after this will not be returned. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**. If the time zone is omitted, the system's current time zone is used.

sn

The globally unique serial number of the drive.

cURL example

```
> GET /v1/reports/drives
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1903
```

```
[
  {
    "location": "drive_F4C0R1",
    "sn": "YD1097000039",
    "time": "2019-04-03T11:13:44-0700",
    "duration": "3600",
    "mounts": 41,
    "cleans": 0,
    "dataReadByHost": 3584,
    "dataWrittenByHost": 408905,
    "dataWrittenToCartridges": 4089050,
    "errorsCorrectedRead": 0,
    "errorsCorrectedWrite": 0,
    "errorsUncorrected": 0,
    "temperatureAverage": 32.2,
    "temperatureMin": 29.1,
    "temperatureMax": 35.9,
    "humidityAverage": 76,
    "humidityMin": 75,
    "humidityMax": 77
  }, {
    . . .
  }
]
```

Attribute summary

Name	Schema
location	String (location)
sn	String
time	String (time/date)
duration	Integer (seconds/h)
mounts	Integer (#mounts/h)
cleans	Integer (#cleans/h)
dataReadByHosts	Integer (MB/h)
dataWrittenByHosts	Integer (MB/h)
dataWrittenToCartridges	Integer (MB/h)
errorsCorrectedRead	Integer (#errors/h)
errorsCorrectedWrite	Integer (#errors/h)
errorsUncorrected	Integer (#errors/h)

Name	Schema
<code>temperatureAverage</code>	Float (deg. Celsius)
<code>temperatureMin</code>	Float (deg. Celsius)
<code>temperatureMax</code>	Float (deg. Celsius)
<code>humidityAverage</code>	Float (percent humidity)
<code>humidityMin</code>	Float (percent humidity)
<code>humidityMax</code>	Float (percent humidity)

Attribute descriptions

`location`

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is `drive_F<f>C<c>R<r>`, where `<f>` is the frame, `<c>` is the column, and `<r>` is the row the drive is installed in. For example, `drive_F16C10R44`.

`sn`

A string representing the serial number of the drive. This can also be used as a unique identifier for the tape drive.

`time`

The time at which this data entry was recorded. Time format is in ISO 8601 format of `YYYY-MM-DDThh:mm:ss+hhmm` or `YYYY-MM-DDThh:mm:ss`. For example, `2018-09-17T23:02:00`.

`duration`

An integer representing the number of seconds this data entry represents in seconds. This will be approximately 3600 seconds, or 1 hour, but may differ slightly due to execution time. The `time` attribute occurs at the end of this duration.

`mounts`

An integer representing the number of mounts performed per hour on this drive over the duration of this measurement.

`cleans`

An integer representing the number of cleans performed per hour on this drive over the duration of this measurement. Prior to library firmware version 1.7.0.1-D00, the value of this attribute is always 0.

`dataReadByHosts`

An integer representing the number of MB per hour of uncompressed data read by the host from the drive over the duration of this measurement.

`dataWrittenByHosts`

An integer representing the number of MB per hour of uncompressed data written by the host to the drive over the duration of this measurement.

`dataWrittenToCartridges`

An integer representing the number of MB per hour of compressed data written to the cartridges mounted in the drive over the duration of this measurement. The average compression ratio can be found by dividing `dataWrittenByHosts` by `dataWrittenToCartridge`.

`errorsCorrectedRead`

An integer representing the number of corrected read errors per hour on the drive over the duration of this measurement.

`errorsCorrectedWrite`

An integer representing the number of corrected write errors per hour on the drive over the duration of this measurement.

`errorsUncorrected`

An integer representing the number of uncorrected errors per hour on the drive over the duration of this measurement.

`temperatureAverage`

A floating-point number accurate to one decimal place representing the average temperature in Celsius of the drive over the duration of this measurement.

`temperatureMin`

A floating-point number accurate to one decimal place representing the minimum temperature reached in Celsius in the drive over the duration of this measurement.

`temperatureMax`

A floating-point number accurate to one decimal place representing the minimum temperature reached in Celsius in the drive over the duration of this measurement.

`humidityAverage`

A floating-point number accurate to one decimal place representing the average percent humidity in the drive over the duration of this measurement. This will be *null* if the drive does not support reporting humidity measurements.

`humidityMin`

A floating-point number accurate to one decimal place representing the minimum (driest) percent humidity reached in the drive over the duration of this measurement. This will be *null* if the drive does not support reporting humidity measurements.

`humidityMax`

A floating-point number accurate to one decimal place representing the highest (wettest) percent humidity reached in the drive over the duration of this measurement. This will be *null* if the drive does not support reporting humidity measurements.

Get library report

Note: Report commands are supported in library firmware version 1.7.0.0 and higher.

The library report contains the usage history for the library, including mounts, inserts, ejects, moves, host I/O, and environmental data.

These reports are taken at intervals of 1 hour and kept for 1 year. However, you can only offload 1 week of data at a time per GET command to ensure the query response size does not get too large. If you do not include query parameters to limit the time frame, all reports for the last week will be returned.

- [Request syntax](#)
- [Query parameters](#)
- [cURL example](#)
- [Attribute summary](#)
- [Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/reports/library](#)

Retrieves all reports for the last week.

[GET](#)
[/v1/reports/library?after=<YYYY-MM-DDThh:mm:ss>&before=<YYYY-MM-DDThh:mm:ss>](#)

Retrieves all reports created within the specified time interval.

Query parameters

after

(Optional) A string representing the time after which reports should be viewed. Any report with a time matching or prior to this will not be returned. Time format is in ISO 8601 format of `YYYY-MM-DDThh:mm:ss+-hhmm` or `YYYY-MM-DDThh:mm:ss`. For example, `2018-09-17T23:02:00`. If the time zone is omitted, the system's current time zone is used.

before

(Optional) A string representing the time before which reports should be viewed. Any report with a time matching or after this will not be returned. Time format is in ISO 8601 format of `YYYY-MM-DDThh:mm:ss+-hhmm` or `YYYY-MM-DDThh:mm:ss`. For example, `2018-09-17T23:02:00`. If the time zone is omitted, the system's current time zone is used.

cURL example

```
> GET /v1/reports/library
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1903
```

```
[
  {
    "time": "2019-04-03T11:13:44-0700",
    "duration": 3600,
    "mounts": 141,
    "imports": 0,
    "exports": 0,
    "moves": 1250,
    "dataReadByHosts": 35840,
    "dataWrittenByHosts": 4089050,
    "dataWrittenToCartridges": 4089050,
    "temperatureAverage": 32.2,
    "temperatureMin": 29.1,
    "temperatureMax": 35.9,
    "humidityAverage": 76,
    "humidityMin": 75,
    "humidityMax": 77
  }, {
    . . .
  }
]
```

Attribute summary

Name	Schema
time	Time/Date
duration	Integer (seconds)
mounts	Integer (#mounts/h)
imports	Integer (#imports/h)
exports	Integer (#exports/h)
moves	Integer (#moves/h)
dataReadByHosts	Integer (MB/h)
dataWrittenByHosts	Integer (MB/h)
dataWrittenToCartridges	Integer (MB/h)
temperatureAverage	Float (Deg. Celsius)
temperatureMin	Float (Deg. Celsius)
temperatureMax	Float (Deg. Celsius)
humidityAverage	Float (Percent Humidity)
humidityMin	Float (Percent Humidity)
humidityMax	Float (Percent Humidity)

Attribute descriptions

time

The time at which this data entry was recorded. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**.

duration

An integer representing the number of seconds this data entry represents in seconds. This will be approximately 3600 seconds, or 1 hour, but may differ slightly due to execution time. The **time** attribute occurs at the end of this duration.

mounts

An integer representing the number of mounts performed per hour on all drives in this library over the duration of this measurement.

imports

An integer representing the number of cartridges added to a library per hour over the duration of this measurement. A cartridge import is not complete until the host sends a SCSI move media command to the library for this cartridge or it was manually assigned to a Logical Library.

exports

An integer representing the number of cartridges moved to the I/O station from a slot per hour over the duration of this measurement. A cartridge export is complete once the cartridge is physically moved to the I/O station.

moves

An integer representing the number of cartridge movement actions, including both the get and put by the gripper, per hour executed by all accessors in the library over the duration of this measurement.

dataReadByHosts

An integer representing the number of MB per hour of uncompressed data read by the host from all drives in the library over the duration of this measurement.

dataWrittenByHosts

An integer representing the number of MB per hour of uncompressed data written by the host to all drives in the library over the duration of this measurement.

dataWrittenToCartridges

An integer representing the number of MB per hour of compressed data written to the cartridges by all drives in the library over the duration of this measurement. The average compression ratio can be found by dividing **dataWrittenByHosts** by **dataWrittenToCartridge**.

temperatureAverage

A floating-point accurate to one decimal place number representing the average temperature in Celsius in all drives in the library over the duration of this measurement.

temperatureMin

A floating-point accurate to one decimal place number representing the minimum temperature reached in Celsius in all drives in the library over the duration of this measurement.

temperatureMax

A floating-point number accurate to one decimal place representing the minimum temperature reached in Celsius accurate in all drives in the library over the duration of this measurement.

humidityAverage

A floating-point number accurate to one decimal place representing the average percent humidity reached in all drives in the library over the duration of this measurement.

humidityMin

A floating-point number accurate to one decimal place representing the minimum (driest) percent humidity reached in all drives in the library over the duration of this measurement.

humidityMax

A floating-point number accurate to one decimal place representing the highest (wettest) percent humidity reached in all drives in the library over the duration of this measurement.

Get accessor report

Note: Report commands are supported in library firmware version 1.7.0.0 and higher.

The accessor report contains the usage history for the accessor, including pivots, scans, distance traveled, and puts/gets done by the two grippers.

These reports are taken at intervals of 1 hour and kept for 1 year. However, you can only offload 1 week of data at a time per GET command to ensure the query response size does not get too large. If you do not include query parameters to limit the time frame, all reports for the last week will be returned.

[Request syntax](#)

[Query parameters](#)

[cURL example](#)

[Attribute summary](#)

[Attribute descriptions](#)

Request syntax

GET

[/v1/reports/accessors](#)

Retrieves all reports for the last week.

GET

[/v1/reports/accessors?after=<YYYY-MM-DDThh:mm:ss>&before=<YYYY-MM-DDThh:mm:ss](#)

Retrieves all reports created within the specified time interval.

Query parameters

after

(Optional) A string representing the time after which reports should be viewed. Any report with a time matching or prior to this will not be returned. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**. If the time zone is omitted, the system's current time zone is used.

before

(Optional) A string representing the time before which reports should be viewed. Any report with a time matching or after this will not be returned. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**. If the time zone is omitted, the system's current time zone is used.

cURL example

```
> GET /v1/reports/accessors
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1903

[
  {
    "location": "accessor_Aa",
    "time": "2019-04-03T11:13:44-0700",
    "duration": 3600,
    "pivots": 55,
    "barCodeScans": 4056,
    "travelX": 50,
    "travelY": 75,
    "getsGripper1": 50,
    "putsGripper1": 50,
    "getsGripper2": 70,
    "putsGripper2": 69
  }, {
    . . .
  }
]
```

Attribute summary

Name	Schema
location	String (location)
time	String (time/date)
duration	Integer (seconds)
pivots	Integer (#pivots/h)
barCodeScans	Integer (#scans/h)
travelX	Integer (meters/h)
travelY	Integer (meters/h)
getsGripper1	Integer (#gets/h)
putsGripper1	Integer (#puts/h)
getsGripper2	Integer (#gets/h)
putsGripper2	Integer (#puts/h)

Attribute descriptions

location

A string that describes the unique identifier for the accessor with a value of **accessor_Aa** or **accessor_Ab**.

time

The time at which this data entry was recorded. Time format is in ISO 8601 format of **YYYY-MM-DDThh:mm:ss+-hhmm** or **YYYY-MM-DDThh:mm:ss**. For example, **2018-09-17T23:02:00**.

duration

An integer representing the number of seconds this data entry represents in seconds. This will be approximately 3600 seconds, or 1 hour, but may differ slightly due to execution time. The **time** attribute occurs at the end of this duration.

pivots

An integer representing the number of pivots per hour performed by this accessor over the duration of this measurement.

barCodeScans

An integer representing the number of bar code scans per hour performed by this accessor over the duration of this measurement.

travelX

An integer representing the number meters per hour of movement in the X (horizontal) direction performed by this accessor over the duration of this measurement.

travelY

An integer representing the number meters per hour of movement in the Y (vertical) direction performed by this accessor over the duration of this measurement.

getsGripper1

An integer representing the number cartridge get actions per hour performed by gripper 1 of this accessor over the duration of this measurement.

putsGripper1

An integer representing the number cartridge put actions per hour performed by gripper 1 of this accessor over the duration of this measurement.

getsGripper2

An integer representing the number cartridge get actions per hour performed by gripper 2 of this accessor over the duration of this measurement.

putsGripper2

An integer representing the number cartridge put actions per hour performed by gripper 2 of this accessor over the duration of this measurement.

Slots

- [Get slot information](#)

Get slot information

[Request syntax](#)
[Path parameters](#)
[cURL example](#)
[Attribute summary](#)
[Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/slots](#)

Retrieves information about all storage slots in the tape library. Default sorting is by location in numerical order based on Frame, Column, and then Row in order.

[GET](#)
[/v1/slots/<location>](#)

Retrieves information about the storage slot in the specified location.

Path parameters

location

The string location of the slot in the library, not including the tier. For example, "slot_F3C4R8".

cURL example

```
> GET /v1/slots
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 1903
```

```
[
  {
    "location": "slot_F2C3R13",
    "state": "normal",
    "contents": ["AAA000L8", null, null, null, null],
    "puts": 4572,
    "putRetries": 10,
    "getRetries": 0,
    "tiers": 5
  }, {
    .
    .
    .
  }
]
```

Attribute summary

Name	Schema
location	String (location)
state	String
contents	Array of Strings (volsers)
puts	Integer
putRetries	Integer
getRetries	Integer
tiers	Integer

Attribute descriptions

location

The string location of the slot in the library, not including the tier. For example, "slot_F3C4R8".

state

The current state of the slot. The state of a slot includes the following values.

State	Description
inServiceMode	The slot is manually placed in service mode. However, it cannot be selected as a cartridge destination, cartridges can be moved from the slot.
normal	The slot is ready for use.

contents

An array of strings that shows the VOLSERS of the cartridges that are contained in the slot. The values are listed in order of lowest numbered tier to highest numbered tier. Any empty tier is listed as null. Note that this is reported as a single-item array for a tier 0 (single-deep, door-side) slot.

puts

An integer that shows the number of times a gripper has put a cartridge into this slot. This includes all put actions, including shuffle and unshuffle moves.

putRetries

An integer that shows the number of times a retry was required while a gripper was putting a cartridge into this slot.

getRetries

An integer that shows the number of times a retry was required while a gripper was getting a cartridge from this slot.

tiers

An integer that represents the number of tiers within the slot.

Tasks

- [Get tasks](#)
- [Inventory tier 0 and 1](#)
- [Inventory all tiers](#)
- [Start service on drive](#)
- [Complete service on drive](#)
- [Calibrate frame](#)
- [Calibrate library](#)
- [Calibrate accessor](#)
- [Start service on accessor](#)
- [Complete service on accessor](#)
- [Test drive](#)

Get tasks

[Request syntax](#)
[Path parameters](#)
[cURL example](#)
[Attribute summary](#)
[Attribute descriptions](#)

Request syntax

[GET](#)
[/v1/tasks](#)

Retrieves information about all currently running tasks.

[GET](#)
[/v1/tasks/<ID>](#)

Retrieves information about the task with the specified ID number.

Path parameters

ID

A decimal integer that is the unique identifier of the task in the library.

cURL example

```
> GET /v1/tasks
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 15891
```

```
[
  {
    "ID": 184,
    "type": "updateLibraryFirmware",
    "location": "library",
    "state": "completed",
    "startTime": "2019-04-03T10:54:42-0700",
    "lastUpdateTime": "2019-04-03T11:06:26-0700",
    "percentComplete": 100,
    "duration": 704,
    "user": "devService",
    "description": "Library Code Update",
    "volser": null
  }, {
    . . .
  }, {
    "ID": 1,
    "type": "discoverHardware",
    "location": "library",
    "state": "completed",
```

```

    "startTime": "2019-02-07T05:44:02-0700",
    "lastUpdateTime": "2019-02-07T06:16:11-0700",
    "percentComplete": 100,
    "duration": 1929,
    "user": "Service",
    "description": "Discover Hardware",
    "volser": null
  }
]

```

Attribute summary

Name	Schema
ID	Integer
type	String
location	String
state	String (Task state)
startTime	String (Date/time)
lastUpdateTime	String (Date/time)
percentComplete	Integer (Percentage)
duration	Integer (#seconds)
user	String (User name)
description	String
volser	String (VOLSER)

Attribute descriptions

ID

A decimal integer that is the unique identifier of the task in the library.

type

A string representing the type of task. Values include:

- `calibrateLibrary`
- `calibrateFrame`
- `calibrateAccessor`
- `calibrateIO`
- `calibrateDrive`
- `updateDriveFirmware`
- `updateLibraryFirmware`
- `inventoryTier0and1`
- `inventoryAllTiers`
- `verifyLibrary`
- `runLibraryDiagnostics`
- `fruDriveReplacement`
- `exportServiceLogs`
- `discoverHardware`
- `updateVOLSERRange`
- `startAccessorService`
- `completeAccessorService`
- `startDriveService`
- `completeDriveService`
- `testDrive`
- `verifyMedia`
- `varySlotOnline`
- `adjustingTemperature`
- `doorsSafeToOpen`

location

A string representing the hardware component that the task is affecting. This can be `null` if no hardware was associated with this task. Hardware components include:

- `accessor_A<a|b>` (for example, `accessor_Ab`)
- `column_F<f>C<c>` (for example, `column_F1C3`)
- `drive_F<f>C<c>R<r>` (for example, `drive_F16C10R44`)
- `ethernetPort_F<f>P<p>` (for example, `ethernetPort_F2Pa`)
- `fiducial_F<f>C<c>L<t|b>` (for example, `fiducial_F1C3Lt`)
- `fiducial_F<f>IO<u|l>L<t|b>` (for example, `fiducial_F1IOuLb`)
- `frame_F<f>` (for example, `frame_F1`)
- `frameSide_F<f>S<a|b>` (for example, `frameSide_F1Sa`)
- `gripper_A<a|b>G<1|2>` (for example, `gripper_AbG1`)
- `ioStation_F<f>IO<u|l>` (for example, `ioStation_F2IOu`)
- `position_F<f>C<c>R<r>` (for example, `frameSide_F1C5R7`)
- `slot_F<f>C<c>R<r>T<t>` (for example, `slot_F1C3R23T0`)

state

A string showing the completion status of the task. Values include:

State	Description
<code>inProgress</code>	The task is in progress. The <code>percentComplete</code> task attribute shows how far along the task is and the <code>duration</code> attribute shows how long the task has been running.
<code>completed</code>	The task completed successfully.
<code>failed</code>	The task failed. To find the reason for the failure, check the event list.
<code>aborted</code>	An LCC failover caused the task to be canceled automatically.
<code>canceled</code>	A user has manually canceled the task or the library has powered off.

startTime

The time the task was started. Time format is in ISO 8601 format of "YYYY-MM-DDThh:mm:ss+hhmm". For example, "2018-09-17T23:02:00-0700". Time format is in ISO 8601 format of `YYYY-MM-DDThh:mm:ss+hhmm` or `YYYY-MM-DDThh:mm:ss`. For example, `2018-09-17T23:02:00`.

lastUpdatedTime

The time this task's state was last updated. Time format is in ISO 8601 format of "YYYY-MM-DDThh:mm:ss+hhmm". For example, "2018-09-17T23:02:00-0700". Time format is in ISO 8601 format of `YYYY-MM-DDThh:mm:ss+hhmm` or `YYYY-MM-DDThh:mm:ss`. For example, `2018-09-17T23:02:00`.

percentComplete

A percentage value accurate to one decimal place showing how close the task is to being complete. This is an estimate of the time the task will take, not a guarantee. This is *null* for tasks that do not report this.

duration

An integer representing the number of seconds this task has been running so far.

user

A string showing the name of the user whose action initiated the task.

volser

For event types of `verifyMedia`, this field shows the VOLSER being verified. For other event types, this is *null*.

Inventory tier 0 and 1

- [Request syntax](#)
- [Request body parameters](#)
- [cURL example](#)

Request syntax

POST

`/v1/tasks/ {"type": "inventoryTier0and1", "location": "<library|frame_F<f>"}`

Executes an inventory scan on tiers 0 and 1 of the library or the specified frame. This starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, `inventoryTier0and1`.

location

This can have the value of `library` for all frames, or the location of a specific frame to inventory (for example, `frame_F1`).

cURL example

```
> POST /v1/tasks/ {"type": "inventoryTier0and1", "location": "library"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 42}
```

Inventory all tiers

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST
[/v1/tasks \[{"type": "inventoryAllTiers", "location": "<library" | "frame_F<f>">}\]](#)

Executes an inventory scan on all tiers of the library or the specified frame. This starts a long-running task in the library that is visible from the GUI.

