Dell PowerVault TL1000 Tape Autoloader

User's Guide

Note

Information in this document is subject to change without notice.

Type: 3572 Model: S3H/S4H/S5H/S6H/S7H/S8H/S9H

Contents

Figures

Tables

Safety and environmental notices

Safety and environmental notices for this product are shown and described.

Safety notices

Observe the safety notices when this product is used. 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).

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

Danger notice

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

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

Caution notice

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

If the symbol is...	It means...
	A hazardous electrical condition with less severity than electrical danger.
	A hazardous condition that is not represented by other safety symbols.
Class I	This product contains a Class II laser. Do not stare into the beam. (*C029*) Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II).
	A hazardous condition due to mechanical movement in or around the product.
> 18 kg (40 lb)	This part or unit is heavy but has a weight smaller than 18 kg (39.7 lb). Use care when lifting, removing, or installing this part or unit. (*C008*)

If the symbol is...	It means...
	A hazardous condition due to the unit's susceptibility to electrostatic discharge.

Laser safety and compliance

Table 1. Class I Laser Product

Class I

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

Performing the safety inspection procedure

Before you service the unit, complete the following safety inspection procedure.

1. Stop all activity between the host and the library's tape drive.
2. Turn off the power to the library by switching the **Power** button on the rear of the tape library to the Off position.
3. Disconnect the tape drive's SAS cable.
4. Unplug the library's power cord from the electrical outlet and the library's power supply unit.
5. Check the library's power cords for damage, such as a pinched, cut, or frayed cord.
6. Check the tape drive's SAS cable for damage.
7. Check the cover of the library for sharp edges, damage, or alterations that expose its internal parts.
8. Check the cover of the library for proper fit. It should be in place and secure.
9. Check the product label at the rear of the library to make sure that it matches the voltage at your outlet.

Rack safety

The following general safety information must be used for all rack-mounted devices.

DANGER

Observe the following precautions when working on or around your IT rack system.

- Heavy equipment - personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet.

- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices. In addition, do not lean on rack mounted devices and do not use them to stabilize your body position (for example, when working from a ladder).

- Each rack cabinet might have more than one power cord.
  - For AC powered racks, be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
  - For racks with a DC power distribution panel (PDP), turn off the circuit breaker that controls the power to the system unit(s), or disconnect the customer's DC power source, when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the 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. (R001 part 1 of 2)

Caution

- Do not install a unit in a rack where the internal rack ambient temperatures might exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit that is used for air flow through the unit.
- Consideration must be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels on the equipment in the rack to determine the total power requirement of the supply circuit.
- (For sliding drawers) Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.

- (For fixed drawers) This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack. (R001 part 2 of 2)

Caution

Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building:

- Reduce the weight of the rack cabinet by removing equipment, starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must do the following:

  - Remove all devices in the 32U position (compliance ID RACK-001) or 22U (compliance ID RR001) and above.

  - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.

  - Ensure that there are little-to-no empty U-levels between devices installed in the rack-cabinet below the 32U (compliance ID RACK-001) or 22U (compliance ID RR001) level, unless the received configuration specifically allowed it.

- If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.

- If the rack cabinet you are relocating was supplied with removable outriggers, they must be reinstalled before the cabinet is relocated.

- Inspect the route that you plan to take to eliminate potential hazards.

- Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.

- Verify that all door openings are at least 760 x 2032 mm (30 x 80 in.).

- Ensure that all devices, shelves, drawers, doors, and cables are secure.

- Ensure that the four leveling pads are raised to their highest position.

- Ensure that no stabilizer bracket is installed on the rack cabinet during movement.

- Do not use a ramp that is inclined at more than 10 degrees.

- When the rack cabinet is in the new location, complete these steps.

  - Lower the four leveling pads.

  - Install stabilizer brackets on the rack cabinet or in an earthquake environment bolt the rack to the floor.

  - If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.

- If a long-distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also, lower the leveling pads to raise the casters off the pallet and bolt the rack cabinet to the pallet. (R002)

- **DANGER:** Racks with a total weight of > 227 kg (500 lb.), Use Only Professional Movers! (R003)

Caution

- Rack is not intended to serve as an enclosure and does not provide any degrees of protection required of enclosures.

- It is intended that equipment installed within this rack will have its own enclosure. (R005)

- Tighten the stabilizer brackets until they are flush against the rack. (R006)

- Use safe practices when lifting. (R007)

- Do not place any object on top of a rack-mounted device unless that rack-mounted device is intended for use as a shelf. (R008)

- If the rack is designed to be coupled to another rack only the same model rack should be coupled together with another same model rack. (R009)

Danger
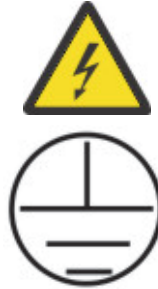
Main Protective Earth (Ground): This symbol is marked on the frame of the rack. The PROTECTIVE EARTHING CONDUCTORS must be terminated at that point. A recognized or certified closed loop connector (ring terminal) must be used and secured to the frame with a lock washer using a boltor stud. The connector must be properly sized to be suitable for the bolt or stud, the locking washer, the rating for the conducting wire used, and the considered rating of the breaker. The intent is to ensure the frame is electrically bonded to the PROTECTIVE EARTHING CONDUCTORS. The hole that the bolt or stud goes into where the terminal connector and the lock washer contact must be free of any non-conductive material to allow for metal to metal contact. All PROTECTIVE BONDING CONDUCTORS must terminate at

this main protective earthing terminal or at points marked with ⏚ . (R010)

Always ensure that a load of 95 kg (210 lb) is inside the bottom of the rack (compliance ID RR001), especially before relocating or servicing units with their Center of Gravity (CoG) higher than 22U. (R011)

Preface

This manual contains information and instructions necessary for the installation, operation, and servicing of the Dell™ PowerVault™ TL1000 Tape Library.

Chapter 1. Overview

The overview of the features and functions of the Dell™ PowerVault™ TL1000 Tape Autoloader is useful for high-level evaluation of the product and planning for the implementation of the product.

Introduction

The Dell™ PowerVault™ TL1000 Tape Autoloader provides compact, high-capacity, low-cost solutions for simple, unattended data backup.

Figure 1. TL1000 Tape Autoloader

The library has a compact 1U form factor with easy access to tape cartridges with a removable magazine. It is equipped with a Serial Attached SCSI (SAS) host adapter attachment that has a data transfer rate of up to 12 Gbps. The TL1000 Tape Autoloader is a rack-mountable unit that incorporates one of following tape drives:

- Ultrium 9 Half-Height Tape Drive (Model S9H)
- Ultrium 8 Half-Height Tape Drive (Model S8H)
- Ultrium 7 Half-Height Tape Drive (Model S7H)
- Ultrium 6 Half-Height Tape Drive (Model S6H)
- Ultrium 5 Half-Height Tape Drive (Model S5H)

The library provides the following capabilities:

- Remote management with the Web User Interface
- LCD display for local management
- Mixed media support
- Removable tape magazine
- Configurable I/O station
- Random and sequential logical library modes
- Remote monitoring with Simple Network Management Protocol (SNMP)
- System and library managed encryption
- Adherence to Linear Tape-Open (LTO) specifications

Components

The library has a compact 1U form factor that houses a Operator Panel, cartridge magazine, power supply, accessor, and bar code reader. The sections that follow provide an illustration of the main components of the library.

Front panel
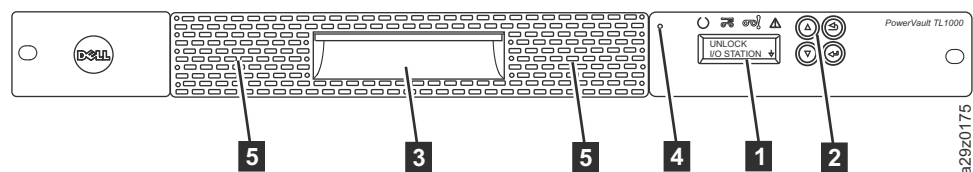
Figure 2. Front panel components

Number	Component	Description
1	Operator Panel	The Operator Panel features a monochrome 16-character LCD graphic display that is on the front of the library. Library operations and service functions are completed from this screen. The Web User Interface offers some of the same functionality as the Operator Panel with a web browser for remote access to the library. For information about the Operator Panel and the Web User Interface, see "User interfaces" on page 5.
2	Control keys	The control keys are located to the right of the Operator Panel LCD display on the front of the library.
3	Cartridge magazine	The tape library has a single cartridge magazine that can hold up to nine data cartridges, or eight data cartridges with a configurable one-slot I/O station. See Figure 4 on page 4. Column 5/Tier 1 in the cartridge magazine can be configured as a one-slot I/O station. Column 5/Tier 2 in the cartridge magazine is reserved for the exchange position and can be accessed by the library only. The I/O station is used to import and export cartridges without interrupting normal library operation. Beginning with Column 4, a minimum of one column can be reserved for cleaning cartridges. Cleaning cartridges are used to clean the tape drive heads. For configuration details, see Chapter 3, "Installing," on page 20.
4	Cartridge magazine release	Emergency cartridge magazine lock release. When the I/O station is locked, insert a large, straightened paper clip twice or hold the paper clip in place while the cartridge magazine slides past the I/O station lock.
5	Air vents	These vents draw cooler air into the library enclosure and allow warm air to escape which helps to keep the library at a normal operating temperature.

Table 2. Front panel component descriptions

Rear panel

Figure 3. Rear panel components

Number	Component	Description
1	Power connector	The library connects to a 110/220 volt ac power supply.
2	Power switch[1]	The library is powered ON/OFF with the power supply switch present on the rear panel. The library has no independent power switch on the front panel. Before powering OFF the library, ensure that the library is in an idle state with no mechanical movement of the accessor. Also, ensure that all the data operations like backup operations, accessing of log files are complete.
3	SAS host interface connector	Serial-attached SCSI host interface cable connection. The connector type depends on the host bus adapter and the drive generation. The LTO-9 tape drive uses a Mini-SAS HD connector cable and (LTO-4 to LTO-8) tape drive uses a Mini-SAS connector cable.
4	Ethernet port	This port is used to connect the library to a network.
5	Accessor locking screw[2]	The accessor locking screw is used to lock the accessor in place during transportation.
6	Air vent	These vents allow air to escape from the power supply and tape drive sled.

Table 3. Rear panel component descriptions

Important:

1. • If you power OFF the library while the library is being accessed, loss of data might occur.
   • When power cycling the library, wait 10 seconds after the power is turned OFF before the library is powered ON again.
2. Remove the accessor locking screw before the library is powered ON.

Cartridge magazine

The library has a single 10-position removable cartridge magazine, providing a maximum of nine data cartridge positions, or a maximum of eight data cartridge positions with a configurable 1-slot I/O station. One position is reserved as the tape drive exchange position and can be accessed by the library only.
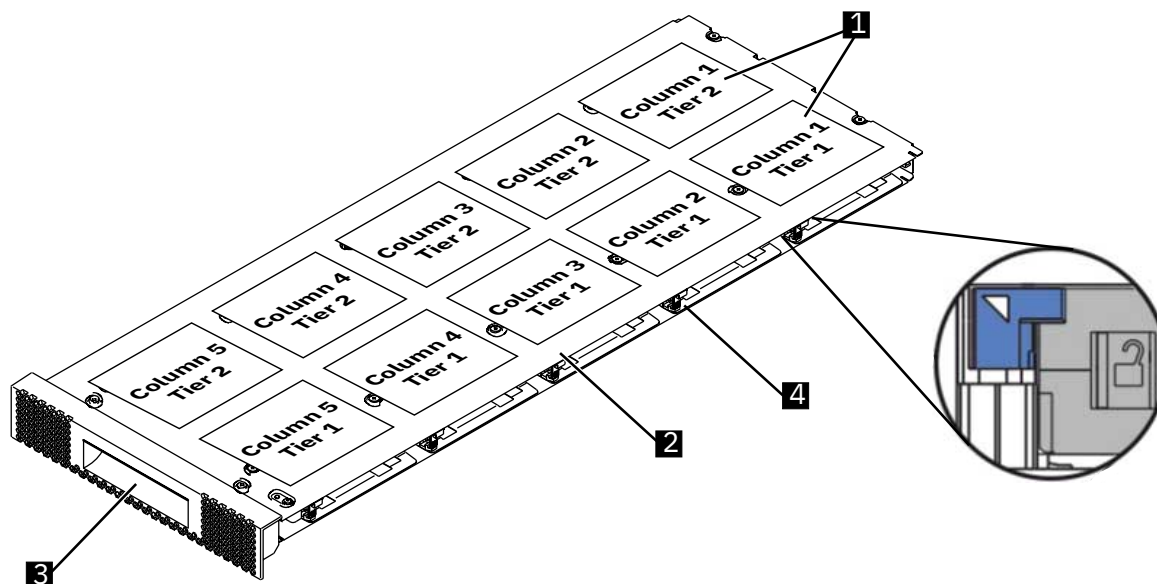
Figure 4. Cartridge magazine

Cartridge magazine components			
[1]	Cartridge locations as they appear in the Library Map[1].	[2]	Cartridge magazine[2]
[3]	Magazine handle	[4]	Blue release gate[3]

Note:

1. These labels are for reference only and do not display on the magazine.
2. If the cartridge magazine is not removed within 5 minutes, it is locked automatically.
3. A blue release gate in the upper left corner of each column in the cartridge magazine prevents each cartridge from falling out of the front of the magazine. When manually releasing the gate with one hand, position your other hand in front of the column opening to protect cartridges that are ejected by the internal column spring.

Figure 5 on page 4 shows the cartridge location label [1], and ruler [2] that appear on the cartridge magazine. The ruler provides an indication of the distance, when the magazine is opened or withdrawn, to the end of the magazine before it clears the front edge of the library. To prevent dropping the magazine, support both ends of the magazine before it clears the front edge of the library.
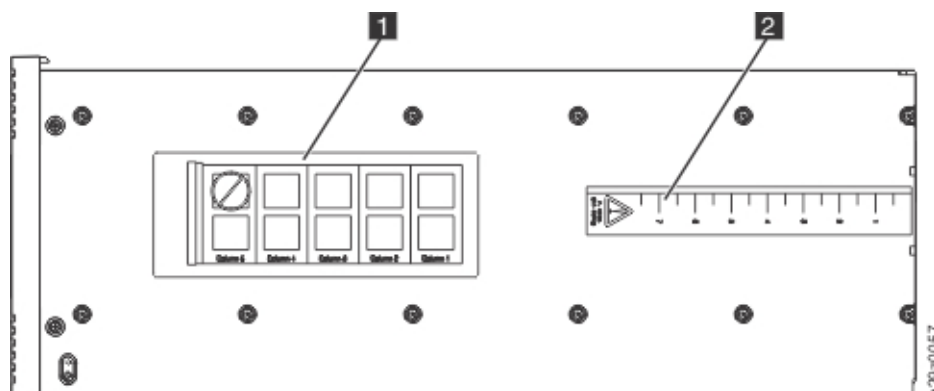
Figure 5. Cartridge magazine (top view)

Location coordinates and element addresses

The library incorporates patented high-density (HD) slot technology, which allows multiple cartridges to be stored in a tiered architecture. The depth of a cartridge location in a high-density slot is known as a tier. High-density slots are designed to contain multiple cartridges in Tiers 1 and 2.

Note: Each column has a spring-loaded mechanism that pushes a tape cartridge into Tier 1 when it is the only cartridge in that column. A single cartridge in a column takes on the Tier 2 element address even though it is physically in Tier 1.
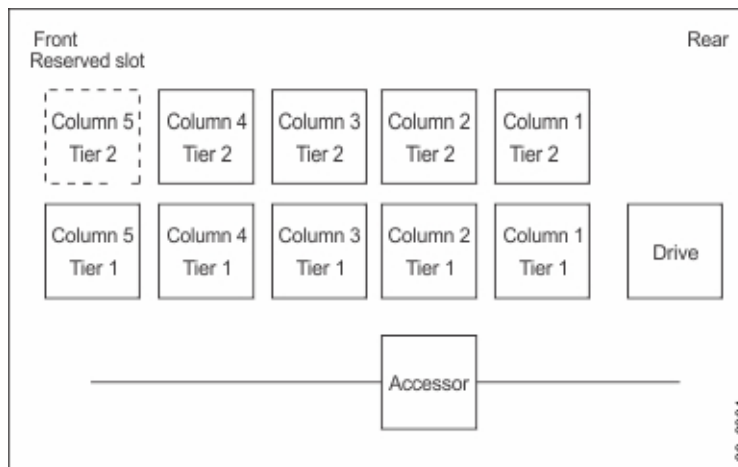
Figure 6. Location coordinates

A storage element address is assigned to each cartridge at the time the cartridge is inserted. Storage element addresses in the range 4097 - 4105 (0x1001 to 0x1009) when the I/O station is not enabled, and 4097 - 4104 (0x1001 to 0x1008) when the I/O station is enabled.

Bar code reader

The bar code reader is a part of the library accessor. The bar code reader reads each cartridge bar code label that identifies the types of cartridge magazines and tape drive that is installed in the library. It also provides inventory feedback to the host application, Operator Panel, and Web User Interface. The library stores the customized inventory data in memory. Library firmware supports a 6 or 8-character volume serial number (VOLSER) on the bar code label on the tape cartridge.

User interfaces

The library has two user interfaces: the Web User Interface and the Operator Panel.

- "The Web User Interface" on page 32
  The Web User Interface allows users and administrators to view and perform some library functions from remote sites. The Web User Interface can also be used to update the library and drive firmware, and to download error logs, drive memory dumps, and other library data.
- "The Operator Panel" on page 53
  The Operator Panel is on the front of the library and allows users to work locally on the library. The Operator Panel displays library information and menu commands that are used to run library management functions in response to the control keys on the right of the LCD display.

Supported tape drives

The library supports a half-height tape drive with Serial Attached SCSI (SAS) interface.

Table 4 on page 6 lists the supported tape drives.

Table 4. Supported tape drives

Generation	LTO-9	LTO-8	LTO-7	LTO-6	LTO-5
Inquiry	ULT3580-HH9 ULTRIUM-HH9	ULT3580-HH8 ULTRIUM-HH8	ULT3580-HH7 ULTRIUM-HH7	ULT3580-HH6 ULTRIUM-HH6	ULT3580-HH5 ULTRIUM-HH5
Interface (speed)	12 Gbps SAS	6 Gbps SAS	6 Gbps SAS	6 Gbps SAS	6 Gbps SAS
Native data rate	300 MB/s (L9) 300 MB/s (L8)	300 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 (L9, L8, L7, and L6 compressed at 2.5:1 compression; L5 and earlier compressed at 2:1 compression)[1]	720 MB/s (L9) 720 MB/s (L8)	600 MB/s (L8) 540 MB/s (M8) 500 MB/s (L7)	500 MB/s (L7) 400 MB/s (L6) 280 MB/s (L5)	400 MB/s (L6) 280 MB/s (L5) 240 MB/s (L4)	280 MB/s (L5) 240 MB/s (L4) 160 MB/s (L3)
Burst data rate	1200 MB/s	600 MB/s	600 MB/s	600 MB/s	600 MB/s
Nominal load-to-ready time	16 seconds	15 seconds	15 seconds	12 seconds	12 seconds
Initialized tape	16 seconds	NA	NA	NA	NA
Uninitialized tape[2]	40 - 132 minutes	NA	NA	NA	NA
Nominal unload time	56 seconds	24 seconds	20 seconds	17 seconds	17 seconds
Average space record time from load point	65 seconds	59 seconds	56 seconds	62 seconds	60 seconds
Average rewind time (REWIND command)	62 seconds	59 seconds	60 seconds	NA	NA
Average rewind time (part of UNLOAD command, dependent on mount activity)[3]					
Less than 5 GB of contiguous data transferred	62 seconds	59 seconds	60 seconds	NA	NA
5 GB to 50 GB of contiguous data transferred	124 seconds	59 seconds	60 seconds	NA	NA
All other types of mount activity	186 seconds	59 seconds	60 seconds	NA	NA

Table 4. Supported tape drives (continued)					
Generation	**LTO-9**	**LTO-8**	**LTO-7**	**LTO-6**	**LTO-5**

1. By using the built-in data compression capability of the tape drive, greater data rates than the native data transfer rate are achieved. However, the actual throughput is a function of many components, such as the host system processor, disk data rate, block size, data compression ratio, SAS bus capabilities, and system or application software.
2. Cartridge initialization time may vary. For more information, see "Media optimization" on page 7.
3. See "Archive mode unthread" on page 7 for more information.

Remember:

- All sustained data rates depend on the capabilities of the interconnect.
- Drive performance varies with media generation and drive interface.

Drive features

Media optimization

Media optimization is a new feature for the LTO-9 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 "Equipment environmental specifications" on page 15 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 that the software can handle the extended first mount time. For additional details, review the detailed section of the LTO Ultrium Tape Drive SCSI Reference.

Archive mode unthread

The time that is required for an unload depends on how the cartridge has been used during the mount. This is based on the current position and how far from beginning of tape (BOT) the media has been moved since mount. For details on unload performance, see "Supported tape drives" on page 5.

Speed matching

The LTO tape drives perform *speed matching* to adjust the native data rate of the tape drives as closely as possible to the net host data rate (after factoring out data compressibility). This approach helps to reduce the number of backhitch repositions and improves throughput performance.

Backhitching is the condition that occurs when a data cartridge stops, reverses, and restarts motion. A backhitch is the result of a mismatch between the data rates of the connected server and the tape drive.

With speed matching, the drive operates at different speeds when it is reading or writing the Ultrium 7 or later cartridge format. Native data rates are shown in Table 5 on page 8.

If the server's net (compressed) data rate is between two of the preceding native data rates, the drive calculates the appropriate data rate at which to operate. Maximum native date rate for half-height tape drives is 300 MB/s.

Table 5. Performance parameters			
Ultrium Generation Media	**Generation 9 media**	**Generation 8 media**	**Generation 7 media**
Speed matching data rates (MB/sec)	284	306.4	306.0
	263	273.0	287.52
	244	249.5	268.56
	223	226.0	250.66
	203	203.0	231.86
	177	180.0	213.06
	-	157.5	194.26
	-	135.0	175.46
	-	112.0	157.67
	-	-	138.52
	-	-	120.11
	-	-	101.46

Channel calibration

System performance is optimized by *channel calibration*.

System performance is further optimized by a feature that is called *channel calibration,* in which the drive automatically customizes each read/write data channel to compensate for variations in such things as the recording channel 's transfer function, the media, and characteristics of the drive head.

Power management

The LTO tape drives feature a power management function. This function controls the drive's electronics so that part of the electronics completely turns OFF when circuit functions are not needed for the drive's operation.

Supported tape cartridges

The library supports LTO tape cartridges.

Within the library, the supported LTO tape drive uses the following cartridge types:

- Data cartridge
- WORM (Write Once, Read Many) cartridge
- "Cleaning cartridge" on page 71

All generations contain 1/2-inch, dual-coat, and magnetic tape.

Table 6. LTO data cartridge compatibility with LTO tape drive

Cartridge generation	LTO-9 Drive	LTO-8 Drive	LTO-7 Drive	LTO-6 Drive	LTO-5 Drive	LTO-4 Drive	LTO-3 Drive	LTO-2 Drive	LTO-1 Drive
Ultrium 9	Read/write								
Ultrium 8	Read/write	Read/write							
Ultrium M8		Read/write							
Ultrium 7		Read/write	Read/write						
Ultrium 6			Read/write	Read/write					
Ultrium 5			Read only	Read/write	Read/write				
Ultrium 4				Read only	Read/write	Read/write			
Ultrium 3					Read only	Read/write	Read/write		
Ultrium 2						Read only	Read/write	Read/write	
Ultrium 1							Read only	Read/write	Read/write

Table 7. Cartridge Information

Cartridge generation	Native Data Capacity	Application Design Capacity	Bar code Label[1]	Load/Unload Cycles	Recording Format[2]	Color
Ultrium 9[3]	18 TB (45 TB at 2.5:1 compression)	17.4 TB	xxxxxxL9 **WORM:** xxxxxxLZ	20,000	Reads and writes data on 8960 tracks, 32 tracks at a time.	Teal **WORM:** Teal and silvery gray
Ultrium 8	12 TB (30 TB at 2.5:1 compression)	11.6 TB	xxxxxxL8 **WORM:** xxxxxxLY	20,000	Reads and writes data on 6656 tracks, 32 tracks at a time.	Burgundy **WORM:** Burgundy and silvery gray

Table 7. Cartridge Information (continued)

Cartridge generation	Native Data Capacity	Application Design Capacity	Bar code Label[1]	Load/Unload Cycles	Recording Format[2]	Color
Ultrium M8[4]	9 TB (22.5 TB at 2.5:1 compression)	8.37 TB	xxxxxxM8	20,000	Reads and writes data on 3584 tracks, 32 tracks at a time.	Purple
Ultrium 7	6 TB (15 TB at 2.5:1 compression)	NA	xxxxxxL7 **WORM:** xxxxxxLX	20,000	Reads and writes data on 3584 tracks, 32 tracks at a time.	Purple **WORM:** Purple and silvery gray
Ultrium 6	2.5 TB (6.25 TB at 2.5:1 compression)	NA	xxxxxxL6 **WORM:** xxxxxxLW	20,000	Reads and writes data on 2176 tracks, 16 tracks at a time.	Black **WORM:** Black and silvery gray
Ultrium 5	1.5 TB (3 TB at 2:1 compression)	NA	xxxxxxL5 **WORM:** xxxxxxLV	20,000	Reads and writes data on 1280 tracks, 16 tracks at a time.	Burgundy **WORM:** Burgundy and silvery gray
Ultrium 4	800 GB (1.6 TB at 2:1 compression)	NA	xxxxxxL4 **WORM:** xxxxxxLU	20,000	Reads and writes data on 896 tracks, 16 tracks at a time.	Green **WORM:**Green and silvery gray

1. You can order tape cartridges with the bar code labels included, or you can order custom labels.
2. When tape is processed in the cartridges, Ultrium tape drives use a linear, serpentine recording format.
3. Cartridge initialization time may vary. For more information, see "Media optimization" on page 7.
4. The library Firmware must be at 0080 or greater and drive firmware must be at HB82 or greater to support the LTO M8 media feature. To know more about Ultrium M8 tape cartridges, see "LTO type M cartridge (M8)" on page 70.

Library functions

The library provides many specific functions, such as alerts and logging, random and sequential logical library modes, and encryption.

Encryption

The LTO-4 and later tape drives support host Application Managed Encryption (AME) with T10 encryption methods. Data encryption is only supported by LTO Ultrium 4 Data cartridges and later.

Note: Application Managed Encryption (AME) does not require a key.

The encryption enabled drive contains the necessary hardware and firmware to encrypt and decrypt host tape application data. Encryption policy and encryption keys are provided by the host application or host server. A drive digital certificate is installed at manufacturing time. Each drive receives a unique serial number and certificate. The T10 application validates each drive instance by checking the drive's digital certificate.

The LTO Ultrium encryption environment is complex and requires knowledge beyond that of product trained Service Support Representatives (SSRs). The Encryption function on tape drives, whether it's a desktop, a stand-alone drive, or within libraries, is configured and managed by the customer. 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 Support (FTSS), customer documentation, and software support for encryption software problems. Customer 'how to' support is also provided by way of support line contract.

For configuration details, see "Configuring encryption for a non-encrypted-licensed library" on page 44.

Alerts and logging

The TL1000 Tape Autoloader sends alerts about the library and attached tape drive, and offers audit-logging to track user actions.

- **TapeAlert Support**: The 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. See "TapeAlert flags" on page 108.
- **Email (SMTP - Simple Mail Transfer Protocol) Notifications**: The library can configure email notification of library events. The library must have network access to an SMTP server. See "Locating management functions" on page 61.
- **SNMP Support**: The Simple Network Management Protocol (SNMP) allows the library to send alerts over a LAN network to a monitoring station.

   Occasionally, the library might encounter a situation that you want to know about, such as an open magazine or a fault that causes the library to stop.

   The library provides a standard TCP/IP protocol that is called SNMP to send alerts about conditions over a TCP/IP LAN network to an SNMP monitoring station. These alerts are called SNMP traps. With the information that is supplied in each SNMP trap, the monitoring station (together with customer-supplied software) can alert operations personnel of possible problems or operator interventions that occur.

   The new configuration capability of SNMP Query provides a common Management Information Base (MIB) across all the tape libraries. This capability allows a product administrator to audit the settings of all their tape libraries to ensure that they comply with their own policies.

   SNMP Traps are alerts or status messages that can be collected, monitored, and used to proactively manage attached libraries with SNMP protocol with the SNMP monitoring stations. In summary, each trap provides the following information.

   - **Product Identification** such as product name, description, manufacturer, model number, firmware level, and the URL that the trap is designated for.

- **Product Status** such as the severity of the trap, status (current and previous) and the time the trap occurred.
- **Library State** (physical device status) such as identification and status of devices that is monitored. It would include enclosure, power supply, controller, magazine status, drive count, cartridge slot count, and I/O station count. Also included would be certain library statistics, and where appropriate, the fault FSC (fault symptom code) including the severity and description of that fault.
- **Drive Status** such as the identification of each drive in the library, firmware level, serial number, and other address and status information.
- **Trap Definitions** such as library status change, open magazine, I/O accessed, hard fault information, requests to clean the drive, excessive retries, and returning to normal operations.
- **SNMP MIBs** The library's MIB contains units of information that specifically describe an aspect of the system, such as the system name, hardware number, or communications configuration. When with SNMP to monitor your TL1000 Tape Autoloader, ensure that the TL1000 MIB file is loaded on your SNMP monitoring station. SNMP traps are sent to the SNMP monitoring stations that are defined for your library (see "Configuring SNMP notifications" on page 48).

Random and sequential logical library modes

A logical library can be configured in one of the two modes: Random and Sequential.

Random Mode

Random Mode is intended to be used by host applications that support SCSI media changer devices. Random Mode is the default.

In Random mode,

- The host application chooses the cartridges that are moved to the drive.
- I/O slots provide the flexibility for the user to add and remove cartridges, and the host application is automatically notified of these changes.
- When you unload the drive, the cartridge in the drive is unloaded from the tape head mechanism, but is still retained inside the tape drive housing. The **Move Cartridges** command moves the cartridge from the drive to another location. Moving a tape cartridge from a drive to another location both unloads and moves the cartridge in a single action.

Sequential Mode

Sequential Mode is intended to be used by host applications that are not supporting SCSI media changer devices and loads another cartridge, if the current cartridge is full.

In Sequential Mode,

- The library predefines the sequential order that the cartridges are moved to the drive.
- No control path drive and no media changer device are configured to the host server.
- When you unload the drive, the cartridge in the drive is unloaded from the tape head mechanism, and returned to the cartridge home position.

The library modes can be configured with the Web User Interface or the Operator Panel. For more information, see "Configuring library settings" on page 41 and "Configuring library settings" on page 57.

Chapter 2. Planning

The library requires an environment that is able to accommodate the appropriate space, power, location, and other technical specifications. Use this section as a reference for onsite requirements to allow for optimum operation of the library.

Save your settings in the .

Acclimation

Server and storage equipment (racks and frames) must be gradually acclimated to the surrounding environment to prevent condensation.

When server and storage equipment (racks and frames) is shipped in a climate where the outside temperature is below the dew point of the destination (indoor location), there's a possibility that water condensation can form on the cooler inside and outside surfaces of the equipment when the equipment is brought indoors.

Sufficient time must be allowed for the shipped equipment to gradually reach thermal equilibrium with the indoor environment before you remove the shipping bag and energize the equipment. Follow these guidelines to properly acclimate your equipment:

- Leave the system in the shipping bag. If the installation or staging environment allows it, leave the product in the full package to minimize condensation on or within the equipment.

- Allow the packaged product to acclimate for 24 hours.[1] if there are visible signs of condensation (either external or internal to the product) after 24 hours, acclimate the system without the shipping bag for an extra 12 - 24 hours or until no visible condensation remains.

- Acclimate the product away from perforated tiles or other direct sources of forced air convection to minimize excessive condensation on or within the equipment.

[1] Unless otherwise stated by product-specific installation instructions.

Note: Condensation is a normal occurrence, especially when you ship equipment in cold-weather climates. All Dell products are tested and verified to withstand condensation that is produced under these circumstances. When sufficient time is provided to allow the hardware to gradually acclimate to the indoor environment, there should be no issues with long-term reliability of the product.

