PART NUMBER
95989

REVISION
N

T9940

Tape Drive

OPERATOR'S GUIDE

PRODUCT TYPE
HARDWARE

StorageTek®

T9940
Tape Drive

Operator's Guide

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Summary of Changes

The following table shows the revision history and summary of the changes for this publication.

EC	Date	Edition	Revision	Change
111539	09/00	First	A	Initial release
124593	12/00	Second	B	Refer to this edition for a description of the changes.
124642	02/01	Third	C	Refer to this edition for a description of the changes.
124665	04/01	Fourth	D	Refer to this edition for a description of the changes.
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124695	06/02	Sixth	F	Refer to this edition for a description of the changes.
111816	11/02	Seventh	G	Refer to this edition for a description of the changes.
111825	03/03	Eighth	H	Refer to this edition for a description of the changes.
111837	04/03	Ninth	J	Refer to this edition for a description of the changes.
111865	09/03	Tenth	K	Refer to this edition for a description of the changes.
111873	11/03	Eleventh	L	Refer to this edition for a description of the changes.
111910	05/04	Twelfth	M	Refer to this edition for a description of the changes.
114110	09/05	Thirteenth	N	• Added the address for the Global Learning Solutions feedback system to the copyright page • Updated all L700 references to L700/L1400 • Updated all drive configuration figures (3-2 through 3-7) in Chapter 3 impacted by firmware release 1.35.202 & 1.35.402. • Modified "Load a Tape Cartridge" on page 4-6 to inspect leader block before loading a cartridge; and, added Figure 4-2 for visual support. • Added leader block precautions to "Tape Cartridge Care", "Handling" on page 4-11. • Updated Table 5-3 on page 5-7 (Translated Display Messages). • Removed the Reader's Comment Form.

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Preface

This guide contains information about operating the StorageTek T9940 Tape Drive. This guide describes the drive's operator panel, menu system, and routine tasks that operators at the customer site can perform. The guide covers operation of the T9940A and T9940B drive models. The specific model suffix will only be used as required for differentiation.

For service information, StorageTek Customer Service Engineers (CSEs) should refer to the *T9x40 Tape Drive Service Reference Manual,* PN 95740.

Organization

This book contains the following information:

Chapter 1	Overview is a high-level description of the T9940 Tape Drive and the tasks involved in operating it.
Chapter 2	Operator Panel describes the front operator panel and its features.
Chapter 3	Menus describes the online and offline menus that the operator can use to perform operator tasks.
Chapter 4	Operator Tasks describes in detail the tasks the operator can perform.
Chapter 5	Indicators and Messages describes in detail the meaning and recommended action for the operator-panel indicators and messages.
Appendix A	Specifications contains reference information about product specifications and requirements.
Glossary	The Glossary defines new or special terms and abbreviations used in this publication.
Index	The Index assists in locating information in this publication.

Alert Messages

Alert messages call the reader's attention to information that is especially important or that has a unique relationship to the main text or graphic.

Note: A note provides additional information that is of special interest. A note might point out exceptions to rules or procedures. A note usually, but not always, follows the information to which it pertains.

CAUTION:
A caution informs the reader of conditions that might result in damage to hardware, corruption of data, corruption of application software, or long-term health problems in people. A caution always precedes the information to which it pertains.

WARNING:
A warning alerts the reader to conditions that might result in injury or death. A warning always precedes the information to which it pertains.

Related Publications

The following publications contain additional information about this product.

Publication	Part Number
Nearline Enterprise 9310/4410/9360 LSM System Assurance Guide	ML6500
4410/11/20/30 and 9310/11/20 Automated Cartridge System Hardware Operator's Guide	9206
9360/30/15/12 Automated Cartridge System Hardware Operator's Guide	9871
TimberWolf 9740 Library Storage Module System Assurance Guide	MT5001
TimberWolf 9740 Library Storage Module Hardware Operator's Guide	95693
L700x/L1400x Tape Libraries and Pass-Thru Port Ordering and Configuration Guide	MT9112
L700x/L1400x Tape Libraries and Pass-Thru Port Operator Guide	95845
L5500 Automated Cartridge System System Assurance Guide	MT9142
L5500 Automated Cartridge System Operator's Guide	96063
StreamLine SL8500 Modular Library System, User's Guide	96154
T9x40 Tape Drive Service Reference Manual	95740

Additional Information

StorageTek offers several methods for you to obtain additional information.

StorageTek's External Web Site

StorageTek's external Web site provides marketing, product, event, corporate, and service information. The external Web site is accessible to anyone with a Web browser and an Internet connection.

The URL for the StorageTek external Web site is http://www.storagetek.com

Customer Resource Center

StorageTek's Customer Resource Center (CRC) is a Web site that enables members to resolve technical issues by searching code fixes and technical documentation. CRC membership entitles you to other proactive services, such as HIPER subscriptions, technical tips, answers to frequently asked questions, and online product support contact information. Customers who have a current warranty or a current maintenance service agreement may apply for membership by clicking on the Request Password button on the CRC home page.

The URL for the CRC is http://www.support.storagetek.com.

e-Partners Site

StorageTek's e-Partners site, formerly known as the Partners Page or the Channels site, is a Web site that provides information about products, services, customer support, upcoming events, training programs, and sales tools to support StorageTek's e-partners. Access to this site, beyond the e-Partners Login page, is restricted. On the e-Partners Login page, current partners who do not have access can request a login ID and password and prospective partners can apply to become StorageTek resellers.

The URL for the e-Partners site is http://members.storagetek.com.

Hardcopy Publications

Contact a StorageTek sales or marketing representative to order additional paper copies of this publication or to order other StorageTek customer publications in paper format.

Conventions

Typographical conventions highlight special words, phrases, and actions in this publication.

Item	Example	Description of Convention
Document titles	*System Assurance Guide*	Italic font
Emphasis	*not* or *must*	Italic font
File names	`fsc.txt`	Monospace font
Hypertext links	Figure 2-1 on page 2-5	Blue (prints black in hardcopy publications)
Indicators	*Open*	Font and capitalization follows label on product
Menu names	Configuration Menu	Capitalization follows label on product
Parameters and variables	Device = *xx*	Italic font
Path names	`c:/mydirectory`	Monospace font
Positions for circuit breakers, jumpers, and switches	ON	Font and capitalization follows label on product; otherwise, all uppercase
Screen text (including screen captures, screen messages, and user input)	`downloading`	Monospace font
Switch names	Power	Font and capitalization follows label on product
URLs	http://www.storagetek.com	Blue (prints black in hardcopy publications)

Customer Initiated Maintenance

Customer Initiated Maintenance begins with a telephone call from you to the StorageTek Remote Resolution Center (RRC). You receive immediate attention from qualified StorageTek personnel, who record problem information and respond with the appropriate level of support.

The RRC is available 24 hours a day, seven days a week, to customers with StorageTek maintenance contracts and to StorageTek employees.

To contact the RRC about a problem:

1. Use the telephone to call the StorageTek RRC at:

   ☎**800.525.0369** (from within the United States)

   ☎**303.673.4056** (from outside the United States)

2. Describe the problem to the call taker. The call taker will ask several questions and will either route your call to or dispatch a support representative.

If you have the following information when placing a service call, the process will be much easier:

Account name _____

Site location number _____

Contact name _____

Telephone number _____

Equipment model number _____

Device address _____

Device serial number (if known) _____

Urgency of problem _____

Fault Symptom Code (FSC) _____

Problem description _____

_____

_____

_____

_____

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Safety

T9940 operators should be familiar with fiber optic safety.

Fiber Optic Safety

WARNING:
EYE INJURY. DO NOT LOOK DIRECTLY INTO A FIBER-OPTIC CABLE, A FIBER-OPTIC CONNECTOR, OR A LASER TRANSCEIVER MODULE.

The laser transceivers in fiber-optic equipment can pose dangers to personal safety. Ensure that anyone who works with this StorageTek equipment understands these dangers and follows safety procedures. Ensure that the optical ports of every laser transceiver module are terminated with an optical connector, a dust plug, or a cover.

Each fiber-optic interface in this StorageTek Fibre Channel equipment contains a laser transceiver that is a Class 1 Laser Product. Each laser transceiver has an output of less than 70 μW and a wavelength of 850 nm. StorageTek's Class 1 Laser Products comply with EN60825-1(+A-11) and with sections 21 CFR 1040.10 and 1040.11 of the Food and Drug Administration (FDA) regulations.

The following translations are for users in Finland and Sweden who wish to identify laser safety and classification:

CLASS 1 LASER
LUOKAN 1 LASERLAITE
KLASSE 1 LASER APPARAT

Laser Product Label

In accordance with safety regulations, a label on each StorageTek Fibre Channel product identifies the laser class of the product and the place and date of the manufacturer. The label appears on top of a Fibre Channel tape drive and near the Fibre Channel connectors on a Fibre Channel tape library. A copy of the label is shown here:

CLASS 1 LASER PRODUCT
LASER KLASSE 1
APPAREIL A LASER DE CLASSE 1
COMPLIES WITH 21 CFR 1040.10 AND 1040.11

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Notices

Please read the following compliance and warning statements for this product.

CAUTION:
Cables that connect peripherals must be shielded and grounded; refer to cable descriptions in the instruction manual. Operation of this equipment with cables that are not shielded and correctly grounded might result in interference to radio and TV reception.

Changes or modifications to this equipment that are not expressly approved in advance by StorageTek will void the warranty. In addition, changes or modifications to this equipment might cause it to create harmful interference.

FCC Compliance Statement

The following compliance statement pertains to Federal Communications Commission Rules 47 CFR 15.105:

Note: This equipment has been tested and found to comply to the limits for Class A digital devices pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.

CISPR 22 and EN55022 Warning

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

Japanese Compliance Statement

The following compliance statement in Japanese pertains to VCCI EMI regulations:

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

English translation: This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may occur, in which case, the user may be required to take corrective actions.

Taiwan Warning Label Statement

The following warning label statement (in Kanji) pertains to BSMI regulations in Taiwan, R.O.C.:

警告使用者: 這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

English translation: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

Internal Code License Statement

The following is the Internal Code License Agreement from StorageTek:

NOTICE

INTERNAL CODE LICENSE

PLEASE READ THIS NOTICE CAREFULLY BEFORE INSTALLING AND OPERATING THIS EQUIPMENT. THIS NOTICE IS A LEGAL AGREEMENT BETWEEN YOU (EITHER AN INDIVIDUAL OR ENTITY), THE END USER, AND STORAGE TECHNOLOGY CORPORATION ("STORAGETEK"), THE MANUFACTURER OF THE EQUIPMENT. BY OPENING THE PACKAGE AND ACCEPTING AND USING ANY UNIT OF EQUIPMENT DESCRIBED IN THIS DOCUMENT, YOU AGREE TO BECOME BOUND BY THE TERMS OF THIS AGREEMENT. IF YOU DO NOT AGREE WITH THE TERMS OF THIS AGREEMENT, DO **NOT** OPEN THE PACKAGE AND USE THE EQUIPMENT. IF YOU DO NOT HAVE THE AUTHORITY TO BIND YOUR COMPANY, DO **NOT** OPEN THE PACKAGE AND USE THE EQUIPMENT. IF YOU HAVE ANY QUESTIONS, CONTACT THE AUTHORIZED STORAGETEK DISTRIBUTOR OR RESELLER FROM WHOM YOU ACQUIRED THIS EQUIPMENT. IF THE EQUIPMENT WAS OBTAINED BY YOU DIRECTLY FROM STORAGETEK, CONTACT YOUR STORAGETEK REPRESENTATIVE.

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   c. "Maintenance Code" is defined as Microcode and other software, including data files, which may reside or execute in or be used by or in connection with Equipment, and which detects, records, displays, and/or analyzes malfunctions in the Equipment.

   d. "Microcode" is defined as a set of instructions (software) that is either imbedded into or is to be loaded into the Equipment and executes below the external user interface of such Equipment. Microcode includes both Internal Code and Maintenance Code, and may be in magnetic or other storage media, integrated circuitry, or other media.

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Overview

1

This chapter provides an overview of the T9940 Tape Drives.

T9940 Tape Drive

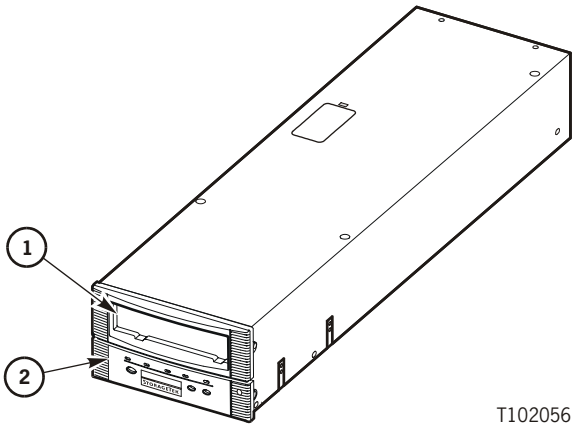
The T9940 Tape Drive (Figure 1-1) is a small, modular, high-performance tape drive for the enterprise and client-server environment for high-capacity storage application. The T9940A Tape Drive (60 GB) is available with Enterprise Systems Connection (ESCON) interface, small computer system interface (SCSI), or Fibre Channel (FC) interface. The T9940B Tape Drive (200 GB, using same tape cartridge) is currently available with FC, ESCON, or FICON interface.

The drive front panel serves as an operator panel for manual control and has a tape load/unload slot. See Chapter 2, "Operator Panel," for detailed information on operator panel controls and indicators.

The drive rear panel has connectors for power, host interface, and maintenance (T9940B). Use of the RJ45 maintenance port is restricted to StorageTek service personnel only, using StorageTek proprietary software applications.

Note: Customer attachment to the port has caused drive problems. StorageTek does not support, nor will assume any responsibility for unauthorized use of the maintenance port by non-StorageTek personnel.

Figure 1-1. T9940 Tape Drive



T9940 Tape Drive (T102_056)

1. Tape load/unload slot
2. Operator Panel

Library Attachment Configurations

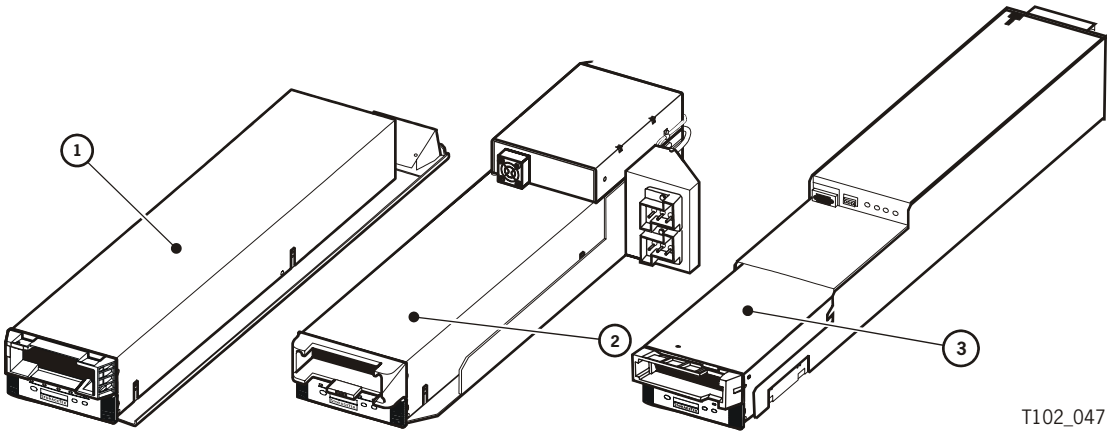
The T9940 Tape Drive comes in the following library attachment configurations:

- 9310 PowderHorn
- 9360 WolfCreek (T9940A only)
- 9740 TimberWolf (T9940A only, and serial control path)
- L180 Tape Library
- L700/L1400 Tape Library
- L5500 Tape Library
- SL8500 Tape Library

Note: Refer to appropriate library documentation for additional information.

Figure 1-2 shows the T9940 library tray assemblies.

