

StorageTek T10000

Tape Drive Operator's Guide

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Preface

This document describes how to operate Oracle's StorageTek T10000 tape drive family. The term T10000 is used in this document to generically reflect all drive models. The specific model suffix is used whenever model differentiation is appropriate.

Audience

This document is intended for anyone involved with the operation of the StorageTek T10000 rackmounted or library-attached tape drive, and the associated tape cartridges.

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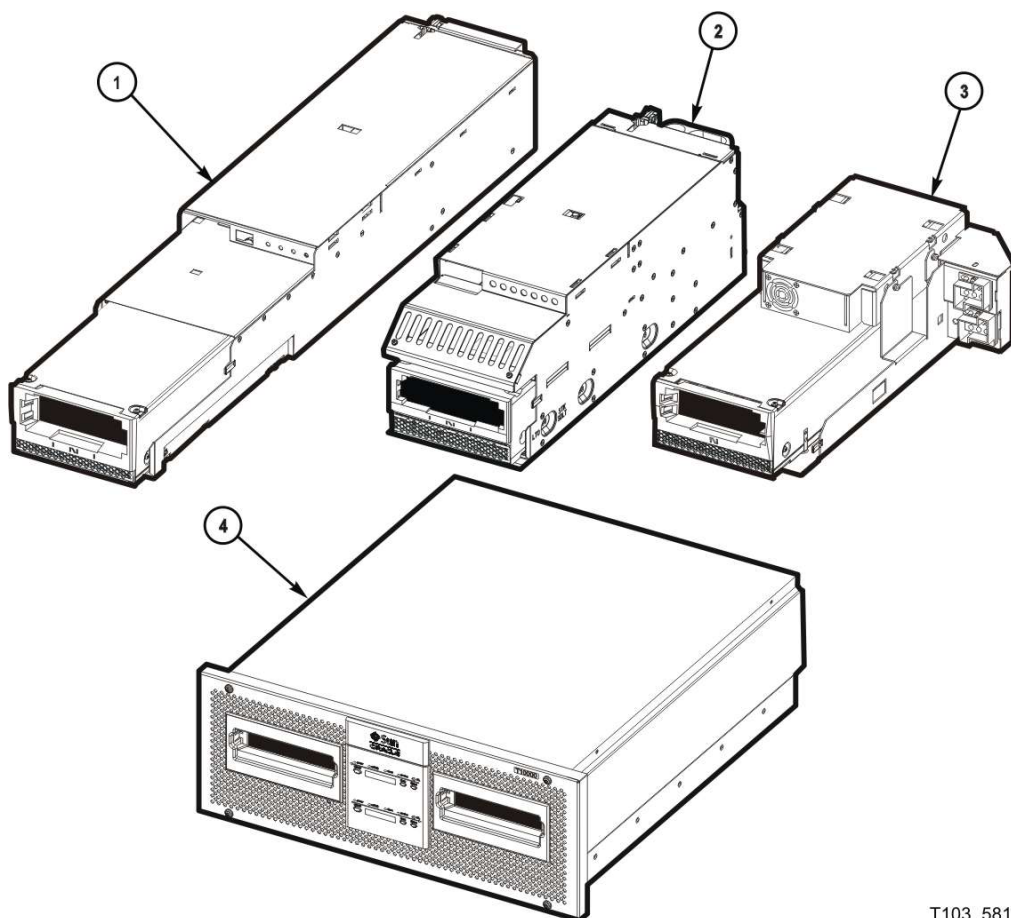
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Introduction

Oracle's StorageTek T10000 tape drive family provides a range of small, modular, high-performance units designed for high-capacity data storage. The tape drive is either rack mounted or used in various StorageTek libraries (Figure 1-1). There are four models in the T10000 drive family: T10000A, T10000B, T10000C, and T10000D.

Figure 1-1 T10000 Tape Drive Configurations



T103_581

Illustration Legend:

- 1 - SL8500 configuration
- 2 - SL3000 configuration
- 3 - L180/L700e/L1400M configuration (T10000A and T10000B only)
- 4 - Rack mount configuration

The following libraries support certain models of the T10000 tape drive family:

- SL3000
- SL8500
- L180/L700e/L1400M (T10000A and T10000B only)
- 9310 (T10000A only)

Tape Drive Description

The drive uses a unique, single-reel cartridge. The file reel is located inside the cartridge while the machine reel resides inside the tape drive. The drive uses a technology called *partial response, maximum likelihood* (PRML) to provide a high-density data format. PRML enables recording and storing an uncompressed capacity of *up to*:

- StorageTek T10000 cartridge:
 - 500 gigabytes (GB) with the T10000A tape drive
 - 1 terabyte (TB) with the T10000B tape drive
- StorageTek T10000 T2 cartridge:
 - 5.5 terabytes (TB) with the T10000C tape drive
 - 8.5 terabytes (TB) with the T10000D tape drive

The T10000A drive can read and reclaim a tape cartridge written by a T10000A drive.

The T10000B drive can:

- Read and reclaim a tape cartridge written by a T10000A drive.
- Write, read, and reclaim a tape cartridge written by a T10000B drive.

The T10000C drive can:

- Read tape cartridges written by either a T10000A or T10000B drive.
- Write, read, and reclaim a tape cartridge written by a T10000C drive.

The T10000D drive can:

- Read tape cartridges written by a T10000A, T10000B, or T10000C drive.
- Reclaim tape cartridges written by a T10000C drive.
- Write, read, and reclaim a tape cartridge written by a T10000D drive.

The tape drive uses fiber optic host connections to provide a high data-transfer rate.

Note: See [Appendix E, "Specifications"](#) and [Appendix F, "Controlling Contaminants"](#) for additional specifications and requirements.

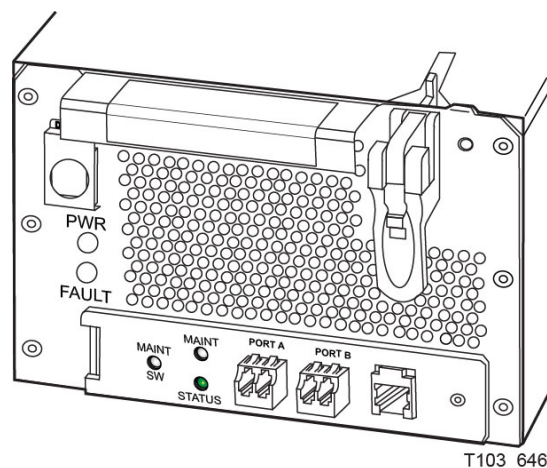
Library Tray Rear Panel

The library tray rear panel has specific tape drive items (see [Figure 1–2](#) for an example of a rear panel):

- Interface ports
- Ethernet port

- Tape drive indicators
 - The T10000A/B/C indicators are labeled STATUS and CRYPT.
 - The T10000D indicators are labeled STATUS and MAINT.
- Tape drive maintenance push button

Figure 1–2 SL8500 Library Drive Tray Rear Panel (T10000D)



Interface Ports Use

It is not recommended to connect a T10000 tape drive to the same host bus port with another tape or a disk subsystem. The stress on the host bus adapter, due to the bandwidth needs, creates unacceptable error recovery issues between both solutions.

The T10000 tape drive supports connection of both ports, in accordance with ANSI Fibre Channel specifications (refer to *InterNational Committee on Information Technology Standards [INCITS] documents: SCSI Primary Commands -3, Section 5.6, and Fibre Channel Protocol -3*). The drive will support two hosts if they each honor the Reserve/Release or the Persistent Reserve/Release specifications.

Maintenance Port Use

All service calls for tape drives under warranty, maintenance contract, or time-and-materials service require physical access and connection to the rear panel maintenance (Ethernet) port.

If a customer has an Ethernet cable physically connected to the drive requiring service, the service person must disconnect this cable to perform the required service action.

- T10000 non-encryption drives supported by the remote support platform require 100% dedication of the drive's Ethernet port to the platform.
- T10000 encryption-enabled drives require 100% dedication of the drive's Ethernet port to the Encryption Service Network except during service activities performed by authorized personnel.

Where Encryption and the remote support platform coexist, the Ethernet Port must be concurrently shared by using the Service Network.

Note: Oracle neither supports nor assumes any responsibility for drive functional failures that occur during the unauthorized use of the drive's maintenance port.

Unauthorized use applies to any use of the drive's Ethernet port for other than the following items:

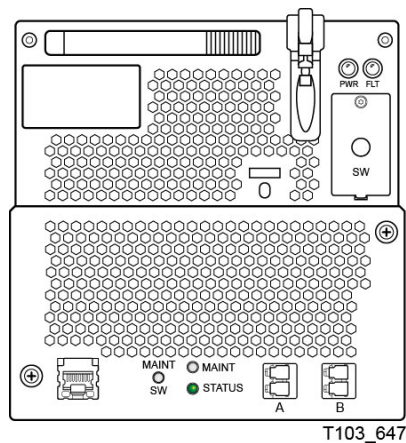
- Encryption 1.x environments (not supported by T10000C and T10000D)
- Encryption 2.x environments
- StorageTek Virtual Operator Panel (VOP) customer or service versions
- Service Delivery Platform (SDP)
- Service's Tape Health Check Tool
- StorageTek Diagnostic System (STDS)

The T10000C and T10000D drives support IPv6 addressing. With drive code level 1.40.x07 or higher, the T10000A or B drive supports IPv6 addressing.

T10000D Library Tray

The rear panel of an SL3000 library drive tray for the T10000D is shown in [Figure 1–3](#).

Figure 1–3 SL3000 Library Drive Tray Rear Panel (T10000D)



Status and Maintenance Indicators

The drive tray has two single color indicators: STATUS (green) and MAINT (yellow). The state of the indicator(s) conveys a meaning:

Green indicator only (on solid)

Indicates the drive is functional.

Green indicator only slow flashing

The drive is in boot monitor mode.

Green indicator only fast flashing

The drive is in IPL mode.

Yellow indicator only (on solid)

The drive is in maintenance mode.

Yellow indicator only fast flashing

The drive is in dump mode.

Green indicator and Yellow indicator on solid

The drive requires service.

Green and Yellow indicators alternating for one cycle

Drive is resetting.

Green and Yellow indicators alternating for one minute

Visual indication to identify the drive for a specific purpose.

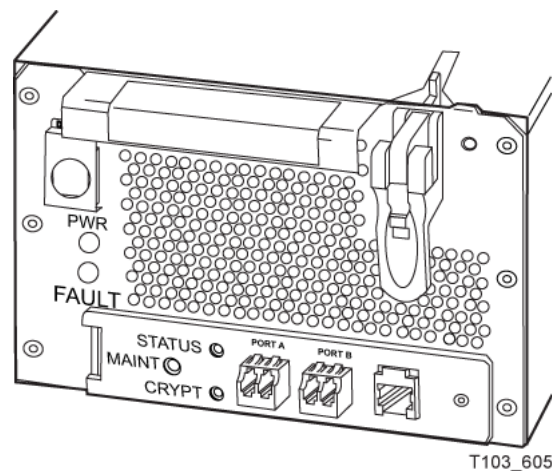
Green and Yellow indicators off

The drive is powered down.

T10000 A, B, or C Library Tray

The rear panel has a push-button switch, two multi-color indicators, and three connectors. The drive status indicator is on all drives while the encryption status indicator is only on encryption-capable T10000A, B, or C drives. The tape drive specific items are grouped together on the bottom edge of the rear panel with the MAINT push-button on the left and the Ethernet connector on the right (see [Figure 1-4](#)).

Figure 1-4 SL8500 Library Drive Tray (T10000A, B, or C)



Note: See [Table 1-1](#) for drive status indicator states. See ["Encryption Status Indicator"](#) on page 1-6 for encryption status indicator states.

Drive Status Indicator

The drive status indicator on the rear panel indicates the general status of the drive. The normal sequence of the drive status indicator during the drive power-on IPL: slow-flashing red, slow-flashing amber, steady or slow-flashing green.

Note: The slow flash rate is one cycle per second, and the fast flash rate is two cycles per second. Some indications alternate between two colors at the slow flash rate.

Table interprets the various states of the drive status indicator:

Table 1–1 Drive Status Indicator State Descriptions

Indicator State	Description	Meaning/Action
Off	Drive powered off	Power not applied to the drive. Turn on the power supply. Possible power related failure if it remains off with power supply switch on.
Red	Hardware failure	Processor not functioning. Call for service.
Red (slow flash rate)	IPL started	Booting, no communication with the drive until the IPL completes.
Amber (slow flash rate)	Functional code loading	Initializing, no communication with the drive until the IPL completes.
Green	IPL complete (dumps <i>not</i> present)	Normal operating condition, drive is ready for functional tasks. Communication with drive is possible.
Green (slow flash rate)	IPL complete (dumps are present)	Normal operating condition, drive is ready for functional tasks. Communication with drive is possible.
Amber	Boot Monitor	Engineering maintenance mode. Call for service.
Red and Blue (alternating)	Hardware failure	Power on failure. Call for service.
Red and Green (alternating)	Service mode	Initiated by service representative. While in the service mode, the drive's IP is static 10.0.0.1.
Red and Green (alternating)	Dump-again state	If indication is present without service mode active, it could indicate a recurring malfunction is present. Call for service.
Red (fast flash rate)	Dump in progress	Do not remove power while the drive is performing a dump operation (drive memory could be corrupted). There is no communication.
Amber (fast flash rate)	Firmware update in progress	Do not disturb the drive until the firmware update is complete. When the update is complete, the indicator will change to green fast flashing.
Green (fast flash rate)	Firmware update is complete	Initiate an IPL when the drive is idle, if the IPL did not auto-initiate.

Encryption Status Indicator

T10000A, B, or C drives that are encryption capable have a multi-color encryption status indicator on the rear panel.

If the encryption status indicator is green, it indicates that the drive is encryption capable, but not encryption enabled. In this state, the drive functions only in a non-encryption Safe mode and can neither read nor write encrypted tape cartridges. However, the drive can function normally for non-encryption tasks.

After the drive is encryption enabled, the indicator turns red to show that the drive is Armed and functional in the encryption mode. In this state, the drive can read and write encrypted tape cartridges. The drive can also read non-encrypted tape cartridges, but *cannot* write to non-encrypted tape cartridges.

The states of the encryption status indicator are:

Note: Slow flash rate is 1 cycle per second.

Indicator state: Off

- The drive does not have encryption hardware.

Indicator state: Green

- Encryption capable, but not enabled.
 - KMS 1.X: Not encrypting
 - KMS 2.x or OKM: Not licensed
- Normal, unencrypted drive write and read cartridge operations.

Indicator state: Green (slow flashing)

- Mode: Reset
- Encryption previously enabled, but requires keys. The drive performs read-only, unencrypted cartridge operations.

Note: The drive cannot perform an unencrypted write operation after encryption has been enabled.

Indicator state: Red

- Mode: Armed, idle
- Encryption enabled or active. Ready to encrypt.

Indicator state: Red (slow flashing)

- Mode: Armed, active
- Encryption read or write cartridge operation in progress.

Indicator state: Amber

- KMS 1.X: Requires media key.
- KMS 2.x or OKM:
 - Enrolled, cartridge not loaded.
 - Enrolled, cartridge loaded but waiting for KMS key.

Indicator state: Amber (slow flashing)

- Requires device key (KMS 1.x only).

Indicator state: Cycling

Note: The indicator continuously cycles through several colors at the slow flash rate.

- Mode: Zeroed
Media, device, and enabling keys missing. The drive is unusable, and must be returned to manufacturing.

Refer to Crypto Key Management documentation for additional information:

Encryption Options

Encryption-capable T10000 tape drives support data-at-rest encryption.

Federal Information Processing Standards compliance:

- FIPS PUB 140-2, *Security Requirements for Cryptographic Modules*
 - Level 1: The basic level with production-grade requirements.
 - Level 2: Adds requirements for physical tamper evidence and role-based authentication.
- With drive code level 1.40.x07 and Key Management System (KMS) 2.1, the T10000A drive complies with FIPS Level 1.
- With drive code level 1.40.x07 and Key Management System (KMS) 2.1, the T10000B drive complies with FIPS Level 2.
- The T10000C drive with code level 1.51.318 and the Oracle Key Manager provides FIPS 140-2 Level 1 security to data on magnetic tape.

There are four encryption modes:

1. Encryption off (manufacturing default).
2. Encryption enabled (on/off switchable) with keys obtained from a KMS.
3. Encryption permanently enabled with keys obtained from a KMS (protected with AES Key wrap). Note that encryption cannot be turned off in this mode.
4. DPKM (see ["Data Path Key Management"](#) on page 1-9).

Key Management Solutions

The StorageTek Crypto Key Management Station (KMS 1.x), StorageTek Crypto Key Management System (KMS 2.x), and Oracle Key Management (OKM) provide device-based encryption solutions. The tape drive is shipped from the factory encryption-capable, but not encryption-enabled. You must explicitly enable the drive for encryption.

Note: A drive that has *not* been enabled for encryption can neither read nor append to any encrypted tape cartridge. It can, however, overwrite an encrypted tape from the beginning of tape (BOT).

What an Encryption-Enabled T10000 Tape Drive *can* do:

- Write to a tape cartridge in encrypted mode only, using its assigned write key
- Read an encrypted tape cartridge, if it has the proper read key
- Read non-encrypted tape cartridges—can neither write to nor append to the cartridge
- Format or reclaim tape cartridges

What an Encryption-Enabled T10000 Tape Drive *cannot* do:

- Append non-encrypted data to an encrypted tape cartridge
- Write a non-encrypted tape cartridge

Oracle/StorageTek Encryption Resources

For additional information on the encryption capabilities and features of the T10000 Tape Drive, see:

<http://www.oracle.com/technetwork/documentation/tape-storage-curr-187744.html#crypto>

For further information on the encryption option, see your sales representative.

Data Path Key Management

The data path key management (DPKM) subsystem is the third installment of encryption for StorageTek tape drives. DPKM uses the SCSI 4 commands `Security Protocol In` and `Security Protocol Out` to implement host-based key management on StorageTek encrypting tape drives. Encryption keys are delivered to the tape drive over the Fibre Channel interface (non-FIPS compliant). DPKM provides the ability to toggle the encryption state on/off on a per cartridge basis which enables the user to have a mix of encrypted/non-encrypted files on each tape cartridge. You use the Virtual Operator Panel to enable or disable the DPKM capability of the tape drive.

Dumps will not be encrypted if the drive setting is either Encryption off or DPKM.

Normal drive firmware updates are not allowed in DPKM mode. When the drive is in DPKM mode, follow these instructions to update firmware:

1. The crypto officer (CO) is required to turn off DPKM.

Note: Turning off DPKM requires a reboot and the drive IPLs into the Encryption off mode.

2. The CO updates the firmware.

The drive may or may not reboot automatically after the firmware is updated.

If the drive does reboot, it IPLs in the Encryption off mode.

3. The CO can enable DPKM which causes the drive to reboot and IPL into DPKM mode.

Interface with the Tape Drive

The T10000 tape drive does not have a built-in physical operator panel; therefore, your communication with library-attached drives is normally through the Virtual Operator Panel (VOP) application.

Virtual Operator Panel

The VOP application window (Figure 1–5) provides a graphical user interface (GUI) to the connected drive. The GUI has a menu bar, a section that provides several drive status indicators and two drive message windows (primary and secondary), and the bottom portion of the GUI contains the VOP text message pane. Additional information is available in the *Virtual Operator's Panel User's Guide*.

Note: When you use VOP with a T10000C drive, another indicator is present that shows the drive hibernate status.

Figure 1–5 VOP Application Window for a T10000C Drive

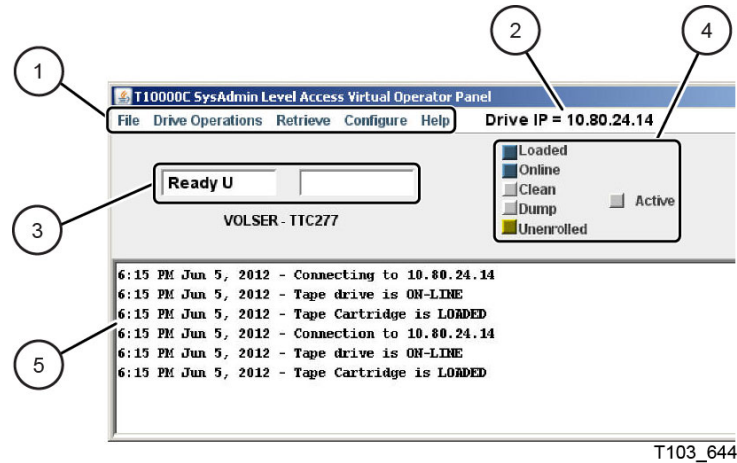


Illustration Legend:

- 1 - Menu bar
- 2 - Drive IP or name
- 3 - Primary and secondary drive message windows
- 4 - Drive status indicator
- 5 - VOP text message area

Download VOP from the following URL: <http://edelivery.oracle.com/>

Select Oracle StorageTek Products and Generic Platform.

Library Drives

Manual drive operations, such as configuration settings and utilities, can be directed by VOP through the drive's rear panel Ethernet maintenance port.

Rack Mount Drives

Rack mounted drive operation is normally accomplished through the drive tray chassis operator panel (see "[Operator Panel Controls and Indicators](#)" on page 2-2). However, you can also operate it with VOP and a connection to the Ethernet port on the rear panel of the drive tray chassis.

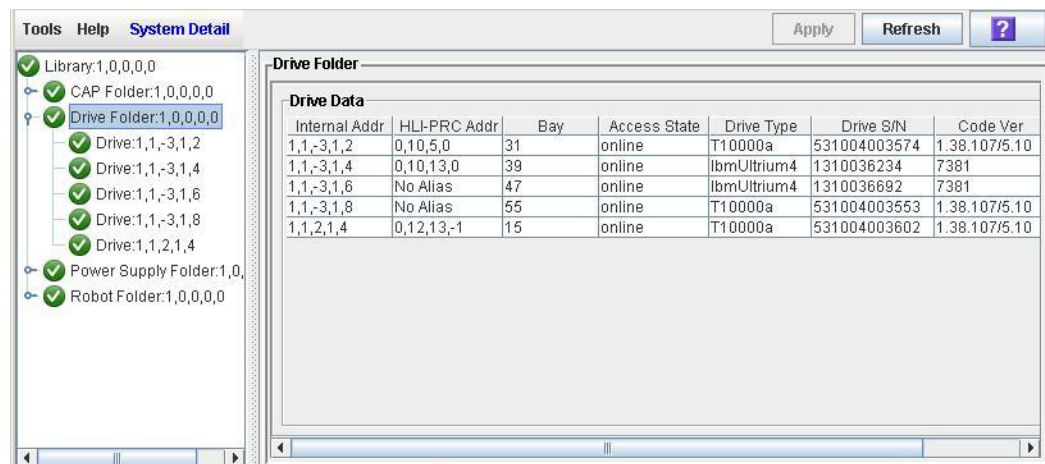
Secure Configuration

The VOP is designed to operate on a service network configured as a private LAN. VOP, tape drives, the Crypto Key Management Station (if drives are encrypted), and Ethernet switches are potential components of the private LAN. The private LAN best practice recommendation ensures security from unauthorized access. See the *StorageTek Crypto Key Management System, Systems Assurance Guide* for details regarding the service network private LAN.