Request body parameters

type
A string representing the task type to run. In this case, `inventoryAllTiers`.

location
This can have the value of `library` for all frames, or the location of a specific frame to inventory (for example, `frame_F1`).

cURL example

```
> POST /v1/tasks {"type": "inventoryAllTiers", "location": "library"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10

{"ID": 43}
```

Start service on drive

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST
[/v1/tasks \[{"type": "startDriveService", "location": "drive_F<f>C<c>R<r>}\]](#)

Initiates a service action on the specified drive. This puts the drive in the `in service` state and starts a long-running task in the library that is visible from the GUI.

POST
[/v1/tasks \[{"type": "startDriveService", "sn": "serialNumber"}\]](#)

Initiates a service action on the drive with the specified serial number. This puts the drive in the `in service` state and starts a long-running task in the library that is visible from the GUI.

Request body parameters

type
A string representing the task type to run. In this case, `startDriveService`.

location
A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is `drive_F<f>C<c>R<r>`, where `<f>` is the frame, `<c>` is the column, and `<r>` is the row the drive is installed in. For example, `drive_F16C10R44`.

sn
The globally unique serial number of the drive.

cURL example

```
> POST /v1/tasks {"type": "startDriveService", "location": "drive_F2C4R2"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10

{"ID": 45}

> POST /v1/tasks {"type": "startDriveService", "sn": "YG1013000616"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10

{"ID": 45}
```

Complete service on drive

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST

`/v1/tasks [{"type": "completeDriveService", "location": "drive_F<f>C<c>R<r>"}]`

Completes a service action on the specified drive. This takes the drive out of the `in service` state and starts a long-running task in the library that is visible from the GUI.

POST

`/v1/tasks [{"type": "completeDriveService", "sn": "serialNumber"}]`

Completes a service action on the drive with the specified serial number. This takes the drive out of the `in service` state and starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, `completeDriveService`.

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is `drive_F<f>C<c>R<r>`, where `<f>` is the frame, `<c>` is the column, and `<r>` is the row the drive is installed in. For example, `drive_F16C10R44`.

sn

The globally unique serial number of the drive.

cURL example

```
> POST /v1/tasks/ {"type": "completeDriveService", "location": "drive_F2C4R2"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 46}
```

```
> POST /v1/tasks/ {"type": "completeDriveService", "sn": "YG1013000616"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 46}
```

Calibrate frame

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST /v1/tasks

`{"type": "calibrateFrame", "location": "frame_F<f>", "accessor": "accessor_A<a|b>"}`

Executes the calibration task on the given frame. This starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, `calibrateFrame`.

location

A string describing the unique identifier of a specific frame (for example, `frame_F1`).

accessor

A string describing the specific accessor to be used for the calibration task.

cURL example

```
> POST /v1/tasks/ {"type": "calibrateFrame", "location": "frame_F1", "accessor": "accessor_Aa"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 47}
```

Calibrate library

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST

[/v1/tasks](#) [{"type": "calibrateLibrary", "accessor": "accessor_A<a|b>"}.]

Executes the calibration task on the library. This starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, `calibrateLibrary`.

accessor

A string describing the specific accessor to be used for the calibration task.

cURL example

```
> POST /v1/tasks/ {"type": "calibrateLibrary", "accessor": "accessor_Ab"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 47}
```

Calibrate accessor

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST

[/v1/tasks](#) [{"type": "calibrateAccessor", "location": "accessor_A<a|b>"}.]

Executes the calibration task on the given accessor. This starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, `calibrateAccessor`.

location

A string that describes the unique identifier for the accessor with a value of `accessor_Aa` or `accessor_Ab`.

cURL example

```
> POST /v1/tasks/ {"type": "calibrateAccessor", "location": "accessor_Aa"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 47}
```

Start service on accessor

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)

Request syntax

POST

[/v1/tasks](#) [{"type": "startAccessorService", "location": "accessor_A<a|b>"}.]

Initiates a service action on the specified accessor. This puts the accessor in the **in service** state and starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, **startAccessorService**.

location

A string that describes the unique identifier for the accessor with a value of **accessor_Aa** or **accessor_Ab**.

cURL example

```
> POST /v1/tasks {"type": "startAccessorService", "location": "accessor_Aa"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10

{"ID": 48}
```

Complete service on accessor

[Request syntax](#)

[Request body parameters](#)

[cURL example](#)

Request syntax

POST

[/v1/tasks \[{"type": "completeAccessorService", "location": "accessor_A<a|b>"}\]](#)

Completes a service action on the specified accessor. This takes the accessor out of the **in service** state and starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, **completeAccessorService**.

location

A string that describes the unique identifier for the accessor with a value of **accessor_Aa** or **accessor_Ab**.

cURL example

```
> POST /v1/tasks/ {"type": "completeAccessorService", "location": "accessor_Aa"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10

{"ID": 49}
```

Test drive

[Request syntax](#)

[Request body parameters](#)

[cURL example](#)

Request syntax

POST /v1/tasks

[\[{"type": "testDrive", "location": "drive_F<f>C<c>R<r>"}\]](#)

Starts a test drive operation using a diagnostic cartridge. This starts a long-running task in the library that is visible from the GUI.

POST /v1/tasks

[\[{"type": "testDrive", "sn": "serialNumber"}\]](#)

Starts a test operation using a diagnostic cartridge on the drive with the specified serial number. This starts a long-running task in the library that is visible from the GUI.

Request body parameters

type

A string representing the task type to run. In this case, **testDrive**.

location

A string that represents the location of the tape drive. This is also the unique identifier for the drive. The format is **drive_F<f>C<c>R<r>**, where **<f>** is the frame, **<c>** is the column, and **<r>** is the row the drive is installed in. For example, **drive_F16C10R44**.

sn

The globally unique serial number of the drive.

cURL example

```
> POST /v1/tasks/ {"type": "testDrive", "location": "drive_F2C4R2"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10

{"ID": 55}

> POST /v1/tasks/ {"type": "testDrive", "sn": "YG1013000616"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10

{"ID": 55}
```

Work items

- [Move cartridge to slot](#)
- [Move cartridge to drive](#)
- [Move cartridge to I/O station](#)

Move cartridge to slot

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)
[Response attribute summary](#)
[Response attribute description](#)

Request syntax

```
POST
/v1/workItems [{"type": "moveToSlot", "cartridge":
<volser>,"sourceInternalAddress":
<internalAddress>,"destinationLocation":
<location>,"destinationInternalAddress":
<internalAddress>}].
```

Moves a cartridge to a slot chosen by the library.

Request body parameters

type

A string that represents the type of work item that is being created. In this case, **moveToSlot**.

cartridge

A string that represents the VOLSER of the cartridge to be moved. If duplicate VOLSERS exist for this cartridge in the library, the **sourceInternalAddress** must be used instead.

sourceInternalAddress

A string that represents the internal address of the location of the cartridge that is to be moved. This might change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

destinationLocation

A string representing the location of the slot (e.g. "slot_F1C3R23T0"). Only tier 0 or tier 1 is allowed as a destination.

destinationInternalLocation

A string representing the internal address of the location the cartridge is to be moved to.

Note:

- The source must be specified by either entering the `cartridge` or `sourceInternalAddress`. Only one of these sources must be specified.
- The destination can be specified by the `destinationLocation`, the `destinationInternalAddress`, or neither. If neither is specified, the library will choose an open slot and an available internal address to move the cartridge to automatically.
- When moving a cartridge using a `destinationLocation`, the command will be rejected if the cartridge to be moved is in a tier 2-5 storage slot or a tape drive.
- When moving a data cartridge using a `destinationInternalAddress`, the command will be rejected if not moved to an internal address within the cartridge existing logical library. This is not applicable to cleaning or diagnostic cartridges.

cURL example

Move cartridge by VOLSER to slot by internal address.

```
> POST /v1/workItems {"type": "moveToSlot", "cartridge": "AAA000L8", "destinationInternalAddress": "010032"}
```

```
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 0}
```

Move a cartridge by VOLSER to the slot chosen by the library.

```
> POST /v1/workItems {"type": "moveToSlot", "cartridge": "AAA000L8"}
```

```
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
```

```
{"ID": 0}
```

Response attribute summary

Name	Schema
ID	Integer (Work item ID)

Response attribute description

The value of `ID`

The value of

`ID` is always 0, since querying by work item ID is not supported at this time. Instead, you may poll the cartridge that is being moved, with a minimum polling interval of 2 seconds and wait for the

`location` attribute to change. Change in the `location`

attribute indicates that the cartridge has reached its destination.

Move cartridge to drive

- [Request syntax](#)
- [Request body parameters](#)
- [cURL example](#)
- [Response attribute summary](#)
- [Response attribute description](#)

Request syntax

```
POST
/v1/workItems [{"type": "moveToDrive", "cartridge":
<volser>, "sourceInternalAddress":
<internalAddress>, "destinationLocation": <location>, "destinationSN":
< serialNumber
>, "destinationInternalAddress": <internalAddress>}]
```

Moves a cartridge to the specified drive.

Request body parameters

type

A string that represents the type of work item that is created. In this case, `moveToDrive`.

cartridge

A string that represents the VOLSER of the cartridge to be moved. If duplicate VOLSERs exist for this cartridge in the library, use `sourceInternalAddress` instead.

sourceInternalAddress

A string that represents the internal address of the location of the cartridge that is to be moved. `sourceInternalAddress` might change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

destinationLocation

A string that represents the location of the destination tape drive (for example, "`drive_F2C4R2`").

destinationSN

A string that represents the location of the destination tape drive (for example, "`00078B3455`").

destinationInternalAddress

A string representing the internal address of the tape drive the cartridge is to be moved to.

Note:

- The source must be specified by either entering the `cartridge` or `sourceInternalAddress`. Only one of the sources must be specified.
- The destination must be specified by either the `destinationLocation`, `destinationSN`, or the `destinationInternalAddress`. Only one of these values is allowed to uniquely identify the drive.
- If a data cartridge, that is to be moved, is not assigned to the same logical library as the drive, the command is rejected. This is not applicable to cleaning or diagnostic cartridges.

cURL example

Move a cartridge by VOLSER to the specified drive.

```
> POST /v1/workItems {"type": "moveToDrive", "cartridge": "AAA000L8", "destinationLocation": "drive_F1R2C3"}
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
{"ID": 0}
```

Response attribute summary

sourceInternalAddress

Name	Schema
ID	Integer (Work item ID)

Response attribute description

ID	
The value of ID is always 0, since querying by work item ID is not supported at this time. Instead, you may poll the cartridge that is being moved, with a minimum polling interval of 2 seconds and wait for the location attribute to change. Change in the location attribute indicates that the cartridge has reached its destination.	

Move cartridge to I/O station

[Request syntax](#)
[Request body parameters](#)
[cURL example](#)
[Response attribute summary](#)
[Response attribute description](#)

Request syntax

```
POST
/v1/workItems [{"type": "moveToIOStation", "cartridge": <volser>,
"sourceInternalAddress": <internalAddress>,
"destinationLocation": <location>,
"destinationInternalAddress": <internalAddress>}]
```

Moves a cartridge to an I/O station chosen by the library.

Request body parameters

type	A string that represents the type of work item that is being created. In this case, moveToIOStation .
cartridge	A string that represents the VOLSER of the cartridge that is to be moved. If duplicate VOLSERs exist for this cartridge in the library, the sourceInternalAddress must be used instead.
sourceInternalAddress	A string that represents the internal address of the location of the cartridge to be moved. This might change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.
destinationLocation	A string representing the location of the destination I/O slot of the I/O station (for example, " ioSlot_F2IOuR4 ").
destinationInternalAddress	A string representing the internal address of the destination I/O slot of the I/O station the cartridge is to be moved to.

Note:

- The source must be specified by either entering the **cartridge** or **sourceInternalAddress**. Only one of these sources must be specified.
- The destination can be specified by the **destinationLocation**, or the **destinationInternalAddress**. Only one or neither of these is allowed. If neither is specified, the library will choose an open I/O slot in the first available I/O station to move the cartridge to automatically.
- When moving a data cartridge using a **destinationInternalAddress**, the command will be rejected if not moved to an internal address within the cartridge existing logical library. This is not applicable to cleaning or diagnostic cartridges.

cURL example

Move a cartridge by VOLSER to the I/O station chosen by the library.

```
> POST /v1/workItems {"type": "moveToIOStation", "cartridge": "AAA000L8"}
```

```
HTTP/1.1 201 Created
Content-Type: application/json
Content-Length: 10
{"ID": 0}
```

Response attribute summary

Name	Schema
ID	Integer (Work item ID)

Response attribute description

ID

The value of

is always 0, since querying by work item ID is not supported at this time. Instead, you may poll the cartridge that is being moved, with a minimum polling interval of 2 seconds and wait for the `location` attribute to change. Change in the `location` attribute indicates that the cartridge has reached its destination.

Error responses

The following message is returned whenever a command cannot be parsed.

```
HTTP/1.1 400 Bad Request
Content-Type: application/json
Content-Length: 88
```

```
{"error_type": "malformed_command", "error_description": "Command could not be parsed."}
```

The following message is returned when the library is initializing. The request cannot be performed until initialization is complete.

```
HTTP/1.1 409 Conflict
Content-Type: application/json
Content-Length: 76
```

```
{"error_type": "not_ready", "error_description": "Library is initializing."}
```

ITDT support for RoS

The IBM Tape Diagnostic Tool (ITDT) Standard Edition provides convenient command-line support for the tape library RoS functions. ITDT is a cross-platform, device-driver-independent utility that can be obtained at no charge from IBM [Fix Central](#).

For detailed ITDT documentation, refer to the [IBM Tape Device Drivers and Diagnostic Tool User's Guide](#).

Example RoS command with ITDT

```
./itdt -f /dev/IBMchanger1 ros GET /v1/library
```

```
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: 627
[
  {
    "name": "AvengersMansion",
    "status": "online",
    "totalCapacity": 2134,
    "licensedCapacity": 1246,
    "totalCartridges": 251,
    "assignedCartridges": 251,
    "firmware": "1.7.0.0-B00",
    "sn": "13FA010",
    "time": "2020-03-18T03:13:12-0700",
    "location": null,
    "address": null,
```

```
"city": null,  
"state": null,  
"country": null,  
"contact": null,  
"telephone": null,  
"secondaryTelephone": null,  
"secureCommunications": "disabled",  
"autoEjectCleaningCartridges": "enabled",  
"elasticCapacity": "doNotUse",  
"activeAccessors": "dualActive",  
"vioStatus": "enabled",  
"nmaDetection": "enabled",  
"capacityUtilThresh": 99.0,  
"dualAccessorUtilThresh": 98.0  
}  
]
```

Exit with code: 0
[root@mosca ITDT]#

Deprecated REST endpoints

- [Move cleaning cartridge to I/O station](#)
- [Move data cartridge to I/O station](#)
- [Move diagnostic cartridge to I/O station](#)

Move cleaning cartridge to I/O station

[Request syntax](#)
[Path parameters](#)
[cURL example](#)

Request syntax

POST
[/v1/cleaningCartridges/<internalAddress>/moveToIOStation](#)

Moves the specified cleaning cartridge to the I/O station.

The export move is queued. Completion is indicated by the location attribute for the specified cartridge changing to an I/O station slot.

Path parameters

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERS. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

cURL example

```
> POST /v1/cleaningCartridges/FF0403/moveToIOStation  
HTTP/1.1 201 CREATED  
Content-Type: application/json  
Content-Length: 0
```

Move data cartridge to I/O station

[Request syntax](#)
[Path parameters](#)
[cURL example](#)

Request syntax

POST
[/v1/dataCartridges/<internalAddress>/moveToIOStation](#)

Moves the specified data cartridge to the I/O station.

The export move is queued. Completion is indicated by the location attribute for the specified cartridge changing to an I/O station slot.

Path parameters

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERS. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

cURL example

```
> POST /v1/dataCartridges/030403/moveToIOStation
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0
```

Move diagnostic cartridge to I/O station

[Request syntax](#)
[Path parameters](#)
[cURL example](#)

Request syntax

POST
[/v1/diagnosticCartridges/<internalAddress>/moveToIOStation](#)

Moves the specified diagnostic cartridge to the I/O station.

The export move is queued. Completion is indicated by the location attribute for the specified cartridge changing to an I/O station slot.

Path parameters

internalAddress

A 6-character hex string that represents the unique identifier of the cartridge within the library. This is used to identify a cartridge when there are duplicate VOLSERs. This can change if the cartridge is assigned or unassigned from a logical library or if the cartridge is moved by the host or system. This value must be queried immediately before use.

cURL example

```
> POST /v1/diagnosticCartridges/FF0403/moveToIOStation
HTTP/1.1 201 CREATED
Content-Type: application/json
Content-Length: 0
```

SCSI Reference

This section describes how SCSI is implemented for the tape library.

- [SCSI element addresses](#)
The tape library firmware assigns a unique logical SCSI element address to each storage slot, I/O slot, and drive in the library to indicate the location of the element.
- [Supported SCSI commands](#)
An introduction to the SCSI commands that are recognized by the TS4500 tape library.
- [SCSI error sense information](#)
This section describes all possible combinations of Sense Keys, Additional Sense Codes (ASC), and Additional Sense Code Qualifiers (ASCQ) that are reported by the tape library.
- [Implementation considerations](#)
This section describes points to consider when implementing SCSI for the tape library.

SCSI element addresses

The tape library firmware assigns a unique logical SCSI element address to each storage slot, I/O slot, and drive in the library to indicate the location of the element.

When you move a tape cartridge within the library, you can specify its source and destination by SCSI element address. However, many operators prefer to specify a volume serial number (VOLSER), or a frame, column, and row address.

- [Storage element \(storage slot\) addresses](#)
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 is unassociated. Association of storage element addresses is accomplished in a way that is transparent to the application software.
- [Import/export element \(I/O slot\) addresses](#)
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 transparent to the application software.
- [Data transfer element \(drive\) addresses](#)
Data transfer element addresses (DTEs) are determined by the sequence in which the drive is assigned to each logical library.

Storage element (storage slot) addresses

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 is unassociated. Association of storage element addresses is accomplished in a way that is transparent to the application software.

The first storage element address of any logical library is equal to 1024 plus the logical library number. For example, logical library 3 has 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 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 to allow future library capacity expansion to be transparent to the host application software. However, application performance might 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 (I/O slot) addresses

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 transparent to the application software.

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 255. Refer to [setMaximumVIOCartridges CLI command](#) to change the maximum number of IEE addresses.

With virtual import/export element addressing, the IEE address range includes addresses from 769 (X'301') to 1023 (X'3FF'). This range allows 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. Virtual IEEs 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 - 1023, but the cartridges are 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 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.

Data transfer element (drive) addresses

Data transfer element addresses (DTEs) are determined by the sequence in which the drive is assigned to each logical library.

Drives are assigned to logical libraries by using the Drives by Logical Library page of the tape library GUI. 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 assignment 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.

Supported SCSI commands

An introduction to the SCSI commands that are recognized by the TS4500 tape library.

[Table 1](#) lists all of the commands that are defined by the referenced SCSI-3 standard for medium changer devices and that are supported or not supported by the TS4500. For each command, the operation code, applicable SCSI-3 standard, and applicable conditions are shown.

For the SCSI commands supported by the IBM® LTO Ultrium tape drives, see the *IBM LTO Ultrium Tape Drive SCSI Reference*.

For the SCSI commands supported by the IBM 3592 tape drives, see the *IBM 3592 Tape Drive SCSI Reference*.

Table 1. Supported SCSI commands

Command name	Operation code	SCSI document	Applicable conditions		
			RVC ¹	UAT ²	NRD ³
Exchange Medium	X'A6'	SMC ⁴	Y ⁵	Y	Y
Initialize Element Status	X'07'	SMC	Y	Y	Y
Initialize Element Status with Range	X'E7'	VU ⁶	Y	Y	Y
Inquiry	X'12'	SPC ⁷	N ⁸	N	N
Log Select (not supported)	X'4C'	SPC	Y	Y	Y
Log Sense	X'4D'	SPC	Y	N	N
Mode Select (6)	X'15'	SPC	Y	Y	N
Mode Select (10)	X'55'	SPC	Y	Y	N
Mode Sense (6)	X'1A'	SPC	N	Y	Y ⁹
Mode Sense (10)	X'5A'	SPC	N	Y	Y ⁹
Move Medium	X'A5'	SMC	Y	Y	Y
Position to Element	X'2B'	SMC	Y	Y	Y

Command name	Operation code	SCSI document	Applicable conditions		
			RVC ¹	UAT ²	NRD ³
Prevent Allow Medium Removal	X'1E'	SPC	Y ¹⁰	Y	Y
Read Buffer	X'3C'	SPC	Y	N	N
Read Element Status	X'B8'	SMC	N	Y	Y ¹¹
Receive Diagnostic Results (not supported)	X'1C'	SPC	Y	Y	N
Release Element (6)	X'17'	SMC	N	Y	N
Request Sense	X'03'	SPC	N	N	N
Request Volume Element Address	X'B5'	SMC	Y	Y	N
Reserve Element (6)	X'16'	SMC	Y	Y	N
Rezero Unit (not supported)	X'01'	SPC	Y	Y	N
Send Diagnostic	X'1D'	SPC	Y	Y	Y
Send Volume Tag	X'B6'	SMC	Y	Y	Y
Test Unit Ready	X'00'	SPC	Y	Y	Y
Write Buffer	X'3B'	SPC	Y	Y	N

Notes:

1. RVC = Reservation Conflict status. When multiple logical libraries or control paths are configured, the library has multiple Medium Changer device ports (through LUN 1 of the drives). Medium changer device reservations prevent access for those initiators only by using the same device port as the initiator that sent the Reserve command. Initiators that use another device port (for example, for a different logical library or different control path) are not affected.
2. UAT = CHECK CONDITION status for Unit Attention.
3. NRD = CHECK CONDITION status for Not Ready.
4. SMC = *SCSI-3 Medium Changer* specification.
5. Y = Yes (command is checked for applicable conditions).
6. VU = The command is unique to the vendor.
7. SPC = *SCSI Primary Commands-2 (SPC-2)* specification.
8. N = No (command is not checked for applicable conditions).
9. The reporting of Not Ready conditions for Mode Sense (6) and Mode Sense (10) is limited to reset conditions with associated sense data of 2/0401.
10. RVC status is only reported if the Prevent field = B'01'. The command is allowed if the Prevent field = B'00'.
11. The reporting of Not Ready conditions for Read Element Status with DVCID=B'1' is limited to reset conditions with associated sense data of 2/0401.