Figure 1-2. T9940 Library Tray Assemblies

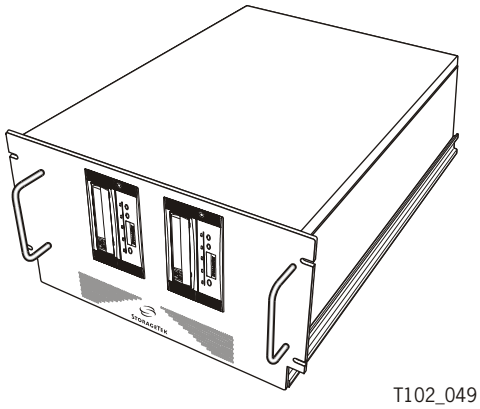


1. T9940 Tray Assembly for 9310/9360/9740/L5500 Libraries
2. T9940 Tray Assembly for L180/L700/L1400 Libraries
3. T9940 Tray Assembly for SL8500 Libraries

Rack-mount Configuration

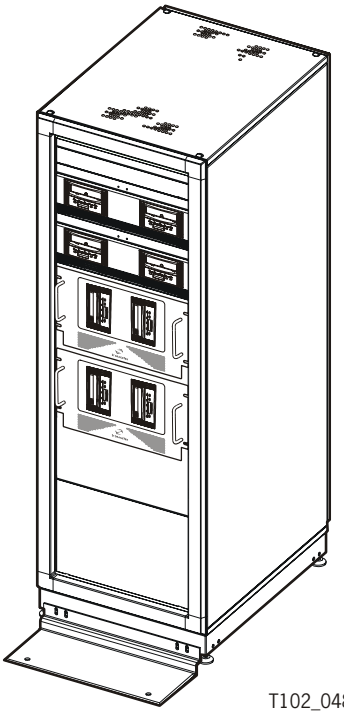
The T9940 is available in a dual-drive, rack-mount configuration (Figure 1-3).

Figure 1-3. T9940A Rack-mount Configuration.



Up to four T9940 rack-mount trays will fit into the StorageTek RACK001 cabinet (Figure 1-4). The T9940 tray can also be combined with T9840 rack-mount trays, and/or T9840A CSL rack-mount trays within a single cabinet. Any combination of trays can be used to fill the rack cabinet.

Figure 1-4. StorageTek RACK001



Interfaces

Host interfaces for the T9840 Tape Drive include Enterprise Systems Connection (ESCON), Fibre Channel (FC), Fibre Connection (FICON), or small computer system interface (SCSI). Not all interfaces are available for all configurations, refer to Table A-8 on page A-5.

Mixed-Media Management

Since both T9940A and T9940B drives use the same 9940 data tape cartridge, extra media management measures must be taken when both drives co-exist in the same library system. The extra measures essentially involve creation and management of separate media pools/sub-pools for T9940A and T9940B formatted/written data cartridges. Guidelines for creation and maintenance of media pools/sub-pools are located in ACSLS and HSC software documentation.

The T9940A Tape Drive cannot read data from a tape cartridge written by a T9940B Tape Drive in the high-density format. An attempt to read data from a high-density data cartridge by a T9940A drive will fail, with sense byte data indicating an error, similar to that of a blank data cartridge.

The T9940B Tape Drive can read data from a tape cartridge written by a T9940A Tape Drive in the low-density format, but does not append data to that cartridge. An attempt to append a low-density data cartridge on a T9940B drive will fail, with sense byte data indicating an error, similar to that of a File Protected data cartridge.

Note: For additional information about mixed-media management see "Cross-Density MIR Processing" on page 1-8.

9940 Tape Cartridges

Two 9940 data tape cartridges standard or geophysical; and a 9940 cleaning cartridge can be used in either the T9940A or T9940B Tape Drives. A VolSafe (append only) data tape can be used only with the T9940B Tape Drive.

The 9940 data cartridges can hold 60 GB of uncompressed data when written by a T9940A (low-density data format); or, 200 GB of uncompressed data when written by a T9940B (high-density data format). Low-density data cartridges can be read, but not appended by T9940B drives. High-density data cartridges cannot be read nor appended by T9940A drives.

The 9940 geophysical data cartridge is identical to the standard data cartridge, but has a larger customer label area.

The 9940B VolSafe data cartridge only allows new data to append to the cartridge which prevents over-write of previously written data.

Note: T9940B drive firmware release level 1.32.423 or higher is required to support 9940B VolSafe data cartridges.

The 9940 cleaning cartridge media has a dry-abrasive surface which is good for 100 cleaning operations.

Tape cartridge distinguishing features:

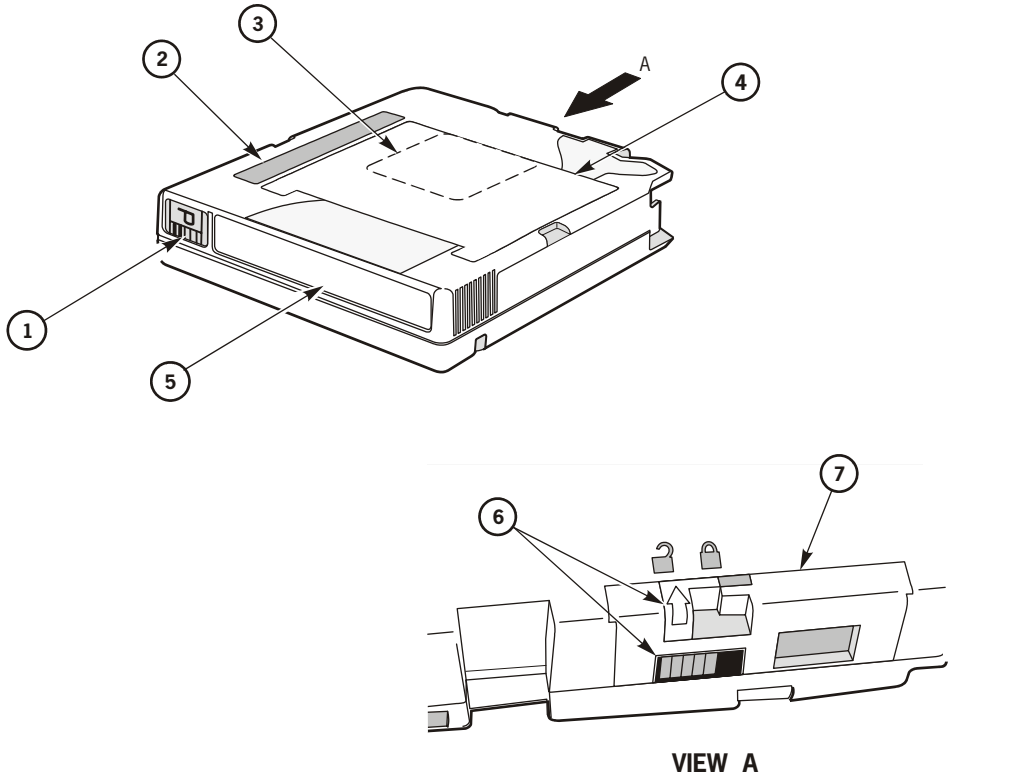
- Media ID label (1, Figure 1-5 on page 1-6):
  - Standard data cartridge: **P** (T9940 data), on white background
  - Geophysical data cartridge: **P** (T9940 data), on white background
  - VolSafe data cartridge: **P** (T9940B data), on yellow background
  - Cleaning cartridge: **W** (T9940 cleaning), on white background
- Manufacturer label area (2, Figure 1-5):
  - Standard and geophysical data cartridge: standard coloring
  - Cleaning cartridge: standard coloring
  - VolSafe data cartridge: yellow background
- Customer label area (3, 4, Figure 1-5):
  - Standard, VolSafe, and cleaning cartridge: standard size
  - Geophysical data cartridge: enlarged size
- Write-protect switch/sensor area (6, 7, Figure 1-5):
  - Standard and geophysical data cartridge: black
  - Cleaning cartridge: black switch, white sensor area
  - VolSafe data cartridge: black switch, yellow sensor area

Cartridge Support Contacts:

- Authorized StorageTek Selling Agent for labeled cartridges.
- EDP/Colorflex at 1-888-438-8362, or http://www.colorflex.com for labels.
- StorageTek Sales Support at 1-800-ask4stk or sales_support@storagetek.com (e-mail) for technical questions.

Figure 1-5 illustrates the distinguishing features of 9940 Tape Cartridges.

Figure 1-5. 9940 Tape Cartridge



9940 Tape Cartridge (T102_136)

1. Media ID label (**P** = data, **W** = cleaning),
2. Manufacturer label area (yellow background on VolSafe data cartridge)
3. Customer label area (standard, VolSafe, and cleaning cartridge)
4. Enlarged customer label area (geophysical data cartridge)
5. VOLSER label area
6. Write-protect switch
7. Sensor area (yellow on VolSafe data cartridge, white on cleaning cartridge)

Media Information Region

The T9940 tape drive uses information recorded on each tape cartridge to access and manage that tape cartridge while loaded in the drive. This information is recorded at the beginning of the tape in an area known as the Media Information Region (MIR). The information contained in the MIR falls into two major categories:

- Statistical Counters

  Statistical counters include read/write activity, error activity, cumulative mounts and other information that reflect tape cartridge usage.

- Data Pointers

  The data pointer information is basically a directory (map) used to locate the data on the physical tape media. Since user 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 user block ID's and the physical block on the tape media. Once the data is written, accessing this directory allows the drive to optimize access to user data.

  A read to a user block ID 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 will result in a high-speed locate to the block location, which is followed by a normal speed read.

The existence of the MIR is usually transparent to the user unless the MIR has a problem.The impact of an invalid MIR occurs in several areas. Since the MIR enables high speed positioning, an invalid MIR 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.

An invalid MIR might be suspected if you observe poor performance on a specific tape. The T9x40 drive also posts a `36B2` informational FSC whenever a tape cartridge with an invalid MIR is loaded.

The following sections describe MIR processing and some potential implications of MIR problems.

Normal MIR Processing

Every time a tape cartridge is loaded, the MIR is read from the tape media and saved in the drive memory. When the MIR is loaded in drive memory, an invalid flag is written in the tape-resident MIR. The tape-resident MIR is marked invalid because it does not reflect results of activity in the current mount session. All subsequent MIR accesses during the current mount session are saved in the memory-resident MIR.

When the tape cartridge is unloaded, as part of the unload routine, the memory-resident MIR information is written to the tape-resident MIR and the MIR invalid flag is turned off.

Cross-Density MIR Processing

Whenever a cartridge written in one data density format is loaded the opposite format drive, model-specific MIR processing occurs.

T9940B Tape Drive

When a data cartridge is loaded into a T9940B, the drive first looks for a MIR at the high-density MIR designated location; and will not find a MIR if the data cartridge is in low-density data format. The high-density MIR location will be blank if it is the first time the low-density data cartridge is loaded into a T9940B drive. This causes the drive to look at the low-density MIR designated location, where it finds a MIR and reads it into drive memory (invalid flag is not set).

The T9940B drive identifies the tape cartridge as low-density data format, which causes "`Ready L`" (low-density) to be displayed on the T9940B operator panel. The T9940B drive uses the memory-resident MIR for user data pointers for read-only functions. During the first mount session, the drive captures statistical counters from the MIR into a memory area called Format Identity Burst (FIB), and continues to build it with drive activity.

During the unload routine, the T9940B drive writes the FIB to the high-density MIR designated tape location. The FIB is written in a special format which can also be read by T9940A drives with the appropriate drive firmware level. The tape-resident, low-density MIR remains intact and valid.

Notes:

- The T9940B Tape Drive cannot cause nor correct an invalid MIR on a low-density data cartridge. A low-density MIR can only become invalid during a mount on a T9940A Tape Drive.
- If a low-density data cartridge MIR is invalid, it is not read into the T9940B drive memory, and not available for user data pointer information. Therefore, T9940B performance for a low-density data cartridge is degraded.
- Since a T9940B Tape Drive cannot correct or rebuild a low-density data cartridge invalid MIR, the only options are:

    1) Migrate the data to a high-density format cartridge, using a copy utility with a second T9940B drive

    2) Rebuild the MIR with a T9940A Tape Drive

    3) Operate with degraded performance.

On subsequent mounts, the T9940B drive sees the tape-resident FIB first, identifies the tape cartridge as low-density, and reads the low-density MIR into drive memory. At dismount, the T9940B updates the tape-resident FIB with cumulative data, including newer statistical data from the MIR, if the cartridge had been loaded into a T9940A drive since the last mount in a T9940B drive.

T9940A Tape Drives

Notes:

- In order to recognize a high-density data cartridge written by a T9940B drive, and to properly handle a low-density data cartridge that has been previously loaded into a T9940B drive, T9940A drives must have R1.32.215, or higher drive firmware level.
- If a T9940A drive has down level drive firmware, a high-density data cartridge would be considered as a blank tape cartridge; and, a low-density data cartridge would lose statistical data stored in the FIB during a previous mount into a T9940B drive.

When a high-density data cartridge is loaded into a T9940A drive with appropriate level firmware, the drive looks for a low-density MIR at the default location but finds a FIB, which identifies the cartridge as high-density data format and displays a "`Ready H`" on the operator panel. Since the T9940A drive cannot read nor write high-density data, subsequent normal read/write attempts will fail.

A T9940A drive cannot update statistical data, such as the mount/dismount count in the FIB. Therefore, cumulative statistical data will not include mounts into a T9940A drive as long as the tape cartridge is in high-density format.

The tape cartridge could be deliberately over-written in low-density data format from beginning of tape point, or reformatted to low-density data format by the offline Drive Operation, Make Data Tape submenu. Either case over-writes the FIB with a low-density MIR, and erases the high-density MIR. Such a reformatted data cartridge is no longer identifiable as a high-density data cartridge, but does include the statistical data read from the FIB.

When a low-density data cartridge with a tape-resident FIB (created by a T9940B drive) is loaded into a T9940A drive with appropriate level firmware, the MIR is read into drive memory and an invalid flag is written to the tape-resident MIR. During the unload routine, the T9940A drive compares statistical data in the tape-resident MIR with statistical data in the tape-resident FIB, and uses the latest data to calculate the statistical data update into the new tape-resident MIR.

Note: If the last load was into a T9940A drive, the tape-resident MIR will contain the latest statistical data; whereas, if the last load was into a T9940B drive, the tape-resident FIB will contain the latest statistical data.

Exceptional MIR Processing

There are instances when the MIR process departs from the normal.

- Write Protect

When the tape cartridge is write protected, the MIR is not rewritten and statistical information for that mount is not captured. If the tape cartridge is in a library that logically write protects the tape cartridge, the MIR is updated as normal on each dismount.

- Major Error/Power Off

If a tape cartridge is mounted and the drive SNO's (should not occur error) or loses power, the drive memory resident MIR is not written to the tape media and the tape resident MIR continues to be marked invalid. It might not be obvious that a SNO has taken place and the MIR has been left marked invalid.

Invalid MIR Correction

Once a tape cartridge has an invalid MIR, some action is required to correct it. An invalid MIR can be corrected in several ways:

1. Reading to the end of existing data (EOD) creates a complete valid MIR. This is done at normal read speeds and could take up to 100 minutes, for a full tape cartridge on a T9940A drive, or up to 120 minutes, for a full tape cartridge on a T9940B drive.
2. Appending to the tape cartridge will also create a valid MIR, although a slow speed read must first be done to the end of existing user data.
3. The Drive Operation Menu (offline) "Rebuild MIR" utility will sequentially read from block ID 0 to the EOD. The MIR will be complete and valid when the tape cartridge is unloaded. (See "Build MIR" on page 4-9.)
4. The Drive Operation Menu (offline) "Make Data Tape" utility will reformat the tape cartridge with a valid MIR. However, all previous data will be lost. (See "Reformat a Tape Cartridge" on page 4-8.)

The memory-resident MIR is always rebuilt to the last block read, on-the-fly, during normal read/write functions. When the partially rebuilt memory-resident MIR is written to the tape during the down-load process, the invalid flag is reset because the MIR is now partially valid. This can result in seemingly conflicting performance from a single tape.

Notes:

- If a tape cartridge with a partially valid MIR is mounted for long periods of time with locates to different locations, locate times will be inconsistent depending on whether the locate is to a record already in the rebuilt MIR, or if some low speed locate is required.
- The longer the tape cartridge is mounted and the more activity occurs, the more rebuilt the memory-resident MIR becomes. Once the EOD is reached, the MIR is complete and valid.