StorageTek Library Console

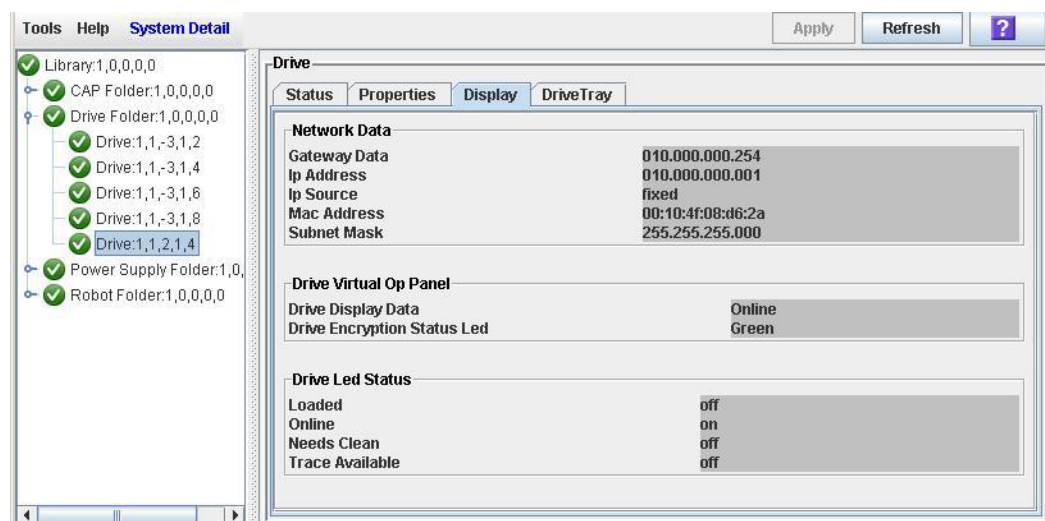
The SL3000 and SL8500 libraries have a GUI called the StorageTek Library Console (SLC) that presents basic drive information. The system detail drive folder, shown in the following figure, contains a list of installed drives and data about each drive (such as the drive access state, the drive type, the drive serial number, and the version of drive code).

Figure 1–6 StorageTek Library Console



When you select a specific drive, additional unique data is available for that drive such as the drive status, drive properties, drive display, and drive tray information (see Figure 1–7).

Figure 1–7 Drive Display - StorageTek Library Console



Note: The SLC drive folder information changes frequently, and the actual data displayed might differ from the example. Click the question mark button on the GUI for additional information.

T10000 Cartridges

The T10000 tape drives support five types of cartridges:

- StorageTek T10000 cartridge (T10000A or B drive):
 - Data: 500 gigabytes T10000A or 1 terabyte T10000B
 - Data, sport: 120 gigabytes T10000A or 240 gigabytes T10000B
 - VolSafe, capacity: 500 gigabytes T10000A or 1 terabyte T10000B
 - VolSafe, sport: 120 gigabytes T10000A or 240 gigabytes T10000B
 - Cleaning cartridge: 50 uses (CT or CL cartridge)
- StorageTek T10000 T2 cartridge (T10000C or D tape drive):
 - Data: up to 5.5 terabytes T10000C or 8.5 terabytes T10000D
 - Data, sport: 1 terabyte T10000C or 1.6 terabytes T10000D
 - VolSafe, capacity: up to 5.5 terabytes T10000C or 8.5 terabytes T10000D
 - VolSafe, sport: 1 terabyte T10000C or 1.6 terabytes T10000D
 - Cleaning cartridge: 50 uses (CC or CL cartridge)

Note: The T10000 tape drives do not accept a data cartridge for any other type of tape drive.

Figure 1–8 identifies key areas of the StorageTek T10000 tape cartridge.

Figure 1–8 T10000 Cartridge

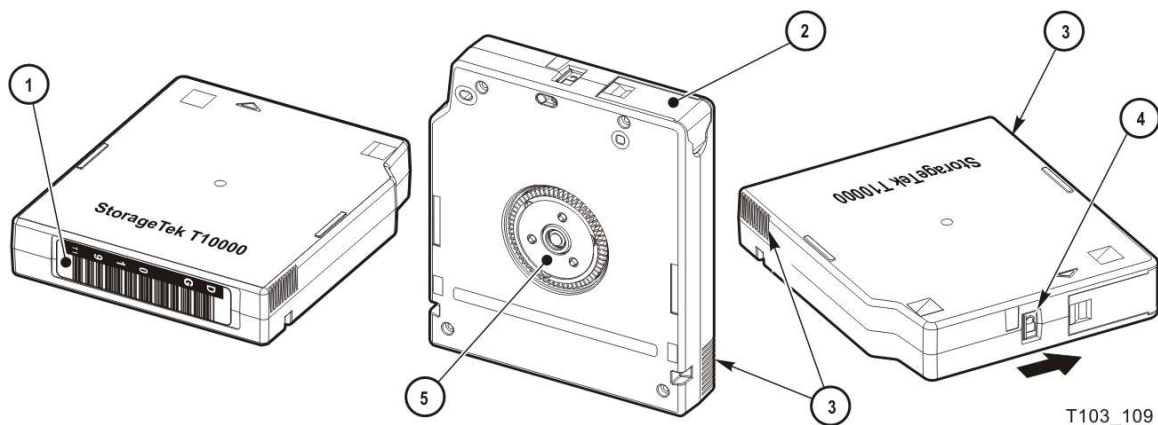


Illustration Legend:

- 1 - Volume label
- 2 - Leader access door (black, red, yellow, or white depending on cartridge type)
- 3 - Finger grips
- 4 - File protect switch (black, red, yellow, or white depending on cartridge type)
- 5 - Hub

Standard Data Cartridge

Data cartridges are the standard common read and write data cartridges (also referred to as native). The data cartridge has a *black* leader access door (see Figure 1–8). Labeled

cartridges have a media identifier of either T1 (StorageTek T10000) or T2 (StorageTek T10000 T2).

The StorageTek T10000 data cartridge specification supports 15,000 mounts.

The StorageTek T10000 T2 data cartridge specification supports 25,000 mounts.

Note: The tape drive issues a warning message to the host when that number is exceeded.

A mount is defined as the tape drive threading the tape onto the take-up reel and moving to the load point.

Diagnostic Cartridges

The Diagnostic cartridge is a special-use version of the data cartridge with a special label. The diagnostic cartridge is typically used by a service representative and most libraries store one or more diagnostic cartridges (see "[Diagnostic Cartridge Labels](#)" on page B-2).

Sport Cartridges

The Sport cartridge is a lower capacity version of the native data cartridge. The Sport cartridge has a *red* leader access door (see [Figure 1-8](#)).

The StorageTek T10000 cartridge specification supports 15,000 mounts.

The StorageTek T10000 T2 cartridge specification supports 25,000 mounts. The tape drive issues a warning message when that number is exceeded.

VolSafe Data Cartridges

VolSafe data cartridges are write-once data cartridges. They cannot be erased without destroying the tape itself. The tape drive writes data on the tape and appends data to the cartridge on free space until the cartridge is full. The tape drives may read the cartridge multiple times. VolSafe cartridges are commonly used for information that must be stored for legal reasons and not altered. There are two versions of the VolSafe cartridge:

- VolSafe cartridge—you can identify this cartridge by a yellow leader access door (see [Figure 1-8](#)). This cartridge has the same capacity as the standard data cartridge.
- Sport VolSafe cartridge—you can identify this cartridge by a yellow leader access door and red file protect switch (see [Figure 1-8](#)). This cartridge has the same capacity as the sport data cartridge.

Cleaning Cartridges

As the name implies, you would use a cleaning cartridge to clean a drive head up to 50 times. An attempt to use a cleaning cartridge beyond that number results in the tape drive rejecting the cleaning cartridge and posting an error message to the host. You can identify a cleaning cartridge by a white leader access door (see [Figure 1-8](#)). There are several versions of the cleaning cartridge:

- T10000A or B cleaning cartridge (CT media identifier)
- Cleaning cartridge for the T10000C only (CC media identifier)

- Cleaning cartridge which cleans all four T10000 drive models (CL media identifier)

Media Information Region

The T10000 tape drives use information recorded on each tape cartridge to reduce access times and manage the useful life of the cartridge. This information is recorded in the cartridge's radio frequency identification (RFID) chip and at the beginning of tape in an area known as the media information region (MIR). The information stored in the RFID is a proper subset of the information stored in the MIR. The media information falls into two categories: statistical counters and data pointers.

Statistical Counters

Statistical counters reflect use of the cartridge and includes read and write activity, error activity, cumulative mounts, and other information about its use.

Data pointers

The data pointer information is a directory (map) used to locate the customer (logical) data on the physical tape media. Because customer data is compressed and written in drive controlled blocks on the tape, a map is needed to efficiently locate the data after it is written. This map provides an index between customer data and the physical block on the tape media. After data is written, the drive accesses this map to optimize access to the customer data.

To locate or space to customer data, the logical object that identifies the block is translated to the physical location on the tape media, and the drive determines the quickest method to read the block. If the block is some physical distance from the current location, a calculation results in a high-speed locate to the block location and is followed by a normal speed read.

The existence of the media information is usually transparent to the customer unless it has a problem. This can occur if the information update fails during a dismount. The impact of invalid media information occurs in several areas. Because it enables high speed positioning, invalid media information forces all operations to a slow speed mode. This has no impact on a sequential read from the beginning of the tape. However, any operation using locate defaults to a sequential slow-speed read to the requested block, which can result in longer processing time.

Note: Invalid media information might be suspected if you observe poor performance on a specific tape cartridge.

The following sections describe how media information is processed and some potential implications of problems with the information.

Normal Processing

Every time a tape cartridge is loaded, the media information is read from the tape media and saved in drive-resident memory. After being loaded in drive memory, a read-invalid state is written in the tape-resident RFID. The tape-resident media information is marked open, read-invalid because it does not reflect results of activity in the current mount session. All subsequent media information accesses during the current mount session are saved in the drive-resident information. If no writes are performed to the cartridge, the RFID remains in the read-invalid state meaning the

MIR directory information is still completely valid. After a write takes place, the RFID is marked write-invalid meaning the MIR directory information on tape is invalid.

The T10000 drives use the drive-resident copy of the information to access customer data pointers for read-only functions. Statistical counters are continuously updated in the memory-resident information with any drive activity.

When the cartridge is unloaded as part of the unload routine, the drive-resident information is written to the cartridge's RFID and the tape-resident MIR with the closed state indication set.

Cross-Density Cartridge Processing

Whenever a data cartridge is loaded that was written in a data density format that is different from the one used when the drive writes, model-specific MIR processing occurs. In an environment with mixed T10000 drive models, a mandatory firmware update provides the capability for the lower-density drive to read the RFID of a higher-density drive.

For a native data cartridge or Sport cartridge written by a T10000A drive, the:

- RFID can be read or updated by a T10000A, B, C, or D drive.
- MIR can be read by a T10000A, B, C, or D drive.
- MIR cannot be updated by a T10000B, C, or D drive.
- T10000A, B, C, or D drive counters can be updated after appropriate firmware updates are installed.
- Cartridge can be reclaimed by a T10000A or B drive.

For a native data cartridge or Sport cartridge written by a T10000B drive, the:

- RFID can be:
 - Read by a T10000A, B, C, or D drive.
 - Updated by a T10000B, C, or D drive.
- MIR can be read by a T10000B, C, or D drive.
- MIR cannot be updated by a T10000A, C, or D drive.
- T10000B, C, or D drive counters can be updated after appropriate firmware updates are installed.
- Cartridge can be reclaimed by a T10000A or B drive.

Note: When the T10000A or B drive identifies the data cartridge as an unreadable-density data format, it displays 3215 on the Virtual Operator Panel (VOP) or the physical operator panel of the rack mount drive.

For a native data cartridge or Sport cartridge written by a T10000C drive, the:

- RFID can be:
 - Read by a T10000A, B, C, or D drive.
 - Updated by a T10000C or D drive.
- MIR can be read by a T10000C or D drive.
- MIR cannot be updated by a T10000A or B drive.

- T10000C drive counters can be updated after appropriate firmware updates are installed.
- Cartridge can be reclaimed by a T10000C or D drive.

For a native data cartridge or Sport cartridge written by a T10000D drive, the:

- RFID can be:
 - Read by a T10000A, B, C, or D drive.
 - Updated by a T10000D drive.
- MIR can be read by a T10000D drive.
- MIR cannot be updated by a T10000A, B, or C drive.
- T10000D drive counters can be updated after appropriate firmware updates are installed.
- Cartridge can be reclaimed by a T10000D drive.

Invalid Media Information Conditions

There are four media invalid conditions for the T10000 drives:

- **Cartridge's RFID is unreadable.** The drive refuses to mount the cartridge (FSC of 403B). Return the cartridge to engineering to recover the customer data.
- **Cartridge's RFID can be partially read.** The drive mounts the cartridge as read-only.
- **RFID and MIR are out-of-sync.** None of the block information, coarse-grained in the RFID or fine-grained in the MIR, can be trusted. The cartridge is usable but the drive must rebuild the block information as it sequentially reads all of the data up to the desired customer data.

Note: This scenario can cause the drive to spend an hour or more rebuilding the block information, potentially causing the application running on the host to time out.

- **MIR is corrupted or unreadable.** The fine-grained block location information on the cartridge cannot be used; the tape can be used with the coarse-grained block information on the RFID but with lower performance.

The drive posts a 4031 or 4032 informational FSC whenever it loads a cartridge with an *invalid* MIR. When a tape cartridge has an invalid media information, some action is required to correct it. Invalid media information can be corrected in several ways:

- Run the media correction utility through the VOP (see "[To Rebuild the MIR \(VOP\)](#)" on page 3-14).
- The drive recovers the media information as it processes host commands, but very slowly.

Tape Drive Features

The following features are available for the T10000C and T10000D tape drives.

Some of the feature descriptions refer to white papers which are located at:

<http://www.oracle.com/technetwork/server-storage/sun-tape-storage/documentation/index.html>

StorageTek Data Integrity Validation

StorageTek Data Integrity Validation (DIV) ensures that a checksum, provided by an application or file system, is validated by the StorageTek T10000 for each record sent to the drive. The user-generated checksum is stored with each record on tape and can be checked on any future read or verify operation (without the added overhead of sending data to the host). Information about how to use this feature is available in:

- *StorageTek T10000 Tape Drive Fibre Channel Reference Manual*
- *Redefining Tape Usage with StorageTek Tape Tiering Accelerator and StorageTek In-Drive Reclaim Accelerator* (white paper)

The DIV feature is available for the FC tape drive and requires application support.

StorageTek Maximum Capacity

Maximum Capacity enables the use of tape capacity that is normally reserved to ensure tape-to-tape copy operations succeed. The *StorageTek T10000 Tape Drive Fibre Channel Interface Reference Manual* describes how to use this feature. This feature increases the capacity of the T10000C to as much as 5.5 TB or the T10000D to as much as 8.5 TB.

Maximum capacity is off by default (enabled through VOP), available on FC drives and VSM, and no application support is needed.

StorageTek File Sync Accelerator

The StorageTek File Sync Accelerator (FSA) enables applications to reduce or eliminate back hitches that are normally caused by writing a tape mark or other sync operations.

The FSA feature is on by default (disabled through VOP), available on FC and FICON drives, and no application support is needed.

Refer to the white paper *Maximizing Tape Performance with the StorageTek T10000 Tape Drives*.

StorageTek Tape Application Accelerator

The StorageTek Tape Application Accelerator (TAA) increases write throughput to tape despite an application inserting sync commands into the data stream. When TAA is enabled, the drive converts tape marks to buffered tape marks and syncs to NO-OPs. Data is written to tape faster because buffered tape marks and NO-OPs do not cause the tape drive to empty the contents of its buffer to tape and back hitch.

The TAA feature is off by default (enabled through VOP), available on FC and FICON drives, and no application support is needed.

Before enabling a TAA configuration, the user must determine how their particular application uses write tape marks and syncs. The terms File Sync and Write Tape Mark are defined differently in FICON and Fibre Channel environments.

- When TAA is enable in a FICON drive, File Syncs are always converted to NO-OPs and tape marks are always treated as buffered tape marks.

Note: This feature must only be used in environments that handle deferred errors. When this feature is enabled, sending a tape mark does not ensure the data has successfully been written to the tape. A deferred error may be reported when buffered data is written to tape after the command has completed. In a FICON *only* environment, duplex write operations should use this feature.

- TAA operation in open systems environments depends on whether the user's storage application automatically restarts a job following a power failure or reset condition.
 - For applications designed to restart a job following a failure event, Oracle highly recommends configuring TAA to convert File Syncs to NO-OPs but *without* treating tape marks as buffered tape marks.
 - For applications that are not designed to restart a job following a failure event, Oracle highly recommends duplexing output-type jobs to two tape drives.

Refer to the white paper *Maximizing Tape Performance with the StorageTek T10000 Tape Drives*.

StorageTek Search Accelerator

The StorageTek Search Accelerator (SSA) enables FICON applications to search for a string up to 1024 bytes in length. This feature usually enhances Mainframe HSM Audit performance in FICON environments.

The SSA feature is available on FC and FICON drives, and application support is required (an API is available).

Refer to the white paper *Using Oracle's StorageTek Search Accelerator*.

StorageTek MIR Assisted Search

The StorageTek T10000C and T10000D tape drives support access to the Media Information Region (MIR) of the cartridge. This command is implemented using a SCSI Read Buffer command similar to the StorageTek T10000B tape drive. MIR data provides location information for tape records and can be used by an application to order which records are read first from tape. The T10000 MAS N677 engineering document describes this feature.

The MAS feature is available for the FC tape drive, and application support is required.

StorageTek In-Drive Reclaim Accelerator

The StorageTek In-Drive Reclaim Accelerator (IDR) enables applications to reclaim space on the tape without rewriting the entire tape. The application must save and manage a partition map to get the full benefit of this feature. The StorageTek Virtual Storage Manager (VSM) supports this feature with the StorageTek T10000B, T10000C, and T10000D drives. For more detailed information about this feature, contact your local sales representative to obtain a copy of the *ALP User's Guide*.

The IDR feature is available on FC and FICON drives, and application support is required (an API is available).

StorageTek Tape Tiering Accelerator

The StorageTek T10000C and T10000D drives have the ability to partition tape. These partitions can be organized by an application to control where file sets are located on tape. Data sets located near the beginning of tape will have faster access characteristics than data written near the end-of-tape (EOT).

- Applications now have the ability to manage the location of data on the tape.
- StorageTek Tape Tiering Accelerator (TTA) enables partitions to be read only.
- TTA provides up to:
 - 480 logical volumes on a cartridge written by a T10000C drive
 - 600 logical volumes on a cartridge written by a T10000D drive

The TTA feature is available on FC and FICON drives, and application support is required (an API is available).

For more detailed information about this feature, contact your local sales representative to obtain a copy of the *ALP User's Guide*.

Rack Mount Controls and Indicators

This chapter provides information about the indicators and switches located on the rack mount drive.

Front Panel

The T10000 Tape Drive rack mount configuration chassis contains one or two drives. The chassis front panel (Figure 2-1) provides manual loading or unloading of tape cartridges into each drive through separate cartridge slots. The front panel also has a dual operator panel mounted between the cartridge slots. The upper portion is for drive A (left), and the lower portion is for drive B (right).

Figure 2-1 Rack Mount Chassis Front Panel

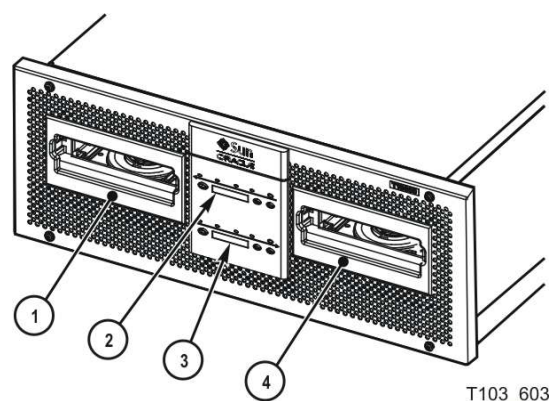


Illustration Legend:

- 1 - Cartridge slot drive A
- 2 - Operator panel drive A
- 3 - Operator panel drive B
- 4 - Cartridge slot drive B

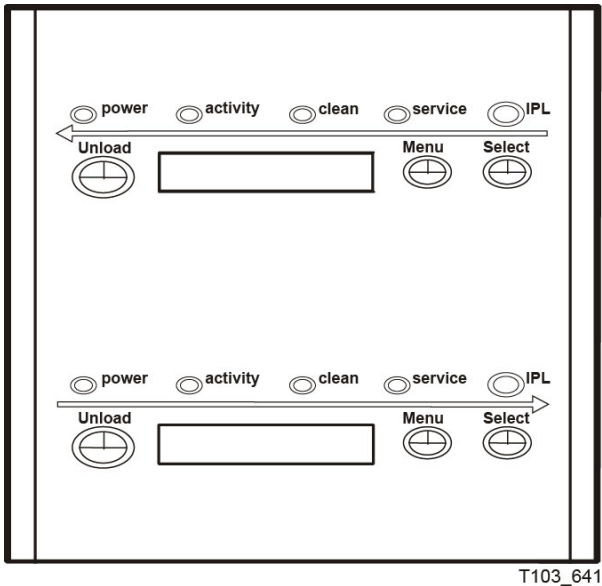
Load/Unload Slot

The cartridge slots accept only StorageTek T10000 or StorageTek T10000 T2 tape cartridges. All other cartridge types will not load into the T10000 tape drive. After you have inserted a tape cartridge, the loader mechanism lowers the cartridge onto the hub motor, and threads the tape.

Operator Panel Controls and Indicators

The rack mount chassis dual-operator panel (Figure 2-2) provides independent control and indications for the two rack mount T10000 tape drives. Each section contains four push-button micro-switches, four indicators, and a ten-character display window. Table 2-1 describes the controls, and Table 2-2 describes the indicator indicators.

Figure 2-2 Operator Panel



T103_641

Table 2-1 is a two column table that lists the four operator panel push button micro-switches and describes their use.

Table 2-1 Operator Panel Controls

Push Button	Use
Unload	Initiates a cartridge rewind and unload operation
Menu	Steps through a menu sequence or answers No to a display window option
Select	Answers Yes to an option appearing in the display window or toggles/increments a variable during a menu sequence
IPL (recessed)	Initiates an IPL

Table 2-2 lists the front-panel indicator states and recommended action. The table lists the four indicators (power, activity, clean, and service), the state of the indicator, the meaning of the indication, and any recommended action.

