StorageTek T10000 Tape Drive

Systems Assurance Guide

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T10000 Tape Drive Systems Assurance Guide

E20715-02

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Preface

The worksheets provided in this guide are part of the systems assurance process and enable the exchange of information to ensure that no aspects of the sale, order, or installation processes are overlooked.

The intended readers of this document are:

- Account Executives
- System Engineers
- Installation Coordinators
- Technical Specialists and Professional Services personnel
- Customer Service Representatives
- Marketing and Sales personnel
- Anyone interested in information about Oracle's StorageTek T10000 tape drive family

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/support/contact.html or visit http://www.oracle.com/accessibility/support.html if you are hearing impaired.

What's New

Added the Controlling Contaminants appendix.

Updated the management software requirements.

Updated the document template.

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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. There are currently three models in the T10000 drive family: T10000A, T10000B, and T10000C. FIGURE 1-1 shows examples of the tape drive in three library tray configurations.

> **Note –** The tape drives are also called T10000, tape drive, or just drive throughout this guide.

FIGURE 1-1 T10000 Tape Drive Library Configurations

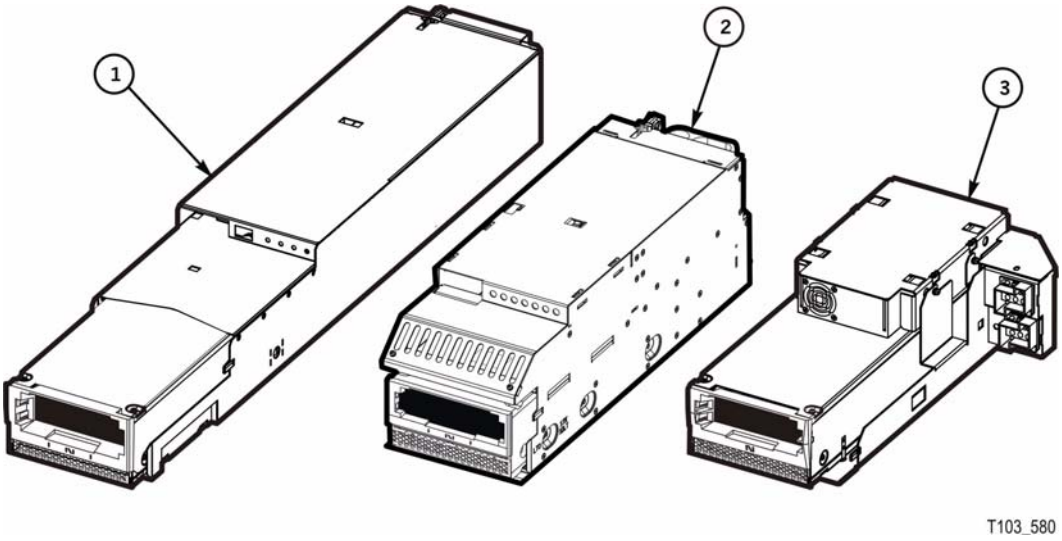


Illustration call-outs:

1. SL8500 configuration
2. SL3000 configuration
3. L180, L700, L700e, and L1400M configuration (T10000A or T10000B only)

Description

The tape drive is 8.89 centimeters (3.5 inches) high, 14.6 centimeters (5.75 inches) wide, and 42.55 centimeters (16.75 inches) deep. The host connections to the tape drive are fiber-optic, such as Fibre Channel and FICON, and provide a high rate of data transfer. The drive uses a single-reel tape cartridge and a technology called partial response, maximum likelihood (PRML) to provide the high-density data format that allows the:

- T10000A to record and store up to 500 gigabytes (GB) of uncompressed data
- T10000B to record and store up to 1 terabyte (TB) of uncompressed data
- T10000C to record and store up to 5 terabytes (TB) of uncompressed data

Tape Drive Components

The tape drive contains the following electrical and mechanical components:

- **Control processor:** Controls all drive functions and contains the embedded firmware.
- **ADC technology:** Performs data compression and decompression. ADC is an adaptive lossless data compression technique.
- **Specialized buffers:** Hold the data in a form written on tape and read back to the host.
- **Read/Write circuitry (Read/Write heads):** Uses PRML complemented by magneto-resistive (MR) head technologies that provide 32 channels (two 16-channel heads) to write data to the tape and read it back. Dual head technology increases data integrity, promotes longer media life, and achieves high transfer rates.
- **Encryption circuitry:** When enabled, encrypts and decrypts data.
- **Head cleaner:** Removes loose debris from the head during a cartridge unload.
- **Data buffer:** The T10000A/B drive has a 256 megabyte data buffer. The T10000C drive has a 2 gigabyte data buffer.
- **Variable speed servo system:** A variable speed servo system allows the tape drive to run at discrete speeds and tension.
- **Loader:** Loads the cartridge and engages it with the cartridge motor.
- **Threader:** Threads tape through the tape path to the take up reel during a load and returns the tape to the cartridge during an unload.
- **Tape path:** Guides the tape past the read/write heads.
- **Ethernet port:** Provides a connection that supports items such as encryption keys, the virtual operator panel, or the Service Delivery Platform (SDP). The drives support IPv4 and IPv6 addresses (see "Network Selections" on page 63).
- **TTI interface:** Transfers commands and status between the drive and the library.
- **RFID (Radio Frequency Identification) system:** Provides an interface to a memory chip in the tape cartridge.

FIGURE 1-2 shows elements of the tape path in the T10000A/B tape drive. The tape path of the T10000C is similar.

FIGURE 1-2 T10000A Tape Path

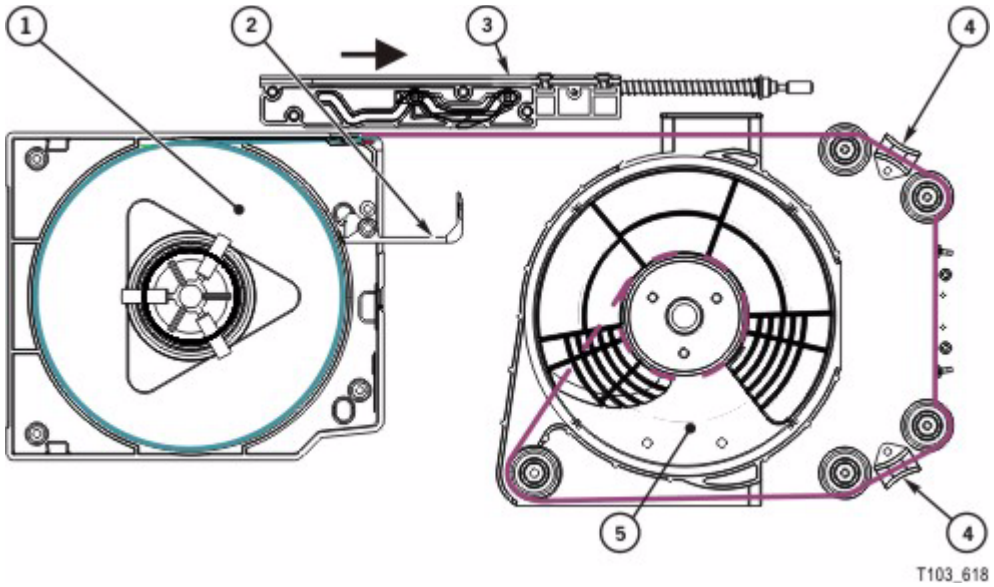


Illustration call-outs (5):

1. Tape cartridge and loader (elevator)
2. Tape cartridge door
3. Buckler
4. Tape path rollers and guides
5. Take-up reel, motor, and hub assembly

Small Form-factor Pluggable Modules

There are two different types of small form-factor pluggable (SFP) modules depending on the *wavelength* (mode) and type of cable:

- Short wavelength SFP module is used with 50-micron multimode cables.
- Long wavelength SFP module is used with 9-micron single mode cables.

The tape drive has two ports, and it can be configured with both ports using:

- Short wavelength SFPs
- Long wavelength SFPs
- Mixed wavelength SFPs (one short wavelength and one long wavelength)

TIP – When planning the network, make sure the SFP module supports the specific network type and configuration including HBAs, switches, wavelength, and cable types.

Power Supply Modules

FIGURE 1-3 shows ways to provide power to the T10000 tape drive depending on the configuration:

FIGURE 1-3 Power Supply Modules

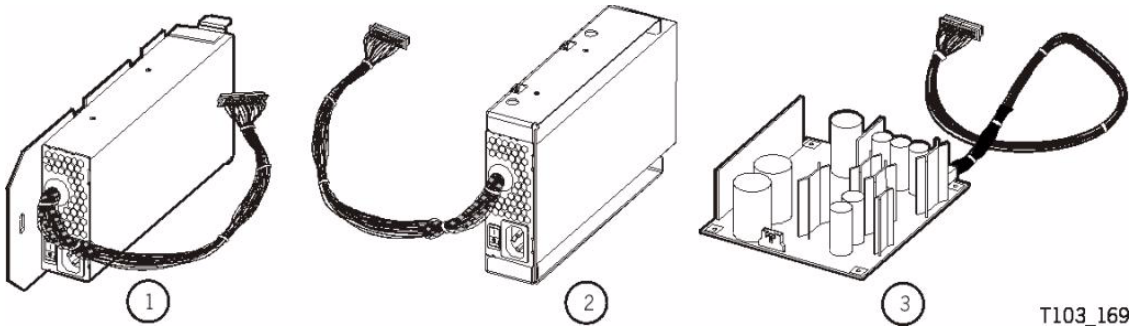


Illustration call-outs (3):

1. AC power supply for the 9741E drive cabinet (T10000A only)
2. AC power supply for the rack chassis and L-Series libraries (T10000A/B only)
3. DC power supply (SL8500 and SL3000 libraries)

- In an SL3000 or SL8500 configuration: the T10000 receives operating voltages from an *internal* DC power module located inside the drive tray.
- In a rack mount configuration: the drive receives operating voltages from an *external* AC power supply module mounted inside the rack tray (chassis).
- In an L-Series library configuration: the T10000 receives operating voltages from an *external* AC power supply module installed above the drive.
- In a 9741E cabinet configuration: the drive receives operating voltages from an *external* AC power supply module mounted inside the cabinet.

All versions of the power supply are field replaceable units (FRUs) with no other servicing requirements. If the power module fails, replace it with another module.

> **Note –** Even though the power supplies look similar and have the same dimensions as other T-Series tape drive power supplies, *the T10000 power supplies are unique to the particular T10000 tape drive model*.

External Power Supply Modules

The external power supply is used in the rack mount chassis, the L-series libraries (T10000A/B drive only), or the 9741E cabinet (T10000A drive only).

Power supply physical dimensions:

- Width: 14.7 centimeters (5.77 inches)
- Depth: 20.4 centimeters (8.04 inches)
- Height: 4.7 centimeters (1.83 inches)

- Weight: 1.4 kilograms (3.5 pounds) or 2.38 kilograms (5.25 pounds) L-series library

Power supply specifications:

- Input voltage: 88 to 264 volts AC
- Input frequency: 48 to 63 Hertz
- Power consumption: 58 Watts (drive only) or 90 Watts (drive and power supply)
- Power dissipation: 420 Btu per hour

Maintenance Port Use

All Oracle service calls to tape drives under warranty or maintenance contract require physical access and connection to the drive maintenance (Ethernet) port. In the event that a customer has an Ethernet cable physically connected to the drive requiring service, the service representative must disconnect the cable to perform the required service action.

- T10000 non-encryption drives supported by the Service Delivery Platform (SDP) require 100% dedication of the drive's Ethernet port to the SDP site unit.
- T10000 encryption-enabled drives require 100% dedication of the drive's Ethernet port to the Encryption Service Network except during service activities by Oracle or Oracle-certified service partners.

Where Encryption and SDP co-exist, 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 or 2.x environments
- Virtual Operator Panel (VOP) customer versions or service versions
- Service Delivery Platform (SDP)
- Services Tape Health Check Tool
- StorageTek Diagnostic System (STDS)

Encryption

The tape drive has built-in encryption and works in conjunction with the Oracle Key Manager (OKM) or Crypto Key Management System (KMS) to encrypt and decrypt data written by the T10000 tape drive. With KMS 2.1, or higher, and:

- Drive code level 1.40.108, 1.41.110, or 1.41.111; the T10000A drive complies with FIPS 140-2 Level 1
- Drive code level 1.40.208, 1.41.210, or 1.41.211; the T10000B drive complies with FIPS 140-2 Level 2
- Initial drive code release for the T10000C complies with FIPS 140-2 Level 1.

Note – Level 1 has production-grade requirements (the lowest level). Level 2 has requirements for physical tamper evidence and role-based authentication.

Things to note about the tape drive are:

- The same drive is capable of either encryption or non-encryption, *not both*
- An LED indicates when encryption is enabled
- The Ethernet port on the tape drive is used to obtain encryption keys

The data path key management (DPKM) subsystem is the third installment of encryption on 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 allows the user to have a mix of encrypted/non-encrypted files on each tape cartridge. DPKM support is available with drive code level 1.41.x10 or higher. You use VOP to enable or disable the DPKM capability of the tape drive.

Tape Drive Features

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). The *StorageTek T10000 Tape Drive Fibre Channel Reference Manual* describes how to use this feature.

StorageTek Maximum Capacity

Maximum Capacity allows the use of tape capacity that is normally reserved to ensure tape-to-tape copy operations succeed. This can increase the capacity by five to ten percent. The *StorageTek T10000 Tape Drive Fibre Channel Reference Manual* describes how to use this feature.

StorageTek File Sync Accelerator

The StorageTek File Sync Accelerator (FSA) allows applications to reduce or eliminate back hitches that are normally caused by writing a tape mark or other sync operations. This feature can be disabled from the Virtual Operator Panel.

StorageTek Tape Application Accelerator

The StorageTek Tape Application Accelerator (TAA) avoids back hitches by converting tape marks to buffered tape marks and syncs to NO-OPs. The feature is enabled with Virtual Operator Panel, but is only available with FICON.

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.

StorageTek Search Accelerator

The StorageTek Search Accelerator (SSA) allows FICON applications to search for a string up to 1024 bytes in length. This feature can be used to enhance Mainframe HSM Audit performance in FICON environments.

StorageTek MIR Assisted Search

The StorageTek T10000C tape drive supports 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.

StorageTek In-Drive Reclaim Accelerator

The StorageTek In-Drive Reclaim Accelerator (IDR) allows 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 and T10000C drives. For more detailed information about this feature, contact your local sales representative to obtain a copy of the *ALP User's Guide*.

StorageTek Tape Tiering Accelerator

The StorageTek T10000C has 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) allows partitions to be read only.
- TTA allows up to 480 logical volumes on a cartridge.

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

Specifications

This section lists the performance, physical, and environmental specifications for the T10000 tape drive.