- [Exchange Medium - X'A6'](#)
- [Initialize Element Status - X'07'](#)
- [Initialize Element Status with Range - X'E7'](#)
- [Inquiry - X'12'](#)
- [Log Sense - X'4D'](#)
- [Mode Select \(6\) - X'15'](#)
- [Mode Select \(10\) - X'55'](#)
- [Mode Sense \(6\) - X'1A'](#)
- [Mode Sense \(10\) - X'5A'](#)
- [Move Medium - X'A5'](#)
- [Position to Element - X'2B'](#)
- [Prevent Allow Medium Removal - X'1E'](#)
- [Read Buffer - X'3C'](#)
- [Read Element Status - X'B8'](#)
- [Release Element \(6\) - X'17'](#)
- [Request Sense - X'03'](#)
- [Request Volume Element Address - X'B5'](#)
- [Reserve Element \(6\) - X'16'](#)
- [Send Diagnostic - X'1D'](#)
- [Send Volume Tag - X'B6'](#)
- [Test Unit Ready - X'00'](#)
- [Write Buffer - X'3B'](#)

Exchange Medium - X'A6'

[Table 1](#) shows the format of the Exchange Medium command.

Table 1. Exchange Medium command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation code (X'A6')							
1	LUN (Obsolete)			Reserved				
2	Transport Element Address							
3								
4	Source Address							
5								
6	First Destination Address							
7								
8	Second Destination Address							
9								

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
10	Reserved						Inv2 (B'0')	Inv1 (B'0')
11	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

The medium in the source element is moved to the first destination element and the medium, which previously occupied the first destination element, is moved to the second destination element. The second destination element might be the same as the source element.

The following tape library-specific parameters apply:

- Transport Element Address: A value of X'0000', X'0001', or X'0002' is allowed for this field. For any of these values, the library selects an MTE based on optimal availability and performance.
- Source/Destination Addresses: The valid element addresses for this field are dependent upon library model and library configuration. For more details, go to the section about locations and addresses of SCSI elements in the tape library.

Notes:

1. The Medium Transport Elements are not capable of an exchange. If this element address is specified as a Destination Address in an Exchange Medium command, the command is presented CHECK CONDITION status with associated sense data of 5/2101 (Illegal Request, Invalid Element Address).
2. If a destination element is an Ultrium 1 Tape Drive and the source element address contains an Ultrium 2 cartridge (VolTag of **xxxxxxL2**), the command is presented CHECK CONDITION status with associated sense data of 5/3000 (Illegal Request, Incompatible Medium Installed).
3. If a destination element is an Ultrium 1 or Ultrium 2 tape drive and the source element address contains an Ultrium 3 cartridge (VolTag of **xxxxxxL3**), the command is presented CHECK CONDITION status with associated sense data of 5/3000 (Illegal Request, Incompatible Medium Installed).

For additional information on element addresses and descriptions, go to the sections about Mode Page X'1D': Element Address Assignment, Mode Page X'1F': Device Capabilities, and Read Element Status - X'B8'.

Initialize Element Status - X'07'

[Table 1](#) shows the format of the Initialize Element Status command for the tape library.

Table 1. Initialize Element Status Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'07')							
1	LUN (Obsolete)			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

The tape library keeps all element status current and valid by performing an automatic inventory operation as required. Therefore, the Initialize Element Status command is allowed and ignored (the library returns GOOD status without performing another inventory). To re-inventory specific elements as part of application error handling, go to the section about the SCSI command Initialize Element Status with Range - X'E7'.

Initialize Element Status with Range - X'E7'

[Table 1](#) shows the format of the Initialize Element Status with Range command for the tape library.

Table 1. Initialize Element Status with Range Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'E7')							
1	LUN (Obsolete)			Reserved				
2	Starting Element Address							
3								
4	Reserved							
5	Reserved							
6	Number of Elements							
7								
8	Reserved							
9	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

The Initialize Element Status with Range command causes the library to check a range of elements for media present and any other status relevant to that element and including the bar code label. The tape library keeps all element status current and valid by automatically performing an inventory operation as required. The intent of this command is to try the library inventory operation again for a specific element address when an unexpected condition is detected by the host application software.

The following tape library-specific parameters apply:

- Range: The following values apply:

	B'0'	Requests the library to check all elements. This value is allowed but no action is taken by the library (it returns GOOD status).
	B'1'	Requests the library to check any valid elements within the range that is specified by the Starting Element Address and Number of Elements fields.

- Starting Element Address: Specifies the minimum element address that is to be checked.
- Number of Elements: Specifies the range of elements that are to be checked, beginning with the Starting Element Address. If ALMS is disabled, any valid elements in the range are checked by the library. If ALMS is enabled, and the number of elements in the range is one and the element is valid, the element is checked. If the

number of elements is greater than one, no action is taken and a GOOD state is returned.

The valid element addresses are dependent upon library model and library configuration. For element addresses that fall within HD slots of HD frames, the entire HD slot is inventoried. It might include up to five LTO cartridges or four 3592 cartridges. For more details, go to the section about locations and addresses of SCSI elements in the tape library.

For additional information on element addresses and descriptions, go to the sections about Mode Page X'1D': Element Address Assignment, Mode Page X'1F': Device Capabilities, and Read Element Status - X'B8'.

Inquiry - X'12'

[Table 1](#) shows the format of the Inquiry command for the tape library.

Table 1. Inquiry Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation code (X'12')							
1	LUN (Obsolete)			Reserved			CmdDt (B'0')	EVPD
2	Page Code							
3	Reserved							
4	Allocation Length							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag (B'0')	Link (B'0')

There are several forms of Inquiry data. The following are supported. For more detail, go to each "Related Reference."

- Inquiry Standard Data: Valid LUN (Logical Unit Number)
- Inquiry Page X'00'
- Inquiry Page X'80': Unit Serial Number
- Inquiry Page X'83': Device Identification
- Inquiry Page X'D0' (the contents are not specified in this document)
- [Inquiry Standard Data: Valid LUN \(Logical Unit Number\)](#)
- [Inquiry Standard Data: Invalid LUN \(DLT Control Port Only\)](#)
- [Inquiry Page X'00'](#)
- [Inquiry Page X'80': Unit Serial Number](#)
- [Inquiry Page X'83': Device Identification](#)

Inquiry Standard Data: Valid LUN (Logical Unit Number)

The following tape library-specific parameters apply to this request:

- CmdDt: B'0'
- EVPD (Enable Vital Product Data): B'0'
- Page Code: X'00'
- Allocation Length: X'38' (56) bytes available

[Table 1](#) shows the standard inquiry data that is returned (character fields are in ASCII) for a logical unit number (LUN) that is configured as a SCSI Medium Changer. For more detail, go to the section about default SCSI ID and Loop ID (AL_PA) assignments for the tape library.

Table 1. Standard Inquiry Data Returned for a SCSI Medium Changer

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier (B'000')			Peripheral Device Type (X'08')				
1	RMB (B'1')	Reserved						
2	ISO/IEC Version (B'00')		ECMA Version (B'000')			ANSI Approved Version (B'011')		
3	AERC (B'0')	Obsolete (B'0')	NormACA (B'0')	HiSupport (B'0')	Response Data Format (B'0010')			
4	Additional Length (n-4) (X'33' or X'35')							
5	SCCS (B'0')							
6	BQue	EncServ (B'0')	BarC (B'1')	MultiP (B'0')	MChngr (B'0')	AckReqQ (B'0')	Addr32 (B'0')	Addr16
7	RelAdr (B'0')	WBus32 (B'0')	WBus16	Sync	Linked (B'0')	TranDis (B'0')	CmdQue	SftRe (B'0')
8-15	Manufacturer ('IBM ') (in ASCII)							
16-31	Product Identification ('03584L22' or '03584L32' or '03584L42')							
32-35	Product Revision Level							
36-37	IBM Plant of Manufacture Code							
38-49	Serial Number of Device							
50-51	'0' (in ASCII)							
52-55	Reserved							
56	Reserved				Clocking		QAS (B'0')	IUS (B'0')
57	Reserved							

For Ultrium 1 control path tape drives, bytes 56 and 57 are not returned.

For SCSI control path drives and control ports, the following values apply:

- BQue: set to 0, which indicates that the drive does not support tagged queuing.

- ADr16: set to 1, which indicates that the drive supports 16 SCSI IDs.
- WBus16: set to 1, which indicates that the drive supports a 16-bit wide data path on a single cable.
- Sync: set to 1, which indicates that the drive supports synchronous data transfers.
- CmdQue: set to 0.
- Clocking: is supported on Ultrium 2 devices only and is set to 11b because the drive supports both ST and DT modes.

For Fibre Channel control path drives, the following values apply:

- BQue: set to 0 (except for Ultrium 1 and Ultrium 2 control path drives with earlier versions of firmware).
- ADr16: set to 0.
- WBus16: set to 0.
- Sync: set to 0.
- CmdQue: set to 1 (except for Ultrium 1 and Ultrium 2 control path drives with earlier versions of firmware).
- Clocking: set to 00b (the Clocking field is not used in Fibre Channel devices).

For all control paths, the following values apply:

- Product Identification:

For 3592 logical libraries in Models L22, D22, L23, D23:	'03584L22	' (in ASCII)
For LTO logical libraries in Models L32, D32, L52, D52, L53, D53:	'03584L32	' (in ASCII)
- Product Revision Level: 3584 Tape Library Firmware Revision Level (in ASCII).
- Serial Number of Device: right justified with leading zeroes (in ASCII).

Inquiry Standard Data: Invalid LUN (DLT Control Port Only)

The following tape library-specific parameters apply to this request:

- CmdDt: B'0'
- EVPD (Enable Vital Product Data): B'0'
- Page Code: X'00'
- Allocation Length: X'24' (36) bytes available

[Table 1](#) shows the standard inquiry data that is returned (character fields are in ASCII) for a LUN that is not associated with an installed device. For more detail, go to the section about default SCSI ID and Loop ID (AL_PA) assignments for the tape library.

Table 1. Standard Inquiry Data Returned for a LUN Not Associated with an Installed Device

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier (B'011')			Peripheral Device Type (X'1F')				
1	RMB (B'0')	Reserved						
2	ISO/IEC Version (B'00')		ECMA Version (B'000')			ANSI Approved Version (B'011')		
3	AERC (B'0')	Obsolete (B'0')	NormACA (B'0')	HiSupport (B'0')	Response Data Format (B'0010')			
4	Additional Length (n-4) (X'1F' or 31 bytes)							
5	SCCS (B'0')	Reserved						
6	BQue (B'0')	EncServ (B'0')	BarC (B'1')	MultiP (B'0')	MChngr (B'0')	AckReqQ (B'0')	Addr32 (B'0')	Addr16
7	RelAdr (B'0')	WBus32 (B'0')	WBus16	Sync	Linked (B'0')	TranDis (B'0')	ComQue (B'0')	SftRe (B'0')
8-15	Manufacturer ('IBM ') (in ASCII)							
16-31	Device Type and Model Number							
32-35	Product Revision Level							

- Device Type and Model Number: ASCII blanks are returned.
- Product Revision Level: ASCII blanks are returned.

Inquiry Page X'00'

The following tape library-specific parameters apply to this request:

- CmdDt: B'0'
- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'00'
- Allocation Length: X'08' bytes available

[Table 1](#) shows the data that is returned.

Table 1. Data Returned for Inquiry Page X'00'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier (B'000')			Peripheral Device Type (X'08')				
1	Page Code (X'00')							
2	Reserved							
3	Page Length (n-3) (X'04')							
4	Supported page (X'00')							
5	Supported page (X'80')							
6	Supported page (X'83')							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7	Supported page (X'D0')							

Inquiry Page X'80': Unit Serial Number

The following tape library-specific parameters apply to this request:

- CmdDt: B'0'
- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'80'
- Allocation Length: X'14' (20) bytes available

[Table 1](#) shows the data that is returned.

Table 1. Data Returned for Inquiry Page X'80'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier (B'000')			Peripheral Device Type (X'08')				
1	Page Code (X'80')							
2	Reserved							
3	Page Length (X'10')							
4-15	Serial Number of Device							
16-19	First Storage Element Address							

- Serial Number of Device: Right justified with leading zeroes, in ASCII (same as Inquiry Standard Data bytes 38-49).
- First Storage Element Address: ASCII representation of four hexadecimal digits from Mode Page X'1D', bytes 6-7.

Inquiry Page X'83': Device Identification

The following tape library-specific parameters apply to this request:

- CmdDt: B'0'
- EVPD (Enable Vital Product Data): B'1'
- Page Code: X'83'
- Allocation Length: X'30' (48) bytes available

[Table 1](#) shows the data that is returned.

Table 1. Data Returned for Inquiry Page X'83'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier (B'000')			Peripheral Device Type (X'08')				
1	Page Code (X'83')							
2	Reserved							
3	Page Length (X'2C')							
4	Reserved				Code Set (X'2')			
5	Reserved		Association (B'00')		Identifier Type (X'1')			
6	Reserved							
7	Identifier Length (X'28')							
8-15	Vendor ID							
16-31	Device Type and Model Number							
32-43	Serial Number of Device							
44-47	First Storage Element Address							

- Code Set: Identifier is all ASCII.
- Vendor ID: Same as Inquiry Standard Data bytes 8-15.
- Device Type and Model Number: Same as Inquiry Standard Data bytes 16-31.
- Serial Number of Device: Right justified with leading zeroes, in ASCII (same as Inquiry Standard Data bytes 38-49).
- First Storage Element Address: ASCII representation of four hexadecimal digits from Mode Page X'1D', bytes 6-7.

Log Sense - X'4D'

The Log Sense command is supported by the tape library. [Table 1](#) shows the command format.

Table 1. Log Sense Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation code (X'4D')							
1	LUN (Obsolete)			Reserved			PPC (B'0')	SP (B'0')
2	PC		Page Code					

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB	
3	Reserved								
4	Reserved								
5-6	Parameter Pointer								
7-8	Allocation Length								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag (B'0')	Link (B'0')	

The following tape library-specific parameters apply:

- PPC: Parameter pointer control.
- SP: Save parameters.
- PC: Page control. The following values apply:

	B'00'	Threshold Values. Supported for all log pages with log counters (the LP field is set to B'0' in the Log Parameter Control Byte).
	B'01'	Cumulative Values. Supported for all log pages.
	B'10'	Default Threshold Values. Supported for all log pages with log counters. The default threshold value for all 2-byte log counter-fields is X'FFFF'. The default threshold value for all 4-byte log counter-fields is X'FFFF FFFF'.
	B'11'	Default Cumulative Values. Not supported. The default cumulative value for all 2-byte log counter-fields is X'0000'. The default cumulative value for all 4-byte log counter-fields is X'0000 0000'.

- **Page Code:** Indicates the log page to be returned.
- **Parameter Pointer:** Indicates the starting log page parameter code to be returned for this request. Parameters will be returned in ascending order up to the maximum allocation length or the maximum parameter code, whichever is less. A parameter pointer of X'0000' returns parameter data starting with the first parameter code.
The parameter pointer is supported for Log Page X'30' only. For all other log pages the parameter pointer must be set to X'0000'.

The log pages that are supported for the Log Sense command are:

- [Log Page X'00': Supported Log Pages](#)
- [Log Page X'2E': TapeAlert](#)
- [Log Page X'30': Library Device Attributes](#)
- [Log Page X'31': Physical Library Utilization](#)

Log Page X'00': Supported Log Pages

The Supported Log Page returns the list of log pages that are supported by the tape library. [Table 1](#) shows the data that is returned.

Table 1. Data Returned for Log Sense Page X'00'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		Page Code (B'000000')					
1	Reserved							
2-3	Page Length (X'0002')							
4	Supported Log Pages (X'00')							
5	TapeAlert Page (X'2E')							
6	Library Device Attributes (X'30')							
7	Physical Library Utilization (X'31')							

Log Page X'2E': TapeAlert

[Table 1](#) shows the data that is returned for the TapeAlert Page of the tape library.

Table 1. Data Returned for Log Sense Page X'2E'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		Page Code (X'2E')					
1	Reserved							
2-3	Page Length (X'0140')							
5n-1 to 5n	Parameter Code (n)							
5n+1	DU (B'0')	DS (B'1')	TSD (B'0')	ETC (B'0')	TMC (B'00')		Reserved	LP (B'0')
5n+2	Parameter Length (X'01')							
5n+3	Reserved							Value of Flag

- Parameter Code: n equals 1-64.
- Value of Flag: The following values apply:

	B'0'	Indicates that the flag is not set.
	B'1'	Indicates that the flag is set.

Note: See [TapeAlert flags](#) for a list of flags that are supported by the library and the 3592 and Ultrium tape drives.

Log Page X'30': Library Device Attributes

[Table 1](#) shows the data that is returned for the Library Attributes Page of the tape library.

Table 1. Data returned for Log Sense Page X'30'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		Page Code					
1	Reserved							
2-3	Page Length (n - 3)							
Log Parameters (see Log Parameter Format)								
4	Log Parameter (first)							
x + 3	Length = x							
:								
n - y + 3	Log Parameter (last)							
n	Length = y							

Log parameter format

Each log parameter begins with a 4-byte parameter header, followed by 1 or more bytes of parameter data. [Table 2](#) shows the log parameter format.

Table 2. Log parameter format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Parameter Code							
2	DU (B'0')	DS (B'1')	TSD (B'0')	ETC (B'0')	TMC (B'0')	Reserved		LP (B'1')
3	Parameter Length (n - 3)							
4	Parameter Value							
n								

Log Parameter Byte 2-Control Byte

A Log Parameter Control Byte is returned for each parameter code that is described in the log pages. The Log Parameter Control Byte is described here one time only. Any parameters that use a different Log Parameter Control Byte have that byte described within that parameter.

Note: The contents of this byte are constant; the user cannot set these values. This byte is part of the returned data that is described in the SCSI standard; it is described in the following list:

Bit	Description
7	DU (Disable Update): B'0'
6	DS (Disable Save): B'1'
5	TSD (Target Save Disable): B'0'
4	ETC (Enable Threshold Comparison): B'0'
3-2	TMC (Threshold Met Comparison): B'00'
1	Reserved
0	LP (List Parameter): B'1' (Indicates a list parameter)

Parameter definitions

[Table 3](#) lists the parameter codes for Log Page X'30'.

Note: All ASCII parameters are left justified padded with X'00'.

Table 3. Log Page X'30' parameter codes

Code	Description	Type	Size
X'0001'	Number of Frames in Library String	Binary	1
X'0002'	Library Web Page URL	ASCII	255
X'0003'	Logical Library Name	ASCII	32
X'0004'	Physical Library Serial Number	ASCII	12
X'0005'	Library Hardware Version	Binary	1

- X'0003' – Logical Library Name:** Indicates the length of the logical library name, where:
 Length = 16 bytes for all TS3500 libraries and TS4500 libraries with firmware versions below 1.3.0.0.
 Length = 32 bytes for TS4500 libraries at firmware version 1.3.0.0 and above.
- X'0005' – Library Hardware Version:** Indicates if the library is a TS3500 or TS4500, where:
 X'00' or parameter not present = TS3500
 X'01' = TS4500

This parameter code is supported on TS4500 libraries at firmware version 1.3.0.0 and above. Therefore the library firmware will need to be at this version or higher to identify the library as a TS4500 using this parameter.

Log Page X'31': Physical Library Utilization

[Table 1](#) shows the data that is returned for the Physical Library Utilization Log Page of the tape library.

Table 1. Data Returned for Log Sense Page X'31'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		Page Code					

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Reserved							
2-3	Page Length (n-3)							
Log Parameters (see Log Parameter Format)								
4	Log Parameter (first)							
x+3	Length = x							
:								
n-y+3	Log Parameter (last)							
n	Length = y							

Log parameter format

A Log Parameter Control Byte is returned for each parameter code that is described in the log pages. The Log Parameter Control Byte is described here one time only. Any parameters using a different Log Parameter Control Byte have that byte described within that parameter.