Table 2-2 Operator-panel Indicators

Indicator State	Meaning	Recommended Action
Power: Off	The drive is not powered.	Power on the drive.
Activity: Off		
Clean: Off		
Service: Off		

Table 2–2 (Cont.) Operator-panel Indicators

Indicator State	Meaning	Recommended Action
Power: Flashing Activity: Off Clean: Off Service: Off	Power on, IPL in progress.	Wait for the IPL to complete.
Power: Flashing steadily Activity: Off Clean: Off Service: Off	Power on IPL sequence failed.	Power cycle the drive. If the problem persists, contact authorized service personnel.
Power: On Activity: Off Clean: Off Service: Off	Power on, IPL complete but cartridge not loaded.	Load a cartridge as required.
Power: On Activity: On Clean: Off Service: Off	Power on, cartridge loaded (tape not moving).	Ready for read/write commands from the host software application.
Power: On Activity: Flashing Clean: Off Service: Off	Power on, cartridge loaded (tape moving).	None, locating or read/write operation in progress.
Power: On Activity: On/Off Clean: On Service: Off	The drive tape path needs cleaning (see "Tape Drive Cleaning" on page 3-7).	Insert a cleaning cartridge.
Power: On Activity: Flashing Clean: Flashing Service: Off	Cleaning cartridge loaded and moving.	Wait for the cleaning operation to complete.
Power: On Activity: On/Off Clean: Off Service: Flashing	An error has occurred and dump data is saved.	Read the display message. See Table D–1 for more information about the message.
Power: On Activity: Off Clean: Off Service: On (steady)	A drive hardware error has occurred.	Initiate an IPL. If the problem persists, contact authorized service personnel.

Operator Panel Display Window

The window displays alphanumeric messages relative to drive operation:

- Drive status

- Menu selections and configuration choices
- Error messages and fault symptom codes
- Host-generated messages

The display window is formed by a horizontal row of ten array segments. Each segment is an array of 35 dots—five wide and seven high. Each array can form an uppercase or lowercase alpha character, a numeral, or a special character (such as an asterisk [*]).

Multiple messages or a message greater than ten characters are displayed by the window, alternating between required character groups.

Note: [Appendix D](#) lists messages that could appear in the display window.

Rear Panel

[Figure 2-3](#) shows the rear of the rack mount chassis. One AC power connector and one AC switch supplies AC power to both drive power supplies, which are mounted internally, between the drives.

Figure 2-3 *Rack Mount Chassis Rear Panel*

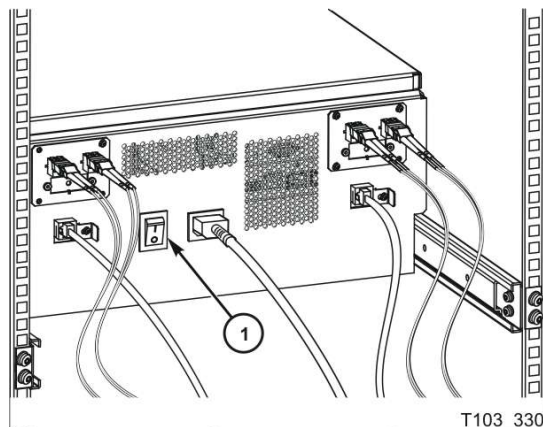


Illustration Legend:

1 - AC power switch

Note: The drive status indicator and encryption status indicator, for encryption-capable drives, are visible through the drive cooling grids (does not apply to the T10000D tape drive).

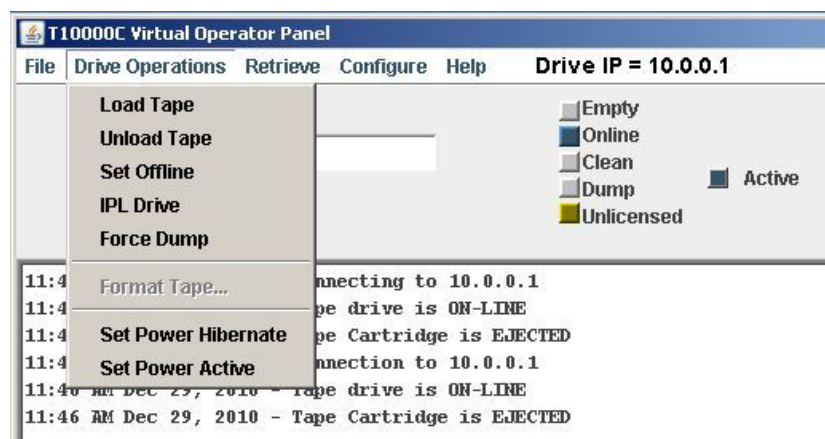
Operator Tasks

This chapter discusses operator tasks which fall into the following broad categories: basic tasks, menu system tasks, and Data Path Key Management (DPKM) settings.

Many tasks are performed by using the physical operator panel switches (see ["Operator Panel Controls and Indicators"](#) on page 2-2) and power switch of the rack-mounted T10000 tape drive while some involve using the drive menu system (see ["Menu System Overview"](#) on page 4-1).

You can choose to use the Virtual Operator Panel (VOP) instead of using the physical operator panel. Many of the drive and cartridge tasks are performed by using the VOP **Drive Operations** menu (see [Figure 3-1](#)) such as load or unload a tape, set the drive offline, IPL the drive, and force a dump. Hibernation controls are also available for the T10000C and T10000D tape drives. Refer to the VOP documentation for additional information regarding program installation, drive connections, and the VOP user interface.

Figure 3-1 Virtual Operator Panel Drive Operations Menu (T10000C Tape Drive)



For operator tasks relating to drives within a library, consult the operator guide for your specific library.

The scope of tasks documented depends on the functionality of the particular library. Library information might describe drive cleaning only or provide a broad range of tasks (for example using the drive operator panel, cleaning a drive, and manually mounting or dismounting a cartridge).

Basic Tasks

The basic tasks include:

- [Power-on Rack Mount Drives](#)
- [Power-off Rack Mount Drives](#)
- ["Write-Protect or Write-Enable a Cartridge" on page 3-3](#)
- ["Manually Load a Cartridge" on page 3-5](#)
- ["Manually Unload a Cartridge" on page 3-6](#)
- ["Tape Drive Cleaning" on page 3-7](#)
- ["Initial Program Load \(IPL\)" on page 3-8](#)

Power-on Rack Mount Drives

To apply power to the rack mount tray:

1. Verify connection of the rack mount tray to an AC power outlet or power strip.
2. Make sure that all interface cables are fully seated.
3. Set the power switch on the rear panel to on (I) [see [Figure 2-3, "Rack Mount Chassis Rear Panel"](#)].

Both drives power-on and start performing an initial program load (IPL).

Note: The power indicator flashes while the IPL is in progress. It is the left most operator panel indicator (see [Figure 2-2, "Operator Panel"](#)). Various messages relative to the IPL sequence appear in the operator panel display window. These messages do not require operator action.

The drive successfully completes an IPL when:

- The drive power indicator is steady.
- An asterisk (*) appears in the operator panel display window.

Power-off Rack Mount Drives

Note: The drive tray switch removes power from both tape drives in a dual-drive rack mount drive tray.

To remove power from the rack mount tray:

1. Make sure there is not a job or application running on the host that is using the tape drive(s). If there is, stop that job or application.
2. Make sure a cartridge is not loaded in the tape drive(s).
3. Set the rear panel power switch to off (O), see [Figure 2-3](#), if needed.

Cartridge Procedures

This section provides instructions for performing tasks related to the tape cartridge.

- Write-Protect or Write-Enable a Cartridge
- "Cartridge Handling Precautions" on page 3-4
- "To Identify a Defective Cartridge" on page 3-4
- "Manually Load a Cartridge" on page 3-5
- "Manually Unload a Cartridge" on page 3-6
- "Tape Drive Cleaning" on page 3-7

Write-Protect or Write-Enable a Cartridge

1. Locate the write-protect switch beside the cartridge door.
2. Move the write-protect switch to the desired setting.

The symbols (see [Figure 3-2](#)) indicate the following status:

Locked—(lock image shown closed) Write-protected.

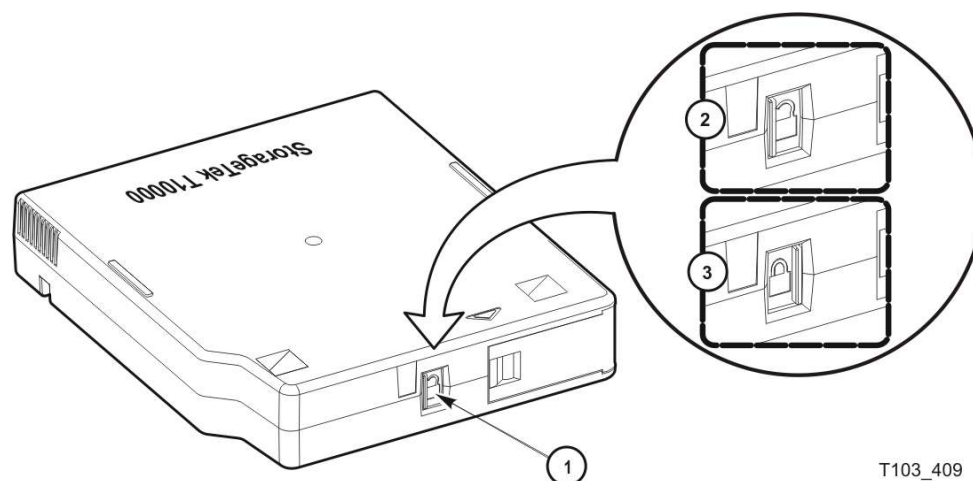
The switch is to the right (toward the cartridge door) when the cartridge is positioned with the hub down and the label edge away from you.

Note: The tape drive can read data from the data cartridge. Write operation attempts will fail.

Unlocked—(lock image shown open) Write-enabled (unprotected).

The switch is to the left (away from the cartridge door). The tape drive can read data from or write data to the data cartridge.

Figure 3-2 Data Cartridge Write Protect/Enable Switch



T103_409

Illustration Legend:

- 1 - Write-protect switch
- 2 - Unlocked position
- 3 - Locked position

Cartridge Handling Precautions

Caution: Be certain that a data cartridge never comes close to strong electrical fields or any form of magnet or magnetic field.

- Avoid electrical or magnetic fields.

Magnetic fields are present near disk drives and electric motors. As the size of the electric motor increases, the magnetic field usually strengthens. Items containing buzzers of any form produce alternating current electrical fields strong enough to partly erase a magnetic tape.

Caution: You must keep cartridges dry to prevent media damage.

- Keep cartridges dry.

Never store cartridges on a floor where moisture might be present or near air conditioners or air handlers.

Air conditioners might leak water as a function of cooling the air, and air handlers might be adding moisture to the air as a function of controlling the environment in a computer room.

Caution: Do not drop or handle cartridges roughly.

- Avoid dropping or handling cartridges roughly.

There is a hub locking mechanism within the T10000 data cartridge, but it has limitations on just how much braking it provides. Rough handling of a data cartridge could cause the locking mechanism or brake to slip, resulting in a loose tape. Loose tapes are easily damaged by a tape drive.

To Identify a Defective Cartridge

Look for cartridge problems before you load a cartridge into a drive or library:

- Cracked or broken case (including the access door)
- Dirty case
- Missing, broken, or cracked leader (open the tape access door, see [Figure A-2](#))

Note: Your service representative can usually replace a broken leader.

- Damaged write-protect switch
- Liquid in the data cartridge case
- Loose label
- Other obvious damage

Also see "[Dropped Cartridges](#)" on page A-3 for additional information.

Manually Load a Cartridge

Manual loading is commonly done on rack mounted drives. For a library failure, you might have to manually load a data cartridge.

A T10000C drive automatically hibernates to save power after a period of inactivity. When hibernating, the drive cannot detect the presence of a cartridge. The library monitors whether a drive is hibernating and commands the drive to wake up whenever a mount is forthcoming.

Hibernation poses a problem when a user opens the library door and attempts to manually mount a cartridge.

Note: With some library code levels (for example SL8500 FRS_6.02 and SL3000 FRS_2.81), hibernating drives remain in the hibernation state and will neither detect nor load a manually inserted cartridge. Always strive to use the most current library code version.

To force the drive out of hibernation, you can either power cycle the drive or use VOP.

The drive remains awake until after a mount or dismount sequence, but resumes its auto-hibernation behavior after the cartridge has been extracted.

To Load a Cartridge

Note: A T10000 tape drive accepts T10000 cartridges only.

To load a cartridge into a T10000 tape drive, do the following:

1. Look into the drive cartridge slot to make sure there are no obstructions.
2. Make sure the cartridge is not defective (see ["To Identify a Defective Cartridge"](#) on page 3-4).
3. Make sure the cartridge write-protect switch is in the proper position.

Note: For any cartridge on which data is to be written, set the write-protect switch to the unlocked position (see [Figure 3-2](#)).

4. Hold the cartridge by the finger grips ([Figure 1-8, "T10000 Cartridge"](#)) with the hub side down, and carefully insert the cartridge into the tape drive loading slot.
5. Push the cartridge all the way into the slot.

Push on the label edge of the cartridge because there is not enough room for your fingers (finger grip recessions do not exist on the bezel of a library drive). You must overcome some resistance to fully seat the cartridge.

When you fully seat the cartridge, the data cartridge lowers onto the file reel motor hub assembly.

Note: When manually loading a library-attached drive, make sure the library hold-off signal to the drive is disabled. Otherwise, the drive will not accept a manual load.

6. When a cartridge loads, observe that the rack mounted operator panel display window indicates one of the following:

Ready A when the tape is ready and is a VolSafe cartridge.

Ready F when the tape is ready and file protected.

Ready H when a higher density, non-VolSafe cartridge is ready and *not* file-protected in a lower density tape drive.

Ready L when a lower density, non-VolSafe cartridge is ready and *not* file-protected in a higher density tape drive.

Ready U when the tape is ready and *not* file protected.

Note: See ["To Unload a Cartridge"](#) if a cartridge fails to load.

Manually Unload a Cartridge

Manual unloading is commonly done on rack mounted drives. For a library failure, you might have to manually unload a data cartridge.

To Unload a Cartridge

Note: A T10000 tape drive does not eject the cartridge from the tape drive as is commonly done by other cartridge tape drives.

Use the following procedure to remove a cartridge from the drive.

1. Make sure the tape drive is not in use.

This is done by checking the following:

- a. There are no active jobs, applications, or programs using this drive.
- b. The rack mount operator panel activity indicator is steady and *not* flashing.
- c. The display window (VOP or operator panel) does not indicate any activity relative to tape movement (such as reading, writing, or locating).

Caution: *Possible data loss:* Do not push the **Unload** button while a data cartridge is in use.

2. Unload the tape drive.

Rack mounted tape drive:

- Press the operator panel **Unload** button and wait for the drive to raise the cartridge to the unload position.

The display should show an asterisk (*) when the operation is complete.

Note: If the drive is offline, the asterisk alternates with *Offline*.

VOP unload:

- Select **Unload Tape** from the Drive Operations menu or use the Shift+U keyboard shortcut.

Caution: Do not forcibly remove a cartridge.

3. Remove the cartridge.

Any resistance to removing the cartridge, beyond the usual friction between the cartridge case and the drive, might indicate that the cartridge leader is not fully rewound. See ["Cartridge Leader Not Fully Rewound"](#) for instructions.

Rack mount drives:

- Use the finger grips on the cartridge (see [Figure 1-8](#)) and carefully withdraw the cartridge from the drive slot.

Library-attached drives:

- Grasp the top and bottom of the cartridge with your finger tips and carefully withdraw the cartridge from the drive slot.

Cartridge Leader Not Fully Rewound

If you believe the cartridge leader is not fully rewound:

1. Use the operator panel (rack-mount drives only), VOP, or library software (if it supports that function) to attempt another load operation.
2. If the cartridge loads properly, perform an unload operation.

When the unload completes, the cartridge unloads.

Should the operation fail to correct the situation, contact your service representative about a possible stuck cartridge.

Tape Drive Cleaning

Caution: *Equipment damage:* Do not wet-clean the tape drive. Do not clean the tape drive unless the Clean indicator lights.

The tape drive **Clean** indicator lights after the drive either transports a predetermined length of tape or records a predetermined number of errors. The tape-to-head contact values are: T10000A tape drive = 1,000,000 meters, T10000B tape drive = 300,000 meters, T10000C tape drive = 10,000,000 meters, and T10000D tape drive = 10,000,000 meters.

You should use a cleaning cartridge to clean the tape drive when the **Clean** indicator is lit.

Note: You can use the cleaning cartridge approximately 50 times before discarding it (see ["Cleaning Cartridges"](#) on page 1-13).

To Clean the T10000 Tape Drive

1. Make sure the tape drive is not in use.

Note: If there is a tape loaded in the tape drive, make sure the application or job that was using that tape drive is no longer running before proceeding.

2. Unload any data cartridge in the tape drive. See ["To Unload a Cartridge"](#) on page 3-6 if a data cartridge is loaded in the tape drive.
3. Insert a cleaning cartridge in the tape drive.
 - After the cartridge loads, the activity light flashes.
 - The activity and clean indicators turn off when cleaning is completed, and the tape drive unloads the cleaning cartridge.

The cleaning cartridge has been used to its maximum number of cleaning cycles, if the tape drive immediately ejects the cleaning cartridge and the message Exp C1Cart appears in the tape drive's front panel display screen (a similar message is displayed on the VOP if that program is being used to monitor the tape drive).

Note: Discard the expired cleaning cartridge and insert a new cleaning cartridge into the tape drive.

A cleaning cartridge failure occurred, if the message CHK xxxx appears in the tape drive's front panel (xxxx is the FSC).

Tip: Try the procedure again with a different cleaning cartridge. If the problem persists, contact your service representative.

Caution: *Tape damage:* Do not forcibly remove a tape cleaning cartridge.

4. Remove the cleaning cartridge from the tape drive.

Note: Any resistance to removing the tape cleaning cartridge, beyond the usual friction between the cleaning cartridge case and the tape drive, probably indicates that the cartridge leader is not fully rewound (see ["Manually Unload a Cartridge"](#) on page 3-6).

This completes the cleaning process and the tape drive is ready to resume normal operations.

Initial Program Load (IPL)

To recover from certain errors, you will perform a forced IPL. When the IPL starts, the following things happen:

- The drive power indicator flashes.
- Various IPL sequence messages appear in the operator panel display window. These messages require no action on your part.

After the drive successfully completes an IPL:

- The drive power indicator is steady.
- An asterisk (*) appears in the operator panel display window.

Note: If there is a dump present, the operator panel display window alternates between the asterisk and the dump message. The dump present indication stops when you load a tape cartridge.

Use a physical switch on the operator panel or a menu command in the VOP to initiate the drive IPL.

To Start an IPL of the Drive from the Operator Panel

Note: The rack mount drive must be powered-on.

1. Make sure there is not a job or application running on the host that is using this tape drive. If there is, stop that job or application.
2. Make sure a data cartridge is *not* loaded.
3. Press the operator panel **IPL** button (see [Figure 2-2, "Operator Panel"](#)).

To Start an IPL of the Drive Using VOP

To IPL the drive using the VOP program (see [Figure 1-5](#)):

1. Make sure there is not a job or application running on the host that is using this tape drive. If there is, stop that job or application.
2. Make sure a data cartridge is *not* loaded.
3. Make sure the drive is *offline* (click **Online**, if the drive is not offline).

The **Online** button turns gray to indicate that the drive is offline.

Note: You can set the drive offline by selecting **Set Offline** from the **Drive Operations** menu.

4. Select **IPL** from the **Drive Operations** menu to start the IPL process.

Menu System Tasks

You can perform the following tasks from the menu system:

- Place the drive online
- View the drive configuration settings
- Place the drive offline
- Rebuild the MIR
- Change the drive configuration settings

To Place the Drive Online (Operator Panel)

Note: In an open systems, multiple-host setting using a switch unit that has a port blocked to this tape drive, unblock that port before proceeding.

To change the tape drive state from offline to online:

1. Press the operator panel **Menu** button until *Offline* appears in the display window.

Note: If you are within a submenu, press the **Menu** button until *Exit* appears in the display window and press the **Select** button to enter the main menu.

2. Press the operator panel **Select** button to toggle the drive state.
Online appears in the display window, indicating the drive state is now online.
3. Press the **Menu** button until *Exit Menu?* appears in the display window.
4. Press the **Select** button to exit the menu system.
5. Bring the tape drive back online to the host by using one of the following methods:
 - **Enterprise:** Set the tape drive online for all host paths to the tape drive by using the appropriate command:

MVS: *V <address> online*
VM: *Vary on, <address>*
 - **Open Systems:** if there is a switch unit installed and the port to this tape drive is blocked, unblock that port.

To Place the Drive Online (VOP)

Note: In an open systems, multiple-host setting using a switch unit that has a port blocked to this tape drive, unblock that port before proceeding.

On the VOP screen, there are two methods to place the drive offline:

Use the menu bar:

1. Open the **Drive Operations** menu (click **Drive Operations** in the menu bar or use the Alt+d keyboard shortcut).
2. Select the **Set Online** command or use the Shift+o keyboard shortcut.

The second drive status indicator/button changes to blue when the tape drive is online.

Use the status indicator:

If the tape drive is offline, the button next to the label *Online* is gray.

- Click the button to change the state to *Online*.

The button color changes to *blue* when the tape drive is online.

To View the Configuration (Operator Panel)

Note: See [Chapter 4, "Menu System"](#) for complete information and guidelines.

1. Press the operator panel **Menu** button to enter the menu system:
 - If **Online** appears in the tape drive's front panel display, go to Step 2.
 - If **Offline** appears, press the **Select** button to toggle the drive state (see "[To Place the Drive Online \(Operator Panel\)](#)" on page 3-10).

Note: It is important that you view configuration settings in the online state, because you cannot accidentally change settings in this drive state. To change settings, you must first set the drive to the offline state (see "[To Place the Drive Offline \(Operator Panel\)](#)" on page 3-12).

2. Press the **Menu** button until **View CFG ?** appears in the window display.
3. Press the operator panel **Select** button (Yes) to enter view configuration submenus.
The first configuration setting appears in the operator panel display window.
4. Press either the **Menu** or the **Select** button to step through the configuration settings.

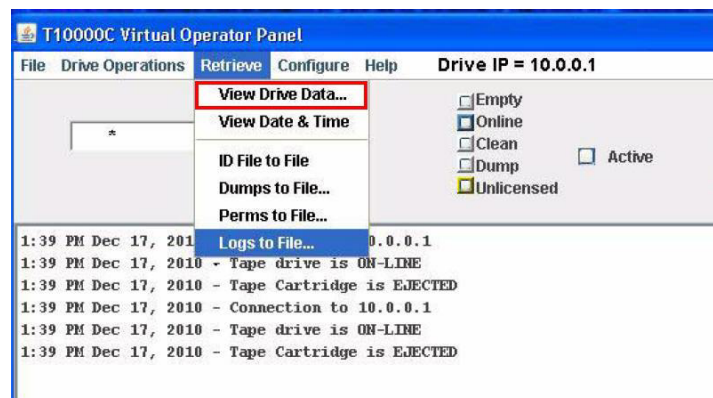
Note: In the drive online state, the **Select** button has the same function as the **Menu** button, unless you are answering a displayed question.

5. Press either the **Menu** or **Select** button until **Exit CFG ?** appears in the display window.
6. Press the **Select** button (Yes) to exit the configuration submenus, or press the **Menu** button (No) to repeat the view configuration sequence.
7. Press the **Menu** button until **Exit Menu?** appears in the display window.
8. Press either the **Select** button (Yes) to exit the menu system or the **Menu** button (No) to return to the online/offline selection menu.

To View the Configuration (VOP)

Note: The drive must be in the online state.

1. Select **Retrieve** from the menu bar or use the Alt+r keyboard shortcut to open the menu.
2. Select **View Drive Data** or use the Shift+v keyboard shortcut to access the View Current Drive Settings dialog box.