Tape Drive Performance Specifications

Capacity and Performance:

- Capacity, native

  T10000A: 500 gigabytes (5×10^{11} bytes)

  T10000B: 1 terabyte (1×10^{12} bytes)

  T10000C: 5 terabytes (5×10^{12} bytes)

- Capacity (Sport Cartridge)

  T10000A: 120 gigabytes

  T10000B: 240 gigabytes

  T10000C: 1 terabyte (1×10^{12} bytes)

- Data buffer size

  T10000A/B: 256 megabytes

  T10000C: 2 gigabytes

- 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 (read only)

    T10000C: 5.62 meters/second
  - File search and locates:

    T10000A/B: 8.0 to 12 meters/second (varying speeds)

    T10000C: 10 to 13 meters/second (varying speeds)
  - High speed rewind:

    T10000A/B: 8.0 to 12 meters/second (varying speeds)

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

Interfaces:

- Types:

  T10000A: 2 gigabit/4 gigabit Fibre Channel and FICON

  T10000B/C: 4 gigabit Fibre Channel and FICON

- Data rate:

  T10000A/B: 120 megabytes/second

  T10000C: 240 megabytes/second

Access times:

- Tape load and thread to ready

  T10000A/B: 16.5 seconds

  T10000C: 13.1 seconds

- File access, average (includes loading)

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

  T10000C: 73.5 seconds (34 seconds for Sport Cartridge)

- Rewind (maximum):

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

  T10000C: 115 seconds (32.5 seconds for Sport Cartridge)

- Unload time: 23 seconds

Reliability:

- Head life: 5 years
- Uncorrected bit error rate: 1×10^{-19}
- Undetected bit error rate: 1×10^{-33}

Physical Specifications

- Width:
  - 14.6 centimeters (5.77 inches) drive [includes cartridge bezel]
  - 48.3 centimeters (19 inches) rackmount tray
- Depth:
  - Drive:
    - 43.3 centimeters (17 inches) T10000A/B [includes cartridge bezel and D connector]
    - 42.7 centimeters (16.8 inches) T10000C [includes cartridge bezel and SFP modules]
  - Rackmount tray: 64 centimeters (25 inches)
- Height: 81 millimeters (3.2 inches)
- Weight:
  - Rackmount tray: 18.6 kilograms (41 pounds) single drive or 25 kilograms (55 pounds) dual drive
  - SL8500 tray: 9.4 kilograms (20.75 pounds)

- SL3000 tray: 10.1 kilograms (22.25 pounds)
- L-series (T10000A/B only): 8.3 kilograms (18.3 pounds)
- 9310 (T10000A only): 6.9 kilograms (15.25 pounds)

Environmental Requirements

Note – Although the T10000 will function over the full list of ranges as specified below, you will achieve *optimal reliability* by maintaining the environment within the recommended ranges.

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°C (84°F)
- Shipping: 35°C (95°F)
- Storing: 35°C (95°F)

TIP – Industry best practices recommend computer rooms maintain a relative humidity of 40% to 50% for best performance.

Airborne Contamination

Tape drives and media are subject to damage from airborne particulates. The operating environment must adhere to the requirements listed in "Controlling Contaminants" on page 95.

Configurations

The T10000 tape drives are available in configurations for StorageTek libraries or for rack mounting.

Library Configurations

- SL3000: Holds from 200 to 6,000 cartridges with up to 56 T10000 tape drives.
- SL8500: A single SL8500 holds up to 10,000 cartridges with up to 64 T10000 tape drives.
- L-series

  Note – The T10000C tape drive is not supported in the L-series libraries.

  - L180: Holds from 84 to 174 cartridges with up to 6 T10000A/B tape drives.
  - L700: Holds from 216 to 678 cartridges with up to 12 T10000A/B tape drives.
  - L700e: Holds from 300 to 1,344 cartridges with up to 24 T10000A/B tape drives when two libraries are connected with a pass-thru port (PTP).
  - L1400M: Holds from 300 to 1,344 cartridges with up to 24 T10000A/B tape drives.
- 9310

  Note – The 9310 library does not support the T10000B or T10000C tape drives.

  A single 9310 holds up to 6,000 cartridges with up to 80 T10000A tape drives on four drive walls with the 9741E drive cabinet.

See "Library Installation Requirements" on page 59.

Rack Mount Configurations

A drive tray for a rack contains either one or two tape drives (see FIGURE 1-4).

A rack can hold either 6 manual-mount drives with *one* drive per tray (chassis), 12 manual-mount drives with *two* drives per tray, or a combination of *both* single-drive and dual-drive trays. See "Rack Mount Configurations" on page 62 for more information.

FIGURE 1-4 Rack Mount Configuration

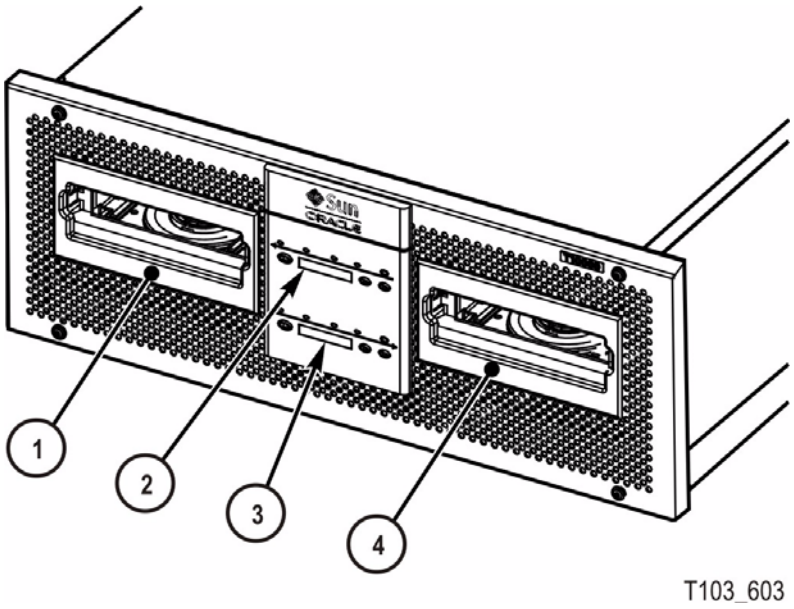


Illustration call-outs (4):

1. Drive A (left)
2. Operator panel A (top center)
3. Operator panel B (bottom center)
4. Drive B (right)

Virtual Operator Panel

The virtual operator panel allows operators and service representatives to monitor and perform tasks on a single tape drive. You can install the VOP software on a variety of platforms, such as Windows, Solaris, and Linux.

The VOP uses a standard RJ-45 Ethernet connection to the tape drive.

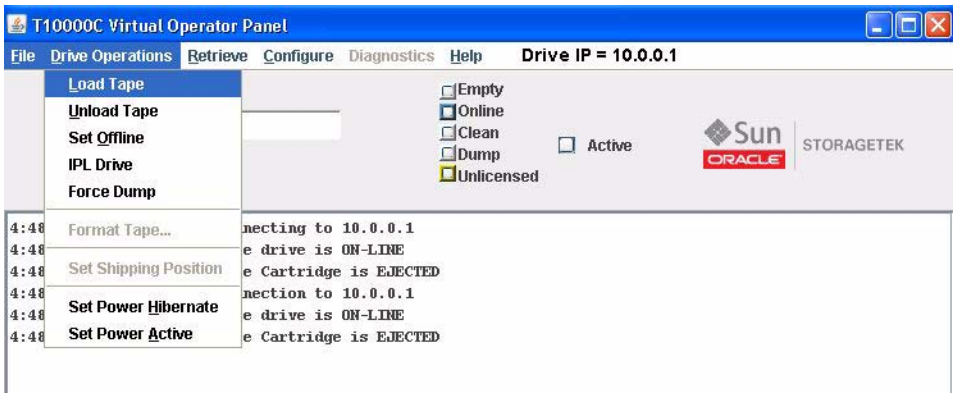
> **Note –** VOP version 1.0.13 or higher in conjunction with the appropriate drive code level supports the use of an IPv6 address.

You can use VOP to:

- Perform drive operations
- Retrieve error information
- Configure the tape drive
  - License and enroll a drive for encryption in a KMS or OKM solution
  - Data path key management (DPKM)
- Run diagnostic routines (service representative version only)

FIGURE 1-5 shows an example of the virtual operator panel (VOP) graphical user interface (GUI) for the T10000 tape drive.

FIGURE 1-5 Virtual Operator Panel



Tape Cartridge

The T10000 supports five types of cartridges:

- StorageTek T10000 T1 cartridge (T10000A/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 tape drive):
  - Data, standard: *5* terabytes
  - Data, sport: *1* terabyte
  - VolSafe, capacity: *5* terabytes
  - VolSafe, sport: *1* terabyte
  - Cleaning cartridge: 50 uses (CC or CL cartridge)

Included inside the cartridge is a Radio Frequency Identification (RFID) memory chip that stores information about the cartridge and its performance over time. The Radio Frequency Identification technology is composed of a:

- Memory chip in the cartridge
- Module in the drive to retrieve information from the chip

All cartridges include a cartridge label area, a cartridge door, and a write protect switch. FIGURE 1-6 on page 29 shows an example of the T10000 tape cartridge.

> **Caution –** *Servo track damage:* Bulk-erase destroys pre-recorded servo tracks.
> **Do not degauss StorageTek T10000 or T10000 T2 tape cartridges.**

See Appendix A, “Tape Cartridges” for:

- More information about the tape cartridges
- Examples of labels
- Specifications

FIGURE 1-6 Tape Cartridge Introduction

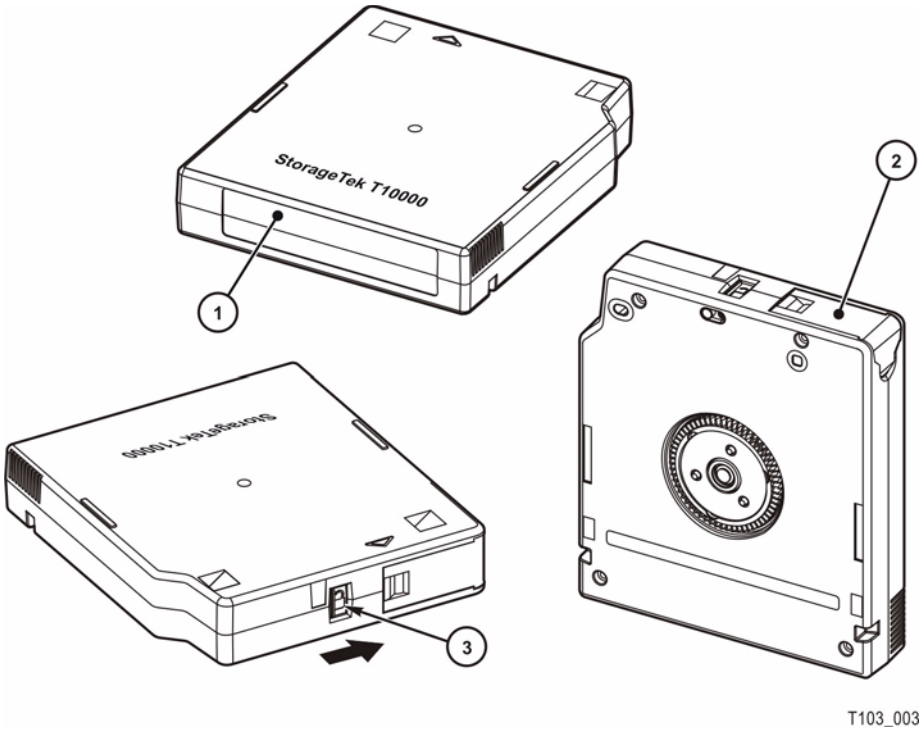


Illustration call-outs (3):

1. Label area
2. Door (black = data, red = sport, white = cleaning, and yellow = VolSafe)
3. Write protect switch

Cables and Connectors

The T10000 tape drive supports fiber-optic based host interfaces only—no small computer system interface (SCSI) connections are available. These interfaces include:

- Fibre Channel for open systems platforms
- FICON (IBM's Fibre Connection) for enterprise mainframes

> **Note –** The drive supports 256 concurrent hosts with code level 1.37.114 or higher.

Both of these interfaces conform to standards:

- American National Standards Institute (ANSI)
- International Organization for Standardization (ISO)
- InterNational Committee for Information Technology Standards (INCITS).

Specific types of cables and connectors are required to interface with the T10000 tape drive.

Cable Guidelines

Single mode:

- Transmission: Laser
- Core/cladding: 9/125
- Color: Yellow
- Interface speed: 1, 2, or 4 gigabits per second
- Distance: 2 m to 10 kilometers

Multimode:

- Transmission: LED
- Core/cladding: 50/125

  Important: Multimode cables with a measurement of 62.5/125 are *not recommended*. If you encounter them at existing installations, replace them with multimode 50/125 interface cables.

- Color: Orange
- Interface speed and distance:
  - 1 gigabit per second, 2 – 500 meters
  - 2 gigabits per second, 2 – 300 meters
  - 4 gigabits per second, 2 – 150 meters

    Note – Exceeding these lengths could introduce problems, exceed error thresholds, and inhibit performance.

LC Connectors

LC connectors are used on fiber-optic cables and connect to the SFP modules in the tape drive interface ports and with network switches and directors.

Connectivity

The T10000 tape drive supports connection of both ports in accordance with ANSI Fibre Channel specifications. Refer to the InterNational Committee on Information Technology Standards [INCITS] documents:

- SCSI Primary Commands -3, Section 5.6
- Fibre Channel Protocol -3

  Note – The drive can support two hosts, provided that they honor the “reserve/release” or the “persistent reserve/release” specifications.

A T10000 tape drive should not be connected to the same host bus port with another tape drive or disk subsystem. The stress on the host bus adapter, due to the bandwidth needs, creates unacceptable error recovery issues between both solutions.

Interop Tool

The Interop Tool is a Web-based tool designed with connectivity information on all supported products regardless of whether they are StorageTek branded or third-party branded. The configurations listed on this Web site are reflective of the most up-to-date information reported from various sources, including internal testing labs as well as our technology partners.

Make sure to visit the Interoperability Web site at:

https://interop.central.sun.com/interop/interop

This site allows searching a connectivity matrix by application, interface, operating system, network component, and product to see what is qualified for support of the T10000 tape drives.

Network Considerations

Planning is foremost when building a storage area network (SAN). Here is a list of items to consider when designing and connecting to a network:

- Create a logical plan for connections.
- Use dual Fabrics and dual HBAs to attach servers.
- Separate vendor's and device types into zones.
- Use WWN zoning for flexibility and use Port zoning for security.
- Keep zone configurations the same on every switch in a single Fabric.
- Use unique names for aliases in a zone.
- Standardize vendors for switches and HBAs when possible.
- Use the same firmware and driver levels on similar devices.
- Use at least two links between switches for redundancy.
- Leave room for growth.
- Document and label everything; provide drawings when possible.
- Keep in mind that while large Fabrics are possible; it is best to limit the size and use multiple smaller Fabrics to reduce errors and confusion.

Binding

Some operating systems do not guarantee that devices will always have the same target ID or path after a reboot. This can cause problems for applications that expect tape drives to have the same ID as before the reboot.

Binding is a method that matches the World Wide Name (WWN) of a component (such as a tape drive, port, switch, or fabric) to a specific target ID in a Fibre Channel network. This capability is useful in environments that share devices.

Types of binding:

- Persistent binding secures an individual drive to a host bus adapter.

- Port binding secures individual ports on a switch to a node.
- Switch binding secures individual switches in a fabric.
- Fabric binding secures the entire fabric in a network.

Zoning

Zoning is a method of grouping different ports and devices that connect to a switch and/or director. Zones:

- Enable or disable communications between devices and systems.
- Limit the access to confidential data on specific systems (security).
- Control the number of data paths between systems and devices.
- Separate different operating system types (such as Windows and UNIX).
- Restrict traffic from being re-directed.

> **Note –** Zoning is highly recommended in mixed environments with different devices connected to the same switch and/or director.