Note: The contents of this byte are constant; the user cannot set these values. This byte is part of the returned data that is described in the SCSI standard; it is described in the following list:

Bit	Description
7	DU (Disable Update): B'0'
6	DS (Disable Save): B'1'
5	TSD (Target Save Disable): B'0'
4	ETC (Enable Threshold Comparison): B'0'
3-2	TMC (Threshold Met Comparison): B'00'
1	Reserved
0	LP (List Parameter): B'1' (Indicates this is a list parameter)

Parameter definitions

Table 2 lists the parameter codes for Log Page X'31'.

Note: Log Page X'31' parameters are returned for the supported media type only.

Table 2. Log Page X'31' parameter codes

Code	Description	Size
X'0000'	Licensed Storage Slot Capacity	2
X'0001'	Unlicensed Storage Slot Capacity	2
X'0002'	Number of Data Cartridges	2
X'0003'	Number of Cleaning Cartridges	2

Mode Select (6) - X'15'

The Mode Select (6) command is supported by the tape library. Table 1 shows the command format.

Note: In the future, the length of the mode parameter list for Mode Sense Page Code X'3F' (return all pages) might exceed 255 bytes. Then, use of the Mode Select (10) and Mode Sense (10) commands is to transfer all mode pages with one command. For this reason, use of the Mode Select (6) and Mode Sense (6) commands is not recommended.

Table 1. Mode Select (6) Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'15')							
1	LUN (Obsolete)			PF (B'1')	Reserved			SP (B'0')
2	Reserved							
3	Reserved							
4	Parameter List Length							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag (B'0')	Link (B'0')

The following 3584 Tape Library-specific parameters apply:

- PF: Page format. The PF bit is explicitly **not** checked.
- Parameter List Length: Specifies the length (in bytes) of the mode parameter list that is transferred from the initiator to the target. A parameter list length of 0 indicates that no data is transferred. This condition is not considered an error. The target terminates the command with CHECK CONDITION status with associated sense data of 5/1A00 (Illegal Request, Parameter List Length Error) if the parameter list length results in the truncation of the mode parameter header, the mode parameter block descriptor, or any mode page.

Note: You can issue a Mode Sense for current values before a Mode Select to avoid accidentally attempting to set fields that cannot be changed by the initiator.

The following mode pages are supported by the tape library. For more detail, go to each "Related Reference."

- Mode Page X'18': Fibre Channel Logical Unit Control Page (Fibre Channel control paths only)
- Mode Page X'1C': Informational Exceptions Control
- Mode Page X'1D': Element Address Assignment
- Mode Page X'1E': Transport Geometry Parameters
- Mode Page X'1F': Device Capabilities
- Mode Page X'20': VU Mode Parameters Page
- [Mode Parameter Header for Mode Select \(6\)](#)

Mode Parameter Header for Mode Select (6)

For the tape library, the Mode Pages for the Mode Select (6) command are preceded by a 4-byte Mode Parameter Header. There is one copy of this header for each initiator.

Table 1. Mode Parameter Header for Mode Select (6)

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

- Mode Data Length: Reserved when used with the Mode Select (6) command. (When used with the Mode Sense commands, this field specifies the length (in bytes) of the following data that is available to be transferred. The length field does not include itself.)
- Medium Type: Reserved on Medium Changer Devices.
- Device-Specific Parameter: Reserved on Medium Changer Devices.
- Block Descriptor Length: Not used on the tape library.

Mode Select (10) - X'55'

The Mode Select (10) command is supported by the tape library. [Table 1](#) shows the command format.

Table 1. Mode Select (10) Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation code (X'55')							
1	LUN (Obsolete)			PF (B'1')	Reserved			SP (B'0')
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Parameter List Length							
8								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag (B'0')	Link (B'0')

The following library-specific parameters apply:

- PF: Page format. The PF bit is explicitly **not** checked.
- Parameter List Length: Specifies the length (in bytes) of the mode parameter list that is transferred from the initiator to the target. A parameter list length of 0 indicates that no data is transferred. This condition is not considered an error. The target terminates the command with CHECK CONDITION status with associated sense data of 5/1A00 (Illegal Request, Parameter List Length Error) if the parameter list length results in the truncation of the mode parameter header, the mode parameter block descriptor, or any mode page.

Note: You can issue a Mode Sense for current values before a Mode Select is to avoid accidentally attempting to set fields that cannot be changed by the initiator. The following mode pages are supported by the tape library. For more detail, go to each "Related Reference."

- Mode Page X'18': Fibre Channel Logical Unit Control Page (Fibre Channel control paths only)
- Mode Page X'1C': Informational Exceptions Control
- Mode Page X'1D': Element Address Assignment
- Mode Page X'1E': Transport Geometry Parameters
- Mode Page X'1F': Device Capabilities
- Mode Page X'20': VU Mode Parameters Page
- [Mode Parameter Header for Mode Select \(10\)](#)

Mode Parameter Header for Mode Select (10)

For the tape library, the Mode Pages for the Mode Select (10) command are preceded by an 8 byte Mode Parameter Header. There is one copy of this header for each initiator.

Table 1. Mode Parameter Header for Mode Select (10)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Mode Data Length (X'0000')							
2	Medium Type (X'00')							
3	Device-Specific Parameter (X'00')							
4-5	Reserved							
6-7	Block Descriptor Length (X'0000')							

- Mode Data Length: Reserved when used with the Mode Select (10) command. When used with the Mode Sense commands, this field specifies the length (in bytes) of the following data that is available to be transferred. The length field does not include itself.
- Medium Type: Reserved on Medium Changer Devices.
- Device-Specific Parameter: Reserved on Medium Changer Devices.
- Block Descriptor Length: Not used on the tape library.

Mode Sense (6) - X'1A'

The Mode Sense (6) command is supported by the tape library. [Table 1](#) shows the command format.

Note: In the future, the length of the mode parameter list for Mode Sense Page Code X'3F' (return all pages) might exceed 255 bytes. Then, the Mode Select (10) and Mode Sense (10) commands are used to transfer all mode pages with one command. For this reason, use of the Mode Select (6) and Mode Sense (6) commands is not recommended.

Table 1. Mode Sense (6) Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'1A')							
1	LUN (Obsolete)			Reserved	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Allocation Length							
5	Vendor Specific (B'00')		Reserved (B'0000')			Flag (B'0')	Link (B'0')	

The following 3584 Tape Library-specific parameters apply:

- DBD: Disable block descriptors. Supported values are B'0' or B'1'.
- PC: Page control. Supported values are B'00', B'01', or B'10'.
- Page Code: Supported values are X'18', X'1C', X'1D', X'1E', X'1F', X'20', and X'3F' (return all pages).
- Allocation Length: The maximum number of bytes to be transferred. If the allocation length specified is less than the amount available, then the allocated amount is transferred and no error is reported.

The following mode pages are supported by the tape library. For more detail, go to each "Related Reference."

- Mode Page X'18': Fibre Channel Logical Unit Control Page (Fibre Channel control paths only)
- Mode Page X'1C': Informational Exceptions Control
- Mode Page X'1D': Element Address Assignment
- Mode Page X'1E': Transport Geometry Parameters
- Mode Page X'1F': Device Capabilities
- Mode Page X'20': VU Mode Parameters Page
- [Mode Parameter Header for Mode Sense \(6\)](#)

Mode Parameter Header for Mode Sense (6)

For a tape library, the Mode Pages for the Mode Sense (6) command are preceded by a 4-byte Mode Parameter Header. There is one copy of this header for each initiator.

Table 1. Mode Parameter Header for Mode Select (6)

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

- Mode Data Length: Specifies the length (in bytes) of the following data that is available to be transferred. The length field does not include itself. The Mode Data Length: field is reserved when used with the Mode Select (6) command..
- Medium Type: Reserved on Medium Changer Devices.
- Device-Specific Parameter: Reserved on Medium Changer Devices.
- Block Descriptor Length: Not used on the tape library.

Mode Sense (10) - X'5A'

The Mode Sense (10) command is supported by the tape library. [Table 1](#) shows the command format.

Table 1. Mode Sense (10) Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation code (X'5A')							
1	LUN (Obsolete)			Reserved	DBD	Reserved		
2	PC		Page Code					
3	Reserved							
4	Reserved							

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
5	Reserved							
6	Reserved							
7	Allocation Length							
8								
9	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

The following tape library-specific parameters apply:

- DBD: Disable block descriptors. Supported values are B'0' or B'1'.
- PC: Page control. Supported values are B'00', B'01', or B'10'.
- Page Code: Supported values are X'18', X'1C', X'1D', X'1E', X'1F', X'20', and X'3F' (return all pages).
- Allocation Length: The maximum number of bytes to be transferred. If the allocation length specified is less than the amount available, then the allocated amount is transferred and no error is reported.

The following mode pages are supported by the tape library. For more detail, go to each "Related Reference."

- Mode Page X'18': Fibre Channel Logical Unit Control Page (Fibre Channel control paths only)
- Mode Page X'1C': Informational Exceptions Control
- Mode Page X'1D': Element Address Assignment
- Mode Page X'1E': Transport Geometry Parameters
- Mode Page X'1F': Device Capabilities
- Mode Page X'20': VU Mode Parameters Page

- [Mode Parameter Header for Mode Sense \(10\)](#)
- [Mode Page Format](#)

For the tape library, Mode Page Format shows the format of the mode parameter list. The individual mode page descriptions that follow the table include field descriptions.

Mode Parameter Header for Mode Sense (10)

For the tape library, the Mode Pages for the Mode Sense (10) command are preceded by an 8-byte Mode Parameter Header. There is one copy of this header for each initiator.

Table 1. Mode Parameter Header for Mode Select (10)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Mode Data Length							
2	Medium Type (X'00')							
3	Device-Specific Parameter (X'00')							
4-5	Reserved							
6-7	Block Descriptor Length (X'0000')							

- Mode Data Length: Specifies the length (in bytes) of the following data that is available to be transferred. The length field does not include itself. The Mode Data Length: field is reserved when used with the Mode Select (10) command.
- Medium Type: Reserved on Medium Changer Devices.
- Device-Specific Parameter: Reserved on Medium Changer Devices.
- Block Descriptor Length: Not used on the tape library.

Mode Page Format

For the tape library, Mode Page Format shows the format of the mode parameter list. The individual mode page descriptions that follow the table include field descriptions.

For the tape library, [Table 1](#) shows the format of the mode parameter list. The individual mode page descriptions that follow this table include the field descriptions. Each field is non-changeable unless identified otherwise.

Table 1. Mode Page Format

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	PS	Reserved	Page code					
1	Page Length (n-1)							
2-n	Mode Parameters							

- [Mode Page X'18': Fibre Channel Logical Unit Control Page](#)
- [Mode Page X'1C': Informational Exceptions Control](#)
- [Mode Page X'1D': Element Address Assignment](#)
- [Mode Page X'1E': Transport Geometry Parameters](#)
- [Mode Page X'1F': Device Capabilities](#)
- [Mode Page X'20': VU Mode Parameters Page](#)

Mode Page X'18': Fibre Channel Logical Unit Control Page

For the tape library, this mode page is defined for Fibre Channel-attached devices only. There is only one copy for each initiator.

Table 1. Data Returned for Mode Page X'18'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (B'0')	Reserved	Page Code (X'18')					
1	Page Length (X'06')							
2	Reserved							
3	Reserved							EPDC
4-7	Reserved							

Enable Precise Delivery Control (EPDC): setting to B'0' or B'1' is allowed but ignored (returns GOOD status without action).

Mode Page X'1C': Informational Exceptions Control

See the SCSI-3 standard.

For the tape library, this mode page is defined as common for all initiators and it is a static page. There are no changeable parameters in this mode page.

Table 1. Data Returned for Mode Page X'1C'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (B'0')	Reserved	Page Code (X'1C')					
1	Page Length (X'0A')							
2	Perf (B'0')	Reserved			DExcept (B'1')	Test (B'0')	Reserved	LogErr (B'0')
3	Reserved			MRIE (X'3')				
4-7	Interval Time (X'00000000')							
8-11	Report Count/Test Flag Number (X'00000000')							

Mode Page X'1D': Element Address Assignment

See the SCSI-3 standard. For the tape library, this Mode Page is defined as common for all initiators. This Mode Page is a static page. Addresses defined here are used with the Move Medium command.

The fields in Mode Page X'1D' depend on the model of the library and the library's configuration. For more details, go to the section about locations and addresses of SCSI elements in the tape library.

Note: The fields in Mode Page X'1D' are not changeable. If a Mode Select command is issued with values other than the values that are returned by a Mode Sense command, the device returns CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

Table 1. Data Returned for Mode Page X'1D'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (B'0')	Reserved	Page Code (X'1D')					
1	Parameter Length (X'12')							
2-3	Medium Transport Element Address (X'0001')							
4-5	Number of Medium Transport Elements: (X'0002')							
6-7	First Storage Element Address							
8-9	Number of Storage Elements							
10-11	First Import/Export Element Address							
12-13	Number of Import/Export Elements							
14-15	First Data Transfer Element Address							
16-17	Number of Data Transfer Elements							
18-19	Reserved							

Note: A valid configuration might include a 'gap' in the drive positions (for example, drives might be installed in positions 1 and 3 but not position 2). The Data Transfer Element information reported in Mode Sense and Read Element Status data always includes these 'gaps' (for the example, the Number of Data Transfer Elements is 3). However, a command to move a cartridge to a non-existent drive is terminated with CHECK CONDITION status and associated sense data of 5/3B82 (Illegal Request; Element Not Accessible, Drive is Not Present).

Mode Page X'1E': Transport Geometry Parameters

The transport geometry parameters page defines whether each medium transport element is a member of a set of elements that share a common robotics subsystem and whether the element is capable of medium rotation. One transport geometry descriptor is returned for each medium transport element. Because the tape library has one or two medium transport elements, one or two descriptors are returned.

This mode page is defined as common to all initiators. This mode page is a static page.

There are no changeable parameters in this mode page.

Table 1. Data Returned for Mode Page X'1E'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (B'0')	Reserved	Page Code (X'1E')					

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Page Length (X'02' or X'04')							
2	Reserved							Rotate (B'0')
3	Member Number in Transport Element Set (X'00')							
4	Reserved							Rotate (B'0')
5	Member Number in Transport Element Set (X'01')							

- Rotate: The tape library does not support media rotation.

Mode Page X'1F': Device Capabilities

See the SCSI-3 standard.

For the , this mode page is defined as common for all initiators. This mode page is a static page.

Note: The fields in Mode Page X'1F' are not changeable. If a Mode Select command is issued with values other than those values returned by a Mode Sense command, the device returns CHECK CONDITION status with associated sense data of 5/2600 (Illegal Request, Invalid Field in Parameter List).

Table 1. Data Returned for Mode Page X'1F'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (B'0')	Reserved	Page Code (X'1F')					
1	Parameter Length (X'0E')							
2	Store XX Field							
	Reserved				StorDT (B'1')	StorI/E (B'1')	StorST (B'1')	StorMT (B'0')
3	Reserved							
4	Medium Transport Capabilities							
	Reserved				MT->DT (B'1')	MT->I/E (B'1')	MT->ST (B'1')	MT->MT (B'0')
5	Storage Element Capabilities							
	Reserved				ST->DT (B'1')	ST->I/E (B'1')	ST->ST (B'1')	ST->MT (B'0')
6	Import/Export Element Capabilities							
	Reserved				I/E->DT (B'1')	I/E->I/E (B'1')	I/E->ST (B'1')	I/E->MT (B'0')
7	Data Transfer Element Capabilities							
	Reserved				DT->DT (B'1')	DT->I/E (B'1')	DT->ST (B'1')	DT->MT (B'0')
8-11	Reserved							
12	Medium Transport Element Exchange Capabilities							
	Reserved				MT<>DT (B'0')	MT<>I/E (B'0')	MT<>ST (B'0')	MT<>MT (B'0')
13	Storage Element Exchange Capabilities							
	Reserved				ST<>DT (B'1')	ST<>I/E (B'1')	ST<>ST (B'1')	ST<>MT (B'0')
14	Import/Export Element Exchange Capabilities							
	Reserved				I/E<>DT (B'1')	I/E<>I/E (B'1')	I/E<>ST (B'1')	I/E<>MT (B'0')
15	Data Transport Element Exchange Capabilities							
	Reserved				DT<>DT (B'1')	DT<>I/E (B'1')	DT<>ST (B'1')	DT<>MT (B'0')

Mode Page X'20': VU Mode Parameters Page

For the tape library, this mode page is defined as common to all initiators.

Table 1. Data Returned for Mode Page X'20'

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	PS (B'0')	Reserved	Page Code (X'20')					
1	Page Length (X'08')							
2	Reserved (Vendor Unique)					AutoClean	Reserved (Vendor Unique)	
3-9	Reserved (Vendor Unique)							

- AutoClean: This field is not changeable. Automatic drive cleaning can be enabled or disabled at the library's operator panel only. The following values apply:

B'0'	Automatic drive cleaning is disabled.
B'1'	Automatic drive cleaning is enabled.

Move Medium - X'A5'

[Table 1](#) shows the format of the Move Medium command.

Table 1. Move Medium Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation code (X'A5')							

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB	
1	LUN (Obsolete)			Reserved					
2	Transport Element Address								
3									
4	Source Address								
5									
6	Destination Address								
7									
8	Reserved								
9	Reserved								
10	Reserved								
11	HD control			Reserved (B'0000')			Flag (B'0')	Link (B'0')	

- Transport Element Address: For any of these values, the library selects an MTE based on optimal availability and performance. The following values apply:

	X'0000'	
	X'0001'	
	X'0002'	

- Source/Destination Addresses: The valid element addresses for these fields depend on the library's configuration. (See [SCSI element addresses](#).)

Notes:

- The Medium Transport Element is not capable of storing a media element. If this element address is specified as a Destination Address in a Move Medium command, the command is presented CHECK CONDITION status with associated sense data of 5/2101 (Illegal Request, Invalid Element Address).
- If a destination element is an Ultrium 1 Tape Drive and the source element address contains an Ultrium 2 cartridge (VolTag of **xxxxxxL2**), the command is presented CHECK CONDITION status with associated sense data of 5/3000 (Illegal Request, Incompatible Medium Installed).
- If a destination element is an Ultrium 1 or Ultrium 2 Tape Drive and the source element address contains an Ultrium 3 cartridge (VolTag of **xxxxxxL3**), the command is presented CHECK CONDITION status with associated sense data of 5/3000 (Illegal Request, Incompatible Medium Installed).
- If the source element address contains a cartridge that is assigned to another logical library (for example, exported to the shared I/O station or inserted into a shared tape drive), the command is presented CHECK CONDITION status with associated sense data of 5/3B81 (Illegal Request, Element Not Accessible, Cartridge is Assigned to Another Logical Library).

- HD Control: The following values apply:

B'00'	Default behavior (Cache optimized)
B'01'	Tier 0 bypass (When the Source Move Element is a drive); Tier 0 destage (When the Source Move Element is a Tier 0 storage slot); Ignored for all other element types
B'10'	No unshuffle (Does not unshuffle cartridges that are shuffled out of an HD slot when the Source Move Element is from a Tier 3, 4, or 5 location)
B'11'	Optimized empty/fill sequence. (When the Source Move Element is a drive, the preferred destination is an empty HD slot. Once selected, that HD slot is then selected as the destination in successive usages of this option until the once-empty HD slot is full. Usage of this option requires frame/column/row/tier awareness for cartridges being moved to drives in order to create the empty HD slots.)

Note:

The depth of a cartridge location in an HD slot is known as a *tier*. The cartridge immediately accessible in an HD slot is a Tier 1 cartridge. Behind that is Tier 2, and so on. The maximum tier in an LTO HD slot is Tier 5. The maximum tier in a 3592 HD slot is Tier 4. The single-deep slots on the door-side of HD frames and in non-HD frames are referred to as Tier 0 slots.

A *shuffle* operation is required to access any cartridge in Tier 2 or beyond. A shuffle is the process of moving cartridges in lower tiers into the gripper or other available slots to access cartridges in higher tiers. Tier 2 cartridges require a swap only by using the dual grippers (assuming both grippers are usable).

To reduce the occurrence of shuffle operations and to take advantage of the typical repeated accesses of cartridges, the role of a *cartridge cache* is given to all single-deep (Tier 0) slots in an HD library. ALMS is required for libraries with HD frames so that cartridge placement is automatically optimized. However, the library supports some manual cache management operations by using the Move Medium HD Control bits.

The HD Control bits allow an application to bypass cache on demount (drive-to-storage move, HD = B'01'), destage from cache to Tier 1 (storage-to-storage move, HD = B'01'), or to prestage a cartridge to cache from Tiers 3-5 (storage-to-storage move, HD = B'00'). With ALMS enabled, storage-to-storage moves previously resulted in no physical motion. The library now conditionally moves the cartridge between Tier 0 and HD slots for these cache operations.