Library layout and location requirements

Information for planning the installation and layout of your library, including various specifications for optimal performance.

The library can be easily installed in a rack. For installing the library in a rack, see .

Security

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

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

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 Web User Interface. See "Locating management functions" on page 61.

Location requirements

Choose a location that meets the criteria in Table 8 on page 14.

Table 8. Location requirements

Criteria	Definition
Rack requirements	Standard EIA 19-inch rack
Power source	• AC Power Voltage: 100 - 240 VAC • Line Frequency: 50 - 60 Hz • Library is located near AC outlet. The AC power cord must be always easily accessible.
Air quality	• Place the library in an area with minimal sources of particulate contamination. • Excessive dust and debris can damage tapes and tape drive. • Avoid areas near frequently used doorways, open windows, fans, air conditioners, copier rooms, stacks of supplies that collect dust, printers, and smoke-filled rooms. • Do not store paper supplies next to the library. • Place the library away from high-traffic areas, especially if the floor is carpeted. Carpeting harbors dust and walking on the carpet can cause the carpet fibers and the dust to become airborne. • Close the machine covers to minimize any contamination from airborne particles.
Room temperature	16 - 32 °C (60 - 90 °F)
Clearance	• Back: Minimum of 15 cm (6 in.) • Front: Minimum of 30 cm (12 in.) • Sides: Minimum of 5 cm (2 in.)

Technical specifications for this library can be referenced in the following tables.

Physical specifications

Table 9. Physical specifications

Characteristic	Specification
Front panel width (chassis/bezel)	445 mm (17.52 in.)/483 mm (19.02 in.)
Height	44 mm (1.73 in.)
Depth	850 mm (33.46 in.)
Weight (library only)	13 kg (28.66 lbs)

Electrical specifications

Table 10. Electrical specifications

Characteristic	Specification
Current	4.0 - 1.5 A
Power	110 W
Voltage	100 - 240 V
Frequency	50 - 60 Hz

For more information about installation specifications, see Chapter 3, "Installing," on page 20.

Equipment environmental specifications

Table 11. Equipment environment specifications for the tape library

Product operation (equipment is powered on)									Product power off[1]		
Dry-bulb temperature			Humidity range, non-condensing			Max wet-bulb temperature [4]	Max dew point temperature [5]	Maximum elevation	Dry-bulb temperature	Relative humidity	Max wet-bulb temperature
Allowable [2]	Recommended [3]	Max rate of change	Allowable	Recommended	Max rate of change						
16°C - 32°C (60°F - 90°F)	16°C - 25°C (60°F - 77°F)	5°C/hour (9°F/hour)	20 - 80% RH	20 - 50% RH	5% RH/hour with no condensation	26°C (79°F)	22°C (72°F)	3050 m (10,000 feet)	5°C - 45°C (40°F to 113°F)	8 - 80% RH	26°C (79°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. Applies to the LTO drive generations 1 through 8.

5. Applies to the LTO drive generation 9.

Psychrometric chart
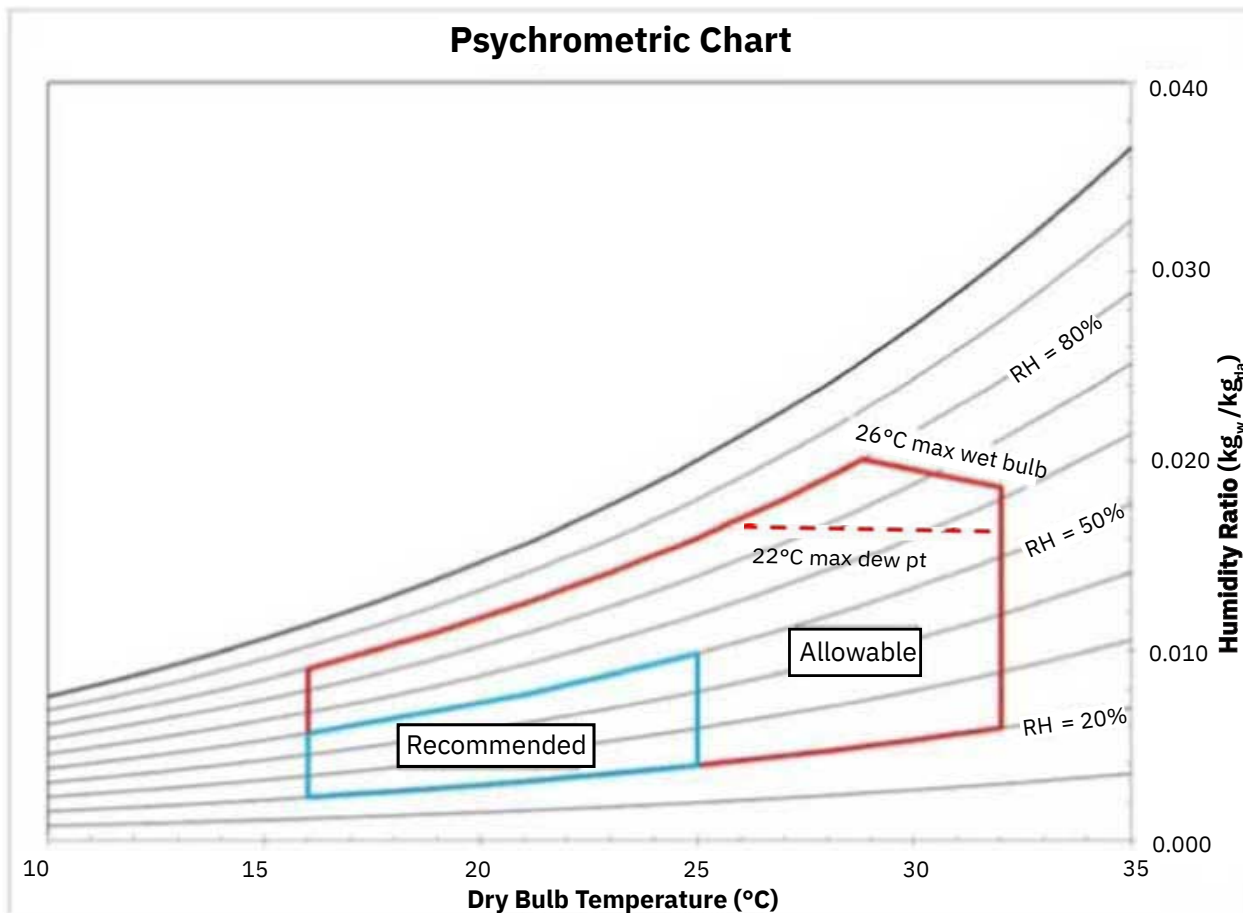
Figure 7. Psychrometric chart showing recommended and allowable operating environments for the tape library

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 was tested to verify functionality.

Gas and particulate exposure

Contamination	Requirement
Table 12. Gas and particulate exposure	
Contamination	**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 fewer than 300 Angstroms per month (Å/month, ≈ 0.0039 µg/cm² - hour weight gain)[2]. In addition, the reactivity rate of silver coupons shall be less than 300 Å/month (≈ 0.0035 µg/cm² - hour weight gain)[3]. The reactive monitoring of gaseous corrosivity should be conducted approximately 5 cm (2 in.) 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 by the choice of the following filtration: • 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.3[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 Å/month and the rate of weight gain assumes that Cu2S and Cu2O grow in equal proportions.

3. The derivation of the equivalence between the rate of silver corrosion product thickness growth in Å/month and the rate of weight gain assumes that Ag2S 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 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

The library meets the acoustical requirements for general business area category 2D. Category 2D states that the library can be installed a minimum of 4 m (13 ft.) from a permanent work station.

Parameter	Measurement
Table 13. Acoustical specifications	
Parameter	**Measurement**
Idling acoustical noise sound power level LwAD in Bels (1 Bel = 10 dB)	6.6
Maximum acoustical noise sound power level LwAD in Bels (1 Bel = 10 dB)	6.8

Network requirements

The library supports an independent customer network.

It is the customer's responsibility to provide the proper length Ethernet cable for this connectivity. The library has an Ethernet port, see "Rear panel" on page 3. This connection allows remote viewing and management of the library with the Web User Interface.

Supported browsers

Dell supports higher versions of the browsers if the vendors do not remove or disable functions 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 Dell support cannot re-create the issue in the lab, the client might be asked to re-create the problem on a certified browser version to determine whether a product defect exists. Defects aren't 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, Dell might investigate potential solutions or workarounds that the client can implement until a permanent solution becomes available.

Supported interfaces

The library supports the following TCP/IP protocols:

IPv4 and IPv6 support
The library supports Internet Protocol (IP) addresses in both IPv4 and IPv6 format.

Simple Network Management Protocol (SNMP)
SNMP traps are supported for drive and library events. SNMP management query functions are supported by using a standard Management Information Block (MIB).

Hyper Text Transfer Protocol (HTTP)
An embedded web server provides a management GUI for library management and query capabilities.

Secure Socket Layer (SSL)
The library supports SSL, a protocol for transmitting private documents through the internet.

Simple Mail Transfer Protocol (SMTP)
The library supports SMTP for sending email alerts.

Network Time Protocol (NTP)
The library supports NTP for external time-and-date synchronization.

Domain Name System (DNS)
The library supports DNS for flexible IP addressing.

Dynamic Host Configuration Protocol (DHCP)
The library supports DHCP for automatically providing an Internet Protocol (IP) host with its IP address and other related configuration information, such as the subnet mask and default gateway.

Host requirements

The library is supported by a wide variety of servers, operating systems, and adapters. Many ways to determine the servers and software that supports this library are available.

SAS interface

The SAS interface speed varies with the generation of the LTO drive. See "Supported tape drives" on page 5 to find out SAS speed of different drive generations.

A drive with a SAS interface can be linked directly to a host server. SAS is a performance improvement over traditional SCSI because SAS enables multiple devices (up to 128) of different sizes and types to be connected simultaneously with thinner and longer cables. Its full-duplex signal transmission supports up to 12 Gbps. In addition, SAS drives can be hot-plugged.

SAS drives auto-negotiate speed. There are no configurable topologies thus no feature switches are associated with SAS.

Compatible configurations

For a comprehensive list of compatible configurations, see https://www.dell.com/support/home/en-in.

Note:

1. These attachments can change throughout the lifecycle of the product.
2. Dell does not provide application software with the drive. To order software, contact your sales representative, Business Partner, or an independent software provider.
3. If you attach your drive to a server with non-Dell software, contact your software vendor for a matrix of compatible hardware, software, firmware revisions, and adapters.

HBA requirements

The library requires attachment to supported SAS HBAs, see "Compatible configurations" on page 19.

The library uses a single SCSI ID and dual LUNs to control the tape drive (LUN 0) and library accessor (LUN 1). The library requires a Host Bus adapter (HBA) that supports LUN scanning. If it is not enabled, your host system cannot scan beyond LUN 0 and fails to detect the library. It detects only the tape drive. Make sure you confirm availability or install a SAS HBA that supports multiple LUNs.

	Static Sensitive
	Risk of damage to devices
	• A discharge of static electricity damages static-sensitive devices or micro circuitry.
	• Proper packaging and grounding techniques are necessary precautions to prevent damage.

Important: Some HBAs, such as RAID controllers, do not support LUN scanning.

Supported device drivers

Device drivers enable the drive to interact with various servers. Dell recommends the use of native operating system drivers unless other drivers are required by the software manufacturer.

Chapter 3. Installing

⚠️	**Installation Precautions**
	• Do not expose the library to moisture.
	• Do not place the library on either the ends or sides as this action might cause damage.

To install and configure a TL1000 Tape Autoloader, complete these procedures in the order they are presented.

Identifying library components

Use the packing slip that is included with your library to identify the library components.

The TL1000 tape autoloader is shipped with a rack mount kit and all cables (power and interface) when the unit is ordered.

1. Locate one or more packing slips.
2. Verify that you received each item that is listed on the packing slips.

You must provide SAS cabling with the correct configuration for your HBA.

Note: Order the power cord that matches the electrical requirements of the country or area.

Installing in a rack

The TL1000 Tape Autoloader can be easily installed into a standard 19-inch rack system.

A standard 19-inch rack system contains multiple mounting locations that are called EIA units as defined by the Electronics Industries Association. Each EIA unit contains three square or round holes that are used to mount rack designed equipment. The library requires 1 EIA unit (1U) of rack space. Each unit is separated by a small space.

When you decide on a location in your rack for the library, consider that the Operator Panel has a small LCD screen. The library must be positioned to allow for easy viewing. The rear of the library must be free from any obstructions to allow easy access to the power switch and other rear panel components.

Note: Before you begin the rack installation of the library, read the safety information in "Rack safety" on page xii. Also, verify that no desktop feet are attached to the bottom of the library.

To install the library in a rack, follow the steps:

1. Verify that your rack kit includes all the necessary contents.
2. Determine the location in your rack for your library to be installed. With a pencil, mark the location on the front vertical rails (Figure 8 on page 21) and rear vertical rails (Figure 9 on page 21) in your rack.
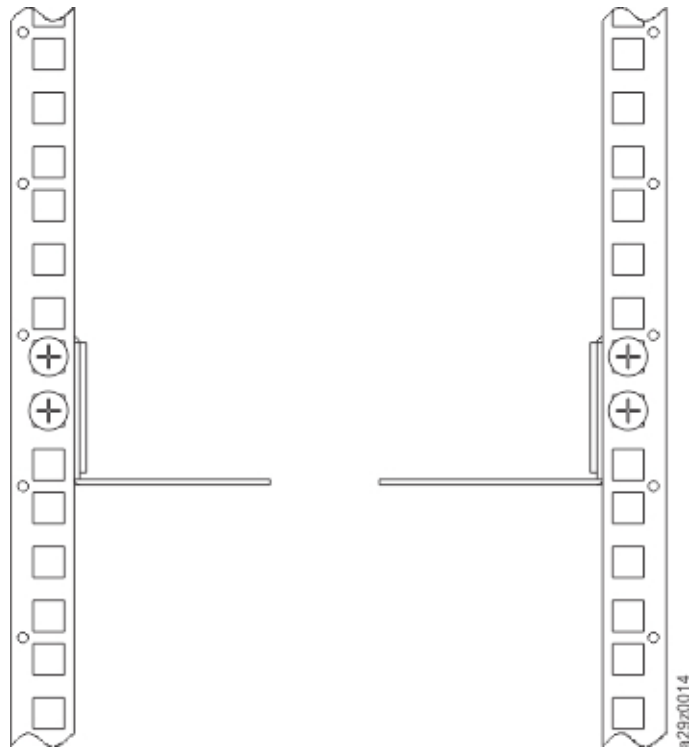
Figure 8. Rack mount screw locations for front vertical rails
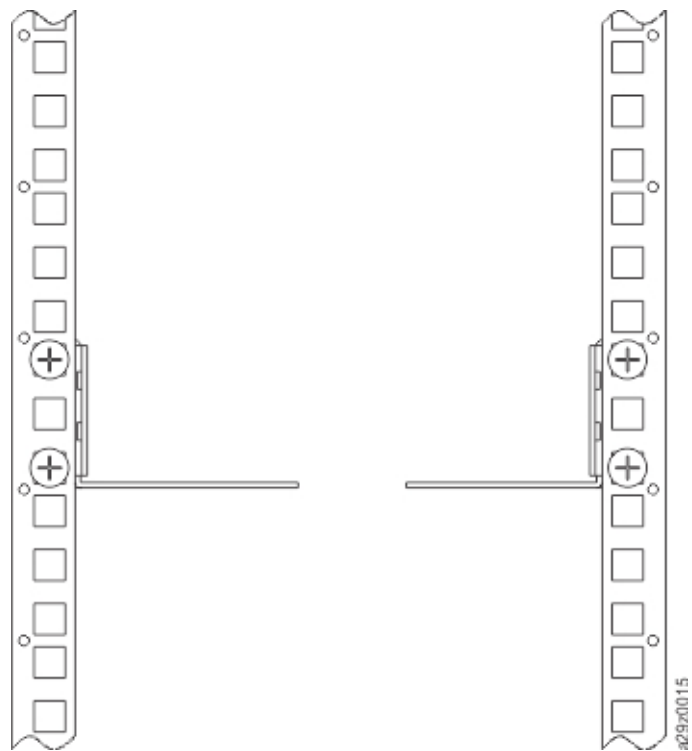
Figure 9. Rack mount screw locations for rear vertical rails

3. Place the screws **11** into the left and right brackets.
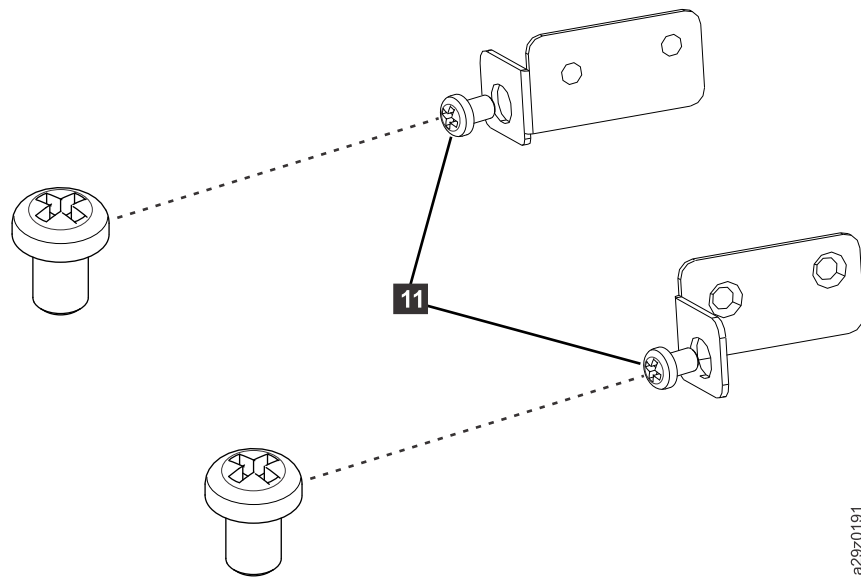
Figure 10. Screws for front brackets

4. Attach the left **3** and right **4** (Figure 11 on page 22) front brackets to the front of the library chassis with 2 flat-head screws **8** on each side. Use the top two screw holes on each side. The flange of each bracket with the inserted screws (**11**) fits into the cutout on each side of the bezel.
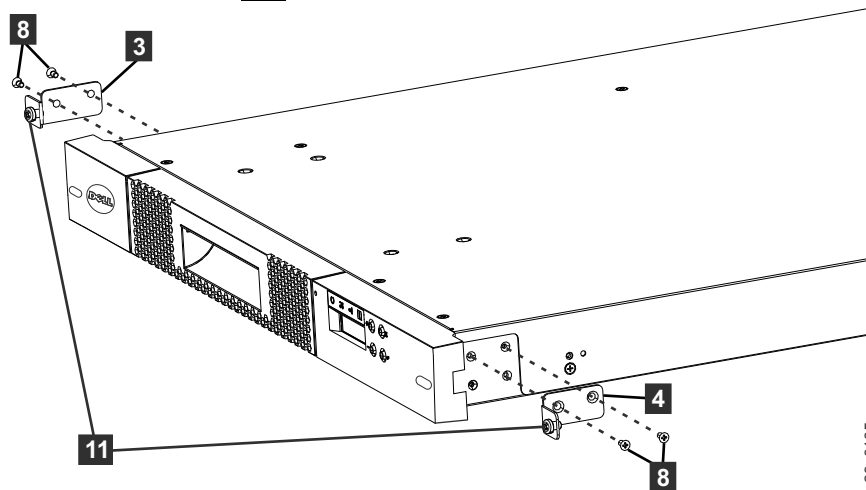
Figure 11. Attaching the front brackets to the library chassis

5. Attach the left **1** and right **2** rear brackets to the left **5** and right **6** front rails with 2 round-head screws **10** on each side (Figure 12 on page 22).
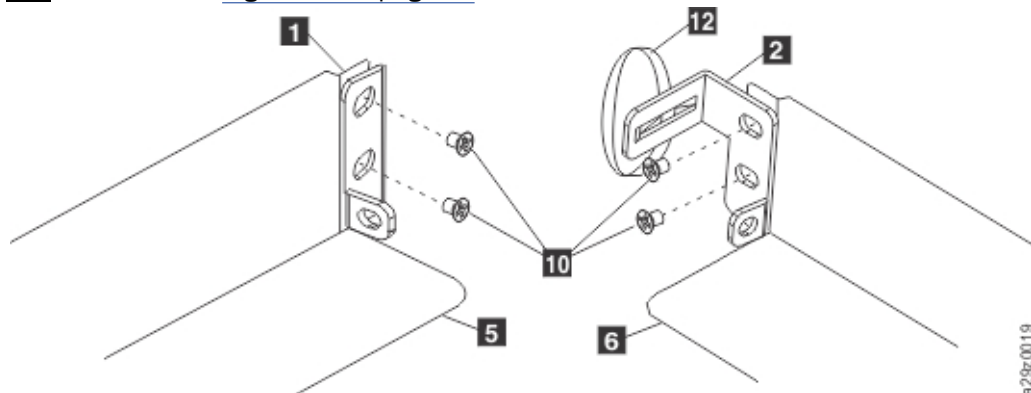
Figure 12. Attaching the rear brackets to the rails

Important: Do NOT tighten these screws completely.

6. Slide in the rear rails **7** from back to front to create the rail assemblies. Ensure that the screw holes face outwards (Figure 13 on page 23).
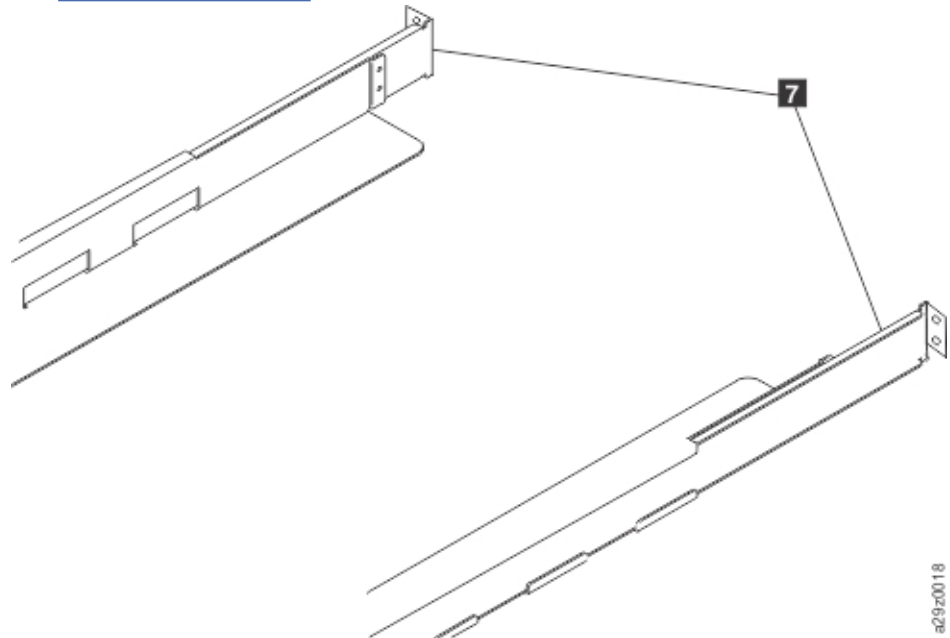
Figure 13. Creating the rail assemblies

7. Install the rail assemblies into the rack (Figure 14 on page 23). Ensure the 3 holes in the front of the unit align with the 1U space marked on the vertical rails in Step 2. Secure the rails to the rack with 4 flat-head screws **9** on each side of the rack. Use both of the two screw locations on the rear of the rack rail (Figure 9 on page 21). Use the top and middle screw locations on the front of the rack rail (Figure 8 on page 21).
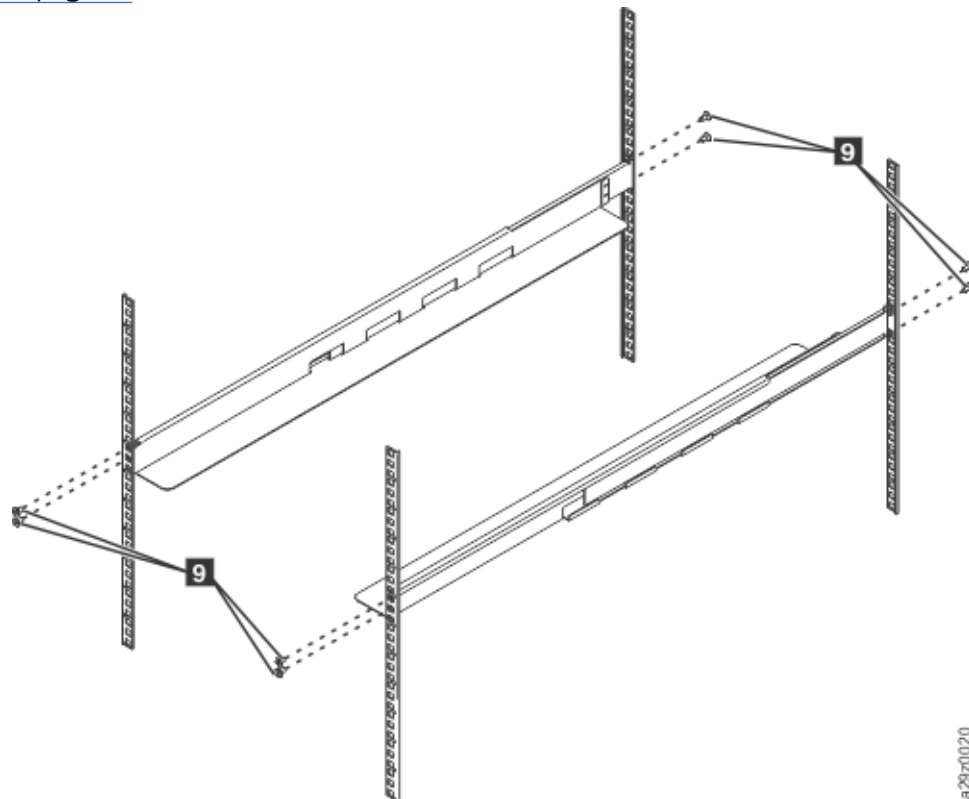
Figure 14. Installing the rail assemblies

8. Slide the library chassis into the rack. The heads of the large screws **11** appear through the oval openings on each side of the bezel. Use a Phillips screwdriver to attach these screws to the rack (Figure 15 on page 24).
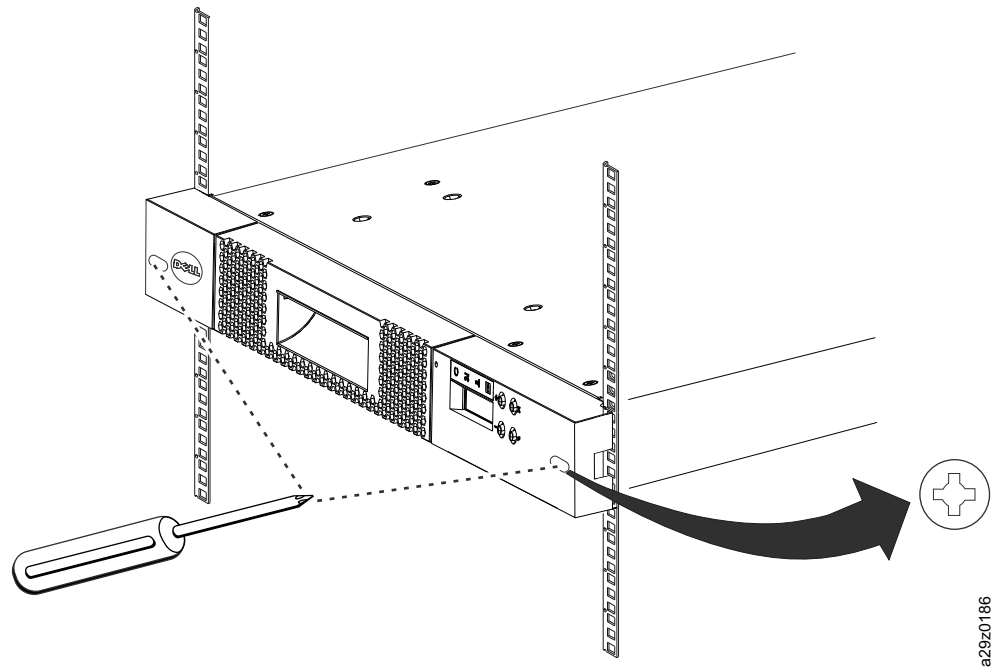
Figure 15. Securing the front of the library in the rack

9. Secure the rear of the library to the rack with a round-head screw **10** on each rear bracket (Figure 16 on page 24). Tighten the other rear bracket screws to secure the library to the rack.
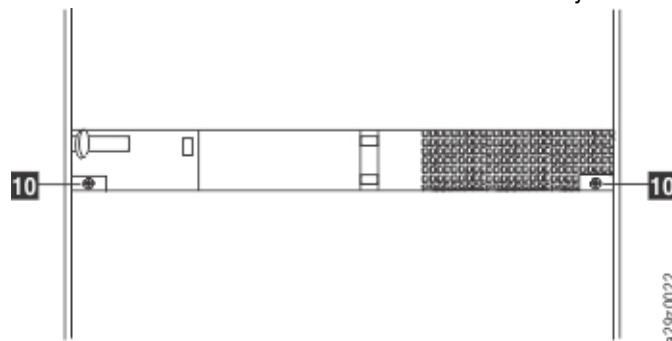
Figure 16. Securing the rear of the library in the rack

10. Run the SAS cable, power cable, and Ethernet cable through the hook-and-loop fastener strap **12**. Leave enough slack to reach the corresponding connectors, then tighten the strap (Figure 17 on page 25).
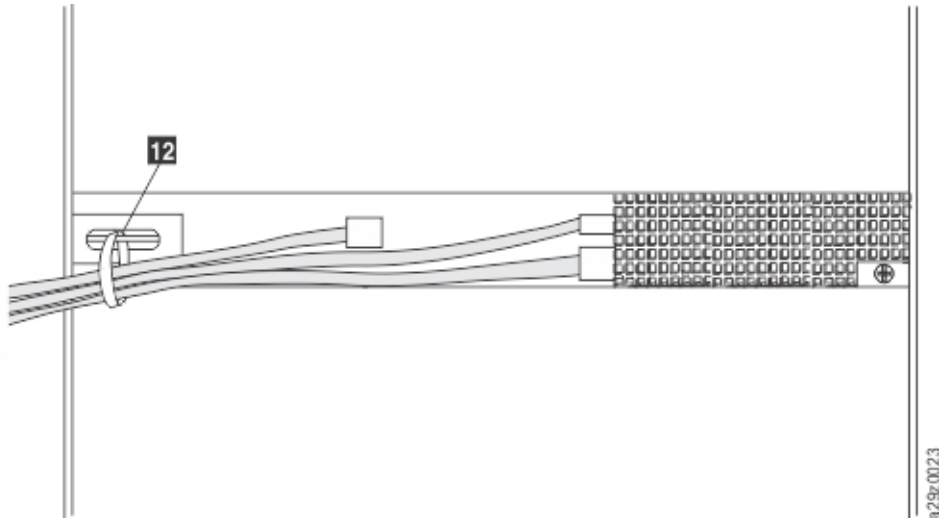
Figure 17. The cables at the rear of the library

Note: For information about converting and relocating the library, see Chapter 7, "Upgrading and servicing," on page 116.

Removing the accessor locking screw

The accessor locking screw must be removed before the library is powered on. Remove the accessor locking screw, located on the rear panel of the library (**1** in Figure 18 on page 25).

Figure 18. accessor locking screw

Important: The accessor locking screw prevents the library accessor from moving during shipment and must be removed before the library is powered ON.