Operator Panel

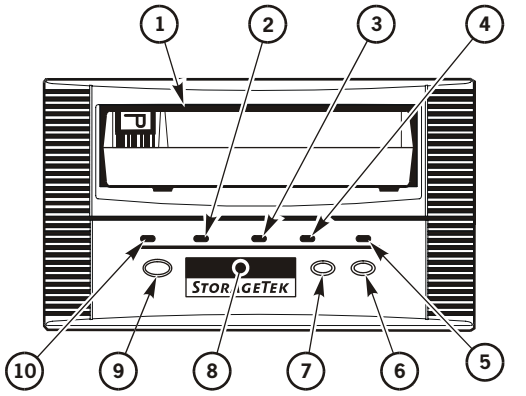
2

The T9940 Tape Drive operator panel (Figure 2-1) is the operator's interface with the drive, and features:

- Tape load.unload slot
- Pushbutton switches
- Indicator lights
- 10-character, alphanumeric display

T9940A and T9940B operator panels are identical except for button color (T9940A - Silver, T9940B - Blue); and, each panel has a specific model label.

Figure 2-1. T9940 Operator Panel



T9940 Operator Panel (T102_027)

1. Tape load/unload slot
2. Activity indicator
3. Clean indicator
4. Service indicator
5. IPL switch T9940A - Silver T9940B - Blue
6. Select switch T9940A - Silver T9940B - Blue
7. Menu switch T9940A - Silver T9940B - Blue
8. Display
9. Unload switch T9940A - Silver T9940B - Blue
10. Power indicator

Load/Unload Slot

The load/unload slot is the opening in the front panel that accepts T9940 Tape Cartridges, loaded by hand on the rack-mount, or by a robotic hand in a library. After the tape cartridge is inserted, a mechanism seats the cartridge and threads the tape. To load a drive manually, see "Load a Tape Cartridge" on page 4-6.

Switches

Table 2-1 describes T9940 operator panel switch functions.

Table 2-1. Operator Panel Switches

Switch	Description
Menu (7, Figure 2-1)	Pressing the Menu switch accesses the menu system, steps through a series of submenus, or answers *No* to a displayed question. Pressing the Menu switch the first time causes the Online/Offline selection to display. See Chapter 3, "Menus," for information/guidance with the menu system.
Select (6, Figure 2-1)	Pressing the Select switch accesses a displayed submenu, steps through possible options of a submenu, or answers *Yes* to a displayed question. When the drive is Online, and the display is showing a view only submenu, pressing Select is same as pressing Menu.
IPL (5, Figure 2-1)	Pressing the IPL switch causes the drive to execute an initial program load (IPL) sequence. During IPL, the drive firmware loads from non-volatile memory in an EEPROM, to RAM. The same process occurs at power-on.
Unload (9, Figure 2-1)	Pressing the Unload switch causes the tape cartridge to rewind, unthread, and unload; ending with the tape cartridge ejected and retrievable. If this switch is pressed *during* a write operation, the drive attempts to write the remaining data before it unloads. A display of `UnWr xxxx` (meaning Unwritten Data, where *xxxx* is a fault symptom code) means that the attempt failed and some data remains unwritten to tape. **Note:** Pressing Unload a second time causes the unwritten data to be lost. Before you press Unload again, see `UnWr xxxx` (page 5-6) in Table 5-2.

Indicators

Table 2-2 describes T9940 Tape Drive operator panel indicators.

Table 2-2. Operator Panel Indicators

Indicator	Indication	Explanation
power (green) (10, Figure 2-1)	Off:	Power is not applied.
	Flashing:	Drive is non-operational for one of the following reasons: • It is powering on, and executing IPL • It is saving diagnostic data to the EEPROM • It failed a power-on diagnostic.
	Flashing does not stop:	IPL failed.
	On (steady):	Power applied and IPL complete.
activity (green) (2, Figure 2-1)	Off:	Tape cartridge not loaded.
	Flashing:	Tape cartridge loaded and tape moving.
	On (steady):	Tape cartridge loaded and tape is stopped.
clean (amber) (3, Figure 2-1)	On (steady):	Drive requires cleaning because: A firmware-defined length of tape has passed over the R/W heads. A read/write perm (permanent error) is detected, and at least one-half the firmware defined length of tape has passed over the R/W heads. See "Clean the Drive" on page 4-10 for use of cleaning cartridges.
service (red) (4, Figure 2-1)	Off:	Error(s) have not been detected.
	Flashing:	Error(s) detected and dump data has been saved to the EEPROM. The message `DumpAgain?` displays if the drive detects the same FSC within one minute. Manually initiate IPL. If IPL does not eliminate the problem, contact authorized service personnel.
	On (steady):	A hardware error is detected and the drive is not functional. If a manually initiated IPL does not eliminate the problem, contact authorized service personnel.

Display

The operator panel has an 10 segment, alphanumeric display that indicates:

- Drive status
- Menu selections and configuration choices
- Error messages and fault symptom codes
- Host-generated messages
- Tape bar, if activated

The display is formed by a horizontal array of 10 segments. Each segment is formed by an array of 35 dots—five wide and seven high. Each array can form an uppercase or lowercase alpha character, a numerical digit, or a special character, such as an asterisk (*). When the tape bar is not activated, the lighted segments and dots form text messages. The text messages may display steadily, flashing, or alternating with other messages.

Tape Bar

The operator panel display can also present a type of bar chart (tape bar) to represent the amount of tape that has been written and read. The tape bar is a configuration option activated by authorized service personnel. Once activated, it appears on the operator panel, alternating with other messages.

When the tape bar is activated, the segment arrays simultaneously show the percentage of the total tape length that has been written and read (see Figure 2-2 on page 2-5). Each LED column represents 2% of the tape length, and each segment represents 10%.

Write Bar

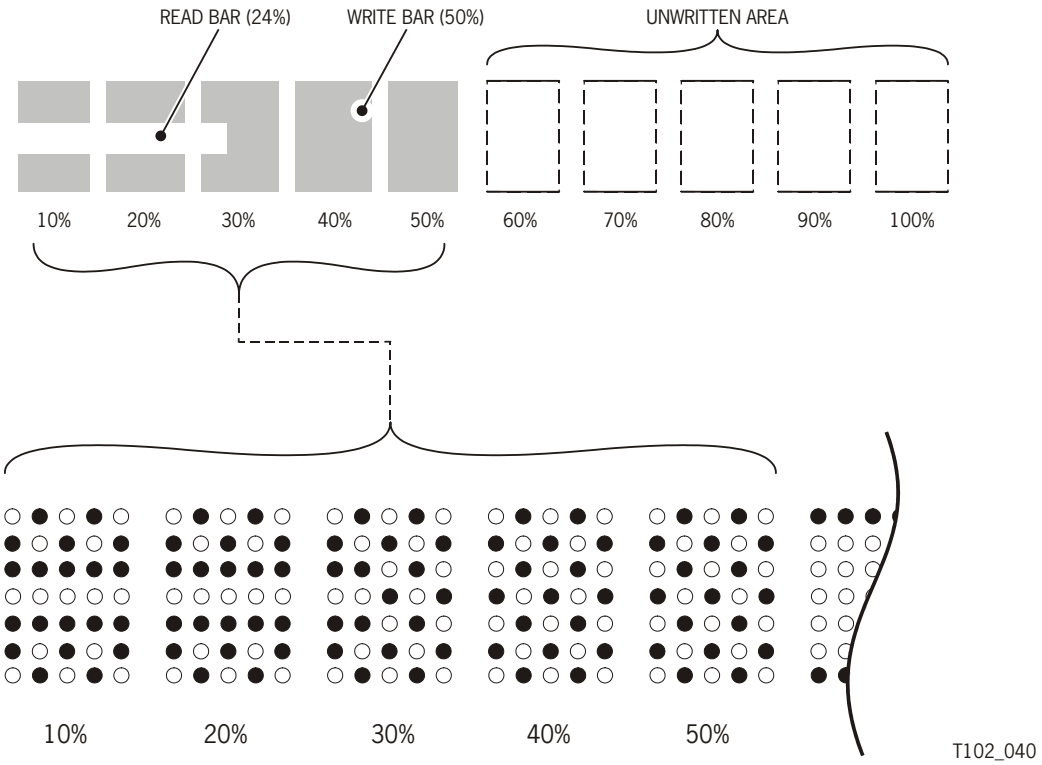
The LEDs forming the write bar advance from left to the right of the display as data is written to tape. The write bar uses the full height of the display. As the lit LEDs fill the display, note that only every other LED is lit. The point at which the write bar ends is the percentage of tape written (50% on Figure 2-2). The remainder of the display is bordered with fully lit top and bottom LED rows, representing the unwritten area of the tape.

Read Bar

As data is read from the tape, the read bar appears in the center of the write bar as a single row of unlit LEDs. This row is bordered above and below by single rows of lit LEDs. The read bar also begins at the left side of the display and advances to the right. The point at which the read bar ends is the percentage point of tape that has just been read (24% on Figure 2-2).

Figure 2-2 is a simplified view of a tape bar display that shows a tape that is 50% written and 24% read.

Figure 2-2. Tape Bar



Note: The tape bar gets its information from the media information region (MIR) on the tape. The MIR is written to the tape when the tape is unloaded. If the MIR is bad, the tape bar does not display. To rebuild the MIR, see "Build MIR" on page 4-9.

SL8500 StreamLine Library Controls/Indicators

When a T9940 Tape Drive is attached to the SL8500 StreamLine™ Library, you cannot access the drive operator panel, nor is there a rear operator panel.

SL8500/T9x40 Drive Tray

Figure 2-3 illustrates the SL8500/T9x40 drive tray rear panel. The power (PWR) switch is a momentary push-switch that manually changes the state of the internal power supply PWA. The green PWR LED indicates the power state of the tray:

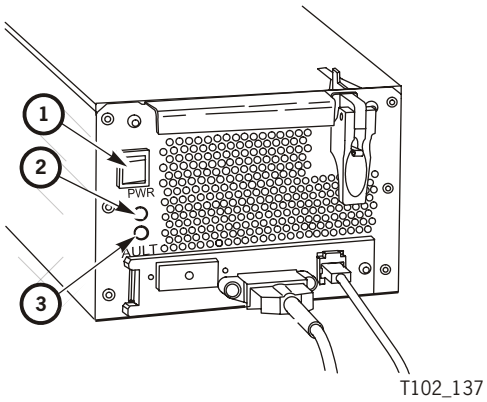
- **Not lit:** Power is *not* on, nor is 48 Vdc input power applied to the tray
- **Blinking:** Power is *not* on, but 48 Vdc input power *is applied* to the tray
- **Steady:** Power is on, and power supply output voltages are normal

The red FAULT LED indicates anomalies within either the internal power supply PWA, or with the drive tray fan assembly.

Notes:

1. Library firmware controls the drive tray power and indicators.
2. The red FAULT LED does not indicate drive-related anomalies.
3. Pressing the SL8500 drive tray PWR switch, while the tray is powered, does not cause an interrupt signal to the library firmware. You must wait at least 10-seconds before pressing the PWR switch to manually power-on the drive. Otherwise, the library's drive audit will be corrupted. Generally, when the red FAULT LED comes on (after power-off), it is safe to re-push the PWR switch to reapply power to the drive tray.

Figure 2-3. SL8500/T9x40 Drive Tray Rear Panel



1. Power Switch
2. Power LED
3. Fault LED

StreamLine Library Console

Although you cannot access the T9940 Tape Drive Operator Panel to view menu items, you can use the StreamLine™ Library Console™ (SLC), local or remote, to display data pertinent to the attached drives.

Drive Folder Top Level Display

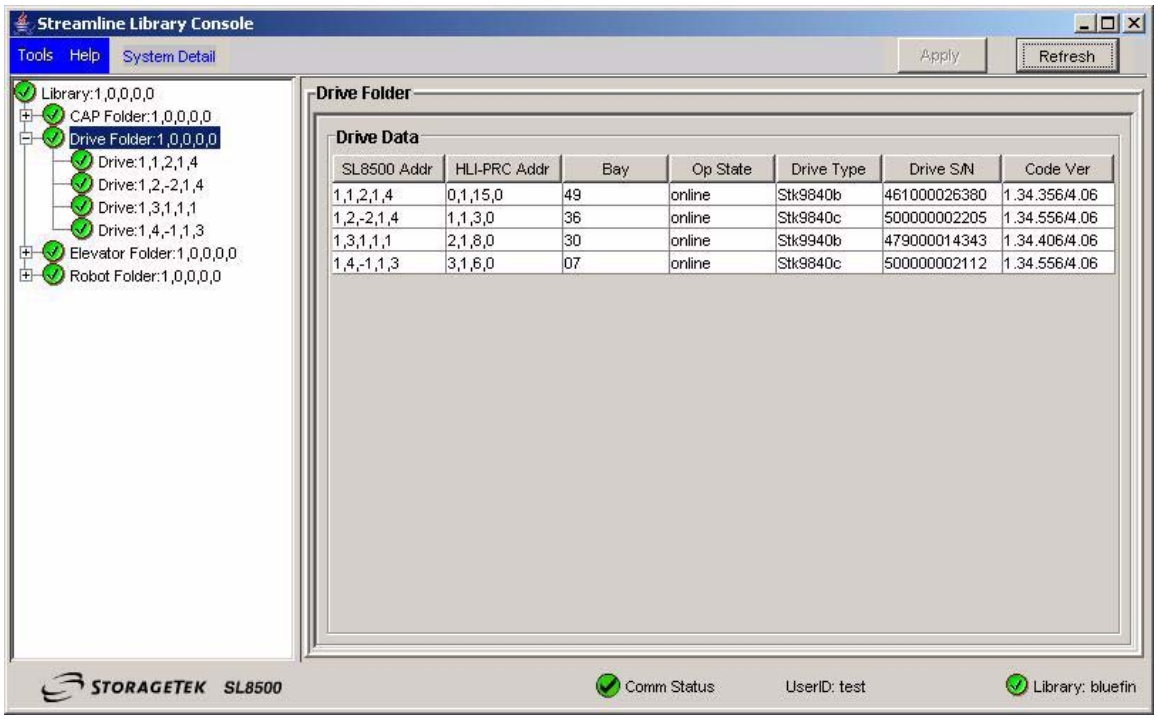
Figure 2-4 shows overall summary the Drive Folder. The left window displays library folders in a tree format, which you can expand or collapse.

The right window summarizes drive data in a tabular format, whether you expand or collapse the drive folder tree view. You can customize how the data is displayed, by sorting the rows, relative to a selected column, and/or reordering/resizing the columns.

Notes:

1. The "HLI-PRC Addr" column displays the host software logical address for the drive, relative to the specific host software.
2. The "Op State" column is online/offline relative to the library drive controller, and not relative to the drive, menu-driven online/offline.
3. The "Code Ver" column displays the drive's current firmware level, including the drive interface sub-module level. Interface level 4.06, or higher is required for proper SL8500 operation.

Figure 2-4. SL8500 SLC Drive Folder Display



Drive Specific Displays

When you select an individual drive in the tree window, the right window will change to display additional data relative to the selected drive, instead of the drive folder summary data.

Note: The following displays are still under development; therefore, they are presented here for illustrative examples only. The final form of the drive specific data displays should also include enhanced drive configuration settings. The enhanced displays will become available as the library firmware and the SLC application matures, and as library-drive firmware interface matures.