Comparisons

Some comparisons between the T10000 tape drive and other drive-types, including StorageTek T-series and Linear Tape-Open follow:

Capacity:

- T10000 drives:
  - T10000A: 500 gigabytes standard cartridge and 120 gigabytes sport cartridge
  - T10000B: 1 terabytes standard cartridge and 240 gigabytes sport cartridge
  - T10000C: 5 terabytes standard cartridge and 1 terabyte sport cartridge
- T9940B: 200 gigabytes
- T9840D: 75 gigabytes
- LTO5: 1.5 terabytes

Media length (*recordable*):

- T10000 T1 tape cartridge: 855 meters (2805 feet)
- T10000 T2 tape cartridge: 1107 meters (3632 feet)
- T9940 tape cartridge: 650 meters (2133 feet)
- T9840 tape cartridge: 251 meters (823 feet)
- LTO5 Ultrium data cartridge: 808 meters (2651 feet)

Tracks:

- T10000 drives:
  - T10000A: 768

  - T10000B: 1152
  - T10000C: 3584
- T9940B: 576
- T9840D: 576
- LTO5: 1280

Data rate:

- T10000 drives:
  - T10000A/B: 125 megabytes per second
  - T10000C: 240 megabytes per second
- T9940B: 30 megabytes per second
- T9840D: 30 megabytes per second
- LTO5: 47 – 140 megabytes per second

Access time (average):

- T10000 drives:
  - T10000A/B: 62.5 seconds standard cartridge and 30.5 seconds sport cartridge
  - T10000C: 73.5 seconds standard cartridge and 34 seconds sport cartridge
- T9940B: 59 seconds
- T9840D: 8 seconds
- LTO5: 52 seconds

Read/write speed:

- T10000 drives:
  - T10000A 2.0 or 4.95 meters/second
  - T10000B: 2.0 or 3.74 meters/second
  - T10000C: 5.62 meters/second
- T9940B: 3.4 meters/second
- T9840D: 3.4 meters/second
- LTO5: 6.04 meters/second

Rewind time (maximum):

- T10000 drives:
  - T10000A/B: 91 seconds (23 seconds for the Sport Cartridge)
  - T10000C: 115 seconds (32.5 seconds for the Sport Cartridge)
- T9940B: 90 seconds
- T9840D: 16 seconds
- LTO5: 96 seconds

2

System Assurance

The system assurance process is the exchange of information among team members to ensure that no aspects of the sale, order, installation, and implementation for the StorageTek T10000 tape drive are overlooked. This process promotes an error-free installation and contributes to overall customer satisfaction.

The system assurance team members (customer and Oracle) ensure that all aspects of the process are planned carefully and performed efficiently.

This process begins when the customer accepts the sales proposal. At this time, an Oracle representative schedules one or more system assurance planning meetings.

Use this chapter to:

- Track the tasks in "System Assurance Team Checklist" on page 36
- Complete the "Customer Team Member Contact Sheet" on page 37 and "Oracle Team Member Contact Sheet" on page 38.

System Assurance Planning Meetings

The purpose of the system assurance planning meetings are to:

- Introduce the customer to the T10000 tape drive
- Explain the system assurance process and establish the team
- Identify and define the customer requirements
- Identify the proposed configurations
- Complete the sales order
- Identify any additional items needed (such as cables and tape cartridges)
- Prepare for the installation and implementation
- Schedule and track the entire process

System Assurance Team Checklist

Introduce the Oracle team to the customer: Date completed _____

Describe the T10000 tape drive to the Team Members: Date completed _____

See Chapter 1, "Introduction" for topics and information.

Complete the Team Member Contact sheets on page 37 and on page 38.

Review and complete Chapter 3, "Site Survey": Date completed _____

Comments: _____

_____

_____

_____

Review and complete Chapter 4, "Site Preparation": Date completed _____

Comments: _____

_____

_____

_____

Note – Refer to Appendix B, "Controlling Contaminants"for additional requirements.

Complete Chapter 5, "Ordering": Date completed _____

Comments: _____

_____

_____

_____

Does the customer want encryption-enabled tape drives? _____

Comments: _____

_____

_____

_____

_____

Note – In addition to the information in this system assurance guide, refer to the Oracle Key Manager or Key Management System guide.

Determine the installation schedule:

Date: _____

Day: _____

Time: _____

Customer Team Member Contact Sheet

Complete the following with information for the customer team members:

Name:_____

Title:_____

Telephone Number:_____

FAX Number:_____

Cell Phone/Pager:_____

E-mail Address:_____

Name:_____

Title:_____

Telephone Number:_____

FAX Number:_____

Cell Phone/Pager:_____

E-mail Address:_____

Name:_____

Title:_____

Telephone Number:_____

FAX Number:_____

Cell Phone/Pager:_____

E-mail Address:_____

Name:_____

Title:_____

Telephone Number:_____

FAX Number:_____

Cell Phone/Pager:_____

E-mail Address:_____

Oracle Team Member Contact Sheet

Complete the following with information for the team members:

Name:_____

Title:_____

Telephone Number:_____

FAX Number:_____

Cell Phone/Pager:_____

E-mail Address:_____

Name:_____

Title:_____

Telephone Number:_____

FAX Number_____

Cell Phone/Pager:_____

E-mail Address:_____

Name:_____

Title:_____

Telephone Number:_____

FAX Number:_____

Cell Phone/Pager:_____

E-mail Address:_____

Name:_____

Title:_____

Telephone Number:_____

FAX Number:_____

Cell Phone/Pager:_____

E-mail Address:_____

Note – Representatives may include: marketing and sales representatives, the installation coordinator, system engineers (SEs), and service representatives.

3

Site Survey

Use this chapter to record your customer's *current* platforms, applications, and hardware configurations.

The types of information you might need to gather include:

Connectivity Matrix

Not sure if your customer's hardware or software of choice supports the StorageTek T10000 tape drive? Make sure you visit the Interop Tool Web site at:

https://interop.central.sun.com/interop/interop

The Interop Tool is a web-based tool designed for connectivity information on all supported products regardless of whether they are Oracle branded or third-party branded.

The configurations listed on this web site are reflective of the most up-to-date information reported from various sources, including internal testing labs as well as our technology partners.

This site allows you to search a connectivity matrix by application, interface, operating system, network component, and product to see what has been qualified in support of the T10000 tape drives.

System Configuration

The next two pages provide space where you can record information about the customer's operating systems and configurations.

Questions About the Customer's Operating System:

1. How many and what types of operating systems or platforms does the customer have?

   Open-Systems:

   Windows: (2008, 2003, ...)

   Server make and model: _____

   Quantity: _____

   UNIX: (Solaris, AIX, HP-UX ...)

   Server make and model: _____

   Quantity: _____

   Linux:

   Server make and model: _____

   Quantity: _____

   Mainframe:

   MVS:

   Make and model: _____

   Quantity: _____

   VM:

   Make and model: _____

   Quantity: _____

   Other (Specify):

   Make and model: _____

   Quantity: _____

2. Are there plans for:

   New purchases? _____

   Future upgrades? _____

   If so, what? _____

3. How many systems/servers are used as:

   Backup servers? _____

   File servers? _____

   Print servers? _____

   Exchange servers? _____

Record specific information about the customer's *current* system configuration.

- System _____
  Vendor make and model: _____
  Operating system type: _____
  Version number and patch level: _____
  Number of channels: _____
  IP address: _____
  HBA vendor and model: _____
  HBA firmware versions: _____
  Switch and port numbers:
    Switch make and model: _____
    Ports: _____
- System _____
  Vendor make and model: _____
  Operating system type: _____
  Version number and patch level: _____
  Number of channels: _____
  IP address: _____
  HBA vendor and model: _____
  HBA firmware versions: _____
  Switch and port numbers:
    Switch make and model: _____
    Ports: _____
- System _____
  Vendor make and model: _____
  Operating system type: _____
  Version number and patch level: _____
  Number of channels: _____
  IP address: _____
  HBA vendor and model: _____
  HBA firmware versions: _____
  Switch and port numbers:
    Switch make and model: _____
    Ports: _____

Backup Applications

The next three pages provide space where you can record information about the customer's backup applications.

Questions About the Customer's Backup and Restore Applications:

1. How are backups performed (manually or automatic)? _____
2. How many servers or systems perform backups? _____
3. On what days are backups performed? _____
4. What types of backups are performed and when?

   Full: _____

   Incremental: _____

   Differential: _____
5. How many hours are available for backups?

   Full backups: _____

   Daily backups: _____
6. How much data is backed up?

   Per day: _____

   Per week: _____

   Per month: _____
7. How much data changes daily (%)? _____
8. Are backup windows being met? _____
9. How long does a backup actually take? _____
10. How long should a backup take? _____
11. Is a different backup schedule needed? _____
12. How long does the customer keep the different levels of backed up data?

    _____
13. How many copies are made (including the original)? _____
14. How many copies are archived? _____
15. How often are restores necessary? _____
    - Why are restores necessary? _____
    - What are the restore requirements? _____
    - What are the restore objectives? _____
16. What types of tape drives and libraries are being used? _____

    _____
17. Are the backup applications able to stream to the tape drives at full speed? ____

- What are the sustained data transfer rates? _____
- What are the typical data block sizes? _____
- What types of data are being backed up? (databases, mail servers, image files, text files, audio, video, ...) _____

18. What types of network topology are being used?

    Storage area network (SAN): _____

    Wide area network (WAN): _____

    Local area network (LAN): _____

    Ethernet (TCP/IP): _____

    Token Ring: _____

    FDDI: _____

    Other: _____

19. Are there plans to upgrade the network? _____

    If yes, describe: _____

    _____

20. What interface-types are planned? (Fibre Channel, FICON, Ethernet, iSCSI, other)

    _____

21. Are there any changes anticipated for the operating system and/or platforms?

    If yes, describe: _____

22. What is the most important aspect for the customer regarding a backup solution?

    _____

23. What is the overall time frame for the entire project (backup, servers, network, software, and hardware)? _____

24. Specifically for the backup solution, what is the maximum available budget?

    _____

Record specific information about the customer's current applications and software.

Backup and Archive Software Version:

Oracle Secure Backup: _____

Storage Archive Manager (SAM): _____

Symantec NetBackup: _____

IBM Tivoli Storage Manager (TSM): _____

EMC NetWorker: _____

CA Arcserve: _____

HP Data Protector: _____

Commvault Galaxy: _____

E-Mail Archive: _____

ASM NT: _____

ASM UNIX: _____

Other (specify): _____

Network Management Software Version:

VERITAS: _____

IBM Tivoli NetView: _____

HP OpenView: _____

Horizon tape drive monitor: _____

RMS/GSM: _____

Other (specify): _____

Library Attachment Software Version:

ACSLS: _____

ACSLS HA: _____

Fibre Channel: _____

Library Station: _____

Host Software Component (HSC): _____

Virtual Storage Manager (VSM): _____

Other (specify): _____

Databases

Questions About the Customer's Database:

1. How much primary storage exists: _____

   Total Capacity: _____

2. What type and size of disk drives does the customer have?

   Make: _____

   Model: _____

   Capacity: _____

   Quantity: _____

   Make: _____

   Model: _____

   Capacity: _____

   Quantity: _____

3. What is the RAID configuration? _____
4. What type of failover product and version is the customer using?

   _____

5. Does all primary storage require backup? _____

   If not, how much does? _____

6. Are additional storage devices needed? _____
7. What database management systems (DBMS) does the customer have?

   _____

8. What type of databases need backup? _____
9. What is the size of the smallest database? _____
10. What is the size of the largest database? _____
11. How often does the customer backup each database? _____
12. What type of data is the customer backing up?
13. How valuable is the data in each database?
14. Do the various databases have different backup requirements?
15. How is the customer currently protecting the databases (tape backup, mirroring, snapshot)? _____

    If mirroring, how many mirrors? _____

    Is mirroring installed because failover is required? _____

Hardware Configurations

The remainder of this chapter provides space to record any of the customer's existing hardware:

- Does the customer have any existing libraries? _____
- Does the customer have any existing tape drives? _____
- Does the customer have an existing network? _____
- Are migration services required? _____

Tape Drives

- Does the customer:

  Have existing StorageTek tape drives? _____
  What types of drives are they? _____
  Have any other types of tape drives? _____
  What types of drives are they? _____

  > **Note –** If the customer has and uses other types of tape drives, media migration services might be required.

  Need to migrate from one tape drive technology to another? _____
  Need help relocating cartridge tapes, tape drives, and racks? _____

Existing Tape Drive:

- Tape drive description:

  Manufacturer: _____

  Make and Model: _____

  Quantity: _____

- Tape drive description:

  Manufacturer: _____

  Make and Model: _____

  Quantity: _____

- Tape drive description:

  Manufacturer: _____

  Make and Model: _____

  Quantity: _____

- Tape drive description:

  Manufacturer: _____

  Make and Model: _____

  Quantity: _____

Libraries

- Does the customer have any existing StorageTek libraries? _____

  If so, what are the model numbers? _____
- Does the customer have any other types of libraries? _____

  If so, what are the make and model numbers? _____

Existing Libraries:

- Library description:

  Manufacturer: _____

  Make and Model: _____

  Quantity: _____

  Cartridge capacity: _____
- Library description:

  Manufacturer: _____

  Make and Model: _____

  Quantity: _____

  Cartridge capacity: _____

Cartridge Tapes

Approximately,

- How many cartridge tapes does the customer have? _____
- What is the media capacity the customer owns? _____
- What is the percentage (%) full for the customer's media?_____

Existing Cartridge Tapes:

- Data Cartridge:

  Type: _____

  Manufacturer: _____

  Quantity: _____
- Data Cartridge:

  Type: _____

  Manufacturer: _____

  Quantity: _____
- Cleaning Cartridge:

  Type: _____

  Manufacturer: _____

  Quantity: _____
- Cleaning Cartridge:

  Type: _____

  Manufacturer: _____

  Quantity: _____

Network

- Does the customer have an existing network? _____

  What type is it? _____
- Are additional network devices required? _____

  What are they? _____
- Does the customer use *zones* in the network? _____
- Are there frequent re-configurations of the network? _____
- Are there multiple floors involved with this network? _____
- Are there inter-connections of hubs and switches? _____
- Are there remote connections to hubs and switches? _____
- Is this a campus network? _____
- Are trunk cables used? _____
- Are patch panels used? _____

TABLE 3-1 Fibre Channel Switches

Information	Switch 1	Switch 2	Switch 3
Manufacturer	_____	_____	_____
Make and model	_____	_____	_____
Software version	_____	_____	_____
Speed	_____	_____	_____
Number of ports	_____	_____	_____
Port types	_____	_____	_____
Module types (SFP)	_____	_____	_____
Number of open ports	_____	_____	_____
IP addresses	_____	_____	_____
IP addresses	_____	_____	_____

TABLE 3-2 Ethernet Hubs and Switches

Information	Switch 1	Switch 2	Switch 3
Manufacturer	_____	_____	_____
Make and model	_____	_____	_____
Software version	_____	_____	_____
Speed	_____	_____	_____
Duplex	_____	_____	_____
Number of ports	_____	_____	_____
Number of open ports	_____	_____	_____
IP addresses	_____	_____	_____
IP addresses	_____	_____	_____

TABLE 3-3 Fibre Channel Switch Connections

FC Switch Information	Switch 1	Switch2	Switch 3
Vendor	_____	_____	_____
Model number	_____	_____	_____
Port 0 connection and status	_____	_____	_____
Port 1 connection and status	_____	_____	_____
Port 2 connection and status	_____	_____	_____
Port 3 connection and status	_____	_____	_____
Port 4 connection and status	_____	_____	_____
Port 5 connection and status	_____	_____	_____
Port 6 connection and status	_____	_____	_____
Port 7 connection and status	_____	_____	_____
Port 8 connection and status	_____	_____	_____
Port 9 connection and status	_____	_____	_____
Port 10 connection and status	_____	_____	_____
Port 11 connection and status	_____	_____	_____
Port 12 connection and status	_____	_____	_____
Port 13 connection and status	_____	_____	_____
Port 14 connection and status	_____	_____	_____
Port 15 connection and status	_____	_____	_____
Port 16 connection and status	_____	_____	_____
Port 17 connection and status	_____	_____	_____
Port 18 connection and status	_____	_____	_____
Port 19 connection and status	_____	_____	_____
Port 20 connection and status	_____	_____	_____
Port 21 connection and status	_____	_____	_____
Port 22 connection and status	_____	_____	_____
Port 23 connection and status	_____	_____	_____
Port 24 connection and status	_____	_____	_____
Port 25 connection and status	_____	_____	_____
Port 26 connection and status	_____	_____	_____
Port 27 connection and status	_____	_____	_____
Port 28 connection and status	_____	_____	_____
Port 29 connection and status	_____	_____	_____
Port 30 connection and status	_____	_____	_____
Port 31 connection and status	_____	_____	_____

Cables and Connectors

TIP – Plan for 1–2 meter (3–7 feet) of slack cable for limited movement and routing.

Interface Cables

Note – The T10000 tape drives use LC-style connectors at the host interface port. If the customer has and uses other types of cables and connectors, a new cable plan should be created.