Drive-to-storage or storage-to-storage moves have the same effect as updating the cartridge "usage" date and time for consideration in subsequent LRU (Least Recently Used) cache destage operations. Hence, an application does not need awareness of the physical locations of cartridges to prepare a set of cartridges for faster future access. The application needs to send storage-to-storage moves only for the entire set of cartridges. If the cartridges are currently in Tier 0, they are protected from LRU destage. Also, they are protected if they are moved to cache (if currently in Tiers 3-5), or left alone (if currently in Tiers 1-2).

For additional information on element addresses and descriptions, refer to the following sections:

- [Mode Page X'1D': Element Address Assignment](#)
- [Mode Page X'1F': Device Capabilities](#)
- [Read Element Status - X'B8'](#)

Position to Element - X'2B'

[Table 1](#) shows the format of the Position to Element command for the tape library.

Table 1. Position to Element Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'2B')							
1	LUN (Obsolete)			Reserved				

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB	
2	Transport Element Address								
3									
4	Destination Element Address								
5									
6	Reserved								
7	Reserved								
8	Reserved								
9	Vendor Specific (B'00')		Reserved (B'0000')				Flag (B'0')	Link (B'0')	

This command positions the transport element (the picker) in front of the destination element specified.

The following tape library-specific parameters apply:

- Transport Element Address: The following values apply. For any of these values, the library selects an MTE based on optimal availability and performance.

	X'0000'	
	X'0001'	
	X'0002'	

- Destination Address: The valid element address for this field depends on the library's configuration. See [SCSI element addresses](#) for more details. Note: The Medium Transport Element is not capable of storing a media element. If this element address is specified as a Destination Address in a Position Element command, the command is presented CHECK CONDITION status with associated sense data of 5/2101 (Illegal Request, Invalid Element Address).

For further information on element addresses and descriptions, go to the sections about Mode Page X'1D': Element Address Assignment and Read Element Status - X'B8'.

Prevent Allow Medium Removal - X'1E'

The Prevent Allow Medium Removal command is supported by the tape library. [Table 1](#) shows the command format.

Table 1. Prevent Allow Medium Removal Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB	
0	Operation Code (X'1E')								
1	LUN (Obsolete)			Reserved					
2	Reserved								
3	Reserved								
4	Reserved						Prevent		
5	Lock Shared	Vendor Specific (B'00')	Reserved (B'0000')				Flag (B'0')	Link (B'0')	

- Prevent: The following values apply:

	B'00'	Allow Cartridge Removal
	B'01'	Prevent Cartridge Removal
	B'10'	Not Supported
	B'11'	Not Supported

- LockShared: Do not set this field by using device drivers or commercial applications. It is intended for use by user-developed applications in specific environments where sharing and locking of the I/O station are both required.

If the I/O station is not shared by multiple logical libraries and the Virtual IO function is not enabled, the tape library supports Prevent Cartridge Removal by locking the I/O station. The Prevent Cartridge Removal option causes a shared I/O station to be locked only if the LockShared bit is set to B'1'. If the I/O station is shared and the LockShared bit is set to B'0', the Prevent Cartridge Removal option is allowed and ignored (returns GOOD status without action). Cartridge removal is enabled again when any initiator issues the Prevent Allow Medium Removal command, with the Prevent field set to B'00' (Allow Cartridge Removal). A power-on reset also restores the tape library to the allow removal state.

For physical security in an unattended environment, the tape library supports a manual lock on the library door. The locked door prevents access to the cartridges in the library.

Read Buffer - X'3C'

The Read Buffer command is supported by the tape library. [Table 1](#) shows the command format.

Table 1. Read Buffer Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'3C')							
1	LUN (Obsolete)			Reserved		Mode		
2	Buffer ID							
3	Buffer Offset							
4								
5								
6	Allocation Length							
7								

8				
9	Vendor Specific (B'00')	Reserved (B'0000')	Flag B'0'	Link B'0'

The following tape library-specific parameters apply:

- **Mode:** The following value applies.

	B'010'	Data mode. Returns data contained in the buffer specified by the Buffer ID.
--	--------	---

- **Buffer ID:** The following read buffer ID is supported:

Buffer ID	Description
X'11'	HTTP response to the most recent REST over SCSI (RoS) command that was sent via SCSI Write Buffer (Buffer ID of X'10') on the same control path. Each Read Buffer command response has a maximum Transfer Length of 1 MiB. In order to determine the remaining length of an HTTP response that has been truncated to 1 MiB, use the value returned for the "Content-Length:" field in the header of the HTTP response (at Buffer Offset of 0). For examples, see Examples of POST/GET commands .

- **Buffer Offset:** For mode B'010', this field is vendor-specific and equates to an offset of 1 MiB (X'100000') for each unit of Buffer Offset.
- **Allocation Length:** The maximum number of bytes to be transferred. The device transfers the number of bytes specified in the Allocation Length field or the number of bytes in the header and buffer being read, whichever is less. This is not an error.

Read Element Status - X'B8'

[Table 1](#) shows the format of the Read Element Status command for the tape library.

Table 1. Read Element Status Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation code (X'B8')							
1	LUN (Obsolete)			VolTag	Element Type Code			
2	Starting Element Address							
3								
4	Number of Elements							
5								
6	Reserved						CURDATA	DVCID
7	Allocation Length							
8								
9								
10	Reserved							
11	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

The following tape library-specific parameters apply:

- VolTag (Volume Tags): The following values apply:

	B'0'	Requests the device to not report volume tag information.
	B'1'	Requests the device to report volume tag information.

- Element Type Code: The following values apply:

	X'0'	Reports all element types.
	X'1'	Reports Medium Transport Elements only.
	X'2'	Reports Storage Elements only.
	X'3'	Reports Import/Export Elements only.
	X'4'	Reports Data Transfer Elements only.

- Starting Element Address: The minimum element address to report.
- Number of Elements: The maximum number of elements to be included in this report. For Element Type Code X'2', when the DVCID bit is set to B'1' and the VolTag bit is set to B'1', the maximum number of elements that can be requested is 5,376 (X'1500'). Any request over this amount returns Illegal Request with the ASC/ASCQ set to 24/00 (Invalid Field in CDB).
- DVCID (Device ID): The following values apply:

	B'0'	Requests the library to report status for the element indicated in the Element Type Code field.
	B'1'	Requests the library to report device identifiers, if available, for the following elements: <ul style="list-style-type: none"> ◦ Data Transfer Elements: If this bit is set to 1b, the VolTag field must be set to 0b and the Element Type Code field must be set to 4h. Only the device identifier data is valid in the response. All other data is returned as invalid with an ASC/ASCQ in each element descriptor set to 81/00 or 82/00 (Status is Questionable). ◦ Storage Elements: If this bit is set to 1b, all element descriptor data for the element is returned the same as when the bit is set to 0b. Additionally, device identifier data is returned that contains the physical location of the cartridge. Note: Cartridge physical location reporting is not supported if the control path drive is an LTO Ultrium 1 or LTO Ultrium 2 drive.

- CURDATA: The following values apply:

	B'0'	Motion is allowed as needed to return a maximum set of valid element status data.
	B'1'	Motion is not allowed; a minimum set of valid data might be returned. This field is supported for SCSI-3 compliance, but it is not required to be set to B'1' to obtain the Device IDs for the Data Transfer Elements.

- Allocation Length: The maximum number of bytes of data to be returned for this report.

- [Element Status Data](#)
- [Element Descriptors](#)

For each Element Type of the Read Element Status SCSI command for the tape library, there is a set of Element Descriptors. There is one descriptor for each element in the library of that Element Type, up to the limit imposed by the CDB.

Element Status Data

For the tape library, this data is a header that precedes the specific element type information, if any. Following this data are zero or more Element Status Pages, up to one for each of the four Element Types that are supported, if the command permits. Following each Element Status Page are zero or more Element Descriptors. There is up to one Element Descriptor for each element cell of that element type in the library, if the data in the CDB permits.

Table 1. Header for Element Type Information

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	First Element Address Reported							
2-3	Number of Elements							
4	Reserved							
5-7	Byte Count of Report Available							

- First Element Address Reported: The smallest element address found to meet the CDB request.
- Number of Elements: The number of elements that meet the request in the CDB.
- [Element Status Page](#)

Element Status Page

For the tape library and the Read Element Status SCSI command, there is one status page for each of the element types to be reported.

Table 1. Element Status Page

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Element Type Code							
1	PVolTag	AVolTag (X'0')	Reserved					
2-3	Element Descriptor Length							
4	Reserved							
5-7	Byte Count of Descriptor Data Available							

- Element Type Code: Indicates the element type that is reported by this status page.
- PVolTag (Primary volume tag): The following values apply:

B'0'	Indicates that the primary volume tag information is omitted from the element descriptors that follow.
B'1'	Indicates that the primary volume tag information field is present in each of the element descriptors that follow.
- AVolTag (Alternate volume tag): The tape library does not support AVolTag.
- Element Descriptor Length: The following values apply:

X'0010'	If DVCID=B'0' and VolTag=B'0'
X'0032'	If DVCID=B'1' and VolTag=B'0' for an LTO logical library
X'0034'	If DVCID=B'1' and VolTag=B'0' for a 3592 logical library
X'0034'	If DVCID=B'0' and VolTag=B'1'
X'004C'	If DVCID=B'1' and VolTag=B'1'
- Byte Count of Descriptor Data Available: The number of bytes of element descriptor data available for elements of this element type that meet the request in the CDB.

Element Descriptors

For each Element Type of the Read Element Status SCSI command for the tape library, there is a set of Element Descriptors. There is one descriptor for each element in the library of that Element Type, up to the limit imposed by the CDB.

- [Element Type 1: Medium Transport](#)
This element is associated with the transport mechanism. Cartridges are never stored in the transport mechanism. However, this element descriptor can indicate that the transport contains a cartridge in certain error conditions.
- [Element Type 2: Storage](#)
This element is used for cartridge storage.
- [Element Type 3: Import/Export](#)
This element is used for moving volumes into and out of the medium changer. This element is also known as the I/O station and bulk I/O slots.
- [Element Type 4: Data Transfer](#)
This element is used for drive status and identification.

Element Type 1: Medium Transport

This element is associated with the transport mechanism. Cartridges are never stored in the transport mechanism. However, this element descriptor can indicate that the transport contains a cartridge in certain error conditions.

Table 1. Element Type 1: Medium Transport Element Descriptor

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

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved				Except	Reserved	Full	
3	Reserved							
4-5	ASC/ASCQ							
6-8	Reserved							
9	SValid	Invert (B'0')	Reserved					
10-11	Source Storage Element Address							
12-47	Primary Volume Tag Information							
48-51 or 12-15	Reserved							

- Element Address: There are two medium transport elements in the library. The following values apply:

	X'0001'	
	X'0002'	

- Except: The following values apply:

	B'0'	The transport is in a normal state.
	B'1'	The transport is in an abnormal state.

- Full: The following values apply:

	B'0'	The transport does not contain a cartridge.
	B'1'	The transport contains a cartridge. A value of B'1' indicates that an error occurred and recovery is required. Recovery of the cartridge from the transport can be performed by the host by using the Move Medium command or by the operator by using operator panel menus.

- ASC/ASCQ: More Sense Code/Additional Sense Code Qualifier. The ASC/ASCQ field might provide specific information on an abnormal element state when the Except bit is set to B'1'. The following values apply:

	11/00	Unable to Read Bar Code Label
	81/00	Status is Questionable (for example, the door is open)

- SValid:

	B'0'	Indicates that the Source Storage Element Address field is not valid.
	B'1'	Indicates that the Source Storage Element Address field is valid.

- Invert: The tape library does not invert cartridges.
- Source Storage Element Address: When SValid is B'1', this field provides the address of the last storage element from which this cartridge was moved.
- Primary Volume Tag Information: The presence or absence of this field is indicated by the PVolTag field in byte 1 of the Element Status Page. To view the content of this page, go to the section about Element Status Page. This is a 36 byte ASCII field that contains the cartridge bar code label, left-adjusted and padded on the right with blanks. Normally, there is no cartridge present in the picker when this command is processed; however, if a cartridge is present and label information is available, it is returned.
- Reserved: Bytes 48-51 (bytes 12-15 if PVolTag is set to B'0').

Element Type 2: Storage

This element is used for cartridge storage.

- [Element Type 2: Storage \(DVCID=B'0'\)](#)
- [Element Type 2: Storage \(DVCID=B'1'\)](#)

Element Type 2: Storage (DVCID=B'0')

Table 1. Element Type 2: Storage Element Descriptor (DVCID=B'0')

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved				Access	Except	Reserved	Full
3	Reserved							
4-5	ASC/ASCQ							
6-8	Reserved							
9	SValid	Invert (B'0')	Reserved					
10-11	Source Storage Element Address							
12-47	Primary Volume Tag Information							
48-51 or 12-15	Reserved							

- Element Address: The range of element addresses that are reported in this field depend on the library's configuration.
- Access: The following values apply:

	B'0'	Indicates that access to the storage element by a medium transport element is denied.
	B'1'	Indicates that access to the storage element by a medium transport element is allowed.

Note: An example of when access would be denied is when the storage element contains a cleaner cartridge and the auto-clean option is enabled.

- Except: The following values apply:

	B'0'	The element is in a normal state.
--	------	-----------------------------------

- | | | |
|--|------|--------------------------------------|
| | B'1' | The element is in an abnormal state. |
|--|------|--------------------------------------|
- Full: The following values apply:

	B'0'	The element does not contain a cartridge.
	B'1'	The element cell contains a cartridge.
 - ASC/ASCQ: More Sense Code/Additional Sense Code Qualifier. The ASC/ASCQ field might provide specific information on an abnormal element state when the Except bit is set to B'1'. The following values apply:

	11/00	Unable to Read Bar Code Label
	30/03	Cleaning Cartridge Installed
	81/00	Status is Questionable (for example, the door is open)
 - SValid:

	B'0'	Indicates that the Source Storage Element Address field provides vendor-specific information
	B'1'	This value is not reported for a Storage Element Descriptor.
 - Invert: The tape library does not invert cartridges.
 - Source Storage Element Address: When SValid is B'0', this field provides the following vendor-specific information:

	Bit 15–1	Reserved
	Bit 0	B'0' Element is located in the preferred zone of accessor A or is not currently assigned to a physical location.
		B'1' Element is located in preferred zone of accessor B.
 - Primary Volume Tag Information: The presence or absence of this field is indicated by the PVolTag field in byte 1 of the Element Status Page. To view the content of this page, go to the section about Element Status Page. This is a 36 byte ASCII field that contains the cartridge bar code label, left-adjusted and padded on the right with blanks.
 - Reserved: Bytes 48-51 (bytes 12-15 if PVolTag is set to B'0').

Element Type 2: Storage (DVCID=B'1')

Table 1. Element Type 2: Storage Element Descriptor (DVCID=B'1')

Bit/byte	7	6	5	4	3	2	1	0
0–1	Element Address							
2	Reserved				Access	Except	Reserved	Full
3	Reserved							
4–5	ASC/ASCQ							
6–8	Reserved							
9	SValid	Invert (B'0')	Reserved					
10–11	Source Storage Element Address							
12–47	Primary Volume Tag Information							
	Device ID							
48	Reserved				Code Set (2h)			
49	Reserved				Identifier Type (0h)			
50	Reserved							
51	Identifier Length 0h to 18h (valid identifier data)							
52–75	Device Identifier ASCII Element Information (Always padded to 24 byte length)							

Note: If the PVoltag bit is set to 0 in the CDB, the Device ID starts at byte 12.

Element Descriptor bytes 0-47 are the same as Storage Element Descriptor w/DVCID=0, as shown in [Table 1](#). If the DVCID bit in the CDB is set to 0, the bytes 48-75 are omitted. If the DVCID bit in CDB is set to 1, bytes 48–75 are included and the following information applies:

- Code Set: This field is set to 2h, indicating that the Identifier data contains ASCII printable characters.
- Identifier Type: This field is set to 0h, indicating that the Identifier Type is Vendor Specific.
- Identifier Length: This field contains the length in bytes of valid Device Identifier information. If no device identifier is available, the Identifier Length field is 0h. If the DVCID bit is set, the Identifier Length can be set between 0-24 (18h) bytes.
- Device Identifier: The Device Identifier contains information about the element reported that can include physical location or other status. The format is ASCII. If location information is reported, it is ASCII comma separated values that represent Frame, Column, Row, and Tier (F3,C7,R34,T3). Other strings such as “Empty” or “Unknown” are reported if no cartridge is present, or if the location or status of the cartridge is unknown. The Device Identifier: field is padded with ASCII 'space' (20h) characters to fill the complete 24 bytes. If the DVCID bit is set and the Identifier Length is 0, this field still contains 24 bytes.

Element Type 3: Import/Export

This element is used for moving volumes into and out of the medium changer. This element is also known as the I/O station and bulk I/O slots.

- [Element Type 3: Import/Export \(DVCID=B'0'\)](#)
- [Element Type 3: Import/Export \(DVCID=B'1'\)](#)

Element Type 3: Import/Export (DVCID=B'0')

Table 1. Element Type 3: Import/Export Element Descriptor (DVCID = B'0')

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

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	OIR (B'0')	CMC	InEnab	ExEnab	Access	Except	ImpExp	Full
3	Reserved							
4-5	ASC/ASCQ							
6-8	Reserved							
9	SValid	Invert (B'0')	Reserved					
10-11	Source Storage Element Address							
12-47	Primary Volume Tag Information							
48-51 or 12-15	Reserved							

- Element Address: The range of element addresses that are reported in this field depends on the library configuration. For more information, see [SCSI element addresses](#).

- CMC: Connected Media Changer. The following values apply:

	B'0'	Exports are to the I/O station and Imports are from the I/O station.
	B'1'	Exports are to a connected media changer and Imports are from a connected media changer.

- InEnab: Import Enable. InEnab indicates that this element supports movement of media into the scope of the library.
- ExEnab: Export Enable. Indicates that this element supports movement of media out of the scope of the library.

- Access: The following values apply:

	B'0'	Indicates that access to the Import/Export element by a Medium Transport Element is denied.
	B'1'	Indicates that access to the Import/Export element by a Medium Transport Element is allowed.

Note: Examples of when access would be denied include (1) when the I/O Station door is open and (2) when a cartridge is moved to the I/O slot from a storage slot or drive that is part of a logical library different from the logical library that reports the status.

- Except: The following values apply:

	B'0'	The element is in a normal state.
	B'1'	The element is in an abnormal state.

- ImpExp: Import/Export. The following values apply:

When the CMC bit = B'0'

	B'0'	Indicates the unit of media in the Import/Export Element was placed there by the Medium Transport Element.
	B'1'	Indicates the unit of media in the Import/Export Element was placed there by an operator.

When the CMC bit = B'1'

	B'0'	Indicates the unit of media in the Shuttle Station was placed there by the Medium Transport Element.
	B'1'	Indicates the unit of media in the Shuttle Station was placed there by the shuttle car.

- Full: The following values apply:

	B'0'	The element does not contain a cartridge.
	B'1'	The element cell contains a cartridge.

- ASC/ASCQ: More Sense Code/Additional Sense Code Qualifier. The ASC/ASCQ: field might provide specific information on an abnormal element state when the Except bit is set to B'1'. The following values apply:

	11/00	Unable to Read Bar Code Label
	81/00	Status is Questionable (for example, the door is open)

- SValid:

	B'0'	Indicates that the Source Storage Element Address field is not valid.
	B'1'	Indicates that the Source Storage Element Address field is valid.

- Invert: The tape library does not invert cartridges.

- Source Storage Element Address: When SValid is B'1', this field provides the address of the last storage element from which this cartridge was moved.

- Primary Volume Tag Information: The presence or absence of this field is indicated by the PVolTag field in byte 1 of the Element Status Page. To view the content of this page, go to the section about Element Status Page). This is a 36 byte ASCII field that contains the cartridge bar code label, left-adjusted and padded on the right with blanks.

- Reserved: Bytes 48-51 (bytes 12-15 if PVolTag is set to B'0').

Element Type 3: Import/Export (DVCID=B'1')

Table 1. Element Type 3: Import/Export Element Descriptor (DVCID = B'1')

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	OIR (B'0')	CMC	InEnab	ExEnab	Access	Except	ImpExp	Full
3	Reserved							
4-5	ASC/ASCQ							
6-8	Reserved							
9	SValid	Invert (B'0')	Reserved					
10-11	Source Storage Element Address							
12-47	Primary Volume Tag Information							
	Device Identifier							
48	Reserved				Code Set (X'2')			
49	Reserved			Association (B'00')		Identifier Type (X'1')		

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
50	Reserved							
51	Identifier Length (X'00' or X'2C')							
52–59	Vendor ID							
60–75	Device Type and Model Number							
76–87	Serial Number of Device							
88–91	First Storage Element Address							
92–94	Frame Number							
95	Reserved							

- CMC: Connected Media Changer. The following values apply:

	B'0'	Exports are to the I/O station and Imports are from the I/O station.
	B'1'	Exports are to a connected media changer and Imports are from a connected media changer.

Note: If the DVCID bit is set to B'1' in the CDB, the Voltag bit must also be set to B'1'. Otherwise, Illegal Request, Invalid Field in the CDB is returned.