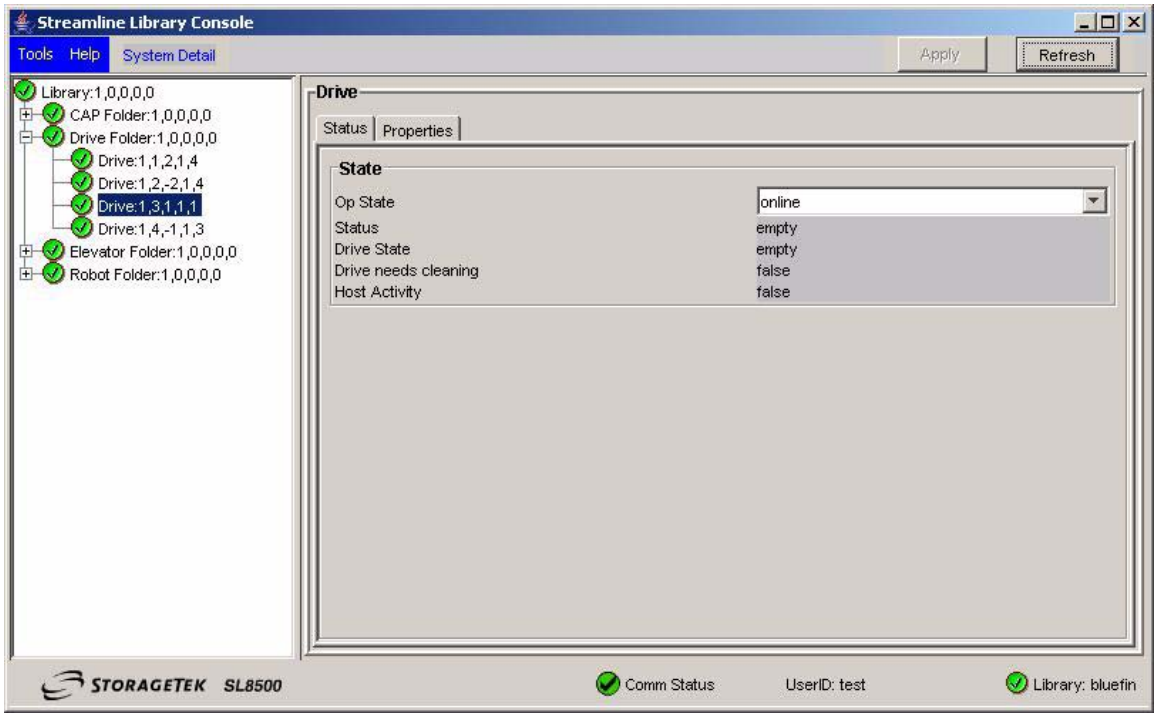
Currently, two display tabs are available:

- Status
- Properties

Status

This tab, Figure 2-5, displays key drive status data.

Figure 2-5. SL8500 SLC Drive Status Display

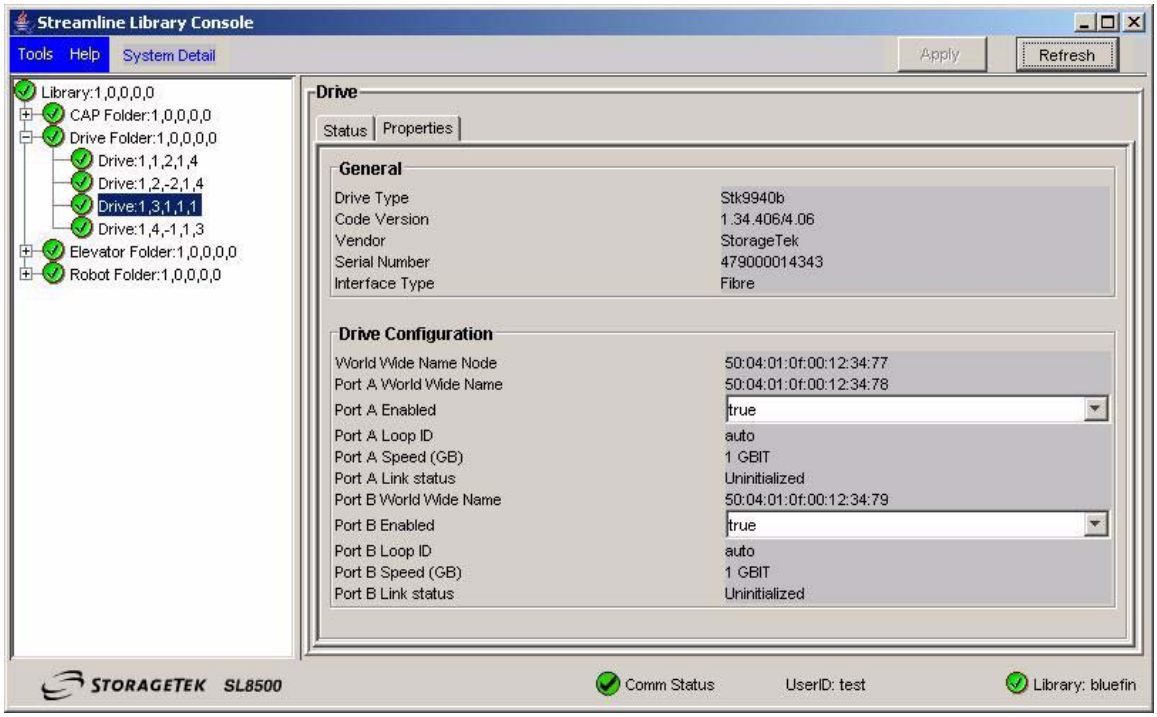


Properties

The General block of this tab, Figure 2-6, displays some of the data from the drive folder summary, but also includes the drive interface type (not displayed in the summary.

The Drive Configuration block displays selected configuration items, such as dynamic World-Wide-Name (dWWN) which is auto-set, relative to the drive bay number, by the library firmware.

Figure 2-6. SL8500 SLC Drive Properties Display



You can view and use the SLC drive displays to develop reports to support and analyze drive-related problems.

Note: Additional T9840 Tape Drive specific guidelines on using the SLC will be included in this document as they become available.

Additional general guidance on using the SLC application is available within the SLC "Help" function.

Refer to the *StreamLine SL8500 Modular Library System, User's Guide,* PN 96154 for additional information about the SL8500.

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Menus

3

This chapter describes the T9940 Tape Drive menu system and how to navigate through the menus to perform tasks, and get configuration and status information.

Online Menus

With the online menus, you can:

- View the drive configuration
- View the firmware release level

When the drive is Online, the main menus shown in Figure 3-1 on page 3-2 are active. With `Online` selected, press Menu (one or more times) to advance to the View Configuration (`View CFG ?`) Main Menu, where you will have two choices:

- Press Select (Yes) to view configuration submenus which display the current drive configuration settings.
- Press Menu (No) to bypass, and advance to the next main menu.

Notes:

1. Fibre Channel and ESCON interface drives provide for Port/s Enable/ Disable selection before the View Configuration Main Menu appears.
2. The View Configuration submenus vary slightly relative to the specific interface type.

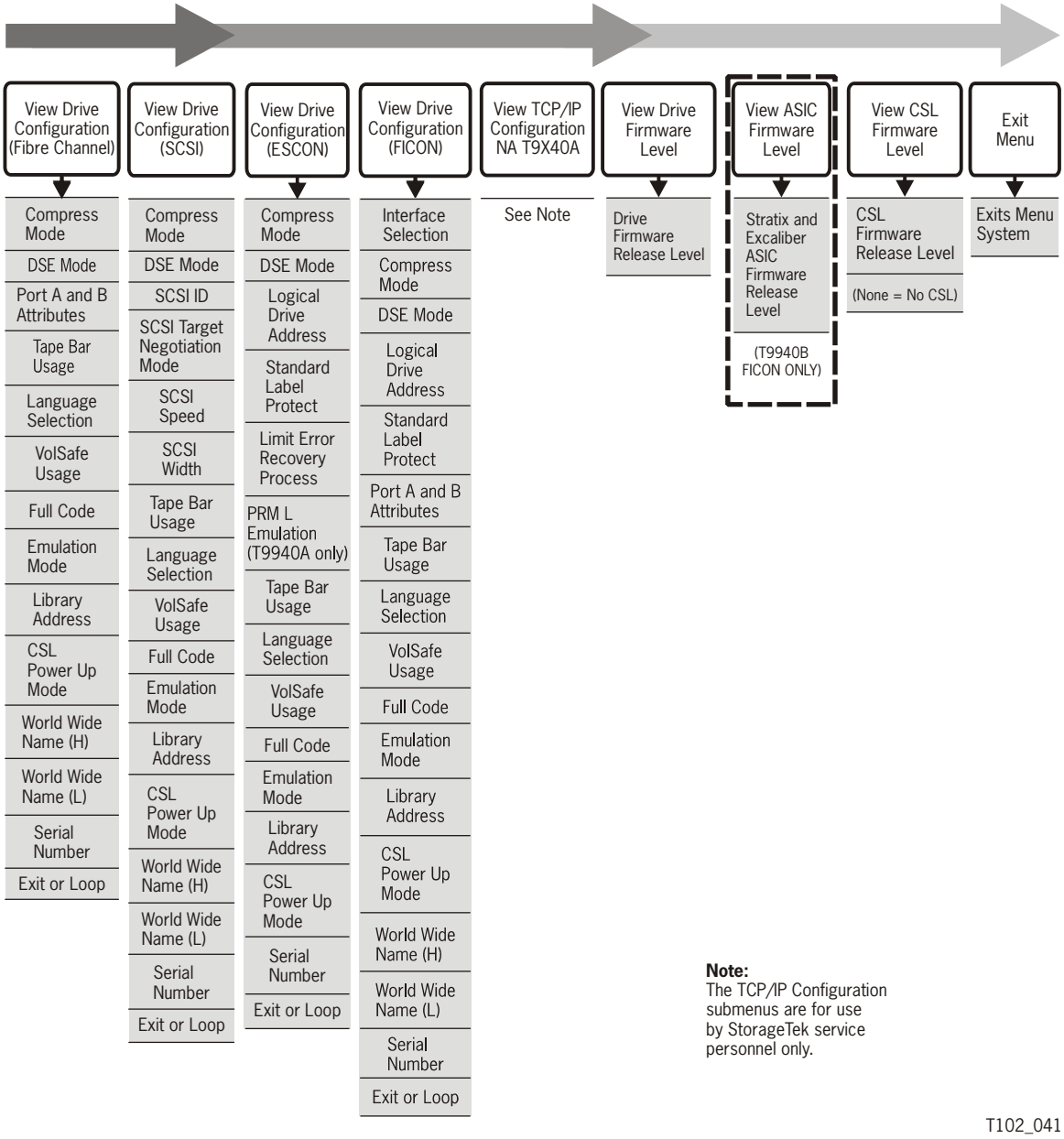
The view-only Firmware Release Main Menu displays the drive's firmware code release level in the following format: R*x.yy.zzzc*; where *x* = major revision level, *y* = minor revision level, *z* = integration number, and *c* = channel interface type (**`e`** for ESCON 3490, **`m`** for ESCON 3590, **`f`** for Fibre Channel, **`s`** for SCSI).

The view-only CSL Firmware Release Main Menu displays `CSL None` for the T9940 drive. It displays the CSL firmware code release level only in a T9840A drive CSL configuration.

The Main Exit Menu (`Exit Menu?`) allows choice to exit the menu system by pressing Select (Yes), or to loop back to the Online/Offline Main Menu by pressing Menu (No).

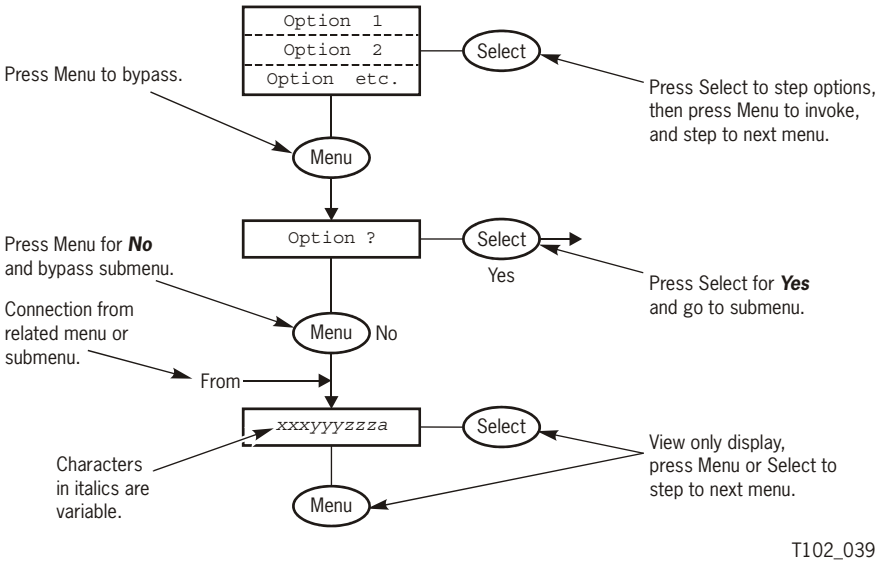
Figure 3-1 shows the online main menu items with their submenus. Note the different view configuration submenus for different interfaces. Only one configuration menu appears, applicable to the specific drive interface.

Figure 3-1. Online Menu



Use the legend, shown in Figure 3-2, as an aid to navigate the Menu Trees shown in this chapter. There are only two Operator Panel switches used for the menu system: Menu and Select. The black-bordered boxes show menu displays.

Figure 3-2. Menu Tree Legend



Most of the information in the online submenus is in the view configuration submenu, which varies according to the drive interface. The next three figures show the submenus for each interface. Each figure shows all the choices available to operators as well as the switches to press to navigate.

- Fibre Channel: Figure 3-3 on page 3-4
- SCSI: Figure 3-4 on page 3-7
- ESCON: Figure 3-5 on page 3-9
- FICONCON: Figure 3-6 on page 3-10

Figure 3-3 is a menu tree for viewing Fibre Channel configuration.

Figure 3-3. Menu Tree—View Fibre Channel Configuration (Sheet 1 of 3)

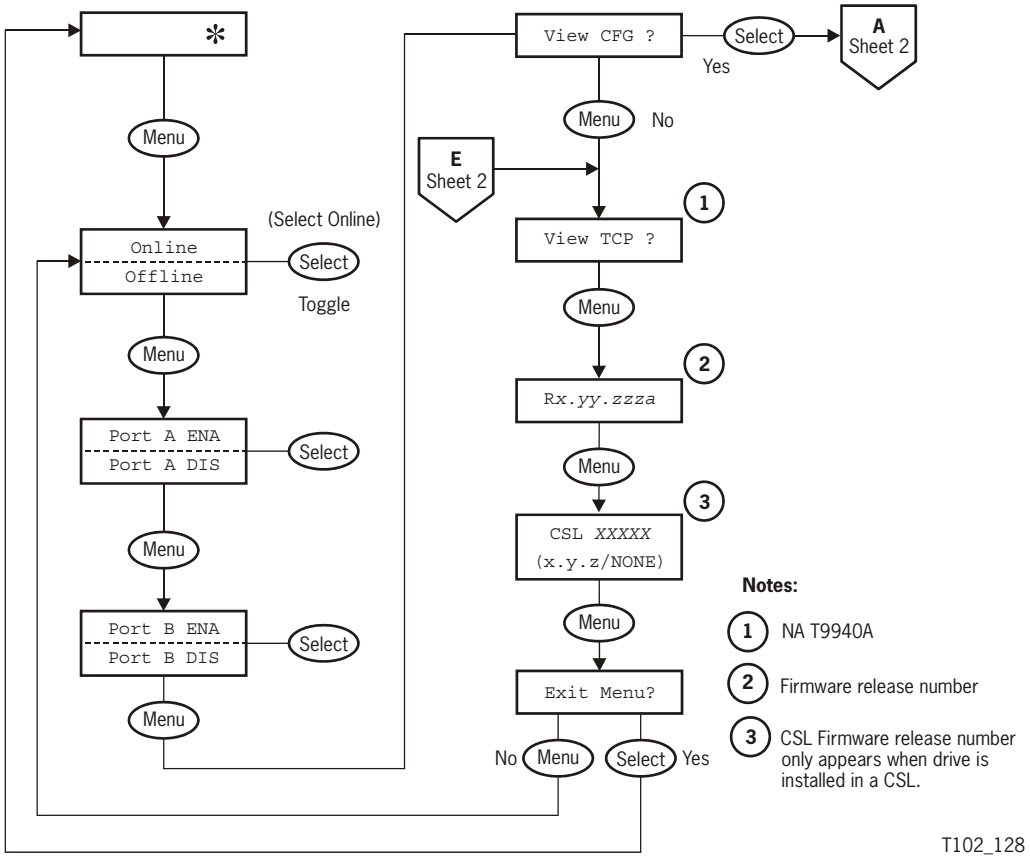


Figure 3-3. Menu Tree—View Fibre Channel Configuration (Sheet 2 of 3)