9 micron fiber-optic:

LC-to-LC connector: Length_____ Quantity_____

LC-to-SC connector: Length_____ Quantity_____

Other (specify):

Connector_____ Length_____ Quantity_____

50 micron fiber-optic:

LC-to-LC connector: Length_____ Quantity_____

LC-to-SC connector: Length_____ Quantity_____

LC-to-ST connector: Length_____ Quantity_____

Other (specify):

Connector_____ Length_____ Quantity_____

Note – Multimode cables with a measurement of 62.5/125 are not recommended. If you encounter them at existing installations, replace them with multimode 50/125 interface cables.

See "Interface Cables" on page 79 for cable part numbers.

Ethernet Cables

Length_____ Quantity_____

Length_____ Quantity_____

Length_____ Quantity_____

See "Ethernet Cables" on page 78 for cable part numbers.

4

Site Preparation

Use this chapter to prepare for the installation by reviewing the information and completing the worksheets:

Site Planning Checklist

Use the following worksheets to ensure that the customer is ready to receive the tape drives and to ensure that you are ready to start the installation.

Delivery and Handling

- Does the customer have a delivery dock?

  If *no*, where will the equipment be delivered? _____

  If a delivery dock *is* available, what are the hours of operation? _____
- Are there street or alley limitations that might hinder delivery? _____
- Will people be available to handle the delivery of the equipment? _____
- Is the delivery location close to the computer room where the tape drive will be installed? _____
- Is an elevator available to move the equipment to the appropriate floors? _____
- Is there a staging area where the tape drives can be placed close to the installation site? _____

> **Note –** Allow the tape drives to acclimate, unpacked, and close to the installation site before installing them.

Environmental Planning

> **Note –** See "Specifications" on page 22 for T10000-specific information.

- Does the site meet the Environmental Requirements for:

  Temperature? _____

  Humidity? _____

  Cooling? _____

  Controlling Contaminants? _____

- Does the site contain features and materials that guard against electrostatic discharge_____
- Are there special requirements to dispose of or recycle the packing material, pallets, and cardboard_____
- Is space available for spare parts? _____
- Are the tape drives being installed in a library?

  Models? _____

  How many tape drives? _____

  How many tape cartridges? _____

- Does the library support or require the Dynamic World Wide Name feature? ____

Power Requirements

- Does the intended site meet the power requirements for the tape drives? _____
- Have you identified the circuit breakers locations and ratings? _____
- Are there any power cable routing concerns to be aware of? _____

Switches and Directors

- Which topology will be used?

  Point-to-point: _____

  Switched: _____

  Cascaded: _____

- How many interfaces will be connected to the switch? _____
- Are additional ports needed? _____
- What is the port wavelength?

  Short (SW) _____

  Long (LW _____

  > **Note –** Wavelength must match the drive port and fiber optic cable.

- Is this a multi-switch fabric network? _____

- Are there *zoning* requirements? _____
- Are existing cables being used? _____

  Connector type: _____

  Note – The cable connector must be the same type as the drive port.

Host Bus Adapters

See the Interop Tool at: https://interop.central.sun.com/interop/interop

- Does the customer have existing HBAs? _____
- Are these HBAs approved in the Connectivity Matrix? _____
- Will the customer provide new or additional HBAs? _____
- What is the vendor for the HBA? _____
- What is the level of device driver of the HBA the T10000 tape drives are attaching to? _____
- Is this the latest driver? _____
- Is this driver supported? _____

Connectivity: Cabling is *very important* to establish a reliable network for the tape drives. See "Interface Cables" on page 79 for more information.

Note – Each tape drive needs an interface cable

- Have you completed a cable plan?
- Have you determined the type and number of cables required?

  Fibre Channel: _____ Quantity: _____

  FICON: _____ Quantity: _____

  Ethernet: _____ Quantity: _____

  Power (if required): _____ Quantity: _____
- Is the customer prepared to supply Ethernet cables for the network? _____
- Can the customer provide the required number of *static* IP addresses? _____
- Will interface cables be run from outside the computer room? _____

  Note – Cables that run outside a computer room require a flammability rating of CL2 or CL2P.
- Will the customer allow use of remote support?

  Note – See "Service Delivery Platform" on page 67 for more information

Tape Drive Settings

- Does the customer want data compression enabled? _____
- Does the customer want Data Security Erase (DSE) enabled? _____

- Does the customer want to use Hard or Soft Arbitrated Loop Physical Address (AL_PA)? _____

  Note – Some libraries do not support drive AL_PA addressing.

- Are there any block size requirements? _____
- Does the customer want to use the VolSafe feature and tape cartridges? _____

  Note – If one drive is configured to support VolSafe, all drives *should be* configured.

- Are there any Emulation mode requirements? _____

Media

Note – The StorageTek T1 T10000 tape cartridge is used with the T10000A/B drives. The StorageTek T10000 T2 tape cartridge is used with the T10000C drive.

- Does the customer have the correct type and number of cartridge tapes? _____

  Are data cartridges required? _____

  Are Sport cartridges required? _____

  Are cleaning cartridges required? _____

  Are VolSafe cartridges required? _____

  Are Sport VolSafe cartridges required? _____

  Are labels required? _____

See Appendix A, "Tape Cartridges" for information about the media.

Remote Support

- Will the customer allow remote support? _____
- Have you completed the Service Delivery Platform (SDP) requirements? _____

  See "Service Delivery Platform" on page 67 for more information.

- Are phone connections available for modems and telephones? _____

Data at Rest Encryption Feature

- Is the customer interested in the encryption feature? _____
- Has the customer data been identified or classified into categories? _____
- What data is considered:

  Secret: _____

  Sensitive: _____

  Business critical: _____

  Non-essential: _____

- What data needs to be encrypted? _____

Refer to the Crypto Key Management Station (1.x), Crypto Key Management System (2.x), or Oracle Key Manager Systems Assurance Guide for more information.

Management Software Requirements

The minimum level software requirements to support the T10000 drives are listed. However, you should strive to use the latest available software level.

T10000C

- ACSLS:

  8.0 (Solaris/SPARC and Solaris/x86)

  7.3.1 (Solaris/SPARC, Solaris/x86, and AIX))

- NCS/VTCS version 6.2

  PTF L1A00SW - SMC

  PTF L1C10AZ - MVS/CSC 6.2

  PTF L1H15T2 - MVS/HSC

  PTF L1H15T1 - VM/HSC

- VTCS:

  PTFs: (non-StorageTek Tape Tiering Accelerator [TTA] and non-StorageTek In-Drive Reclaim [IDR])

  L1H15I6

  L1H15I4

- ELS version 7.0

  PTFs:

  VTCS 7.0: L1H15I7 (non-StorageTek Tape Tiering Accelerator [TTA] and non-StorageTek In-Drive Reclaim [IDR])

  MVS/CSC: L1C10B0

  HSC/SMC: L1H15T3

- ELS version 7.1

  T10000C and T10000 T2 cleaning cartridge (CC) support

  VTCS support is non-StorageTek Tape Tiering Accelerator [TTA]

  PTF:

  L1H15UX T10000 T2 cleaning cartridge (CL) support

- VTSS (VSM4/5)

  D02.11.xxx (non-StorageTek Tape Tiering Accelerator [TTA] and non-StorageTek In-Drive Reclaim [IDR])

  D02.12.xxx (StorageTek Tape Tiering Accelerator [TTA] and StorageTek In-Drive Reclaim [IDR])

T10000B

- ACSLS - 7.2 (PUT0702)
- NCS/VTCS

  NCS/VTCS 6.2

  PTF L1H14EP - HSC 6.2 (MVS)

  PTF L1A00OT - SMC 6.2

  PTF L1H142C - VTCS 6.2

  PTF L1C109N - MVS/CSC 6.2

  PTF L1H14EO - HSC 6.2 (VM)

  NCS/VTCS 6.1

  PTF L1H14EN - HSC 6.1 (MVS)

  PTF L1A00OS - SMC 6.1

  PTF L1H1429 - VTCS 6.1

  PTF L1C109M - MVS/CSC 6.1

  PTF L1H14EM - HSC 6.1 (VM)
- VTSS

  VSM4/5 (D02.03.00.00 and later releases)

T10000A

- ACSLS

  7.1 - PUT0601 or PUT0502
- NCS/VTCS
  - NCS/VTCS 6.0

    PTF L1H12E3 - HSC 6.0 (MVS)

    PTF L1A00D7 - SMC 6.0

    PTF L1H12E1 - VTCS 6.0

    PTF L1S1054 - LibraryStation 6.0

    PTF L1C1074 - MVS/CSC 6.0

    PTF L1H12E2 - HSC 6.0 (VM)
  - NCS/VTCS 6.1

    PTF L1H12FC - HSC 6.1 (MVS)

    PTF L1A00DV - SMC 6.1

    PTF L1H12FA - VTCS 6.1

    PTF L1S1059 - LibraryStation 6.1

PTF L1C1075 - MVS/CSC 6.1

PTF L1H12FB - HSC 6.1 (VM)

Library Installation Requirements

If you are installing the T10000 tape drive in one of StorageTek tape libraries, review the following information and requirements for that library:

- StorageTek SL3000 Modular Library System
- StorageTek SL8500 Modular Library System
- "L-Series—L180 Library" on page 60
- "L-Series—L700/L700e Libraries" on page 60
- "L-Series—L1400M Library" on page 60
- "L-Series—Tape Drive Installation Guidelines" on page 61

> **Note –** All of the libraries require a T10000 drive tray—that is specific for each library—and the appropriate firmware in order to support the T10000.

StorageTek SL3000 Modular Library System

The SL3000 holds 200 to 6,000 cartridges and up to 56 tape drives. When a drive is properly seated in a library drive bay, the power and TTI (tape transport interface) connections are complete.

The tape drive microcode level (minimum) needed:

- T10000A/B: FRS_2.00
- T10000C: FRS_2.81 (SPS 2.82 preferred) or higher

> **Note –** FRS_2.81 supports the CL cleaning cartridge (T10000C), but an expired cleaning cartridge is not reported to HLI hosts. Compat 22 does not support the T10000C hibernation function. FRS_3.00 fully supports the T10000C.

StorageTek SL8500 Modular Library System

The SL8500 library holds 1,448 to 10,000 cartridges and up to 64 tape drives. A *library complex* consists of two or more libraries and can store up to 100,000 tape cartridges with up to 640 tape drives. When a drive is properly seated in a library drive bay, the power and TTI (tape transport interface) connections are complete.

The tape drive microcode level (minimum) needed:

- T10000A: FRS_3.00 or higher
- T10000B: FRS_3.98 or higher
- T10000C: FRS_6.02 (SPS 6.0.4 preferred) or higher

Note – FRS_6.02 supports the CL cleaning cartridge (T10000C), but an expired cleaning cartridge is not reported to HLI hosts. Compat 22 does not support the T10000C hibernation function. FRS_7.00 will fully support the T10000C drive.

L-Series—L180 Library

Note – The T10000C tape drive is not supported by the L-Series libraries.

The L700 holds 84 to 174 cartridges and up to six T10000A/B drives. See L-Series—Tape Drive Installation Guidelines for additional information. When a drive is properly seated in a drive slot, the power and TTI (tape transport interface) connections are complete; you do *not* have to install a separate TTI cable.

The tape drive microcode level (minimum) needed:

- T10000A: 3.11.02 or higher
- T10000B: 3.17.03

L-Series—L700/L700e Libraries

Note – The T10000C tape drive is not supported by the L-Series libraries.

The L700 holds 216 to 678 cartridges while the L700e holds 300 to 1,344 cartridges. The library holds up to **12** T10000A/B drives (single frame) or up to **24** T10000 drives when two libraries are connected with a pass-thru port (PTP). See L-Series—Tape Drive Installation Guidelines for additional information. When a drive is properly seated in a drive slot, the power and TTI (tape transport interface) connections are complete; you do *not* have to install a separate TTI cable.

The tape drive microcode level (minimum) needed:

- T10000A: 3.11.02 or higher
- T10000B: 3.17.03

L-Series—L1400M Library

Note – The T10000C tape drive is not supported by the L-Series libraries.

The L1400M single frame library holds up to 678 cartridges while the L1400M dual frame holds up to 1,344 cartridges. The library holds up to **12** T10000A/B drives (single frame) or up to **24** T10000 drives (dual frame). See L-Series—Tape Drive Installation Guidelines for additional information. When a drive is properly seated in a drive slot, the power and TTI (tape transport interface) connections are complete; you do *not* have to install a separate TTI cable.

The tape drive microcode level (minimum) needed:

- T10000A: 3.11.02 or higher
- T10000B: 3.17.03

L-Series—Tape Drive Installation Guidelines

L-Series libraries handle multiple tape drive technologies with multiple cartridge types.

> **Note –** The T10000C tape drive is not supported by the L-Series libraries.

These libraries have internal drive columns with drive slots which can hold up to:

- 6 T10000A/B tape drives
- 6 T9840*x* or T9940*x* Tape Drives
- 10 Digital Linear Tape (DLT or Super DLT) drives
- 10 Linear Tape-Open (LTO) drives
- A combination of T10000A/B, T9x40, LTO, and DLT/SDLT drives

A drive tray for a DLT/SDLT or LTO drive consists of the tape drive and a power supply card mounted behind the drive. The drive tray with a T9840, T9940 or T10000 drive consists of the tape drive and an external power supply mounted above the drive which requires one and one-half drive slots. See FIGURE 4-1 for drive installation guidelines.

FIGURE 4-1 L-Series Tape Drive Installation Guidelines

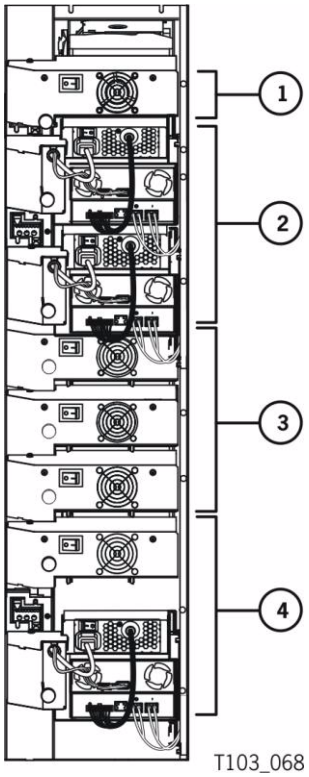


Illustration call-outs (4):

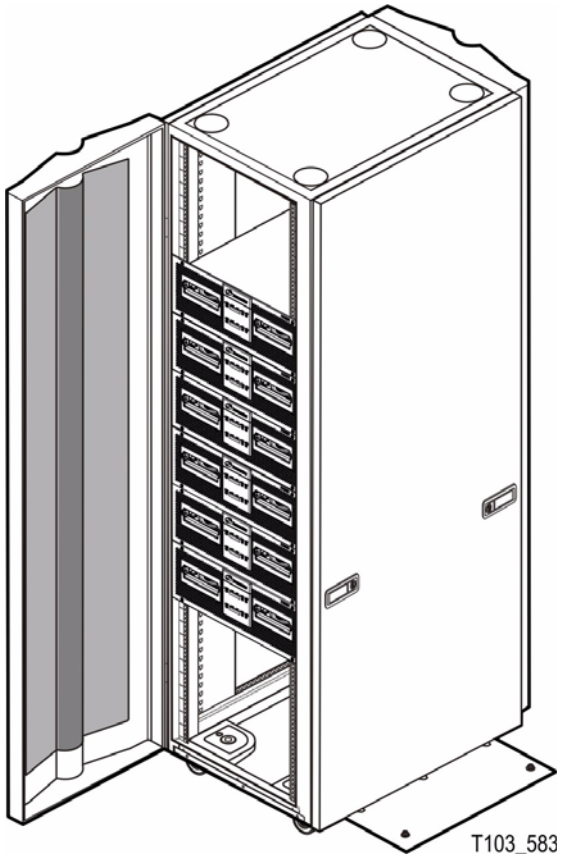
1. Top most drive slot used for a DLT/SDLT or LTO drive only.
2. Upper grouping of three drive slots, but containing two T10000A drives.
3. Central grouping of three drive slots with three DLT/SDLT or LTO drives.
4. Lower grouping of three drive slots containing one DLT/SDLT/LTO drive and one T10000A drive.