Connecting cables

Steps to connect the Ethernet and SAS cables.
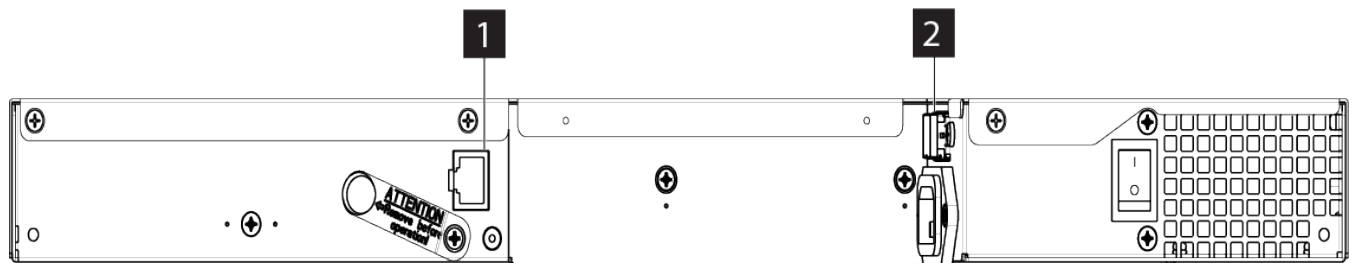
Figure 19. Interface cable connection

1. Attach an Ethernet cable to the Ethernet port (**1** in Figure 19 on page 25.)

Note: On rack mount installations, run the cable through the hook-and-loop fastener strap on the right rear bracket.

Note: It is recommended that you shut down and turn OFF the associated server before you connect the SAS interface cable. Turn ON the associated server after the SAS interface cable is connected to the library and server, the library is powered ON, and the library completed the initialization.

2. Attach the host end of the SAS cable to the drive's SAS connector (**2** in Figure 19 on page 25). For more information about the type of SAS connector that is required for attachment to the drive, see "Rear panel" on page 3.

   Note: On rack mount installations, run the cable through the hook-and-loop fastener strap on the right rear bracket.

3. Attach the other end of the host SAS interface cable to the host or to an interposer if required.

4. • Method 1: Plug the Ethernet cable into your server to access the Web User Interface directly. This method modifies your server network settings to match the library default settings. You can also use the Operator Panel to change the library network settings to match the server network settings before you use the Web User Interface to access the library. If the Ethernet connection is directly attached to a server, a crossover Ethernet cable might be required.

   • Method 2: Plug the Ethernet cable into an Ethernet switch or router to access the Web User Interface on a LAN (local area network). The library network settings must be entered with the Operator Panel before the Web User Interface is used to access the library.

Powering on the library

Steps to power on the library.

Note: This product can ONLY be used with an approved power cord for your specific geographic region. Use of an unapproved power cord might result in:

- Not meeting individual country-specific safety requirements
- Overheating with potential personal injury or property damage
- A fracture that results in internal contacts that are exposed, which might subject the user to a shock hazard
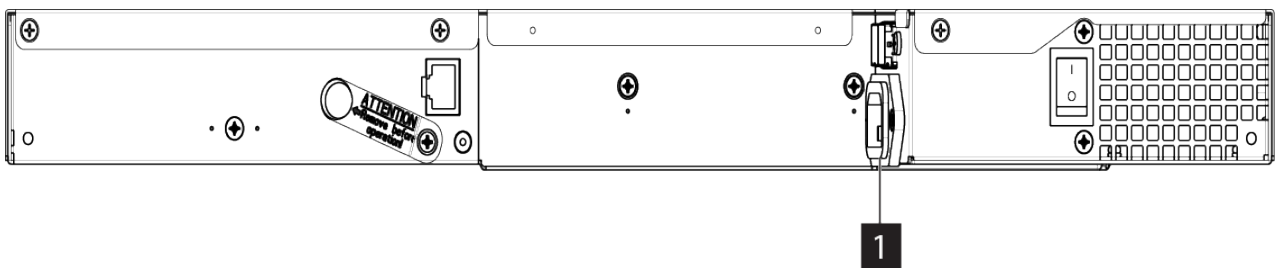
Figure 20. Power cord connection

1. Plug one end of the power cord or rack PDU power cord into the power connector (**1** in Figure 20 on page 26) on the rear panel of the library.

   Note: On rack mount installations, run the rack PDU power cord through the hook-and-loop fastener strap on the right rear bracket, and tighten the strap. The rack PDU power cord is a special power cord that plugs into a rack power strip.

2. Plug the other end of the power cord into the nearest properly grounded power outlet. On rack mount installations, plug the other end of the rack PDU power cord into the nearest rack PDU.

3. Power ON the library by toggling the power switch on the power supply to the ON (|) position.

4. Wait for the library to initialize.

   During initialization, the library completes a Power ON Self-Test (POST) to ensure that the library hardware is functional. The library also tests communications with the tape drive over the internal bus.

After the library is turned ON, an inventory is conducted automatically.

Note:

- If the Operator Panel does not initialize, check all cable connections, and ensure that the cartridge magazine is closed and in the locked position. Ensure that the power supply switch is in the ON position. If the Operator Panel still does not initialize, see Chapter 6, "Troubleshooting," on page 78.

- When the library is power-cycled, wait 10 seconds after the power is OFF before the library is powered ON again.

Important: To disconnect all power from the library, turn the power switch to the OFF position, then remove the power cord from the outlet. The power switch removes power from portions of the library and the drive, but the power supply still has ac power at its input.

Initial configuration and customization

The library can be configured with the Web User Interface or the Operator Panel. For more information, see "The Web User Interface" on page 32 and "The Operator Panel" on page 53.

When you power on the library for the first time and the library is serviced by a Dynamic Host Configuration Protocol (DHCP) server, the network parameters are set automatically. You can also modify and set the static library network settings in the library. The static library network settings must be entered with the Operator Panel before the library can be accessed with the Web User Interface.

To view or modify the library network settings from the Operator Panel, see "Logging in to the Operator Panel" on page 27.

To view or modify the library network settings from the Web User Interface, see "Logging in to the Web User Interface" on page 28.

The library is set to default settings when first purchased. To view the default settings, see "Default settings" on page 65. Many of these settings can be customized. You can customize these settings with Web User Interface or Operator Panel. The preferred method is by using the Web User Interface.

For detailed information about all the functions available on the library with the Web User Interface and Operator Panel, see "Locating management functions" on page 61.

Logging in to the Operator Panel

Steps to log in to the Operator Panel.

In many environments, the default network settings might be sufficient to access your tape library on a network. To view or change the default network settings with the Operator Panel, complete the following procedure.

1. When the library is initialized, press **Enter** to move to the **Password** screen.

Figure 21. Library ready screen

2. Press the **UP** and **DOWN** arrow keys to change the current digit. Press the **Enter** key to advance to the next digit. The default password is **0000**.

When you are logged in, you can change the password with the **Change Login Password** command.
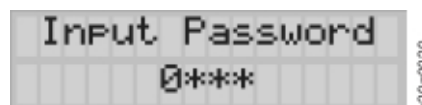
Figure 22. Password entry screen

3. To view the network parameters, press the **Minus** key from the top menu screen to select **Configuration** > **View Settings**, and press **Enter**.

4. To change the network parameters, press the **Minus** key from the top menu screen to select **Configuration**, and press **Enter**. See "Configuring network settings" on page 59.

5. Press **Cancel** to return to the top menu screen.

If needed, you can view or customize the following basic features from the Operator Panel.

- "Configuring library settings" on page 57
- "Configuring date and time settings" on page 60

For detailed information about all the functions available on the library with the Operator Panel, see "Locating management functions" on page 61.

Logging in to the Web User Interface

Before the library can be managed over a network with the Web User Interface, set up the initial network configuration of the library with the Operator Panel. For information, see "Configuring network settings" on page 59.

To log in to the Web User Interface:

1. Obtain the IP address of the library on the Operator Panel.

    a. From the top menu of the Operator Panel, press the Minus key to select **View Current Information**, and press **Enter**.

    b. Press the **Minus** key until the **IP Address** setting is displayed and make a note of the IP address.

    c. Press the **Cancel** key repeatedly to log out of the Operator Panel.

2. Open the web browser on your server or PC to access the Web User Interface.

3. In the browser address field, enter the IP address of the library. For example, `https://192.168.1.1`

4. On the Web User Interface login screen, enter the administrator login account name and default password.

    The account name and password are case-sensitive.

    - Account: **admin**
    - Password: **secure**

5. Click **Login** or press **Enter**.

    Note: You **must** change the password during the initial login. For directions on resetting or changing passwords, go to "Managing user access" on page 38.

If needed, you can view or customize the following basic features from the Web User Interface.

- "Configuring network settings" on page 43
- "Configuring library settings" on page 41
- "Configuring date and time settings" on page 46

For detailed information about all the functions available on the library with the Web User Interface, see "Locating management functions" on page 61.

Labeling and loading tape cartridges

The procedure for loading the library with cartridges.

To load the library with data and cleaning cartridges, complete the following procedure:

1. From the top menu screen on the Operator Panel, press the Minus key to select **Unlock Magazine**, and press **Enter**, or from Web User Interface: **Manage Library** > **Unlock Magazine**.

2. Insert cartridges in the magazine.

   Note: A blue release gate (**1** in Figure 23 on page 29) in the upper left corner of each column in the cartridge magazine prevents each cartridge from falling out of the front of the magazine. When manually releasing the gate with one hand, position your other hand in front of the column opening to protect cartridges that are ejected by the internal column spring.

Figure 23. Cartridge release gate
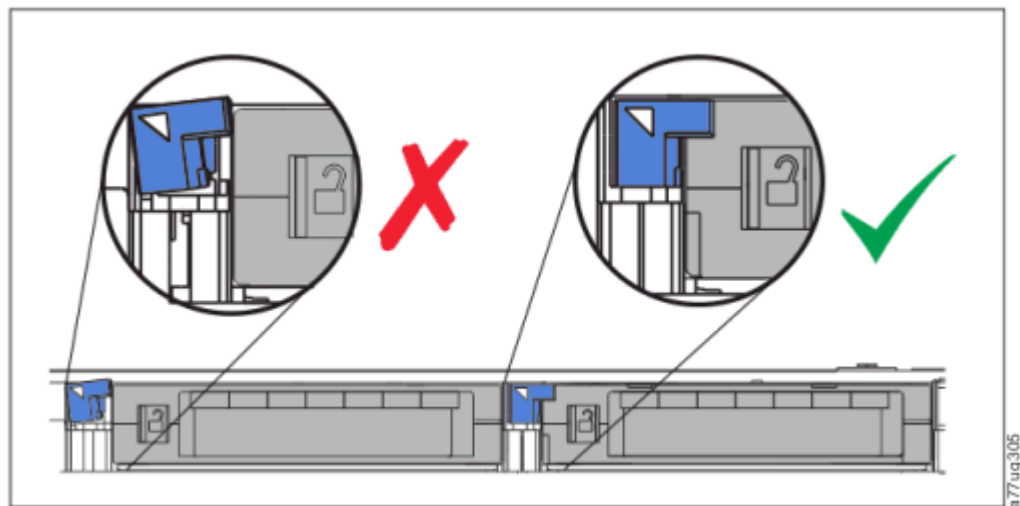
Figure 24. Incorrect (left) and correct (right) placement of release gate

Note: Column 5 Tier 2 is reserved as the exchange position. This position is accessible by the library only. A locking mechanism prevents insertion of a cartridge into the reserved slot.

Each cartridge must be inserted with the indicator arrow on the leading edge of the upper surface of the cartridge pointing towards the cartridge magazine (see Figure 25 on page 30).

Note: Do not rely on the bar code label orientation, if attached, to provide an indication of the correct cartridge orientation. The bar code label is right side up if attached correctly.
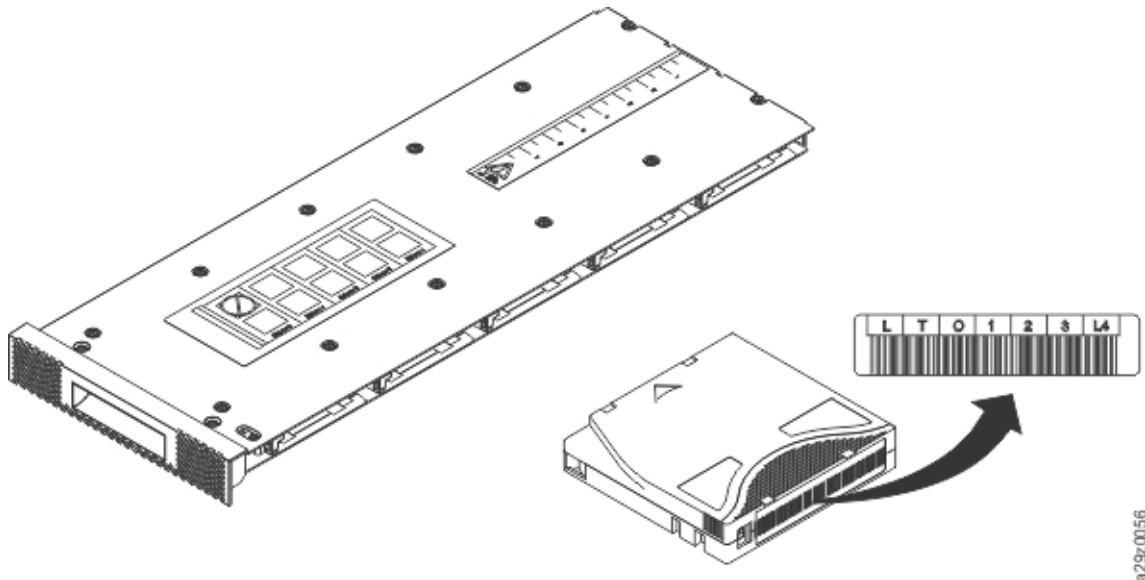
Figure 25. Cartridge orientation

The Auto Cleaning function can be enabled only if the number of active slots is less than the maximum available slots. The active slots are always enabled starting with the lowest numerical cartridge position number in the magazine. This position is at the drive end of the cartridge magazine. Place cleaning cartridges in inactive cartridge positions for use by the auto cleaning function.

Do not store data or cleaning cartridges in the I/O Station (Column 5, Tier 1) if the I/O station is enabled.

3. Put the magazine back into the library and wait for the library inventory to complete. Then, you can proceed to the next step.

4. Press **Cancel** to return to the top-level menu.

Verifying the installation

To verify the installation, follow the steps:

1. Verify that the library has the latest firmware revision.

   - To view the current firmware revision of the library from Web User Interface: **Monitor System** > **System Summary**
   - To view the current firmware revision of the library from Operator Panel: **Service** > **View Firmware Revision**

   To update the firmware, see "Updating library and drive firmware" on page 66.

2. Run **Library Verify** from the Operator Panel: **Service** > **Diagnostics** > **Run Library Verify**. See "Running library verify test" on page 78.

3. Save the configuration settings to a file on your computer from the Web User Interface: **Configure Library** > **Save/Restore** > **Save Library Settings**. See "Saving and restoring configuration settings" on page 52.

4. Take the library online.

   - To take the library online with Web User Interface: **Manage Library** > **Library State**
   - To take the library online with Operator Panel: **Commands** > **Change Library State**

   Note: The tape drive is always online, regardless of whether the library is online or offline.

Verifying the host connection

Procedure to verify the connection between the host computer and the library.

To verify the connections between the host computer and the library.

1. Install the application software and drivers that are compatible with the library. Backup software packages might require extra software or licensing to communicate with the robotics.

2. Verify the connection between the library and the host by using the host server's operating system utilities. Or, use the Tape Diagnostic Tool (ITDT) to verify the communication between library and host. See "ITDT-SE" on page 89.

Registering for support notification

Support notification registration provides email notification when new firmware levels are updated and are available for download and installation.

Enter your user name and password on the Appendix C, "Library Configuration Form," on page 121.

Note: Library firmware and tape drive firmware are verified and released together. When the latest firmware is updated, verify that all installed components such as the tape drive and library are at the latest levels noted on the Support website. Mixing different levels of library and tape drive firmware is not supported and might cause unpredictable results.

Dell suggests that you update library and drive firmware when new levels become available. For instructions on updating library and drive firmware, see "Updating library and drive firmware" on page 66.

Now you are ready to use your library.

Chapter 4. Managing

The user roles are manually assigned to user accounts created within the library. Controlling access to screens and operations within the library preserves the integrity of the library and the data that is stored within the library.

There are four types of user roles for accessing the library with the Web User Interface:

- **User** is allowed to monitor the library, but not complete actions that affect the physical library.
- **Superuser** is allowed to operate the physical and logical library, but not complete actions that affect the library configuration.
- **Administrator** user is allowed access to the entire physical library and logical library, including configuration. Only one administrator user must be assigned the login name **admin**.
- **Service** user is allowed access to the entire physical library and logical library. In addition, the Service user account can access diagnostic tools to help identify and resolve library and drive problems.

Note:

- The **admin** role is the default for the library. However, the administrator can create other access user roles for servicing or using the library.
- Multiple users can log in to the Web User Interface. A user can be logged in to only one interface at a time.

For a comparison on user role access privileges, see Appendix B, "Web User Interface functions and roles," on page 119.

The Web User Interface

With the Web User Interface, you can monitor, configure, and operate most library functions from a web browser.

When possible, use the Web User Interface as the primary library interface. The web interface provides access to more features and is intuitive to use.

Before the library can be managed over a network with the Web User Interface, set up the initial network configuration of the library with the Operator Panel. For more information, see "Configuring network settings" on page 59.

Logging in

1. Open a supported web browser and enter the IP address of the library.

   The IP address can be obtained with the **View Current Information** command from the Operator Panel. For example, `https://192.168.1.1`.
2. Type in the username (`admin` or other administrator-created user) and the password.
3. Click **Login**.

For more information about initial logging in to the Web User Interface, see "Logging in to the Web User Interface" on page 28.

The Library main screen on the Web User Interface

Figure 26 on page 33 shows the **Web User Interface** window for an Administrator account.
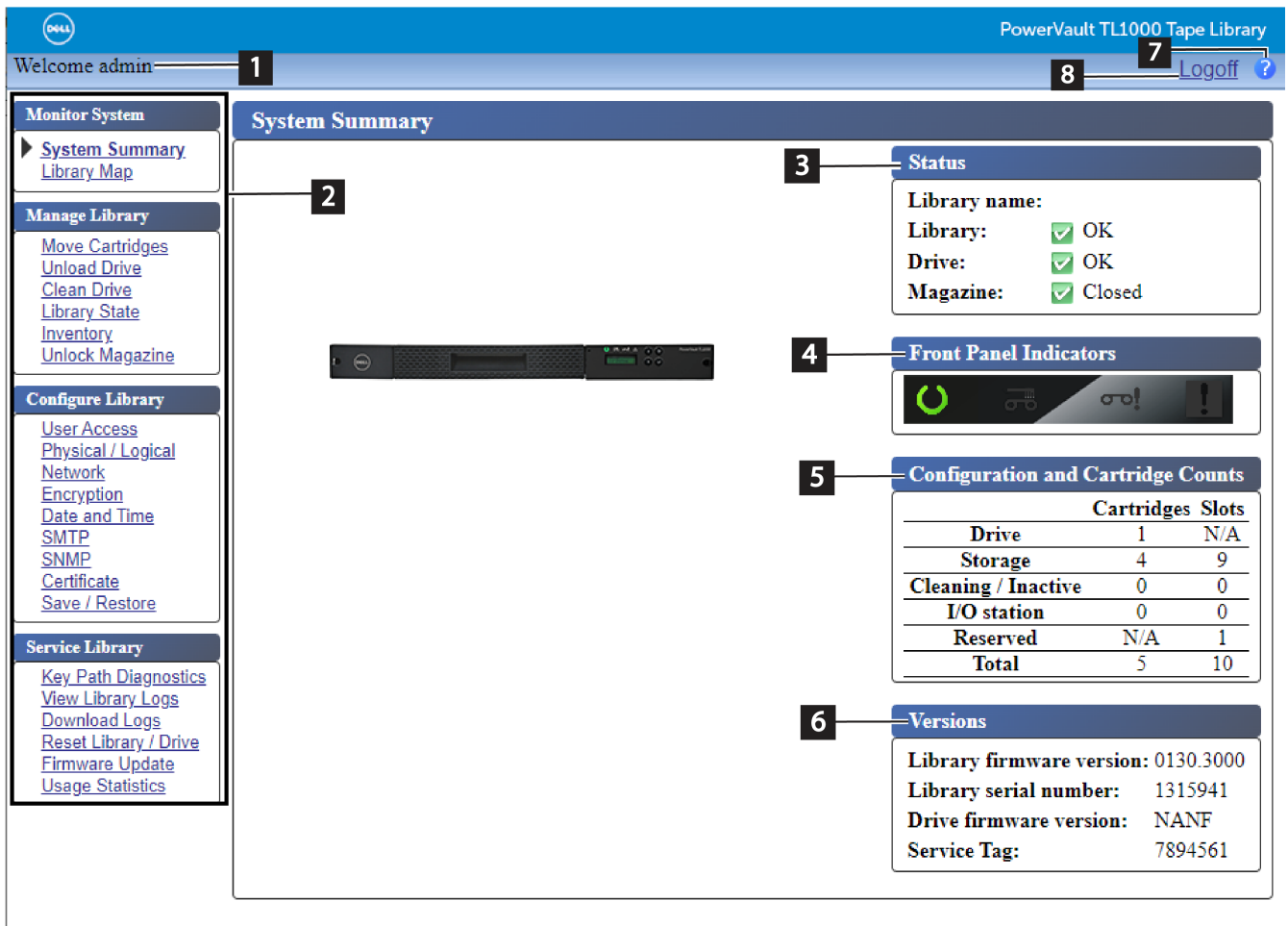
Figure 26. Administrator account window

	Element	Description
Table 14. Main screen elements		
1	User logged in	Displays the username of the user role that is logged in. See Chapter 4, "Managing," on page 32 to know the different user roles.
2	Menu tree	Lists the menu options available from Administrator account window, see Table 15 on page 34.

3	Status	Displays the status of the tape drive and the library
		
		• Library status (OK, Degraded, or Failed).
		
		  It displays Not Ready while initializing.
		
		• Drive status (OK, Degraded, or Failed).
		
		  It displays Empty, Loading, or Ejected when the drive is empty, loading media, or media is ejected or unloaded in the drive. It displays Cleaning when the cleaning cartridge is in the drive, and Calibrating while performing media optimization. See "Media optimization" on page 7.
		
		• Magazine status (Open/Closed, when Magazine is enabled)

4	Front Panel Indicators	Displays the status of the Operator Panel LEDs, see Table 17 on page 53.

Table 14. Main screen elements (continued)

	Element	Description
5	Configuration and Cartridge Counts	Displays the number of cartridges and slot configuration • Cartridge in the drive (0 or 1); Slots value is always "N/A" • Number of cartridges in the active slots; Number of active slots • Number of cartridges in the cleaning/inactive slots; Number of cleaning/inactive slots • Number of cartridges in the I/O Station (0 or 1) when enabled; Number of I/O Station slots • Number of cartridges in the reserved slot; Number of reserved slots
6	Versions	Displays the Library firmware version, Library serial number, Drive firmware version, and Service Tag number.
7	Logoff	Click **logoff** to log out of the library.
8	Help	Click **?** at the upper right of the screen to view the help pages.

The Table 15 on page 34 shows all the menu options available from the Web User Interface for the Administrator account. For a comparison on user role access privileges, see Appendix B, "Web User Interface functions and roles," on page 119.

Table 15. Web User Interface menu tree

Monitor System	Manage Library	Configure Library	Service Library
System Summary Library Map	Move Cartridges Unload Drive Clean Drive Library State Inventory Unlock Magazine	User Access Physical/Logical Network Encryption Date and Time SMTP SNMP Certificate Save/Restore	Key Path Diagnostics View Library Logs Download Logs Reset Library/Drive Firmware Update Usage Statistics

Graphical view of library

The graphical view of the library the shows graphical representation of the library and library components, such as tape drive, cartridges, cartridge magazine, accessor, and Ethernet.

Each component of the library is represented by a clickable icon. Select a component to view the detailed information for that component of the library on the right side of the page. A grayed-out column represents the I/O station.

To view the graphical representation of the library, go to **Monitor System** > **Library Map**.

Monitor System
- System Summary
- ▶ Library Map

Manage Library
- Move Cartridges
- Unload Drive
- Clean Drive
- Library State
- Inventory
- Unlock Magazine

Configure Library
- User Access
- Physical / Logical
- Network
- Encryption
- Date and Time
- SMTP
- SNMP
- Certificate
- Save / Restore

Service Library
- Key Path Diagnostics
- View Library Logs
- Download Logs
- Reset Library / Drive
- Firmware Update
- Usage Statistics

Library Map

Front ◀   Rear ▶

Slots   6

| Column 5 | Column 4 | Column 3 | Column 2 | Column 1 |

CLNU24L1

DV0101L8

1 ☑ Library
2 ☑ Ethernet
3 ☑ Drive

5

4

☑ Accessor

Figure 27. Graphical view of the library

The Table 16 on page 36 shows the information according to the type of component selected.

	Component	Status
Table 16. Library components and status		

1	Library	Displays the Unit status and Library settings:
		
		• Unit Status
		
		  – Library status (`OK`, `Degraded`, or `Failed`)
		  – Accessor status (`OK`, `Degraded`, or `Failed`)
		  – Drive Status (`OK`, `Degraded`, or `Failed`).
		
		    Drive Status displays `Empty`, `Loading`, or `Ejected` when the drive is empty, loading media, or media is ejected/ unloaded in the drive. It displays `Cleaning` when the cleaning cartridge is in the drive, and Calibrating while performing media optimization. See "Media optimization" on page 7.
		
		  – Magazine status (`Closed`, `Inserted`, or `Open`)
		
		• Library Settings
		
		  – I/O station (`Enabled` or `Disabled`)
		  – Auto cleaning (`Enabled` or `Disabled`)
		  – Library mode (`Random` or `Sequential`).
		
		    In Sequential mode, Loop and Auto load mode are also displayed.
		
		  – Bar code label length

2	Ethernet	Displays the following information: • Ethernet Information • TCP/IP Settings • IPv4/IPv6 Settings • SMTP Settings • SNMP Settings
3	Drive	Displays the drive information: • Status (`OK`, `Degraded`, or `Failed`). Drive Status displays `Empty`, `Loading`, or `Ejected` when the drive is empty, loading media, or media is ejected/unloaded in the drive. It displays `Cleaning` when the cleaning cartridge is in the drive, and Calibrating while performing media optimization. See "Media optimization" on page 7 • Vendor ID • Product ID • Serial number • F/W version (firmware) • Worldwide ID (node name) • Encryption method (None)
4	Accessor	Displays the accessor status (`OK`, `Degraded`, or `Failed`).

	Component	Status
Table 16. Library components and status (continued)		
	Component	**Status**
5	Cartridge	Displays the cartridge information • Media status (OK, Degraded, or Failed) • Cartridge label that is detected by the bar code reader. • Encryption setting for data cartridges (Not encrypted, Encrypted, or Unknown) • Remain - Number of uses left for cleaning cartridges. When a cleaning cartridge is added to the library (I/O station or cleaning slot), the remaining uses is displayed as 50. The actual remaining uses are updated when the cleaning cartridge is loaded into the tape drive. • Write protect (Yes or No) **Note: Write protect** status is only detected and displayed when a cartridge is in a drive.
6	Slots	Each column has a spring loaded mechanism that pushes the cartridges into Tier 1. Moving a second cartridge into a column moves the first cartridge into Tier 2. **Note:** 1. Cartridges cannot be moved directly from Tier 1 in one column to Tier 2 in another column in a single move operation (intermediate move operations are required). 2. Cartridges cannot be moved to the accessor with **Move** command. However, cartridges can be moved from the accessor with this command if the library was powered OFF with a cartridge that is still held in the accessor.

Configuring the library

Managing user access

Users that can access the library are added, modified, or removed by using the Web User Interface. Up to seven users can be configured with the Web User Interface.

User Access

Users

Current users:

User Name	Role	Password	Operation	
admin	Administrator	Available	Modify	Remove
super	Superuser	Available	Modify	Remove
user	User	Available	Modify	Remove

Add

Password Rules

Current rules:

Minimum number of characters:	8
Minimum number of upper case alphabetic characters (A-Z):	0
Minimum number of lower case alphabetic characters (a-z):	1
Minimum number of numeric characters (0-9):	1
Minimum number of special characters (!@#$%^&*()_+-={}|[]\;':"<>?,./):	0
Maximum number of identical consecutive characters:	2
Maximum number of failed logins before password is locked:	5
Maximum number of days before password must be changed:	90
Minimum number of days before password can be changed:	1
Number of password changes before an old password can be used again:	8

Submit

Figure 28. User Access screen

To add, modify, or remove users that are able to access the library with the Web User Interface:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **User Access**.
2. To add, modify, or remove a user account, follow the steps:
   - Add a user account:
     a. Click **Add**

CLOSE ⊗

Add a User

User Name:	
Password:	(0/16)
Confirm:	
Role:	Administrator ▼

Cancel Submit

Figure 29. Add User dialog box

   b. Enter the **User Name** and **Password** into the dialog box and assign the user's role. Re-enter password to **Confirm**.
   c. Select one of the following from the **Role** menu:

- **User** - User access permission allows users to monitor the library, but not to complete functions that affect the library.
- **Superuser** - Superuser access permission allows users to operate the physical and logical library, but not to change configuration settings.
- **Administrator** - Administrator access permission allows users to complete tape library functions and change configuration settings.
- **Service** - Service access permission allows users to complete tape library functions and change configuration settings. In addition, service access permission allows the use of diagnostic tools to help identify and resolve library and drive problems.

d. Click **Submit** to save the new user.

Note: A new user's **Password** status is set to *Expired*. A new user is presented with a **Login failure** message and given the opportunity to create a new password.

- Modify a user account:

a. Observe the **Password** status of the user:

- **Available**: The password is available to be changed.
- **Expired**: The maximum password age was exceeded. **The password is now invalid.**
- **Unchangeable**: The minimum password age was not exceeded. **You cannot change the password.**
- **Locked**: The maximum number of failed login attempts for the account was exceeded.

  Note: An administrator must unlock the account by modifying the account and entering a new password. The **Password** status changes to *Expired*.

b. Click **Modify** next to the User Name of the account.
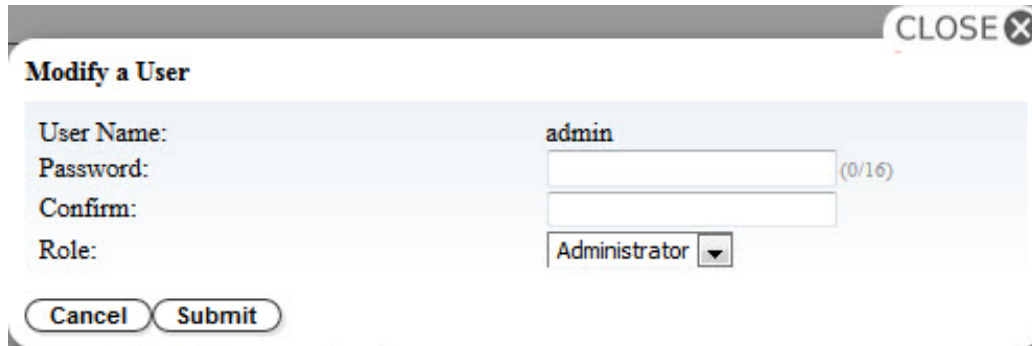
Figure 30. Modify user

c. Enter and confirm a new password (see "Configuring Password Rules Settings" on page 40).

d. Select one of the following from the **Role** menu:

- **User** - User access permission allows users to monitor the library, but not to complete functions that affect the library.
- **Superuser** - Superuser access permission allows users to operate the physical and logical library, but not to change configuration settings.
- **Administrator** - Administrator access permission allows users to complete tape library functions and change configuration settings.
- **Service** - Service access permission allows users to complete tape library functions and change configuration settings. In addition, service access permission allows the use of diagnostic tools to help identify and resolve library and drive problems.

e. Click **Submit** to save the modified user account.

- Remove a user account:

a. Click **Remove** next to a **User Name** to delete the account from the system.

Enter all user IDs and passwords on the Library Configuration form in Appendix C, "Library Configuration Form," on page 121.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings are updated successfully.

Configuring Password Rules Settings

Password Rules	
Current rules:	
Minimum number of characters:	8
Minimum number of upper case alphabetic characters (A-Z):	0
Minimum number of lower case alphabetic characters (a-z):	1
Minimum number of numeric characters (0-9):	1
Minimum number of special characters (!@#$%^&*()_+-={}|[]\;':"<>?,./):	0
Maximum number of identical consecutive characters:	2
Maximum number of failed logins before password is locked:	5
Maximum number of days before password must be changed:	90
Minimum number of days before password can be changed:	1
Number of password changes before an old password can be used again:	8
Submit	

Figure 31. Password Rules screen

The **Password Rules** tab displays the rules for user passwords.