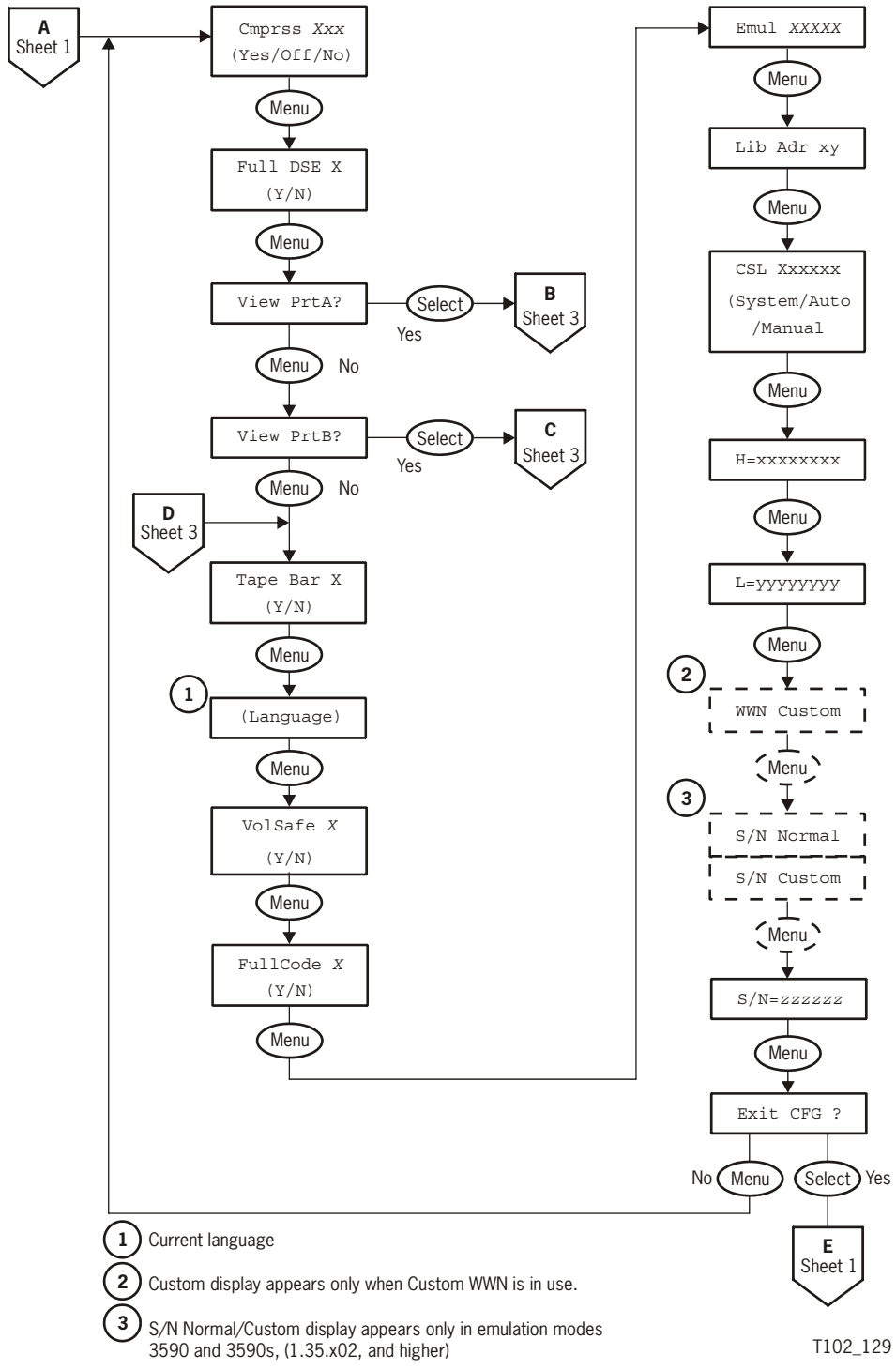


Figure 3-3. Menu Tree—View Fibre Channel Configuration (Sheet 3 of 3)

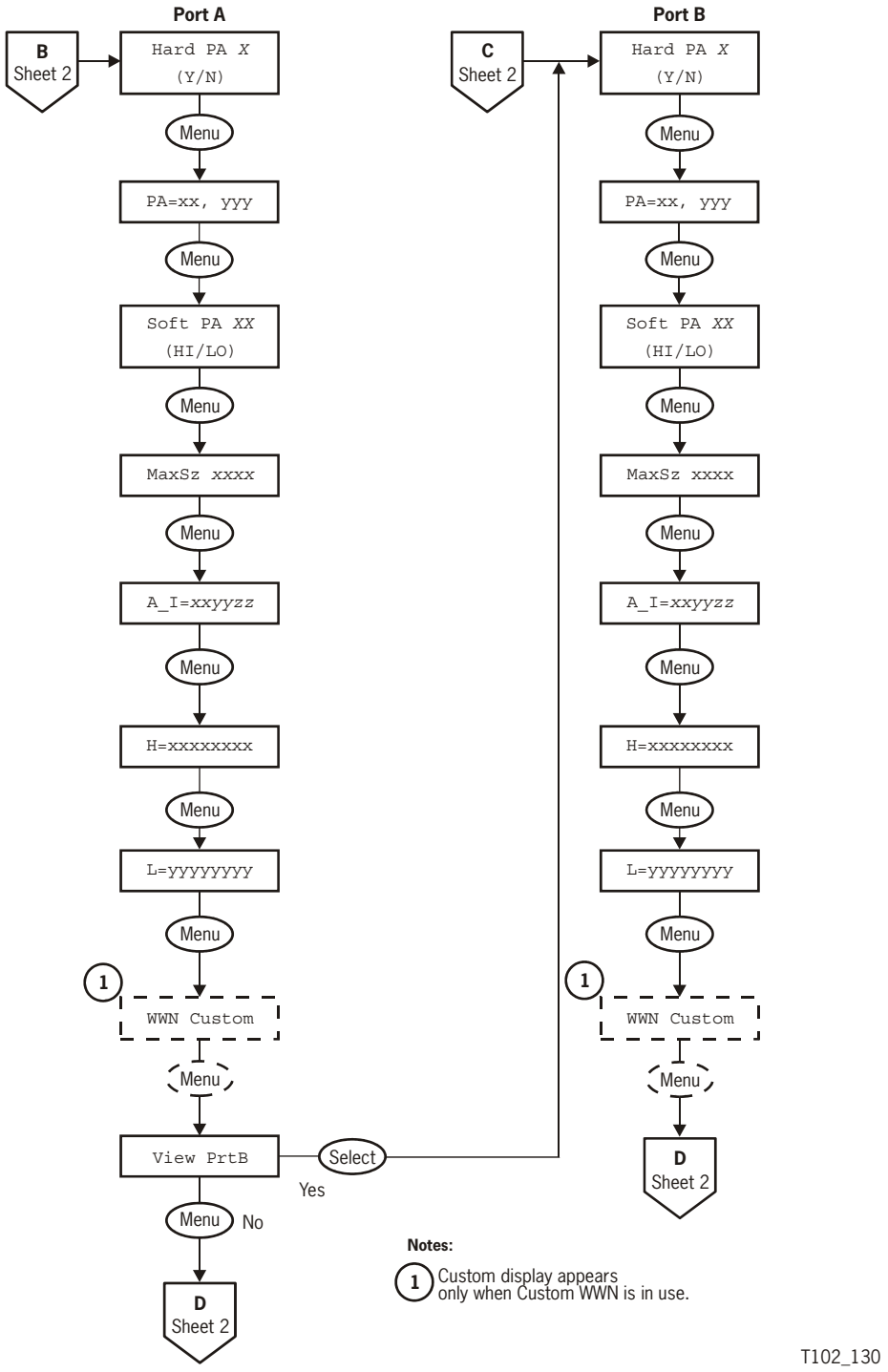


Figure 3-4 is a menu tree for viewing SCSI configuration (T9940A only).

Figure 3-4. Menu Tree—View SCSI Configuration (Sheet 1 of 2)

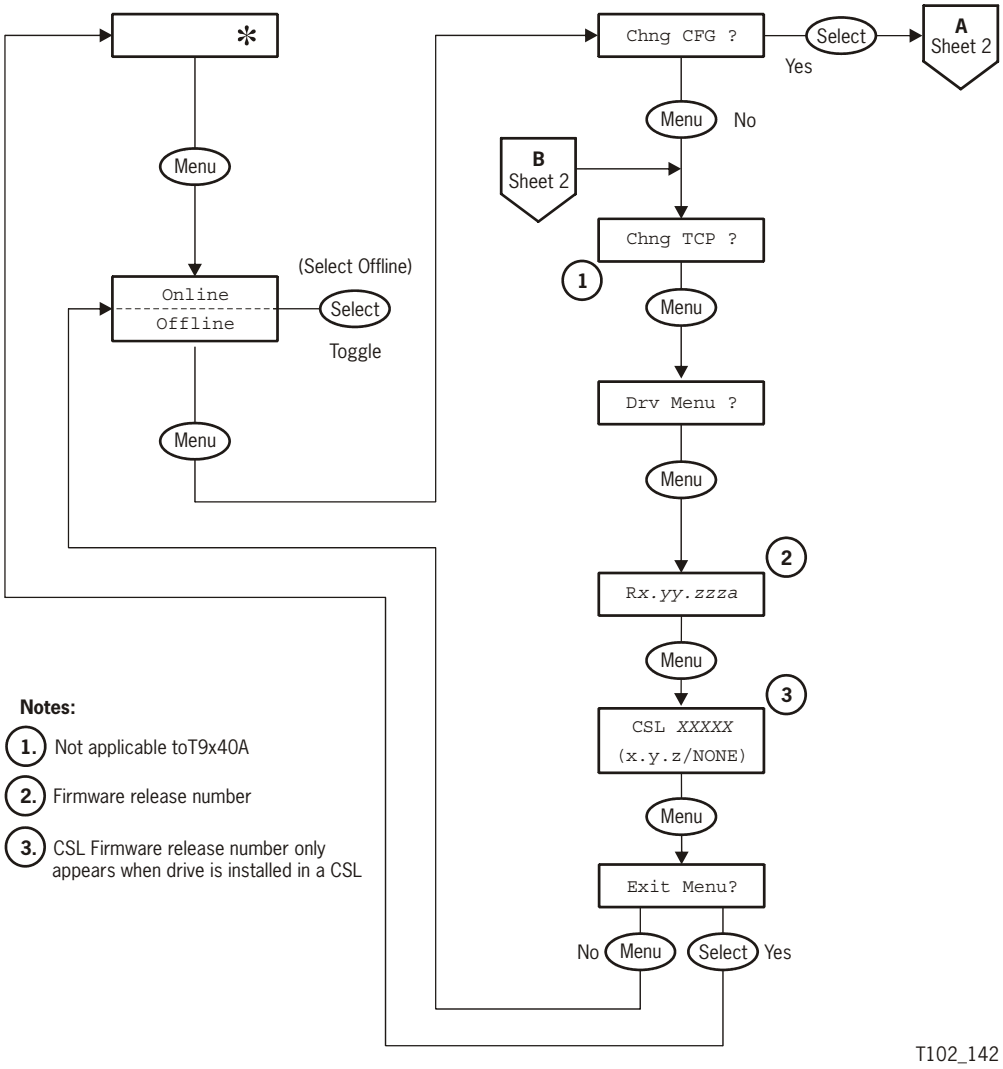
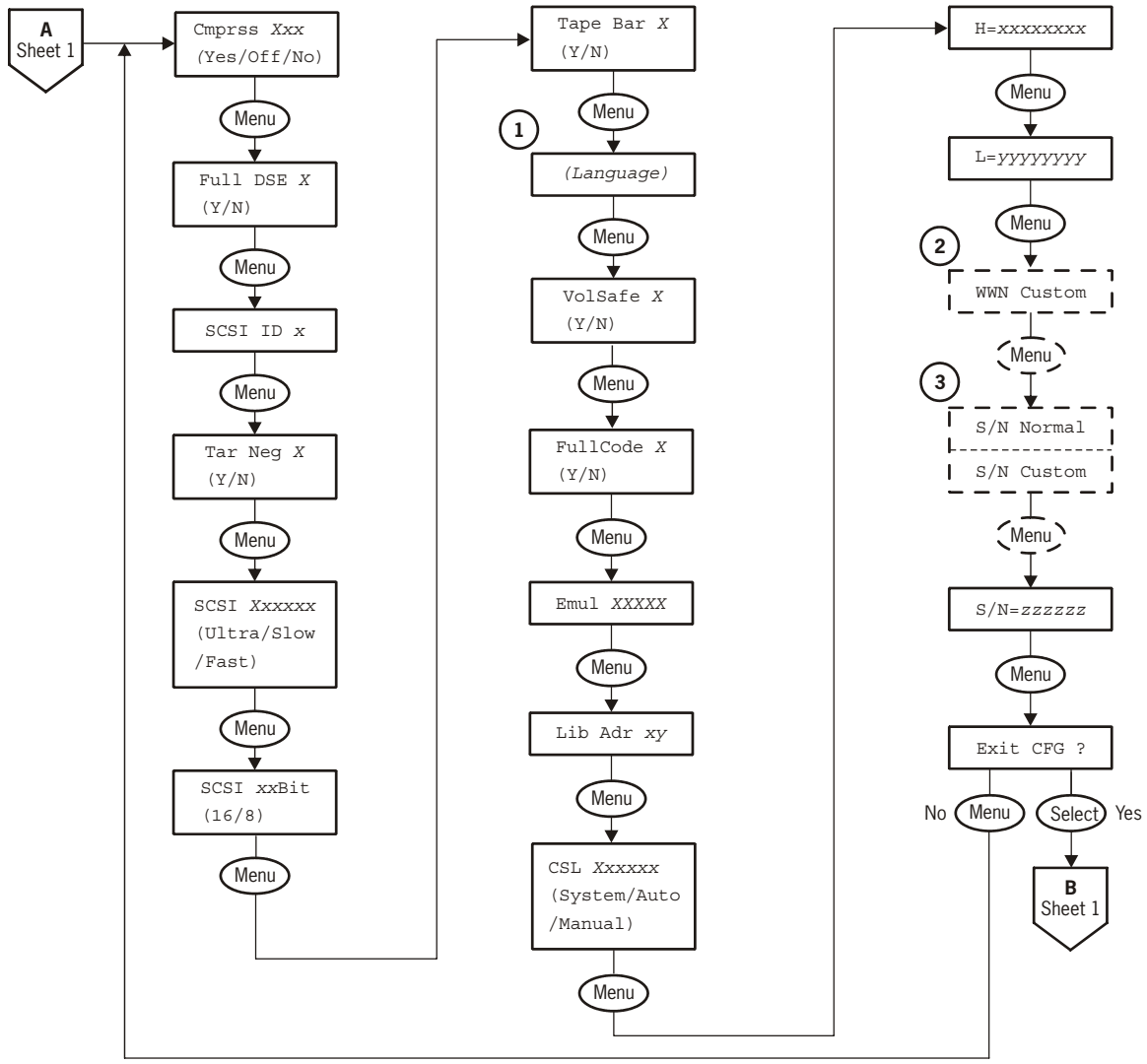


Figure 3-4. Menu Tree—View SCSI Configuration (Sheet 2 of 2)



1 Current language selection.

2 Custom display appears only when Custom WWN is in use.

3 S/N Normal/Custom display appears only in emulation modes 3590 and 3590s, (1.35.x02, and higher)

T102_143

Figure 3-5 is a menu tree for viewing ESCON configuration.