Rack Mount Configurations

A 42U rack can hold up to 12 manual-mount drives in six dual-drive units (see FIGURE 4-2). Each unit provides a control panel that provides a cartridge load/unload slot, several LEDs, several switches, and a 10-character display panel. The top (A) operator panel works with the drive on the left. The bottom (B) operator panel works with the drive on the right. When only one drive is installed in the unit, it must be installed on the left (A). The rack units are installed between the U11 and U34 locations as counted from the bottom of the cabinet.

> **Note –** The acceptable spacing between the cabinet front vertical rail and rear vertical rail is from 71 centimeters (28 inches) to 73 centimeters (28.75 inches). The horizontal separation between the front or rear set of vertical rails must be at least 43.8 centimeters (17.25 inches) but not greater than 44.2 centimeters (17.4 inches).

FIGURE 4-2 Rack Mount Configuration



Tape Drive Configuration and Planning

The following section provides information to help plan the configuration for the tape drives. Drives arrive with configuration parameters that were set during the manufacturing process. You can use Virtual Operator Panel (VOP) to change a parameter.

> **Note –** There are two versions of VOP (customer/system administrator and CSE). Refer to the user's guide for the particular VOP version to obtain additional information.

Drive Parameters

The drive configuration property sheet lists the current setting for each parameter and provides radio buttons or list boxes for other choices. The list of configuration parameters can vary by drive interface and drive model. The following list provides an overview of typical drive parameters:

- Drive emulation option (varies by drive interface)
- Data compression (No, Yes, or Off)
- Data security erase (No or Yes)
- Standard label protection (No or Yes)
- Tape completion display (No or Yes)
- Language of system messages (English is the default but four other options are available)
- Interface port attributes such as defining a hard address or speed negotiation.

  > **Note –** The SL3000 and SL8500 libraries do not support Arbitrated Loop addresses.

- T10000C additional parameters:
  - File Sync Accelerator
  - Tape App Accelerator
  - Power (hibernation)

FIGURE 4-3 on page 64 provides an example of the Fibre drive property sheet in the customer version of VOP.

Network Selections

The network property sheet provides parameters to:

- Set a static IP address (IPv4 and IPv6)
- Set a gateway address
- Set a subnet mask

FIGURE 4-4 on page 65 provides an example of the Network property sheet in the customer version of VOP.

FIGURE 4-3 VOP Configuration Settings (T10000C Tape Drive)

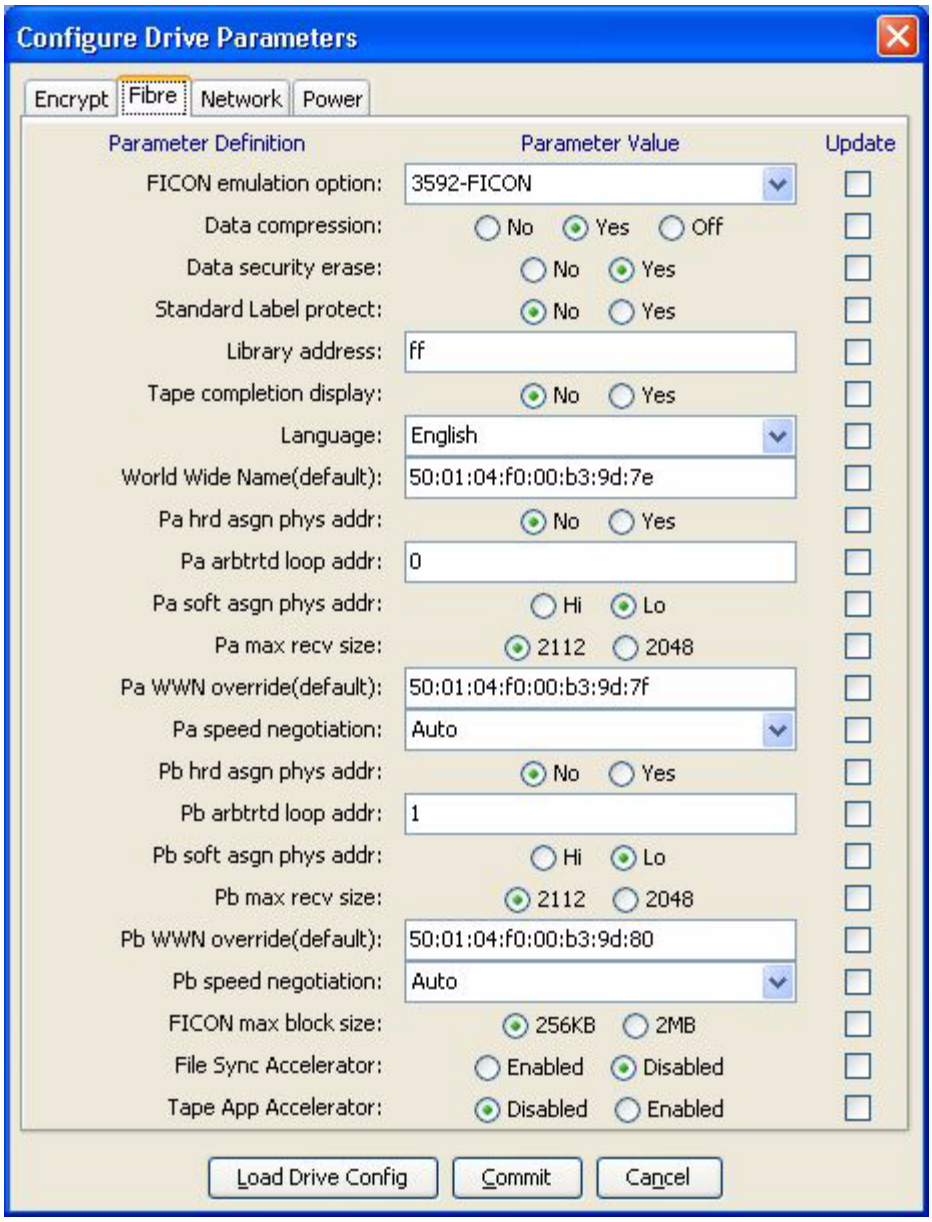
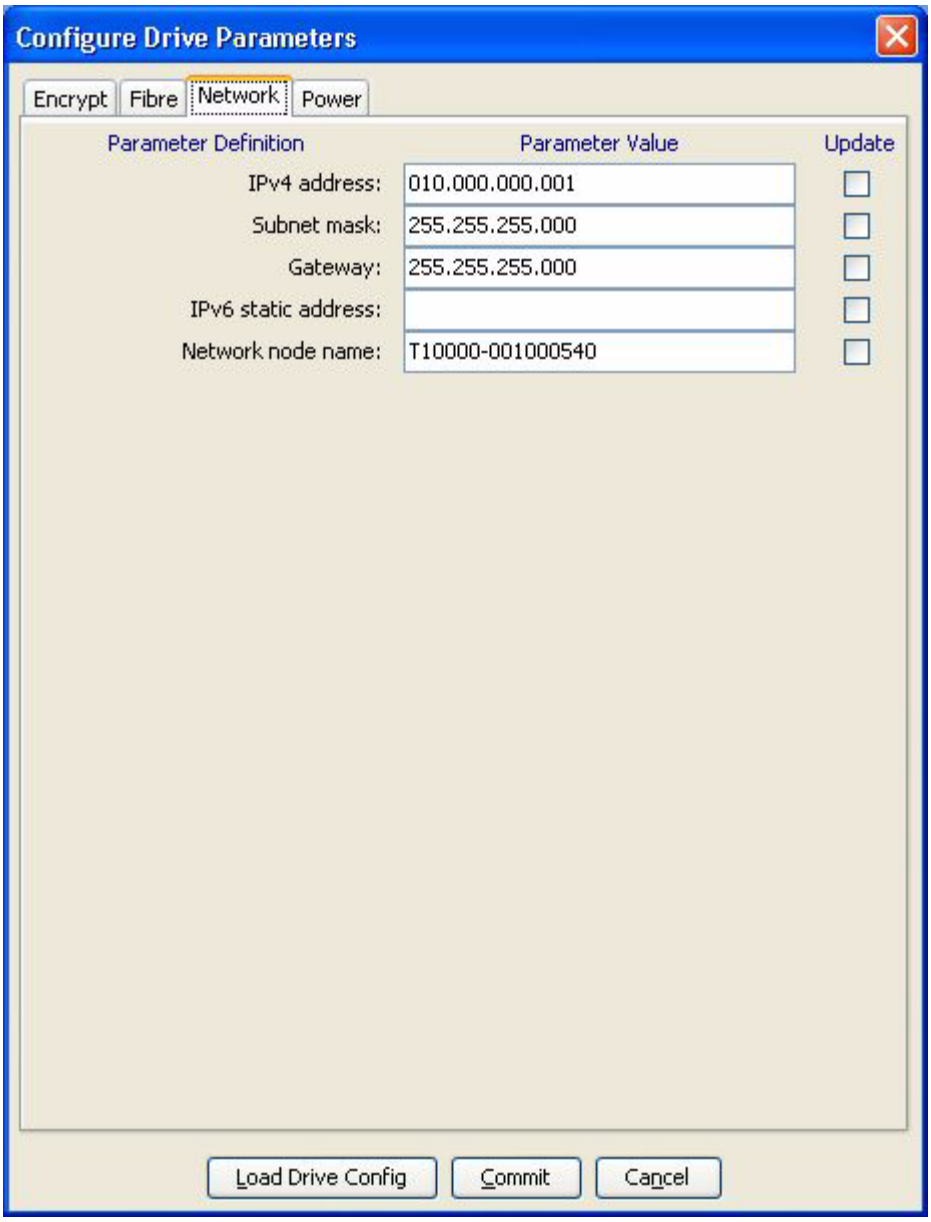


FIGURE 4-4 Network Configuration



Initial Drive Settings

There are no default settings as such for the T10000. Before being shipped, manufacturing erases the configuration sector after internal testing.

The following registers are set to these initial settings:

- IP address: 10.0.0.1
- IP Mask: 255.255.255.0
- IP Gateway: 255.255.255.255
- IP NodeName: T10000-<last 9 digits of Serial Number>

FICON Configurations

Fibre Connection (FICON) is a proprietary IBM channel. The benefits of a FICON channel include greater bandwidth, more logical paths, more devices per channel, and greater distance.

- A total of 256 logical paths are possible. On dual-port tape drives, the 256 total logical paths can be unevenly split between Port A and Port B.
- Approximately *six* T-Series FICON tape drives, concurrently reading and writing large (64 KB) blocks, can be attached to a single channel.
- Approximately 16 T-Series FICON tape drives, concurrently reading and writing small (16 KB) blocks, can be attached to a single channel.

Hardware Configuration Definition

After FICON drives are installed, you need to set the Hardware Configuration Definition (HCD) for each drive.

Go to the White Papers section of the SE Tools web site at:
http://xmen.east.sun.com/setools/aaaNotForCD/Papers/T10000_hcd_config.pdf

Port Configuration

Using standard Fibre Channel infrastructure and cables, the T10000 FICON tape drives can be configured as: 1) single-port (short or long wave), 2) dual port (short or long wave), or 3) mixed-port (one short wave and one long wave port).

- Use multimode cables when connecting to short wave ports.
- Use single mode cables when connecting to long wave ports.

Notes:

1. Maximum total non-repeated channel distance for a short wave 850 nm small form-factor pluggable (SFP) using a 50 micron multimode cable on a 100 MB/s channel is 500 m (1640 feet).

2. Maximum total non-repeated channel distance for an 850 nm SFP using a 50 micron multimode cable on a 200 MB/s channel is 300 m (984 feet).

3. Maximum total non-repeated channel distance for an 850 nm SFP using a 50 micron multimode cable on a 400 MB/s channel is 150 m (492 feet).

4. Maximum total non-repeated channel distance for a long wave 1310 nm SFP using a single mode cable is 10 kilometers (6.21 miles).

5. Single mode cable maximum distances can be extended through an amplifier-repeater unit up to 20 kilometers (12.4 mi) for a 100 MB/s channel or to 12 kilometers (7.46 miles) for a 200 MB/s channel.

Cables and Connectors

What are the fiber optic cabling requirements? Here are some considerations to help determine what is needed:

- Are there existing fiber optic cables at the customer site?
  - Should you consider reusing these cables rather than installing new ones?
  - Are these cables the correct type to use?
  - Are the cable connectors the correct type to use?

    If the customer is upgrading their system to support LC connectors and SFP modules, no other modifications are required.
- Is there a link distance constraint?
- Are kits or adapters (LC to SC) included in the cable plan for a storage area network?
- Are cascaded directors or inter-switch links (ISLs) being used to extend distances?

Remote Support

Service representatives are available to assist you and the customer with hardware and software problem resolution. During the initial order and installation planning, make sure that you inform the customer about local and remote support options.

Service Delivery Platform

The Service Delivery Platform (SDP) is a remote support solution that consists of a smart appliance placed at the customer site that connects to the library and any StorageTek T10000 tape drives.

> **Note –** The T10000C tape drive code level 1.51.314 supports the Service Delivery Platform.

1. **If the customer wants remote support as part of the T10000 drive installation, you complete the SDP Systems Assurance Guide.**

   This document is located online at:

   https://csa-wiki.east.sun.com/display/SDP/Home

2. **Ask your local logistics personnel to order the parts.**

Preparing for Drive Installation and Service

Site preparation is important to ensure that no aspects of the installation and implementation are overlooked and to promote an error-free installation. Considerations that you and the customer must make before the equipment arrives includes:

- Unpacking and acclimating the tape drives before installing them.
- Providing enough space to route cables and work comfortably.
- Disposing of the shipping cartons and packaging material.

Personnel

To install a T10000 tape drive requires *one* or *two qualified installers* depending on the attachment, the number of drives, and the configuration.

Tools

The tools to install the tape drive—both standard and special tools include: tool kit and grounding kit (ESD kit).

5

Ordering

Use this chapter to help order tape drives, cables, and media. If you have answers to the following questions, the task of locating the pertinent part number becomes easier.

1. What host interface is used?

   Fibre Channel: _____

   FICON: _____

2. Number of interface ports?

   One port: _____ or two ports: _____

3. Type of interface transceiver (select both for mixed port)?

   Long wavelength (LW): _____ or Short wavelength (SW): _____

   > **Note –** Long wavelength ports require single-mode (9-micron fiber) cables while short wavelength ports require multimode cables.

4. Is the drive installed in a library or a rack?

   SL8500: _____

   SL3000: _____

   L180/L700e/L1400M (T10000A/B only): _____

   9310 (T10000A only): _____

   rack: single drive: _____ or two drives: _____

   > **Note –** Transceivers in a rack drive must be the same type (all LW or all SW).

A part number is composed of many of the elements listed in the table above. For example, the part number T10C-4FC-SW-85Z is comprised of:

- **T10C** indicates the tape drive model number (T10000C in this example)
- **4** indicates that the drive is capable of 4 Gbit data transfer rates
- **FC** indicates a Fibre Channel interface

- **SW** indicates the drive interface transceivers use short wavelength
- **85** indicates the library model (SL8500)
- **Z** usually indicates that the drive complies with ROHS requirements

The following figure shows typical drive configurations. Note that the tape drive is fully enclosed by sheet metal in some configurations.

> **Note –** The 9310 and L-series configurations do not ship from the plant with the interface transceivers installed. You must order a conversion bill to obtain the transceiver, and the service representative will install them.