- **Minimum number of characters** - Choose the minimum password length. The factory default value is 8. The maximum password length is 16.
- **Minimum number of upper case alphabetic characters (A-Z)** - Choose the minimum number of uppercase alphabetic characters. The factory default value is 1.
- **Minimum number of lower case alphabetic characters (a-z)** - Choose the minimum number of lowercase alphabetic characters. The factory default value is 1.
- **Minimum number of numeric characters (0-9)** - Choose the minimum number of numeric characters. The factory default value is 1.
- **Minimum number of special characters (!@#$%^&*()_+={}|[]\;':"<>?,./)** - Choose the minimum number of special characters. The factory default value is 0.
- **Maximum number of identical consecutive characters** - Choose the maximum number of identical consecutive characters. The factory default value is 2. There is no limitation if 0 is selected.
- **Maximum number of failed logins before password is locked** - Choose the maximum number of failed logins before the password is locked. The factory default value is 5. Possible range for this configuration option is 0 - 10. There is no limitation if 0 is selected.
- **Maximum number of days before password must be changed** - Choose the maximum number of days before the password must be changed. There is no limitation if 0 is selected.
- **Minimum number of days before password can be changed** - Choose the minimum number of days before the password can be changed. A password can be changed immediately if 0 is selected.
- **Number of password changes before an old password can be used again** - Choose the number of password changes that are required before a password can be used again. A password can be reused immediately if 0 is selected.

Click **Submit** to save all the information.

Configuring library settings

Configure the physical and logical library settings.

Physical library settings

Figure 32. Cartridge assignment settings

To configure the library cartridge assignment settings, complete the following procedure:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Physical/ Logical**.

2. In the **Physical Settings**, enter the library settings:

   - **Library name** - Enter a name for your library.

   - **Auto cleaning** - Automatically cleans the drive when the drive requests that cleaning and a cleaning cartridge is present in the library. Auto cleaning can be enabled only when there is at least one inactive position in the magazine in the library. Use the **Logical Settings** box to set the number of active slots.

     Note: It is recommended to enable the Auto cleaning function on the library. With the Auto cleaning function enabled, drive cleaning occurs automatically. The only time Auto cleaning must be disabled is when your Backup Application requires that it has control.

   - **Bar code label length** - Use to choose the number of characters in the cartridge bar code that is reported to the host computer.

3. Click **Submit** to enable the settings.

Logical library settings
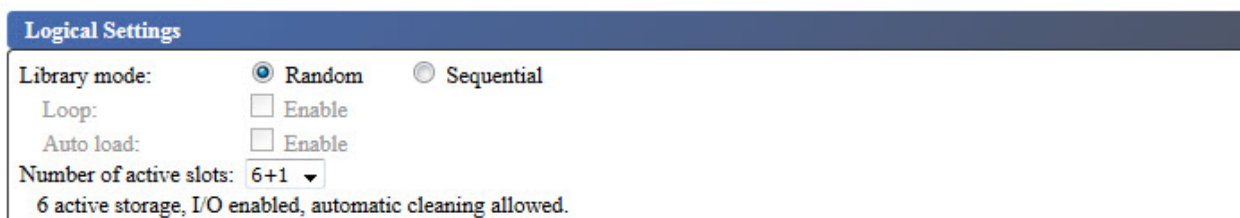
Figure 33. Logical library mode settings

To configure the library access mode settings for the logical library:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Physical/ Logical**.

2. In the **Logical Settings**, select the **Library Mode**:

   - **Random** - In random mode, the library allows the server's (host's) application software to select any data cartridge in any order.

   - **Sequential** - In sequential mode, the library's firmware predefines the selection of the cartridges. After initialization, the firmware causes the library to select the first available cartridge found (counting from the lowest Column/Tier position through the highest cartridge position in your library) for loading into the drive. See "Location coordinates and element addresses" on page 5.

     - **Loop** - When **Library mode** is **Sequential** with **Loop** mode **Enabled**, the cartridge in the lowest Column/Tier cartridge position is loaded after the cartridge in the highest Column/Tier cartridge

position is filled with data and sent back to its home position. This mode allows endless backup operations without user interaction.

– **Auto load** - When **Library mode** is **Sequential** with **Auto load** mode **Enabled**, the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) is loaded automatically if the library powers ON, or resets, with an empty drive. If the library powers ON with a cartridge already in the drive, sequential mode starts from the home position of that cartridge, unless the host issues a rewind and unload command to the drive. In which case the next cartridge in sequence will be loaded into the drive.

To start sequential mode if **Auto load** is not **Enabled**, use the **Move Cartridges** command to load the first cartridge into the drive. The sequence starts from the home position of that cartridge. Cartridges need not to be in contiguous slots.

To stop sequential mode, use the **Move Cartridges** command to unload the drive. This mode cancels sequential mode; the next sequential cartridge is NOT loaded.

To restart sequential mode, use the **Move Cartridges** command again to load a cartridge; the loading sequence resumes from the home position of that cartridge.

- **Number of active slots** - Select the number of active slots you would like to assign in your library. Selecting the number of active slots defines the number of storage slots, number of cleaning/inactive slots, whether the I/O station is enabled/disabled, and whether auto cleaning is allowed. The first digit configures the number of active storage positions (4, 6, 8, or 9). The second digit configures Column 5, Tier 1 of the magazine as an I/O Station (0 when disabled, and 1 when enabled). The Auto cleaning function can be enabled only if there is at least one inactive position in the magazine. If Auto cleaning is enabled, the inactive positions become cleaning cartridge positions.

3. Click **Submit** to enable the settings.

Configuring network settings

After the network settings are entered on the Operator Panel, the current network configuration of the library can be modified with the Web User Interface. The changes that are made to the network settings take effect after the library is rebooted.

Figure 34. Network settings screen

Note: The Internet Protocol (IPv4, IPv6, or dual IPv4/IPv6) selection is used for the TL1000 Tape Autoloader IP address, subnet mask, gateway address, time server address, mail server address, SNMP trap address, and EKM server addresses.

To modify the network settings, follow the procedure:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Network**.

2. In **Ethernet**, select the link speed duplex mode (Auto, 10Base-T Full, 10Base-T Half, 100Base-TX Full, 100Base-TX Half).

3. In **Security**, select **Enable SSL for Web** to provide secure communications between the web browser and the tape library.

4. Select the TCP/IP settings. IPv4, IPv6, and dual stack IPv4/IPv6 are supported. To enable the dual IPv4/IPv6 protocol, select both **Use IPv4** and **Use IPv6** and enter parameters for both.

   - **IPv4 Settings** - Select **Use IPv4** to enable the IPv4 Internet Protocol. Select the corresponding option to obtain an IP address automatically (DHCP) or use static IP address settings. When with

DHCP, use the Operator Panel to determine the library IP address. See "Locating management functions" on page 61. Enter the following parameters if you are using static IP address settings.

- **IPv4 address** - Sets the TCP/IPv4 address of the library on the network.
- **Subnet mask** - Defines and limits users within a local network.
- **Gateway** - Allows access outside the local network.

- **IPv6 Settings** - Select **Use IPv6** to enable the IPv6 Internet Protocol. Select the corresponding checkbox to obtain an IP address with stateless auto configuration. Select the corresponding option to obtain an IP address automatically (DHCP) or to use a static IP address. Enter the following parameters if you are using static IP address settings:

  - **IPv6 address** - Sets the TCP/IPv6 address of the library on the network.
  - **Prefix Length** - Decimal value 0 - 128 indicating the number of contiguous, high-order bits comprising the network portion of the address.
  - **Gateway** - Allows access outside the local network.

5. In **DNS settings**, select **Use DNS** to use a domain name server. The DNS server, if entered, allows the encryption, date and time, and notifications IP addresses to be specified with host names instead of numerical IP addresses.

  - **DNS IP address** - Sets the IP address of the DNS server.

6. Click **Submit** to enable the settings.

   Note: The changes that are made to the network settings take effect after the library is rebooted.

Configuring encryption for a non-encrypted-licensed library

Figure 35. Encryption settings screen for a non-encrypted-licensed library

Select **Configure Library** > **Encryption** to configure an encryption method for data that is stored on tape cartridges.

Note: Application Managed Encryption (AME) does not require a key.

Figure 36. Encryption licensed settings screen

Note: Application Managed Encryption is the only option on a non-encryped-licensed library.

To modify the encryption settings:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Encryption**

2. In the **Encryption method:** drop-down menu, choose **Application Managed** or **Library Managed** to enable encryption in your library. No further configuration steps are necessary.

3. Click **Submit** to enable the settings.

To determine whether a cartridge is encrypted, use **Configure Library** > **Library Map** and select the cartridge. The screen displays whether the cartridge is encrypted, not encrypted, or unknown.

Click **Submit** to transfer the settings to the library. A dialog message is displayed when the settings are updated successfully.

Key Path Diagnostics

Figure 37. Key path diagnostics screen

Select **Service Library** > **Key Path Diagnostics** to run diagnostic tests of the encryption key path if the drive in your Model S4H, S5H, S6H, S7H, S8H, or S9H library is set up for library-managed encryption. Key Path Diagnostics run tests for the tape drives, network connection, EKM path, and the EKM configuration.

Note: Verify the device is Offline at the host prior to exercising any service functions. Ensure that any media in the drive is moved from the drive.

The test consists of four parts:

- **Drive Test** - The library completes a drive communication test to confirm communication with the drive Ethernet test.
- **Ethernet Test** - The library pings each EKM server IP address and records the result.
- **EKM Path Test** - The library completes an EKM communication test for each EKM server IP address that passed the Ethernet Test. The library sends an **LDI Crypto Diagnostics** command to the drive. This drive command causes the drive to send a test message to the EKM verifying that the application is up and running.
- **EKM Config Test** - The library completes an EKM configuration test for each EKM server IP address that passed the EKM Path Test. The library sends an **LDI Crypto Diagnostics** command to the drive. This drive command causes the drive to establish a link and obtain a default key from the EKM. This test verifies that the drive is correctly configured in the EKM.

Click **Start** to run the diagnostics tests.

Configuring date and time settings
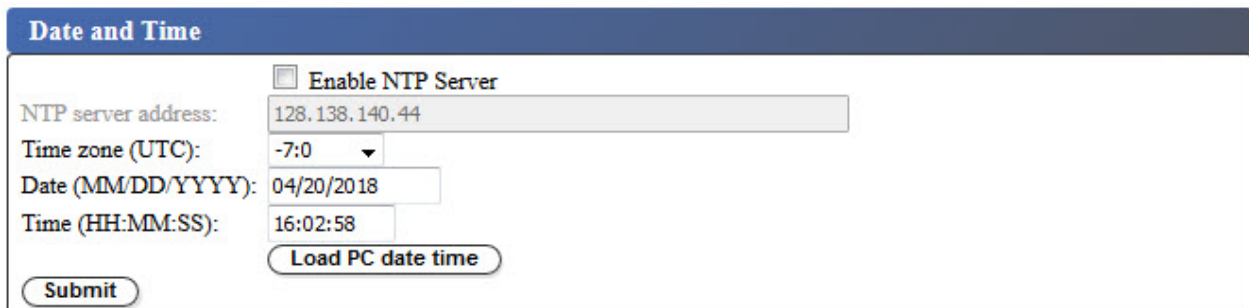
Figure 38. Date and time settings screen

Configure the date and time settings with any of three methods: automatically with a remote NTP time server on the network, automatically with the clock on your host computer, or manually.

Note:

1. If you manually set your date and time, you must reset the date and time after the library is power-cycled and after a library reset.
2. When the library is power-cycled, wait 10 seconds after the power is OFF before the library is powered ON again.

Once the network settings are entered on the Operator Panel, the current date and time can be modified with the Web User Interface.

The library communicates with an NTP server with the following conditions:

- Client/server basis operation
- UDP (User Datagram Protocol) to access the NTP server
- Does not use authentication keys
- Library polling is every 12 hours

To modify the date and time settings, follow the procedure:

1. In the **Configure Library** menu in the left navigation panel of the Web User Interface, click **Date and Time**.

2. Select the **Date and Time** settings.

   - Select the **Enable NTP Server** checkbox to enable time and date control with a time server on the network.

     – **NTP server address** - Enter the IP address of the time server. IPv4 and IPv6 addresses are supported, depending on the TCP/IP settings. Host names can be entered instead of numerical IP addresses if **Use DNS** is selected in the **Network** settings.

     – **Time zone** - Enter the time zone relative to Coordinated Universal Time (UTC).

   - If the time server is disabled, enter the local time and date manually.

     – **Date** - Enter the date with the MM/DD/YYYY format.

     – **Time** - Enter the time with the HH:MM:SS format.

   - Click **Load PC date time** to synchronize the library with the clock on your host computer at regular intervals.

3. Click **Submit** to update the settings.

Configuring email notifications

Email notifications can be configured to notify you when a library event takes place.

Figure 39. Email notifications

Note: This procedure is optional.

To set up email notifications of library events:

1. In the **Configure Library** menu in the left navigation panel of the Web User Interface, click **SMTP**.

2. Configure the **Send server** settings.

   - **SMTP server address** - SMTP mail server address. IPv4 and IPv6 addresses are supported. Host names can be entered instead of numerical IP addresses if the DNS server is specified in the Network settings.

- **Sender address** - Mail header information.
- **Subject** - Mail header information.

3. Enter the email addresses to be notified when an event takes place in the **Mail To** fields, and click the **Enable** check boxes to select each address.

4. Select the event level to report in the **Mail Event** settings.

5. Click **Test** to send a test email message to the enabled addresses.

6. Click **Submit** to enable the settings.

Configuring SNMP notifications

SNMP notifications can be configured for this library.

SNMP

SNMP Settings

☑ SNMP Enabled

Community: public

Name:

Location:

Contact:

SNMPv3 engine ID: 80 00 00 02 03 00 16 97 72 3A 3B

Trap Event

⦿ Error Events

◯ Error and Warning Events   Test

◯ Error, Warning, and Information Events

Submit

Trap List

Validity	Address	Version	Type	Community	User name	
Disable	0.0.0.0	v1	trap	public	–	modify
Disable	0.0.0.0	v1	trap	public	–	modify
Disable	0.0.0.0	v1	trap	public	–	modify
Disable	0.0.0.0	v1	trap	public	–	modify

SNMPv3 User List

Validity	User name	Authentication	Privacy	
Disable		disable	disable	modify
Disable		disable	disable	modify
Disable		disable	disable	modify
Disable		disable	disable	modify
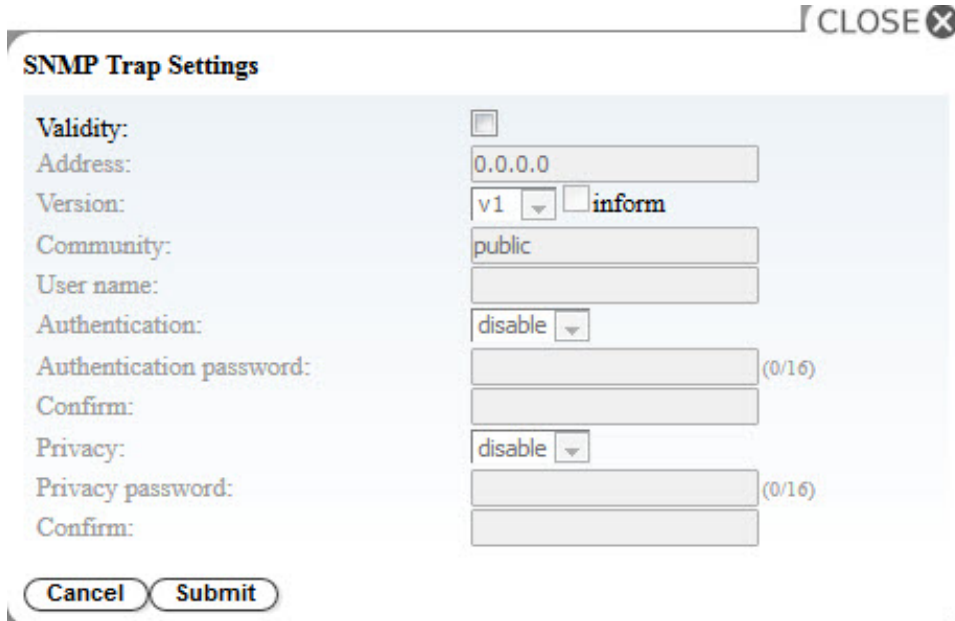
Figure 40. Trap notifications

Note: This procedure is optional. SNMP notifications are not enabled unless you have selected the **SNMP Enabled** check box. To disable SNMP notifications, clear the **SNMP Enable** check box and click **Submit**.

The traps that are supported by the library are listed in "Trap definitions (types)" on page 107.

To set up trap notifications for an SNMP server:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **SNMP**
2. Select the **SNMP Enabled** check box.
3. Configure the SNMP server and header settings.
   - **Community** - SNMP community name to which the library belongs.
   - **Name** - Unique SNMP name for the system.
   - **Location** - Physical location of the system.
   - **Contact** - Contact person's name.
   - **SNMPv3 engine ID** - A read-only attribute that identifies the SNMPv3 engine.
4. Enter the settings of the SNMP monitoring stations to be notified when an event takes place by clicking the **modify** buttons in the **Trap List** box.

Figure 41. SNMP trap settings

   - **Validity** - Select the check box to enable and clear the check box to disable.
   - **Address** - IPv4 and IPv6 addresses are supported. Host names can be entered instead of numerical IP addresses if the DNS server is specified.
   - **Version** - Trap version v1, v2c, or v3. For v2c and v3, the **Inform** check box determines if an SNMP INFORM request is sent instead of a trap event.
   - **Community** (v1 or v2c) - SNMP community name.
   - **User name** (v3 only) - SNMPv3 unique user name.
   - **Authentication** (v3 only) - Authentication algorithm: **disable**, **MD5**, or **SHA**.
   - **Authentication Password** - When an **Authentication** algorithm is enabled, an **Authentication Password** is required. (see "Configuring Password Rules Settings" on page 40).
   - **Confirm** - Re-enter the Authentication Password to confirm it.
   - **Privacy** (v3 only) - Privacy service encryption and decryption algorithm: **disable**, **DES**, or **AES**. When an algorithm is specified, a privacy password is required.
   - **Privacy password** - enter a password (see "Configuring Password Rules Settings" on page 40).
   - **Confirm** - Re-enter the **Privacy password** to confirm it.
5. Click **Submit** to save the SNMP Trap settings. Modify each trap's settings by repeating the previous step.
6. Enter the SNMPv3 users who are allowed to access the tape library by clicking the **modify** buttons in the **SNMPv3 User List** box.

Figure 42. SNMPv3 user settings

- **Validity** - Select the check box to enable and clear the check box to disable.
- **User name** - SNMPv3 unique user name.
- **Authentication** - Authentication algorithm: **disable**, **MD5**, or **SHA**. When an algorithm is specified, an authentication password is required.
- **Authentication password** - enter a password (see "Configuring Password Rules Settings" on page 40).
- **Confirm** - Re-enter the **Authentication password** to confirm it.
- **Privacy** - Privacy service encryption and decryption algorithm: **disable**, **DES**, or **AES**. When a privacy algorithm is specified, a privacy password is required.
- **Privacy password** - enter a password (see "Configuring Password Rules Settings" on page 40).
- **Confirm** - Re-enter the **Privacy password** to confirm it.

7. Select the event level to report in the **Trap Event** box.

8. Click **Test** to send a test trap notification to the enabled IP addresses.

9. Click **Submit** to enable the settings.

Uploading and configuring the SSL certificate

Figure 43. Certificate screen

This library takes in certificate content and key content in two separate `.pem` files. The library requires a browser restart or library power reset for a certificate change or update.

1. Use **Configure Library** > **Certificate** to upload a SSL certificate.
2. In the **Import** box, click the **Browse...** buttons to navigate to the Certificate and Private Key files to be imported.
3. When the **Certificate** and **Private Key** files are selected, click **Import** in the **Import** box.
4. Click **Ok** in the message box to start the certificate import.
5. When the import completes, an `Import was successful` message appears. Click **OK**.

   Where the current SSL session uses the previous certificate as-is, the new SSL session uses the imported Certificate. Log off, close and restart the browser, and log back in, using the new imported Certificate.
6. The information for the imported Certificate is shown.

Figure 44. New certificate

7. To remove a Certificate and Private Key, click **Remove** in the **Remove** box.

> **Note:** When a user-provided certificate and private key are removed, the system defaults to the self-signed certificate and private key that shipped with the machine.

Note: The imported SSL Certificate/Private Key is not saved during the **Save/Restore** function on the Autoloader. If the Dell PowerVault TL1000 Autoloader is replaced, the SSL Certificate and the Private Key must be imported again, if needed.

Saving and restoring configuration settings

Your library configuration can be saved and restored automatically by a cookie and manually by with the Web User Interface. It is recommended that you use the Web User Interface method whether you use the cookie method.

Important: Verify all configuration settings after your library configuration is restored. Reset the library date and time (see "Configuring date and time settings" on page 46).

Saving and restoring configuration automatically with cookies

If allowed by your web browser preference settings, cookies are employed to automatically save your library configuration on your host computer and automatically restore your library configuration if your library network configuration uses a static IP address. The following flowchart illustrates how VPD data is saved from and restored to a library with cookies.
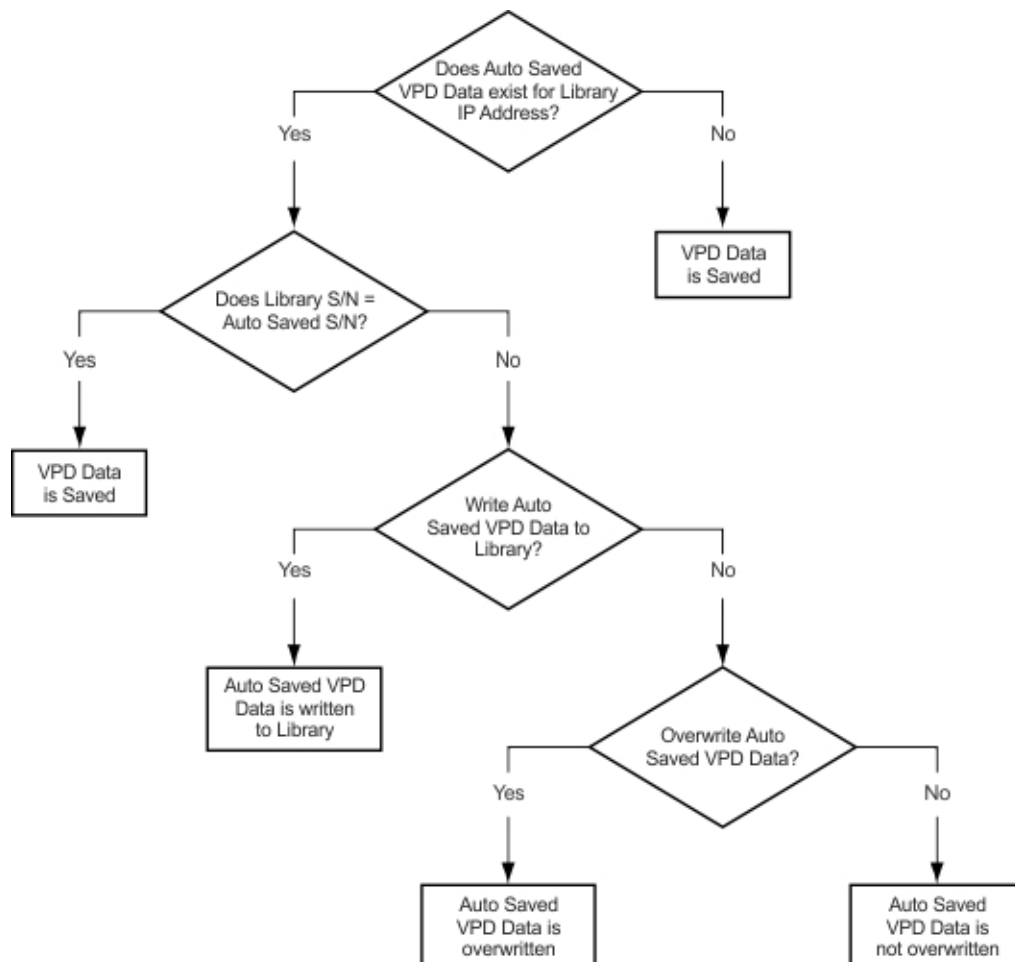
Figure 45. Save/Restore configuration with cookies

Saving and restoring configuration manually with Web User Interface

Figure 46. Save configuration

Note: This procedure is recommended.

Each time that you change the configuration of your library, save the configuration. This function also maintains several library configuration profiles that can be restored to the library when wanted with the Web User Interface.

To save a library configuration:

1. In the **Configure Library** menu in the left navigation pane of the Web User Interface, click **Save/Restore**

2. In the **Save Library Settings** box, click **Save** to create a configuration file of your library on your computer.

To restore a library configuration:

1. Click **Browse** to navigate to and select your saved configuration file.

2. Click **Restore** to load the settings from a file.

The Operator Panel

With the Operator Panel, you can monitor, configure, and operate library functions from the library front panel.

Figure 47. Operator Panel components

Number	Component	Description
1	LCD display	16-character LCD graphic display

Table 17. Operator Panel component descriptions

Number	Component	Description
2	Up key (Δ)	Button that is used to navigate upward (↑) through the menu items.
3	Down key (∇)	Button that is used to navigate downward (↓) through the menu items.
4	Cancel key	Button that is used to cancel a user action and return to the last menu item.
5	Enter key	Button that is used to display a submenu or to select a user action.
6	Ready/Activity LED	Green LED lit when the unit is powered ON and functional. The LED flashes when there is any library activity or the library is offline.
7	Clean Drive LED	Amber LED lit when the drive needs cleaning. The LED turns OFF after the drive is cleaned successfully.
8	Attention LED	Amber LED lit when a cartridge is bad/marginal, or invalid. The LED turns OFF when all marginal and invalid cartridges are removed from the library. The LED turns on if Autoclean is enabled and no cleaning cartridge is in a cleaning position. The LED might also be lit when there is a power supply problem.
9	Error LED	Amber LED lit when there is an unrecoverable library or drive failure. The corresponding error message is displayed on the LCD screen and the LED remains ON until the error state is resolved.

Table 17. Operator Panel component descriptions (continued)

All LEDs are updated during power ON and reset sequences. At power ON or software reset, all LEDs turn on as soon as POST allows. For more information, see .

The Operator Panel operates in two basic modes:

- **User Interaction mode** - Mode that is employed when a user is pushing keys on the Operator Panel. User Interaction mode continues until 3 minutes after a user stops pushing keys, or the requested accessor action stops, whichever is longer.
- **System Driven mode** - Normal mode of operation where the Operator Panel displays status in response to commands issued from the drive's internal interface.

Note: Any operational conflict between commands that are received over the host interface or the Web User Interface and those commands that are entered by way of the Operator Panel are avoided with a reservation mechanism on a first-come, first-served basis. Operator Panel commands are canceled by an Operator Panel logout or timeout.

For information on logging in to the Operator Panel, see .

Input modes

There are several ways to enter values in the different menu items. These values are selectable predefined values, toggle values, and numerical values like network addresses.

Selecting predefined values/ toggling states

1. To set the predefined value/ toggling state, press **Enter** to select the menu item.
2. With the **Plus** and **Minus** keys, select the predefined value/toggling state for that item.
3. As soon as the Operator Panel display shows the correct value, press **Enter** to apply the value/state.

Entering numerical values

Numerical values are needed for network addresses, password entries, and other configuration entries.

1. After you navigate to the menu item, the current value is displayed and the cursor highlights the first digit of the value that can be changed.

2. For each digit to be changed in the value, follow the steps below:

   a. Use the **Plus** and **Minus** keys to increment or decrement the digit.

   b. Press **Enter** to highlight the next editable digit.

3. Press **Enter** at the last digit to apply the complete entry. Press **Cancel** to cancel the whole edit process and maintain the original value.

Table 18 on page 55 shows the top-level menu tree structure of the Operator Panel on the front of the library.

Table 18. Operator Panel menu tree						
Unlock I/O Station	**Unlock Magazine**	**Commands**	**Configuration[1]**	**View Current Information**	**Service**	**Logout**
		Move Cartridge Unload Clean Drive Inventory Move to Ship Position Reboot Drive Reboot Library Change Library State	Configure Library Configure Auto Cleaning Configure Network Settings Configure Op Panel Settings Configure Web GUI Settings View Settings Set Default	Setting Information Slot Information	View Error Status Diagnostics View Firmware Revision Telnet Service Port[2]	
1. In the **Configuration** menu, the current configuration setting is indicated by an asterisk on the Operator Panel screen.						
2. For use by technical support personnel only.						

The Operator Panel provides a subset of menu items that are compared to the full capability of the Web User Interface. For the operations that are available on the Operator Panel, see "Locating management functions" on page 61.

Front panel Indicators

LEDs on the front panel of the library provide a visual indication about the status of certain library components. The library also displays an appropriate message on the LCD screen to help identify the reason of failure.

Table 19. Front Panel Indicators					
Library Condition	**Ready/Activity LED**	**Cleaning LED**	**Attention LED**	**Error LED**	**Message on the LCD screen**
POST (Power ON Self Test)	Flashes 2 times every 3 seconds	OFF	OFF	OFF	INITIALIZING... INVENTORY...
Library is online and ready to receive a command	ON	OFF	OFF	OFF	READY

Library Condition	Ready/Activity LED	Cleaning LED	Attention LED	Error LED	Message on the LCD screen
Magazine open	Flashes 2 times every 3 seconds	OFF	OFF	OFF	PLEASE INSERT MAGAZINE
Magazine unlocked	Flashes 2 times every 3 seconds	OFF	OFF	OFF	MAGAZINE UNLOCKED
I/O Station open	Flashes 2 times every 3 seconds	OFF	OFF	OFF	PLEASE CLOSE I/O STATION
I/O Station unlocked	Flashes 2 times every 3 seconds	OFF	OFF	OFF	N/A
Library firmware is being updated	Flashes 2 times every 3 seconds	OFF	OFF	OFF	LOADER FIRMWARE UPDATING!
Drive firmware is being updated	Flashes 2 times every 3 seconds	OFF	OFF	OFF	DRIVE FIRMWARE UPDATING!
Drive dump is being uploaded to host computer	Flashes 2 times every 3 seconds	OFF	OFF	OFF	DRIVE DUMP DATA UPLOADING!
Library is offline	Flashes 2 times every 3 seconds	OFF	OFF	OFF	OFFLINE
Cartridge is being moved	Flashes 2 times every 3 seconds	OFF	OFF	OFF	READY
Library error occurred	ON	OFF	OFF	ON	*** CHK *** CODE: [XXXX]
Drive error occurred	ON	OFF	OFF	ON	DRIVE FAULT CODE: [X]
Cartridge error occurred	ON	OFF	ON	OFF	MEDIA FAULT CODE: [X]
Cleaning cartridge expired	ON	OFF	ON	OFF	REPLACE CLEANING MEDIA
Drive requested cleaning	ON	ON	OFF	OFF	CLEAN DRIVE
Drive is being cleaned	ON	Flashes 1 time per second	OFF	OFF	CLEANING...

Table 19. Front Panel Indicators (continued)

Any error that is detected by the library or drive controller and not recoverable through predetermined firmware algorithms is considered unrecoverable. When an error occurs, an error code is displayed on the Operator Panel display and the error LED is ON. The error code remains on the Operator Panel until a key is pressed, which causes the Operator Panel to return to the Home Screen. Numeric error codes and or text status messages are displayed. See "Error codes" on page 90.