Figure 3–3 VOP Retrieve Menu Commands

A new dialog box containing several tabs (such as: **Encrypt**, **Fibre**, **Keyid**, **Manufacturing**, **Missing**, **Network**, **Rfid**, and **Version**) appears.

Note: See the VOP documentation for complete information and instructions.

To Place the Drive Offline (Operator Panel)

1. Stop all I/O activity from the host.

In mainframe environments, set the tape drive offline for all host paths to the tape drive by using one of the following Vary commands:

- MVS: V <address> offline
- VM: Vary off, <address>

In open systems environments, do one of the following:

- Stop the job that is using the tape drive.
- In a multi-host setting, stop any job that is using the tape drive and then, if there is a switch unit in use, block the port in that switch to the tape drive.

2. Press the operator panel **Menu** button.

Online appears in the display window, indicating the current state of the drive.

3. Press the operator panel **Select** button to toggle the drive state.

Offline appears in the display window, indicating a successful transition to the offline state.

4. Press the **Menu** button until Exit Menu? appears in the display window.
5. Press the **Select** button to exit the menu system.

Note: If you select Exit Menu?, the display alternates between **Offline** and the normal message after a cartridge is loaded as a reminder that the drive is still in the offline state.

To Place the Tape Drive Offline (VOP)

1. Cease all I/O activity from the host.

In mainframe environments, set the tape drive offline for all host paths to the tape drive by using one of the following Vary commands:

- MVS: V <address> offline
- VM: Vary off, <address>

In open systems environments, do one of the following:

- Stop the job that is using that tape drive.
- In a multi-host setting, stop any job that is using the tape drive and then, if there is a switch unit in use, block the port in that switch to the tape drive.

2. Click **Online**.

If the tape drive is online, the button is *blue*. You click the blue button to change it to *gray*, indicating that the tape drive is offline.

Note: You can also set the drive offline by selecting **Set Offline** from the **Drive Operations** menu.

Rebuilding the MIR

This section discusses the rebuilding of the MIR. This is an abnormal situation as the tape drive automatically builds and changes the MIR as the tape is used. The rebuild process is only used when the MIR on a tape becomes damaged or corrupted.

Note: This can be a lengthy process, especially on a fully written cartridge. Rebuilding the MIR for a full data cartridge could take 90 minutes (T10000A formatted cartridge) or longer.

To Rebuild the MIR (Operator Panel)

Note: Make sure the write protect switch on the data cartridge is set to the *unlocked* position.

This process rebuilds an MIR from the rack mount drive tray operator panel.

1. Set the drive to the offline state.
See "[To Place the Drive Offline \(Operator Panel\)](#)" on page 3-12 as needed.
2. Press the **Menu** button until Drv Menu? appears in the display window.
3. Press the **Select** button (Yes) once.

The display window now shows the beginning of drive utilities submenus.

4. Press the **Menu** button until Build MIR appears.
5. Press the **Select** button to begin the MIR rebuilding process.

Ld Cust Tp appears in the display window.

Note: The drive unloads any loaded cartridge. Remove the cartridge.

6. Insert a write-enabled cartridge with a defective MIR.

See ["To Load a Cartridge"](#) on page 3-5 as needed.

When the rebuild completes, the cartridge is unloaded.

Note: See ["Cartridge Leader Does Not Rewind"](#) on page 3-14 if the cartridge does not unload

Caution: *Tape damage:* Any resistance to removing the cartridge, beyond the usual friction between the data cartridge case and the tape drive, probably indicates that the leader is not fully rewound. **Do not forcibly remove a cartridge.**

7. Remove the cartridge from the drive.

If there are other cartridges for MIR rebuilding, for each cartridge repeat Step 6 and Step 7.

When you have rebuilt all cartridges with defective MIRs, continue with the next step.

8. Press the **Menu** button once.

Exit Drv? appears in the display window.

9. Press the **Select** button (Yes) to exit the drive utilities submenus, or press the **Menu** button (No) to repeat the utilities submenu sequence.

10. Return the drive to an online state

See ["To Place the Drive Online \(Operator Panel\)"](#) on page 3-10 as needed.

Cartridge Leader Does Not Rewind

If you believe the cartridge leader is not fully rewound:

1. Attempt another load operation by pushing the cartridge back into the tape drive.
2. If it loads properly, use the tape operator panel **Unload** button to attempt an unload operation.
3. Grasp the cartridge and remove it from the drive.

Do not forcibly remove a cartridge.

Should the operation fail to correct the situation, contact your service representative about a possible stuck cartridge.

To Rebuild the MIR (VOP)

1. Make sure the tape drive is in the offline state.

If the display shows Online, click **Drive Operations** and select **Set Offline**. This sets the tape drive to the Offline state.

2. Select **Format Tape** from the **Drive Operations** menu.
3. Select **Rebuild MIR** in the dialog box.

Tip: You can stop this function before you load a cartridge by clicking **Abort** in the Format Tape dialog box.

4. Follow the on-screen prompts and directions.

After a successful MIR rebuild, the cartridge automatically unloads.

See "[MIR Rebuild Fails \(VOP\)](#)" on page 3-15 if the MIR rebuild does not complete successfully.

Caution: *Tape damage:* Any resistance to removing the data cartridge, beyond the usual friction between the data cartridge case and the tape drive, might indicate that the leader is not fully rewound (see "[Cartridge Leader Does Not Rewind](#)" on page 3-14).

5. Remove the cartridge from the drive.

If more than one tape has a defective MIR, load the next cartridge into the tape drive when the VOP screen displays the prompt to load a customer cartridge. Repeat Step 4 and Step 5 until all defective MIRs have been rebuilt.

6. Click **Done** on the format selection dialog box after you have repaired all cartridges with defective MIRs.
7. Click **Drive Operations** and select **Set Online**.

This completes the rebuild of the MIR on one or more cartridges. The tape drive is now back online and ready for normal operations.

MIR Rebuild Fails (VOP)

If the MIR rebuild fails:

- The message part of the VOP screen contains a failure message and an FSC.
- The tape drive does *not* automatically eject the cartridge.

To unload the cartridge:

1. Click **Drive Operations** and select **Unload Tape**.

The cartridge unloads.

2. Remove the cartridge from the drive.
3. Attempt another rebuild of the MIR.

If the rebuild operation fails again, the MIR part of the tape in that cartridge is defective. Manually unload the cartridge following the first two steps of this procedure.

Change the Drive Configuration

Note: The drive must be offline to change most configuration parameter values and typically requires an IPL to invoke a change.

You can change drive configuration parameter values using the drive menu system or the **Configure** menu of VOP. Note that some configuration parameters must be changed with VOP as there is not an equivalent menu item.

Note: VOP is the preferred tool for viewing and changing drive configuration parameters. Make every effort to use VOP instead of the physical operator panel on the rack mount chassis.

Data Path Key Management Procedures

You must use VOP to perform the data path key management (DPKM) procedures.

To View Current Drive Settings - Encrypt Tab (DPKM)

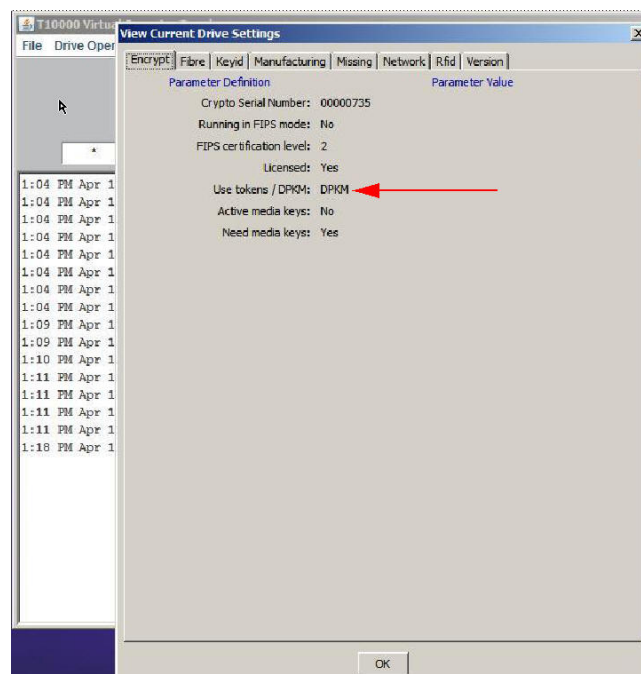
To view the current drive encryption settings:

1. Select **View Drive Data** from the **Retrieve** menu, and click the **Encrypt** tab.

Note: The **Use tokens/DPKM** parameter value is DPKM as identified by the arrow in the following illustration.

2. Click **OK** to return to the main VOP window.

Figure 3–4 VOP Drive Data Encrypt Tab



To Turn DPKM On

1. Set the drive offline.
2. Select **Drive Data** from the **Configure** menu.
3. Select **Encrypt** from the Configure Drive Parameters dialog box.
4. Select **DPKM** for the *Use tokens/DPKM* parameter.

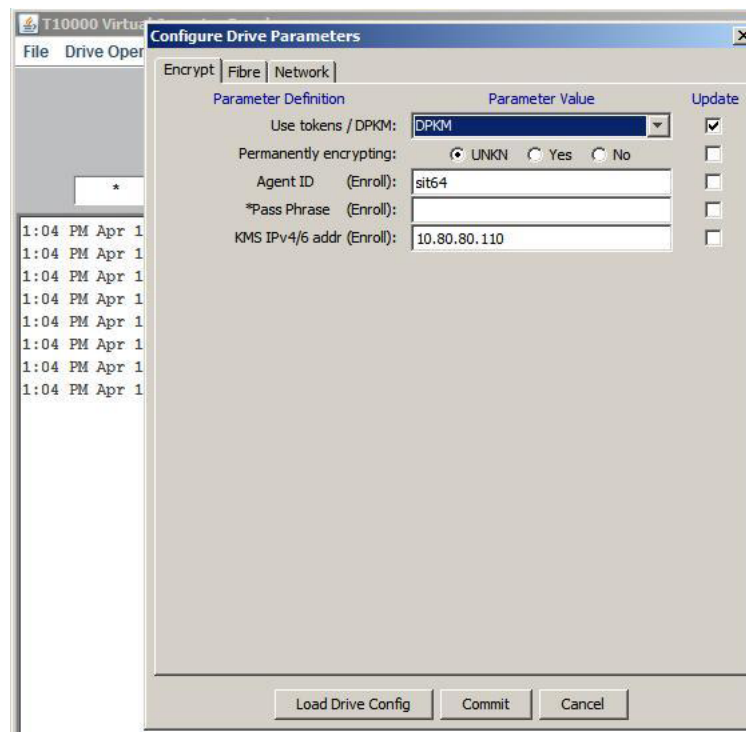
Note: A check mark appears in the Update box adjacent to the parameter.

5. Click **Commit** at the bottom of the dialog box.

Note: The drive performs an initial program load (IPL).

See "Data Path Key Management" on page 1-9 for additional information.

Figure 3–5 Turn DPKM On



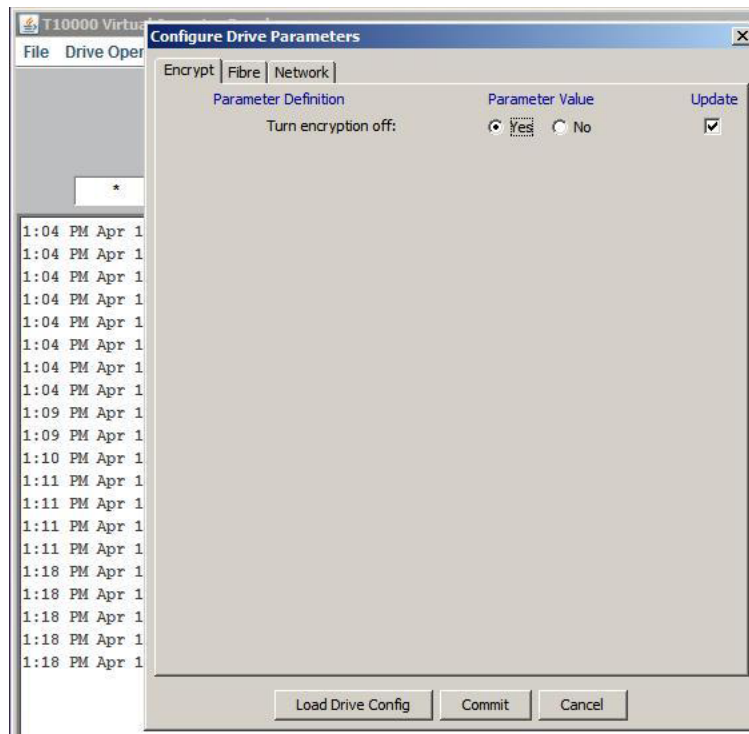
To Turn DPKM Off

1. Set the drive offline.
2. Select **Drive Data** from the **Configure** menu.
3. Select **Encrypt** from the Configure Drive Parameters dialog box.
4. Select the **Yes** option for the *Turn encryption off* parameter.

Note: A check mark appears in the Update box adjacent to the parameter.

5. Click **Commit** at the bottom of the dialog box.

Note: The drive performs an initial program load (IPL).

Figure 3–6 Turn DPKM Off

Menu System

This chapter provides information for using the T10000 menu system as accessed from the physical operator panel of a rack mount drive. The T10000 tape drive menu system provides the means to determine the drive configuration settings and access the drive utilities.

Menu System Overview

The rack mount drive chassis has a physical operator panel on the front panel (see [Figure 2-2](#)) that enables direct access to the menu system. On library-attached drives, the primary means of accessing the menu system is through the drive's Ethernet maintenance port and the use of the virtual operator panel (VOP) application. The rack mount drive tray also has an Ethernet maintenance port for each drive.

Note: VOP is the preferred tool for viewing and changing drive configuration parameters. Make every effort to use VOP instead of the physical operator panel on the rack mount drive to view or change configuration parameters.

The menu system information is described in the following order:

1. ["Menu Structure Overview"](#) on page 4-2
2. ["Menu Operations"](#) on page 4-2
3. ["Online or Offline Menu"](#) on page 4-3
4. ["View or Change Configuration Settings"](#) on page 4-3
5. ["View or Change TCP/IP Settings"](#) on page 4-16
6. ["Drive Operations Menu"](#) on page 4-21
7. ["Firmware Release Level Menu"](#) on page 4-24
8. ["Exit Menu"](#) on page 4-24

The information describes the menu system as seen from the physical operator panel.

Note: Although the VOP GUI representation is visually very different from the operator panel view, the information in this chapter is supplementary to the VOP documentation.

Menu Structure Overview

The menu structure consists of six categories. When you press the **Menu** switch on the operator panel, the first menu provides selection of Online (default) or Offline menus. The current drive state appears in the operator panel display window.

- Press the **Select** switch to toggle the mode, as desired.
- Press the **Menu** switch to advance to the next menu (drive configuration settings).

View or Change Configuration menus display drive configuration settings when the drive is online and allow configuration changes when the drive is offline.

- Press **Select** to enter the drive configuration submenus.
- Press **Menu** to advance the display to the next menu (TCP/IP Configuration).

View or Change TCP Configuration menus display the drive Transmission Control Protocol /Internet Protocol (TCP/IP) configuration settings when online and allow changes to IP addresses or selection of DHCP when offline.

- Press **Select** to enter the TCP/IP configuration submenus.
- Press **Menu** to advance the display to the next menu (Drive Operations).

Drive Operations menus (offline only) provide drive utilities (IPL from tape, make a dump tape, make a code tape, make a data tape, or rebuild the MIR).

- Press **Select** to enter the drive operations submenus.
- Press **Menu** to advance the display to the next menu (Drive Firmware).

The **Drive Firmware** menu displays the current drive firmware release level.

- Release level format is Rx.yy.zzzc where:
 - x =major revision level
 - y =minor revision level
 - z =integration number
 - c =channel interface type (f=Fibre Channel, e=FICON 3490 image, and m=FICON 3592 image)

The **Exit** menu provides the choice to either return to the Online/Offline selection menu by pressing **Menu** or to exit the menu system by pressing **Select**.

Note: If you exit the menu system with the drive offline, the Operator Panel alternately flashes *Offline* (if a data cartridge has been loaded at least once) as a reminder that drive status is still offline. This reminder flashes until the drive is either placed back online or powered-off.

Menu Operations

Menu operations for online (view) mode and offline (change) mode are very similar. In both menu systems:

- Press **Menu** to advance or to answer No when the menu prompt is a question
- Press **Select** to scroll options or to answer Yes when the menu prompt is a question

To enter variable characters or digits:

1. Press **Select** to start the change mode.

The left-most segment of the ten-character display begins to flash.

2. Press the **Select** switch repeatedly until the segment shows the desired value.

Note: When you press the **Select** switch, the value increments one step.

3. Press **Menu** to set the value and advance the flashing display to the next variable character or digit.
4. After you have set the last variable character or digit, either press **Menu** to accept the displayed entry and advance to the next menu or press **Select** to restart the change mode.

Online or Offline Menu

When the drive is in the online state, you can view the current drive configuration settings. If you want to change any settings, you must place the drive offline.

Defaults to Online at power-on.

You must select Offline to change a configuration setting.

OffLn Pend might appear while waiting for a system response or diagnostics completion.

Procedure:

1. Press **Menu** repeatedly until Online or Offline appears, if required.
2. Press **Select** to change modes.
3. Press **Menu** to advance to the next main menu option.

View or Change Configuration Settings

You can view the current configuration settings when the drive is online and view or change configuration settings when the drive is offline.

The operator panel window shows either View CFG ? (**online**) or Chng CFG ? (offline).

This is the entry point to the configuration submenus.

Procedure:

- Press **Menu** (No) to bypass or press **Select** (Yes) to enter the submenus.

Note: If bypassed, the display advances to the **View or Change TCP/IP Configuration** menu.

Interface Selection Submenu

Menu options are:

- Intf FCP which enables the drive interface to run FCP protocol.
- Intf FCoE which enable the drive interface to run Fibre Channel over Ethernet protocol (T10000D only).

- `Intf FICON` which enables the drive interface to run FICON protocol.

Defaults to the last saved selection.

In the online (view) mode, the current interface selection appears. You must switch to the offline (change) mode to toggle the selection.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to bypass.
 - Press **Select** (offline) until desired option appears; then, press **Menu** to set and initiate an IPL to load the desired firmware modules.

Note: Manufacturing ships drive FRUs with the `Intf FCP` option selected. When a defective drive in a FICON interface is replaced, you must change the selection to `Intf FICON`. After IPL is complete, the menu system displays the appropriate FICON related items.

Port A Attributes Menu

The operator panel window shows either `View PrtA ?` (online) or `Cfg PrtA ?` (offline).

Procedure:

- Press **Menu** (No) to bypass or press **Select** (Yes) to enter submenus.

View or configure port attributes as defined in the following submenus.

Port A/B 24-Bit Address Identifier Submenu

The submenu is present when the drive is in the online state.

- `A=xyyzzan` or `B=xyyzzan` 24-bit (6 hexadecimal characters) port identifier at interface log on, plus connection type and speed.
 - `xx` = domain (00 in private loop or point-to-point)
 - `yy` = area (00 in private loop or point-to-point)
 - `zz` = 00 - EF (per connection type)
 - `a` = connection type (**f**: fabric, **n**: point-to-point, **0**: public loop, **v**: private loop)
 - `n` = connection speed (varies by tape drive model)

- `A=.....` or `B=.....` appears when the port is not logged onto an interface

Procedure:

- Press **Menu** or **Select** to advance to the next submenu.

Port A/B SFP Module Parameter Submenu

Shows the Small Form-factor Pluggable (SFP) module information.

Note: Display is information only and appears in both online and offline menus.

- Operator panel window shows: `nnGMM0nnnm`, `nnGSRnnnm`, or `nnGSMnn.nk`.

Appears when an SFP module is present and readable:

mmG = max. Gigabit speed
MM - Multimode (short wave)
SR - Multimode FCoE (short range)
SM - Single Mode (long wave)
mmmm = maximum distance, meters (m) (short wave)
mm.nk = maximum distance, kilometers (k) (long wave)

- ?G ?? appears when an SFP module is present but unreadable.
- No SFP appears when an SFP module is not present in the port.

Procedure:

- Press **Menu** or **Select** to advance to the next submenu.

Port A/B Physical Addressing Submenu

The operator panel window shows either Hard PA N or Hard PA Y.

Note: Manufacturing ships drives with the Hard PA N option selected.

Defaults to the last saved selection.

Hard PA N disables hard physical address (PA) and causes the drive to seek a soft PA assignment at loop initialization.

Hard PA Y enables a hard PA, manually set by the Hard Physical Address Submenu. If the preset hard PA is not available at loop initialization, the drive then seeks a soft PA.

Procedure:

- Press **Menu** (No) to bypass or press **Select** (Yes) to enter submenus.

Port A/B Hard Physical Address Submenu

Appears only with Hard PA Y.

Note: The SL3000 and SL8500 libraries do not support AL_PA addressing.

Defaults to the last saved selection.

The operator panel window shows PA=xx,ddd.

- xx (hexadecimal) is the Arbitrated Loop Physical Address (AL_PA).
- ddd is the decimal index into the ALPA table.

As you manually change the decimal index digits (valid indexes are 125 [highest priority] through 000 [lowest priority]), the PA xx display automatically changes.

Procedure:

1. Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to start the change mode.
2. Press **Select** to increment the digit until the desired value appears, then press **Menu** to set.

3. Repeat step 2 for each digit.
4. Press **Menu** to advance to the next submenu or press **Select** to restart the change mode.

Port A/B Soft Physical Addressing Submenu

Appears only with Hard PA N.

Defaults to the last saved selection.

Note: Manufacturing ships drives with Soft PA LO option selected. The Solaris default FCP-driver behavior requires a setting of Soft PA LO.

The operator panel window shows:

Soft PA HI the drive seeks a soft PA in an ascending order at loop initialization.

Soft PA LO the drive seeks a soft PA in a descending order at loop initialization.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then, press **Menu** to set and advance to the next submenu.

Interface Speed Rate Submenu

Selects interface speed rate.

Note: Manufacturing ships drives with the Rate Auto option selected.

Speed is determined by the network (Rate Auto) or by selecting a fixed rate (varies by drive model number).

Note: When you select a fixed speed rate, the drive operates at the selected rate only. If the network is fixed at a different rate, the drive does not log on.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** until desired option appears; then, press **Menu** to set and advance to the next submenu.

Rate Auto

Rate 16Gb (T10000D only)

Rate 10Gb (T10000D FCoE only)

Rate 8Gb (T10000D only)

Rate 4Gb

Rate 2Gb
Rate 1Gb

Port A/B Maximum Data Frame Size Submenu

The operator panel window shows either `MaxSz 2112` or `MaxSz 2048`.

Selects the maximum frame size.

Note: Manufacturing ships drives with the `MaxSz 2112` option selected.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then, press **Menu** to set and advance to the next submenu.

Port A/B World Wide Name (WWN) Submenu

Note: Manufacturing generates *normal* drive node and port A/B WWNs as a set, and stores them in the drive EEPROM. The format is:

Drive Node: H=500104F0 (StorageTek brand device), L=yyyyyyyy.

Port A: H=500104F0, L=yyyyyyyy (last character, one higher than drive node).

Port B: H=500104F0, L=yyyyyyyy (last character, one higher than port A).

You can create or edit a Custom WWN as required for special circumstances. When Custom WWNs are used, Port A, Port B, and Drive Node WWNs should all be changed to designated Custom WWNs to meet special circumstances.