FIGURE 5-1 Configuration Models

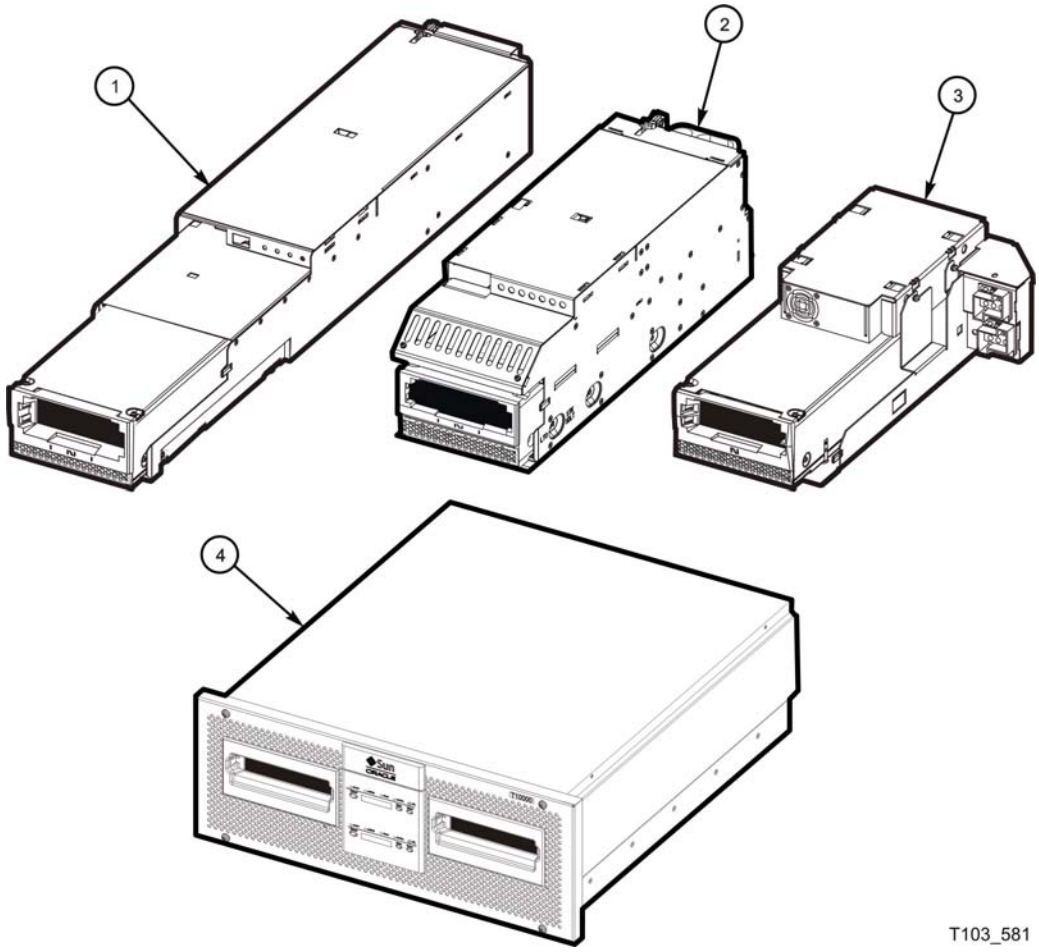


Illustration call-outs (4):

1. SL8500 library drive tray
2. SL3000 library drive tray
3. L-Series drive tray (T10000A/B only)
4. Rack mount

This chapter provides the following information:

Tape Drive Order Numbers

See the appropriate section for the desired tape drive:

T10000C Order Numbers

Library mounted drives:

- SL3000 library:
  - SL3000 FIBRE CHANNEL Drive 2-port Short Wavelength (T10C-4FC-SW-30Z)
  - SL3000 FICON Drive 2-port Long Wavelength (T10C-4FI-LW-30Z)
- SL8500 library:
  - SL8500 FIBRE CHANNEL Drive 2-port Short Wavelength (T10C-4FC-SW-85Z)
  - SL8500 FICON Drive 2-port Long Wavelength (T10C-4FI-LW-85Z)

    Note – SFP conversion kits are available to obtain SW or LW modules (see "Conversion Kits and Upgrades" on page 76).
  - Port conversions:
    - T10K 4 Gbit 2 port Long Wavelength (two XT10K-4GB-LW-Z-N)
    - T10K 4 Gbit 2 port Mix Wavelength (XT10K-4GB-LW-Z-N and XT10K-4GB-SW-Z-N)
    - T10K 4 Gbit 2 port Short Wavelength (two XT10K-4GB-SW-Z-N)

Rack mount:

- Rack mount FIBER CHANNEL Short Wavelength 1 Drive (T10C-4FC-SW-RK1Z)
- Rack mount FICON Long Wavelength 1 Drive (T10C-4FI-LW-RK1Z)

  Note – A conversion kit is available to obtain a second drive (see "Conversion Kits and Upgrades" on page 76).

T10000B Order Numbers

T10000B (New)

Library mounted drives:

- SL3000 library:
  - SL3000 FIBRE CHANNEL Drive 2-port Short Wave (T10B-4FC-SW-30Z-N)
  - SL3000 FICON Drive 2-port Long Wave (T10B-4FI-LW-30Z-N)
- SL8500 library:
  - SL8500 FIBRE CHANNEL Drive 2-port Short Wave (T10B-4FC-SW-85Z-N)
  - SL8500 FICON Drive 2-port Long Wave (T10B-4FI-LW-85Z-N)

    Note – SFP conversion kits are available to obtain SW or LW modules (see "Conversion Kits and Upgrades" on page 76).
- L-series library:
  - L700/1400/180 FIBRE CHANNEL Drive (T10B4FC-L7/14/18-N)
  - L700/1400/180 FICON Drive (T10B4FI-L7/14/18-N)

    Note – Interface transceivers (SFP modules) do not ship with the tape drive for the L-Series libraries. A complete order consists of a tape drive number and a port conversion kit (a number beginning with an X).
  - Port conversions:
    - T10K 4 Gbit 1 port Long Wavelength (XT10K-4GB-LW-Z-N)
    - T10K 4 Gbit 1 port Short Wavelength (XT10K-4GB-SW-Z-N)
    - T10K 4 Gbit 2 port Long Wavelength (two XT10K-4GB-LW-Z-N)
    - T10K 4 Gbit 2 port Mix Wavelength (XT10K-4GB-LW-Z-N and XT10K-4GB-SW-Z-N)
    - T10K 4 Gbit 2 port Short Wavelength (two XT10K-4GB-SW-Z-N)

Rack mount:

- Rack mount FIBER CHANNEL Short Wavelength 1 Drive (T10B-4FC-SW-RK1Z-N)
- Rack mount FICON Long Wavelength 1 Drive (T10B-4FI-LW-RK1Z-N)

  Note – A conversion kit is available to obtain a second drive (see "Conversion Kits and Upgrades" on page 76).

T10000B (*Used*)

Library mounted drive:

SL3000 FIBRE CHANNEL Drive 2-port Short Wavelength (YT10B-4FC-SW-30Z)

SL8500 FIBRE CHANNEL Drive 2-port Short Wavelength (YT10B-4FC-SW-85Z)

SL8500 FICON Drive 2-port Long Wavelength (YT10B-4FI-LW-85Z)

Rack mount:

Rack mount FICON Long Wavelength 1 Drive (YT10B-4FI-LW-RK1Z)

T10000A Order Numbers (*Used*)

Used 4 gigabit T10000A drives:

- Library mounted drive:
  - *Used* T10K 4 Gbit 9310, 9741E (YT10A-4FC-9310Z-N)

    Note – Tape drives for the 9310 library require SFP modules, see "Conversion Kits and Upgrades" on page 76. Installation in a 9310 library requires additional hardware upgrades.
  - *Used* T10K 4 Gbit, L-series (YT10A-4FCL7/14/18Z)
  - *Used* T10K 4 Gbit, DPLW, SL8500 (YT10A-4FC-LW-85Z-N)
  - *Used* T10K 4 Gbit, DPMW, SL8500 (YT10A-4FC-MW-85Z-N)
  - *Used* T10K 4 Gbit, DPSW, SL8500 (YT10A-4FC-SW-85Z-N)
- Rack drives (T10000A - 4 gigabit):
  - *Used* 4 Gbit FC 1 drv Long Wave Rack, RoHS (YT10A-4FC-LWRK1Z-N)
  - *Used* 4 Gbit FC 2 drv Long Wave Rack, RoHS (YT10A-4FC-LWRK2Z-N)
  - *Used* 4 Gbit FC 1 drv Short Wave Rack (YT10A4FC-SW-RK1-N)
  - *Used* 4 Gbit FC 2 drv Short Wave Rack, RoHS (YT10A-4FC-SWRK2Z-N)

Used 2 gigabit T10000A drives:

- Library drives:
  - **Fibre Channel interface:**
    - *Used* 2 Gbit FC drv 9310, NON-RoHS (YT10A-2FC-9310-N)
    - *Used* 2 Gbit FC drv 9310 (YT10A-2FC-9310Z-N)

      Note – Tape drives for the 9310 library require SFP modules, see "Conversion Kits and Upgrades" on page 76. Installation in a 9310 library requires additional hardware upgrades.
    - *Used* 2 Gbit FC drv L-Series, NON-RoHS (YT10A2FCL7/14/18-N)
    - *Used* 2 Gbit FC drv Long Wave SL8500, NON-RoHS (YT10A-2FC-LW-85-N)
    - *Used* 2 Gbit FC drv Long Wave SL8500 (YT10A-2FC-LW-85Z-N)
    - *Used* 2 Gbit FC drv Mix Wave SL8500, NON-RoHS (YT10A-2FC-MW-85-N)

- *Used* 2 Gbit FC drv Mix Wave SL8500 (YT10A-2FC-MW-85Z-N)
- *Used* 2 Gbit FC drv Short Wave SL8500, NON-RoHS (YT10A-2FC-SW-85-N)
- *Used* 2 Gbit FC drv Short Wave SL8500 (YT10A-2FC-SW-85Z-N)

- **FICON interface (encryption capable):**
  - *Used* 2 Gbit FC drv 9310 (YT10A-2FI-C9310Z-N)
  - *Used* 2 Gbit FC drv Long Wave SL8500 (YT10A-2FI-CLW85Z-N)
  - *Used* 2 Gbit FC drv Mix Wave SL8500 (YT10A-2FI-CMW85Z-N)
  - *Used* 2 Gbit FC drv Short Wave SL8500 (YT10A-2FI-CSW85Z-N)
- **FICON interface (not encryption capable):**
  - *Used* 2 Gbit FICON drv 9310, NON-RoHS (YT10A-2FI-9310-N)
  - *Used* 2 Gbit FICON drv 9310 (YT10A-2FI-9310Z-N)

    Note – Tape drives for the 9310 library require SFP modules, see "Conversion Kits and Upgrades" on page 76. Installation in a 9310 library requires additional hardware upgrades.
  - *Used* 2 Gbit FICON drv L-Series, NON-RoHS (YT10A2FIL7/14/18-N)
  - *Used* 2 Gbit FICON drv L-Series (YT10A-2FI-LSERZ-N)
  - *Used* 2 Gbit FICON drv Long Wave SL8500, NON-RoHS (YT10A-2FI-LW-85-N)
  - *Used* 2 Gbit FICON drv Long Wave SL8500 (YT10A-2FI-LW-85Z-N)
  - *Used* 2 Gbit FICON drv Mix Wave SL8500, NON-RoHS (YT10A-2FI-MW-85-N)
  - *Used* 2 Gbit FICON drv Mix Wave SL8500 (YT10A-2FI-MW-85Z-N)
  - *Used* 2 Gbit FICON drv Short Wave SL8500, NON-RoHS (YT10A-2FI-SW-85-N)
  - *Used* 2 Gbit FICON drv Short Wave SL8500 (YT10A-2FI-SW-85Z-N)

- Rack drives (T10000A - 2 gigabit):
  - **Fibre Channel interface:**
    - *Used* 2 Gbit FC 1 drv Long Wave Rack, NON-RoHS (YT10A-2FC-LW-RK1-N)
    - *Used* 2 Gbit FC 1 drv Long Wave Rack (YT10A2FC-LW-RK1-N)
    - *Used* 2 Gbit FC 2 drv Long Wave Rack, NON-RoHS (YT10A-2FC-LW-RK2-N)
    - *Used* 2 Gbit FC 2 drv Long Wave Rack (YT10A2FC-LW-RK2-N)
    - *Used* 2 Gbit FC 1 drv Short Wave Rack, NON-RoHS (YT10A-2FC-SW-RK1-N)
    - *Used* 2 Gbit FC 1 drv Short Wave Rack (YT10A2FC-SW-RK1Z-N)

- *Used* 2 Gbit FC 2 drv Short Wave Rack, NON-RoHS (YT10A-2FC-SW-RK2-N)
- *Used* 2 Gbit FC 2 drv Short Wave Rack (YT10A2FC-SW-RK2-N)

- **FICON interface (encryption capable):**
  - *Used* 2 Gbit FICON 1 drv Lng Wv Rack (YT10A-2FICLWRK1Z-N)
  - *Used* 2 Gbit FICON 2 drv Lng Wv Rack (YT10A-2FICLWRK2Z-N)
  - *Used* 2 Gbit FICON 1 drv Shrt Wv Rack (YT10A-2FICSWRK1Z-N)
  - *Used* 2 Gbit FICON 2 drv Shrt Wv Rack (YT10A-2FICSWRK2Z-N)
- **FICON interface (not encryption capable):**
  - *Used* 2 Gbit FICON 1 drv Lng Wv Rack, NON-RoHS (YT10A-2FI-LW-RK1-N)
  - *Used* 2 Gbit FICON 1 drv Lng Wv Rack (YT10A2FI-LW-RK1-N)
  - *Used* 2 Gbit FICON 2 drv Lng Wv Rack, NON-RoHS (YT10A-2FI-LW-RK2-N)
  - *Used* 2 Gbit FICON 2 drv Lng Wv Rack (YT10A2FI-LW-RK2-N)
  - *Used* 2 Gbit FICON 1 drv Shrt Wv Rack, NON-RoHS (YT10A-2FI-SW-RK1-N)
  - *Used* 2 Gbit FICON 1 drv Shrt Wv Rack (YT10A2FI-SW-RK1-N)
  - *Used* 2 Gbit FICON 2 drv Shrt Wv Rack, NON-RoHS (YT10A-2FI-SW-RK2-N)
  - *Used* 2 Gbit FICON 2 drv Shrt Wv Rack (YT10A2FI-SW-RK2-N)

Encryption Features

The encryption feature provides a key to license a drive and enable encryption.

Note – One required per encryption-enabled tape drive.

Encryption activation after drive installation (T10K-EKEY-A-N)

Encryption activation at drive installation (T10K-EKEY-B-N)

Conversion Kits and Upgrades

Conversion kits or upgrade kits are available for installation at the customer's site. See:

- Drive Port and Rack Mount Kits
- "Library Tray Kits" on page 77

TIP – When planning the network, make sure the SFP module supports the specific network type and configuration (HBAs, switches, wavelength, and cable types).

Drive Port and Rack Mount Kits

Port conversions:

- 4 Gigabit port:
  - T10000 4 Gbit LW (long wave) SFP, cable kit (XT10K-4GB-LW-Z-N)
  - T10000 4 Gbit SW (short wave) SFP, cable kit (XT10K-4GB-SW-Z-N)
- 2 Gigabit port:
  - T9840/T10K 2 Gbit LW SFP, cable kit (X984/T10K-2GB-LW-N)
  - T9840/T10K 2 Gbit SW SFP, cable kit (X984/T10K-2GB-SW-N)

Note – Drives have two ports, but you can choose to use only one port. You must order a kit for each drive port - a mixed port drive requires one SW kit and one LW kit.