Element Descriptor bytes 0–47 are the same as the Import/Export Element Descriptor bytes 0–47 with DVCID=0, as shown in [Table 1](#). If the DVCID bit in the CDB is set to B'0', bytes 48–91 are omitted.

For libraries where there is at least one shuttle station is assigned to a logical library:

If the DVCID bit in the CDB is set to B'1' and the Import/Export element is present and the CMC bit is set to B'1', bytes 48–95 are reported and the following information applies. If the Import/Export element is not present or if the CMC bit is set to B'0', bytes 48–95 are reported and are set to X'00' and the Identifier Length is set X'00'.

For libraries where there are no shuttle stations are assigned to a logical library:

If the DVCID bit in the CDB is set to B'1', the device returns CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid Field) in the CDB.

Note: Each IE device identifier reports the same information as reported in Inquiry Data Device Identifier page X'83' for the associated logical library, with the addition of the frame number, bytes 92–95.

- Code set: This field is set to X'2' indicating the Identifier data contains ASCII printable characters.
- Identifier Type: This field is set to X'1' indicating the Identifier Type is T10 vendor ID based.
- Identifier Length: This field contains the length in bytes of valid Device Identifier information. If the DCVID bit is set to B'1', the Identifier Length can be X'00' (no element present or CMC bit = B'0') or X'2C' (element present).
- Vendor ID: This is the same as Inquiry Standard Data bytes 8–15 of the associated logical library.
- Device Type and Model Number: This is the same as Inquiry Standard Data bytes 16–31 of the associated logical library.
- Serial Number of Device: This is right justified with leading zeroes, in ASCII (same as Inquiry Standard Data bytes 38–49 of the associated logical library).
- First Storage Element Address: ASCII representation of four hexadecimal digits from Mode Page X'1D', bytes 6–7 of the associated logical library.
- Frame Number: ASCII representation of 'Fxx' where xx is the frame number of the destination shuttle station that ranges from '01' to '16'.

Element Type 4: Data Transfer

This element is used for drive status and identification.

- [Element Type 4: Data Transfer \(DVCID=B'0'\)](#)
This element descriptor block is used to report the status of the drive.
- [Element Type 4: Data Transfer \(DVCID=B'1'\)](#)
This element descriptor block is used to report the device identifiers for the drive.

Element Type 4: Data Transfer (DVCID=B'0')

This element descriptor block is used to report the status of the drive.

Table 1. Element Type 4: Data Transfer Element Descriptor (DVCID=B'0')

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved				Access	Except	Reserved	Full
3	Reserved							
4-5	ASC/ASCQ							
6	Not Bus	Reserved	ID Valid	LU Valid	Reserved	Logical Unit Number (B'000')		
7	SCSI Bus Address							
8	Reserved							
9	SValid	Invert (B'0')	Reserved					
10-11	Source Storage Element Address							
12-47	Primary Volume Tag Information							
48-51 or 12-15	Reserved							

- Element Address: The range of element addresses that are reported in this field depend on the library's configuration.
Note: A valid configuration might include a 'gap' in the drive positions (for example, drives might be installed in positions 1 and 3 but not position 2). The Data Transfer Element information reported in Mode Sense and Read Element Status data always includes these 'gaps' (in the preceding example, the range of Data Transfer Element addresses includes X'0101', X'0102', and X'0103'). The ASC/ASCQ field of the Data Transfer Element Descriptor indicates whether the associated drive is not present.

- Access:

	B'0'	Indicates that access to the Data Transfer element by a Medium Transport Element is denied.
	B'1'	Indicates that access to the Data Transfer element by a Medium Transport Element is allowed.

Note: Examples of when access would be denied include (1) when the tape drive contains a cartridge in the loaded position and (2) when a shared tape drive contains a cartridge that is assigned to another logical library.

- Except: The following values apply:

	B'0'	The element is in a normal state.
	B'1'	The element is in an abnormal state.

- Full: The following values apply:

	B'0'	The element does not contain a cartridge.
	B'1'	The element contains a cartridge in a loaded or ejected position.

Note: A cartridge in the loaded position is indicated by the Full bit set to B'1' and the Access bit set to B'0'. A cartridge in the ejected position is indicated by the Full bit set to B'1' and the Access bit set to B'1'.

- ASC/ASCQ: More Sense Code/Additional Sense Code Qualifier. The ASC/ASCQ: field might provide specific information on an abnormal element state when the Except bit is set to B'1'. The following values apply:

	11/00	Unable to Read Bar Code Label
	81/00	Status is Questionable (for example, the door is open)
	82/00	Drive is Not Present or is Unable to Communicate
	83/00	Medium in Drive (Unable to Access Bar Code Label)

- Not Bus: Not this bus. This bit is not supported.

- ID Valid: The following values apply:

	B'0'	Indicates that the SCSI Bus Address field is not valid.
	B'1'	Indicates that the SCSI Bus Address field contains valid information.

- LU Valid: The following values apply:

	B'0'	Indicates that the Logical Unit Number field is not valid.
	B'1'	Indicates that the Logical Unit Number field contains valid information.

- Logical Unit Number: The LUN is always 0.

- SCSI Bus Address: Set to the SCSI ID of the drive.

- SValid:

	B'0'	Indicates that the Source Storage Element Address field provides vendor-specific information. The SValid field is set to B'0' when the Full field is set to B'0'.
	B'1'	Indicates that the Source Storage Element Address field is valid.

- Invert: The tape library does not invert cartridges.

- Source Storage Element Address: When SValid is B'1', this field provides the address of the last storage element from which this cartridge was moved. When SValid is B'0' and the Full field is set to B'0', this field provides the following vendor-specific information:

	Bit	Description
	15-1	Reserved
	0	B'0' Element is located in the preferred zone of accessor A or is not currently assigned to a physical location.
		B'1' Element is located in the preferred zone of accessor B.

- Primary Volume Tag Information: The presence or absence of this field is indicated by the PVolTag field in byte 1 of the Element Status Page. To view the content of this page, go to the section about Element Status Page. This is a 36 byte ASCII field that contains the cartridge bar code label, left-adjusted and padded on the right with blanks.

- Reserved: Bytes 48-51 (bytes 12-15 if PVolTag is set to B'0').

Element Type 4: Data Transfer (DVCID=B'1')

This element descriptor block is used to report the device identifiers for the drive.

Table 1. Element Type 4: Data Transfer Element Descriptor (DVCID=B'1')

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	Element Address							
2	Reserved			Access (B'0')		Except (B'1')	Reserved	Full (B'0')
3	Reserved							
4-5	ASC/ASCQ							
6	Not Bus (B'0')	Reserved	ID Valid (B'0')	LU Valid (B'0')	Reserved	Logical Unit Number (B'000')		
7	SCSI Bus Address (X'00')							
8	Reserved							
9	SValid	Invert (B'0')	Reserved					
10-11	Source Storage Element Address							
12-49 or 12-51	Identification Descriptor							

- Element Address: The range of element addresses that are reported in this field depend on the library's configuration. The range is X'0101-0148'.

Note: A valid configuration might include a 'gap' in the drive positions (for example, drives might be installed in positions 1 and 3 but not position 2). The Data Transfer Element information reported in Mode Sense and Read Element Status data always includes these 'gaps' (in the preceding example, the range of Data Transfer Element addresses includes X'0101', X'0102', and X'0103'). The ASC/ASCQ field of the Data Transfer Element Descriptor indicates whether the associated drive is not present.

- Access: Not supported when DVCID = B'1'.
- Except: Always set when DVCID = B'1'.
- Full: Not supported when DVCID = B'1'.

- ASC/ASCQ: More Sense Code/Additional Sense Code Qualifier. The ASC/ASCQ: field might provide specific information on an abnormal element state when the Except bit is set to B'1'. The following values apply:

8100	Status is Questionable, Drive is Present
8200	Status is Questionable, Drive is Not Present

- Not Bus: Not this bus.
- ID Valid: Not supported when DVCID = B'1'.
- LU Valid: Not supported when DVCID = B'1'.
- Logical Unit Number: The LUN is always 0.
- SCSI Bus Address: Not supported when DVCID = B'1'.
- SValid:

B'0'	Indicates that the Source Storage Element Address field provides vendor-specific information.
B'1'	Not supported when DVCID = B'1'.

- Source Storage Element Address: When SValid is B'0', this field provides the following vendor-specific information:

Bit	Description
15–11	Drive frame physical location. Binary encoded value that represents the drive frame position (e.g., B'10001' = frame 17).
10–8	Drive column physical location. Binary encoded value that represents the drive column number (e.g., B'100' = column 4).
7–4	Drive row physical location. Binary encoded value that represents the drive row number (e.g., B'0011' = row 3).
3–1	Reserved
0	B'0' indicates the element is located in the preferred zone of accessor A or is not currently assigned to a physical location. B'1' indicates the element is located in the preferred zone of accessor B.

Note: Frames and columns are numbered left to right when viewing from the front of the library. Rows are numbered top to bottom.

- Identification Descriptor: Indicates that the following information applies:
 - If no drive is present, all bytes are set to X'00'.
 - For LTO or 3592 devices, these bytes are the same as reported by the drive in Inquiry Page X'83', specifically the Identification Descriptor with Identifier Type of X'1'.

Release Element (6) - X'17'

[Table 1](#) shows the format of the Release Element command for the tape library.

Table 1. Release Element (6) Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'17')							
1	LUN (Obsolete)			3rdPty (B'0')	Third Party Device ID (B'000')			Element (B'0')
2	Reservation Identification (X'00')							
3	Reserved							
4	Reserved							
5	Vendor Specific (B'00')		Reserved (B'0000')			Flag (B'0')	Link (B'0')	

The following tape library-specific parameters apply:

- 3rdPty: Third Party. This release is not supported by the tape library.
- Third Party Device ID: Not supported by the tape library.
- Element: Element reservation. Not supported by the tape library.
- Reservation Identification: Not supported by the tape library.

Request Sense - X'03'

The Request Sense command is supported by the tape library. [Table 1](#) shows the command format.

Table 1. Request Sense Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'03')							
1	LUN (Obsolete)			Reserved				
2	Reserved							
3	Reserved							
4	Allocation Length							
5	Vendor Specific (B'00')		Reserved (B'0000')			Flag (B'0')	Link (B'0')	

The following tape library-specific parameter applies:

- Allocation Length: The maximum number of bytes to be transferred. This device has up to 78 bytes of sense data. If the allocation length specified is less, then the allocated amount is transferred, the remaining sense data is lost, and no error is reported. If the allocated length specified is greater, then only up to 78 bytes of sense data are transferred and no error is reported.
- [Library Sense Data](#)

Library Sense Data

For the tape library and the Request Sense SCSI command, the format of the sense data is shown in the following table:

Table 1. Format of Library Sense Data

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Valid (B'0')	Error Code (X'70')						
1	Segment Number (X'00')							
2	Filemark (B'0')	EOM (B'0')	ILI (B'0')	Reserved	Sense Key			
3-6	Information (X'0000 0000')							
7	Additional Sense Length (n-7)							
8-11	Command-Specific Information (X'0000 0000')							
12	ASC							
13	ASCQ							
14	Field Replaceable Unit Code (X'00')							
15-17	Sense Key Specific (see explanation that follows)							
18	Hardware Error Code							
19	Hardware Error Code Qualifier							
20-22	Reserved							
23	Mechanism Status Bit Map							
24	Control Path Frame/Device							
25	Failing Frame/Device							
26	TapeAlert Flag Number							
27	Retry Count							
28	Object ID							
29-30	Object Error Code							
31-34	Reserved							
35	Source Element Bit Map							
36-37	Source Element Address							
38	Destination Element Bit Map							
39-40	Destination Element Address							
41	Secondary Source Element Bit Map							
42-43	Secondary Source Element Address							
44	Second Destination Element Bit Map							
45-46	Second Destination Element Address							
47-77	Reserved							

- Sense Key: Go to the section about SCSI Error Sense in the tape library.
- Additional Sense Length: When the Sense Key field is Recovered Error (1) or Hardware Error (4), the library reports a total of 78 bytes of sense data. For any other Sense Key, the library reports a total of 18 bytes of sense data. Supported values for this field are:

	X'0A' (10)	
	X'46' (70)	

- Command-Specific Information: The tape library does not support the commands that are associated with this field.
- Additional Sense Code (ASC): Go to the section about SCSI Error Sense in the tape library.
- Additional Sense Code Qualifier (ASCQ): Go to the section about SCSI Error Sense in the tape library.
- Sense Key Specific: Values vary, depending on the following conditions.
 - When the sense key field value is not Illegal Request, the SKSV bit is B'0' and bytes 15-17 are all set to X'00'.
 - When the sense key field value is Illegal Request and the SKSV bit is B'1', bytes 15-17 are interpreted as follows:

Table 2. Sense Key Specific Values

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
15	SKSV (B'1')	C/D	Reserved		BPV	Bit Pointer		
16-17	Field Pointer							

- SKSV: Sense key specific valid.
- C/D: Control/data

	B'0'	Specifies that the error is in a data field of the parameter list.
	B'1'	Specifies that the error is in a CDB field.
- BPV: Bit Pointer Valid.

	B'0'	Specifies that the Bit Pointer Field is not valid.
	B'1'	Specifies that the Bit Pointer Field is valid.
- Bit Pointer: When BPV is set to B'1', this field points to the bit in error of the field that is specified by the Field Pointer.
- Field Pointer: Points to the CDB byte or parameter byte in error.
- Mechanism Status Bit Map (byte 23): This is the state of the accessor after the termination of any retry or recovery algorithms. This byte is bit-mapped, as shown in the following table, from Most Significant Bit (7) to Least Significant Bit (0):

Table 3. Mechanism Status Bit Map Values

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
23	Move capability	Last SCSI state	Completed	All returned	PKR1 full	PKR2 full	Determines which accessor failed	Fail 2

- Move capability: A "1" indicates that the accessor is capable of performing movement commands.
- Last SCSI state: A "1" indicates that the accessor is in the same condition as before the execution of the failed command.
- Completed: A "1" indicates that the cartridges were moved and the last command that was completed successfully.
- All returned: A "1" indicates that the cartridges were restored to the locations they occupied prior to the previous failed command.

- PKR1 full: A "1" indicates that a cartridge is in the first media transport element. The transport was either unexpectedly full, or a cartridge remained in it after an attempt to recover from a failure. If the latter is true, the appropriate Element Bit Map byte will indicate which cartridge is in the transport.
- PKR2 full: A "1" indicates that a cartridge is in the second media transport element. The transport was either unexpectedly full, or a cartridge remained in it after an attempt to recover from a failure. If the latter is true, the appropriate Element Bit Map byte indicates which cartridge is in the transport.
- Accessor: A "0" indicates accessor A. A "1" indicates accessor B.
- Fail2: A "1" indicates that the failure occurred on the second move of an EXCHANGE MEDIUM command (from the First Destination Element to the Second Destination Element). A "0" indicates that the failure occurred on the first move (from the Source Element to the First Destination Element).

When the Sense Key field value is Recovered Error (1) or Hardware Error (4), the library reports more sense bytes 18-77. For more information, see the *IBM® TS3500 Maintenance Information* manual.

Request Volume Element Address - X'B5'

For the tape library, the Request Volume Element Address command transfers the results of a Send Volume Tag command. Multiple Request Volume Element Address commands can be used to retrieve the results of a single Send Volume Tag command with the translate option. [Table 1](#) shows the command format.

Table 1. Request Volume Element Address Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (X'B5')							
1	Reserved			Voltag		Element Type Code		
2-3	Element Address							
4-5	Number of Elements to Report							
6	Reserved							
7-9	Allocation Length							
10	Reserved							
11	Control							

The following tape library-specific behaviors apply:

Element Type Code acts as a filter similar to (Minimum) Element Address, which, if the criteria are met, advances the most recent element address reported. Once information for an element address is reported, only higher element addresses are reported by subsequent Request Volume Element Address commands. Even if it means that some Send Volume Tag element list matches are skipped and never reported. If the criteria are not met based on the Element Type Code or Element Address (and there are still element addresses to be reported), this command responds with an empty volume element address header. However, the most recent element address that was reported is not advanced and the element list is not to be considered reported completely.

[Table 2](#) shows the volume element address header format.

Table 2. Volume Element Address Header

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0-1	First Element Address Reported							
2-3	Number of Elements Reported							
4	Reserved			Send Action Code				
5-7	Byte Count of Report Available (all pages, x - 7)							
8-x	Element status page(s)							

If a Request Volume Element Address command is received and no prior Send Volume Tag command was executed or the element list was reported completely for the most recently successful Send Volume Tag command, the library returns command response data that consists of only the volume element address header, with First Element Address Reported set to X'0000', Number of Elements Reported set to X'0000', and Byte Count of Report Available set to X'000000'.

Reserve Element (6) - X'16'

[Table 1](#) shows the format of the Reserve Element command for the tape library.

Table 1. Reserve Element (6) Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'16')							
1	LUN (Obsolete)			3rdPty (B'0')		Third Party Device ID (B'000')		Element (B'0')
2	Reservation Identification (X'00')							
3-4	Element List Length (X'0000')							
5	Vendor Specific (B'00')		Reserved (B'0000')				Flag (B'0')	Link (B'0')

Note: When multiple logical libraries or control paths are configured, the library has multiple medium changer device ports (through LUN 1 of the drives in LTO Ultrium or 3592 frames). See the *IBM® TS3500 Introduction and Planning Guide*. Medium changer device reservations prevent access for those initiators only by using the same device port as the initiator that sent the Reserve command. Initiators that use another device port (for example, for a different logical library or different control path) are not affected.

The following tape library-specific parameters apply:

- 3rdPty: Third Party. Not supported by the tape library.
- Third Party Device ID: Not supported by the tape library.
- Element: Element reservation. Not supported by the tape library.
- Reservation Identification: Not supported by the tape library.
- Element List Length: Not supported by the tape library.

Send Diagnostic - X'1D'

The Send Diagnostic command is supported by the tape library. Send Diagnostic is used to initiate the library's self-test diagnostics. [Table 1](#) shows the command format.

Table 1. Send Diagnostic Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'1D')							
1	LUN (Obsolete)			PF (B'0')	Reserved	SlfTst (B'1')	DevOfI (B'0')	UnitOfI (B'0')
2	Reserved							
3	Parameter List Length (X'0000')							
4								
5	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

Send Volume Tag - X'B6'

For the tape library, the Send Volume Tag command transfers a volume tag template to be used for a search of existing volume tag information. The Request Volume Element Address command can be used to transfer the results of a translate search operation. [Table 1](#) shows the command format.

Table 1. Send Volume Tag Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Operation Code (X'B6')							
1	Reserved				Element Type Code			
2-3	Element Address							
4	Reserved							
5	Reserved			Send Action Code				
6-7	Reserved							
8-9	Parameter List Length							
10	Reserved							
11	Control							

The following tape library-specific behaviors apply:

- Send Action Code: The following values are the only supported values:
 - X'4' Translate - search all defined tags - ignore sequence numbers
 - X'5' Translate - search primary tags - ignore sequence numbers
- Parameter List Length: Must be X'20' or X'28', otherwise the command is presented CHECK CONDITION status with associated sense data of 5/2400 (Illegal Request, Invalid CDB).

[Table 2](#) shows the Send Volume Tag Parameters Format.

Table 2. Send Volume Tag Parameters Format

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

The only tape library-specific behavior to apply is the Volume Identification Template, with the following special characters:

- '*' (X'2A') matches any string of characters. When it appears in a template, the remainder of the template at higher offsets is not used.
- '?' (X'3F'), blank character (X'20'), or null character (X'00') in a template can be treated the same as an '*'.

Test Unit Ready - X'00'

The Test Unit Ready command is supported by the tape library. [Table 1](#) shows the command format.

Table 1. Test Unit Ready Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'00')							
1	LUN (Obsolete)			Reserved				
2	Reserved							
3	Reserved							

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
4	Reserved							
5	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

Write Buffer - X'3B'

[Table 1](#) shows the format of the Write Buffer command for the tape library.

Table 1. Write Buffer Command

Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
0	Operation Code (X'3B')							
1	LUN (Obsolete)			Reserved		Mode		
2	Buffer ID							
3	Buffer Offset							
4								
5								
6	Parameter List Length							
7								
8								
9	Vendor Specific (B'00')			Reserved (B'0000')			Flag (B'0')	Link (B'0')

Mode: Supported modes are:

	Mode 2	Data Mode
	Mode 4	Download Microcode
	Mode 5	Download Microcode and Save
	Mode 6	Download Microcode With Offsets
	Mode 7	Download Microcode With Offsets and Save

The following 3584 Tape Library-specific parameters apply for Modes 4–7:

- **Buffer ID:** X'00' for microcode.
- **Buffer Offset:** This field is vendor-specific and equates to an offset of 1 MiB (X'100000') for each unit of Buffer Offset.
- **Parameter List Length:** The number of bytes to be transferred. This must be X'100000' for all but the last Write Buffer command in the sequence.