Make sure the Custom WWN is registered in the *host* interface software. Unregistered or duplicate WWNs cause *host* interface anomalies. Libraries using the dynamic WWN (dWWN) feature automatically set the drive Custom WWN setting to a library-determined WWN.

Defaults to the last saved selection.

H=500104F0 comprises the first half of a unique 64-bit WWN that identifies the specific port node. This first half includes a company identification (characters 2 through 6); and for StorageTek branded devices, the company ID is 00104F.

Note: You would not typically edit the first half of a WWN.

L=yyyyyyyy comprises the second half of the 64-bit WWN that identifies this specific port node. Typically, only the last character is different than the other port node. Generally, when setting a Custom WWN in a drive, you edit the second half of the WWN to replicate the second half of the WWN which was in use for the removed drive.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. Press **Select** to increment character until desired value appears, then press **Menu**.
3. Repeat step 2 for each character.
4. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Port A/B Custom/Normal WWN Submenu

This submenu appears only when the Custom WWN is in use or when one is being created/edited.

WWN Custom appears whenever a Custom WWN is in use, or is being created/edited.

WWN Custom also appears when the drive is using dynamic WWN, set by a library invoking dWWN.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass to the next submenu.
 - Press **Select** to toggle the selection to WWN Normal.

WWN Normal selection recalls the stored *normal* WWN from the drive EEPROM.

Procedure:

- Do one of the following actions:
 - Press **Menu** to recall the stored Normal WWN, and advance to the next submenu.
 - Press **Select** to toggle the selection to WWN Custom.

Port B Attributes Menu

The operator panel window shows either View PrtB ? (online) or Cfg PrtB ? (offline).

View or change Port B attributes as defined in the preceding port A/B attributes submenus (see "[Port A Attributes Menu](#)" on page 4-4).

Procedure:

- Press **Menu** to bypass or press **Select** to enter the port attributes submenu.

Emulation Mode Submenu (FCP)

Note: Manufacturing ships Fibre Channel (FCP) drives with the Emul STD option selected. Use the special emulation modes (Emul 9840 and Emul 9940) only at the direction of company technical support.

Procedure:

- Do one of the following actions:

- Press **Menu** to bypass.
- Press **Select** until the desired option appears; then, press **Menu** to set and advance to the next submenu.

Emul STD (Native)

Emul 9840

Emul 9940

Emul 3592

Emulation Mode Submenu (FICON)

Note: Manufacturing ships FICON drives with the Emul 3592 option selected. Change the selection to Emul VSM as needed to match site requirements.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then, press **Menu** to set, and advance to the next submenu.

Emul 3592

Emul VSM

Compress Mode Submenu

Note: Manufacturing ships drives with the Cmprss Yes option selected.

Defaults to the last saved selection.

Cmprss Yes when you select Yes, data is compressed, by default. The host can request no data compression.

Cmprss Off when you select Off, data is not compressed, and a host request has no effect.

Cmprss No when you select No, data is not compressed, by default. The host can request data compression.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** until the desired option appears; then, press **Menu** to set and advance to the next submenu.

Data Security Erase Mode Submenu

Note: Manufacturing ships drives with the **Full DSE Y** option selected.

Defaults to the last saved selection.

Full DSE Y writes a random binary pattern on the media, over-writing existing data from the point of an *erase* command, to the end-of-tape.

Full DSE N writes data on the media that indicates valid data does not exist beyond the point of an *erase* command.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then, press **Menu** to set and advance to the next submenu.

Drive Address Submenu (FICON only)

Note: Manufacturing ships drives with **Drv Adr 00** selected when the FICON interface is active.

Defaults to the last saved selection.

Drv Adr xy

- x and y are hexadecimal characters.

Establishes the device (not CU) address for the drive. It should usually remain zero (00). Recheck this address if the link is not operating.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. Press **Select** to increment the x character until the desired value appears, then press **Menu**.
3. Repeat step 2 for the y character.
4. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Standard Label Overwrite Protection Submenu

Note: Customers using NL or NSL tape processing cannot use **SL Prot**.

Note that Manufacturing ships drives with **SL Prot N** selected.

Defaults to the last saved selection.

Contact Technical Support for any assistance.

Note: POST WRCART cannot be run with this feature enabled.

SL Prot Y selects standard label overwrite protection.

Note: Only select **SL Prot Y** if label overwrite code is loaded, or if running standard labels and want the drive to display a fatal error (CHK 33EX) when writing a non-80-byte record for VOLSER or HDR1.

SL Prot N deselects standard label overwrite protection.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then, press **Menu** to set and advance to the next submenu.

Language Selection Submenu

Selects the operator panel display language: **English, Espanol, Francais, Italiano, or Deutsch.**

Note: Manufacturing ships drives with the **English** option selected.

Defaults to the last saved selection.

In the online (View) mode, the active language only appears.

In the offline mode, the operator panel window shows Language ?

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** until desired option appears; then, press **Menu** to set and advance to the next submenu.

Tape Bar Submenu

Note: Manufacturing ships drives with the **Tape Bar N** option selected.

Defaults to the last saved selection.

TapeBar Y enables secondary display of the current read/write point, relative to the beginning of data mark on the tape.

TapeBar N disables the option.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then, press **Menu** to set and advance to the next submenu.

Library Address Submenu

Note: Manufacturing ships drives with `Lib Adr FF` selected.

The operator panel window shows `Lib Adr xy`.

- For SL8500, SL3000, and L180/L700/L1400 libraries; use the factory preset (FF) with T10000 tape drives.
- In 9310 libraries (T10000A only), looking at the back of the drives, the address sequence in the drive cabinet is:
 - Left column from top: **00** through **09**.
 - Right column from top: **0A** through **13**.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. Press **Select** to increment the x digit until the desired value appears, then press **Menu** to set.
3. Repeat step 2 for the y digit.
4. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

StorageTek File Sync Accelerator Submenu

Note: Manufacturing ships drives with `SFileAcclY` selected.

SFileAcclY selects file sync accelerator. enables applications to reduce or eliminate back hitches caused by writing a tape mark or other sync operations.

SFileAcclN deselects file sync accelerator.

Defaults to the last saved selection.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.

- Press **Select** to toggle; then press **Menu** to set and advance to the next submenu.

Note: If the drive interface type is changed, this parameter is reset to the manufacturing (Preset) value.

StorageTek Tape Application Accelerator Submenu

Note: Manufacturing ships drives with TAA N selected.

TAA N deselects tape application accelerator.

TAA **Sync** WFM 0 operations will be NOP.

TAA **TMK** WFM will be place in a buffer.

TAA **A11** WFM0 will be NOP, normal WFM will be placed in a buffer.

Defaults to the last saved selection.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then press **Menu** to set and advance to the next submenu.

Note: If the drive interface type is changed, this parameter is reset to the manufacturing (Preset) value.

StorageTek Maximum Capacity Submenu

Note: Manufacturing ships drives with MaxCap OFF selected (firmware level 1.57.xxx and higher).

MaxCap ON selects maximum capacity. enables the use of tape capacity that is normally reserved to ensure tape-to-tape copy operations succeed. Enabling this feature on the T10000C drive can increase cartridge capacity by five to ten percent.

MaxCap OFF deselects maximum capacity.

Defaults to the last saved selection.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.
 - Press **Select** to toggle; then press **Menu** to set and advance to the next submenu.

Note: If the drive interface type is changed, this parameter is reset to the manufacturing (Preset) value.

Drive Node WWN Submenu

Note: You can create or edit a Custom WWN as required for special circumstances. When Custom WWNs are used, Drive Node, Port A, and Port B WWNs should all be changed to the designated Custom WWNs to meet special circumstances.

Make sure the Custom WWN is registered in the Host interface software. Unregistered or duplicate WWNs cause Host interface anomalies. Libraries using the dynamic WWN (dWWN) feature automatically set the drive Custom WWN setting to a library-determined WWN.

H=500104F0 comprises the first half of a unique 64-bit node WWN that identifies this drive node. This first half includes a company identification (characters 2 through 6); and for StorageTek branded devices, the company ID is 00104F. Therefore, you would not typically custom edit the first half of a WWN.

Note: Manufacturing generates the *normal* drive node and port A/B WWNs as a set and stores them in the drive EEPROM. The WWN format is:

Drive Node: H=500104F0 (StorageTek brand device), L=yyyyyyyy. (lowest of set).

Port A: H=500104F0, L=yyyyyyyy (last character, one higher than drive node).

Port B: H=500104F0, L=yyyyyyyy (last character, one higher than port A node).

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. Press **Select** to increment the character until the desired value appears, then press **Menu**.
3. Repeat step 2 for each character.
4. Press **Menu** to advance to the second half of the WWN; or, press **Select** to restart the change mode.

L=yyyyyyyy

Comprises the second half of the 64-bit WWN that identifies this specific node. Typically, only the last character is different than the port nodes. Generally, when setting a Custom WWN in a drive, you edit the second half of the WWN to replicate the second half of the WWN which was in use for the removed drive.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.

- b. Press **Select** to start the change mode.
2. Press **Select** to increment the character until the desired value appears, then press **Menu**.
3. Repeat step 2 for each character.
4. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Drive Node Custom/Normal WWN Submenu

Note: This submenu only appears if either a Custom WWN is in use or when one is being created/edited.

WWN Custom appears when either a Custom WWN is in use or is being created/edited.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass to the next submenu.
 - Press **Select** to toggle the selection to *WWN Normal*.

WWN Normal recalls the stored Normal WWN from the drive EEPROM.

Procedure:

- Do one of the following actions:
 - Press **Menu** to recall the stored normal WWN and advance to the next submenu.
 - Press **Select** to toggle the selection to *WWN Custom*.

Serial Number Menu

Operator panel window shows *S/N=zzzzzz* (online only).

Identifies the manufacturing assigned serial number of the drive.

zzzzzz = the last six characters of the rear panel DMOD label.

This data is read from an internal EEPROM for online viewing only.

Procedure:

- Press **Menu** or **Select** to advance to the next submenu.

Save Configuration Submenu

Operator panel window shows *Save/IPL ?* (offline only).

This submenu appears only if changes were made in any submenu.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to cancel changes.
 - Press **Select** (Yes) to save changes and initiate an IPL.
- Saving CFG appears for 2 seconds after you press **Select**.

After you save the configuration, the drive performs an IPL.

Exit Configuration Submenu

Operator panel window shows `Exit CFG ?`

This submenu offers the option to either repeat the change configuration submenus or exit the configuration submenus.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to loop back to the Interface Select Submenu.
 - Press **Select** (Yes) to exit and advance to the TCP/IP Configuration Menu.

View or Change TCP/IP Settings

Note: Make sure the host has varied the drive offline before setting the drive offline.

Operator panel window shows either `View TCP ? (online)` or `Chng TCP ? (offline)`.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to bypass.
 - Press **Select** (Yes) to enter the TCP/IP submenus.

Note: If bypassed, the display advances to the Firmware Release Level menu (online) or the Drive Operations menu (offline).

See the DHCP Submenu section for details of TCP/IP configuration settings, and guidelines for changing selected settings when the drive is offline.

DHCP Submenu

Note: Manufacturing ships all drives with the DHCP `N` option selected.

Operator panel window shows DHCP `Y` or DHCP `N`.

Defaults to the last saved selection.

With DHCP `Y` selected, a DHCP server (remote to the drive) assigns the dynamic TCP/IP settings.

With DHCP `N` selected, DHCP is disabled. The drive uses Static TCP/IP settings.

Procedure:

- Do one of the following actions:
 - Press **Menu** to bypass.

- Press **Select** to toggle; then, press **Menu** to set and advance to the next submenu.

Note: When DHCP *Y* is active, you *cannot* change the static IP, Net Mask, and Gateway.

IP Address Hi Submenu

The operator panel window shows IP`aaaa.bbb`.

Note: Manufacturing ships all drives with the static IP Address Hi set to `010.000`.

Valid entries are **000-255** for each digit trio.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. For each digit:
 - a. Press **Select** to increment the flashing digit until the desired value appears.
 - b. Press **Menu** to set.

If you attempt to enter a value greater than **255** in either trio, all digits flash when the last digit is set.
3. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Note: If all digits flash, press either **Select** or **Menu** to clear; then, press **Select** to restart the change mode.

IP Address Lo Submenu

Note: Manufacturing ships all drives with static IP Address Lo set to `000.001`.

Operator panel window shows IP`cccc.ddd`.

Valid entries are **000-255** for each digit trio.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.

2. For each digit:
 - a. Press **Select** to increment the flashing digit until the desired value appears.
 - b. Press **Menu** to set.If you attempt to enter a value greater than **255** in either trio, all digits flash when the last digit is set.
3. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Note: If all digits flash, press either **Select** or **Menu** to clear; then, press **Select** to restart the change more.

Net Mask Hi Submenu

Note: Manufacturing ships all drives with static Net Mask Hi set to 255.255.

Operator panel window shows NMhaaa.bbb.

Valid entries are **000-255** for each digit trio.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. For each digit:
 - a. Press **Select** to increment the flashing digit until the desired value appears.
 - b. Press **Menu** to set.If you attempt to enter a value greater than **255** in either trio, all digits flash when the last digit is set.
3. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Note: If all digits flash, press either **Select** or **Menu** to clear; then, press **Select** to restart the change more.

Net Mask Lo Submenu

Note: Manufacturing ships all drives with static Net Mask Lo set to 255.000.

Operator panel window shows NMlccc.ddd.

Valid entries are **000-255** for each digit trio.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. For each digit:
 - a. Press **Select** to increment the flashing digit until the desired value appears.
 - b. Press **Menu** to set.

If you attempt to enter a value greater than **255** in either trio, all digits flash when the last digit is set.

3. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Note: If all digits flash, press either **Select** or **Menu** to clear; then, press **Select** to restart the change more.

Gateway Hi Submenu

Note: Manufacturing ships drives with a static Gateway Hi set to either 000.000. or 255.255

Operator panel window shows GWhaaa.bbb.

Valid entries are **000-255** for each digit trio.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. For each digit:
 - a. Press **Select** to increment the flashing digit until the desired value appears.
 - b. Press **Menu** to set.

If you attempt to enter a value greater than **255** in either trio, all digits flash when the last digit is set.

3. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Note: If all digits flash, press either **Select** or **Menu** to clear; then, press **Select** to restart the change more.

Gateway Lo Submenu

Note: Manufacturing ships drives with static Gateway Lo set to either 000.000. or 255.255

Operator panel window shows GWlccc.ddd.

Valid entries are **000-255** for each digit trio.

Defaults to the last saved selection.

Procedure:

1. Do one of the following actions:
 - a. Press **Menu** to bypass.
 - b. Press **Select** to start the change mode.
2. For each digit:
 - a. Press **Select** to increment the flashing digit until the desired value appears.
 - b. Press **Menu** to set.

If you attempt to enter a value greater than **255** in either trio, all digits flash when the last digit is set.
3. Press **Menu** to advance to the next submenu; or, press **Select** to restart the change mode.

Note: If all digits flash, press either **Select** or **Menu** to clear; then, press **Select** to restart the change more.

Save TCP/IP Submenu

Operator panel window shows Save/IPL ?

This submenu is present if either the DHCP selection or the static TCP/IP settings were changed.

Saving TCP appears for 2 seconds after you press **Select**.

After saving the TCP configuration, the drive automatically perform an IPL.

Save Fails appears for RAM problems.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to cancel changes.
 - Press **Select** (Yes) to save changes and initiate an IPL.

Exit TCP/IP Submenu

Operator panel window shows Exit TCP ?

This submenu offers you the option to either repeat the TCP/IP submenus or advance to the next menu.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to loop back to the DHCP Y/N submenu.
 - Press **Select** (Yes) to exit and advance to the Firmware Release Level menu (online), or the Drive Operation menu (offline).

Drive Operations Menu

The **Drv Menu** is only available when the drive is offline.

Note: Make sure the host has varied the drive offline before you set the drive offline.

Operator panel window shows `Drv Menu ? (offline only)`. This is the entry point to the Drive Operations submenus.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to bypass.
 - Press **Select** (Yes) to enter the submenus.

Note: If bypassed, the display advances to the Firmware Release Level menu.

Code Update Submenu

Operator panel window shows `IPL FromTP`.

IPL From Tape, updates the drive firmware from a code tape that you insert in the drive.

A normal data cartridge, if present, unloads when this function is activated.

If `CHK xxxx` appears, try a different code tape.

Procedure:

1. Press **Menu** to bypass or press **Select** to activate.
2. When `Ld IPL Tp` appears, insert the code tape (write-protected data cartridge that contains the desired firmware release level image).

Note: After the update completes, the drive unloads the code tape and initiates an IPL.

3. Remove the unloaded code tape.

Make Dump Tape Submenu

Operator panel window shows `MakeDumpTp`.

Make Dump Tape specially formats and identifies a data cartridge as a *dump tape*; but, it does not collect dump logs. Data cartridges used to collect dump logs must first be formatted this way to accept dump logs.

A normal data cartridge, if present, ejects when this function is activated.

If Make Dump Tape fails and `CHK xxxx` appears, try a different data cartridge.

Procedure:

1. Press **Menu** to bypass or press **Select** to activate.
2. When `Ld Dump Tp` appears, insert a write-enabled data cartridge.
3. After the formatted dump tape unloads, remove the cartridge.
4. Insert another write-enabled data cartridge, or press **Menu** to exit the dump tape submenu.

Make Code Tape Submenu

Note: Only drives with all images loaded into the EEPROM can make code tapes.

Operator panel window shows `MakeCodeTp`.

Make Code Tape copies the firmware image from the drive EEPROM to a data cartridge. You can use this *code tape* to update firmware in other drives using the Code Update submenu.

A normal data cartridge, if present, ejects when this function is activated.

If Make Code Tape fails and `CHK xxxx` appears, try a different cartridge. If the problem persists, consult your service representative.

Notes:

This operation might not work on encryption-enabled tape drives.

Make sure the drive is properly prepared to create code tapes. If required, exit the Drive Operations menu and update the drive to a full code of the desired firmware release level.

Procedure:

1. Press **Menu** to bypass or press **Select** to activate.
2. When `Ld Code Tp` appears, insert a write-enabled data cartridge.
3. After the new code tape unloads, remove the cartridge and write protect it (set the switch to the locked position).
4. Insert another write-enabled data cartridge, or press **Menu** to exit the create code tape submenu.

Make Data Tape Submenu

Note: VolSafe data cartridges cannot be reformatted. If inserted, the drive rejects a VolSafe cartridge.

Make Data Tape reformats cartridges so they can be reused as normal *data tapes*. This is sometimes referred to as *reclaiming*.

A cartridge, if present, unloads when this function is activated.

Information in the MIR about old data files on a tape being reformatted is erased.

If Make Data Tape Fails, and `CHK xxxx` appears, try a different data cartridge.

Procedure:

1. Press **Menu** to bypass or press **Select** to activate.
2. When `Ld Data Tp` appears, insert a write-enabled data cartridge.
`MakeDataTp` appears in the drive display.
3. After the reformatted data tape unloads, remove the data cartridge.
4. Insert another write-enabled data cartridge, or press **Menu** to exit the reclaim tape submenu.

Build Media Information Region Submenu

Operator panel window shows `Build MIR`.

T10000 tape drives use information recorded on a data cartridge at the beginning of tape, in an area known as the Media Information Region (MIR), to access and manage data files while the data cartridge is loaded in the drive.

Procedure:

1. Press **Menu** to bypass or press **Select** to activate.

Caution: Make sure the drive is unloaded before you activate Build MIR.

2. When `Ld Cust Tp` appears, insert the write-enabled data cartridge with an invalid MIR.

`Rebuild MIR` flashes on the operator panel while the MIR is rebuilding.

Note: After the MIR is rebuilt, the cartridge unloads.

3. Remove the data cartridge.
4. Insert another write-enabled data cartridge requiring a MIR rebuild; or, press **Menu** to exit the build MIR submenu.

Exit Drive Submenu

Operator panel window shows `Exit Drv ?`

This submenu offers the choice to either repeat the drive operations submenus or advance to the next menu.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to loop back to the Code Update Submenu.
 - Press **Select** (Yes) to exit Drive Operations and advance to the Firmware Release menu.

Firmware Release Level Menu

Operator panel window shows Rx.yy.zzza.

This submenu displays the current drive firmware release level.

Procedure:

- Press **Menu** or **Select** and advance to the Exit menu.

Exit Menu

Operator panel window shows Exit Menu?

This menu offers the option to either stay in the menu system and return the drive to Online or to exit the menu system.

Procedure:

- Do one of the following actions:
 - Press **Menu** (No) to go to the Online/Offline menu.
 - Press **Select** (Yes) to exit the menu system.

Note: If you exit the menu system with the drive offline, the display flashes *Offline* every few seconds as a reminder that drive is still *Offline* (if a data cartridge has been loaded at least once).

Service Calls and Help

A fault symptom code (FSC) might appear on the Virtual Operator Panel (VOP) screen or the tape drive's front panel display screen of rack mounted tape drives. You might be able to correct the problem (see [Table D-1](#) or "[Potential Operator Recovery Scenarios](#)" on page D-3). If you cannot correct the problem:

- **Record the FSC information for your service representative.**

Some errors result in the state of the drive status indicator changing color, flashing, or both. Refer to "[Library Tray Rear Panel](#)" on page 1-2 for additional details.

If you gather as much of the following information as possible before you open a service request, the process is much easier:

- Account name and location
- Contact name and telephone number
- Equipment model number
- Tape drive address
- Tape drive code level
- Tape drive serial number
- Urgency of the problem
- FSC from either the tape drive's front panel display screen (rack mount), the VOP window, or as displayed on the host system display screen
- Problem description
- What color and flash rate is exhibited by indicators on the rear of the drive tray?
- Is the tape drive in a library? If so, which library?
- If the tape drive was running properly before this incident:
 - What changes have been made to the site recently?
 - What software application was running at the time of the failure?
 - Were any hardware configuration changes made recently?
 - Were any software configuration or upgrades done recently?
 - Were any additions or deletions to the hardware or software done at the site?
- If the drive was *not* running properly, what was the last problem?

Open a service request at My Oracle Support (MOS):

<https://support.oracle.com>

Cartridge Care

StorageTek T10000 tape cartridges require care to ensure proper operation and longevity. This appendix provides:

- Information for storing and handling cartridges
- Instructions for unpacking cartridges or for shipping them to another site
- Information to follow when a cartridge is dropped

Note: In this chapter, *data cartridge* refers to all data cartridges: Standard data, Sport data, VolSafe data, and Sport VolSafe.

See "[Library Use Cartridge Labels](#)" on page B-1 for information regarding cartridge labels, particularly those cartridges used inside a library.

Storage Environment

Always store cartridges in an environment within the specified range of temperature and humidity (see "[Tape Cartridge Environmental Requirements](#)" on page E-6). When you store cartridges, follow these recommendations:

- Do not take data cartridges out of their protective wrapping until you need them.
- Store cartridges in a dirt-free environment that, if possible, duplicates the conditions of the data processing center.
- Before you use a cartridge that has been in storage, acclimate it to the operating environment for at least 72 hours.

Guidelines for Handling

Caution: *Tape Damage:* Cartridges are easily damaged and you must handle them carefully.