Configuring the library

Configuring library settings

To configure the library settings, complete this procedure.

```
Configuration
   └─ Configure Library
         └─ Configure Library Mode
               ├─ Set Random Mode
               └─ Set Sequential Mode
                     ├─ Configure Loop Mode
                     │     ├─ Enable Loop Mode
                     │     └─ Disable Loop Mode
                     └─ Configure Autoload Mode
                           ├─ Enable Autoload Mode
                           └─ Disable Autoload Mode
```
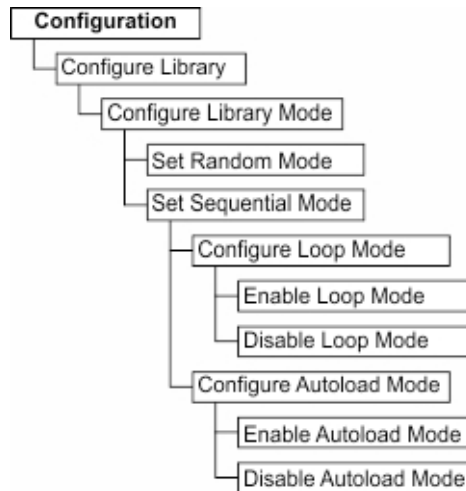
Figure 48. Library access mode settings

1. From the top menu screen, press the **Minus** key to select **Configuration**, and press **Enter**.
2. Select **Configure Library**, and press **Enter**.
3. **Active Slots** (Default: All)

   a. Select **Configure Library** > **Set Active Slots Count**.

   b. Select the number of active slots you would like to assign for the logical library.

   c. To enable I/O station, select **Active and I/O X Active + 1 I/O**.

   d. To disable I/O station, select **Active and I/O X Active + 0 I/O**.

   e. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

4. **Library Mode** (Default: Random)

   a. Select **Configure Library** > **Configure Library Mode**.

   b. Select **Set Random Mode** or **Configure Sequential Mode**, and press Enter.

   Random - In random mode, the library allows the server's (host's) application software to select any data cartridge in any order.

   Sequential - In sequential mode, the library's firmware predefines the selection of the cartridges. After initialization, the firmware causes the library to select the first available cartridge found (counting from the lowest Column/Tier position through the highest cartridge position in your library) for loading into the drive.

   - **Loop** - Sequential mode with loop mode ON loads the cartridge in the lowest Column/Tier cartridge position after the cartridge in the highest Column/Tier cartridge position is filled with data and sent back to its home position. This procedure allows endless backup operations without user interaction.

   - **Autoload** - Sequential mode with autoload mode ON loads the first available cartridge (the lowest Column/Tier cartridge position that contains a cartridge) automatically if the library powers ON, or resets, with an empty drive. If the library powers ON with a cartridge already in the drive, sequential mode starts from the home position of that cartridge, unless the host issues a rewind and unload command to the drive. In which case the next cartridge in sequence is loaded into the drive.

To start sequential mode if autoload is OFF, use the **Move Cartridge** command to load the first cartridge into the drive. The sequence starts from the home position of that cartridge. Cartridges need not to be in contiguous slots.

To stop sequential mode, use the **Move Cartridge** command to unload the drive. This command cancels sequential mode; the next sequential cartridge is NOT loaded.

To restart sequential mode, use the **Move Cartridge** command again to load a cartridge; the loading sequence resumes from the home position of that cartridge.

  c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

  d. Press **Cancel** to backtrack through the menu hierarchy.

5. Auto Cleaning (Default: Disabled)

  a. Select **Cofiguration** > **Configure Auto Cleaning**.

  b. Select **Enable Auto Cleaning** or **Disable Auto Cleaning**, and press **Enter**. The Auto Cleaning function is enabled only if there is at least one inactive position in the magazine in the library.

  c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

  d. Press **Cancel** to backtrack through the menu hierarchy.

Configuring network settings

In many environments, the default network settings might be sufficient to access your tape library on a network. To change the default network settings with the Operator Panel, complete this procedure.
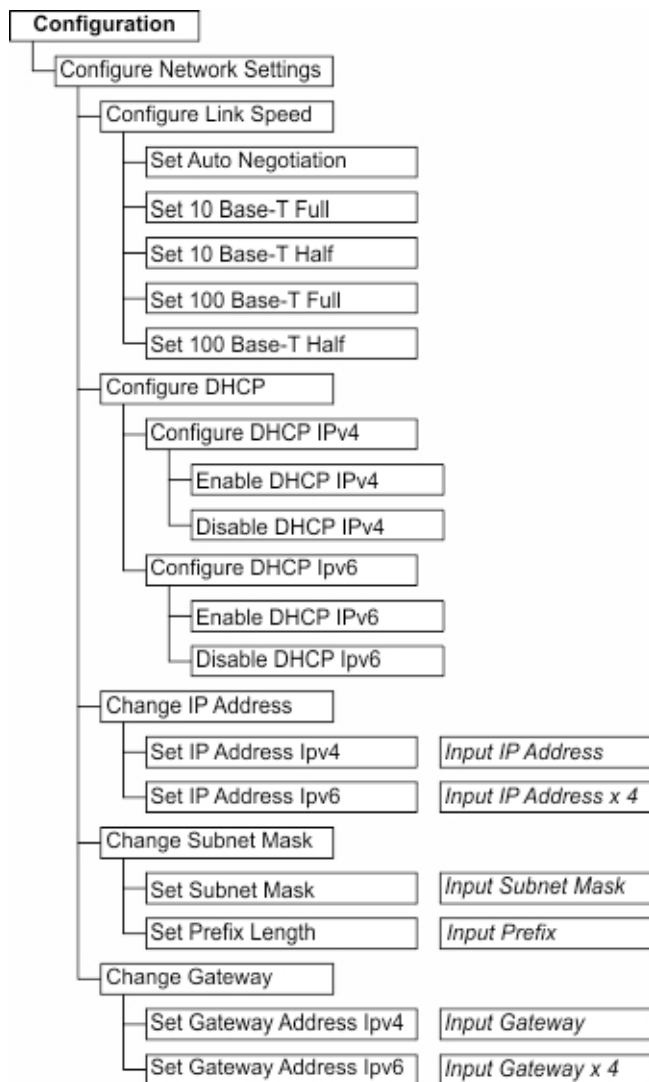
Figure 49. Network settings

1. From the top menu screen, press the **Minus** key to select **Configuration**, and press **Enter**.

2. Link speed (Default: Auto Negotiation)

   a. Select **Configure Network Settings** > **Configure Link Speed**.

   b. Select the required speed and press **Enter**.

   c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

      The speed must be set to **Set Auto Negotiation** for gigabit Ethernet networks.

   d. Press **Cancel** to backtrack through the menu hierarchy.

3. DHCP IPv4 (Default: Enabled)

   a. Select **Configure Network Settings** > **Configure DHCP** > **Configure DHCPIPv4**.

   b. Select **Enable DHCP IPv4** and press **Enter** to enable, or press **Down** and select **Disable DHCP IPv4** to disable.

   c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

   d. Press **Cancel** to backtrack through the menu hierarchy.

4. DHCP IPv6 (Default: Disabled)

   a. Select **Configure Network Settings** > **Configure DHCP** > **Configure DHCPIPv6**.

   b. Select **Enable DHCP IPv6** and press **Enter** to enable, or press **Down** and select **Disable DHCP IPv6** to disable.

   c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

   d. Press **Cancel** to backtrack through the menu hierarchy.

5. IPv4/IPv6 Address (Default: 0.0.0.0). If DHCP is disabled, set the IP address manually.

   a. Select **Configure Network Settings** > **Change IP Address**.

   b. Select **Set IP Address IPv4** to enter the IPv4 address of the tape library. **Set IP Address IPv6** to enter the IPv6 IP address (split over 4 screens).

   c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

   d. Press **Cancel** to backtrack through the menu hierarchy.

6. IPv4 Subnet Mask (Default: 255.255.255.0). If DHCP IPv4 is disabled, set the IPv4 subnet mask manually.

   a. Select **Configure Network Settings** > **Change Subnet Mask** > **Set Subnet Mask**.

   b. Enter the IPv4 subnet mask.

   c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

   d. Press **Cancel** to backtrack through the menu hierarchy.

7. IPv6 Prefix Length (Default: 64). If DHCP IPv6 is disabled, set the IPv6 prefix length manually.

   a. Select **Configure Network Settings** > **Change Subnet Mask** > **Set Prefix Length**.

   b. Enter the IPv4 prefix length.

   c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

   d. Press **Cancel** to backtrack through the menu hierarchy.

8. IPv4/IPv6 Gateway (Default: 0.0.0.0). If DHCP is disabled, set the IP address manually.

   a. Select **Configure Network Settings** > **Change Gateway**.

   b. Select **Set Gateway Address IPv4** to enter the IPv4 gateway address or **Set Gateway Address IPv6** to enter the IPv6 gateway address (split over 4 screens).

   c. Press **Enter** again to apply the setting, or **Cancel** to reject the setting.

   d. Press **Cancel** to backtrack through the menu hierarchy.

9. Press **Cancel** to return to the **Network Settings** menu.

10. Press **Cancel** to return to the **Configuration** menu.

11. Press **Cancel** to return to the top menu screen.

Configuring date and time settings
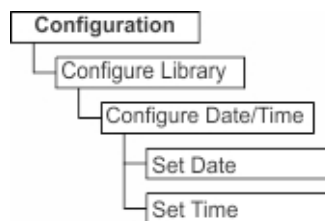
Figure 50. Date and time settings

Select **Configuration** > **Configure Library** > **Configure Date/Time** to set the date and time on your library manually after a power disruption and when Daylight Saving Time starts and ends. The date is set in MM/DD/YYYY format, and the time is set in 24-hour HH:MM:SS format.

The current date and time is also controlled automatically with a network-based Network Time Protocol (NTP) server. For more information, see "Configuring network settings" on page 59.

Locating management functions

This section provides the menu navigation to assist with library configuration, managing, and monitoring.

Refer to the following sections:

- Configuring the library Table 20 on page 61
- Managing the library Table 21 on page 62
- Monitoring the library Table 22 on page 63
- Managing drive Table 23 on page 63
- Managing cartridges Table 24 on page 64
- Managing security Table 25 on page 64

Table 20. Configuring the library

Task	Web User Interface	Operator Panel
Enable auto cleaning	**Configure Library** > **Physical/ Logical** > **Physical Settings**. See "Methods of cleaning the tape drive" on page 67.	**Configuration** > **Configure Auto Cleaning**. See "Methods of cleaning the tape drive" on page 67.
Reset configuration[*]	Not available with this interface	**Configuration** > **Set Default**
Set active slots count	**Configure Library** > **Physical/ Logical** > **Logical Settings**. See "Logical library settings" on page 41.	**Configuration** > **Configure Library** > **Set Active Slots Count**. See "Configuring library settings" on page 57.
Set date and time	**Configure Library** > **Date and Time**. See "Configuring date and time settings" on page 46.	**Configuration** > **Configure Library** > **Configure Date/Time**. See "Configuring date and time settings" on page 60.
Set email notification	**Configure Library** > **SMTP**. See "Configuring email notifications" on page 47.	Not available with this interface
Set random or sequential mode	**Configure Library** > **Physical/ Logical** > **Logical Settings**. See "Logical library settings" on page 41.	**Configuration** > **Configure Library** > **Configure Library Mode**. See "Configuring library settings" on page 57.
Set network settings	**Configure Library** > **Network**. See "Configuring network settings" on page 43.	**Configuration** > **Configure Network Settings**. See "Configuring network settings" on page 59.
Set SNMP	**Configure Library** > **SNMP**. See "Configuring SNMP notifications" on page 48.	Not available with this interface
Set SNTP	**Configure Library** > **Date and Time**. See "Configuring date and time settings" on page 46.	**Configuration** > **Configure Library** > **Configure Date/Time**. See "Configuring date and time settings" on page 60.

Table 20. Configuring the library (continued)		
Task	**Web User Interface**	**Operator Panel**
Save and restore configuration	**Configure Library** > **Save/Restore**. See "Saving and restoring configuration settings" on page 52.	Not available with this interface

* The date and time must be reset after restoring the factory default settings. See "Configuring date and time settings" on page 60. To restore your library configuration again, see "Saving and restoring configuration settings" on page 52.

Important: This configuration setting deletes all current library settings, and should be used with utmost caution.

Table 21. Managing the library		
Task	**Web User Interface**	**Operator Panel**
Enable or disable I/O station	**Configure Library** > **Physical/ Logical** > **Logical Settings** > **Number of active slots**. See "Logical library settings" on page 41.	**Configuration** > **Configure Library** > **Active Slots**. See "Configuring library settings" on page 57.
Enable or disable back light	Not available with this interface	**Configuration** > **Configure Op Panel Settings** > **Configure LCD Back Light**
Set auto turn Off of back light	Not available with this interface	**Configuration** > **Configure Op Panel Settings** > **Configure LCD Back Light** > **Enable Auto Back Light** > **Input Count**
Run Encryption Key Path Diagnostic	**Service Library** > **Key Path Diagnostics**. See "Key Path Diagnostics" on page 45.	Not available with this interface
Run Library Verify	Not available with this interface	**Service** > **Diagnostics** > **Run Library Verify**. See "Running library verify test" on page 78.
Reboot library[1]	**Service Library** > **Reset Library/ Drive**	**Commands** > **Reboot Library**
Take library online or offline[2]	**Manage Library** > **Library State**	**Commands** > **Change Library State**
Unlock magazine[3]	**Manage Library** > **Unlock Magazine**	**Unlock Magazine**
Unlock I/O Station[4]	Not available with this interface	**Unlock I/O Station**
Ship the library	Not available with this interface	**Commands** > **Move to Ship Position**. See "Shipping the library" on page 117.
Conduct library inventory[5]	**Manage Library** > **Inventory**	**Commands** > **Inventory**

Table 21. Managing the library (continued)		
Task	**Web User Interface**	**Operator Panel**
1. The library status may display `Failed` until the library is back online.		
2. The tape drive is always online, even when the library is offline.		
3. If the cartridge magazine is not removed within 5 minutes, it is automatically locked.		
4. This menu option is available only when the I/O station is enabled in the library configuration settings.		
5. An inventory is conducted automatically when power is first turned ON or when the cartridge magazine is removed and reinserted.		

Table 22. Monitoring the library		
Task	**Web User Interface**	**Operator Panel**
Graphical view of library	**Monitor System** > **Library Map**. See "Graphical view of library" on page 34.	Not available with this interface
View library settings	**Monitor System** > **Library Map**	**Configuration** > **View Settings**
View library firmware	**Monitor System** > **System Summary**	**Service** > **View Firmware Revision**
View library logs	**Service Library** > **View Library Logs**. See "Library logs" on page 90.	Not available with this interface
View library error status [*]	**Service Library** > **View Library Log** . See "Library logs" on page 90.	**Service** > **View Error Status** > **View Library Error Status**
View drive error status[*]	**Service Library** > **View Library Log** . See "Library logs" on page 90.	**Service** > **View Error Status** > **View Drive Error Status**
View network settings	**Monitor System** > **Library Map**	**Configuration** > **View Settings**
View system summary	**Monitor System** > **System Summary**	Not available with this interface
View usage statistics	**Service Library** > **Usage Statistics**	Not available with this interface
[*] If an error occurs, press **Enter** to display specific error information. You can check the meaning of error codes in "Error codes" on page 90.		

Table 23. Managing drive		
Task	**Web User Interface**	**Operator Panel**
Clean drive	**Manage Library** > **Clean Drive**	**Commands** > **Clean Drive**
Download drive logs	**Service Library** > **Download Logs**	Not available with this interface
Eject cartridge from drive	**Manage Library** > **Move Cartridges**	**Commands** > **Move Cartridge**
Reboot drive[*]	**Service Library** > **Reset Library/ Drive**	**Commands** > **Reboot Drive**
Run drive test	Not available with this interface	**Service** > **Diagnostics** > **Drive Diagnostics**

Table 23. Managing drive (continued)

Task	Web User Interface	Operator Panel
Unload drive	**Manage Library** > **Unload Drive**. See "Random and sequential logical library modes" on page 12.	**Commands** > **Unload**. See "Random and sequential logical library modes" on page 12.
Update drive firmware	**Service Library** > **Firmware Update**. See "Updating library and drive firmware" on page 66.	Not available with this interface
* The drive status may display `Failed` until the drive is back online.		

Table 24. Managing cartridges

Task	Web User Interface	Operator Panel
Move cartridges*	**Manage Library** > **Move Cartridges** Two methods to move cartridges between the I/O station, storage positions, and tape drive: • Click and drag a cartridge from one location to another. • Click a cartridge, select location coordinates from the **Destination slot** menu, and click **Move**.	**Commands** > **Move Cartridge** Specify the **Source Slot** and the **Destination Slot** and press **Enter**.
Graphical view of cartridges	**Monitor System** > **Library Map**. See "Graphical view of library" on page 34.	Not available with this interface
View library inventory	**Manage Library** > **Inventory**	**Commands** > **Inventory**
* Cartridges cannot be moved to the accessor with this command. However, cartridges can be moved from the accessor with this command if the library was powered OFF with a cartridge still held in the accessor.		

Table 25. Managing security

Task	Web User Interface	Operator Panel
Upload certificates	**Configure Library** > **Certificate**. See "Uploading and configuring the SSL certificate" on page 51.	Not available with this interface
Configure encryption	**Configure Library** > **Encryption** . See "Configuring encryption for a non-encrypted-licensed library" on page 44.	Not available with this interface
Modify users	**Configure Library** > **User Access**. See "Managing user access" on page 38.	Not available with this interface
Add users	**Configure Library** > **User Access**. See "Managing user access" on page 38.	Not available with this interface
Remove users	**Configure Library** > **User Access**. See "Managing user access" on page 38.	Not available with this interface

Table 25. Managing security (continued)		
Task	**Web User Interface**	**Operator Panel**
Enable or disable SSL for Web	**Configure Library** > **Network**. See "Configuring network settings" on page 43.	Not available with this interface
Configure Web GUI settings*	Not available with this interface	**Configuration** > **Configure Web GUI settings** > **Unlock a User Account**
* In case you forget the password of a user account, you can reset the password using the **Configure Web GUI settings**. The password of the user account unlocked is changed to **secure** automatically.		

Default settings

The library is set to default settings when first purchased. Many of these settings can be customized.

Table 26. Default library configuration settings	
Configuration Item	**Default Setting**
NETWORK	
Ethernet link speed	Auto
SSL security	Disabled
IPv4 settings	Enabled
DHCP (Dynamic Host Configuration Protocol)	Enabled
Static IP address	Disabled
IPv4 address	0.0.0.0
Subnet mask	255.255.255.0
Gateway	0.0.0.0
IPv6 settings	Disabled
DHCP (Dynamic Host Configuration Protocol)	Enabled
Stateless auto-configuration	Enabled
Static IP address	Disabled
IPv6 address	0:0:0:0:0:0:0:0
Prefix length	64
Gateway	0:0:0:0:0:0:0:0
DNS setting	Disabled
DNS IP address	0.0.0.0
PHYSICAL	
Library name	(Blank)
Auto Cleaning	Disabled
Bar code label length	8 characters
LOGICAL	
Library mode	Random

Table 26. Default library configuration settings (continued)

Configuration Item	Default Setting
Loop	Enabled
Auto Load	Enabled
Active slots	9 + 0
ENCRYPTION (S4H and LATER ONLY)	
Encryption method	None
DATE and TIME	
NTP server	Disabled
NTP server address	0.0.0.0
Time zone (GMT)	+00:00
Date (MM/DD/YYYY)	01/08/2008
Auto adjustment by PC	Every 1 minute
NOTIFICATIONS	
SMTP (mail) settings	
Mail server address	0.0.0.0
Mail event	Error events enabled
SNMP (trap) settings	
Community	Public
Trap event	Error events enabled
SNMPv3 engine ID	(Set by library firmware)

# Updating library and drive firmware

Figure 51. Firmware Update screen

Select **Service Library** > **Firmware Update** to update the library and drive firmware.

Note: It is the customer's responsibility to maintain the library and drive firmware at the most recent level.

Consider these recommendations to provide maximum performance and reliability:

- The latest version of microcode must be installed on your tape libraries and devices.
- The library code must be updated first, unless noted otherwise. This action supports any changes that are introduced in the library code for that drive, or any changes made to the drive for that release.
- These firmware updates are intended to increase overall reliability, improve tape handling, reduce the possibility of data errors, and enhance diagnostic capabilities.

To determine the current library and drive firmware revision from the Web User Interface: **Service Library** > **Firmware Update**. The current library and drive firmware revision can also be found by navigating to **Monitor System** > **Library Map**. Select the **Drive** component in the library map to display the **Drive Information** box. The **Product ID** is the drive that is installed in the library.

Note: Ensure that you download and install the correct drive firmware.

- Firmware for the ULT3580-HH4 drive is not compatible with the ULT3580-HH4 V2 drive.
- Firmware for the ULT3580-HH4 V2 drive is not compatible with the ULT3580-HH4 drive.

To update library and drive firmware:

1. Unload the tape drive, if there is a cartridge in the tape drive, before the library and drive firmware are updated.
2. Use **Service Library** > **Firmware Update** and click **Browse** to locate the library firmware file with extension ".fmg" (for example, TL1000_31.3000.fmg) or the LTO SAS drive firmware file with extension".ro" (for example, 85F0L3AH.ro) that you downloaded from the Dell web site, then click **Update**.
3. Wait for the library to reboot before normal library operations resume. It can take several minutes before the library reboots.
4. Verify the firmware update by viewing the **System Summary** on the Web User Interface.

Important: After the update process starts, you must wait until the library reboots. Do not attempt to interrupt the process in any way, or the upgrade will not be successful.

Methods of cleaning the tape drive

Automatic cleaning of the tape drive is disabled by default in the library. It is also possible to clean the drive manually. However, automatic cleaning of the tape drive is recommended for the library.

The head of the tape drive in the tape library must be kept clean to prevent errors that are caused by contamination. To help you keep the drive clean, Dell provides a cleaning cartridge with the library. The library uses the cleaning cartridge to clean the drive with whatever cleaning method that you choose. In all methods, cleaning is done after the data cartridge is unloaded from the drive and before the next load.

If you put the cleaning cartridge into an active slot, it is visible to any host application. If you do not want the cleaning cartridge to be visible to the host application, put it into an inactive slot.

It is the operator's responsibility to monitor cleaning cartridge usage and replace cleaning cartridge as necessary. The library provides multiple ways to monitor and manage cleaning cartridge. If SNMP traps are enabled, a trap is generated when a cleaning cartridge expires. It is also possible to use the Web User Interface to monitor the cleaning cycles that remain on the cleaning cartridge.

Two methods of cleaning are available.

Auto cleaning
  Automatic cleaning enables the library to automatically clean the tape drive. The cleaning process is transparent to any host application that uses the library. When enabled, the library automatically initiates a cleaning operation when media is unloaded from the drive that requires cleaning instead of creating a warning event when a drive requires cleaning.

  The Auto cleaning function can be enabled only if there is at least one inactive position in the magazine. If auto cleaning is enabled, the inactive positions become cleaning cartridge positions. To

enable auto cleaning with Web User Interface and Operator Panel, see "Configuring library settings" on page 41 and "Configuring library settings" on page 57.

Note: Dell recommends enabling the Auto cleaning function on the library. With the Auto cleaning function enabled, the drive cleaning occurs automatically. The only time Auto cleaning must be disabled is when your backup application requires that it has control.

Manual cleaning

Manual cleaning requires that you select a menu option from the Web User Interface or Operator Panel to clean the tape drive. Manual cleaning is always supported. See "Locating management functions" on page 61.

For information on tape cartridges, see "Supported tape cartridges" on page 8.

Chapter 5. LTO media

This section provides an overview of LTO media, which is recommended for use with this autoloader.

TheUltrium media is available in the following types:

- Data cartridge
- "WORM (Write once, read many) cartridges" on page 70
- "Cleaning cartridge" on page 71

To ensure that your Ultrium Tape Drive conforms to Dell's specifications for reliability, use only LTO Ultrium tape cartridges. You might use other LTO-certified data cartridges, but they might not meet the standards of reliability that are established by Dell. The LTO Ultrium Data Cartridge cannot be interchanged with the media used in other non-LTO Ultrium tape products.
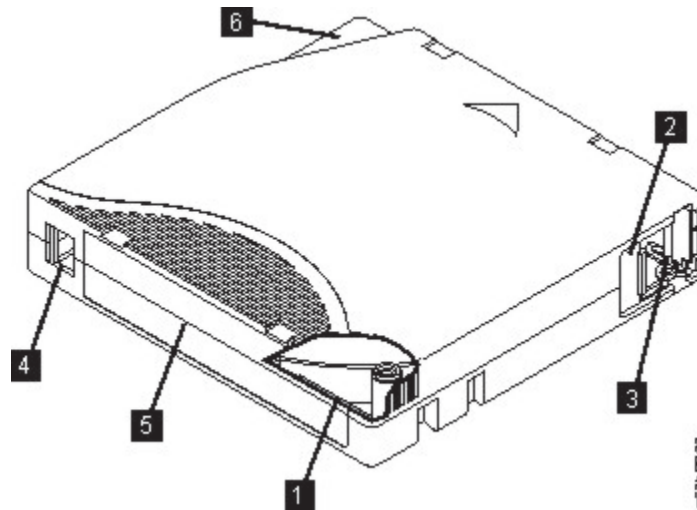
Figure 52. The LTO Ultrium Data Cartridge

Figure 52 on page 69 shows the LTO Ultrium Data Cartridge and its components.

1	LTO cartridge memory	4	Write-protect Switch
2	Cartridge door	5	Label area
3	Leader Pin	6	Insertion guide

When tape is processed in the cartridges, Ultrium tape drives use a linear, serpentine recording format. The first set of tracks is written from near the beginning of the tape almost to 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 cartridge is full, or until all data is written.

The cartridge door **2** protects the tape from contamination when the cartridge is out of the drive. The tape is attached to a leader pin **3** behind the door. When the cartridge is inserted into the drive, a threading mechanism pulls the pin (and tape) out of the cartridge, across the drive head, and onto a non-removable take-up 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. For more information, see "Write-Protect switch" on page 73.

The label area **5** provides a location to place a label. .

The insertion guide **6** is a large, notched area that prevents the cartridge from being inserted incorrectly.

Note: The same components are on all the LTO Ultrium Data 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 LTO7 initialized LTO Type M cartridge. These LTO Type M cartridges are identifiable by using an automation bar code label that ends with the last 2 characters "M8".

Cartridge/Density type	Bar code label	Cartridge Packaging/ Silkscreen labeling	Native capacity	Tape Drive compatibility
L8	xxxxxxL8	LTO Ultrium 8	12 TB	LTO8
M8	xxxxxxM8	LTO Ultrium 7	9 TB	LTO8
L7	xxxxxxL7	LTO Ultrium 7	6 TB	LTO7, LTO8

Table 27. LTO7 and LTO8 Cartridge Types

From now on, these cartridges are referred to as L8, M8, and L7.

Only new, unused LTO Ultrium 7 cartridges can be initialized as M8 cartridges. When a cartridge is initialized as M8, it cannot be changed back to L7. Initialized M8 cartridges can be written and read-only in an LTO8 tape drive. LTO7 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 uninitialized M8 data cartridges (M8 WORM cartridges are not supported). For either option, the bar code label is included. However, the uninitialized M8 data cartridge must first be initialized in tape libraries that support the automatic initialization of uninitialized M8 cartridges while under the control of ISV applications that recognize the "M8" bar code 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 then establishes the density of the media.

If an uninitialized M8 cartridge is not initialized in a tape library that supports uninitialized M8 cartridges, then the cartridge might inadvertently and silently be initialized at the L7 density (that is, at a 6 TB native capacity) even if the bar code label states "M8". This action might occur with the usage of non-TL1000 Tape Autoloaders, stand-alone LTO-7 tape drives, stand-alone LTO-8 tape drives, earlier LTO-8 tape drive firmware, earlier TL1000 Tape Autoloader firmware, or earlier ISV software that does not recognize that M8 cartridges must be mounted only in LTO8 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 remain limited to the 6 TB native capacity.

TL1000 Tape Autoloader firmware version 0080 added support for uninitialized M8 cartridges, in addition to support for pre-initialized M8 cartridges. In any tape product with M8 cartridges, the minimum LTO8 tape drive firmware version is HB82.

WORM (Write once, read many) cartridges

Certain records retention and data security applications require a write once, read many (WORM) method for storing data on tape.

The LTO Ultrium 4 and later drives enable WORM support when a WORM tape cartridge is loaded into the drive.

WORM media

The standard read/write media are incompatible with the WORM feature so a specially formatted WORM tape cartridge is required, see Figure 53 on page 71. Each WORM cartridge has a unique, worldwide

cartridge identifier (WWCID), which consists of the unique CM chip serial number and the unique tape media serial number.
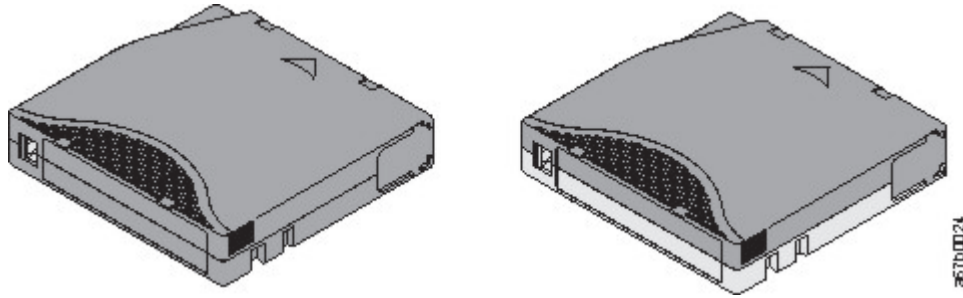

Figure 53. Ultrium data and WORM tape cartridges

Data security on WORM media

Certain built-in security measures help ensure that the data that is written on a WORM cartridge does not become compromised, for example:

- The format of an Ultrium WORM tape cartridge is unlike standard read/write media. This unique format prevents a drive that lacks WORM-capable firmware from writing on a WORM tape cartridge. For LTO 9, native data capacity is 18 TB and compressed data capacity is 45 TB.
- When the drive senses a WORM cartridge, the firmware prohibits user data from being changed or altered. The firmware tracks the last point on the tape that can be appended.

WORM media errors

The following conditions cause WORM media errors to occur:

- Information in the servo manufacturer's word (SMW) on the tape must match information from the cartridge memory (CM) module in the cartridge. If it does not match, a media error code 7 posts on the drive's single-character display (SCD).
- Inserting a WORM tape cartridge into a drive that is not compatible with WORM causes the cartridge to be treated as an unsupported medium. The drive reports a media error code 7. Upgrading the drive firmware to the correct code level resolves the problem.

Requirements for WORM capability

To use the WORM capability of your LTO Ultrium drive, you must use a compatible WORM tape cartridge. See for cartridge and VOLSER compatibility.

Cleaning cartridge

An Ultrium Universal Cleaning Cartridge is required to clean the tape drive.

The drive itself determines when it must be cleaned and notifies the library. When notified, the library indicates that the drive needs cleaning by turning ON the "Clean Drive" LED on the front panel of the library and posting a message on the library display.

A tape drive within a library requires the use of a library menu function to either automatically or manually clean the tape drive. See .

Important: The drive must be cleaned only when it is requested by the drive.

The Ultrium Universal Cleaning Cartridge is valid for 50 uses. The cartridge's LTO-CM (Cartridge Memory) chip tracks the number of times that the cartridge is used.

Note: The drive automatically ejects an expired cleaning cartridge.

Bar code labels

Bar code label requirements for LTO drives.

A bar code label contains:

- A volume serial number (VOLSER) that is human-readable.
- A bar code that the library can read.

Note: LTO drives do not require cartridges to have bar code labels. Specific library types or models might require cartridges to have bar code labels.

When read by a library's bar code reader, the bar code identifies the cartridge's VOLSER to the library. The bar code also tells the library whether the cartridge is a data cartridge or cleaning cartridge. In addition, the bar code includes the two-character media-type identifier or M8, or Lx, where x equals 1, 2, 3, 4, 5, 6, 7, 8, or 9 . The letter L identifies the cartridge as an LTO cartridge and the number represents the generation of cartridge for that cartridge type. Figure 54 on page 73 shows a sample bar code label for the LTO Ultrium tape cartridge.

Tape cartridges can be ordered with the labels included or with custom labels.