Figure 3-5. Menu Tree—View ESCON Configuration

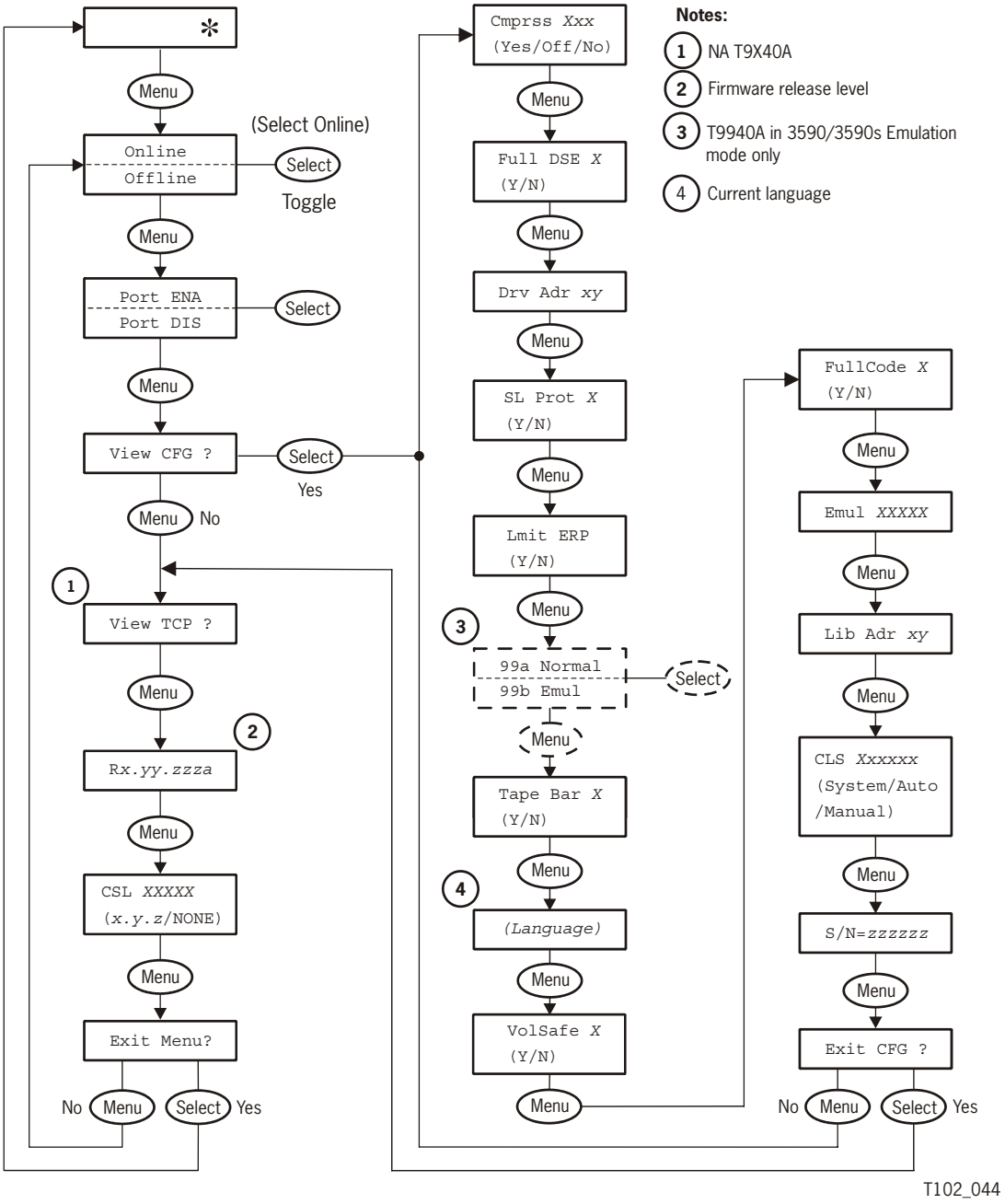


Figure 3-6 is a menu tree for viewing FICON configuration (NA T9940A).

Figure 3-6. Menu Tree—View FICON Configuration (Sheet 1 of 3)

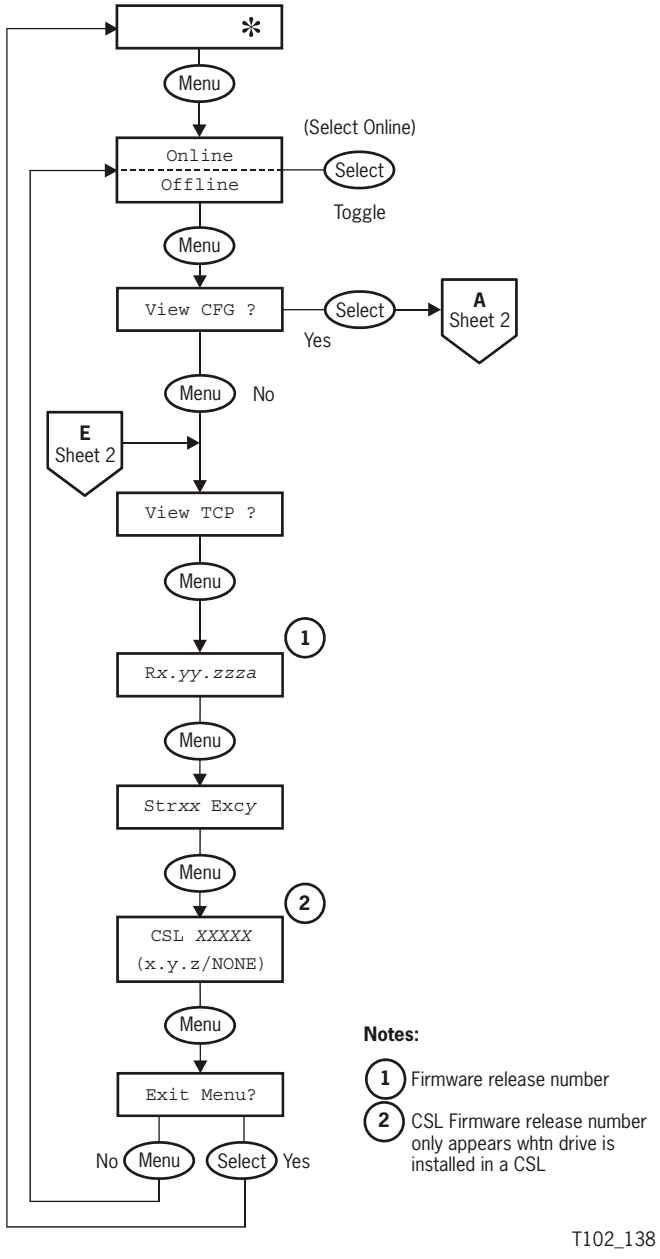


Figure 3-6. Menu Tree—View FICON Configuration (Sheet 2 of 3)

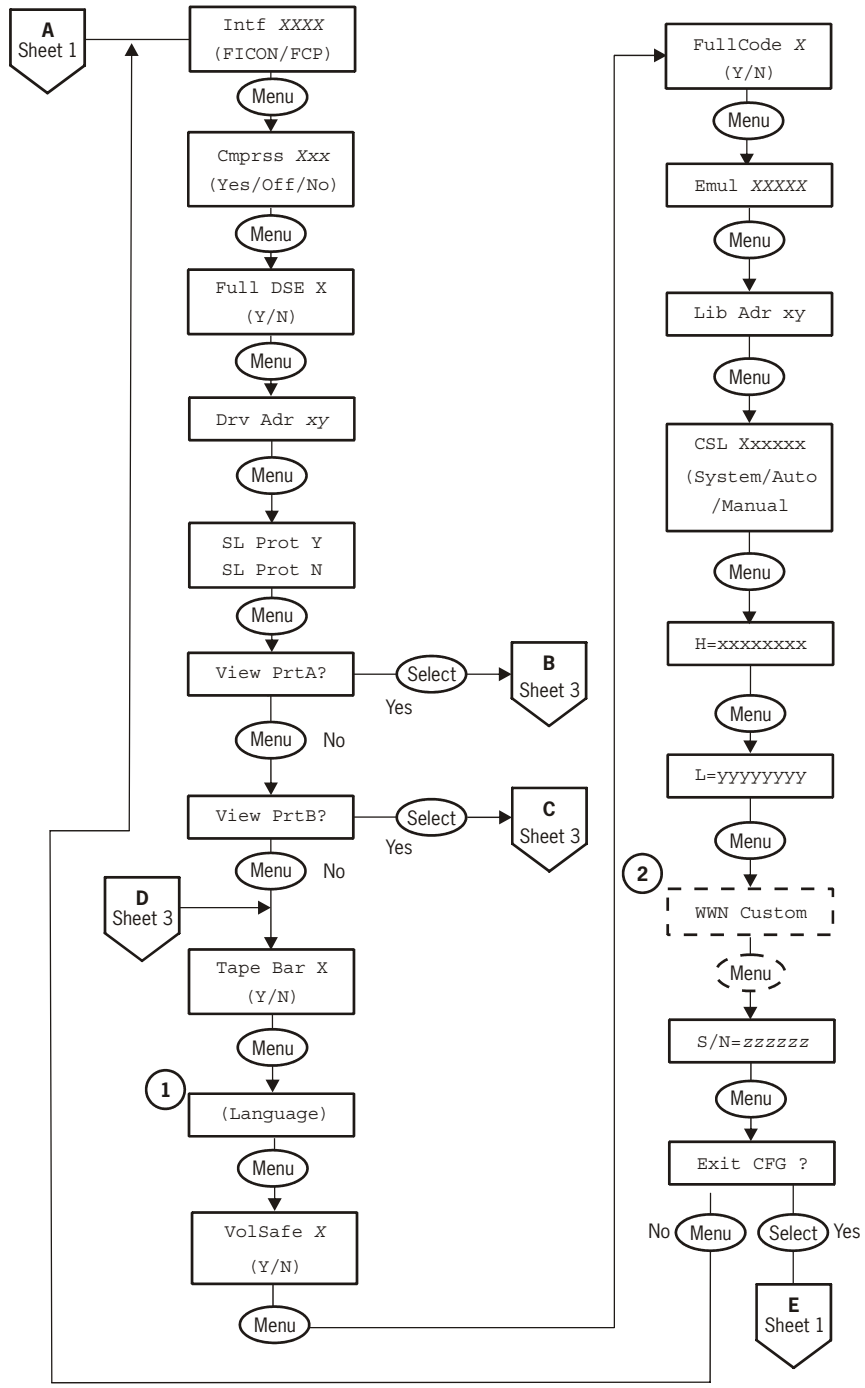
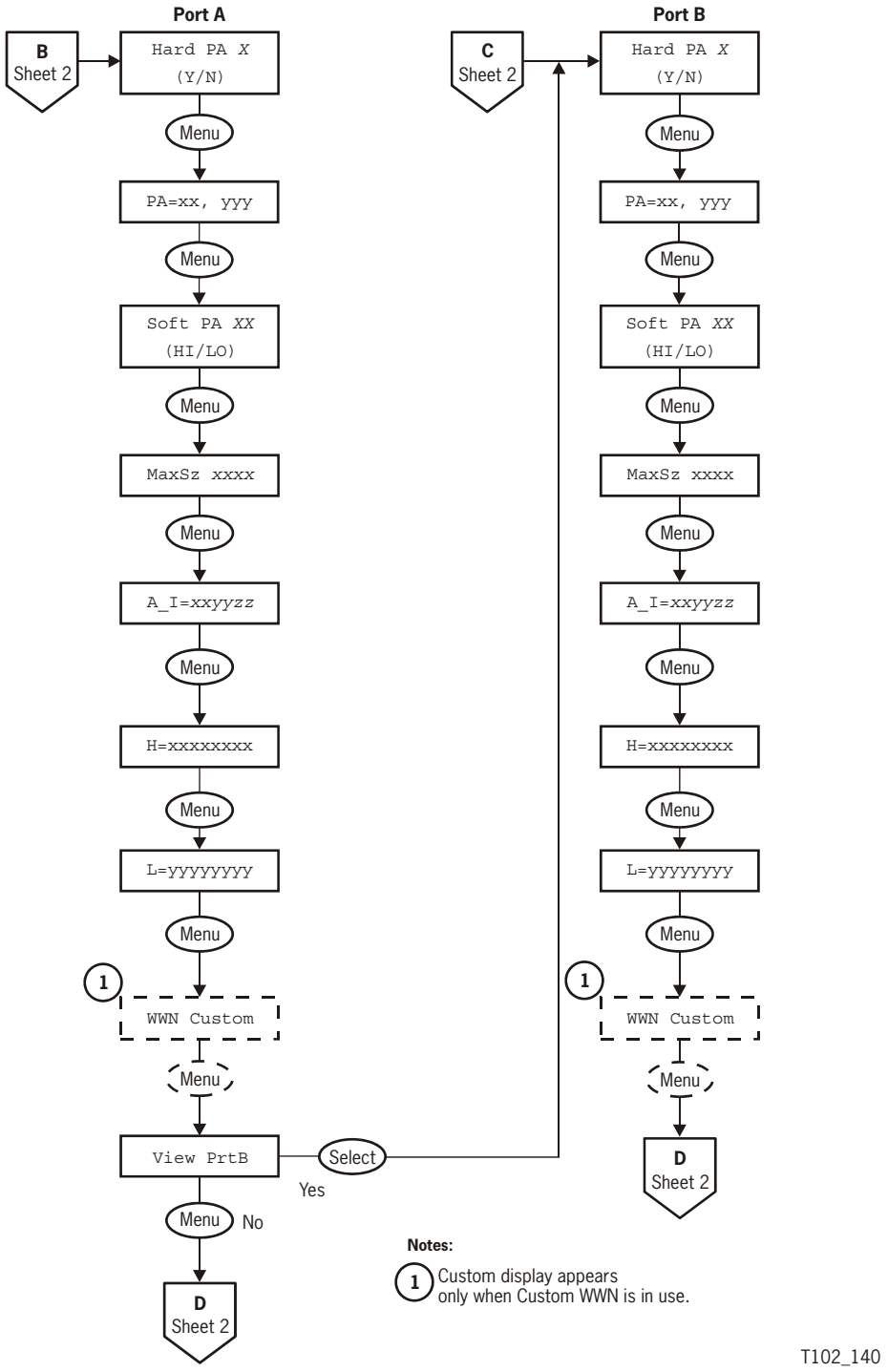


Figure 3-6. Menu Tree—View FICON Configuration (Sheet 3 of 3)



Offline Menus

Offline menus permit changing of configuration settings, and performing other operator tasks, relative to drive operations.

When the drive is Offline, the main menus shown in Figure 3-7 on page 3-14 are active. With `Offline` selected, press **Menu** (two or more times) to advance to the Drive Operation (`Drv Menu ?)` main menu, where you will have two choices:

- Press **Select** (Yes) to enter drive operation submenus which display the drive operation tasks.
- Press **Menu** (No) to bypass, and advance to the next main menu.

Note: Fibre Channel and ESCON interface drives provide for Port/s Enable/Disable selection before the change configuration main menu appears.

CAUTION:
DRIVE OR INTERFACE MALFUNCTIONS. DO NOT PRESS THE Select SWITCH WHEN THE DISPLAY READS "Chng CFG ?"

The change configuration menu (`Chng CFG ?`) menu, which first appears during offline menus display, is for qualified service personnel only. The drive operations menu is the only offline menu operators may use.

With the offline drive operations submenus (Figure 3-8 on page 3-15), you can:

- Reformat (reclaim) a data tape cartridge
- Rebuild the media information region (MIR) on a tape cartridge
- Format a diagnostic dump tape (special format for collecting diagnostic data from the drive) at the request of qualified service personnel

Refer to Chapter 4, "Operator Tasks," for detailed instructions.

Figure 3-7 shows the offline main menu items with their submenus.