- Do not expose the tape or cartridge to direct sunlight or moisture.
- Do not expose a data cartridge to magnetic fields.
- Maintain clean operating, working, and storage environments.

Note: See [Appendix F, "Controlling Contaminants"](#) for details.

To Unpack and Acclimate Cartridges

1. Unpack new data cartridges in the area intended for use.
2. Allow the cartridge(s) to acclimate for a period of at least 72 hours.

To Clean a Cartridge

- Wipe all dust, dirt, and moisture from the cartridge case with a lint-free cloth.

To Ship a Cartridge

Note: Customers must obtain cartridge shipping packages from service representatives.

Only the following assemblies are qualified for shipping T10000 cartridges:

- Single Cartridge - PN 1095329xx, T10000 Cartridge 1-Pack Packaging Assembly
- Five Cartridges - PN 1095332xx, T10000 Cartridge 5-Pack Packaging Assembly

The 5-Pack packaging assembly protects *exactly* five (5) T10000 tape cartridges.

- **Do not** attempt to package more than five cartridges by forcing the additional cartridge(s) into the package.
- **Do not** attempt to package less than five cartridges by filling the missing cartridge void(s) with any other material.

Note: When packaging less than five cartridges, use one or more single cartridge 1-Pack packaging assemblies.

Use the following guidelines to prepare StorageTek T10000 tape cartridges for shipment:

Cation: *Potential Cartridge Damage:* Cartridges are easily damaged in shipment if improperly packaged. Use the designated packaging assemblies only, and in matching quantities with the number of cartridges.

1. Obtain appropriate quantities of the designated packaging assemblies:
2. Follow the packaging instructions included in the packaging assembly.

Each packaging assembly includes specific packaging instructions.

Note: Do not improvise or use older packaging instructions as they might not be applicable to the current packaging assembly.

3. Attach the appropriate shipping label to the sealed package.

Shipping labels will vary relative to prescribed or available shipping services.

Dropped Cartridges

Whenever a cartridge is dropped, there is a potential for damage to the case. Even if the case is visibly undamaged, the cartridge leader might be jarred out of the home position and result in a load failure.

Always thoroughly inspect a dropped cartridge by looking for damage to the case, and making sure the leader is recovered to the home position (see ["To Inspect a Dropped Cartridge"](#)).

Note: If the drop was greater than 75 centimeters (29.5 inches), use the cartridge only for a one-time data transfer, even if otherwise undamaged, then discard it.

If your inspection results determine the cartridge is damaged but fit for loading, transfer data to a serviceable cartridge.

To Inspect a Dropped Cartridge

1. Closely examine the entire case, front and back, for breaks, cracks or both.

If cracks or breaks are visible, you must discard the cartridge.

Note: A dropped cartridge with visible damage that precludes normal loading into a drive might be a candidate for data recovery. Contact your service representative regarding damaged data cartridge recovery options.

2. Check all four case screws (1, [Figure A-1](#)) for security.

If a screw post is broken, the screw might be noticeably loose.

3. Attempt to separate the case halves near each screw.

If a screw post is broken, the case separates slightly, even if the screw seems tight.

4. Examine the sonic weld area near the tape access door, (3, [Figure A-1](#)) for integrity.

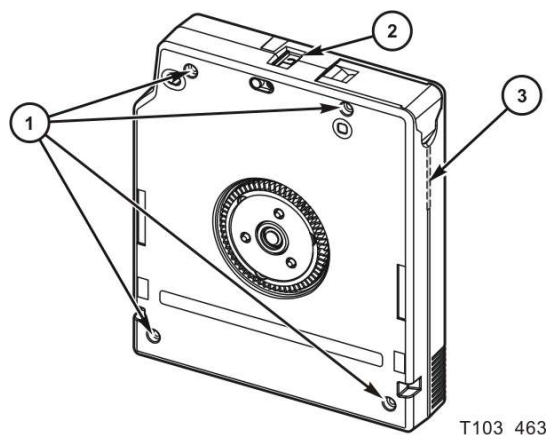
Sonic weld damage might not be easily discernible. If there is any question about the integrity of the sonic weld, consult your service representative. If the sonic weld area has failed, you must discard the cartridge, even if it appears to be undamaged.

5. Slowly turn the cartridge over and listen for any loose items within the cartridge.

Caution: *Equipment Damage:* Any loose items within the cartridge indicate internal damage. Loading an internally damaged cartridge could either damage the tape so data can never be retrieved or damage the tape drive.

6. Operate the write-protect switch, (2, [Figure A-1](#)) several cycles.

The write-protect switch should slide smoothly.

Figure A-1 Cartridge Inspection Points

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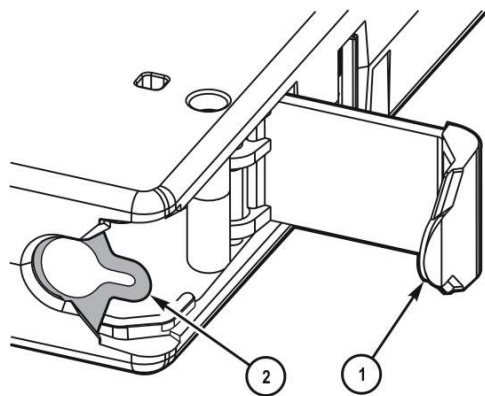
Illustration Legend:**1 - Case screw (4x)****2 - Write-protect switch****3 - Sonic weld area**

7. Open and close the tape access door (1, [Figure A-2](#)) several times, and examine the door for damage.

If the door is visibly damaged, does not open, or does not close smoothly, discard the cartridge.

Caution: Do not attempt to force the leader back into the home position. If the leader is not in the home position, contact your service representative.

8. Hold the tape access door open, and determine if the leader (2, [Figure A-2](#)) is in the home position (securely butted against stops).

Figure A-2 Cartridge Door and Tape Leader

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Illustration Legend:**1 - Tape access door**

2 - Leader

- If the leader was jarred out of the home position, it is loose and floppy, or might be fully retracted into the cartridge case.
- If a load attempt was made with the leader out of the home position, the tape drive fully retracts the leader; it is pulled back into the cartridge and is no longer visible.

Data Cartridge Labels

A cartridge label contains bar codes and visual characters. The visual characters are for operator use and are not used by the library. Moreover, the visual characters do not have to line up with the bar code lines for that character.

Rack Mount Cartridge Labels

If you are using the data cartridges in a rack mount situation, almost any label across the data cartridge is acceptable, as long as it does not interfere with the operation of the tape drive.

Library Use Cartridge Labels

If you are using the data cartridges in a library, the labels must conform to a specification for the label size. See the library User's Guide for information regarding the label requirements. It is very important to follow these specifications.

- AIM Uniform Symbology Specification USS-39
- ANSI MH10.8M-1993 ANSI Code 39 Barcode Specification
- ANSI NCITS 314-199X SCSI 3 Medium Changer Commands (SMC)

You must put a label on the data cartridge in the label attachment area as shown by item 1 in [Figure 1–8](#). You must carefully place the label in the label area with the bar code down (to the hub side of the data cartridge—the hub is shown in the *bottom view* in the figure).

Standard/Sport Cartridge Labels

Standard data cartridge labels consist of eight characters and the associated bar code.

- The first six characters in the label are the customer volume ID (such as NGD018). Label characters may consist of A through Z and the numbers 0 through 9. No special characters (& \$%#@#and so on) may be used.
- The last two characters are the media identifier:
 - StorageTek T10000 cartridge (written with a T10000A and B drive)
 - T1 for the standard T10000A and data cartridge
 - TS for the T10000A and B sport data cartridge
 - StorageTek T10000 T2 cartridge (written with a T10000C and D drive)
 - T2 for the standard T10000C and D data cartridge

TT for the T10000C and D Sport data cartridge

The color behind the media identifier is usually white for standard cartridges. An example of a label for the T1 cartridge is shown in [Figure B-1](#).

Figure B-1 T10000A/B Standard Eight-character Label



VolSafe/Sport VolSafe Cartridge Labels

VolSafe labels are the same as standard cartridge labels with the exception that the background color of the media ID area is usually yellow.

Diagnostic Cartridge Labels

To be recognized by the library as a diagnostic cartridge, the label on the data cartridge must start with DG and a space (no third character is used). The five remaining label characters are:

- xxx can be 000 to 999
- Media identifier (two characters)
 - T1 for the StorageTek T10000 cartridge (used with T10000A and B drive)
 - T2 for the StorageTek T10000 T2 cartridge (used with T10000C and D drive)

An example of a diagnostic cartridge label for a T10000A/B drive is shown in [Figure B-2](#).

Figure B-2 T10000A/B Diagnostic Cartridge Label



Cleaning Cartridge Labels

The cleaning label characters are:

- CLN (the first three characters)
- Fourth through sixth characters can be 000 to 999 (for identification of each individual cleaning cartridge)
- Media identifier (two characters):
 - CT for the T10000A and B cartridge
 - CC for the T10000C cartridge
 - CL for the cleaning cartridge used on the T10000A, B, C, and D drives

An example of a cleaning cartridge label for a T10000A and B drive is shown in [Figure B-3](#).

Figure B-3 T1000A/B Cleaning Cartridge Label



Initial Drive Configuration Settings

Manufacturing presets the drive configuration sector with values shown in this appendix after internal testing is complete and before the tape drive is shipped. See:

- ["Initial Configuration Menu Settings"](#)
- ["Initial TCP/IP Menu Settings"](#) on page C-3
- ["FICON Configuration Differences"](#) on page C-3
- ["T10000C/D Additional Parameters"](#) on page C-3

These preset, initial settings suffice for most sites. However, specific site requirements might dictate some alternative settings.

Initial Configuration Menu Settings

- Hard Physical Address of the drive port
Operator Panel Display: Hard PA N
Preset: N
Option: Yes (Y), No (N)
- Soft Physical Address of the drive port
Operator Panel Display: Soft PA LO
Preset: LO
Option: HI, LO
- Data transfer speed
Operator Panel Display: Rate Auto
Preset: Auto
Option: Auto, 16Gb, 8 Gb, 4 Gb, 2 Gb, 1 Gb (fixed speed setting depends on the capability of the specific drive model, for example a T10000C drive can be set to 4 Gb, 2 Gb, or 1 Gb).
- Maximum data frame
Operator Panel Display: MAXSz 2112
Preset: 2112
Option: 2112, 2048
- Port World-wide Name

Operator Panel Display: `WWN Normal`

Preset: Normal (assigned)

Option: Normal, Custom

- Emulation Mode

Operator Panel Display: `Emul STD` (see ["FICON Configuration Differences"](#) on page C-3)

Preset: STD

Option: FCP interface =Standard, 9840B, 9940B, 3592 while the FICON interface options are VSM or 3592

Note: Emulation modes 9840B and 9940B are special modes used only at the direction of technical support.

- Data compression

Operator Panel Display: `Cmprss Yes`

Preset: Yes

Option: Yes, Off, No

- Data Security Erase

Operator Panel Display: `Full DSE Y`

Preset: Y

Option: Yes (Y), No (N)

- Standard Label Protection

Operator Panel Display: `SL Prot N`

Preset: N

Option: Yes (Y), No (N)

- Message language (specific messages)

Operator Panel Display: `English`

Preset: English

Option: English, Spanish, French, Italian, German

- Tape activity display

Operator Panel Display: `Tape Bar N`

Preset: N

Option: Yes (Y), No (N)

- Library Address (hexadecimal)

Operator Panel Display: `LIB Adr FF`

Preset: FF

Option: Two digit hexadecimal

- Drive Node World-wide Name

Operator Panel Display: WWN

Preset: Normal (assigned)

Option: Normal, Custom

Initial TCP/IP Menu Settings

- Dynamic Host Control
Operator Panel Display: DHCP N
Preset: N
Option: Yes (Y), No (N)
- Static IP Address
Operator Panel Display: IPh010.000 and IP1000.001
Preset: 10.000.000.001
Option: aaa.bbb.ccc.ddd
- Sub Net Mask
Operator Panel Display: NMh255.255 and NM1255.000
Preset: 255.255.255.000
Option: aaa.bbb.ccc.ddd
- Gateway
Operator Panel Display: GWh255.255 and GW1255.255
Preset: 255.255.255.255
Option: aaa.bbb.ccc.ddd

FICON Configuration Differences

The FICON interface has the following configuration differences:

- Emulation Mode: Emul VSM
Preset: VSM
Options: VSM, 3592
- Drive Address (device):
Preset: 00
Option: Two-digit hexadecimal

All other configuration settings are the same as shown previously.

T10000C/D Additional Parameters

Between the Lib Adr xy parameter and the drive node WWN parameter, there are additional parameters for the T10000C/D drive:

- SFileAcel (StorageTek File Sync Accelerator)
Preset value is **SFileAcelY**.
Options: No (N) or Yes (Y)

- TAA (Tape Application Accelerator)
Preset value is **TAA N**.
Options: Sync, TMK, All, or No (N)
- MaxCap (StorageTek Maximum Capacity)
Preset value is **MaxCap OFF**.
Options: OFF or ON

Note: If the drive interface type is changed, the SFileAcel, TAA, and MaxCap parameters are reset to the factory default (Preset) value.

Other Configuration Settings

The following registers are set to the conditions shown:

- IP Node Name: T10000-<last 9 digits of Serial Number>
- SNMP Alerts: All turned OFF
- Library Locator: ACS: 0 LSM: 0 Panel: 0 Drive: 0
- SNMP Managers: None Specified
- Drive Statistics: All zeroed
- Permanent Errors: All zeroed, pointers initialized.
- Temporary Errors: All zeroed, pointers initialized.

Messages and Translated Messages

This appendix summarizes the T10000 tape drive operator-panel indicator lights and display messages. Where applicable, this appendix recommends operator actions.

Messages

Table D-1 lists operator panel display messages, meanings, and recommended actions.

Table D-1 Operator Panel Display Messages

Display	Meaning	Recommended Action
* (asterisk)	The tape drive is online but a cartridge tape is not loaded.	Load a cartridge tape as required.
ASIA Diags	IPL diagnostics are running.	None
Bank n Bad	During boot, a section of memory was found bad.	Perform a drive IPL. If the problem persists, contact authorized service personnel.
Boot Fail	The IPL failed.	Perform a drive IPL again. If the problem persists, contact authorized service personnel.
BT Monitor	A sequence of switches accessed an engineering area.	Perform a drive IPL.
CC Diags	IPL diagnostics are running.	None
Chk xxxx, xxxx is an FSC	An operational failure occurred; the tape drive automatically performs an IPL.	Wait for the IPL to complete and retry the operation (see Table D-2). If the problem persists, contact authorized service personnel.
Cleaning (*Cleaning*)	A cleaning cartridge is in the tape drive and is now cleaning.	None
cmhndnsn (Hardware revision level supported by the firmware in this drive)	The tape drive firmware level is insufficient to control the tape drive hardware.	Contact authorized service personnel.
CodCrFail1	The tape drive cannot write code onto the data cartridge tape, or the tape drive cannot position the data cartridge tape.	Ensure that the tape is write-enabled, or try another cartridge tape.
CodCrFail2	The tape drive cannot read code from the data cartridge tape.	Retry the operation, or try another cartridge tape. If the problem persists, contact authorized service personnel.
CodeUpDate	The firmware in the tape drive is being updated from the host; the operator panel switches are locked.	None
CodUpFail1	The tape drive cannot read the data cartridge tape, or the tape drive cannot position the data cartridge tape.	Try another cartridge tape.
CodUpFail2	The EEPROM failed.	Contact authorized service personnel.

Table D–1 (Cont.) Operator Panel Display Messages

Display	Meaning	Recommended Action
CodUpFail3	The tape drive cannot read code from the data cartridge tape.	Retry the operation, or try another cartridge tape. If the problem persists, contact authorized service personnel.
CodUpFail4	The data cartridge tape is not a code update cartridge tape.	Try another code update cartridge tape. If the problem persists, contact authorized service personnel.
DatCrFail1	The tape drive cannot create (reformat or reclaim) a cartridge tape.	Ensure that the data cartridge tape is write-enabled, or try to reformat the tape on another drive. If the problem persists, contact authorized service personnel.
DmpCrFail1	The tape drive cannot create (reformat or reclaim) a diagnostic dump tape.	Ensure that the data cartridge tape is write-enabled. If the problem persists, contact authorized service personnel.
DmpCrFail2	The tape drive cannot read the format of the data cartridge tape.	Retry the operation, or try another cartridge tape. If the problem persists, contact authorized service personnel.
DmpWrFail1	The tape drive cannot write diagnostic data onto the data cartridge tape, or the tape drive cannot position the data cartridge tape.	Contact authorized service personnel.
DmpWrFail2	There is no diagnostic dump data to process.	Contact authorized service personnel.
xxxx:Dmp y	Alternates with *(an asterisk) after completion of IPL, where xxxx = the FSC of last dump data collected and Y = number of uncollected dumps in non-volatile memory.	Contact authorized service personnel who accesses the diagnostic data and collects it to tape or to the host.
DumpAgain? alternating with Chk xxxx, xxxx is an FSC. The Service indicator is flashing.	The tape drive detected the same error within a minute.	IPL the tape drive. If the problem persists, contact authorized service personnel.
DumpToHost	The dump or event log is being transferred to the host; operator panel switches are locked.	None
Exp ClCart	The cleaning cartridge is used up.	Replace the cleaning cartridge.
Fix CfgErr	The checksum does not match after an IPL.	Contact authorized service personnel.
Init xxxx. xxxx is an FSC	An initialization error occurred.	Contact authorized service personnel.
IPL Pend	The IPL switch has been pressed.	None
Load CC	The common controller code is loading; IPL is proceeding.	None
Loading	A cartridge tape is loading.	None
Load xxxx, xxxx is an FSC	The load or unload operation failed.	If the load failed, insert another cartridge tape. If it loads successfully, suspect the original tape. If another tape fails to load, IPL the tape drive. If the problem persists, contact authorized service personnel.
Load FIBRE	Fibre Channel firmware is loading; IPL is proceeding.	None
Locating	The tape drive is doing a high-speed seek.	None
Memory Err	The IPL failed.	Perform the tape drive IPL again. If the problem persists, contact authorized service personnel.
NTReady F	A write-protected tape is in the process of a manual unload.	None
NTReady U	A write-enabled tape is in the process of a manual unload.	None
Offline alternating with *	The tape drive is offline.	None

Table D–1 (Cont.) Operator Panel Display Messages

Display	Meaning	Recommended Action
Online	The tape drive is online.	None
Power Fail	The power supply failed.	Contact authorized service personnel.
Reading	The tape drive is reading data.	None
Ready A	The loaded cartridge tape is a VolSafe cartridge.	None
Ready F	The loaded cartridge tape is write-protected.	None
Ready H	The loaded higher density, non-VolSafe cartridge tape is ready and not file protected in a lower density drive.	Reload with a low-density cartridge or intentionally over-write from BOT. Note - High-density data cannot be read by a lower density drive.
Ready L	The loaded lower density, non-VolSafe cartridge tape is ready and not file protected in a higher density drive.	Use for read-only jobs or intentionally over-write from BOT. Note - Low-density data file can be read, but not revised by a higher density drive.
Ready U	The loaded cartridge tape is write-enabled (write-unprotected).	None
Rewinding	The tape drive is rewinding.	None
Save Fails	The new configuration cannot be saved because the read-access memory (RAM) might be defective.	This message is associated with changing the tape drive configuration, a task for authorized service personnel only.
SavingDump	A dump is being saved to non-volatile memory.	None
Start Init	Initialization has started.	None
Trapped	The IPL process is trapped in a loop.	IPL the tape drive again. If the problem persists, contact authorized service personnel.
Unloading	A cartridge tape is unloading.	None
UnWr xxxx, where xxxx is an FSC	The Unload switch was pressed during a write operation. Some data remains unwritten.	To write the unwritten data, issue the command: ESCON Swap in VM/MVS environment Or, Press the Unload switch again; the unwritten data is lost.
Write Prot	The tape drive attempted to write to a write-protected cartridge tape.	Change the switch on the data cartridge tape to enable writing.
Writing	The tape drive is writing data.	None

Potential Operator Recovery Scenarios

The following table contains Fault Symptom Codes (FSCs) that commonly result from an operator error. The first column in the table lists an operator panel message at the time of the error event. The description column provides insight into the error condition from which you can determine a recovery action.

Table D–2 Selected Check Message Meanings

Message	Description
CHK 6109	This drive does not contain the key needed to decrypt this tape. The ID of the missing key can be viewed from this drive using the VOP program.
CHK A33A	The user requested a motion operation that requires a tape to be installed, however, a tape has not been loaded.
CHK A34C	The user requested a write operation that requires a tape to be installed, however, a tape has not been loaded.

Table D–2 (Cont.) Selected Check Message Meanings

Message	Description
CHK A3FB	A format override tape write operation failed. The failure may not be serious. Error recovery was not invoked for the failure. Re-attempting the test may resolve this issue.
CHK A733	The operator or library inserted a write protected tape into the drive while in a menu selected create tape mode. If the write protect switch on the cartridge is moved to the unlocked position, the operation will work.

Translated Messages

Table D–3 lists operator panel display messages selected for translation. The messages appear in the language set in the drive configuration menu.

Note: See "[Language Selection Submenu](#)" on page 4-11 for additional information.

Table D–3 Translated Display Messages

English	Espanol	Francais	Italiano	Deutsch
Cleaning	*LIMPIEZA*	*NETTOYAGE	*PULIZIA*	*REINIGEN*
Erasing	*BORRANDO*	EFFACEMENT	*CANCELLA*	*LOESCHEN*
Locating	Localizar	Recherche	Ricerca	Suchen
Loading	Cargando	Chargement	Carico	Laden
NT Ready F	No Listo A	NPret F	No Prnt F	N Bereit F
NT Ready U	No Listo U	NPret U	No Prnt U	N Bereit U
Ready A	Listo A	Pret A	Pronto A	Bereit A
Ready F	Listo F	Pret F	Pronto F	Bereit F
Ready H	Listo H	Pret H	Pronto H	Bereit H
Ready L	Listo L	Pret L	Pronto L	Bereit L
Ready U	Listo U	Pret U	Pronto U	Bereit U
Rewinding	Rebobinar	Rebobinage	Riavvolgi	Spulen
Unloading	Descarga	Dechargemt	Scarico	Entladen

Specifications

This appendix lists the physical, power, and performance specifications; and, environmental requirements for the T10000 tape drive and tape cartridge.