Table 28. Cartridges and VOLSERs compatible with the Ultrium Tape Drives	
Cartridges	**VOLSER**
Ultrium 9 Data Cartridge	xxxxxxL9
Ultrium 9 WORM Cartridge	xxxxxxLZ
Ultrium 8 Data Cartridge	xxxxxxL8
Ultrium 8 WORM Cartridge	xxxxxxLY
Ultrium M8 Data Cartridge	xxxxxxM8
Ultrium 7 Data Cartridge	xxxxxxL7
Ultrium 7 WORM Cartridge	xxxxxxLX
Ultrium 6 Data Cartridge	xxxxxxL6
Ultrium 6 WORM Cartridge	xxxxxxLW
Ultrium 5 Data Cartridge	xxxxxxL5
Ultrium 5 WORM Cartridge	xxxxxxLV
Ultrium 4 Data Cartridge	xxxxxxL4
Ultrium 4 WORM Cartridge	xxxxxxLU
Ultrium 3 Data Cartridge	xxxxxxL3
Ultrium 3 WORM Cartridge	xxxxxxLT
Ultrium 2 Data Cartridge	xxxxxxL2
Ultrium 1 Data Cartridge (READ ONLY)	xxxxxxL1
LTO Ultrium Cleaning Cartridge	CLNxxxLx

To determine the complete specifications of the bar code and the bar code label, contact your sales representative.

When a bar code label is attached to a tape cartridge, place the label only in the recessed label area (see **5** in Figure 52 on page 69). A label that extends outside of the recessed area can cause loading problems in the drive.

Attention: Do not place any type of mark on the white space at either end of the bar code. A mark in this area might prevent the library from reading the label.
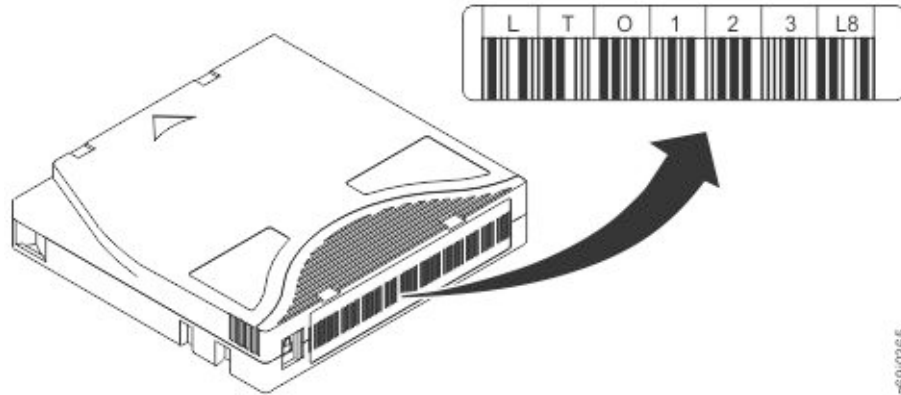

Figure 54. Sample bar code label on the LTO Ultrium 8 Tape Cartridge

Guidelines for the use of bar code labels

Apply the following guidelines whenever using 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 it is applied to the cartridge. Do not use the label if it has voids or smears in the printed characters or bar code (a library's inventory operation takes much longer if the bar code label is not readable).
- Remove the label from the label sheet carefully. Do not stretch the label or cause the edges to curl.
- Position the label within the recessed label area (see **5** in Figure 52 on page 69).
- 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 drive to load the cartridge.

Write-Protect switch

The position of the write-protect switch on the tape cartridge determines whether you can write to the tape.

If the switch **1** is set to:

- The locked position ⬜ (solid red), data cannot be written to the tape.
- The unlocked position (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 application allows the server's software to identify a cartridge that no longer contains current data and is eligible to become a scratch (blank) data cartridge. Do not write-protect scratch (blank) cartridges. The tape drive cannot write new data to them.

If you must manually set the write-protect switch, slide it left or right to the desired position.
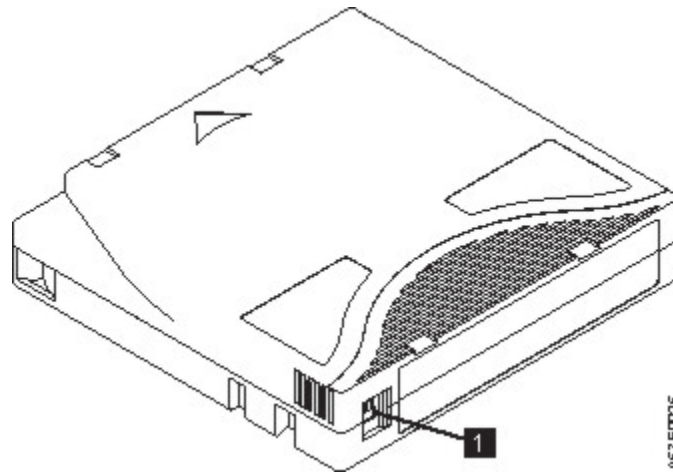
Figure 55. Setting the write-protect switch

Table 29. Location of the write-protect switch

1	Write-Protect switch

Cartridge care and handling

Incorrect handling or an incorrect environment can damage cartridges or their magnetic tape.

⚠️ **Attention:** Do not insert a damaged tape cartridge into the drive. A damaged cartridge can interfere with the reliability of a drive and might 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.

Incorrect handling or an incorrect environment can damage cartridges or their magnetic tape. To avoid damage to your tape cartridges and to ensure the continued high reliability of your LTO Ultrium Tape Drives, use the following guidelines.

Provide training

Providing training to the users of your tape drive can prolong the life of your 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.

Ensuring proper packaging

- When shipping a cartridge, use the 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.
- 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 the following:
  - 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 (see Figure 56 on page 75).

Figure 56. Double-boxing tape cartridges for shipping

Proper acclimation and environmental conditions

- 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).
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields of greater than 100 oersteds (for example, 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 conditions that are described in "Environmental and shipping specifications for tape cartridges" on page 77.

Perform a thorough inspection

After you purchase a cartridge and before you use it, complete the following steps:

- Inspect the cartridge's packaging to determine potential rough handling.
- When a cartridge is inspected, 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.
- Inspect the cartridge for damage before you use or store it.
- Inspect the rear of the cartridge (the part that loads first into the tape load compartment) and ensure that there are no gaps in the seam of the cartridge case. If there are gaps in the seam (see Figure 57 on page 76), the leader pin might be dislodged.
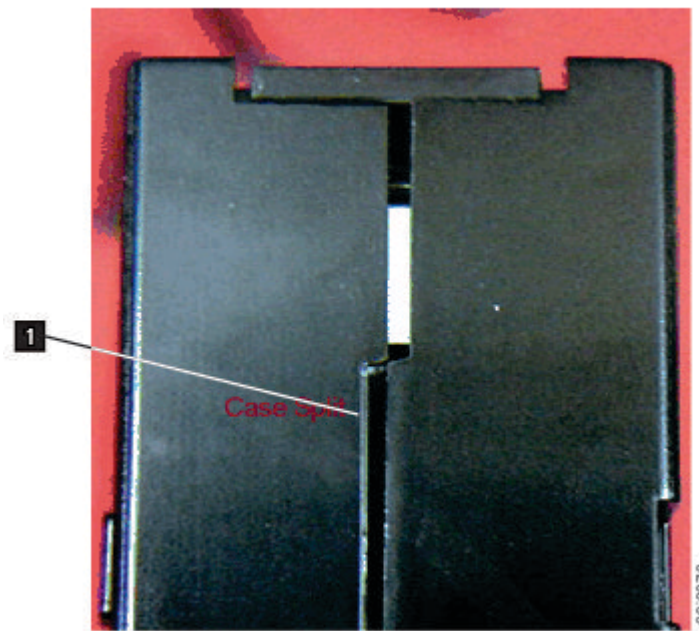
Figure 57. Checking for gaps in the seams of a cartridge

- Check that the leader pin is properly seated.
- If you suspect that the cartridge was mishandled but it appears usable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.
- Review handling and shipping procedures.

Handling the cartridges

- Do not drop the cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly seated in the pin-retaining spring clips.
- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which might 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

Several examples of cartridge problems.

Example: Split cartridge case (see "Perform a thorough inspection" on page 75)

The cartridge's case is damaged. There is a high possibility of media damage and potential loss. Perform the following steps:

1. Look for cartridge mishandling.
2. Use the Leader Pin Reattachment Kit (part number 08L9129) to correctly seat 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

1. Look for cartridge damage.
2. Use the Leader Pin Reattachment Kit (part number 08L9129) to correctly seat the pin. Then, immediately use data recovery procedures to minimize chances of data loss.

Environmental and shipping specifications for tape cartridges

Specific storage and shipping environmental conditions apply to 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 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.

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.

gives the environment for storing and shipping LTO Ultrium Tape Cartridges.

Table 30. Environment for storing and shipping the LTO Ultrium Tape Cartridge

Environmental Factor	Allowable Storage	Recommended Storage	Shipping
Temperature	16 - 32°C (61 - 90°F)	16 - 25°C (61 - 77°F)	-23 to 49°C (-9 to 120°F)
Relative humidity (noncondensing)	20 - 80%	20 - 50%	5 - 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).		

Chapter 6. Troubleshooting

The TL1000 Tape Autoloader is a customer replaceable unit (CRU). The customer is responsible for the setup and maintenance of the library. Warranty replacement of the TL1000 Tape Autoloader, if required, is provided by exchanging the old unit with a new unit. The customer is charged for onsite service if a service contract is not in place.

When an error occurs during operation of the library, the library stops the current operation and displays an error code on the Operator Panel. Unless otherwise noted, try to resolve the problem by cycling power to the library and retrying the last operation.

Note: When power cycling the library, wait 10 seconds after the power is switched OFF before the library is powered ON again.

Before you place a service call or inform Dell Technical Support, check the status of the library and drive from the Web User Interface, see Table 14 on page 33. Also, observe the LEDs on the front panel and error messages on the Operator Panel to determine exactly which part is failing, see "Front panel Indicators" on page 55. You can frequently resolve a simple problem yourself with the information that is available in "Troubleshooting guide" on page 79.

How the library reports problems

The library uses advanced problem detection, reporting, and notification technology to alert customers of problems as soon as they occur.

It completes numerous self-tests to monitor the library's temperature, voltage and currents, and standard library operations. These tests monitor the library when the library is powered ON, and during normal operation when the library is idle.

If the test detects a problem, the library generates a message that identifies which component is likely causing the problem. The library's Error LED and Attention LED might turn ON to indicate an abnormal state. If the problem is not severe, the Attention LED turns ON and the library continues to provide full functionality to the library. If the problem is not recoverable, the Error LED turns ON and an error message is displayed on the Operator Panel.

When the library generates an attention event or an error event, support staff can be notified immediately by setting up email event notification or SNMP trap notification. The type of event that generates email notification or SNMP trap notification can be selected to limit the number of events to a specific priority level.

Customers can frequently resolve a simple problem themselves by with the information found in "Troubleshooting guide" on page 79. If the problem is unrecoverable, the customer must contact Dell Technical Support, see "Contacting Dell technical support" on page 89.

Running library tests

The library provides the following tests to verify library operations.

- Library Verify is used to test the library and drive hardware, communications, and the read or write capability of the library. It is the most critical and frequently used test, and is run after all maintenance procedures to ensure correct library performance. See "Running library verify test" on page 78.
- Drive Diagnostics is used to run various drive-related tests such as Normal R/W test, Perform R/W Test, Media test, Head test, and SAS Wrap test. See "Running drive diagnostic test" on page 79.

Running library verify test

To run the library verification test, follow the steps:

1. Select **Service** > **Diagnostics** > **Run Library Verify** and press **Enter**. Follow the on-screen instructions.

If a cartridge is present in the drive, the library moves the cartridge to its home position, or to the I/O station if the home position is not known.

2. When prompted, insert a scratch cartridge into the I/O station.

When the scratch cartridge is loaded, an inventory is conducted and the bar code reader reads the bar code label on the cartridge and stores it for later comparison. The scratch cartridge is then moved to the tape drive, where the drive runs its own write/read/verify test. When the test is done, the library tells the drive to eject the scratch cartridge, and then the cartridge is moved back to the I/O station. The bar code is read again and compared with the value stored earlier.

3. When prompted, remove the scratch cartridge from the I/O station.

The result of the test (PASSED or error message) is reported on the Operator Panel.

4. View the **Error Log** to check for errors.

If an error occurs, see "Error codes" on page 90 to identify and locate the problem.

Note: If the host application hasn't already unloaded tape cartridges in the drives, run the Library Verify test.

Running drive diagnostic test

To run drive diagnostic tests, follow the steps:

1. Select **Service** > **Diagnostics** > **Drive Diagnostics** and press **Enter**.

Select one of the diagnostic tests and follow the on-screen instructions.

2. When prompted, insert a scratch (blank) cartridge into the I/O station.

- **Normal R/W Test** - Runs a shortened version of the **Performance R/W Test**. It does not include the POST diagnostic, calibrate drive, or unique tape motion tests. It checks the motors and head by running read/write tests on a shortened section of tape, both inbound and outbound. Takes approximately 4 minutes (if no error occurs) to 9 minutes (if calibration is required).

- **Perform R/W Test** (Performance R/W Test) - Runs most of the tests that normally occur when the library is powered ON (POST). When prompted, load a CE scratch cartridge to run the calibrate drive, read/write, and tape motion tests. These tests calibrate the read/write channel to optimum settings, run a long read/write test with all servo positions, and exercise all of the tape motion functions of the drive. Takes up to 30 minutes.

- When prompted, remove the cartridge from the I/O station.

The result of the test (PASSED or error message) is reported on the Operator Panel.

- View the **Error Log** to check if any errors occur.

If an error occurs, see "Error codes" on page 90 to identify and locate the problem.

Troubleshooting guide

Refer to the following tables that list the errors or symptoms that might occur with the TL1000 Tape Autoloader.

The tables provide action to correct the problems.

- Error codes or LED Indication on Operator Panel and TapeAlert Flags Table 31 on page 80
- Library problems Table 32 on page 80
- Tape drive problems Table 33 on page 83
- Cartridge problems Table 34 on page 84
- Communication problems Table 35 on page 85
- Encryption problems Table 36 on page 88

Table 31. Error codes or LED Indication on Operator Panel and TapeAlert Flags	
Problem	**Solution**

The library issued an error code
 	
An error message was received by way of email notification (if enabled)
	1. Make note of the error code.
	2. Power cycle the library.
	
	   a. If the error recurs, see "Error codes" on page 90.
	
	   b. If the error does not recur, resume normal library operations.

One or more front panel LEDs is ON or flashing	See "Front panel Indicators" on page 55.
The error code represents an unrecoverable error	See "Contacting Dell technical support" on page 89.
You get repeated errors	1. Reset the library. 2. If the library is still reporting errors, power cycle the library. If no errors are reported, resume normal library operations. 3. If the library still fails, reset factory defaults. If no errors are reported, resume normal library operations. 4. If the problem persists, see "Contacting Dell technical support" on page 89.
You are experiencing a problem with your library and no error code was created	1. Run **Library Verify** to identify and resolve the problem. See "Running library verify test" on page 78. 2. If the problem persists, see "Contacting Dell technical support" on page 89.

A TapeAlert flag was received	1. Make note of the TapeAlert flag.
	2. Power cycle the library.
	
	   a. If the TapeAlert recurs, see "TapeAlert flags" on page 108.
	
	   b. If the TapeAlert does not recur, resume normal library operations.

Table 32. Library problems	
Problem	**Solution**
You are experiencing trouble installing your library	1. Ensure that the accessor locking screw on the rear panel of the library is removed before the library is powered ON. See "Removing the accessor locking screw" on page 25. 2. Review the information in Chapter 3, "Installing," on page 20 to determine whether a step was missed or misread. 3. If you are still experiencing difficulty with installing your library, see "Contacting Dell technical support" on page 89. **Important:** Do not disassemble the library. The warranty on your library is voided if the unit is disassembled without the approval of Dell Technical Support.

Table 32. Library problems (continued)	
Problem	**Solution**
You are experiencing trouble configuring your library	1. If you have a recent backup of your configuration, proceed to the next step. If you do not, try to save one now (Web User Interface: **Configure Library** > **Save/Restore**). 2. If a static IP address is used, make note of your library's IP address. With DHCP, proceed to the next step. 3. Restore factory defaults (Operator Panel: **Configuration** > **Set Default**). 4. With a static IP address, disable DHCP (the default setting) and enter the library IP address (Web User Interface: **Configure Library** > **Network**; Operator Panel: **Configuration** > **Configure Network Settings**). With DHCP, proceed to the next step. 5. Restore the library configuration (Web User Interface: **Configure Library** > **Save/Restore**).

If the power supply switch is ON and the library is OFF	1. Ensure that the power cord is plugged in at the power supply and at the electrical outlet, then turn library power ON. Feel for air that is flowing out of the cooling fan grill on the rear of the library. Power is good if air is flowing from the cooling fan grill.
	
	 2. If power is not working, follow the steps:
	
	   a. Plug the power cord into another electrical outlet.
	
	   b. Plug another device into the outlet to test.
	
	   c. If the outlet tests OK, try another power cord.
	
	 3. If you verified that the electrical outlet and power cord works properly, but the power supply is still failing, replace the library.
	
	 4. If the power supply seems to be delivering power to the library, but air does not flow from the power-supply cooling fan grill on the rear of the library, replace the library.

There is a blank operator panel/display **The accessor does not move** **The display is stuck on initialization for extended period of time**	Failure of the login screen to display on the Operator Panel in 15 minutes indicates that the boot-up process is not completing. 1. Power OFF the library and wait at least one minute before the library is powered ON to recover from the problem. 2. If a library firmware update was completed, try repeating the update procedure.

The magazine will not unlock after issuing the Unlock Magazine command from the Operator Panel	1. Power cycle the library.
	
	 2. Try unlocking the magazine again (Operator Panel: **Unlock Magazine**, or Web User Interface: **Manage Library** > **Unlock Magazine**).
	
	   a. If the magazine does not unlock, see "Unlocking the cartridge magazine manually" on page 116.
	
	   b. If the magazine does unlock, resume normal library operations.

Table 32. Library problems (continued)	
Problem	**Solution**
The magazine can be partially removed from the library **The magazine seems stuck on something inside the library**	1. Verify that you requested the library to unlock the entire magazine, not just the I/O station (if enabled) then retry the operation. 2. Carefully pull the magazine out of the library. Stop if you feel any resistance (as if something is blocking the magazine inside the library). 3. If the magazine still cannot be removed from the library, see "Contacting Dell technical support" on page 89.

Reseating cables	1. Locate the following cables on the rear panel of the library.
	
	   a. SAS attachment for the drive
	
	   b. Ethernet cable for connection to a network
	
	   c. Power supply cable
	
	2. Check and reseat, if necessary, all of the cables that are connected to your library.
	
	3. Ensure that the connector pins are not damaged.

The Library firmware does not complete the boot-up process and appears hung	Failure of the login screen to display on the Operator Panel in 15 minutes indicates that the boot-up process is not completing. 1. Power OFF the library and wait at least 1 minute before the library is powered ON to recover from the problem. 2. If a library firmware update was completed, try repeating the update procedure.
The library time is not being updated by the NTP server	Using the Web User Interface. 1. Disable NTP. 2. Set the time manually. 3. Enable NTP.

Table 33. Tape drive problems	
Problem	**Solution**
Tape drive error reported	1. Refer to the drive reported errors. See "Drive error codes" on page 103.
	2. Check drive status by viewing the "Front panel Indicators" on page 55, using "ITDT-SE" on page 89, or other connections (for example: if drive is installed in library). If the drive is in the middle of performing an operation, wait until the drive is "idle" before attempting any other steps
	3. Check that the drive firmware is at the most recent level. See "Updating library and drive firmware" on page 66.
	4. Reset drive.
	5. Run Drive test. See "Running drive diagnostic test" on page 79.
	6. Utilize ITDT to that the host application interface can detect the drive and the library, see "ITDT-SE" on page 89.
	7. If the host tool, ITDT, cannot detect the drive or library, look for problems with the host interface cabling, the HBA, the device driver, or the backup application software.

Table 34. Cartridge problems	
Problem	**Solution**
Cartridge failing to load and unload properly	**Note:**
	• The tape drive must rewind the tape before it is ejected. The amount of time for this procedure can vary, depending on how the tape was used. See "Supported tape drives" on page 5.
	• The tape drive performs media optimization on the first load of a cartridge. The amount of time for this procedure can vary. See "Supported tape drives" on page 5.
	Follow these instructions for removing cartridge from the tape drive:
	1. Stop all host activity.
	2. Check drive status by using any of the following methods:
	• ITDT-SE
	• If the drive is installed in a library, check for any indicator that the library reports.
	3. If the drive is in the middle of performing an operation, wait until the drive is idle before attempting any further steps.
	4. Attempt to unload the cartridge.
	5. Power off the drive.
	6. Disconnect the host cable from the drive.
	7. Power on the drive, and wait until the tape drive is idle or ready.
	8. Attempt to unload the cartridge.
	Follow these steps to inspect a cartridge for damage:
	1. Check that the leader pin is attached and properly seated by opening the cartridge door and observing the pin's placement.
	2. Inspect the cartridge case, the cartridge door, and the write-protect switch for damage.
	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. If there are gaps, the leader pin might be dislodged.
	4. Try loading or unloading another tape cartridge.
	• If it fails, contact your service representative for more problem determination.
	• If it is successful, discard the cartridge that originally failed.
	Notes:
	• If a damaged or mishandled cartridge is the problem, see "Cartridge care and handling" on page 74 for instructions about handling the media. It is possible that your other cartridges might also be damaged.
	• If your cartridge does not eject properly, contact your service representative.

Table 34. Cartridge problems (continued)

Problem	Solution
A cartridge is not ejecting from the drive	1. Try unloading the drive (Operator Panel: **Commands** > **Unload**). 2. Power cycle the library. 3. If the cartridge does not eject from the drive, see "Contacting Dell technical support" on page 89.
The cartridge case or tape inside the cartridge is damaged	Replace the tape cartridge.
Your cleaning cartridge expires	Replace the cleaning cartridge.

A bar code label cannot be read by the bar code reader	1. Export the suspect cartridge from the library.
	2. Confirm that the bar code label is not damaged or missing. Replace the bar code label, if necessary.
	3. Import the cartridge back into the library.
	4. Inventory the library.
	    a. If no errors are reported, resume normal library operations.
	    b. If an error is reported, see "Error codes" on page 90.

Table 35. Communication problems

Problem	Solution

You are experiencing host attachment interface problems	After successfully exercising Table 33 on page 83, and more specifically "Running library verify test" on page 78 from the Operator Panel, the following procedures are suggested to help isolate the failure to properly establish connectivity to the Host Bus adapter (HBA).
	
	1. Use the ITDT-DCR utility to evaluate connectivity from the HBA through the cabling to the drive. ITDT-DCR does not require separate device drivers, thus the Operating System can scan, and find all the LTO devices that are attached.
	    a. If ITDT-DCR cannot locate the LTO drive successfully, suspect cabling or HBA problems, and skip to Step 4.
	    b. If ITDT-DCR located the LTO drive successfully, proceed to Step 3. See "ITDT-SE" on page 89 for a brief description of ITDT-DCR and instructions on how to download the tool from the web.
	2. If ITDT-DCR locates the LTO devices successfully, verify that the correct application device drivers and backup application software is properly installed.
	3. Ensure that all the required or latest available Operating System files or updates (DLLs, PTFs) are installed and applied.

Table 35. Communication problems (continued)	
Problem	**Solution**
Cannot connect to the Web User Interface	1. Verify that you entered the account name and password correctly. The account name and password are case-sensitive.
	2. Verify that other library users are not entering commands from the Web User Interface or Operator Panel at the same time you are issuing commands.
	3. Ensure that the Ethernet cable is securely plugged in the rear of the library at the Ethernet port.
	4. Ensure that the correct IP, netmask, and gateway addresses are keyed into the network parameters.
	5. Ensure that the correct IP address is being used on the web browser.
	6. If the Ethernet connection is a direct connection between the PC and the library, a special "crossover" Ethernet cable is required. **Note:** On newer PCs, either straight through or crossover Ethernet cables might be used since the crossover requirement is provided internally.
	7. Check the Ethernet cable carefully (or try another cable) and, if the cable is connected to a network hub or switch, try a different port.
	8. If the Web User Interface is still malfunctioning, refer to "Contacting Dell technical support" on page 89.
If the application software that you are using is not communicating with the library after installation	1. Ensure that the accessor locking screw on the rear panel of the library is removed before the library is powered ON. See "Removing the accessor locking screw" on page 25.
	2. A single ID addresses both drive and library since the drive is LUN 0 and the library is LUN 1. These models require an HBA that supports LUN scanning, which must be enabled at the HBA. See "HBA requirements" on page 19.
	3. Ensure that SAS cables and interposers (if any) are properly attached. See "Connecting cables" on page 25.
	4. Refer to the documentation included with your backup application software for instructions on how to verify installation.
	5. Ensure that the correct device driver, if applicable, is installed for the library. **Note:** Many backup applications use their own drivers for the library and drive. Before a driver is installed, make sure that it is not in conflict with the software. Contact your backup application vendor for this information.
	If you are still experiencing difficulty with installing or configuring your library, see "Contacting Dell technical support" on page 89. **Important:** Do not disassemble the library. The warranty on your library is voided if the unit is disassembled without the approval of "Contacting Dell technical support" on page 89.

Table 35. Communication problems (continued)	
Problem	**Solution**
The Performance Test duration varies	Following items affect the duration of the test: • The level of adapter device driver • Your adapter model and type

Host application reporting SCSI timeout	**Note:**
	
	 • The tape drive must rewind the tape before it is ejected. The amount of time for this procedure can vary, depending on how the tape was used. See "Supported tape drives" on page 5.
	 • The tape drive performs media optimization on the first load of a cartridge. The amount of time for this procedure can vary. See "Supported tape drives" on page 5.
	
	 The procedure for SCSI timeouts varies depending on whether timeout is consistent or intermittent, and on your drive configuration. Follow these steps to troubleshoot a SCSI timeout:
	
	 1. Stop all Host Activity.
	 2. Check drive status by using any of the following methods:
	    • ITDT-SE
	    • If the drive is installed in a library, check for any indicator that the library reports.
	 3. If the drive is in the middle of performing an operation, wait until the drive is idle before attempting any further steps.
	 4. Validate that the drive has the latest firmware.
	 5. Check with software application provider for any updates.
	 6. Check whether the tape drive power is on.
	 7. Power off the drive.
	 8. Verify that the SAS cable is connected properly to the server and to the tape drive.
	 9. Replace SAS cable if it shows any signs of damage.
	 10. Power on the drive and wait until the tape drive is idle or ready.

Table 36. Encryption problems

Problem	Solution

Encryption error displayed when the drive detects an error that is associated with an encryption operation, if the problem occurred while the tape drive was writing data to, or reading data from tape	1. Check the host application to ensure that the host application is providing the correct encryption key.
	
	   a. Refer to the Sense Data that are returned for an encryption operation.
	
	   b. Retry the encryption operation after the host application problems are resolved.
	
	2. Reset the drive.
	
	   a. Refer to the error code displayed on the Operator Panel if the drive resets and the POST fails.
	
	   b. Retry the encryption operation if the drive resets and POST complete without errors.
	
	3. Ensure that the correct media is being used. Data encryption is only supported by LTO-4 Data cartridges and later.

Encryption-related error is posted	Check the host application's error logs, device driver logs, tape library error logs, and tape drive error logs for entries that are related to encryption.
Connection problem with the Encryption Key Manager (EKM)	If you are using library-managed encryption, complete the Key Path Diagnostic. If the test fails, a problem might exist with the IP address, the Ethernet cable, or the EKM server. 1. Check the Ethernet connection between the library and the EKM server. 2. Check the TCP/IP configuration of the library and the server. 3. Check that the EKM is correctly installed and configured, and that the EKM application is properly started (refer to your EKM documentation). 4. Ensure that the tape drive is registered in the EKM (refer to your EKM documentation). 5. Ensure that a default key label is defined in the EKM (refer to your EKM documentation). If you are using application-managed encryption check your key proxy server's documentation for a similar test.

Pre-call checklist

If you have questions or problems with the library, complete these steps before a call to Dell technical support is placed.

Note: Where instructions refer you to the web, go to http://www.Dell.com/support.

1. Verify that you exhausted all troubleshooting options. See "Troubleshooting guide" on page 79.

2. Collect library and drive logs. See "Locating management functions" on page 61.

3. Verify that the library and drive firmware is at the most recent level. See "Updating library and drive firmware" on page 66.

4. Verify that your device drivers are at the most recent level.

   • For the current release of device drivers, see "Supported device drivers" on page 19.

- For the current release of device drivers by independent software vendors (ISVs), go to the appropriate third-party website.

5. Verify whether your hardware and software configuration is supported. See "Compatible configurations" on page 19.

6. Check the hardware and connections:

   - Ensure that the host interface cable connector does not contain bent or recessed pins.

   - Ensure that all retention screws for the host interface cable and terminator are securely tightened.

   - Verify the host connection. See "Verifying the host connection" on page 31.

   If you still have a problem after these steps are completed, see "Contacting Dell technical support" on page 89.

Contacting Dell technical support

For customers in the United States, call 800-WWW-DELL (800-999-3355).

Note: If you do not have an active Internet connection, you can find contact information about your purchase invoice, packing slip, bill, or Dell product catalog.

Dell provides online and telephone-based support and service options. Service availability varies by country and product, and some services might not be available in your area. To contact Dell for sales, technical support, or customer service issues follow the steps that are listed:

1. Go to http://www.dell.com/support.
2. Verify your country or region in the **Choose A Country/Region** menu at the bottom of the page.
3. Click **Contact Us** on the left side of the page.
4. Select the appropriate service or support link that is based on your need.
5. Choose the method of contacting Dell that is convenient for you.

Diagnostic information

This section provides various diagnostic tools and information.

ITDT-SE

ITDT-SE is a tool with multifunction capability and is a quick, convenient, and efficient method for drive firmware updates. It can also assist with drive dump retrievals.

Some of the capabilities of this tool:

- Runs quick or extended diagnostic procedures on tape drives. If the library is online to the server/host where the tool is, ITDT-SE communicates with the drive through the library to load and unload a test cartridge.

- Retrieves firmware memory dumps from tape drives and libraries.

- Completes a firmware update on tape drives or libraries. See the note about library firmware updates.

- Tests the performance of the environment by completely writing a cartridge and measuring performance.

- Retrieves and displays cartridge information.

- Verifies the encryption environment.

- Does not require special device drivers.

- Is available for most major platforms. Scans the host interface and finds and displays for selection all LTO devices.

The Tape Diagnostic tool (ITDT-SE) is available as a command-line utility and a graphical user interface (GUI) version.

- The *Tape Diagnostic Tool (ITDT-SE)* is a command-line utility. Start it by entering the executable command from the directory where the tool is located. The Help feature gives a brief explanation of each function and shows the required syntax.
- The *Tape Diagnostic Tool (ITDT-SE)* is a GUI version for Microsoft Windows. Microsoft Windows XP and Microsoft Windows Server 2003 (IX86, 32-bit) are supported.

Note: Be sure that you have the most current version of ITDT-SE if you are updating firmware on a recent drive type. Before ITDT-SE is used, verify that your library host operating system is at the latest released level. This verification ensures optimum read/write operations for diagnostic procedures.

Note: If the library has a BCR (Barcode Reader) that requires 9.00 or greater firmware, the Update function stops with an error code of "Unexpected Data" if you attempt to downgrade the library firmware.

To download the ITDT-SE tool and instructions for using the tool, visit http://www.dell.com/support.

Library logs

Select **Service Library** > **View Library Logs** to display a log history summary of errors that occurred.

The error log is displayed with sense data information. The summary can be filtered to display errors with specific sense data code types.

Click **Refresh** to read the log of errors from the tape library.

Click **detail** in the index of error messages to see more information about the error.

The information that is displayed for the error comprises:

Index
Index number in the error listing.

Date Time
Timestamp of the error.

Check Code
Library error code. Information about errors and actions to resolve the problem is listed in "Error codes" on page 90.

Sense Key
Sense data is generated by a drive when it encounters errors. Information about sense keys is listed in "Sense data" on page 115.

ASC/ASCQ
Additional Sense Code/Additional Sense Code Qualifiers. Information about ASC/ASCQ is listed in "Sense data" on page 115.

Description
Description of the error.

detail
Link to more details about the error

Error codes

Error codes are used in the library and drive system to store all types of events with a unique error code and event description.