Rack mount conversion:

- T10000C:
  - T10000C Single LW drive to LW 2-drive rack mount (XT10C-4-LW-RK1-2Z)
  - T10000C Single SW drive to SW 2-drive rack mount (XT10C-4-SW-RK1-2Z)
- T10000B:
  - T10000B Single LW drive to LW 2-drive rack mount (XT10B-4-LW-RK1-2-N)
  - T10000B Single SW drive to SW 2-drive rack mount (XT10B-4-SW-RK1-2-N)

Library Tray Kits

T10000C:

From SL3000 to SL8500: T10C-S30/S85-CKITZ

From SL8500 to SL3000: T10C-S85/S30-CKITZ

T10000B:

From L180, L700/e, L1400:

To SL8500: T10K-4-SL85-CKIT-N

To SL3000: T10AB-FCFI-SL3-Z-N

From SL3000 to SL8500: T10K-S30/S85CKIT-N

From SL8500 to SL3000: T10K-S85/S30CKIT-N

T10000A (4Gbit):

From L180, L700/e, L1400:

To SL8500: T10K-4-SL85-CKIT-N

To SL3000: T10AB-FCFI-SL3-Z-N

From L5500:

To SL8500: T10K-4-SL85-CKIT-N

To SL3000: T10AB-FCFI-SL3-Z-N

From 9310:

To SL8500: T10K-4-SL85-CKIT-N

To SL3000: T10AB-FCFI-SL3-Z-N

From SL3000 to SL8500: T10K-S30/S85CKIT-N

From SL8500 to SL3000: T10K-S85/S30CKIT-N

T10000A (2Gbit):

From L180, L700/e, L1400:

To SL8500: T10A-LSER/85-KIT-N

To SL3000: T10AB-FCFI-SL3-Z-N

From L5500:

To SL8500: T10A-LSER/85-KIT-N

To SL3000: T10AB-FCFI-SL3-Z-N

From 9310:

To SL8500: T10A-LSER/85-KIT-N

To SL3000: T10AB-FCFI-SL3-Z-N

From SL8500 to SL3000: T10K-S85/S30CKIT-N

Ordering Media and Cartridge Labels

Ordering tape cartridges is easy.

- Call **1.877.STK.TAPE** to order media from your local reseller or to obtain media pre-sales support.
- E-mail addresses for local support questions: **tapemediaorders_ww@oracle.com**

See either Appendix A, "Tape Cartridges" for additional information or the tape media area on the corporate web site.

http://www.oracle.com/us/products/servers-storage/storage/tape-storage/029155.htm

Power Cords

The following table lists the power cord requirements for the rack mount drive trays.

- PWRCORD10187018-Z

  StorageTek Cord Set, 3X1MM2, 250Volt/10Amps, BELGIUM, HOLLAND, FRANCE, GERMANY, SWEDEN, NORWAY, FINLAND, Female/IEC320, 2.5 Meter, RoHS-5

- PWRCORD10187019-Z

  StorageTek Cord Set, 3X18AWG, 125Volt/10Amps, USA, CANADA, Female/C13, 7.5FT, RoHS-5

- PWRCORD10187045-Z

  StorageTek Power Cord, IEC320,3,SVT,18AWG, RoHS-5

Ethernet Cables

The tape drive uses Ethernet cables for virtual operator panel and maintenance port connections. The following table lists the available cables.

- CAT5E, 8 feet, 24 AWG, shielded (CABLE10187033-Z)
- CAT5E, 35 feet, 24 AWG, shielded (CABLE10187034-Z)
- CAT5E, 50 inches, 24 AWG, shielded (CABLE10187035-Z)
- Plenum rated cables:
  - CAT5E, 35 feet, 24AWG, shielded, plenum (CABLE10187039-Z)
  - CAT5E, 55 feet, 24AWG, shielded, plenum (CABLE10187040-Z)
  - CAT5E, 100 feet, 24AWG, shielded, plenum (CABLE10187041-Z)

    Note – Always use shielded Ethernet cables to connect to a drive installed in a library.

Interface Cables

The following sections provide information about the different interface cables.

When you order cables, keep in mind:

- **Riser cable** materials are not classified according to flammability.
- **Plenum cables** meet UL standards for flammability.

Multimode Fiber-optic Cable Numbers

The following multimode (50-micron) fiber-optic cables connect Fibre Channel devices and FICON devices. These cables are orange with a tan LC connector at the drive end.

Note – The tape drive only supports LC connectors.

Cables with LC connectors on both ends:

- CABLE10800310-Z

  LC-LC, 50/125/ duplex, riser, 10 meter, RoHS-5
- CABLE10800311-Z

  LC-LC, 50/125/ duplex, riser, 50 meter, RoHS-5
- CABLE10800312-Z

  LC-LC, 50/125/ duplex, riser, 100 meter, RoHS-5
- CABLE10800313-Z

  LC-LC, 50/125/ duplex, plenum, 10 meter, RoHS-5
- CABLE10800314-Z

  LC-LC, 50/125/ duplex, plenum, 50 meter, RoHS-5
- CABLE10800315-Z

  LC-LC, 50/125/ duplex, plenum, 100 meter, RoHS-5
- CABLE10800316-Z

  LC-LC, 50/125/ duplex, riser, 0.5 meter, RoHS-5

Cables with an LC connectors on one end and an SC connector on the other end:

- CABLE10800317-Z

  LC-SC, 50/125/ duplex, riser, 10 meter, RoHS-5
- CABLE10800318-Z

  LC-SC, 50/125/ duplex, riser, 50 meter, RoHS-5

- CABLE10800319-Z

  LC-SC, 50/125/ duplex, riser, 100 meter, RoHS-5

- CABLE10800320-Z

  LC-SC, 50/125/ duplex, plenum, 10 meter, RoHS-5

- CABLE10800321-Z

  LC-SC, 50/125/ duplex, plenum, 50 meter, RoHS-5

- CABLE10800322-Z

  LC-SC, 50/125/ duplex, plenum, 100 meter, RoHS-5

Cables with an LC connectors on one end and an ST connector on the other end:

- CABLE10800323-Z

  LC-ST, 50/125/ duplex, plenum, 10 meter, RoHS-5

  Note – This cable might not appear in the price list

Single Mode Fiber-optic Cable Worksheet

The following single mode (9-micron) fiber optic cables are used with FICON devices configured with a long wave SFP. These cables are yellow and have a blue LC connector at the drive end.

Note – The tape drive only supports LC connectors.

Cables with LC connectors on both ends:

- CABLE10800330-Z

  LC-LC, 9/125/ duplex, plenum, 10 meter, RoHS-5

- CABLE10800331-Z

  LC-LC, 9/125/ duplex, riser, 10 meter, RoHS-5

- CABLE10800332-Z

  LC-LC, 9/125/ duplex, plenum, 50 meter, RoHS-5

- CABLE10800333-Z

  LC-LC, 9/125/ duplex, riser, 50 meter, RoHS-5

Cables with an LC connectors on one end and an SC connector on the other end:

- CABLE10800334-Z

  LC-SC, 9/125/ duplex, plenum, 10 meter, RoHS-5

- CABLE10800335-Z

  LC-SC, 9/125/ duplex, riser, 10 meter, RoHS-5

- CABLE10800336-Z

  LC-SC, 9/125/ duplex, plenum, 50 meter, RoHS-5

- CABLE10800337-Z

  LC-SC, 9/125/ duplex, riser, 50 meter, RoHS-5

One Gigabit Fiber-optic Cable Worksheet

SC connectors are the standard for 1 Gbps Fibre Channel devices such as the T9840A Tape Drive. You might see these connectors when replacing a T9x40 tape drive with a T10000 tape drive.

The cables are orange and have SC connectors at both ends.

> **Note –** The T10000 tape drive only supports LC connectors.

Cables with SC connectors on both ends.

- CABLE10800294-Z

  SC-SC, 5-/125/ Duplex, Plenum, 10 Meter, RoHS-5

- CABLE10800295-Z

  SC-SC, 5-/125/ Duplex, Plenum, 50 Meter, RoHS-5

- CABLE10800297-Z

  SC-SC, 5-/125/ Duplex, Riser, 10 Meter, RoHS-5

- CABLE10800298-Z

  SC-SC, 5-/125/ Duplex, Riser, 50 Meter, RoHS-5

> **TIP –** When using cables with SC connectors, you must have an SC to LC adapter. See "Cables and Connectors" on page 67.

A

Tape Cartridges

Tape cartridges are not shipped as part of the T10000 tape drive; you must order them separately. See "Ordering Media and Cartridge Labels" on page 78 for more information.

This appendix lists and describes the StorageTek T10000 tape cartridges.

FIGURE A-1 Tape Cartridge Types

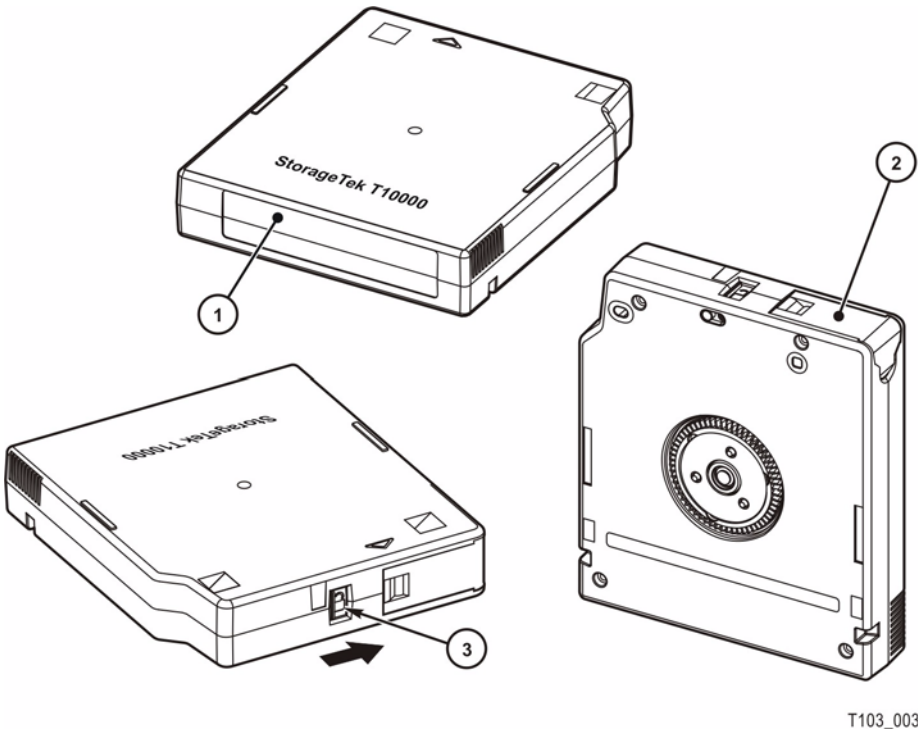


Illustration call-outs (3):

1. Label area
2. Door (black = data, red = sport, white = cleaning, and yellow = VolSafe)
3. Write protect switch

Disclaimer

Media Usage:

The storage media (tape cartridges) used in a library and tape drive can have a *significant* impact on the overall performance. The following is a policy regarding tape storage media:

- StorageTek-branded media has a warranty.
- The customer is responsible for all expenses and costs related to the repair or replacement of hardware damaged by non-StorageTek branded tape storage media.

Tape Cartridges

Optimized for high capacity, these cartridges use a single reel hub to maximize performance. The basic types of cartridges are:

- StorageTek T10000 T1 (for the T10000A/B tape drives)
  - Standard
  - Sport
  - VolSafe (standard or sport)
  - Cleaning
- StorageTek T10000 T2 (for the T10000C tape drive)
  - Standard
  - Sport
  - VolSafe (standard or sport)
  - Cleaning

Standard Cartridges

Standard cartridges are the common read/write data cartridges. You can identify a standard cartridge by the *black* access door.

- Each *standard* data cartridge has a native capacity of:
  - StorageTek T10000 T1: 500 GB (T10000A) or 1 TB (T10000B)
  - StorageTek T10000 T2: 5 TB (T10000C)
- The StorageTek T10000 T1 data cartridge is under warranty for 15,000 mounts. The StorageTek T10000 T2 data cartridge is under warranty for 25,000 mounts. The tape drive issues a warning message to the host when that number is exceeded.

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

Sport Cartridges

Sport cartridges are a smaller version of the standard data cartridges. You can identify a sport cartridge by the *red* access door.

- Each *sport* data cartridge has a native capacity of:
  - StorageTek T10000 T1: 120 GB (T10000A) or 240 GB (T10000B)
  - StorageTek T10000 T2: 1 TB (T10000C)
- The StorageTek T10000 T1 cartridge is under warranty for 15,000 mounts. The StorageTek T10000 T2 cartridge is under warranty for 25,000 mounts. The tape drive issues a warning message when that number is exceeded.

VolSafe Cartridges

VolSafe is an extension of the write protect function. Use VolSafe cartridges for write-once, read-many (WORM) applications. You cannot erase them without destroying the tape itself.

You can identify a VolSafe cartridge by the *yellow* access door.

- T10000 writes data to a VolSafe tape then the drive can append a multitude of data sets onto the cartridge until the cartridge is full. In this way, VolSafe enables permanent archival of data on the tape without the possibility of data loss.
- VolSafe cartridges come in both standard and sport capacities.
- The StorageTek T10000 T1 cartridge is under warranty for 15,000 mounts. The StorageTek T10000 T2 cartridge is under warranty for 25,000 mounts. The tape drive issues a warning message to the host when that number is exceeded.

VolSafe and WORM technologies are ideal for data storage, protection, and archive for a variety of applications such as the Sarbanes-Oxley Act.

The Sarbanes-Oxley Act was signed into law on July 30, 2002. This act introduced highly significant legislative changes to financial practice and corporate governance regulation. It introduced stringent new rules with the stated objective: “to protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the securities laws.”

> **Note –** VolSafe cartridges written on a T10000B drive can not be reclaimed on a T10000A drive. VolSafe cartridges written on a T10000C drive can not be reclaimed on a T10000A/B drive.

Cleaning Cartridges

As the name implies, use a cleaning cartridge to clean a tape drive’s read/write head and tape path.

> **Note –** After the tape drive transports a predetermined length of tape or records a pre-determined number of errors, the drive automatically requests cleaning.

You can use a cleaning cartridge to clean a drive’s read/write head up to the rated number of passes. An attempt to use a cleaning cartridge beyond that results in the tape drive rejecting the cartridge and posting an error message to the host.

You can identify these cartridges by a **white** leader access door.

Additional Components

Two additional T10000 tape cartridge components are the Radio Frequency Identification and Media Information.

Radio Frequency Identification

The T10000 drive RFID circuitry reads the information in the RFID chip located in the cartridge when a tape is loaded. This information helps determine the type of tape and the state of the media information region (MIR).

- When the tape is loaded, the MIR is marked as invalid—or, subject to change—then updated with new information when it is unloaded.
- When the tape is released from the drive, the RFID chip is refreshed by the drive with the current MIR information, statistics, and status.

Media Information

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/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/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 standard data cartridge or Sport cartridge written by a T10000A drive, the:

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

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

- RFID can be:
  - Read by a T10000A, B, or C drive
  - Updated by a T10000B or C drive

- MIR can be read by a T10000B or C drive
- MIR cannot be updated by a T10000A or C drive
- T10000B or C 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/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 standard data cartridge or Sport cartridge written by a T10000C drive, the:

- RFID can be:
  - Read by a T10000A, B, or C drive
  - Updated by a T10000C drive
- MIR can be read by a T10000C 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 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 4031/4032 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.

- The drive recovers the media information as it processes host commands, but very slowly.

Cartridge Environmental Requirements

Operating (tape path):

- Temperature: 10° to 45°C (50° to 113°F)
- Relative humidity (non-condensing): 20% to 80%
- Wet bulb (maximum): 26°C (79°F) with no condensation

Note – Conditioning time before use is 24 hours minimum but 72 hours preferred.