Physical Specifications (Drive)

- Width: 147 mm (5.77 inches) drive, 483 mm (19 inches) rackmount tray
- Depth:
 - 433 mm (17 inches) T10000A/B drive [includes cartridge bezel and D connector]
 - 427 mm (16.8 inches) T10000C/D drive [includes cartridge bezel and SFP modules]
 - 640 mm (25 inches) rackmount tray
- Height: 81 mm (3.2 inches), 178 mm (7 inches) rackmount tray
- Weight (with drive tray):
 - SL8500 =9.4 kg (20.75 pounds)
 - SL3000 =10.1 kg (22.25 pounds)
 - L-Series (T10000A/B only) =8.3 kg (18.3 pounds)
 - 9310 (T10000A only) =6.9 kg (15.25 pounds)

Physical Specifications (Tape Cartridge)

- Tape cartridge physical specifications:
 - Height: 24.5 mm (0.96 inches)
 - Width: 109 mm (4.29 inches)
 - Length: 125 mm (4.92 inches)
- Media length:
 - 917 meters (3,009 feet) [recordable 855 m (2,805 feet)] for the StorageTek T10000 cartridge
 - 1,147 meters (3,763 feet) [recordable 1107 m (3,632 feet)] for the StorageTek T10000 T2 cartridge
- Media thickness:
 - 6.5 microns (µm) for the StorageTek T10000 cartridge (T1 media ID)

5.2 microns (μm) for the StorageTek T10000 T2 cartridge (T2 media ID)

- Nominal weights:

StorageTek T10000 cartridge:

- Standard data cartridge (T1 media ID): 262.5 grams (0.59 pound)
- Sport data cartridge (TS media ID): 187.0 grams (0.41 pound)
- Cleaning cartridge: 196.3 grams (0.433 pound)

StorageTek T10000 T2 cartridge:

- Standard data cartridge (T2 media ID): 270 grams (0.595 pound)
- Sport data cartridge (TT media ID): 191 grams (0.42 pound)
- Cleaning cartridge: 196.3 grams (0.433 pound)

Power Specifications

This section lists power specifications for the tape drive configurations.

Rack Mount Tape Drive Power Specifications

The input power requirement for a rack with two tape drives and two power supplies when the tape drive is moving tape in read/write and rewind modes:

- T10000D: 240 watts (approximately 819 Btu/hr)
- T10000C: 229 watts (approximately 782 Btu/hr)
- T10000A or B: 172 W (approximately 587 Btu/hr)

Note: The tape drive draws the same power from the power supply regardless of the AC input voltage.

If the rack unit contains a single tape drive, the power requirement is half the value listed above.

Library-attached Tape Drive Power Specifications

For SL3000 and SL8500 libraries, the maximum continuous power consumption for each tape drive tray is:

- T10000D: 144 watts (approximately 491 Btu/hr)
- T10000C: 97.9 watts (approximately 334 Btu/hr)
- T10000B: 96 watts (approximately 328 Btu/hr)
- T10000A: 100 watts (approximately 341 Btu/hr)

For other libraries, use the power specifications for a single rack mount tape drive and power supply. In those libraries, there is one AC/DC power supply for each tape drive.

T10000C/D Power Specifications

- Operating max. continuous - not peak:
T10000D: 94 W (approximately 321 Btu/hr)

T10000C: 67 W (approximately 229 Btu/hr)

- Hibernate mode:

T10000D: 32 W (approximately 109 Btu/hr)

T10000C: 31 W (approximately 106 Btu/hr)

Note: The external interfaces remain active during all power management modes.

Performance Specifications

Capacity and Performance:

- Capacity, native

T10000A: 500 GB (5×10^{11} bytes)

T10000B: 1 TB (1×10^{12} bytes)

T10000C: up to 5.5 TB (5.5×10^{12} bytes)

T10000D: up to 8.5 TB (8.5×10^{12} bytes)

- Capacity (Sport Cartridge)

T10000A: 120 GB

T10000B: 240 GB

T10000C: 1 TB (1×10^{12} bytes)

T10000D: up to 1.6 TB (1.6×10^{12} bytes)

- Data buffer size

T10000A or B: 256 MB

T10000C or D: 2 GB

- Tape speeds:

Read and Write:

- T10000A: 2.0 and 4.95 meters/second

- T10000B:

T10000B-formatted cartridges: 2.0 and 3.74 meters/second

T10000A-formatted cartridges: 2.0 and 4.95 meters/second

- T10000C: 5.62 meters/second

- T10000D: 4.75 meters/second (with additional speeds of 4.25, 3.75, 3.25, and 2.75 meters/second)

File search and locates:

- T10000A or B: 8 to 12 meters/second (varying speeds)

- T10000C or D: 10 to 13 meters/second (varying speeds)

High speed rewind:

- T10000A or B: 8 to 12 meters/second (varying speeds)

- T10000C or D: 10 to 13 meters/second (varying speeds)

Interfaces:

- Types:

T10000A: 2 gigabit or 4 gigabit Fibre Channel and FICON

T10000B or C: 4 gigabit Fibre Channel and FICON

T10000D: 16 gigabit Fibre Channel, 16 gigabit FICON, and 10 gigabit Fibre Channel over Ethernet (FCoE)

Note: The 16 gigabit tape drive interfaces are compatible with 8 gigabit and 4 gigabit environments.

- Data rate:

T10000A or B: 120 megabytes/second

T10000C: 252 megabytes/second (native sustained) and 240 megabytes/second (full file host)

T10000D: 252 megabytes/second (native sustained)

Note: The actual data rate achieved is a function of the complete system, including processor, disk data rate, data block size, data compressibility, interface, I/O attachments, storage area network (SAN), and software used. Although the drive has a native data rate {252 megabytes/second (T10000C or D) or 120 megabytes/second (T10000A or B)}, other components may limit the actual effective data rate.

Access times:

- Tape load and thread to ready

T10000A or B: 16.5 seconds

T10000C: 13.1 seconds

T10000D: 13 seconds

- File access, average (includes loading)

T10000A or B: 62.5 seconds (30.5 seconds for Sport Cartridge)

T10000C: 70.1 seconds (30.6 seconds for Sport Cartridge)

T10000D: 62.5 seconds (28 seconds for Sport Cartridge)

- Rewind (maximum):

T10000A or B: 91 seconds (23 seconds for Sport Cartridge)

T10000C: 115 seconds (32.5 seconds for Sport Cartridge)

T10000D: 97 seconds (26 seconds for Sport Cartridge)

- Unload time: 23 seconds

Reliability:

- Head life: 5 years

- Uncorrected bit error rate: 1×10^{-19}

Environmental Requirements

This section lists the environmental requirements for the T10000 tape drive, and the T10000 tape cartridge.

Note: Industry best practices recommends computer rooms maintain a relative humidity of 40% to 50% for best performance.

Tape Drive Environmental Requirements

Temperature:

- Operating:
Optimal: 22°C (72°F)
Recommended: 20° – 25°C (68° – 77°F)
Ranges: 15.6° to 32.2°C (60° to 90°F) - dry bulb
- Shipping:
Optimal: 22°C (72°F)
Recommended: 20° – 25°C (68° – 77°F)
Ranges: -40° to 60°C (-40° to 140°F)
- Storing:
Optimal: 22°C (72°F)
Recommended: 20° – 25°C (68° – 77°F)
Ranges: 10° to 40°C (50° to 104°F) - dry bulb

Relative Humidity:

- Operating:
Optimal: 45%
Recommended: 40% – 50%
Ranges: 20% to 80%
- Shipping: 10% to 95%
Optimal: 45%
Recommended: 40% – 50%
Ranges: 10% to 95%
- Storing:
Optimal: 45%
Recommended: 40% – 50%
Ranges: 10% to 95%

Wet bulb (non-condensing):

- Operating: 29.2°C (84.5°F)
- Shipping: 35°C (95°F)
- Storing: 35°C (95°F)

Although the tape drive functions over the full list of ranges as specified previously, *optimal reliability* is achieved if the environment is maintained between the optimum and recommended ranges.

Tape Cartridge Environmental Requirements

Note: The acclimation time before use is 72 hours (see "[Guidelines for Handling](#)" on page A-1).

The shipping environment must not exceed the limit of the storage environment, archive or non-archive, for longer than 10 days.

The T10000 tape cartridge environmental requirements follow:

Temperature:

- Operating: 10° to 45°C (50° to 113°F)
- Storage (up to four weeks): 10° to 32°C (50° to 90°F)
- Storage (archival): 15° to 26°C (59° to 79°F)
- Shipping: -23° to 49°C (-9° to 120°F)

Relative Humidity, Non-condensing:

- Operating: 20% to 80%
- Storage (up to four weeks): 5% to 80%
- Storage (archival): 15% to 50%
- Shipping: 5% to 80%

Wet Bulb Maximum:

- Operating: 26°C (79°F)
- Storage (non-archive): 26°C (79°F)
- Storage (archival): 26°C (79°F)
- Shipping: 26°C (79°F) with no condensation

Airborne Contamination

Tape drives and media are subject to damage from airborne particles. The operating environment must adhere to the requirements listed in [Appendix F, "Controlling Contaminants"](#).

Controlling Contaminants

Control over contaminant levels in a computer room is extremely important because tape libraries, tape drives, and tape media are subject to damage from airborne particulates.

Environmental Contaminants

Control over contaminant levels in a computer room is extremely important because tape libraries, tape drives, and tape media are subject to damage from airborne particulates. Most particles smaller than ten microns are not visible to the naked eye under most conditions, but these particles can be the most damaging. As a result, the operating environment must adhere to the following requirements:

- ISO 14644-1 Class 8 Environment
- The total mass of airborne particulates must be less than or equal to 200 micrograms per cubic meter
- Severity level G1 per ANSI/ISA 71.04-1985

Oracle currently requires the ISO 14644-1 standard approved in 1999, but will require any updated standards for ISO 14644-1 as they are approved by the ISO governing body. The ISO 14644-1 standard primarily focuses on the quantity and size of particulates and the proper measurement methodology, but does not address the overall mass of the particulates. As a result, the requirement for total mass limitations is also necessary as a computer room or data center could meet the ISO 14644-1 specification, but still damage equipment because of the specific type of particulates in the room. In addition, the ANSI/ISA 71.04-1985 specification addresses gaseous contaminations as some airborne chemicals are more hazardous. All three requirements are consistent with the requirements set by other major tape storage vendors.

Required Air Quality Levels

Particles, gasses and other contaminants may impact the sustained operations of computer hardware. Effects can range from intermittent interference to actual component failures. The computer room must be designed to achieve a high level of cleanliness. Airborne dusts, gasses and vapors must be maintained within defined limits to help minimize their potential impact on the hardware.

Airborne particulate levels must be maintained within the limits of *ISO 14644-1 Class 8 Environment*. This standard defines air quality classes for clean zones based on airborne particulate concentrations. This standard has an order of magnitude less particles than standard air in an office environment. Particles ten microns or smaller

are harmful to most data processing hardware because they tend to exist in large numbers, and can easily circumvent many sensitive components' internal air filtration systems. When computer hardware is exposed to these submicron particles in great numbers they endanger system reliability by posing a threat to moving parts, sensitive contacts and component corrosion.

Excessive concentrations of certain gasses can also accelerate corrosion and cause failure in electronic components. Gaseous contaminants are a particular concern in a computer room both because of the sensitivity of the hardware, and because a proper computer room environment is almost entirely recirculating. Any contaminant threat in the room is compounded by the cyclical nature of the airflow patterns. Levels of exposure that might not be concerning in a well ventilated site repeatedly attack the hardware in a room with recirculating air. The isolation that prevents exposure of the computer room environment to outside influences can also multiply any detrimental influences left unaddressed in the room.

Gasses that are particularly dangerous to electronic components include chlorine compounds, ammonia and its derivatives, oxides of sulfur and petrol hydrocarbons. In the absence of appropriate hardware exposure limits, health exposure limits must be used.

While the following sections will describe some best practices for maintaining an ISO 14644-1 Class 8 Environment in detail, there are some basic precautions that must be adhered to:

- Do not allow food or drink into the area
- Cardboard, wood, or packing materials must not be stored in the data center clean area
- Identify a separate area for unpacking new equipment from crates and boxes
- Do not allow construction or drilling in the data center without first isolating sensitive equipment and any air targeted specifically for the equipment. Construction generates a high level of particulates that exceed ISO 14644-1 Class 8 criteria in a localized area. Dry wall and gypsum are especially damaging to storage equipment.

Contaminant Properties and Sources

Contaminants in the room can take many forms, and can come from numerous sources. Any mechanical process in the room can produce dangerous contaminants or agitate settled contaminants. A particle must meet two basic criteria to be considered a contaminant:

- It must have the physical properties that could potentially cause damage to the hardware
- It must be able to migrate to areas where it can cause the physical damage

The only differences between a potential contaminant and an actual contaminant are time and location. Particulate matter is most likely to migrate to areas where it can do damage if it is airborne. For this reason, airborne particulate concentration is a useful measurement in determining the quality of the computer room environment. Depending on local conditions, particles as big as 1,000 microns can become airborne, but their active life is very short, and they are arrested by most filtration devices. Submicron particulates are much more dangerous to sensitive computer hardware because they remain airborne for a longer time, and they are more apt to bypass filters.

Operator Activity

Human movement within the computer space is probably the single greatest source of contamination in an otherwise clean computer room. Normal movement can dislodge tissue fragments, such as dander or hair, or fabric fibers from clothing. The opening and closing of drawers or hardware panels or any metal-on-metal activity can produce metal filings. Simply walking across the floor can agitate settled contamination making it airborne and potentially dangerous.

Hardware Movement

Hardware installation or reconfiguration involves a great deal of subfloor activity, and settled contaminants can very easily be disturbed, forcing them to become airborne in the supply air stream to the room's hardware. This is particularly dangerous if the subfloor deck is unsealed. Unsealed concrete sheds fine dust particles into the airstream, and is susceptible to efflorescence -- mineral salts brought to the surface of the deck through evaporation or hydrostatic pressure.

Outside Air

Inadequately filtered air from outside the controlled environment can introduce innumerable contaminants. Post-filtration contamination in duct work can be dislodged by air flow, and introduced into the hardware environment. This is particularly important in a downward-flow air conditioning system in which the sub-floor void is used as a supply air duct. If the structural deck is contaminated, or if the concrete slab is not sealed, fine particulate matter (such as concrete dust or efflorescence) can be carried directly to the room's hardware.

Stored Items

Storage and handling of unused hardware or supplies can also be a source of contamination. Corrugated cardboard boxes or wooden skids shed fibers when moved or handled. Stored items are not only contamination sources; their handling in the computer room controlled areas can agitate settled contamination already in the room.

Outside Influences

A negatively pressurized environment can allow contaminants from adjoining office areas or the exterior of the building to infiltrate the computer room environment through gaps in the doors or penetrations in the walls. Ammonia and phosphates are often associated with agricultural processes, and numerous chemical agents can be produced in manufacturing areas. If such industries are present near the data center facility, chemical filtration may be necessary. Potential impact from automobile emissions, dusts from local quarries or masonry fabrication facilities or sea mists should also be assessed if relevant.

Cleaning Activity

Inappropriate cleaning practices can also degrade the environment. Many chemicals used in normal or *office* cleaning applications can damage sensitive computer equipment. Potentially hazardous chemicals outlined in the "[Cleaning Procedures and Equipment](#)" on page F-8 section should be avoided. Out-gassing from these products or direct contact with hardware components can cause failure. Certain biocide treatments used in building air handlers are also inappropriate for use in computer rooms either because they contain chemicals, that can degrade components, or because

they are not designed to be used in the airstream of a re-circulating air system. The use of push mops or inadequately filtered vacuums can also stimulate contamination.

It is essential that steps be taken to prevent air contaminants, such as metal particles, atmospheric dust, solvent vapors, corrosive gasses, soot, airborne fibers or salts from entering or being generated within the computer room environment. In the absence of hardware exposure limits, use applicable human exposure limits from OSHA, NIOSH or the ACGIH.

Contaminant Effects

Destructive interactions between airborne particulate and electronic instrumentation can occur in numerous ways. The means of interference depends on the time and location of the critical incident, the physical properties of the contaminant and the environment in which the component is placed.

Physical Interference

Hard particles with a tensile strength at least 10% greater than that of the component material can remove material from the surface of the component by grinding action or embedding. Soft particles will not damage the surface of the component, but can collect in patches that can interfere with proper functioning. If these particles are tacky they can collect other particulate matter. Even very small particles can have an impact if they collect on a tacky surface, or agglomerate as the result of electrostatic charge build-up.

Corrosive Failure

Corrosive failure or contact intermittence due to the intrinsic composition of the particles or due to absorption of water vapor and gaseous contaminants by the particles can also cause failures. The chemical composition of the contaminant can be very important. Salts, for instance, can grow by absorbing water vapor from the air (nucleating). If a mineral salts deposit exists in a sensitive location, and the environment is sufficiently moist, it can grow large enough to physically interfere with a mechanism or cause damage by forming salt solutions.

Shorts

Conductive pathways can arise through the accumulation of particles on circuit boards or other components. Many types of particulate are not inherently conductive, but can absorb significant quantities of water in high-moisture environments. Problems caused by electrically conductive particles can range from intermittent malfunctioning to actual damage to components and operational failures.

Thermal Failure

Premature clogging of filtered devices will cause a restriction in air flow that could induce internal overheating and head crashes. Heavy layers of accumulated dust on hardware components can also form an insulative layer that can lead to heat-related failures.

Room Conditions

Maintain a high level of cleanliness on all surfaces within the controlled zone of the data center. Trained professionals should periodically clean all surfaces on a regular

basis, as outlined in the "[Cleaning Procedures and Equipment](#)" on page F-8 section. Pay particular attention to the areas beneath the hardware and the access floor grid. Contaminants near the air intakes of the hardware can more easily be transferred to areas where they can do damage. Particulate accumulations on the access floor grid can be forced airborne when floor tiles are lifted to gain access to the sub-floor.

The subfloor void in a downward-flow air conditioning system acts as the supply air plenum. This area is pressurized by the air conditioners, and the conditioned air is then introduced into the hardware spaces through perforated floor panels. Thus, all air traveling from the air conditioners to the hardware must first pass through the subfloor void. Inappropriate conditions in the supply air plenum can have a dramatic effect on conditions in the hardware areas.

The subfloor void in a data center is often viewed solely as a convenient place to run cables and pipes. It is important to remember that this is also a duct, and that conditions below the false floor must be maintained at a high level of cleanliness. Contaminant sources can include degrading building materials, operator activity or infiltration from outside the controlled zone. Often particulate deposits are formed where cables or other subfloor items form air dams that allow particulate to settle and accumulate. When these items are moved, the particulate is re-introduced into the supply airstream, where it can be carried directly to hardware.

Damaged or inappropriately protected building materials are often sources of subfloor contamination. Unprotected concrete, masonry block, plaster or gypsum wall-board will deteriorate over time, shedding fine particulate into the air. Corrosion on post-filtration air conditioner surfaces or subfloor items can also be a concern. The subfloor void must be thoroughly and appropriately decontaminated on a regular basis to address these contaminants. Use vacuums equipped with only High Efficiency Particulate Air (HEPA) filtration in any decontamination procedure. Inadequately filtered vacuums will not arrest fine particles, passing them through the unit at high speeds, and forcing them airborne.

Unsealed concrete, masonry or other similar materials are subject to continued degradation. The sealants and hardeners normally used during construction are often designed to protect the deck against heavy traffic, or to prepare the deck for the application of flooring materials, and are not meant for the interior surfaces of a supply air plenum. While regular decontaminations will help address loose particulate, the surfaces will still be subject to deterioration over time, or as subfloor activity causes wear. Ideally all of the subfloor surfaces will be appropriately sealed at the time of construction. If this is not the case, special precautions will be necessary to address the surfaces in an on-line room.

It is extremely important that only appropriate materials and methodology are used in the encapsulation process. Inappropriate sealants or procedures can actually degrade the conditions they are meant to improve, impacting hardware operations and reliability. Take the following precautions when encapsulating the supply air plenum in an on-line room:

- Manually apply the encapsulant. Spray applications are totally inappropriate in an on-line data center. The spraying process forces the sealant airborne in the supply airstream, and is more likely to encapsulate cables to the deck.
- Use a pigmented encapsulant. The pigmentation makes the encapsulant visible in application, ensuring complete coverage, and helps in identifying areas that are damaged or exposed over time.
- It must have a high flexibility and low porosity to effectively cover the irregular textures of the subject area, and to minimize moisture migration and water damage.

- The encapsulant must not out-gas any harmful contaminants. Many encapsulants commonly used in industry are highly ammoniated or contain other chemicals that can be harmful to hardware. It is very unlikely that this out-gassing could cause immediate, catastrophic failure, but these chemicals will often contribute to corrosion of contacts, heads or other components.

Effectively encapsulating a subfloor deck in an on-line computer room is a very sensitive and difficult task, but it can be conducted safely if appropriate procedures and materials are used. Avoid using the ceiling void as an open supply or return for the building air system. This area is typically very dirty and difficult to clean. Often the structural surfaces are coated with fibrous fire-proofing, and the ceiling tiles and insulation are also subject to shedding. Even before filtration, this is an unnecessary exposure that can adversely affect environmental conditions in the room. It is also important that the ceiling void does not become pressurized, as this will force dirty air into the computer room. Columns or cable chases with penetrations in both the subfloor and ceiling void can lead to ceiling void pressurization.

Exposure Points

Address all potential exposure points in the data center to minimize potential influences from outside the controlled zone. Positive pressurization of the computer rooms will help limit contaminant infiltration, but it is also important to minimize any breaches in the room perimeter. To ensure the environment is maintained correctly, consider the following:

- Make sure all doors should fit snugly in their frames.
- Use gaskets and sweeps to address any gaps.
- Avoid automatic doors in areas where they can be accidentally triggered. An alternate means of control would be to remotely locate a door trigger so that personnel pushing carts can open the doors easily. In highly sensitive areas, or where the data center is exposed to undesirable conditions, it may be advisable to design and install personnel traps. Double sets of doors with a buffer between can help limit direct exposure to outside conditions.
- Seal all penetrations between the data center and adjacent areas.
- Avoid sharing a computer room ceiling or subfloor plenum with loosely controlled adjacent areas.

Filtration

Filtration is an effective means of addressing airborne particulate in a controlled environment. It is important that all air handlers serving the data center are adequately filtered to ensure appropriate conditions are maintained within the room. In-room process cooling is the recommended method of controlling the room environment. The in-room process coolers re-circulate room air. Air from the hardware areas is passed through the units where it is filtered and cooled, and then introduced into the subfloor plenum. The plenum is pressurized, and the conditioned air is forced into the room, through perforated tiles, which then travels back to the air conditioner for reconditioning. The airflow patterns and design associated with a typical computer room air handler have a much higher rate of air change than typical comfort cooling air conditioners so air is filtered much more often than in an office environment. Proper filtration can capture a great deal of particulates. The filters installed in the in-room, re-circulating air conditioners should have a minimum efficiency of 40% (Atmospheric Dust-Spot Efficiency, ASHRAE Standard 52.1). Install low-grade pre-filters to help prolong the life of the more expensive primary filters.

Any air being introduced into the computer room controlled zone, for ventilation or positive pressurization, should first pass through high efficiency filtration. Ideally, filter air from sources outside the building using High Efficiency Particulate Air (HEPA) filtration rated at 99.97% efficiency (DOP Efficiency MILSTD-282) or greater. Protect the expensive high efficiency filters by multiple layers of pre-filters that are changed on a more frequent basis. Low-grade pre-filters, 20% ASHRAE atmospheric dust-spot efficiency, are the primary line of defense. The next filter bank should consist of pleated or bag type filters with efficiencies between 60% and 80% ASHRAE atmospheric dust-spot efficiency.

ASHRAE 52-76	Fractional Efficiencies Percent		
	3.0 micron	1.0 micron	0.3 micron
Dust spot efficiency Percent			
25-30	80	20	<5
60-65	93	50	20
80-85	99	90	50
90	>99	92	60
DOP 95	--	>99	95

Low efficiency filters are almost totally ineffective at removing sub-micron particulates from the air. It is also important that the filters used are properly sized for the air handlers. Gaps around the filter panels can allow air to bypass the filter as it passes through the air conditioner. Fill any gaps or openings using appropriate materials, such as stainless steel panels or custom filter assemblies.