When an error occurs during operation of the library, the library stops the current operation and displays an error code on the Operator Panel. Unless otherwise noted, try to resolve the problem by cycling power to the library and retrying the last operation.

Note: When power cycling the library, wait 10 seconds after the power is switched OFF before powering ON again.

Library error codes

When a library event occurs, the event is logged in to flash memory on the Library Control Board.

The library error log can be viewed on the Web User Interface or Operator Panel. The library error log on the Web User Interface displays a log history summary of information, warning, and error events. The log summary can be filtered to display the **Operator Interventions** log for a specific hardware component and specific event levels. The log is stored in memory on the Library Control Board. When the memory buffer is full, new events overwrite the oldest events. The log is not cleared from memory when power is turned OFF. The information that is displayed in the **Detail** panel for the selected operator intervention event consists of:

- Index number of the event
- Date the event occurred
- Time the event occurred
- Unit in the library where the event occurred
- Event level
- Description of the event

The library error log on the Operator Panel lists all the library error messages in the order in which they occurred, starting with the most recent at the top. To view the library error logs using the Web User Interface or Operator Panel, see Table 22 on page 63.

"Table 37" on page 91 describes the library error codes.

Code (H)	Description	Panel Indication	Action Required
Table 37. Library error codes			
0000	No valid error code information.	-	-

0001	At power-on initialization, a firmware error was detected.	All 4 LEDs ON	1. Upgrade or reinstall firmware and try again.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

0002	At power-on initialization, a RAM (base area) error was detected.	Ready or Activity LED ON and Error LED ON	
0003	At power-on initialization, a RAM (buffer area) error was detected.	CHK 0003	

0008	A usable drive was not detected.	CHK 0008	1. Observe LEDs. See "Front panel Indicators" on page 55.
			2. Reseat all cables. See Reseating cables.
			3. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

Table 37. Library error codes (continued)			
Code (H)	**Description**	**Panel Indication**	**Action Required**
0009	The accessor locking screw has not been removed.	CHK 0009	1. Remove the accessor locking screws. See "Removing the accessor locking screw" on page 25. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0010	Information acquisition from the DHCP server failed.	-	1. Observe LEDs. See "Front panel Indicators" on page 55. 2. Confirm the DHCP server settings. 3. Reseat all cables. See Reseating cables. 4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0011	Time acquisition from the NTP server failed.	-	1. Observe LEDs. See "Front panel Indicators" on page 55. 2. Confirm the time server settings. 3. Reseat all cables. See Reseating cables. 4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.

Table 37. Library error codes (continued)			
Code (H)	**Description**	**Panel Indication**	**Action Required**
0020	LDI I/F error. Transmit data abnormality detected (NAK reception).	-	1. Observe LEDs. See "Front panel Indicators" on page 55. 2. Reseat all cables. See Reseating cables. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0021	LDI I/F error. Receive timeout detected (ACK/NAK reception).	-	
0022	LDI I/F error. Response packet reception timeout detected.	-	
0023	LDI I/F error. ENQ receive timeout detected.	-	
0024	LDI I/F error. Receive data abnormality detected.	-	
0029	LDI command ends abnormally.	-	1. Confirm the Encryption Key Manager settings. 2. Reseat all cables. See Reseating cables. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
002A	Commands to the Encryption Key Manager over the retry limit.	-	
002B	Commands to the encryption capable drive over the retry limit.	-	1. Reseat all cables. See Reseating cables. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.

Code (H)	Description	Panel Indication	Action Required
002C	LDI I/F error. ACK IU event timeout detected.	-	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
002D	LDI I/F error. Response IU event timeout detected.	-	
002E	LDI I/F error. Transfer Ready IU event timeout detected.	-	
002F	LDI I/F error. Undefined error detected.	-	
0040	A drive media error detected upon insertion.	CHK 0040	1. Verify that the cartridge is compatible with the drive in your library. See Table 6 on page 9. 2. Verify that the cartridge is not write-protected. See "Write-Protect switch" on page 73. 3. If it is a cleaning cartridge, verify that the cartridge is not expired. See "Cleaning cartridge" on page 71.
0041	A hardware error detected upon media insertion.	CHK 0041	4. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0042	A drive load timeout error detected upon insertion.	CHK 0042	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0048	Incompatible medium installed.	CHK 0048	Verify that the cartridge is compatible with the drive installed in the library. See Table 6 on page 9. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.

Table 37. Library error codes (continued)

Table 37. Library error codes (continued)			
Code (H)	Description	Panel Indication	Action Required

0053	Response acknowledge error received from bar code reader. Suspect the bar code reader cable connection.	CHK 0053	1. Initiate an inventory. See Table 21 on page 62.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

0056	Receive data checksum error received from bar code reader. Suspect the bar code reader cable connection.	CHK 0056	
0057	Invalid data received from bar code reader. Suspect the bar code reader cable connection.	CHK 0057	
0058	A bar code reader read-error detected. Suspect the bar code reader cable connection.	CHK 0058	
0059	A bar code reader FLASH control error detected. Suspect the bar code reader cable connection.	CHK 0059	
005A	A bar code reader diagnostics error detected. Suspect the bar code reader cable connection.	CHK 005A	
005B	I^2C I/F error. A transfer retry detected. Suspect the bar code reader cable connection.	CHK 005B	
005C	I^2C I/F error. Interrupt timeout detected. Suspect the bar code reader cable connection.	CHK 005C	
005D	I^2C I/F error. Invalid signal (NAK) detected. Suspect the bar code reader cable connection.	CHK 005D	
005E	I^2C I/F error. Bus arbitration lost error detected. Suspect the bar code reader cable connection.	CHK 005E	
005F	I^2C I/F error. Ready condition does not occur. Suspect the bar code reader cable connection.	CHK 005F	

Table 37. Library error codes (continued)			
Code (H)	**Description**	**Panel Indication**	**Action Required**
0070	Calibration failed because the accessor contains media. Suspect the centering sensor.	CHK 0070	1. Attempt to unload the cartridge from the accessor. See Table 24 on page 64 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0071	Calibration failed due to an empty magazine. Suspect the magazine set sensor.	CHK 0071	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0072	Calibration measurement invalid data error. Suspect the centering sensor, X motor, or P motor.	CHK 0072	
0074	GET, centering check, or bar code reader read operation failed because the accessor contains media. Suspect the centering sensor.	CHK 0074	
0075	PUT operation failed because the accessor contains no media. Suspect the centering sensor.	CHK 0075	
007C	Drive does not enter EJECT state (and media not ejected) within 200 seconds of a GET command. Suspect the drive.	CHK 007C	1. If the cartridge does not eject, try to unload the cartridge from the drive with the Web User Interface (**Manage Library** > **Unload**) or the Operator Panel (**Commands** > **Unload**). Move the cartridge from the drive to the I/O Station. Remove the cartridge from the library and inspect for damage and replace, if necessary. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.

Code (H)	Description	Panel Indication	Action Required
007D	Drive does not enter MOUNT state within 200 seconds of a PUT command. Suspect the drive or X motor.	CHK 007D	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
007E	Drive does not enter SET state within 3 seconds of a PUT command. Suspect the drive or X motor.	CHK 007E	• If the problem persists, see "Contacting Dell technical support" on page 89.

007F	Drive I/F or connection error occurs during a PUT operation or GET operation. Suspect the drive.	CHK 007F	1. Reseat all cables. See Reseating cables.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

Table 37. Library error codes (continued)

Table 37. Library error codes (continued)			
Code (H)	**Description**	**Panel Indication**	**Action Required**

0080	X movement error #1.
	
	During X movement, the target stop position's origin sensor error detected. Suspect the X origin sensor or X motor.
		CHK 0080	1. Check the accessor locking screw and remove it if it is installed. See "Removing the accessor locking screw" on page 25.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

0081	X movement error #2. During X movement, a motor sync error detected. Suspect the X encoder sensor or X motor.	CHK 0081	
0082	X movement error #3. During initialization, a motor sync error detected. Suspect the X encoder sensor or X motor.	CHK 0082	
0083	During an eject operation or move operation (to a storage position), the X origin sensor is not detected. Suspect the X origin sensor or X motor.	CHK 0083	
0084	During initialization, the X origin position is not detected. Suspect the X origin sensor or X motor.	CHK 0084	
0088	X calibration error #1. During X calibration, centering sensor OFF condition is not detected.	CHK 0088	
0089	X calibration error #2. During X calibration, centering sensor ON condition is not detected.	CHK 0089	

008F	During X operation, the cartridge magazine was removed. Suspect the magazine set sensor.	CHK 008F	1. Confirm that the magazine is closed.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

Code (H)	Description	Panel Indication	Action Required
00B0	Failed to detect media in the accessor at completion of GET operation. Suspect the centering sensor, X motor, or P motor.	CHK 00B0	1. Confirm the media is compatible. See Table 6 on page 9. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
00B1	No media is contained in the specified cell (Cell Empty). Suspect the centering sensor, X motor, or P motor.	CHK 00B1	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
00B2	Media detected in the accessor at completion of centering check operation. Suspect the centering sensor.	CHK 00B2	1. If the cartridge remains in the accessor, try to move the cartridge from the accessor to the I/O Station with the Web User Interface or the Operator Panel. Remove the cartridge from the library and inspect for damage and replace, if necessary. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
00B3	Media detected in the accessor at completion of PUT operation. Suspect the centering sensor.	CHK 00B3	

Table 37. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required

00B8	accessor error #1.
	
	Reverse REV position (PP1) error (accessor origin not detected or FWD position detected). Suspect the P origin sensor, FWD sensor, or P motor.
		CHK 00B8	1. Check the accessor locking screw and remove it if it is installed. See "Removing the accessor locking screw" on page 25.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

00B9	accessor error #2. Forward FWD position (PP2) error (accessor origin detected or FWD not detected). Suspect the P origin sensor, FWD sensor, or P motor.	CHK 00B9	
00BA	accessor error #3. PUT/GET/bar code reader position (PP4/PP5/PPBF/PPBR) error (accessor origin or FWD detected, or cell full). Suspect the P origin sensor, FWD sensor, or P motor.	CHK 00BA	
00BC	During initialization, the accessor origin is not detected. Suspect the P origin sensor, FWD sensor, or P motor.	CHK 00BC	
00BD	During accessor movement, the movement stop condition is detected. Suspect the P encoder sensor or P motor.	CHK 00BD	
00BF	No gap condition detected at the completion of accessor operation. Suspect the centering sensor, P origin sensor, FWD sensor, or P motor.	CHK 00BF	

00C0	accessor operation disabled because a cartridge magazine was removed. Suspect the magazine set sensor.	CHK 00C0	1. Confirm that the magazine is closed.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

Table 37. Library error codes (continued)

Code (H)	Description	Panel Indication	Action Required
00C8	Centering calibration error #1. During centering calibration, centering sensor OFF condition is not detected. Suspect the centering sensor or P motor.	CHK 00C8	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
00C9	Centering calibration error #2. During centering calibration, centering sensor ON condition is not detected. Suspect the centering sensor, X motor, or P motor.	CHK 00C9	

00D0	Checksum error detected during firmware update.	CHK 00D0	1. Confirm the firmware file version.
			2. Reinstall the firmware file.
			3. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

00D1	Firmware ID error detected during firmware update.	CHK 00D1	
00D2	Boot information error detected during firmware update.	CHK 00D2	

00D3	Bar code reader is not in maintenance mode during bar code reader firmware update (operation interrupted). Suspect the bar code reader cable connection.	CHK 00D3	1. Initiate an inventory. See Table 21 on page 62.
			2. Cycle the power supply and try again.
			  • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If the problem persists, see "Contacting Dell technical support" on page 89.

00D9	Magazine failed to unlock. Suspect the magazine or magazine sensor.	CHK 00D9	1. Cycle the power supply and try again.
			2. Manually unlock the magazine, remove the magazine from the library, and inspect it for damage.
			  • If not damaged, return it to the library and run Library Verify before normal library operations resume. See "Running library verify test" on page 78.
			  • If damaged, replace the magazine.

00DA	I/O Station failed to unlock. Suspect the magazine or magazine sensor.	CHK 00DA	

Table 37. Library error codes (continued)

Table 37. Library error codes (continued)			
Code (H)	**Description**	**Panel Indication**	**Action Required**
00DD	An error detected during bar code reader firmware check. Suspect the bar code reader cable connection.	CHK 00DD	1. Initiate an inventory. See Table 21 on page 62. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
00E0	Write operation not finished within 1 ms when writing data to flash memory.	CHK 00E0	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
00E1	Clear operation not finished within 10 seconds when clearing a sector in flash memory.	CHK 00E1	
00E2	Error detected in tape library configuration stored in flash memory.	CHK 00E2	
00E3	Checksum error detected in flash memory.	CHK 00E3	
00F0	Sensor error #1. Accessor encoder sensor B error detected during blink check. Suspect the accessor encoder sensor B.	CHK 00F0	

Table 37. Library error codes (continued)			
Code (H)	Description	Panel Indication	Action Required
00F1	Sensor error #2. Accessor encoder sensor A error detected during blink check. Suspect the accessor encoder sensor A.	CHK 00F1	Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
00F2	Sensor error #3. X encoder sensor error detected during blink check. Suspect the X encoder sensor.	CHK 00F2	
00F3	Sensor error #4. Magazine sensor error detected during blink check. Suspect the magazine sensor.	CHK 00F3	
00F8	Sensor error #5. X origin sensor error detected during blink check. Suspect the X origin sensor.	CHK 00F8	
00F9	Sensor error #6. Cartridge sensor error detected during blink check. Suspect the cartridge sensor.	CHK 00F9	
00FA	Sensor error #7. Accessor forward sensor error detected during blink check. Suspect the accessor forward sensor.	CHK 00FA	
00FB	Sensor error #8. Accessor origin sensor error detected during blink check. Suspect the accessor origin sensor.	CHK 00FB	

Drive error codes

"Table 38" on page 104 describes the drive error codes.

Table 38. Drive error codes			
Code (H)	**Description**	**Panel indication**	**Action Required**
0200	Invalid data sent to drive. NAK detected.	CHK 0200	1. Reseat all cables. See Reseating cables. 2. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.
0201	Timeout error occurred while drive is waiting for response.	CHK 0201	
0203	Drive disconnected.	CHK 0203	
0205	Drive busy.	CHK 0205	
0206	Command could not be executed because drive is not mounted.	CHK 0206	
020E	Drive error detected.	CHK 020E	
020F	Unsupported drive detected.	CHK 020F	
0222	Media could not be ejected because drive is in Prevent Medium Removal state.	CHK 0222	1. Release the drive Prevent Medium Removal state from the host. 2. Reseat all cables. See Reseating cables. 3. Cycle the power supply and try again. • If the problem is corrected, run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the problem persists, see "Contacting Dell technical support" on page 89.

Web User Interface error messages

"Table 39" on page 104 lists the Web User Interface error messages.

Table 39. Web user error messages		
Title	**Message**	**Issuing Panel**
Error	Users full.	User Access
	You cannot remove yourself.	User Access

Table 39. Web user error messages (continued)

Title	Message	Issuing Panel
Parameter Error	Login failure.	Login
	Unsupported update file.	Firmware Update
	Invalid parameter found in [***].	Configure Library
	Please input parameter of [***].	Configure Library
	Password parameter error.	User Access
	User name parameter error.	User Access
	Not enough role.	User Access
	A user name unmatched.	User Access
	A user is already existing.	User Access
	Users full.	User Access
	Flush ROM write error detected.	User Access
	User information access failure.	User Access
Command Error	Move command execution failure. (Code:"****")	Move Cartridges
	Unload command execution failure: [****].	Unload Drive
	Drive not ready.	Unload Drive, Download Drive Logs, Firmware Update
	Medium not present.	Unload Drive
	Online command execution failure: [****].	Library State
	Offline command execution failure: [****].	Library State
	Reset command execution failure: [****].	Reset Library/Drive
	Inventory command execution failure: [****].	Inventory
	"Normal Dump" command execution failure: [****].	Download Drive Logs
	"Force Dump" command execution failure: [****].	Download Drive Logs
	Restore failure. Library serial number is unmatched	Save/Restore
	Writing to cookie was failure. The configuration data was not saved to cookie.	All

Table 39. Web user error messages (continued)

Title	Message	Issuing Panel
Cleaning Command Error	Illegal medium.	Clean Drive
	Source element empty.	Clean Drive
	Destination element full.	Clean Drive
	Drive failure.	Clean Drive
	Prevent medium removal.	Clean Drive
	During import/export element access.	Clean Drive
	Gap detected.	Clean Drive
	Not loaded.	Clean Drive
	Expired medium.	Clean Drive
	Write protect error.	Clean Drive
	Cleaning execution failure: [****].	Clean Drive
I/O Error	File open failure.	Download Drive Logs, Download Library Logs, Save/Restore, Firmware Update
	Unsupported file.	Save/Restore, Firmware Update
Network Error	*** command transmission failure.	Manage Library
	*** information access failure.	All
	Library logs download failure. Retry download.	Download Library Logs
	Email submit failure.	Notifications
	SNMP trap submit failure.	Notifications
	Log data access failure.	Traces, View Library Logs
	Port open failure [**.**.**.**:****]. Do you want to retry?	Displayed after 3 unsuccessful attempts.
	Port open failure [**.**.**.**:****]. Check the library and the network condition setting.	Displayed after 3 unsuccessful attempts.
	Web interface version is not matched between Library and the web application. Restart the browser. There is a possibility of malfunctioning if you proceed operation from Web.	All
Library Busy	Library information updating now. Cannot access library information	All

Trap definitions (types)

The library supports the following types of SNMP traps.

Table 40. Trap list

Trap ID	Event Type	Description	Clean Drive LED	Attention LED	Error LED
1	Emergency	• Drive error	-	-	ON
2		• Library error	-	-	ON
21	Error	• Drive error	-	-	ON
22		• Library error	-	-	ON
51 (Drive) 52 (Library)	Warning	• Drive error • Library error • Endurance frequency attainment	-	-	ON
53 (Drive)		• Cleaning demand reception from drive	ON	-	-
54 (Library)		• Cleaning cartridge demand for an exchange	-	ON	-
101 (Drive) 102 (Library)	Information	• Beginning of inventory • Change in library operation mode • Beginning of medium move • Completion of medium move • Library/Drive not ready • Library/Drive to online • Magazine unlock operation • I/O Station unlock operation	-	-	-

TapeAlert flags

This section is intended to provide information to the reader about the library and tape drive by using TapeAlert technology.

Additional information is provided to the reader about the tape library and tape drive. All error code and diagnostic information cannot be accessed from the Operator Panel of the library. The Operator Panel will, however, display other library error codes and drive error codes when problems occur. For a listing of Operator Panel error messages, see "Error codes" on page 90.

TapeAlert is a standard that defines status conditions and problems that are experienced by devices such as tape drives, autoloaders, and libraries. The standard enables a server to read TapeAlert messages (called *flags*) from a tape drive. The server reads the flags from Log Sense Page 0x2E.

This library is compatible with TapeAlert technology, which provides error and diagnostic information about the drives and the library to the server. Because library and drive firmware might change periodically, the SNMP interface in the library does not require code changes if devices add extra TapeAlerts that are not supported today. However, if this change occurs, the MIB is written to minimize impact to the SNMP monitoring station. At the time of this writing, the TapeAlert flags in this appendix correctly represent TapeAlerts that are sent. The MIB file must not be taken to mean that all traps that are defined in the MIB will be sent by the library or that they will be sent in the future.

TapeAlert flags supported by the library

This section lists the TapeAlert flags that are supported by the library.

Table 41. TapeAlert flags supported by the library

Flag Number	Flag Name	Description	Action Required	Type[1]
01	Library Hardware A	The library mechanism is having trouble with communicating with the tape drive.	1. Cycle the power supply and try again. 2. If the problem persists, see "Contacting Dell technical support" on page 89.	C
02	Library Hardware B	The library mechanism has a hardware fault.		W
03	Library Hardware C	Library mechanism has a hardware fault that requires a reset to recover.	1. Reset the library. For details, see Table 23 on page 63. 2. Restart the operation. 3. If the problem persists, see "Contacting Dell technical support" on page 89.	C
04	Library Hardware D	The library mechanism has a hardware fault that is not mechanism-related, or requires power cycle to recover.	1. Cycle the power supply and try again. 2. If the problem persists, see "Contacting Dell technical support" on page 89.	C

Table 41. TapeAlert flags supported by the library (continued)				
Flag Number	Flag Name	Description	Action Required	Type[1]
06	Library Interface	The library identified an interface fault.	1. Check all cables and cable connections. 2. Restart the operation. 3. If the problem persists, see "Contacting Dell technical support" on page 89.	C
08	Library Maintenance	Library preventive maintenance required.	Preventive maintenance of the library is required. Consult the library user's manual for device-specific preventive maintenance tasks.	W
12	Library Stray Tape	A cartridge was left in the drive inside the library by a previous hardware fault.	1. Try unloading the cartridge from the drive with the Web User Interface or Operator Panel. • If the cartridge unloads, move the cartridge from the drive to the I/O station. Remove the cartridge and inspect for damage. If not damaged, return the cartridge to the library. Run Library Verify before normal library operations resume. See "Running library verify test" on page 78. • If the cartridge did not unload from the drive, cycle the power supply and try again. 2. If the problem persists, see "Contacting Dell technical support" on page 89.	C
13	Library Pick Retry	There is a potential problem with the drive ejecting a cartridge short or with the library mechanism picking a cartridge from a slot.	No action is required.	W
14	Library Place Retry	There is a potential problem with the library mechanism placing a cartridge into a slot.	No action is required.	W
16	Library I/O station	The operation failed because the library I/O station is open.	Close the I/O station.	W
17	Library Mailslot	Mechanical problem with the I/O station.	There is a mechanical problem with the library I/O station.	C

Table 41. TapeAlert flags supported by the library (continued)

Flag Number	Flag Name	Description	Action Required	Type[1]
18	Library Magazine	Library magazine not present.	The library cannot operate without the magazine. 1. Insert the magazine into the library. 2. Restart the operation.	C
21	Library Offline	Library manually turned offline.	The library was manually turned offline and is unavailable for use.	I
22	Library Drive Offline	Library turned internal drive offline.	The drive inside the library was taken offline. This flag is for information purposes only. No action is required.	I
23	Library Scan Retry	There is a potential problem with the bar code label of the scanner hardware in the library mechanism.	No action is required.	W
28	Power Supply	PSU failure inside the library subsystem.	The power supply failed inside the library. See "Contacting Dell technical support" on page 89.	W

[1] C = Critical: Needs immediate action. W = Warning: Action to be taken. I = Information: Information for user.

TapeAlert flags supported by the tape drive

This section lists the TapeAlert flags supported by the tape drive.

Table 42. TapeAlert flags supported by the tape drive

Flag Number	Flag Name	Description	Action Required
3	Hard error	Set for any unrecoverable read, write, or positioning error (this flag is set with flags 4, 5, or 6).	See the action that is required for Flag Number 4, 5, or 6, if set, in this table.
4	Media	Set for any unrecoverable read, write, or positioning error that is because of a faulty tape cartridge.	Replace the tape cartridge.
5	Read failure	Set for any unrecoverable read error where the isolation is uncertain and failure might be because of a faulty tape cartridge or drive hardware.	If Flag Number 4 is also set, the tape cartridge is defective. Replace the tape cartridge.

Table 42. TapeAlert flags supported by the tape drive (continued)

Flag Number	Flag Name	Description	Action Required
6	Write failure	Set for any unrecoverable write or positioning error where isolation is uncertain and failure might be because of a faulty tape cartridge.	If Flag Number 9 is also set, make sure that the write-protect switch is set so that data can be written to the tape. See "Write-Protect switch" on page 73. If Flag Number 4 is also set, the tape cartridge is defective. Replace the tape cartridge.
7	Media life	Set when the tape cartridge reaches its end of life (EOL).	1. Copy the data to another tap cartridge. 2. Discard the old (EOL) tape.
8	Not data grade	Set when the tape cartridge is not data-grade. Any data that you back up to the tape is at risk.	Replace the tape cartridge with a data-grade tape cartridge.
9	Write protect	Set when the tape drive detects that the tape cartridge is write-protected.	Ensure that the cartridge's write-protect switch is set so that data can be written to the tape. See "Write-Protect switch" on page 73.
10	No removal	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.
11	Cleaning media	Set when a cleaning tape is loaded into the drive.	No action that is required. Status only.
12	Unsupported format	Set when a non-supported cartridge type is loaded into the drive or when the cartridge format was corrupted.	Replace the invalid cartridge with a supported tape cartridge.
14	Unrecoverable snapped tape	Set when the operation failed because the tape in the drive snapped.	Do not attempt to extract the tape cartridge. See "Contacting Dell technical support" on page 89.
15	Cartridge memory chip failure	Set when a cartridge memory (CM) failure is detected on the loaded tape cartridge.	Replace the tape cartridge.
16	Forced eject	Set when a tape cartridge was unloaded manually while the drive was reading or writing.	No action that is required. Status only.
17	Media that are loaded is Read-only format	Set when a cartridge marked as read-only is loaded into the drive. The flag is cleared when the cartridge is ejected.	No action that is required. Status only.
18	Tape directory that is corrupted in cartridge memory	Set when the tape drive detects that the tape directory in the cartridge memory was corrupted.	Re-read all data from the tape to rebuild the tape directory.

Table 42. TapeAlert flags supported by the tape drive (continued)

Flag Number	Flag Name	Description	Action Required
19	Nearing media life	Set when the tape cartridge is nearing its specified end of life. It is cleared when the cartridge is removed from the drive.	1. Copy the data to another tape cartridge. 2. Replace the tape cartridge.
20	Clean now	Set when the tape drive detects that it needs cleaning.	Clean the tape drive.
21	Clean periodic	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 requires cleaning soon.
22	Expired cleaning media	Set when the tape drive detects a cleaning cartridge that is expired.	Replace the cleaning cartridge.
23	Invalid cleaning cartridge	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.
30	Hardware A	Set when a hardware failure occurs that requires that you reset the tape drive to recover.	See "Contacting Dell technical support" on page 89.
31	Hardware B	Set when the tape drive fails its internal Power-On Self-Tests (POSTs).	Note the error code on the single-character display and see "Contacting Dell technical support" on page 89.
32	Interface	Set when the tape drive detects a problem with the host interface.	See "Contacting Dell technical support" on page 89.
33	Eject media	Set when a failure occurs that requires the tape cartridge to be unloaded from the drive.	Unload the tape cartridge, then reinsert and restart the operation. If this procedure fails, use different media.
34	Download fail	Set when an FMR image is unsuccessfully downloaded to the tape drive via the SAS interface.	Check the FMR image is correct. If necessary, download the correct FMR image.

Flag Number	Flag Name	Description	Action Required
35	Drive humidity	Set when the drive humidity sensor indicates that the drive's humidity exceeds the recommended humidity of the drive.	See "Contacting Dell technical support" on page 89.
36	Drive temperature	Set when the drive temperature sensor indicates that the drive's temperature exceeds the recommended temperature of the drive.	
37	Drive voltage	Set when the drive detects power supply voltages that approach or exceed the specified voltage limits.	
38	Predictive failure of drive hardware	Set when a hardware failure of the tape drive is predicted.	
39	Diagnostics required	Set when the tape drive detects a failure that requires diagnostics for isolation.	
51	Tape directory invalid at unload	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.
52	Tape system area write failure	Set when the tape cartridge that was previously unloaded might not write its system area successfully.	Copy the data to another tape cartridge, then discard the old tape cartridge.
53	Tape system area read failure	Set when the tape system area might not be read successfully at load time.	Copy the data to another tape cartridge, then discard the old tape cartridge.

Table 42. TapeAlert flags supported by the tape drive (continued)

Flag Number	Flag Name	Description	Action Required
55	Load failure	Set when a hardware malfunction prevents the tape cartridge from being loaded into the drive, or when a tape cartridge is stuck in the drive.	If the tape cartridge does not load in the drive: 1. Remove the tape cartridge from the library and inspect it for damage. If damaged, discard it. 2. Insert another tape cartridge into the tape drive. If the problem persists, see "Contacting Dell technical support" on page 89. If the tape cartridge is stuck in the drive: 1. Attempt to unload the tape from the drive with the host backup application that is with the drive, or with the remote or local UI. 2. If the cartridge still does not unload, see "Contacting Dell technical support" on page 89.
56	Unload failure	Set when a drive hardware error prevents the tape cartridge from being unloaded from the tape drive, or when the tape cartridge is stuck in the drive.	1. Unload the cartridge from the drive with the Web User Interface or Operator Panel. 2. Try a power cycle of the entire library. This procedure causes the drive to reset and attempt to rewind and unload when power is restored. If the cartridge unloads, remove it from the library and inspect it. If damaged, discard it. 3. Try to unload the cartridge from the drive again with the Web User Interface or Operator Panel. 4. If the cartridge still does not unload from the drive, see "Contacting Dell technical support" on page 89.
59	WORM Media integrity check failed	Set when the drive determines that the data on the tape is suspect from a WORM point of view.	1. Copy the data to another WORM tape cartridge. 2. Discard the old WORM tape.

Table 42. TapeAlert flags supported by the tape drive (continued)

Table 42. TapeAlert flags supported by the tape drive (continued)			
Flag Number	**Flag Name**	**Description**	**Action Required**
60	WORM Media overwrite attempted	Set when the drive rejects a write operation because the rules for allowing WORM writes are not met. Data is appended to WORM media only. Overwrites to WORM media are not allowed.	Append the information about a WORM tape cartridge or write the data to a non-WORM cartridge.

Sense data

When a drive encounters an error, it provides sense data as a response to the host.

Refer to the Tape Autoloader SCSI Reference for library sense data information and LTO Ultrium Tape Drive SCSI Reference for tape drive sense data information.

In addition, you can use the Tape Diagnostic Tool (ITDT) to further examine data and determine errors. See "ITDT-SE" on page 89 for more information.

Chapter 7. Upgrading and servicing

Recommended tools

Installing or relocating the rack mount kit for your library requires the following tool:

• #2 Phillips screwdriver

Replacing a defective cartridge magazine

After your replacement cartridge magazine is received, complete the following steps to replace the defective cartridge magazine. The library does not need to be powered OFF for this procedure.

1. Remove the defective cartridge magazine from the library with the Operator Panel, the Web User Interface, or the manual method of removal.

   • Operator Panel: Use the **Unlock Magazine** command.
   • Web User Interface: **Manage Library** > **Unlock Magazine**.
   • Manual method: See "Unlocking the cartridge magazine manually" on page 116.

2. After the defective magazine is removed from the library, remove all cartridges from the defective magazine and insert them into the replacement magazine.

3. Insert the new magazine with cartridges into the library. Wait for the library to complete its inventory before normal library operations resume.

4. Properly dispose of the defective magazine.

Unlocking the cartridge magazine manually

This procedure is used to remove the cartridge magazine manually when, for example, the power is turned OFF or if the magazine fails to unlock in response to the **Unlock Magazine** command from the Operator Panel and Web User Interface.

To unlock the cartridge magazine manually:

1. On the front panel, locate the access hole for the cartridge magazine lock release mechanism to the left of the Operator Panel (**1** in Figure 58 on page 116).
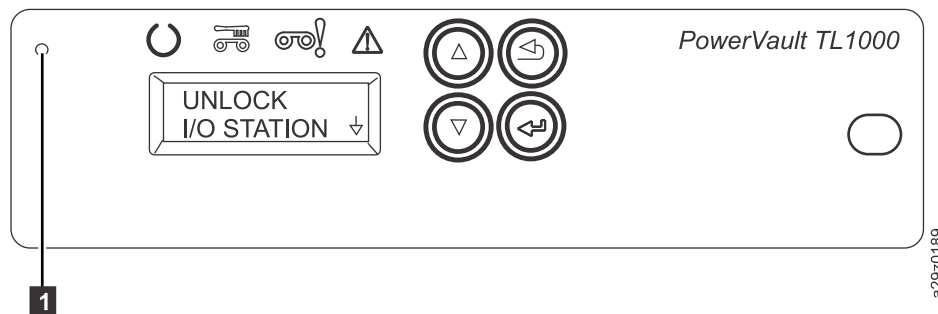
Figure 58. Cartridge magazine lock release access hole

2. Insert the end of a straightened paper clip, or similar object, into the lock release access hole. Gently push the lock mechanism to release the lock and eject the cartridge magazine.