The following 3584 Tape Library-specific parameters apply for Data Mode 2:

- **Buffer ID:**
The following write buffer ID is supported:

Buffer ID	Description
X'10'	<p>REST over SCSI (RoS) command.</p> <p>Use SCSI Read Buffer with Buffer ID of X'11' to receive the HTTP Response to this RoS command. The HTTP Response is maintained separately for each control path in the library. Thus, when performing control path failover of a SCSI Write Buffer for a POST task, the application must first send GET (all) tasks to check if the original POST task was accepted or not. For control path failover of all other RoS commands, the application can blindly retry the SCSI Write Buffer command. For examples, see Examples of POST/GET commands.</p> <p>All RoS commands are allowed during SCSI Not Ready conditions such as door open. For the POST of a task, the task will be created but will report a state of failed if the library is in a SCSI Not Ready condition at any time during the execution of that task. For additional details on SCSI Not Ready conditions, see Supported SCSI commands and Sense Key 2 (Not Ready).</p>

- **Buffer Offset:** For Data Mode 2, the Buffer Offset field is always 0.
- **Parameter List Length:** The number of Data Mode bytes to be transferred with the current Write Buffer command.

SCSI error sense information

This section describes all possible combinations of Sense Keys, Additional Sense Codes (ASC), and Additional Sense Code Qualifiers (ASCQ) that are reported by the tape library.

- [Sense Key 2 \(Not Ready\)](#)
- [Sense Key 4 \(Hardware Error\)](#)
- [Sense Key 5 \(Illegal Request\)](#)
- [Sense Key 6 \(Unit Attention\)](#)
- [Sense Key B \(Aborted Command\)](#)

Sense Key 2 (Not Ready)

[Table 1](#) gives the ASC and ASCQ summary for Sense Key 2 (Not Ready) in the tape library.

Table 1. ASC and ASCQ Summary for Sense Key 2 (Not Ready)

ASC ASCQ	Description
3E 00	Logical Unit has not self-configured
04 00	Logical Unit Not Ready, Cause Not Reportable
04 01	Logical Unit Is in Process of Becoming Ready
04 03	Logical Unit Not Ready, Manual Intervention Required
04 82	Library has not been calibrated
04 83	Library has not been set up
04 84	I/O Station is open or Magazine is not present
04 85	Logical Unit Not Ready, Door is Open

Sense Key 4 (Hardware Error)

[Table 1](#) gives the ASC and ASCQ summary for Sense Key 4 (Hardware Error) in the tape library.

Table 1. ASC and ASCQ Summary for Sense Key 4 (Hardware Error)

ASC ASCQ	Description
44 00	Internal Target Failure

Sense Key 5 (Illegal Request)

[Table 1](#) gives the ASC and ASCQ summary for Sense Key 5 (Illegal Request) in the tape library.

Table 1. ASC and ASCQ Summary for Sense Key 5 (Illegal Request)

ASC ASCQ	Description
1A 00	Parameter List Length Error
20 00	Invalid Command Operation Code
21 01	Invalid Element Address
24 00	Invalid Field in CDB
25 00	Logical Unit Not Supported
26 00	Invalid Field in Parameter List
2C 00	Command Sequence Error
30 00	Incompatible Medium Installed
39 00	Saving Parameters Not Supported
3B 0D	Medium Destination Element Full
3B 0E	Medium Source Element Empty
3B 80	Medium Transport Element Full
3B 81	Element Not Accessible, Cartridge Present is Assigned to Another Logical Library
3B 82	Element Not Accessible, Drive is Not Present
3D 00	Invalid Bits in Identify Message
53 02	Medium Removal Prevented

Sense Key 6 (Unit Attention)

[Table 1](#) gives the ASC and ASCQ summary for Sense Key 6 (Unit Attention) in the tape library.

Table 1. ASC and ASCQ Summary for Sense Key 6 (Unit Attention)

ASC ASCQ	Description
28 00	Not Ready to Ready Transition, Medium Might Have Changed
28 01	Import or Export Element Accessed
29 00	Power On, Reset, or Bus Device Reset Occurred
2A 01	Mode Parameters Changed
3F 01	Microcode Has Been Changed

Sense Key B (Aborted Command)

[Table 1](#) gives the ASC and ASCQ summary for Sense Key B (Aborted Command) in the tape library.

Table 1. ASC and ASCQ Summary for Sense Key B (Aborted Command)

ASC ASCQ	Description
08 01	Logical Unit communication timeout

ASC ASCQ	Description
1B 00	Synchronous Data Transfer Error
29 07	I_T Nexus loss occurred
43 00	Message Error
44 00	Internal Target Failure
45 00	Select or Reselect Failure
47 00	SCSI Parity Error
48 00	Initiator Detected Error Message Received
49 00	Invalid Message Error
4A 00	Command Phase Error
4B 00	Data Phase Error
4E 00	Overlapped Commands Attempted

Implementation considerations

This section describes points to consider when implementing SCSI for the tape library.

- [Default SCSI ID and Loop ID \(AL_PA\) Assignments for Drives](#)
- [Status of Tape Library During Automatic Cleaning](#)
- [Cleaning Cartridge Presence Indicators in the Tape Library](#)
- [Automatic Cleaning Enabled Indicator](#)
- [Drive Cleaning Indicators](#)

Default SCSI ID and Loop ID (AL_PA) Assignments for Drives

Based on its physical position in the frame of a tape library, each tape drive is assigned a default SCSI ID (from 0-12) or a default Loop ID (Arbitrated Loop Physical Address, commonly abbreviated as AL_PA). [Table 1](#) lists the default SCSI IDs.

Table 1. Default SCSI ID for each drive in the IBM TS3500

Device Position	SCSI ID
Drive 1	0
Drive 2	1
Drive 3	2
Drive 4	3
Drive 5	4
Drive 6	5
Drive 7	6
Drive 8	8
Drive 9	9
Drive 10	10
Drive 11	11
Drive 12	12

Note: You can change the SCSI IDs or Loop IDs for the drives by using the SETTINGS menu option on the operator panel, or by using the IBM® Tape Library Specialist web interface. To change the IDs, refer to the appropriate procedure in the *IBM TS3500 Operator Guide*.

[Table 2](#) lists the default Loop IDs (AL_PAs).

Table 2. Default Loop IDs and their associated AL_PAs for drives with single or dual ports. For drives with single ports, use the values for Port 1; for drives with dual ports, use Ports 1 and 2.

Drive	Frames 1, 7, 13		Frames 2, 8, 14		Frames 3, 9, 15		Frames 4, 10, 16		Frames 5, 11		Frames 6, 12	
	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA
Row 1												
Port 1	17	X'CC'	33	X'B1'	49	X'97'	65	X'71'	81	X'54'	97	X'39'
Port 2	81	X'54'	97	X'39'	18	X'CB'	34	X'AE'	17	X'CC'	33	X'B1'
Row 2												
Port 1	18	X'CB'	34	X'AE'	50	X'90'	66	X'6E'	82	X'53'	98	X'36'
Port 2	82	X'53'	98	X'36'	19	X'CA'	35	X'AD'	18	X'CB'	34	X'AE'
Row 3												
Port 1	19	X'CA'	35	X'AD'	51	X'8F'	67	X'6D'	83	X'52'	99	X'35'
Port 2	83	X'52'	99	X'35'	20	X'C9'	36	X'AC'	19	X'CA'	35	X'AD'
Row 4												
Port 1	20	X'C9'	36	X'AC'	52	X'88'	68	X'6C'	84	X'51'	100	X'34'
Port 2	84	X'51'	100	X'34'	21	X'C7'	37	X'AB'	20	X'C9'	36	X'AC'
Row 5												
Port 1	21	X'C7'	37	X'AB'	53	X'84'	69	X'6B'	85	X'4E'	101	X'33'
Port 2	85	X'4E'	101	X'33'	22	X'C6'	38	X'AA'	21	X'C7'	37	X'AB'
Row 6												

Drive	Frames 1, 7, 13		Frames 2, 8, 14		Frames 3, 9, 15		Frames 4, 10, 16		Frames 5, 11		Frames 6, 12	
	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA	Loop ID	AL_PA
Port 1	22	X'C6'	38	X'AA'	54	X'82'	70	X'6A'	86	X'4D'	102	X'32'
Port 2	86	X'4D'	102	X'32'	23	X'C5'	39	X'A9'	22	X'C6'	38	X'AA'
Row 7												
Port 1	23	X'C5'	39	X'A9'	55	X'81'	71	X'69'	87	X'4C'	103	X'31'
Port 2	87	X'4C'	103	X'31'	24	X'C3'	40	X'A7'	23	X'C5'	39	X'A9'
Row 8												
Port 1	24	X'C3'	40	X'A7'	56	X'80'	72	X'67'	88	X'4B'	104	X'2E'
Port 2	88	X'4B'	104	X'2E'	25	X'BC'	41	X'A6'	24	X'C3'	40	X'A7'
Row 9												
Port 1	25	X'BC'	41	X'A6'	57	X'7C'	73	X'66'	89	X'4A'	105	X'2D'
Port 2	89	X'4A'	105	X'2D'	26	X'BA'	42	X'A5'	25	X'BC'	41	X'A6'
Row 10												
Port 1	26	X'BA'	42	X'A5'	58	X'7A'	74	X'65'	90	X'49'	106	X'2C'
Port 2	90	X'49'	106	X'2C'	27	X'B9'	43	X'A3'	26	X'BA'	42	X'A5'
Row 11												
Port 1	27	X'B9'	43	X'A3'	59	X'79'	75	X'63'	91	X'47'	107	X'2B'
Port 2	91	X'47'	107	X'2B'	28	X'B6'	44	X'9F'	27	X'B9'	43	X'A3'
Row 12												
Port 1	28	X'B6'	44	X'9F'	60	X'76'	76	X'5C'	92	X'46'	108	X'2A'
Port 2	92	X'46'	108	X'2A'	29	X'B5'	45	X'9E'	28	X'B6'	44	X'9F'

Note: Loop IDs are given in decimal format and AL_PA values are given in hexadecimal format.

- [LUN Assignments for Ultrium and 3592 Tape Drives in the 3584 Tape Library](#)
- [LUN Assignments for DLT 8000 Tape Systems and Control Ports in the tape library](#)

LUN Assignments for Ultrium and 3592 Tape Drives in the 3584 Tape Library

In the 3584 Tape Library, the logical unit number (LUN) for the Sequential Access device is always LUN 0 of the drive. The LUN for the Medium Changer device is always LUN 1 (all other LUNs are invalid addresses). These devices are compatible with the SCSI-2 or SCSI-3 standard. For information about the SCSI commands for the tape drive and the library, go to the section about SCSI commands for the 3584 Tape Library or the *IBM LTO Ultrium Tape Drive SCSI Reference*.

LUN Assignments for DLT 8000 Tape Systems and Control Ports in the tape library

In the tape library, the logical unit number (LUN) for the Sequential Access device is always LUN 0 of the drive. The LUN for the Medium Changer device is always LUN 0 of each control port (all other LUNs are invalid addresses). These devices are compatible with the SCSI-2 or SCSI-3 standard. For information about the SCSI commands for the tape drive and the library, see the *Quantum DLT 8000 Tape System Product Manual* or this manual.

Status of Tape Library During Automatic Cleaning

For an overview of the methods that are supported for cleaning a drive in the tape library, see the section about cleaning the drive in the *TS4500 Introduction and Planning Guide*.

The design of automatic cleaning is intended to make the cleaning process as transparent as possible to any host application that is using the library. The library performs the following steps during an automatic cleaning process:

1. Detect the need and opportunity to clean a drive.
2. Move the cleaning cartridge from the storage cell to the drive.
3. Wait for the cleaning to complete (approximately 90 seconds for Ultrium Tape Drives and about 3 minutes for 3592 Tape Drives).
While you wait for the cleaning to complete, the tape library (medium changer) accepts and processes all SCSI commands except for a move to a drive that is being cleaned. Any command to move a data cartridge to a drive that is being cleaned is queued.

While an automatic cleaning is in progress, movement of the cleaning cartridge is not reflected in the element descriptors reported in response to a Read Element Status command. The Storage Element descriptor reported for the cleaning cartridge slot does not change while the cleaning cartridge is in a drive (indicates the FULL bit set to 1). Similarly, the Data Transfer Element descriptor reported for the drive that is cleaning does not change (indicates the FULL bit set to 0).

4. Move the cleaning cartridge from the drive to the storage cell.
5. Increment the cleaning cartridge usage counter.
This counter is used by the library to determine when the cleaning cartridge must be replaced. When the usage counter exceeds the recommended threshold, the library displays a warning message on the operator panel that indicates the need to replace the cleaning cartridge.

Cleaning Cartridge Presence Indicators in the Tape Library

The tape library can monitor up to 100 cleaning cartridges in the physical library for any supported method of cleaning. See the section about cleaning the drive in the *TS4500 Introduction and Planning Guide*. The presence of a library-monitored cleaning cartridge is indicated in the Storage Element descriptor of Read Element Status

data as follows:

- EXCEPT bit is set to **1**
- FULL bit is set to **1**
- ASC/ASCQ field is set to **30/03**
- The first, second, and third characters of the Primary Volume Tag field, if available, are set to **CLN** in ASCII

In addition, when automatic cleaning is enabled, the ACCESS bit is set to **0**; when automatic cleaning is disabled, the ACCESS bit is set to **1**.

While an automatic cleaning is in progress, movement of the cleaning cartridge is not reflected in the element descriptors. The Storage Element descriptor reported for the cleaning cartridge slot does not change while the cleaning cartridge is in a drive. Similarly, the Data Transfer Element descriptor reported for the drive that is cleaning does not change (indicates the FULL bit set to **0**).

While a host cleaning is in progress, movement of the cleaning cartridge is reflected in the element descriptors in the same manner as for a data cartridge.

Automatic Cleaning Enabled Indicator

In the tape library, you can enable or disable automatic cleaning from the operator panel or IBM® Tape Library Specialist web interface. The current setting can be detected by sending a SCSI Mode Sense command to the library (Medium Changer). Bit 2 of byte 2 in Mode Page 20 is set to **1** when automatic cleaning is enabled. This field cannot be changed by using Mode Select.

Note: The tape drive has no knowledge of the automatic cleaning setting and therefore, the drive does not suppress the cleaning indicators when automatic cleaning is enabled. It is recommended that the host application log these notifications rather than present them to the operator when automatic cleaning is enabled.

Drive Cleaning Indicators

Automatic cleaning of the drives by the tape library can be disabled (although it is not recommended). When automatic cleaning is disabled, the cleaning of the drives must be managed by the host application or manually by the operator.

Note: Failure to clean a drive might result in data loss.

For a description of how cleaning indicators are presented from the drive, see the applicable drive's SCSI command reference. The cleaning indicators might be presented even with automatic cleaning enabled in a library environment.

Library card information

This section provides information about the printed circuit cards that control the operation of the tape library.

- [Library Control Card \(LCC\) display codes](#)

The Library Control Card (LCC) in the TS4500 tape library has a 4 character display code. The display code provides status information for the card and library.

Library Control Card (LCC) display codes

The Library Control Card (LCC) in the TS4500 tape library has a 4 character display code. The display code provides status information for the card and library.

Boot-up process

When the LCC is reset, or the library is powered up the following codes are presented:

- FPGA version
EXXX: The XXX refers to the version of the chip that controls the hardware logic.
- Boot sequence countdown
Starting from FFFF, the display counts down to FFF0. Each change indicates a different step in the boot-up sequence.

Note: If an LCC display stays the codes EXXX or FXXX for more than 30 seconds, there is an internal LCC problem.

Determining the primary and cache LCC

Once the boot-up sequence is finished, the library selects which LCC will be the primary and which LCCs will be cache.

The display for primary LCC will toggle between two sets of codes.

1. If the LCC is plugged into slot A (the right-hand LCC slot in the card cage, from the perspective facing the back of the library), the display toggles between A0XX and 00AX.
 - a. The A in A0XX refers to the LCC slot position. The XX refers to the frame number.
 - b. The A in 00AX means that the LCC is primary. The X refers to the primary/cache negotiation step. This numeric number counts down and eventually remains at zero.
2. If the LCC is plugged into slot B (the left-hand LCC slot in the card cage, from the perspective facing the back of the library), the display toggles between B0XX and 00AX.
 - a. The B in B0XX refers to the slot position. The XX refers to the frame position.
 - b. The A in 00AX means that the LCC is primary. The X refers to the primary/cache negotiation step. This numeric number counts down and eventually remains at zero.

Final display codes

Once the primary LCC is selected and the library is running normally, you will see the following in the LCC display:

1. The primary LCC in the slot A will toggle between A0XX and 00AX. If there is a primary LCC in the B slot then it will toggle between B0XX and 00AX. The display for the primary/cache negotiation step will be zero.
Note: When the primary LCC displays code 00AX, there is a dot in the lower right side of the display. The dot helps you identify the primary LCC when an error code is also being displayed. For example, if there is a power error then 00AX is replaced by the HEC/HECQ code for that particular error.
2. The LCCs in slot A that are not primary will toggle between A0XX and 00C0. If there is a non-primary LCC in slot B then it will toggle between B0XX and 00C0. The C in 00C0 means that the LCC is cache and not primary.

Updating the library firmware

There are two codes that can appear when the library firmware is updated:

1. CFOX: This code means that a user is updating the library firmware. The X shows the update progress by a descending sequence (F, E, D...0).
2. CE0X: This code means the LCC is down level and is updating its firmware from the primary LCC. This update is not initiated by a user. As with the previous code, the X shows the update progress by a descending progress sequence (F, E, D...0) .

Notices

This section provides legal and regulatory information, such as electromagnetic compatibility notices, safety notices, and electronic emissions notices.

Note:

- The LED lighting in the HD frames is specifically designed for use only in the TS4500 tape library and is not suitable for other applications.
- At the following link, you will find the instructions for removing the battery from the DELL 7040/7050 PC:
<http://cdn.cnetcontent.com/b2/d2/b2d2788e-e86f-4ec8-b5d6-8a1d926c0791.pdf>
- [Agency and power rating labels](#)
Each Lx5, Dx5, and Sx5 frame is equipped with two permanent labels – an agency label and a power rating label.
- [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.
- [Environmental notices](#)
This information contains all the required environmental notices for IBM Systems products in English and other languages.
- [Homologation statement](#)
This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Contact an IBM representative or reseller for any questions.
- [Trademarks](#)
- [Technical Documentation for Product Conformance for Regulation EU No 1194/2012 of 12 December 2012](#)
Implementing EU Directive 2009/125/EU of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment. 2013-09-01
- [Electromagnetic compatibility notices](#)
The following Class A statements apply to IBM products and their features unless designated as electromagnetic compatibility (EMC) Class B in the feature information.

Agency and power rating labels

Each Lx5, Dx5, and Sx5 frame is equipped with two permanent labels – an agency label and a power rating label.

The agency label provides legal and regulatory information about the frame. The agency label also includes the serial number label. The power rating label provides the power requirements for that frame model. These labels are installed by manufacturing and must not be removed.