Positive Pressurization and Ventilation

A designed introduction of air from outside the computer room system will be necessary to accommodate positive pressurization and ventilation requirements. Design the data center to achieve positive pressurization in relation to more loosely controlled surrounding areas. Positive pressurization of the more sensitive areas is an effective means of controlling contaminant infiltration through any minor breaches in the room perimeter. Positive pressure systems are designed to apply outward air forces to doorways and other access points within the data processing center to minimize contaminant infiltration of the computer room. Introduce only a minimal amount of air into the controlled environment. In data centers with multiple rooms, highly pressurize the most sensitive areas. It is, however, extremely important that the air being used to positively pressurize the room does not adversely affect the environmental conditions in the room. It is essential that any air introduction from outside the computer room is adequately filtered and conditioned to ensure that it is within acceptable parameters. These parameters can be looser than the goal conditions for the room since minimal air is introduced. Base a precise determination of acceptable limits on the amount of air being introduced and the potential impact on the environment of the data center.

Because a closed-loop, re-circulating air conditioning system is used in most data centers, it will be necessary to introduce a minimal amount of air to meet the ventilation requirements of the room occupants. Data center areas normally have a very low human population density; thus the air required for ventilation will be minimal. Usually, the air needed to achieve positive pressurization exceeds that needed to accommodate the room occupants. Normally, outside air quantities of less than 5% make-up air is sufficient (ASHRAE Handbook: Applications, Chapter 17). A

volume of 15 CFM outside air per occupant or workstation should sufficiently accommodate the ventilation needs of the room.

Cleaning Procedures and Equipment

Even a perfectly designed data center will require continued maintenance. Data centers containing design flaws or compromises may require extensive efforts to maintain conditions within desired limits. Hardware performance is an important factor contributing to the need for a high level of cleanliness in the data center.

Operator awareness is another consideration. Maintaining a fairly high level of cleanliness will raise the level of occupant awareness about special requirements and restrictions while in the data center. Occupants or visitors to the data center will hold the controlled environment in high regard and are more likely to act appropriately. Any environment that is maintained to a fairly high level of cleanliness and is kept in a neat and well organized fashion will also command respect from the room's inhabitants and visitors. When potential clients visit the room they will interpret the overall appearance of the room as a reflection of an overall commitment to excellence and quality. An effective cleaning schedule must consist of specially designed short-term and long-term actions. These can be summarized as follows:

Frequency	Task
Daily Actions	Rubbish removal
Weekly Actions	Access floor maintenance (vacuum and damp mop)
Quarterly Actions	Hardware decontamination Room surface decontamination
Biennial Actions	Subfloor void decontamination Air conditioner decontamination (as necessary)

Daily Tasks

This statement of work focuses on the removal of each day's discarded trash and rubbish from the room. In addition, daily floor vacuuming may be required in Print Rooms or rooms with a considerable amount of operator activity.

Weekly Tasks

This statement of work focuses on the maintenance of the access floor system. During the week, the access floor becomes soiled with dust accumulations and blemishes. Vacuum and damp mop the entire access floor. Equip all vacuums used in the data center, for any purpose, with High Efficiency Particulate Air (HEPA) filtration. Inadequately filtered equipment cannot arrest smaller particles, but rather simply agitates them, degrading the environment they were meant to improve. It is also important that mop-heads and dust wipes are of appropriate non-shedding designs.

Cleaning solutions used within the data center must not pose a threat to the hardware. Solutions that could potentially damage hardware include products that are:

- Ammoniated
- Chlorine-based
- Phosphate-based
- Bleach enriched

- Petro-chemical based
- Floor strippers or re-conditioners

It is also important that the recommended concentrations are used, as even an appropriate agent in an inappropriate concentration can be potentially damaging. Maintain the solution in good condition throughout the project, and avoid excessive applications.

Quarterly Tasks

The quarterly statement of work involves a much more detailed and comprehensive decontamination schedule and should only be conducted by experienced computer room contamination-control professionals. Perform these actions three to four times per year, based on the levels of activity and contamination present. Thoroughly decontaminate all room surfaces including cupboards, ledges, racks, shelves and support equipment. Treat or vacuum high ledges and light fixtures and generally accessible areas as appropriate. Thoroughly treat vertical surfaces including windows, glass partitions, doors, and so forth. Special dust cloths that are impregnated with a particle absorbent material are to be used in the surface decontamination process. Do not use generic dust rags or fabric cloths to perform these activities. Do not use any chemicals, waxes or solvents during these activities.

Remove settled contamination from all exterior hardware surfaces including horizontal and vertical surfaces. Treat the unit's air inlet and outlet grilles also. Do not wipe the unit's control surfaces as these areas can be decontaminated by the use of lightly compressed air. Special care should also be taken when cleaning keyboards and life-safety controls. Use specially treated dust wipes to treat all hardware surfaces. Treat monitors with optical cleansers and static-free cloths. Do not use Electro-Static Discharge (ESD) dissipative chemicals on the computer hardware, since these agents are caustic and harmful to most sensitive hardware. The computer hardware is sufficiently designed to permit electrostatic dissipation thus no further treatments are required. After all of the hardware and room surfaces have been thoroughly decontaminated, the access floor must be HEPA vacuumed and damp mopped as detailed in the Weekly Actions.

Biennial Tasks

Decontaminate the subfloor void every 18 months to 24 months based on the conditions of the plenum surfaces and the degree of contaminant accumulation. Over the course of the year, the subfloor void undergoes a considerable amount of activity that creates new contamination accumulations. Although the weekly above floor cleaning activities will greatly reduce the subfloor dust accumulations, a certain amount of surface dirt will migrate into the subfloor void. It is important to maintain the subfloor to a high degree of cleanliness since this area acts as the hardware's supply air plenum. It is best to perform the subfloor decontamination treatment in a short time frame to reduce cross contamination. The personnel performing this operation must be fully trained to assess cable connectivity and priority. Inspect and assess each exposed area of the subfloor void individually for possible cable handling and movement. All twist-in and plug-in connections must be checked and fully engaged before cable movement. All subfloor activities must be conducted with proper consideration for air distribution and floor loading. In an effort to maintain access floor integrity and proper psychrometric conditions, carefully manage the number of floor tiles removed from the floor system. Each work crew should usually have no more than 24 square feet (six tiles) of open access flooring at any one time. The access floor's supporting grid system should also be thoroughly decontaminated, first by vacuuming the loose debris and then by damp-sponging the accumulated residue.

Rubber gaskets, if present, as the metal framework that makes up the grid system must be removed from the grid work and cleaned with a damp sponge. Note and report any unusual conditions, such as damaged floor suspension, floor tiles, cables and surfaces, within the floor void.

Activity and Processes

Isolation of the data center is an integral factor in maintaining appropriate conditions. Avoid all unnecessary activity in the data center, and limit access to necessary personnel only. Limit periodic activity, such as tours, and restrict traffic away from the hardware to avoid accidental contact. Train all personnel working in the room, including temporary employees and janitorial personnel, in the most basic sensitivities of the hardware to avoid unnecessary exposure. Thoroughly isolate the controlled areas of the data center from contaminant producing activities. Ideally, print rooms, check sorting rooms, command centers or other areas with high levels of mechanical or human activity should have no direct exposure to the data center. Paths to and from these areas should not necessitate traffic through the main data center areas.

Glossary

This glossary defines terms and abbreviations in this publication.

Some of the definitions are taken from other glossaries. The letters in the parentheses that follow some definitions indicate the source of the definition:

(A) *The American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI).

(E) The ANSI/Electronic Industries Association (EIA) Standard-440-A, *Fiber Optic Terminology*.

(I) *The Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and International Electro-technical Commission (ISO/IEC/JTC1/SC1).

(IBM) *The IBM Dictionary of Computing*, copyright 1994 by IBM.

(T) Draft international standards committee drafts, and working papers being developed by the ISO/IEC/JTC1/SC1.

accessory rack

An area of the drive and electronics module that is used for SL8500 library electronic and power equipment and for other standard 19-inch rack-mount electronic equipment. Up to four racks are permitted in the electronics/drive assembly. Rack-mount equipment must be on the approved equipment list.

adapter

Any hardware that joins different connector types.

address

A character or group of characters that identifies a register, a particular part of storage, or some other data source or destination. (A).

alphanumeric

A character or group of characters that identifies a register, a particular part of storage, or some other data source or destination. (A).

arbitrated loop

A Fibre Channel interconnect topology in which all parts are connected in a common loop. Before transmitting data, devices must participate in arbitration to gain control of the loop.

arbitrated loop physical address (AL_PA)

A one-byte value that identifies a port in an arbitrated loop topology.

arbitration

Any process by which a user of shared resources negotiates with other users for the right to use the resource. A port connected to a shared bus must win arbitration before it transmits data on the bus.

buffered write tape mark

A command that separates record data from standard labels or other record data. This command only adds the tape mark to the data buffer without data synchronization to the tape media.

cartridge

A storage device that consists of magnetic tape on a supply reel in a protective housing.

cascading

The process of connecting two or more Fibre Channel switches together to increase the number of ports or to extend distances.

channel

A functional unit, controlled by the processor (or host), that handles the transfer of data between processor storage and local peripheral equipment. (IBM)

cleaning cartridge

A data cartridge that contains special material to clean the tape path in a transport or drive.

compress

To save space by eliminating gaps, empty fields, redundancy, or unnecessary data to shorten the length of records or files. (IBM)

condition

One of a set of specified values that a data item can assume. (IBM)

conditioning time

The amount of time to prepare a tape cartridge for use in a T10000 Tape Drive.

configuration

The manner in which the hardware and software of an information processing system is organized and interconnected. (T)

connector

An electrical or optical part that joins two or more other parts.

coupler

Fiber-optic hardware that joins optical fiber connectors of the same type.

data path key management (DPKM)

The use of the SCSI 4 commands Security Protocol In and Security Protocol Out to implement host-based key management encryption on StorageTek tape drives.

data rate

The speed of a data transfer process, usually expressed in bits per second or bytes per second. (IBM)

data security erase (DSE)

A random binary pattern over-writing existing data from the point of an Erase command to the end-of-tape.

data tape

A data cartridge formatted for use as a regular data tape for the system in which it is used.

data tracks

The regions of recorded tape containing user data formed as discreet longitudinal tracks (similar to railroad tracks).

diagnostics

Pertaining to the detection and isolation of errors in programs and faults in equipment.

DPKM

See data path key management.

drive

A drive controls the movement of the tape and records or reads the data on the tape as desired by the customer.

DSE

See data security erase.

dump

To copy the contents of all or part of storage to collect error information.

dynamic host configuration protocol (DHCP)

A network protocol that enables a server to automatically assign an IP address to devices on a network. DHCP assigns a number dynamically from a defined range of numbers for a given network.

dynamic world wide name (dWWN)

A feature that applies dynamic names to network devices rather than fixed names. When a dWWN-named device is replaced, it is assigned the same WWN as the one it replaced, preventing re-configuration of the network.

emulation

The use of programming techniques and special machine features to permit a computing system to execute programs written for another system. (IBM)

encryption

The translation of data into a secret code. Encryption is one of the most effective ways to achieve data security. To read an encrypted file, you must have access to a special key or password that enables you to decipher it.

end of block (EOB)

A code that marks the end of a block of data. (IBM)

end of file (EOF)

A coded character recorded on a data medium to indicate the end of the medium. (IBM)

end-of-file label

1. An internal label indicating the end of a file and possibly containing data for file control. (T)
2. Synonymous with trailer label.

end-of-tape marker (EOT)

A marker on a magnetic tape to indicate the end of the permissible recording area. (IBM)

environmental requirement

Any of the physical conditions required for the protection and proper operation of a functional unit; the requirement is usually specified as a nominal value and a tolerance range. For a device, there may be more than one set of environmental requirements; for example, one set for transport, another for storage, and another for operation. (T) (A)

EOT

End of tape.

erase

To remove data from a data medium, leaving the medium available for recording new data. (I) (A)

error

A discrepancy between a computed, observed, or measured value or condition and the true, specified, or theoretically correct value or condition. (I) (A)

ESD

Electrostatic Discharge.

F_Port

A port in a fabric to which an N_Port or NL_Port attaches.

fabric

The Fibre Channel topology similar to a telephone switch in that the initiator of a call to the receiving port simply provides the receiver with the port address, and the fabric routes the transmission to the correct port. A fabric differs from a point-to-point or arbitrated loop topology in that it provides for interconnections between ports without having a point-to-point connection. The fabric also serves as a media-type converter.

fault symptom code (FSC)

A four-character hexadecimal code generated in response to an error to help isolate failures within the device. Some FSCs are for information purposes only.

FC

See Fibre Channel.

fiber optics

The branch of optical technology concerned with the transmission of radiant power through fibers made of transparent materials such as glass, fused silica, and plastic. (E)

fiber-optic cable

A cable made of ultra-thin glass or silica fibers which can transmit data using pulses of laser light. Fiber-optic cables have several advantages over copper cables: they have much less signal loss; they allow information to be transmitted at higher speeds and over longer distances; they are not affected by external electrical noise; and they are better for transmissions which require security.

fiber-optic connector

One of several types of devices used to join pairs of optical fibers together.

Fibre Channel

The National Committee for Information Technology Standards standard that defines an ultrahigh-speed, content-independent, multilevel data transmission interface that supports multiple protocols simultaneously. Fibre Channel supports connectivity to millions of devices over copper or fiber-optic physical media and provides the best characteristics of both networks and channels over diverse topologies.

fibre connection (FICON)

An ESA/390 and zSeries computer peripheral interface. The I/O interface uses ESA/390 and zSeries FICON protocols (FC-FS and FC-SB-2) over a Fibre Channel serial interface that configures units attached to a FICON-supported Fibre Channel communications fabric.

FICON channel

A channel having a Fibre Channel connection (FICON) channel-to-control-unit I/O interface that uses optical cables as a transmission medium. May operate in either FC or FCV mode.

file-protect

To prevent the erasure or overwriting of data stored on data cartridges. *See also* write-protect switch.

file sync

A sync operation or command used to force data to tape.

- For FICON: The command protocol is a tape mark command without a count field.
- For Fibre Channel: The command protocol is not an actual synch command. It is a tape mark command that includes a count field. A count equal to zero indicates a file synch.

firmware

An ordered set of instructions and data stored in a way that is functionally independent of main storage; for example, microprograms stored in a ROM. (T) *See also* microcode.

FL_Port

A special type of fabric port that an arbitrated loop uses to connect N_Ports and NL_Ports into a fabric, thus making a public loop.

FRU

Field replaceable unit.

FSC

Fault symptom code.

full duplex

A communication protocol that enables signals to be transmitted and received simultaneously.

gateway

A 32-bit, or 4-byte, number in dotted decimal format (typically written as four numbers separated by periods, such as 107.4.1.3 or 84.2.1.111) that is applied to an IP Address to identify router interface.

Gb

Gigabit, equal to 10^9 bits.

Gbps

Gigabits per second.

gigabyte (GB)

One billion (10^9) bytes. When referring to disk and tape capacity, one GB equals 1,000,000,000 bytes.

When referring to memory capacity, one GB equals 1,073,741,824 in decimal notation or 2^{30} bytes.

gripper

The portion of the hand assembly that grasps the cartridge.

hand assembly

A part of the library robot whose function is to grasp cartridges and move them between storage slots and drives. A camera on the hand assembly reads cartridge volume labels.

hardware

All or part of the physical components of an information processing system, such as computers or peripheral devices. (T) (A)

host

The primary computer on a network with which other computers interact.

host bus adapter (HBA)

A circuit installed in a multi-platform host or device that interfaces between the device and the bus.

host interface

An interface between a network and host computer. (T)

hub

A Fibre Channel Arbitrated Loop switching device that enables multiple servers and targets, such as storage systems, to connect at a central point. A single hub configuration appears as a single loop.

indicator

A device that provides a visual or other indication of the existence of a defined state. (T)

initial program load (IPL)

A process that activates a machine reset and loads system programs to prepare a computer system for operation. Processors having diagnostic programs activate these programs at initial program load execution. Devices running firmware usually reload the functional firmware from a diskette or disk drive at initial program load execution.

initialization

The operations required for setting a device to a starting state, before the use of a data medium, or before implementation of a process. (T)

interface

Hardware, software, or both, that links systems, programs, or devices. (IBM)

internet protocol (IP)

A protocol used to route data from its source to its destination in an Internet environment. (IBM)

internet protocol v4 (IPv4) address

A four-byte value that identifies a device and makes it accessible through a network. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be from 0 to 255. For example, 129.80.145.23 could be an IP address.

internet protocol v6 (IPv6) address

The next generation internet protocol. It provides a much larger address space than IPv4. This is based upon the definition of a 128-bit address - IPv4 used a 32-bit address. The IPv6 address format is eight fields of four hexadecimal characters separated by colons (for example, 2001:0db8:85a3:0000:0000:8a2e:0370:7334)

IP

See internet protocol.

IPL

See initial program load.

LC connector

A standard connector for 2-Gbps or 4-Gbps Fibre Channel data transfer. This type of connector is used on fiber-optic cables.

library

A robotic system that stores, moves, mounts, and dismounts data cartridges that are used in data read or write operations.

link

A physical connection (electrical or optical) between two nodes of a network.

logical path

A relationship between a channel and control unit that designates the physical path to be used for device-level communication between each entity, defined by a link address assigned to each entity.

magnetic tape

A tape with a magnetizable layer on which data can be stored. (T)

magnetic tape drive

A mechanism for moving magnetic tape and controlling its movement.

MB

Megabytes or 1,000,000 bytes for disk or tape storage but 1,048,576 (2^{20}) bytes of memory capacity.

menu

A list of options displayed to the user by a data processing system, from which the user can select an action to be initiated. (T)

microcode

A code, representing the instructions of an instruction set, that is implemented in a part of storage that is not program-addressable. (IBM)

multi mode

A graded-index or step-index optical fiber that enables more than one bound mode to propagate. (E) Contrast with single mode.

multimode fiber

An optical fiber designed to carry multiple signals, distinguished by frequency or phase, at the same time.

N_Port

A port that connects a node to a fabric or to another node.

net mask

A 32-bit, or 4-byte number, in dotted decimal format (typically written as four numbers separated by periods, such as 255.255.0.0 or 255.255.255.0) that is applied to an IP address to identify the network and node address of a host or router interface. (*Synonymous* with subnet mask.)

network

An arrangement of nodes and branches that connects data processing devices to one another through software and hardware links to facilitate information interchange.

nexus

A connection that exists between an initiator, a target, and a logical unit. This is where one initiator port talks to one target port, addressing one LUN and together they execute a task.

NL_Port

A port attached to a node for use in the point-to-point arbitrated loop and fabric topologies of Fibre Channel. The NL_Port is configured as a private or a public loop.

node

A device that contains a minimum of one N_Port, one NL_Port, or both.

offline

Neither controlled by, nor communicating with, a computer. (IBM)

online

Pertaining to the operation of a functional unit when under the direct control of the computer. (T)

operator control panel

A functional unit that contains switches used to control all or part of a computer and possibly the indicators giving information about its functioning. (T)

performance

One of two major factors on which the total productivity of a system depends. Performance is largely determined by a combination of throughput, response time, and availability. (IBM)

point-to-point

A topology in which exactly two ports communicate. In Fibre Channel, the two ports are N_Ports.

port

A specific communications end point within a host. A port is identified by a port number. (IBM) (2) In Fibre Channel, an access point in a device where a link attaches.

private loop

A Fibre Channel arbitrated loop with no fabric attachment.

Private NL_Port

An NL_Port that does not attempt a Fabric Login.

protocol

A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. (I)

public loop

A Fibre Channel arbitrated loop with an attachment to a fabric.

Public NL_Port

An NL_Port that attempts a Fabric Login.

R/W

Read or write

read/write head

The data sensing and recording unit of a tape drive. (IBM)

reclaim

The act of overwriting a legacy data cartridge by a newer generation drive. For example, a cartridge written by a T10000A drive can be overwritten (reclaimed) by a T10000B drive while a cartridge written by a T10000B drive can be reclaimed by a T10000A drive.

release

A distribution of a new product or new function and fixes for an existing product. (IBM)

rewind

To move tape from the take-up hub to the supply hub. (IBM)

SC connector

A standard connector for 1-Gbps Fibre Channel data transfer. This type of connector is used on fiber-optic cable.

serial transmission

A transmission in which bits are sent in a stream in a single fiber.

single mode fiber

Optical fiber in which only the lowest-order bound mode can propagate at the wavelength of interest. (E)

small form-factor pluggable (SFP)

Technology with a 2-gigabit or 4-gigabit transfer speed over smaller connectors, cables, and transceivers for larger bandwidth capability.

submenu

A menu related to and reached from a main menu. (IBM)

subsystem

A system that is part of some larger system.

switch

In Fibre Channel technology, a device that connects Fibre Channel devices together in a fabric.

system

A combination of functionally interrelated interacting mechanical and electrical elements designed to work as a coherent entity.

tape

See magnetic tape.

tape cartridge

A container holding magnetic tape that can be processed without separating the tape from the container.

tape drive

A device for moving magnetic tape and controlling its movement. (T)

TB

See terabyte.

TCP/IP

Transmission Control Protocol/Internet Protocol.

terabyte (TB)

A unit of measure equal to one trillion (10^{12}) bytes of disk or tape storage capacity. When referring to memory capacity, one TB equals 1,099,511,627,776 in decimal notation or 2^{40} bytes.

transmission control protocol/internet protocol (TCP/IP)

A set of communication protocols that support peer-to-peer connectivity functions for both local and wide area networks. (IBM)

vary offline

To change the status of a device from online to offline. When a device is offline, no data set may be opened on that device. (IBM)

vary online

To restore a device to a state where it is available for use by the system. (IBM)

virtual operator panel (VOP)

A software application that enables a user to monitor and perform some operations on one or more tape drives remotely.

VolSafe

VolSafe (volume safe) is a special feature that provides write once, read many (WORM) technology to VolSafe-designated tape cartridges. VolSafe permits new data to only append the tape media, while it prevents erasure or overwrite of previously written data.

volume serial number (VOLSER)

An alphanumeric label that the host software uses to identify a volume. It attaches to the spine of a cartridge and is both human- and machine-readable.

VOP

See virtual operator panel.

world wide name (WWN)

A 64-bit integer that identifies a Fibre Channel port.

World Wide Node Name (WWNN)

A 64-bit network address that identifies the company (in IEEE format) with a vendor specific identifier.

World Wide Port Name (WWPN)

A 64-bit network address that identifies the port name.

wrap

A single pass of tape from either BOT to EOT or EOT to BOT with the heads in a fixed transverse location.

write-enabled

A setting on a data cartridge that enables data to be written on the tape.

write once read many (WORM)

A storage classification for media that can be written only once but read many times.

write operation

An output operation that sends a processed record to an output device or output file. (IBM)

write-protected

A setting on data cartridges that prevents data from being written on the tape. Reading data is still possible.

write tape mark

A command that separates record data from standard labels or other record data. This command implies buffered data synchronization to tape media.

- For FICON: The command protocol is a tape mark command without a count field.
- For Fibre Channel: The command protocol includes a count field. A count field greater than zero indicates “count” number of physical tape marks must be written to tape.

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