Figure 3-7. Offline Menus

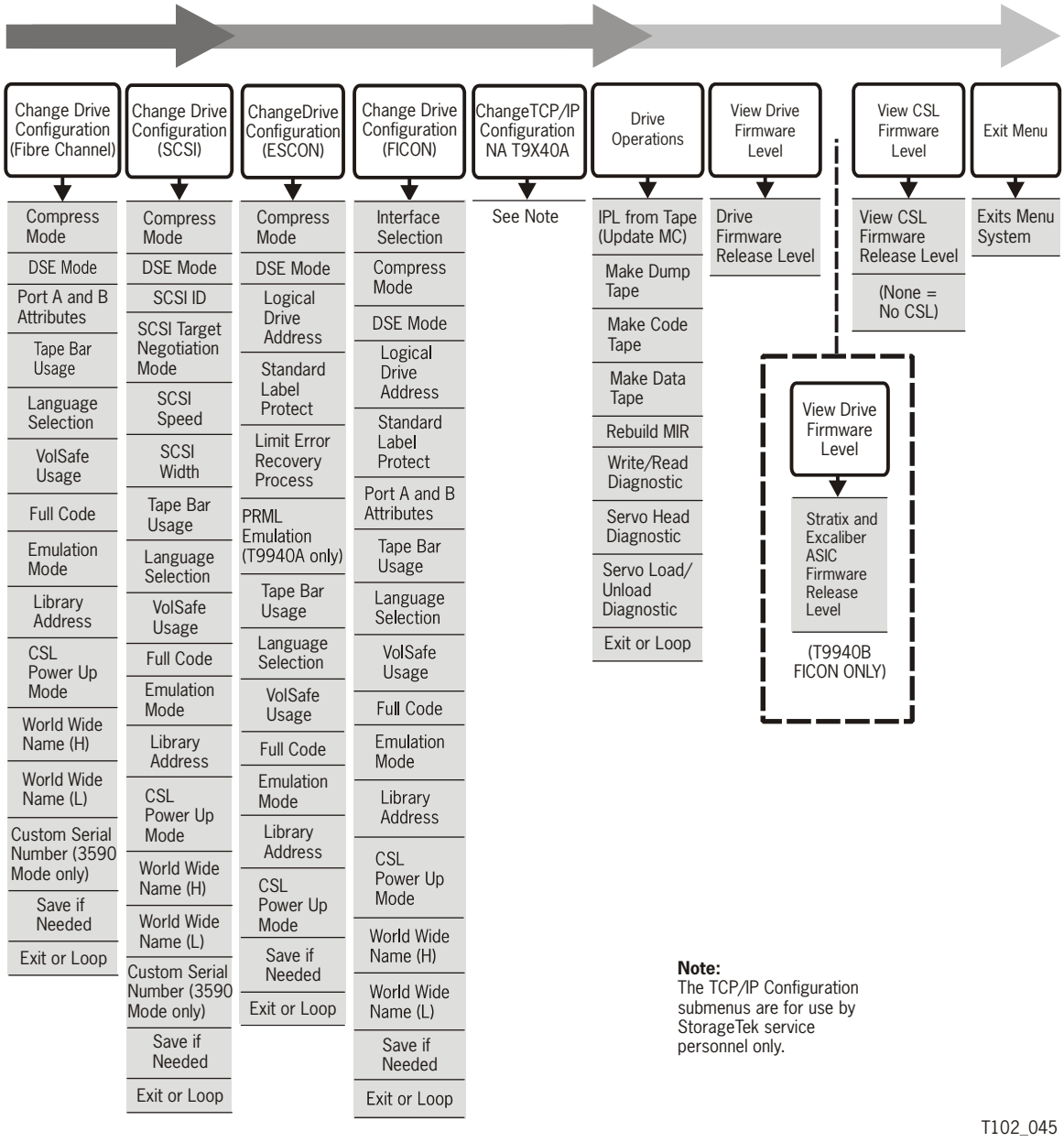
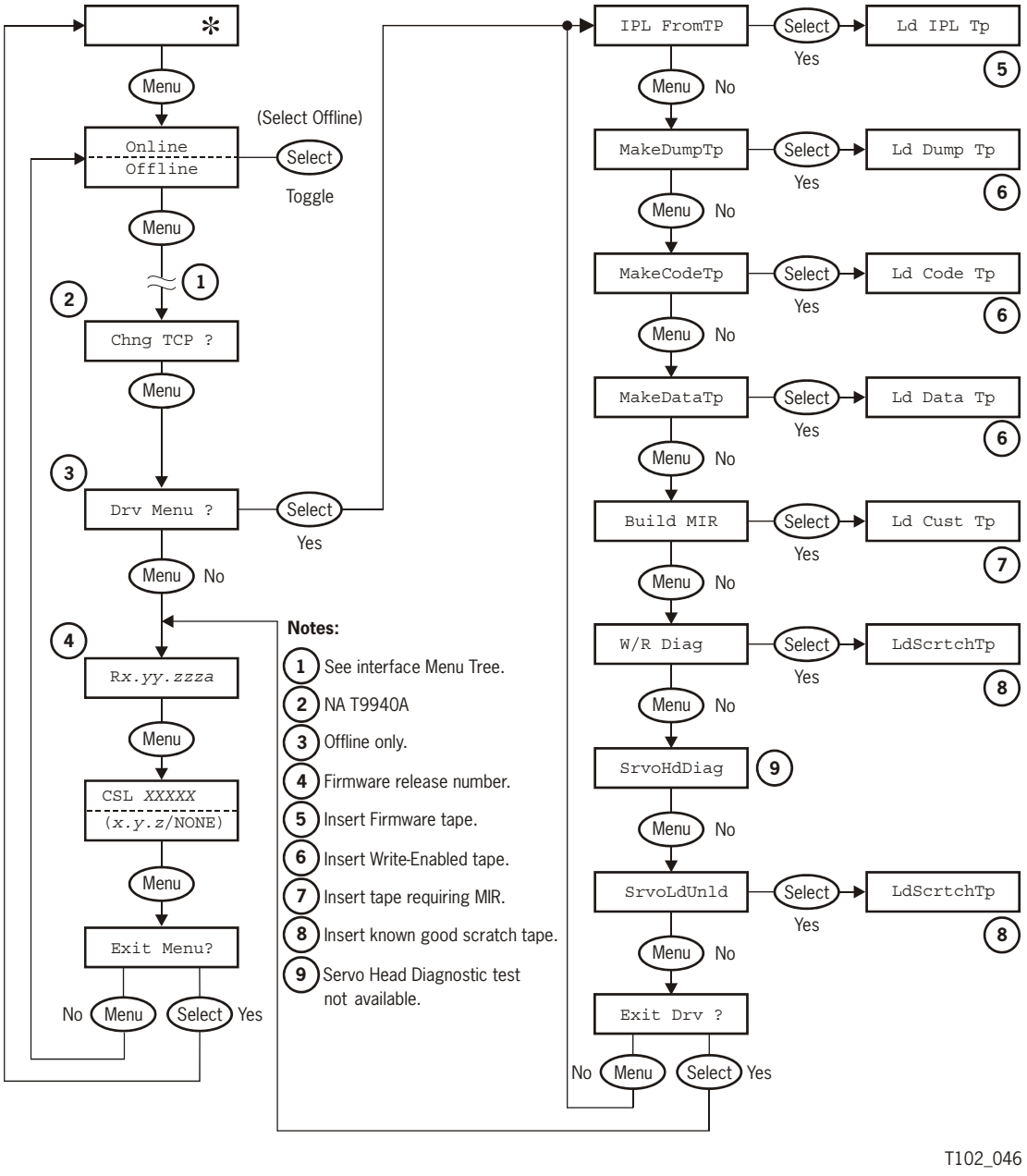


Figure 3-8 is a detailed view of the offline submenus. It shows all the choices available to operators as well as the switches to press to navigate.

Figure 3-8. Menu Tree—Drive Operations



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Operator Tasks

4

This chapter describes the tasks the T9940 operator could perform:

- Power-on the Drive
- Power-off the Drive
- Reset the Drive
- Place the Drive Offline
- Place the Drive Online
- View Drive Configuration
- Exit the Menu System
- Write-protect/enable a Tape Cartridge
- Load a Tape Cartridge
- Unload a Tape Cartridge
- Reformat a Tape Cartridge
- Build MIR
- Identify a Defective Tape Cartridge
- Clean the Drive
- Tape Cartridge Care

Direct operator tasks with the T9940 Tape Drive involve using the operator panel, which is readily accessible only on the T9940A rack-mount configuration. Library configuration drive operator panels are accessible only from inside the library. Refer to the appropriate library publications for information about entering a library, and your safety when you enter a library: See "Related Publications" on page -xii.

Power-on the Drive

To apply power to the rack-mount tray:

1. Make sure a power cord connects the receptacle on the back of the rack-mount tray to an AC power outlet or power strip.
2. Set the power switch on the back of the rack-mount tray to ON (1).

The drive powers on and starts performing an initial program load (IPL).

- The *power* indicator flashes.
- The display shows various messages indicating that the IPL is proceeding. These messages require no action on your part.

When the drive successfully completes an IPL:

- The *power* indicator is lit steadily.
- The display shows a steady "*" (asterisk).
- The drive is now in the online state.

Power-off the Drive

To remove power from the rack-mount tray:

1. Make sure the drive is not selected from the host.
2. Make sure a tape cartridge is not loaded in the drive.
3. Set the power switch on the back of the rack-mount tray to OFF (0).

Reset the Drive

Pressing the IPL switch resets the drive and reloads the drive firmware into drive memory. The same process occurs automatically at power-on.

To reset a drive that is already powered on:

1. Make sure a tape cartridge is not loaded in the drive.
2. Press IPL.
    - The *power* indicator flashes.
    - The display shows various messages indicating that the IPL is proceeding. These messages require no action on your part.

When the drive successfully completes an IPL:

- The *power* indicator is lit steadily.
- The display shows a steady "*" (asterisk).
- The drive is now in the online state.

Place the Drive Offline

By default, the drive is in the online state following a successful IPL. To change the drive state to offline:

1. Cease all I/O activity from the host.
   - Enterprise: Vary the drive offline for all host paths to the drive by keying in one of the following commands:

     MVS: `V <address> offline`
     VM: `Vary off, <address>`
   - Fibre Channel, SCSI: Cease all I/O activity from the host.
2. Press **Menu**.

   The display shows `Online`, indicating the current state of the drive.
3. Press **Select** to place the drive offline.

   The display shows `Offline`, indicating a successful transition.
4. Press **Menu** until the display shows `Exit Menu?`.
5. Press **Select** to exit, or **Menu** to repeat Online/Offline selection.

   Note: If `Exit Menu?` is selected, the display shows `Offline,` alternating with the normal message, as a reminder that the drive is in the offline state.

Place the Drive Online

To change the drive state back to online:

1. Press **Menu**.

   The display shows `Offline`, indicating the offline state of the drive.
2. Press **Select** to place the drive online.

   The display shows `Online`, indicating a successful transition.
3. Press **Menu** until the display shows `Exit Menu?`
4. Press **Select** to exit, or **Menu** to repeat the Online/Offline selection.
5. Bring the drive back online to the host.
   - Enterprise: Vary the drive online for all host paths to the drive by keying in one of the following commands:

     MVS: `V <address> online`
     VM: `Vary on, <address>`
   - Fibre Channel, SCSI: No additional action needed for host I/O activity.

View Drive Configuration

To view current drive configuration:

1. Press Menu to enter the menu system.
   a. If the display shows `Online`, go to step 2.
   b. If the display shows `Offline`, press Select to place the drive online
2. Press Menu until the display shows `View CFG ?`.
3. Press Select to enter the view configuration submenus.
   - The display shows the first configuration setting.
4. Press Menu to step through the configuration settings.
5. Press Select to exit when the display shows `Exit CFG ?`,
   or press Menu to repeat the view configuration submenus.
6. Press Menu until the display shows `Exit Menu?`
7. Press Select to exit the menu system, or press Menu to repeat the Online/Offline selection.

View Firmware Release Level

To view the firmware release level:

1. Press Menu to enter the menu system.
2. Press Menu until the display shows a number in the following format:

   R*x.yy.zzzc*, where:

   x is the major revision level
   yy is the minor revision level
   zzz is the integration number
   c is the channel type, where
   `e` is ESCON (3490 image)
   `m` is ESCON (3590 image)
   `f` is Fibre Channel
   `s` is SCSI
3. Press Menu until the display shows `Exit Menu?`
4. Press Select to exit the menu system, or press Menu to repeat.

Exit the Menu System

To exit the menu system:

1. Press Menu repeatedly until the display shows `Exit Menu?`.
2. Press Select.

   The display will show one of the following:

   - `"*"` (asterisk) - The drive is online, but a tape cartridge is not loaded.
   - A "`Ready`" message - The drive is online, and a tape cartridge is loaded.

     Note: See a list of possible "`Ready`" messages under "Load a Tape Cartridge" on page 4-6.

   - `Offline`, alternating with any of the above messages - The drive is in the offline state.

Write-protect/enable a Tape Cartridge

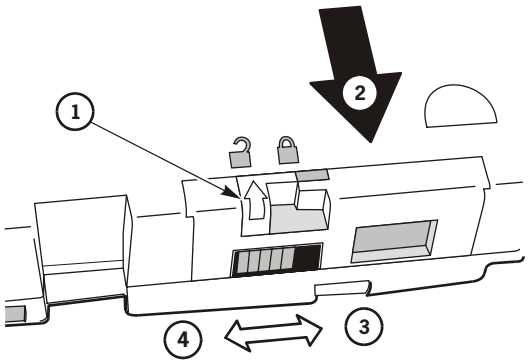
To write-protect or write-enable a tape cartridge, move the write-protect switch on the tape cartridge to the desired setting.

The write-protect switch is on the leading edge of the 9940 tape cartridge (the edge that enters the drive first). A pointer on the switch points to padlock symbols on the case that indicate the following status:

Locked:	Write-protected. Data can only be read from the tape cartridge.
Unlocked:	Write-enabled (unprotected). Data can be read from, and written to the tape cartridge.

Figure 4-1 shows the write-protect switch on the 9940 tape cartridge.

Figure 4-1. 9940 Tape Cartridge Write-Protect Switch



1. Write-protect switch
2. Insert direction arrow
3. Locked (write-protected)
4. Unlocked (write-unprotected)

Load a Tape Cartridge

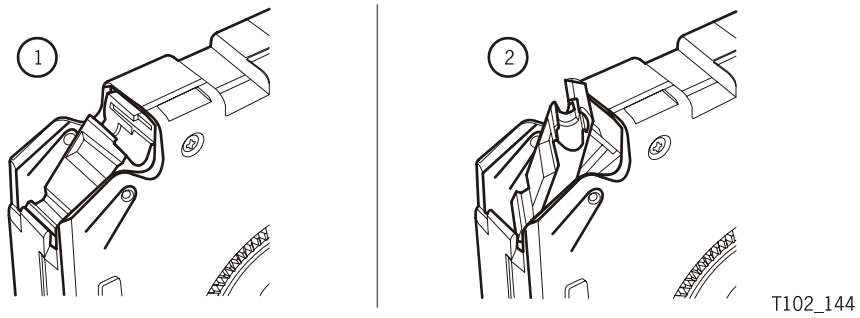
To load a tape cartridge:

1. Inspect the tape cartridge for serviceability (see "Inspecting" on page 4-12)

CAUTION:
POSSIBLE LOAD FAILURE. If the leader block is not properly latched in the cartridge, a load failure could result, and possibly damage the cartridge and/or the tape drive. MAKE SURE THE LEADER BLOCK IS LATCHED IN THE CARTRIDGE.

2. Verify that the leader block is latched in the cartridge (see Figure 4-2).

Figure 4-2. T9940 Tape Cartridge Leader Block



1.Correct Seating 2. Incorrect Seating

3. Manually insert the tape cartridge into the drive loading slot in the direction shown in Figure 4-1 on page 4-5.

4. Observe the following messages on the display:

   `Ready U` (file-unprotected) - The drive is loaded with a write-unprotected (write-enabled) 9940 standard data cartridge, and the cartridge data density format matches the drive model (low -T9940A) (high -T9940B). The drive can read, write, and/or append data.

   `Ready H` (high-density data format) - A T9940A drive is loaded with a write-unprotected (write-enabled) 9940 standard data cartridge in high-density data format. The drive cannot read nor append data.

   `READY L` (low-density data format) - A T9940B drive is loaded with a write-unprotected (write-enabled) 9940 standard data cartridge in low-density data format. The T9940B drive can read any low-density data present (T9940A), but cannot append data.

   `Ready A` (Volsafe) - A T9940B drive is loaded with a write-enabled, VolSafe data cartridge, and the drive VolSafe option is enabled. The drive can read any existing data, and can append new data to the tape.

`Ready F` (file-protected) - The drive is loaded with a data cartridge and one of the following conditions exist:

- Standard or VolSafe data cartridge with the cartridge write-protect switch in the locked position.
- VolSafe data cartridge, but the drive VolSafe option is disabled (No), regardless of the write-protect switch position.

The drive can read existing data (if the density is compatible), but cannot write nor append data.

Note: The write-protect switch locked position detection overrides data density format identification. The loaded cartridge data density is unknown. If the loaded data cartridge is high-density format, a read attempt will fail on a T9940A drive.

`*CLEANING*` - The drive is loaded with a cleaning cartridge and the cleaning operation is in progress.

`Load xxxx` – The attempted load was unsuccessful; *xxxx* is the FSC. See Table 5-2 on page 5-2 to resolve this condition.