Storage (less than four weeks):

- Temperature: 10° to 32°C (50° to 90°F)
- Relative humidity (non-condensing): 5% to 80%
- Wet bulb (maximum): 26°C (79°F) with no condensation

Archival:

- Temperature: 15° to 26°C (59° to 79°F)
- Relative humidity (non-condensing): 15% to 50%
- Wet bulb (maximum): 26°C (79°F) with no condensation

Shipping (less than 10 days):

- Temperature: -23° to 49°C (-9° to 120°F)
- Relative humidity (non-condensing): 5% to 80%
- Wet bulb (maximum): 26°C (79°F) with no condensation

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

Tape Cartridge Specifications

Physical specifications:

- Height: 2.45 centimeters (0.964 inches)
- Length: 12.5 centimeters (4.92 inches)
- Depth (width): 10.9 centimeters (4.29 inches)
- Weight:
  - StorageTek T10000 T1 cartridges (used with T10000A/B drives):
    - Standard data cartridge: 262.5 grams (9.26 ounces)
    - Sport data cartridge: 187 grams (6.60 ounces)
    - Cleaning cartridge: 196.3 grams (6.94 ounces)

- StorageTek T10000 T2 cartridges (used with the T10000C drive):
  - Standard data cartridge: 270 grams (9.52 ounces)
  - Sport data cartridge: 191 grams (6.74 ounces)
  - Cleaning cartridge: 196.3 grams (6.94 ounces)

- Cartridge life:
  - StorageTek T10000 T1 (used with T10000A/B drives): 15,000 mounts
  - StorageTek T10000 T2 (used with the T10000C drive): 25,000 mounts

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

Tape media data:

- StorageTek T10000 T1 cartridges (used with T10000A/B drives):
  - Standard data cartridge:
    - Capacity: 500 gigabytes (T10000A) or 1 terabyte (T10000B)
    - Media length: 917 meters (3,009 feet) [recordable 855 meters (2,805 feet)]
  - Sport data cartridge:
    - capacity: 120 gigabytes (T10000A) or 240 gigabytes (T10000B)
    - Media length: 267 meters (876 feet) [recordable 205 meters (672.6 feet))]
  - Media thickness: 6.5 microns
  - Tracks:
    - T10000A: 768/32 channels/24 wraps
    - T10000B: 1,152/32 channels/36 wraps
- StorageTek T10000 T2 cartridges (used with the T10000C drive):
  - Standard data cartridge:
    - Capacity: 5 terabytes
    - Media length: 1,147 meters (3,763 feet) [recordable 1,107 meters (3,632 feet)]
  - Sport data cartridge:
    - Capacity: 1 terabyte
    - Media length: 334 meters (1,096 feet) [recordable 303 meters (994 feet)]
  - Media thickness: 5.2 microns
  - Tracks (T10000C): 3,584/32 channels/112 wraps

    Caution – *Servo track damage*: Bulk-erase will destroy pre-recorded servo tracks. **Do not degauss T10000 tape cartridges.**

Labels

A cartridge label contains bar codes and visual characters. The visual characters do not need to line up with the bar code.

If you are using cartridges in rack mount tape drives, the cartridges may be labeled on the rear of the cartridge as desired.

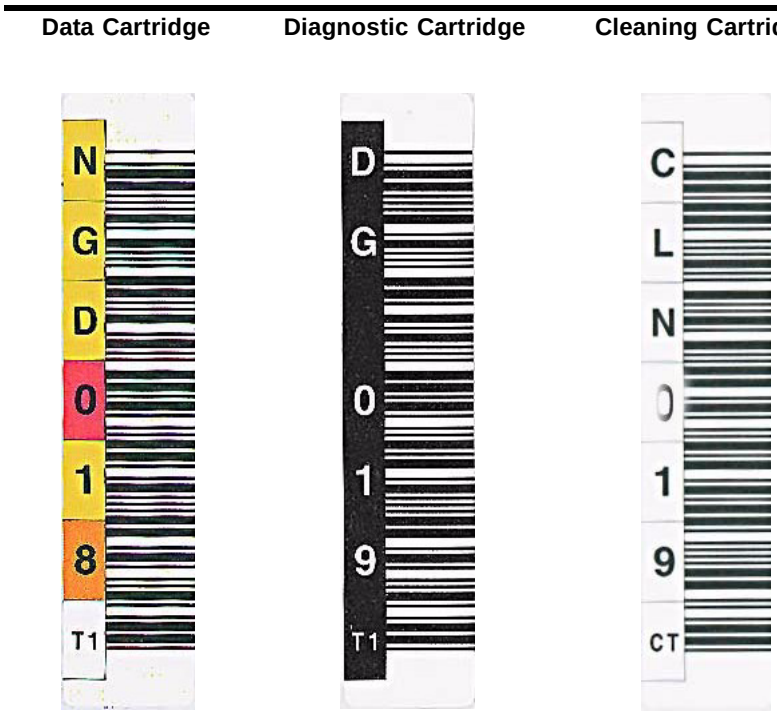
If you are using the cartridges in a StorageTek library, see the *User's Guide* for that library regarding the label requirements.

The following specifications are pertinent to the label:

- AIM Uniform Symbology Specification USS-39
- ANSI MH10.8M-1993 ANSI Code 39 Barcode Specification

FIGURE A-2 shows examples of three tape cartridge labels for the T10000A/B tape drive.

FIGURE A-2 Label Examples



Data Cartridge Labels

Data cartridge labels consist of eight characters and the associated barcode. These characters may consist of letters A–Z and numbers 0–9. No special characters (&$%@# and so on) may be used. The first six characters in the label are the customer volume ID or volume serial number (VOLSER). The last two characters are the media ID usually with a white background.

- T1 is the media ID for the StorageTek T10000 T1 cartridge
- T2 is the media ID for StorageTek T10000 T2 cartridge

Note – VolSafe cartridge labels are the same as data cartridge labels except that the background color of the media ID is usually yellow.

Diagnostic Cartridge Labels

The label must start with DG <space> so a library can recognize a diagnostic cartridge. The next three characters can be 000 to 999 while the last two characters indicate the media ID (T1 for a cartridge used with a T10000A/B drive or T2 for a cartridge used with the T10000C drive).

Cleaning Cartridge Labels

The cleaning label is “CLNxxx” where xxx is 00 to 99 to identify each individual cleaning tape. The library recognizes a cleaning cartridge by the label media identifier (CT for a T10000A/B drive, CC for a cartridge used with a T10000C drive, or CL for a cartridge that can be used with any model in the T10000 drive family).

Tape Cartridge Care

T10000 cartridges require care to ensure proper operation and longevity.

New Cartridges

Unpack new tape cartridges in the area in which they will be used and allow them to acclimate for a period of at least 24 hours.

Handling

Caution – *Tape and cartridge damage:* Tape cartridges are easily damaged and you must handle them carefully. Follow these tape cartridge handling guidelines:

- Do not open a tape cartridge or touch the tape.
- Do not carry tape cartridges loosely in a container.
- Do not expose the tape or cartridge to direct sunlight or moisture.
- Do not expose a recorded tape cartridge to magnetic fields.
- Maintain clean operating, working, and storage environments.

Cleaning

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

Storing

Always store tape cartridges in an environment within the specified range of temperature and humidity. Follow these recommendations when you store cartridges:

- Do not take tape cartridges out of their protective wrapping until you need them. Use the tear string, not a sharp instrument, to remove wrapping.
- Store tape cartridges in a dirt-free environment that, if possible, duplicates the conditions of the data processing center.
- Before you use tape cartridges that have been in tape storage, acclimate them to the operating environment for at least 72 hours.

Shipping

> **Caution –** *Tape and cartridge damage:* Tape cartridges are easily damaged. Proper packaging is required for shipping.

If you must ship cartridges, especially if they are for remote system backup, remote database duplication, or disaster recovery, follow these guidelines:

- **Save the original factory packaging** when you receive new tape cartridges. Use this packaging material, or the equivalent, to package tape cartridges for shipment.
- Wrap the tape cartridges in plastic to block moisture and contamination from entering the tape cartridges.
- Pack the tape cartridges on edge, with the leader door on *top*. If you pack the tape cartridges flat, shipping vibration causes the clutches in the tape cartridges to disengage and slip.
- Pad the tape cartridges on all six (6) sides.
- If you are using factory packaging to ship fewer tape cartridges than the packaging originally held, or if you are using other packaging, fill voids in the packaging with foam padding equivalent to the original contents.
- Label the outside of the shipping carton clearly with text or accepted symbols that indicate:
  - Do not expose to magnetic fields
  - Do not expose to moisture
  - This end up
  - Fragile

B

Controlling Contaminants

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 as well as 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 much longer period of 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 in the vicinity of 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" 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, applicable human exposure limits from OSHA, NIOSH or the ACGIH should be used.

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 in size 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 to a size where it can physically interfere with a mechanism, or can 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

All surfaces within the controlled zone of the data center should be maintained at a high level of cleanliness. All surfaces should be periodically cleaned by trained professionals on a regular basis, as outlined in the "Cleaning Procedures and Equipment" section. Particular attention should be paid 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. Only vacuums equipped with High Efficiency Particulate Air (HEPA) filtration should be used 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. The following precautions should be taken 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 thorough coverage, and helps in identifying areas that are damaged or exposed over time.
- It must have a high flexibility and low porosity in order 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 prior to 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

All potential exposure points in the data center should be addressed 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, the following should be considered:

- All doors should fit snugly in their frames.
- Gaskets and sweeps can be used to address any gaps.
- Automatic doors should be avoided 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, and 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). Low-grade pre-filters should be installed 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, air from sources outside the building should be filtered using High Efficiency Particulate Air (HEPA) filtration rated at 99.97% efficiency (DOP Efficiency MILSTD-282) or greater. The expensive high efficiency filters should be protected by multiple layers of pre-filters that are changed on a more frequent basis. Low-grade pre-filters, 20% ASHRAE atmospheric dust-spot efficiency, should be 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 %**		
Dust spot efficiency %	**3.0 micron**	**1.0 micron**	**0.3 micron**
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. Any gaps or openings should be filled 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 in order to accommodate positive pressurization and ventilation requirements. The data center should be designed 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 in order to minimize contaminant infiltration of the computer room. Only a minimal amount of air should be introduced into the controlled environment. In data centers with multiple rooms, the most sensitive areas should be the most highly pressurized. 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 the air introduction should be minimal. A precise determination of acceptable limits should be based 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. In most cases, the air needed to achieve positive pressurization will likely exceed that needed to accommodate the room occupants. Normally, outside air quantities of less than 5% make-up air should be 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 with respect to 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
Bi-Annual 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. The entire access floor should be vacuumed and damp mopped. All vacuums used in the data center, for any purpose, should be equipped 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. The solution should be maintained in good condition throughout the project, and excessive applications should be avoided.

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. These actions should be performed three to four times per year, based on the levels of activity and contamination present. All

room surfaces should be thoroughly decontaminated including cupboards, ledges, racks, shelves and support equipment. High ledges and light fixtures and generally accessible areas should be treated or vacuumed as appropriate. Vertical surfaces including windows, glass partitions, doors, etc. should be thoroughly treated. 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.

Settled contamination should be removed from all exterior hardware surfaces including horizontal and vertical surfaces. The unit's air inlet and outlet grilles should be treated as well. 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. Specially treated dust wipes should be used to treat all hardware surfaces. Monitors should be treated with optical cleansers and static-free cloths. No Electro-Static Discharge (ESD) dissipative chemicals should be used 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 should be HEPA vacuumed and damp mopped as detailed in the Weekly Actions.

Bi-Annual Tasks

The subfloor void should be decontaminated 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 should be fully trained to assess cable connectivity and priority. Each exposed area of the subfloor void should be individually inspected and assessed for possible cable handling and movement. All twist-in and plug-in connections should 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, the number of floor tiles removed from the floor system should be carefully managed. In most cases, each work crew should 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 should be removed from the grid work and cleaned with a damp sponge as well. Any unusual conditions, such as damaged floor suspension, floor tiles, cables and surfaces, within the floor void should be noted and reported.

Activity and Processes

Isolation of the data center is an integral factor in maintaining appropriate conditions. All unnecessary activity should be avoided in the data center, and access should be limited to necessary personnel only. Periodic activity, such as tours, should be limited, and traffic should be restricted to away from the hardware so as to avoid accidental contact. All personnel working in the room, including temporary employees and janitorial personnel, should be trained in the most basic sensitivities of the hardware so as to avoid unnecessary exposure. The controlled areas of the data center should be thoroughly isolated 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 related to the T10000 tape drive.

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.

A

access time
The time interval between the instant at which a call for data is initialized and the instant at which the delivery of data is completed. (T)

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)

AL_PA
See Arbitrated Loop Physical Address.

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.

B

beginning-of-tape (BOT)
The location on a tape where written data begins.

block
A collection of contiguous records recorded as a unit. Interblock gaps separate blocks, and each block can contain one or more records.

buffer
A routine or storage that compensates for a difference in the rate of data flow, or the time of occurrence of events when transferring data from one device to another.

burst
In data communication, a sequence of signals counted as one unit in accordance with a specific criterion or measure. (A)

C

capacity
Total amount of User Data stored on one data cartridge in 8-bit bytes. *Synonymous with* "User Capacity" or "Native Capacity". This is the capacity that the user sees after the ECC/Format/ERP and other overhead has been assessed (no compression).

capacity, raw
Total amount of data stored on one data cartridge in 8-bit bytes before any ECC/Format/ERP and other overhead has been assessed (no compression).

capacity, user
Total amount of data stored on one data cartridge in 8-bit bytes that is sent by the host computer. This is the capacity that the user sees after the ECC/Format/ERP and other overhead has been assessed (no compression).

cartridge
A storage device that consists of magnetic tape on a supply reel in a protective housing.

channel
A functional unit, controlled by the processor (or host), that handles the transfer of data between processor storage and logical peripheral equipment.

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.

D

data error rate
The number of errors that occur per a measurable amount of data on a tape.

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).

DHCP
See Dynamic Host Configuration Protocol.

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)
An IP protocol that a host uses to obtain all necessary configuration information, including an IP address.

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.

E

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 possible 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)

F

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 ultrathin 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.

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 and/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.

firmware
An ordered set of instructions and data stored in a way that is functionally independent of main storage; for example, microprograms stored in ROM. (T)

FRU
Field replaceable unit.

FSC
Fault symptom code.

FTP
File Transfer Protocol.

G

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.

H

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
Interface between a network and host computer. (T)

hub
A Fibre Channel Arbitrated Loop switching device that allows multiple servers and targets, such as storage systems, to connect at a central point. A single hub configuration appears as a single loop.

I

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.

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.

L

laser
See light amplification by simulated emission of radiation.

LC connector
A standard connector for 2-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.

light amplification by simulated emission of radiation (LASER)
Laser devices generate coherent radiation in the visible, ultraviolet, and infrared portions of the electromagnetic spectrum. Regarding Fibre Channel, lasers can transmit either short waves or long waves, depending on the composition of the arbitrated loop or fabric.

link
A physical connection (electrical or optical) between two nodes of a network.

M

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.

mainframe
A large computer with the ability to support hundreds or thousands of users simultaneously.

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)

multimode
A graded-index or step-index optical fiber that allows 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

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.

O

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)

open systems
A system whose characteristics comply with standards made available throughout the industry and that can connect to other systems complying with the same standards.

operating system
Software that controls the execution of programs and that provides services such as resource allocation, scheduling, input/output control, and data management. Although operating systems are predominantly software, partial hardware implementations are possible.

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)

P

Partial Response Maximum Likelihood (PRML)
A method for converting a weak analog signal into a stronger digital signal to provide a higher recording density and contributes to faster data transfer rates.

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)

plenum cable
A cable made of fire-resistant material that, when burned, generates little smoke. Plenum cables are used for installation in air ducts (plenums).

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.

protocol
A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication.

R

read/write head
The data sensing and recording unit of a tape drive. (IBM)

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)

R/W
Read/write

S

SCSI
Small Computer Serial Interface.

single mode
An 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 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.

T

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)

U

U
A standard unit of measure of vertical space inside a rack mount cabinet equal to 44.5 mm (1.75 in.).

V

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 allows 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.

VOLSER
1. VOLume SERial Number. It is usually six characters long and is both the paper label stuck on the back edge of the cartridge and in the VOLID label that is recorded, particularly by MVS systems, at the beginning of the media.

2. 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.

W

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 allows 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.

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