3. If the I/O station is enabled, push the lock mechanism twice or push and hold the lock mechanism until the cartridge is withdrawn far enough to clear the I/O station lock.

4. Remove the cartridge magazine from the front of the library. If the magazine is stuck in the library and does not eject, see "Contacting Dell technical support" on page 89

5. Examine the magazine and cartridges for damage.

- If there is damage to a cartridge, replace that cartridge.
- If there is damage to the magazine, replace the magazine.

Shipping the library

Select **Commands** > **Move to Ship Position** when the library is prepared to move to a new location. The accessor must be placed in a parked position within the library housing. **Move to Ship Position** finishes all active commands that are received from the host application, does not process any new commands, and moves the accessor to the parked position before the power is turned OFF.

1. When **Unlock Magazine** is displayed, press **Enter** to unlock the cartridge magazine. The magazine unlocks and the display prompts the removal of the magazine.

2. Remove all cartridges from the magazine and reinsert the magazine into the slide mechanism. The library completes an inventory to verify no cartridges are in the magazine.

3. If the magazine is empty, the library moves the accessor to the ship position. The library can be powered down. If the magazine is NOT empty, the library prompts to remove cartridges. After all cartridges are removed and the magazine is replaced, start the ship position process again.

Appendix A. Minimum firmware levels for common library features

Minimum firmware levels for common library features.

Feature	Minimum Firmware Levels Required
LTO-9 Tape Drive	Library firmware must be at 0130.3000 or greater to support the Ultrium 9 drives. Ensure any host applications and software are at the minimum level required to support Ultrium 9 tape drives.
LTO-M8 media	Library Firmware must be at 0080.3000 or greater to support the M8 media feature.
LTO-8 Tape Drive	Library firmware must be at 0074.3000 or greater to support the Ultrium 8 drives. Ensure any host applications and software are at the minimum level required to support Ultrium 8 tape drives.
TLS 1.2	Library firmware must be at 0074.3000 or greater to support the TLS 1.2 for communication of web-SSL and EKM-SSL.
SHA-256 security protocol	Library firmware must be at 0074.3000 or greater to support the SHA-256 security protocol.
LTO-7 Tape Drive	Library firmware must be at 0058.3000 or greater to support the Ultrium 7 drives. Ensure any host applications and software are at the minimum level required to support Ultrium 7 tape drives.
LTO-6, 5, and 4 Tape Drives	Library firmware must be at 0034.3000 or greater to support the Ultrium 6 , 5, and 4 drives. Ensure any host applications and software are at the minimum level required to support Ultrium 6 , 5, and 4 tape drives.

Appendix B. Web User Interface functions and roles

The administrator can access all functions of the library and can make changes. Other user roles have restrictions on what features can be accessed or changed. An administrator can give others access to the library but can restrict their full capability.

See Chapter 4, "Managing," on page 32 for an overview of the four user roles.

Table 43. Web User Interface functions and roles				
Menu Command	**User**	**Superuser**	**Administrator User**	**Service User**
MONITOR SYSTEM				
System Summary	✓	✓	✓	✓
Library Map	✓	✓	✓	✓
MANAGE LIBRARY				
Move Cartridges	-	✓	✓	✓
Unload Drive	-	✓	✓	✓
Clean Drive	-	✓	✓	✓
Library State	-	✓	✓	✓
Inventory	-	✓	✓	✓
CONFIGURE LIBRARY				
User Access	-	-	✓	✓
Physical	-	-	✓	✓
Logical	-	-	✓	✓
Network	-	-	✓	✓
Encryption	-	-	✓	✓
Date and Time	-	-	✓	✓
Notifications	-	-	✓	✓
Save/Restore	-	-	✓	✓
SERVICE LIBRARY				
Key Path Diagnostics	-	-	✓	✓
Operator Interventions	✓	✓	✓	✓
View Library Logs	✓	✓	✓	✓
Traces	-	-	✓	✓
Download Drive Logs	-	-	✓	✓
Download Library Logs	✓	✓	✓	✓

Table 43. Web User Interface functions and roles (continued)				
Menu Command	**User**	**Superuser**	**Administrator User**	**Service User**
Reset Library/ Drive	-	-	✓	✓
Firmware Update	-	-	✓	✓
Usage Statistics	-	-	✓	✓

Appendix C. Library Configuration Form

Make a copy of this form, and fill it out as you are installing and configuring your library.

Update the form each time changes are made to the library configuration. The information that is contained on this form is important, and helpful if a call to Dell service is necessary. Store this form in a secure location.

You can also save library configuration data from the Web User Interface. See "Saving and restoring configuration settings" on page 52.

Physical Library

Machine type	TL1000
Serial Number	
Library Name	
Auto Cleaning	
Bar code label length	

Logical Library

Library Access Mode	
Loop	
Autoload	
Active Slots	

Tape Drive

Serial Number	
Worldwide Node Name	

Network Settings

Ethernet Link Speed	
SSL Security	
IPv4	
DHCP	
Static IP address	
Subnet Mask Address	
Gateway Address	
IPv6	
DHCP	
Stateless Auto Configuration	
Static IP address	

Prefix Length	
Gateway	
DNS	
DNS IP address	
NTP Date/Time Server	
NTP Server IP address	
Time Zone	
Auto Adjustment by PC	
SMTP (Mail) Server	
SMTP Server Address	
Sender Address	
Subject	
Mail to 01	
Mail to 02	
Mail to 03	
Mail to 04	
Mail Event Level	
SNMP Server	
Community	
Name	
Location	
Contact	
Trap to 01	
Trap to 02	
Trap to 03	
Trap to 04	
User 1	
User 2	
User 3	
User 4	
Trap Event Level	

Library and Drive Firmware

Type of Firmware	Current Firmware Level				
Library					
Drive					

User Accounts

The Administrator (admin) password is listed in the table. Modify and add extra Administrator, Superuser, Service, and User names and passwords that are created. User names and passwords are case-sensitive.

Table 44. User Accounts		
User name	**Access Level**	**Password**
admin	Administrator	secure

Support Notification

User name	
Password	

Appendix D. Accessibility

Accessibility features help a user with a physical disability, such as restricted mobility or limited vision, to use the HTML version of the customer documentation successfully.

Features

The major accessibility features for the PDF version of the *Dell PowerVault TL1000 Tape Autoloader User's Guide* are:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. The following screen readers are tested: WebKing and Window-Eyes.
- You can operate all features with the keyboard instead of the mouse.

Navigating by keyboard

You can use keys or key combinations to perform operations and initiate many menu actions that can also be done through mouse actions. You can navigate the PDF version of the *Dell PowerVault TL1000 Tape Autoloader User's Guide* help system from the keyboard. Use the following keyboard combinations:

- To traverse to the next link, button, or topic, press **Tab** inside a frame (page).
- To move to the previous topic, press ^ or Shift+Tab.
- To scroll all the way up or down, press **Home** or **End**.
- To print the current page or active frame, press Ctrl+P.
- To select, press **Enter**.

Accessing the publications

You can view the publications for this library in Adobe Portable Document Format (PDF) with the Adobe Acrobat Reader. The PDFs are provided at the following website: http://www.dell.com/support.

Glossary

This glossary defines the special terms, abbreviations, and acronyms that are used in this publication. If you do not find the term that you are looking for, refer to the index or to the *Dictionary of Computing,* 1994.

Numbers

2:1 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.

A

A
> Ampere.

ac
> Alternating current.

access method
> A technique for moving data between main storage and input or output devices.

accessor
> This component contains the library robot and bar code reader. The accessor moves cartridges to and from the I/O station, storage slots, and tape drives.

adapter card
> A circuit board that adds function to a computer.

adj
> Adjustment.

Administrator
> The Administrator role has access to all menus. The default password is `secure`, and the default PIN is `0000`.

AES
> Advanced Encryption Standard. A data encryption technique that improved upon and officially replaced the Data Encryption Standard (DES).

AH
> Authentication Header. An Internet Protocol intended to guarantee connectionless integrity and data origin authentication of IP datagrams. Further, it can optionally protect against replay attacks by using the sliding window technique and discarding old packets.

AIX
> Advanced Interactive Executive. IBM's implementation of the UNIX operating system. The System p system, among others, uses AIX as its operating system.

alphanumeric
> Pertaining to a character set that contains letters, numerals, and other characters, such as punctuation marks.

alter
> To change.

ambient temperature
> The temperature of air or other media in a designated area, particularly the area that is surrounding equipment.

AME
> Application Managed Encryption.

ampere (A)
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.

ANSI
American National Standards Institute.

application-managed encryption
Tape encryption that is controlled by an application.

archive
To collect and store files in a designated place.

ASCII
American National Standard Code for Information Interchange. A 7 bit coded character set (8 bits including parity check) that consists of control characters and graphic characters.

assigning a device
The establishing of the relationship of a device to a running task, process, job, or program.

assignment
The naming of a specific device to perform a function.

asynchronous
Pertaining to two or more processes that do not depend upon the occurrence of specific events such as common timing signals.

attention (notice)
A word for calling attention to the possibility of danger to a program, device, or system, or to data. Contrast with *caution* and *danger*.

ATTN
Attention.

B

backup
To make extra copies of documents or software for safekeeping.

bar code
A code that represents characters by sets of parallel bars of varying thickness and separation, which are read optically by transverse scanning.

bar code label
Paper bearing a bar code and having an adhesive backing. The bar code label must be affixed to a tape cartridge to enable the library to identify the cartridge and its volume serial number.

bar code reader
A laser device that is specialized for scanning and reading bar codes and converting them into either the ASCII or EBCDIC digital character code.

bezel
Decorative and safety cover.

bicolored
Having two colors.

bit
Either of the digits 0 or 1 when used in the binary numbering system.

BOM or bill of materials
A list of specific types and amounts of direct materials that are expected to be used to produce a specific job or quantity of output.

Border Gateway Protocol (BGP)
BGP is the core routing protocol of the Internet. It works by maintaining a table of IP networks or 'prefixes' that designate network reachability among autonomous systems (AS).

BRMS
Backup Recovery and Media Services.

browser
A client program that initiates requests to a web server and displays the information that the server returns.

buffer
A routine or storage that is used to compensate for a difference in rate of flow of data or time of occurrence of events, when data is transferred from one device to another.

bus
A facility for transferring data between several devices that are located between two end points, only one device able to transmit at a specified moment.

byte
A string that consists of some bits (usually 8) that are treated as a unit and represent a character. A fundamental data unit.

C

CA certification
In cryptography, a certificate from a certificate authority (CA).

capacity
The amount of data that can be contained on storage media and expressed in bytes of data.

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 (CM)
Within each data cartridge, an embedded electronics and interface module that can store and retrieve a cartridge's historical usage and other information.

cartridge storage slot
Individual slot that is located within a magazine that is used to house tape cartridges.

caution (notice)
A word to call attention to possible personal harm to people. Contrast with *attention* and *danger*.

CE
Customer engineer; field engineer; service representative.

centimeter (cm)
One one-hundredth of a meter (0.01 m). Approximately 0.39 inch.

channel command
An instruction that directs a data channel, control unit, or device to perform an operation or set of operations.

char
Character.

CHK
Check.

cleaning cartridge
A tape cartridge that is used to clean the heads of a tape drive. Contrast with *data cartridge*.

COD
Capacity On Demand.

command
A control signal that initiates an action or the start of a sequence of actions.

compact disc (CD)
A disc, usually 4.75 inches in diameter, from which data is read optically by using a laser.

compression
The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

concurrent

Refers to diagnostic procedures that can be run on one control unit while the rest of the subsystem remains available for customer applications.

contingent connection

A connection between a channel path and a drive that is caused when a unit check occurs during an I/O operation.

controller

A device that provides the interface between a system and one or more tape drives.

control path drive

A drive that communicates messages from the host computer to the library in which the drive is installed.

cookie

A packet of data that is exchanged between the library and a web browser to track configuration.

CP

Circuit protector.

CPF

Control Path Failover.

CRU

Customer Replaceable Unit.

CSA

Canadian Standards Association.

ctrl

Control.

CU

Control unit.

D

danger (notice)

A word to call attention to possible lethal harm to people. Contrast with *attention* and *caution*.

data

Any representations such as characters or analog quantities to which meaning is or might be assigned.

data buffer

The storage buffer in the control unit. This buffer is used to increase the data transfer rate between the control unit and the channel.

data cartridge

A tape cartridge that is dedicated to storing data. Contrast with *cleaning cartridge*.

data check

A synchronous or asynchronous indication of a condition that is caused by invalid data or incorrect positioning of data.

dc

Direct current.

DCS

Designated Cleaning Slot.

degauss

To make a magnetic tape nonmagnetic by using electrical coils that carry currents that neutralize the magnetism of the tape.

degausser

A device that makes magnetic tape nonmagnetic.

degradation

A decrease in quality of output or throughput or an increase in machine error rate.

degraded

Decreased in quality of output or throughput or increased machine error rate.

DES

Data Encryption Standard. A cryptographic algorithm designed to encrypt and decrypt data using a private key.

deserialize

To change from serial-by-bit to parallel-by-byte.

detented

A part that is held in position with a catch or lever.

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.

DHCPv6

The Dynamic Host Configuration Protocol for IPv6. Although IPv6's stateless address autoconfiguration removes the primary motivation for DHCP in IPv4, DHCPv6 can still be used to statefully assign addresses if the network administrator wants more control over addressing.

DH group

Diffie-Hellman group.

DIAG

Diagnostic section of maintenance information manual.

differential

See *High Voltage Differential (HVD)*.

direct access storage

A storage device in which the access time is independent of the location of the data.

display contrast

The brightness of the display on the Operator Panel.

DLL

Dynamic Link Library. The Microsoft implementation of the shared library concept. These libraries usually have the file extension dll, ocs (for libraries that contain activeX controls, or drv (for legacy system drivers).

DNS

Directory Name System. This allows the library to recognize text-based addresses instead of numeric IP addresses.

download

To transfer programs or data from a computer to a connected device, typically a personal computer.

To transfer data from a computer to a connected device, such as a workstation or personal computer.

DPF

Data Path Failover.

DRAM

Dynamic random-access memory.

drive, magnetic tape

A mechanism for moving magnetic tape and controlling its movement.

Drive Not Configured

This message occurs during the first boot after a factory settings restore is run. This message is not a real issue since it takes time for the library to configure.

DRV

Drive.

DSA key
Encryption key type.

DSE
Data security erase.

DSP
Digital signal processor.

E

EBCDIC
Extended binary-coded decimal interchange code.

EC
Edge connector. Engineering change.

ECC
Error correction code.

EEB
Ethernet Expansion Blade

EEPROM
Electrically erasable programmable read-only memory.

EIA
Electronics Industries Association.

EIA unit
A unit of measure, which is established by the Electronic Industries Association, equal to 44.45 millimeters (1.75 inches).

eject
To remove or force out from within.

EKM
Encryption Key Manager.

electronic mail
Correspondence in the form of messages that are transmitted between user terminals over a computer network.

email
See *electronic mail*.

encryption
A method of storing data in a format that helps protect data from inadvertent or deliberate compromise. An encryption-enabled drive contains the necessary hardware and firmware to encrypt and decrypt host tape application data. Encryption policy and encryption keys are provided by the host application or host server.

encryption key manager (EKM)
A Java™ software program that assists encrypting tape drives in generating, protecting, storing, and maintaining encryption keys that encrypt information that is written to and decrypt information that is read from tape media.

entitlement
Entitlement is the official right to receive service and support for your tape library.

EPO
Emergency power off.

EPROM
Erasable programmable read only memory.

EQC
Equipment check.

equipment check
An asynchronous indication of a malfunction.

Error log
A data set or file in a product or system where error information is stored for later access.

ESD
Electrostatic discharge.

ESP
Encapsulating Security Payload. An Internet Protocol that provides origin authenticity, integrity, and confidentiality protection of a packet. ESP also supports encryption-only and authentication-only configurations, but encryption without authentication is discouraged because it is insecure.

F

fault symptom code (FSC)
A hexadecimal code that is generated by the drive or the control unit microcode in response to a detected subsystem error.

FC
Feature code.

FCC
Federal communications commission.

FE
Field engineer, customer engineer, or service representative.

fiducial
A target that is used for teaching a physical location to a robot.

field replaceable unit (FRU)
An assembly that is replaced in its entirety when any one of its components fails.

file
A named set of records that are stored or processed as a unit. Also referred to as a data set.

file protection
The processes and procedures that are established in an information system that are designed to inhibit unauthorized access to, contamination of, or deletion of a file.

file transfer protocol (FTP)
In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or hosts.

firmware
Proprietary code that is delivered as microcode as part of an operating system. Firmware is more efficient than software loaded from an alterable medium and 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 system board.

FLASH EEPROM
An electrically erasable programmable read-only memory (EEPROM) that can be updated.

FMR
Field microcode replacement.

format
The arrangement or layout of data on a data medium.

formatter
Part of a magnetic tape subsystem that performs data conversion, speed matching, encoding, first level error recovery, and interfaces to one or more tape drives.

FP
File protect.

frayed
Damaged as if by an abrasive substance.

FRU
    Field replaceable unit.

FSC
    Fault symptom code.

FSI
    Fault symptom index.

FTSS
    Field Technical Sales Support.

functional microcode
    Microcode that is resident in the machine during normal customer operation.

G

g
    Gram.

GB
    gigabyte.

GBIC
    Gigabit Interface Converter.

Gbs
    gigabits/second

Gbi
    gigabit

gigabit (Gbit)
    1 000 000 000 bits.

gigabyte (GB)
    1 000 000 000 bytes.

Gigabit Interface Converter (GBIC)
    Converts copper interface to optic interface.

gnd
    Ground.

H

HBA
    Host Bus Adapter.

HD Slot Technology
    High-density (HD) slot technology. Allows multiple cartridges to be stored in a tiered architecture.

hertz (Hz)
    Unit of frequency. 1 hertz equals one cycle per second.

hex
    Hexadecimal.

High Voltage Differential (HVD)
    A logic signaling system that enables data communication between a supported host and the 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 canceled. Synonymous with *differential*.

HVD
    SCSI Bus High Voltage Differential

Hz
    Hertz (cycles per second).

I

ID

Identifier.

identifier (ID)

(1) In programming languages, a lexical unit that names a language object; for example, the names of variables, arrays, records, labels, or procedures. An identifier usually consists of a letter optionally followed by letters, digits, or other characters. (2) One or more characters that are used to identify or name data element and possibly to indicate certain properties of that data element. (3) A sequence of bits or characters that identifies a program, device, or system to another program, device, or system.

IEC

International Electrotechnical Commission.

IKE

Internet Key Exchange that is used in the IPsec protocol.

IML

Initial microprogram load.

incompatible magazine

This message might display on the Operator Panel during library initialization. It occurs during factory restore or VPD. This message is not a real issue since it takes time for the library to configure.

initial microprogram load (IML)

The action of loading a microprogram from an external storage to writable control storage.

initiator

The component that runs a command. The initiator can be the host system or the tape control unit.

INST

Installation.

interface

A shared boundary. An interface might be a hardware component to link two devices or it might be a portion of storage or registers accessed by two or more computer programs.

Internet Protocol Version 4 (IPv4)

See *IPv4*.

Internet Protocol Version 6 (IPv6)

See *IPv6*.

interposer

The part that is used to convert a 68-pin connector to a 50-pin D-shell connector.

intervention required

Manual action is needed.

INTRO

Introduction.

I/O

Input/output.

I/O station

Cartridge location that is dedicated for the insertion of cartridges into and the removal of cartridges from the library.

IOP

Input/output processor.

IP

Internet Protocol.

IP address

An identifier for a computer or device on an Internet Protocol (TCP/IP) network. Networks that use the TCP/IP protocol route messages that are based on the IP address of the destination. See *IPv4* and *IPv6*.

IPL

Initial program load.

IPSec (IP security)

A set of protocols for securing IPv6 network communications by authentication and encryption.

IP Stack

A TCP/IP protocol stack that manages static IP addresses.

IPv4

A network layer protocol for packet-switched networks. IPv4 supports 2^{32} (about 4.3 billion) addresses.

IPv6

A network layer protocol for packet-switched networks. It is the designated successor of IPv4 for general use on the Internet. The main improvement that is brought by IPv6 is the increase in the number of addresses available for networked devices, allowing, for example, each mobile phone and mobile electronic device to have its own unique address.

ISV

Independent software vendor.

ITST

Idle-time self-test.

K

Kerberos

Kerberos Authentication is a standard (RFC 1510) third-party authentication protocol that provides end-to-end security for distributed computing environments.

kilogram (kg)

1000 grams (approximately 2.2 pounds).

km

kilometer. 1000 Meters, Approximately 5/8 mile.

L

LAN

Local area network. A computer network within a limited area.

LCB

Library Control Blade

LCD

See *liquid crystal display*.

LDAP

Lightweight Directory Access Protocol. This allows the library to use login and password information that is stored on a server to grant access to the library functionality.

LDAPS

Secure LDAP over SSL.

LDI

Library Drive Interface.

LED

Light-emitting diode.

library certification

In cryptography, a certificate that is provided by the library.

library-managed encryption

Tape encryption that is controlled by the tape library.

Linear Tape-Open (LTO)
A type of tape storage technology that is developed by the IBM Corporation, Hewlett-Packard, and Quantum. 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 Ultrium format focuses on high capacity. The Ultrium format is the preferred format when capacity (rather than fast access) is the key storage consideration. An Ultrium cartridge has a compressed data capacity of up to 15 TB (2.5:1 compression) and a native data capacity of up to 6 TB.

liquid crystal display (LCD)
A low-power display technology that is used in computers and other I/O devices.

loadable
The ability to be loaded.

LME
Library Managed Encryption.

LTO cartridge memory (LTO-CM)
Within each LTO Ultrium data cartridge, an embedded electronics and interface module that can store and retrieve a cartridge's historical usage and other information.

LUN
Logical Unit Number.

LVD
SCSI Bus Low Voltage Differential

M

MAC address
The Media Access Control address of a computer networking device.

magnetic tape
A tape with a magnetic surface layer on which data can be stored by magnetic recording.

MAP
Maintenance analysis procedure.

mask
A pattern of characters that controls the retention or elimination of portions of another pattern of characters. To use a pattern of characters to control the retention or elimination of portions of another pattern of characters.

master file
A file that is used as an authority in a job and that is relatively permanent, even though its contents might change. Synonymous with main file.

Maximum Transmission Unit (MTU)
The size of the largest packet that a network protocol can transmit.

MB
Megabyte (expressed as data rate in MB/s or MB/second).

media capacity
The amount of data that can be contained on a storage medium, expressed in bytes of data.

media-type identifier
Pertaining to the bar code on the bar code label of the Ultrium Tape Cartridge, a 2-character code, L1, that represents information about the cartridge. L identifies the cartridge as one that can be read by devices that incorporate LTO technology; 1 indicates that it is the first generation of its type.

mega
One million of.

meter
In the Metric System, the basic unit of length; equal to approximately 39.37 inches.

MIB
> Management Information Base. Information repository that is used by SNMP.

micro
> One millionth of.

microcode
> (1) One or more micro instructions. (2) A code, representing the instructions of an instruction set, which is implemented in a part of storage that is not program-addressable. (3) To design, write, and test one or more micro instructions. (4) See also *microprogram*.

microdiagnostic routine
> A program that runs under the control of a supervisor, usually to identify field replaceable units.

microdiagnostic utility
> A program that is run by the customer engineer to test the machine.

microinstruction
> A basic or elementary machine instruction.

microprogram
> A group of microinstructions that when run performs a planned function.
>
> The term microprogram represents a dynamic arrangement or selection of one or more groups of microinstructions for execution to perform a particular function. The term microcode represents microinstructions that are used in a product as an alternative to hard-wired circuitry to implement certain functions of a processor or other system component.

MIM
> Media information message.

mm
> Millimeter.

modifier
> That which changes the meaning.

mount a device
> To assign an I/O device with a request to the operator.

MP
> Microprocessor.

ms
> Millisecond.

MSG
> Message.

multipath
> Pertaining to using more than one path.

N

N/A
> Not applicable.

Network Address Translation (NAT)
> NAT involves rewriting the source or destination addresses of IP packets as they pass through a router or firewall. Most systems that use NAT do so to enable multiple hosts on a private network to access the Internet over a single public IP address.

NEMA
> National Electrical Manufacturers Association.

node
> In a network, a point at which one or more functional units connect channels or data circuits.

NTP

Network Time Protocol. This protocol allows the library to set its internal date and time that is based on the date and time of a server.

NVS

Nonvolatile storage. A storage device whose contents are not lost when power is cut off.

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 abampere per 4π centimeters of axial length.

offline

Pertaining to the operation of a functional unit without the continual control of a computer. Contrast with *online*.

online

Pertaining to the operation of a functional unit that is under the continual control of a computer. Contrast with *offline*.

OPER

Operation.

ov

Over voltage.

overrun

Loss of data because a receiving device is unable to accept data at the rate it is transmitted.

overtightening

To tighten too much.

P

parameter

A variable that is given a constant value for a specified application and that might denote the application.

p bit

Parity bit.

PC

Parity check.

PCC

Power control compartment.

PDF

Portable Document Format.

PE

Parity error. Product engineer.

PFS

Perfect forward secrecy.

pick

Pertaining to the library, to remove, by using a robotic device, a tape cartridge from a storage slot or drive.

picker

A robotic mechanism that is located inside the library that moves cartridges between the cartridge storage slots and the drive.

PM
> Preventive maintenance.

POR
> Power-on reset.

port
> A physical connection for communication between the 3590 and the host processor. The 3590 has 2 SCSI ports.

Portable Document Format (PDF)
> A standard that is specified by Adobe Systems, Incorporated, for the electronic distribution of documents. PDF files are compact, can be distributed globally (by way of email, the web, intranets, or CD-ROM), and can be viewed with the Acrobat Reader, which is software from Adobe Systems that can be downloaded at no cost from the Adobe Systems home page.

Private key
> A cryptographic key that is used to decrypt a message.

PROM
> Programmable read only memory.

PS
> Power supply.

PTF
> Program temporary fix. A single bugfix or group of bugfixes that are distributed in a form ready to install for customers.

PWR
> Power.

R

rack
> A unit that houses the components of a storage subsystem, such as the library.

rackmount kit
> A packaged collection of articles that are used to install the rack mounted version of the library.

RAM
> Random access memory.

Random access memory
> A storage device into which data is entered and from which data is retrieved in a nonsequential manner.

RAS
> Reliability, availability, and serviceability.

record
> A collection of related data or words, which are treated as a unit.

recording density
> The number of bits in a single linear track measured per unit of length of the recording medium.

recoverable error
> An error condition that allows continued execution of a program.

ref
> Reference.

reg
> Register.

reinventory
> To inventory again.

retension
The process or function of tightening the tape onto the cartridge, if it is sensed that the tape has a loose wrap on the cartridge.

RFC (Request for Comments)
Request for Comments (RFC) documents are a series of memoranda, which encompasses new research, innovations, and methodologies applicable to Internet technologies.

RH
Relative humidity.

RID tag
Repair identification tag.

RML
Rack Mount Line.

robot
Picker.

robotics
Picker assembly.

root CA certification
In cryptography, a root certificate from a certificate authority (CA).

RPQ
Request for price quotation.

RSA key
Encryption key type.

R/W
read/write.

S

s
Seconds of time.

SAC
Service Action Code. Code that is developed to indicate possible FRU or FRUs to replace to repair the hardware.

SAN
Storage area network.

SAS
Serial Attached SCSI. A computer bus technology and serial communication protocol for direct attached storage devices. SAS is a replacement for parallel SCSI with higher speeds, but still utilizing SCSI commands.

scratch cartridge
A data cartridge that contains no useful data, but can be written to with new data.

SCD
Single Character Display.

SCSI
Small computer system interface.

SE
Single-ended.

segment
A part.

sel
Select.

Serial Attached SCSI (SAS)
　　A drive with a SAS interface can be linked directly to controllers. SAS is a performance improvement over traditional SCSI because SAS enables multiple devices (up to 128) of different sizes and types to be connected simultaneously with thinner and longer cables. It supports full-duplex signal transmission up to 3 Gb/s. In addition, SAS drives can be hot-plugged.

serialize
　　To change from parallel-by-byte to serial-by-bit.

serializer
　　A device that converts a space distribution of simultaneous states, which represents data into a corresponding time sequence of states.

servo, servos
　　An adjective for use in qualifying some part or aspect of a servomechanism.

servomechanism
　　A feedback control system in which at least one of the system signals represents mechanical motion.

signature
　　A digital signature that is used in cryptography to identify one party to ensure authenticity.

slot blocker
　　A slot blocker is used to restrict/close off a data cell so a data cartridge cannot be inserted.

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 320 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.
- Ultra320 SCSI: Uses a 16-bit bus and supports data rates of 320 MBps.

SMI-S
　　See *Storage Management Initiative Specification (SMI-S)*.

SMTP
　　Simple Mail Transfer Protocol. SMTP is a standard for email transmissions across the internet.

SMW
　　Servo Manufacturer's Word.

SNMP
　　Simple Network Management Protocol. SNMP is used by network management systems to monitor network-attached devices for conditions that warrant administrative attention.

SNTP
　　Simple Network Time Protocol. Used to synchronize the clocks of network-attached devices.

SNS
　　Sense.

special feature
　　A feature that can be ordered to enhance the capability, storage capacity, or performance of a product, but is not essential for its basic work.

SPI
　　Security Parameters Index.

SR

Service representative, see also *CE*.

SRAM

Static random access memory.

SS

Status store.

SSL (Secure Sockets Layer)

A set of cryptographic protocols for secure communications on the Internet for such things as web browsing, email, Internet faxing, instant messaging, and other data transfer. SSL allows applications to communicate across a network in a way that is designed to prevent eavesdropping, tampering, and message forgery.

SSP

Serial SCSI Protocol.

ST

Store.

standard feature

The significant design elements of a product that are included as part of the fundamental product.

START

Start maintenance.

StartTLS

Secure LDAP communication that uses TLS.

Storage Management Initiative Specification (SMI-S)

A storage standard that is developed and maintained by the Storage Networking Industry Association (SNIA). It is also ratified as an ISO standard. The main objective of SMI-S is to enable broad interoperable management of heterogeneous storage vendor systems.

subsystem

A secondary or subordinate system, capable of operating independently of, or asynchronously with, a controlling system.

SUPP

Support.

sync

Synchronous, synchronize. Occurring with a regular or predictable time relationship.

T

tachometer, tach

A device that emits pulses that are used to measure/check speed or distance.

tape cartridge

A container that holds magnetic tape, that can be processed without separating it from the container.

tape void

An area in the tape in which no signal can be detected.

TB

terabyte

TCP/IP

Transmission Control Protocol/Internet Protocol.

TCU

Tape control unit.

TDT

Tape Diagnostic tool.

TH

Thermal.

thread/load operation
A procedure that places tape along the tape path.

TM
Tapemark.

transport mode
End-to-end communications security in which the end-point computers do the security processing.

trusted certification
In cryptography, a trustworthy certificate that is not registered with a certificate authority.

tunnel mode
Port-to-port communications security in which security is provided to several machines by a single node.

U

UART
Universal asynchronous receiver/transmitter.

UL
Underwriter's Laboratories.

Ultrium Tape Drive
Located within the library, a data-storage device that controls the movement of the magnetic tape in an LTO Ultrium Tape Cartridge. The drive houses the mechanism (drive head) that reads and writes data to the tape.

unload
Prepare the tape cartridge for removal from the drive.

utilities
Utility programs.

utility programs
A computer program in general support of the processes of a computer; for instance, a diagnostic program.

uv
Under voltage.

V

VOLSER
Volume serial number.

volume
A certain portion of data, together with its data carrier, that can be handled conveniently as a unit.

VPD
Vital product data. The information that is contained within the tape drive that requires nonvolatile storage that is used by functional areas of the drive, and information that is required for manufacturing, RAS, and engineering.

W

word
A character string that is convenient for some purpose to consider as an entity.

World Wide Node Name (WWNN)
A unique character string which identifies Fibre Channel Host Bus adapters (HBA).

WORM
Write Once Read Many.

Write
Write command.

WT
   World trade.

WWCID
   Worldwide Cartridge Identifier.

WWN
   Worldwide Name.

WWNN
   Worldwide Node Name.

WWPN
   Worldwide port name.

X

XR
   External register.

XRA
   External register address register.

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