The following figures provide an example of each label:

- [Figure 1](#) – Example agency label
- [Figure 2](#) – Example power rating label, L25 frame
- [Figure 3](#) – Example power rating label, L55 frame
- [Figure 4](#) – Example power rating label, D25 frame
- [Figure 5](#) – Example power rating label, D55 frame
- [Figure 6](#) – Example power rating label, S25 frame
- [Figure 7](#) – Example power rating label, S55 frame

The following figures show where the labels are located in each frame model:

- [Figure 8](#) – Location of agency label and power rating label, Lx5/Dx5 frames
- [Figure 9](#) – Location of agency label and power rating label, Sx5 frame

Figure 1. Example agency label

IBM Registered Trademark of International Business Machines Corporation
New Orchard Road Armonk, New York 10504
http://www.ibm.com/customer-support/
Marca Registrada

Made in Mexico
墨西哥制造

製造商/製造商 IBM Corporation

IBM Deutschland GmbH
Technical Relations Europe
IBM-Allee 1 D-71139 Ebnlingen GDL

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

Place s/n label here

Licensed Internal Code - Property of IBM
©Copyright IBM Corp. 2017. All rights reserved.
US Government Users Restricted Rights. Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Apparaten skall anslutas till jordat uttag
Apparatet må tilkoples jordet stikkontakt
Laite on liitettävä suojakoskettimilla varustettuun pistorasiaan
Apparatets stikprop skal tilsluttes en stikkontakt med jord, som giver forbindelse til stikproppens jord

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

仅适用于海拔两千米以下地区安全使用。
仅适用于非热带气候条件下安全使用。
This machine is manufactured from new parts or new and used parts.
CAN ICES-3 (A)/NMB-3(A)

 D33026
RoHS

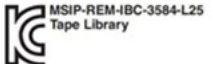

   

PN 02CE195 EC M14081

Figure 2. Example power rating label, L25 frame

PN 02XV429

型號 MT MODEL
型号 3584-L25
磁帶庫 / 磁帶庫 Tape Library

		with FC 1951	with FC 1952	with FC 9948	
額定電壓	200 - 240	200 - 240	200-240	380-415	V [~] 額定電壓
額定電流	8	24	24	20	A 額定電流
額定頻率	50/60	50/60	50/60	50/60	Hz 額定頻率
	2W+G	2W+G	2W+G	3W+N+PE	

Figure 3. Example power rating label, L55 frame

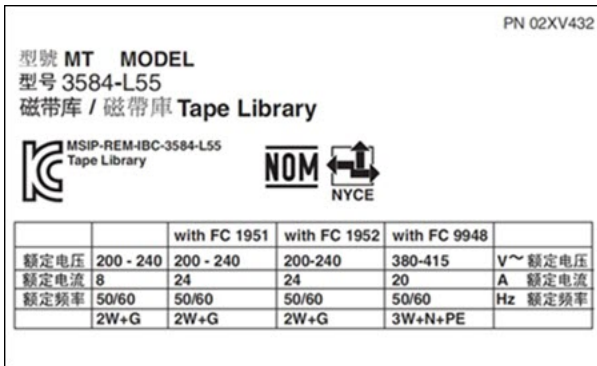


Figure 4. Example power rating label, D25 frame

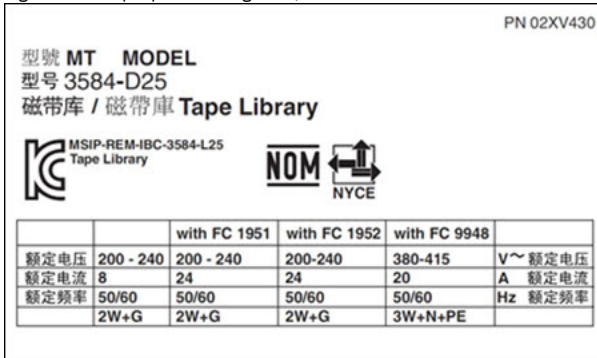


Figure 5. Example power rating label, D55 frame

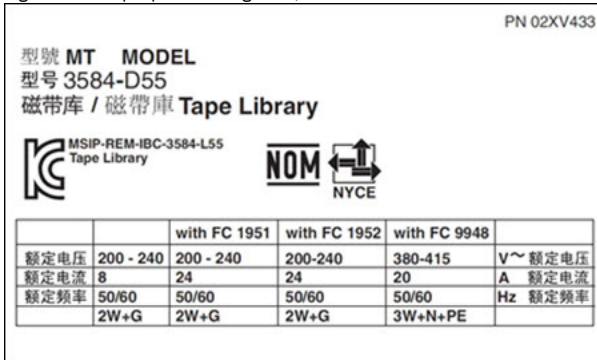


Figure 6. Example power rating label, S25 frame

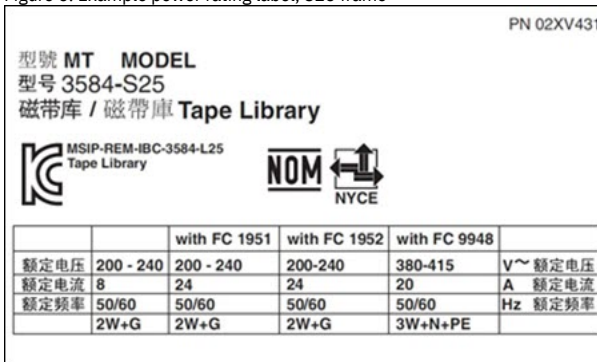
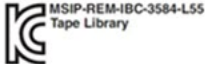



Figure 7. Example power rating label, S55 frame

PN 02XV434

型號 MT MODEL
 型号 3584-S55
 磁带库 / 磁帶庫 Tape Library

	with FC 1951	with FC 1952	with FC 9948	
额定电压	200 - 240	200 - 240	380-415	V~ 额定电压
额定电流	8	24	20	A 额定电流
额定频率	50/60	50/60	50/60	Hz 额定频率
	2W+G	2W+G	2W+G	3W+N+PE

Figure 8. Location of agency label and power rating label, Lx5/Dx5 frames



Figure 9. Location of agency label and power rating label, Sx5 frame



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. This manual is on the publications CD-ROM that is shipped with the product.

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

Danger notice

A danger notice is a special note in the text that calls attention to a situation that is potentially lethal or extremely hazardous to people. A sample danger notice follows:



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 is a special note in the text that 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.
	A hazardous condition due to mechanical movement in or around the product.
	This part or unit is heavy, with a weight greater 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 a lithium ion battery. To avoid possible explosion, do not burn. (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)

Attention notices

Attention:

This product is not intended to be connected directly or indirectly by any means whatsoever to interfaces of public telecommunications networks.

Environmental notices

This information contains all the required environmental notices for IBM® Systems products in English and other languages.

The [IBM Systems Environmental Notices](https://www.ibm.com/docs/environmental-safety?topic=environmental-safety-notices) (<https://www.ibm.com/docs/environmental-safety?topic=environmental-safety-notices>) information includes statements on limitations, product information, product recycling and disposal, battery information, flat panel display, refrigeration and water-cooling systems, external power supplies, and safety data sheets.

Homologation statement

This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Contact an IBM representative or reseller for any questions.

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Linear Tape-Open, LTO, the LTO Logo, Ultrium, and the Ultrium logo are trademarks of HP, IBM Corp. and Quantum in the U.S. and other countries.

Technical Documentation for Product Conformance for Regulation EU No 1194/2012 of 12 December 2012

Implementing EU Directive 2009/125/EU of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment. 2013-09-01

The following information is based on IBM's knowledge as of the date of this document, which may be based on its records and information from third parties. This documentation applies to finished products that IBM newly puts on the market in the European Union and other jurisdictions which require this Technical Documentation as of the above date.

Table 1. Product Information

Machine Type	Model(s)	Part Number	Marketing Name
3584	L25, L55, D25, D55, S25, S55, S24, S54	12X4505	TS3500 or TS4500

This LED lighting assembly is intended to illuminate the inside of the TS4500 tape library. The LED lighting assembly is powered from the TS4500 Tape Library power supply. It is a special purpose product specifically designed for use in the TS4500 and is not suitable for other applications.

Figure 1. Label for the LED light assembly



Figure 2. The year of manufacture is found on a separate label on the product

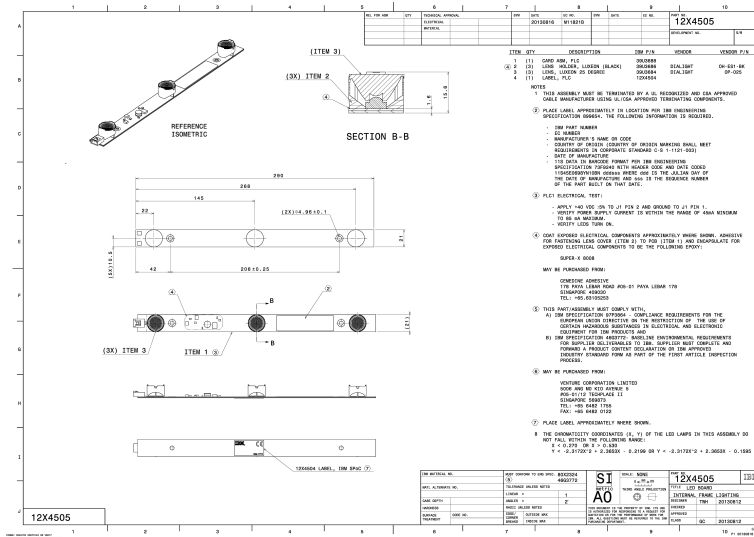


Chromaticity: This product does not fall within the chromaticity coordinates outlines in the Annex I of 1194/2012.

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Figure 3. 12X4505 - LED Board



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- [European Community and Morocco Notice](#)
- [Germany Notice](#)
- [Japan Electronics and Information Technology Industries Association \(JEITA\) Notice](#)
- [Japan Voluntary Control Council for Interference \(VCCI\) Notice](#)
- [Korea Notice](#)
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- [Russia Notice](#)
- [Taiwan Notice](#)
- [United States Federal Communications Commission \(FCC\) Notice](#)

Canada Notice

CAN ICES-3 (A)/NMB-3(A)

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Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

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Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55032 Klasse A ein.

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Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC Richtlinie 2014/30/EU) für Geräte der Klasse A

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Verantwortlich für die Einhaltung der EMV-Vorschriften ist der Hersteller:

International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:

IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 800 225 5426
e-mail: Halloibm@de.ibm.com

Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55032 Klasse A.

Japan Electronics and Information Technology Industries Association (JEITA) Notice

(一社) 電子情報技術産業協会 高調波電流抑制対策実施
要領に基づく定格入力電力値 : IBM Documentationの各製品
の仕様ページ参照

This statement applies to products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

This statement applies to products greater than 20 A, single phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

- 回路分類：6（単相、PFC回路付）
- 換算係数：0

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VCCI – A

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020001

Taiwan Notice

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台灣國際商業機器股份有限公司
台北市松仁路7號3樓
電話：0800-016-888

12c00780

United States Federal Communications Commission (FCC) Notice

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

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM® is not responsible for any radio or television interference caused by using other than recommended cables and connectors, or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device might not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.

Responsible Party:
International Business Machines Corporation
New Orchard Road
Armonk, NY 10504
Contact for FCC compliance information only: fccinfo@us.ibm.com

Additional information

This section contains miscellaneous reference information, such as a discussion of the units used to express data storage values. This section also provides a list of additional publications and a glossary.

- [Data storage values](#)
Data storage values are displayed using both decimal (base-10) prefixes and binary (base-2) units of measurement.
- [Additional publications and resources](#)
This topic lists sources for additional information about the IBM TS4500 tape library and its associated products.
- [Glossary](#)
This glossary defines the special terms, abbreviations, and acronyms that are used in this publication and other related publications.

Data storage values

Data storage values are displayed using both decimal (base-10) prefixes and binary (base-2) units of measurement.

Decimal units such as K, MB, GB, and TB are commonly used to express data storage values, though these values are more accurately expressed by 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 TS4500 tape library documentation represents data storage using both decimal and binary units. Data storage values are displayed by using the following format:

decimal unit (binary unit)

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

512 TB (465.6 TiB)

[Table 1](#) compares the names, symbols, and values of the binary and decimal units. [Table 2](#) shows the increasing percentage of difference between binary and decimal units.

Table 1. 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

Decimal			Binary		
Name	Symbol	Value (base-10)	Name	Symbol	Value (base-2)
exa	E	10 ¹⁸	exbi	Ei	2 ⁶⁰

Table 2. 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%

Additional publications and resources

This topic lists sources for additional information about the IBM® TS4500 tape library and its associated products.

Planning and implementation

- [IBM TS4500 Introduction and Planning Guide \(SC27-5990\)](#)
- [IBM System Storage 3592 Tape Drives and TS1120 Controller Introduction and Planning Guide \(GA32-0555\)](#)
- [The IBM TotalStorage Tape Libraries Guide for Open Systems \(SG24-5946\)](#)
- [Implementing IBM Tape in Linux and Windows](#) (Redbook, SG24-6268)
- [Implementing IBM Tape in Unix Systems](#) (Redbook, SG24-6502)

Compatible software, operating systems, and servers for tape drives

- [Independent software vendor matrix \(ISV\) for 3592 \(1120 and later\) and LTO tape drives](#)

Tape device drivers

- [IBM Tape Device Drivers and Diagnostic Tool User's Guide](#)
- [IBM Tape Device Drivers Programming Reference](#)

Tape cartridge label specifications

- [IBM LTO Ultrium Cartridge Label Specification](#)
- [Barcode label specification for use with 3592 tape media](#)

IBM System Console

- [IBM TS3000 and TS4500 System Console Maintenance Information \(PN 2727119\)](#)

SCSI

- [TS4500 SCSI Reference](#)
- [IBM 3592 Tape Drive SCSI Reference \(GA32-0466\)](#)
- [IBM TotalStorage LTO Ultrium Tape Drive SCSI Reference \(GA32-0450\)](#)

IBM TS7700

- [IBM TS7700 customer documentation](#)
Select Select a product_>...TS7700

IBM Security Key Lifecycle Manager

- [IBM Security Key Lifecycle Manager](#) (formerly Tivoli® Key Lifecycle Manager)
Select Select a product_>...IBM Security Key Lifecycle Manager

Safety notices

- [Systems Safety Notices](#) (G229-9054)
To access, register for a user ID and password, then select Library in the navigation area.

Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication and other related publications.

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

If you do not find the term that you are looking for, see the [IBM Terminology](#) web site.

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 *Linear Tape-Open*.

3592 Tape Controller Model J70

See IBM® 3592 Tape Controller Model J70.

3593 Tape System

The IBM 3593 Tape Frame Model F05 and the IBM 3593 Library Manager Model L05.

A

A

Ampere.

AAP

See *authorized assembler program*.

ac

See *alternating current*.

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 tape library for normal operation.

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 that was 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 TS4500 management GUI. Logical libraries can also be added, deleted, or easily changed without disruption.

aggregate sustained data transfer rate

For all of the drives in the tape library, 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 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 1 coulomb per second, or to the current produced by 1 volt applied across a resistance of 1 ohm.

Arbitrated Loop Physical Address (AL_PA)

An 8-bit value that is 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 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 their customers.

automatic cleaning

A method by which the library automatically responds to any tape drive's request for cleaning by beginning the cleaning process.

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 the speed of the drive, the action of stopping the tape, rewinding some distance, and restarting.

backup

The short-term retention of records that are used for restoring essential business and system files when vital data is 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 that bears 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

On the dual-gripper transport mechanism of the library, a laser device that is 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 tape library. The base frame is distinguished from an expansion frame by its I/O stations and display panel. The base frame includes a rail assembly for the cartridge accessor and up to 16 tape drives.

beacon light-emitting diode (LED)

An LED on any frame with an I/O station that is used to identify a frame that is in service or needs service, or to identify a frame for other reasons to someone at the storage library.

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 that is required to raise the temperature of one pound of water 1 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 that consists of a 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

On the cartridge accessor of the TS4500 tape library, the component that provides the means to find certain positions within the library precisely during the calibration operation.

Call Home

A feature that allows the 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

Applies only to the base frame of the TS4500 tape library. The cartridge storage slots that are on the interior of the front door and enabled for more 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 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 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 TS4500 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 on the pivot assembly of the accessor. One gripper can grip a single cartridge.

cartridge inventory time
The amount of time that is required for the 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 that is 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 TS4500 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.

cell top cap
On each column of the storage slots within the TS4500 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 that are 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 TS4500 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 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 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 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 the use of electrical coils that carry 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 that is 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*.

disable

To make nonfunctional.

door safety switch

On each frame of the TS4500 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

On the cartridge accessor of the TS4500 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.

element address

The SCSI term for the host's view of a cartridge location.

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 that is written to and decrypt information that is read from tape media.

enhanced node cards

Node cards with increased synchronous dynamic and nonvolatile random-access memory (RAM).

error-recovery procedures (ERP)

Procedures that are 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.

expansion frame

A unit that can be added to the base frame of the TS4500 tape library. The expansion frame includes a rail assembly for the cartridge accessor and up to 16 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 capable of interconnecting LTO tape drives and 3592 tape drives to servers that 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 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 that deal 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 that are 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).

firmware

Proprietary code that is 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 that are 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 consists of one Library Control Card (LCC), internal library communication cables, and two 12 V power supplies.

front door

At the front of each frame in the TS4500 tape library, the swinging barrier by which entry is closed or opened to the frame.

FRU

See *field replaceable unit*.

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 that is 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 is transmitted by SNMP.

get-response

The information that is provided in response to an SNMP get request.

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 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 the 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 can be installed in the leftmost position (frame 1) of the library and can be utilized as an integrated service bay. All expansion frames that are installed to the left of the TS4500 base frame, or that are serving as a TS4500 service bay, must be HD2 frames. 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 that is 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.

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 they create 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*.

Hz

Hertz.

I

IBM 3592 Tape Controller Model J70

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 tape library.

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 18 frames and 128 drives.

IBM TotalStorage™ 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.

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 that contain the structure information. All former contents of the tape are lost.

initializing

The act of performing an inventory on the TS4500 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

Two compartments on the front door of the TS4500 tape library 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 tape library when the ac line voltage is first applied.

insert

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)

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 that is prepared by another system.

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.

Kerberos
A network authentication protocol that allows nodes communicating over a non-secure network to prove their identity to one another in a secure manner. It is designed to provide strong authentication for client/server applications by using secret-key cryptography.

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 that are 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*.

LDAP
See *lightweight directory access protocol*.

leader pin
On the LTO tape cartridge and 3592 tape cartridge, a small metal column that is attached to the end of the magnetic tape. During the processing of the tape, 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
One of four screw-operated jacks on the bottom of the tape library for raising or lowering the library.

library frame
The basic unit of the TS4500 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
A button on the front of the tape library that switches power 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 that are used to access information directories. LDAP, an open protocol, is based on the standards that are contained within the X.500 standard, but is 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 that was 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 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.

load

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 is 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 that is 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 might 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
A set of tape drives and tape cartridges 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 tape library so that its robotics are shared by homogenous (similar) and heterogeneous (dissimilar) servers. The tape library can be partitioned into individual logical libraries that independently communicate with individual servers using individual control paths.

logical unit number (LUN)
A number that is 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 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.

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*.

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, or communications configuration. A collection of related MIB objects is defined as an MIB. The 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 TS4500 management GUI to perform the cleaning procedure on one or more 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 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 two-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; **I**, **U**, **V**, and **W** represent different generations of WORM cartridges.

medium
A physical material in or on which data might be represented, such as magnetic tape.

Medium Changer Device
In SCSI terms, an instrument that moves removable storage units from and to storage slots and tape drives. The TS4500 tape library is a Medium Changer Device.

megabyte (MB)
1 × 10⁶ bytes.

metal-particle tape

In the LTO and 3592 tape cartridges, tape that uses 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 - 250 GB.

mixed drive types

The concept of using both LTO and 3592 tape cartridges in a 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 might be inserted or removed from the library through the base frame, if 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 that is 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

One of four circuit assemblies (accessor controller card, motor driver assembly, Medium Changer card pack, and operator panel assembly) within the TS4500 tape library that communicate with each other.

nominal

Approximate.

nominal power

The amount of power (in kilowatts) that the tape library dissipates during normal operation.

non-addressable cartridge storage slot

See *inaccessible cartridge storage slot*.

non-disruptive firmware update

The ability to update drive or library firmware without scheduling downtime. A non-disruptive update can be performed for TS4500 tape 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 TS4500 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 1 ampere per 4π centimeters of axial length.

operating environment

The temperature, relative humidity rate, and wet bulb temperature of the room in which the tape library routinely conducts the processing.

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

An optional unit that houses the fiber cable connections between the servers and the individual drives. Located at the rear of the base or expansion frame in a TS4500 tape library.

Pause key

A button on the TS4500 tape library display panel 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 button enables quick recovery when you power on the library or close the front door.

PB

Petabyte.

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

A group of parts on the cartridge accessor that provides a mounting platform for the gripper mechanism and the bar code reader. The pivot assembly can rotate 180° 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.

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 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 is applied to it.

power-on indicator

A green light above the power button that, when lit, indicates that dc power is available within the TS4500 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 that are used for managing a network, transferring data, and synchronizing the states of network components.

put

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

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 tape library is in when the host applications can interact with it.

recursive accumulating backhitchless flush (RABF)
A non-volatile caching technique that are 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 another externally encrypted data key. The cartridge can then be shipped to a business partner that holds the corresponding private key that allows the data key to be unwrapped and the tape can be decrypted on a different encryption-capable 3592 tape drive.

relative humidity
The ratio of the amount of water vapor 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, and tips on how to deal with the problems.

remove
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 tape library.

RS-422 interface
An electrical interface standard that is 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 encryption-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 tape library to the SCSI interface. 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 that 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 by using the internet. SSL uses a cryptographic system that uses two keys to encrypt data - a public key that is known to everyone and a private or secret key that is 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

The space that is required for an IBM Service Representative to perform maintenance on the tape library.

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 needs to know the description of the service that he is interested in only. SLP is then able to return the URL of the service that the user wants.

service ratings

The values for criteria that is 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 tape library.

shipping environment

The temperature, relative humidity rate, and wet bulb temperature of the environment to which the 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 to access cartridges in higher tiers.

Simple Network Management Protocol (SNMP)

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

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 that is 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 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.

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 is 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 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 are 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 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 started 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 TS4500 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 can 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 that contains 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 that reside 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 tools provided by the IBM TS3000 system console (TSSC), an externally rack-mounted system console.

target

A SCSI device that performs an operation that is 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 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 that is 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 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)

A software solution that manages storage infrastructures in Open Systems environments.

topology

In communications, the physical or logical arrangement of nodes in a network, especially the relationships among nodes and the links between them.

Total Productivity Center (TPC)

See *IBM Total Productivity Center*.

TPC

See *IBM Total 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 might not use the same protocol and communicate by using a switch.

two-phase power

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*.

unload

A term that is 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.

V

V

Volt.

V ac

Volts ac (alternating current).

vital product data (VPD)

Information about a product, such as a library, drive, or node card. The VPD might 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

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 that is carrying a constant current of 1 ampere, when the power dissipated between these points is equal to 1 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 that is required to keep a current of 1 ampere flowing under a potential drop of 1 volt; about 1/736 of 1 horsepower.

wet bulb temperature

The temperature at which pure water must be evaporated adiabatically at constant pressure into a sample of air 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 that is assigned to a device by its manufacturer and used to identify participants in a topology. The World Wide Node Name is unique if the manufacturer 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.

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 the data is written, it 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

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

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 might be physically isolated from traffic outside the zone.