Unload a Tape Cartridge

Pressing the Unload switch causes the cartridge in the drive to rewind and eject.

Pressing the Unload switch once during a write operation causes the drive to try to write the remaining data before the tape cartridge unloads. An operator display of `UnWr xxxx` (unwritten data, where `xxxx` is the FSC) means that some data is not written to the tape. Pressing Unload a second time causes the unwritten data to be lost. Before you press Unload again, see `UnWr xxxx` in Table 5-2 on page 5-2.

To unload a tape cartridge:

1. Ensure that the drive is not selected from the host.

CAUTION:
DATA LOSS. DO NOT PRESS THE Unload SWITCH TWICE DURING A WRITE OPERATION.

2. Press the Unload switch once.

   Note: One of the following conditions occurs:

   - The tape cartridge rewinds and ejects from the drive.
     Remove the tape cartridge from the drive.
   - The tape cartridge rewinds but fails to eject. The display shows `Load xxxx`, where `xxxx` is the FSC.
     The tape cartridge is jammed and the drive requires service to resolve the problem.

Reformat a Tape Cartridge

A standard or geophysical data tape cartridge can be reformatted for new data recording using the offline drive operations menu. Once a tape cartridge is reformatted (reclaimed), old data is no longer accessible because the reformatting and new data recording overwrites previous data areas.

Note: A 9940B VolSafe data tape cartridge cannot be reformatted.

The change configuration menu (`Chng CFG ?`) is for qualified service personnel only. The drive operations menu (`Drv Menu ?`) is the only offline menu operators may use.

To reformat a standard or geophysical data tape cartridge:

1. Press Menu to access the menu system.
   a. If the display shows `Offline`, go to step 2.
   b. If the display shows `Online`, press Select to place the drive offline.

CAUTION:
DRIVE OR INTERFACE MALFUNCTIONS. DO NOT PRESS THE Select SWITCH WHEN THE DISPLAY READS `Chng CFG ?`

2. Press Menu until the display shows `Drv Menu ?`
3. Press Select.
4. Press Menu until the display shows `MakeDataTp.`
5. Press Select.
   - The display shows `Ld Data Tp.`
6. Load a write-enabled data tape cartridge in the drive loading slot.
   - The drive reformats and ejects the tape cartridge.
7. Remove the tape cartridge.

   Note: To reformat another tape, repeat steps 6 and 7.
8. Press Menu until the display shows `Exit Drv ?.`
9. Press Select to exit, or press Menu to repeat the drive operations menu.
10. Press Menu until the display shows `Exit Menu?.`
11. Press Select to exit the menu system, or press Menu to repeat the Online/Offline selection.

Build MIR

The media information region (MIR) is an area at the beginning of a tape cartridge that contains metadata—information about data on the tape cartridge that helps the drive access and manage it. If an error occurs, the MIR can be rebuilt (restored) by a utility that sequentially reads the tape.

The change configuration menu (`Chng CFG ?`) is for qualified service personnel only. The drive operations menu (`Drv Menu ?`) is the only offline menu operators may use.

To build an MIR:

1. Press Menu to access the menu system.
   a. If the display shows `Offline`, go to step 2.
   b. If the display shows `Online`, press Select to place the drive offline.

CAUTION:
DRIVE OR INTERFACE MALFUNCTIONS. DO NOT PRESS THE Select SWITCH WHEN THE DISPLAY READS `Chng CFG ?`.

2. Press Menu until the display shows `Drv Menu ?`.
3. Press Select.
4. Press Menu until the display shows `Build MIR`.
5. Press Select.
   - The display shows `Ld Cust Tp`.
6. Load a write-enabled data tape cartridge in the drive loading slot.

   Note: While the drive builds the MIR, the display shows `ReBldg MIR` and the green *activity* indicators flashes. When the rebuild MIR is complete (could be up to 90 minutes for a full tape), the drive ejects the tape cartridge, and the display shows `Ld Cust Tp`.
7. Remove the tape cartridge.

   Note: To build the MIR on another tape, repeat steps 6 and 7.
8. Press Menu until the display shows `Exit Drv ?`.
9. Press Select to exit, or press Menu to repeat the drive operations menu.
10. Press Menu until the display shows `Exit Menu?`.
11. Press Select to exit the menu system, or press Menu to repeat the Online/Offline selection.

Identify a Defective Tape Cartridge

To confirm a tape is defective:

1. Try the tape in another drive. If the tape fails in a second drive, the tape is probably defective.
2. Try a known good tape in both drives. If the drive operates with the known good tape operate, the original tape is probably defective.

Clean the Drive

After the drive transports a predetermined length of tape or records a pre-determined number of errors, the amber ***clean*** indicator lights. It is time to clean the drive.

CAUTION:
EQUIPMENT DAMAGE.
DO NOT WET-CLEAN (CHEMICAL-CLEAN) THE DRIVE.
DO NOT CLEAN THE DRIVE UNLESS THE *clean* INDICATOR LIGHTS.

To clean the drive:

1. Unload any data tape cartridge in the drive.
2. Insert a cleaning cartridge in the drive.
   - The green ***activity*** indicator flashes.
     When the ***activity*** and ***clean*** indicators turn off, cleaning is complete and the cleaning cartridge ejects.

   Note: If the drive immediately ejects the cleaning cartridge and the display shows `Exp ClCart`, the cleaning cartridge is used up. Discard the worn cleaning cartridge and insert a new cleaning cartridge. The cleaning cartridge can be used about 100 times before you must discard it.

   If the display shows `CHK xxxx`, where `xxxx` is the FSC, a cleaning cartridge failure occurred. Try the procedure again with a different cleaning cartridge. If the problem persists, contact authorized service personnel.
3. Remove the cleaning cartridge from the drive.

Tape Cartridge Care

9940 tape cartridges require care to ensure proper operation and longevity.

Handling

CAUTION:
TAPE CARTRIDGE DAMAGE OR DATA LOSS. HANDLE TAPE CARTRIDGES PROPERLY.

Follow these guidelines to properly handle tape cartridges:

- Make sure leader block is latched every time you pick up a cartridge.
- Do not carry several cartridges loosely in a container.
  The leader blocks can snag on other cartridges and become unlatched.
- Never release a leader block and pull tape from a cartridge.
- Do not open a tape cartridge or touch the tape.
- 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 environment.

Cleaning

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

Storing

Always store tape cartridges in an environment with the specified range of temperature and humidity found in "Tape Cartridges" on page A-4. When storing cartridges, follow these recommendations:

- Do not take tape cartridges out of their protective wrapping until they are needed. 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 using tape cartridges that have been in tape storage, acclimate them to the operating environment for at least 24 hours.

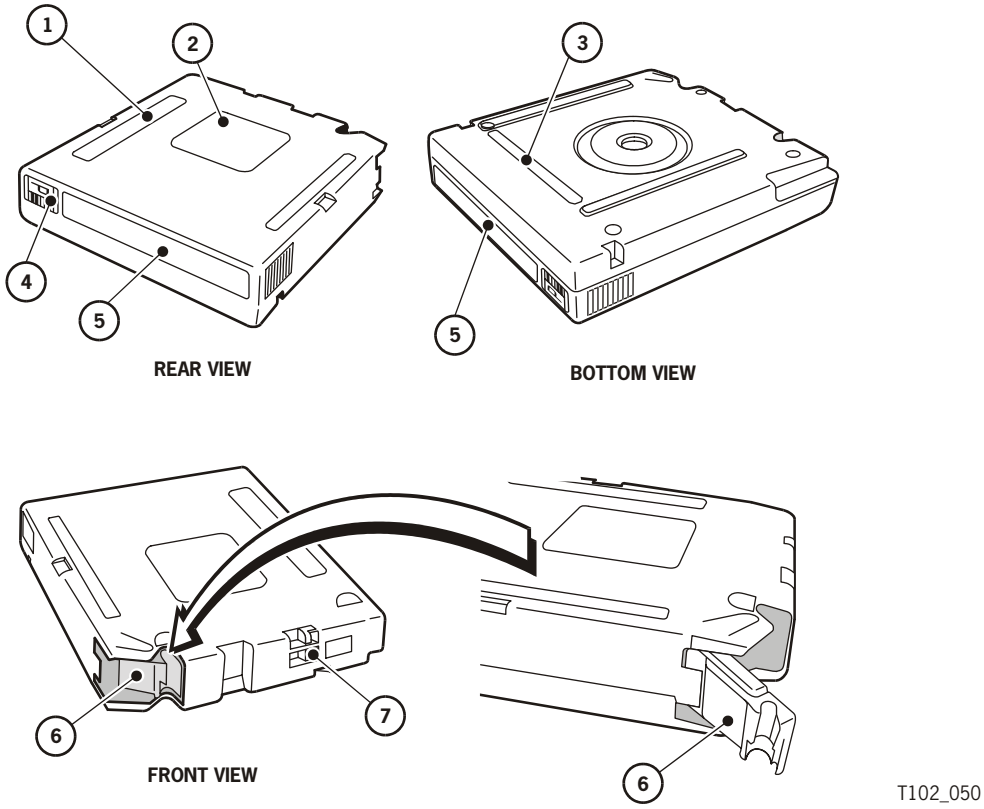
Inspecting

CAUTION:
EQUIPMENT DAMAGE. DO NOT LOAD DAMAGED TAPE CARTRIDGES.

Before loading a cartridge into a drive, look for the following problems:

- A cracked or broken case
- A dirty case
- A missing or broken leader block
- Leader block loose or improperly latched
- A damaged write-protect switch
- Liquid in the cartridge
- A loose label
- Any other obvious damage

Figure 4-3. 9940 Tape Cartridge Inspection



9940 Tape Cartridge Inspection (T102_050)

1. Manufacturer label area
2. Customer label area
3. Manufacturer part ID
4. Media ID
5. VOLSER label area
6. Leader block
7. Write-protect switch

Shipping

CAUTION:
TAPE CARTRIDGE DAMAGE. SHIP TAPE CARTRIDGES PROPERLY.

If you must ship 9940 tape cartridges, especially if they are for remote system backup, remote database duplication, or disaster recovery, follow these guidelines:

- Save the original factory packaging. Use it, or the equivalent, to package tape cartridges.
- 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 block pointing up. If tape cartridges are packed flat, shipping vibration causes the clutches in the tape cartridges to disengage and slip.
- Pad the tape cartridges on all sides.
- Fill voids in the packaging with foam padding equivalent to the original padding, if you are using factory packaging to ship fewer tape cartridges than the packaging originally held, or if you are using other packaging.
- 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

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Indicators and Messages

5

This chapter summarizes the T9940 Tape Drive operator-panel indicator lights and display messages. Where applicable, this chapter recommends action for error recovery.

Indicators

Table 5-1 shows the front-panel indicators with their meaning and recommended action.

Table 5-1. Operator-panel Indicators

Indicator				Meaning	Recommended Action
power	***activity***	***clean***	***service***		
Off				The drive is powered off.	Power on the drive as required.
On			Off	Normal operation	None
On			On	A drive error occurred.	Perform an initial program load (IPL) on the drive. If the problem persists, contact authorized service personnel.
Flashing			Off	The drive is performing IPL.	None
Persistent flashing			Off	The drive failed IPL and cannot exit the sequence.	Power the drive off and on again. If the problem persists, contact authorized service personnel.
On			Flashing	An error occurred and diagnostic data was saved to the drive EEPROM.	Observe the display message. See "Messages" on page 5-2 for more information about the message.
On	On			A tape cartridge is loaded.	None

Table 5-1. Operator-panel Indicators (Continued)

Indicator				Meaning	Recommended Action
power	***activity***	***clean***	***service***		
On	Flashing			The tape is moving.	None
On	Off			Tape cartridge is not loaded.	Load a tape cartridge as required.
On		Off		No cleaning is required.	None
On		On		Cleaning is required.	Clean the drive.
On	Flashing	On		Cleaning in progress.	None

Messages

Table 5-2 shows the front-panel display messages with their meaning and recommended action.

Table 5-2. Operator-panel Display Messages

Display	Meaning	Recommended Action
*	The drive is online but a tape cartridge is not loaded.	Load a tape cartridge as required.
`ASIA Diags`	IPL diagnostics are running.	None
`Bank n Bad`	During boot, a section of memory was found bad.	Initiate IPL. If the problem persists, contact authorized service personnel.
`BldMIRFail`	Rebuild of tape Media Information Region (MIR) unsuccessful.	
Note: In code level 1.30.209 and up, error message is replaced by `CHK` *xxxx*.		
`Boot Fail`	The IPL failed.	Initiate IPL again. If the problem persists, contact authorized service personnel.
`BT Monitor`	A sequence of switches accessed an engineering area.	Initiate IPL.

Table 5-2. Operator-panel Display Messages (Continued)

Display	Meaning	Recommended Action
`CC Diags`	IPL diagnostics are running.	None
`CHK xxxx`	An operational failure occurred. (*xxxx* = actual FSC that caused the failure.) Some failures will initiate a diagnostic dump and IPL.	If required, wait for IPL to complete, then retry the operation. If the problem persists, contact authorized service personnel.
`*CLEANING*`	A cleaning cartridge is in the drive and is now cleaning.	None
`c`***n***`h`***n***`d`***n***`s`***n***	The hardware revision level supported by the firmware in this drive, where: ***n***=any number 0–9, *c*=controller processor level, *h*=host side formatter level, *d*=device side formatter level, *s*=servo level.	Contact authorized service personnel.
`DatCrFail`	The drive cannot create (reformat or reclaim) a tape cartridge.	Ensure that the tape cartridge is write-enabled, or try to reformat the tape on another drive. If the problem persists, contact authorized service personnel.
Note: In code level 1.30.209 and up, error message is replaced by `CHK xxxx`.		
`DmpCrFail`	The drive cannot create (reformat or reclaim) a diagnostic dump tape.	Ensure that the tape cartridge is write-enabled. If the problem persists, contact authorized service personnel.
Note: In code level 1.30.209 and up, error message is replaced by `CHK xxxx`.		
`DmpCrFail2`	The drive cannot read the format of the tape cartridge.	Retry the operation, or try another tape cartridge. If the problem persists, contact authorized service personnel.
Note: In code level 1.30.209 and up, error message is replaced by `CHK xxxx`.		
`DmpWrFail`	The drive cannot write diagnostic data onto the tape cartridge, or the drive cannot position the tape cartridge.	Contact authorized service personnel.
Note: In code level 1.30.209 and up, error message is replaced by `CHK xxxx`.		
`DmpWrFail2`	There is no diagnostic dump data to process.	Contact authorized service personnel.
Note: In code level 1.30.209 and up, error message is replaced by `CHK xxxx`.		

Table 5-2. Operator-panel Display Messages (Continued)

Display	Meaning	Recommended Action
xxxx:Dmpyy	Alternates with "*" (an asterisk) after completion of IPL, where *xxxx* = the FSC of last dump data collected and *yy* = number of uncollected dumps in non-volatile memory.	Contact authorized service personnel who will access the diagnostic data and collect it to tape or to the host.
DumpAgain? alternating with CHK *xxxx*.	The drive detected the same error within a minute.	Initiate IPL. If the problem persists, contact authorized service personnel.
DumpToHost	The dump or event log is being transferred to the host; operator panel switches are locked.	None
Exp ClCart	The cleaning cartridge is used up.	Replace the cleaning cartridge.
Fix CfgErr	The checksum does not match after an IPL.	Contact authorized service personnel.
Init *xxxx*.	An initialization error occurred.	Contact authorized service personnel.
IPL Pend	The IPL switch has been pressed.	None
LOAD CC	The common controller code is loading; IPL is proceeding.	None
LOAD ESCON	ESCON firmware is loading; IPL is proceeding.	None
LOAD FIBRE	Fibre Channel firmware is loading; IPL is proceeding.	None
LOAD FICON	FICON firmware is loading; IPL is proceeding.	None
LOAD SCSI	SCSI firmware is loading; IPL is proceeding.	None
LOAD SERVO	IPL is proceeding.	None
Load *xxxx*	The load or unload operation failed.	If the load failed, insert another tape cartridge. If it loads successfully, suspect the original tape. If another tape fails to load, initiate IPL. If the unload failed, the tape might be jammed or its leader block broken. If either problem persists, contact authorized service personnel.
Loading	A tape cartridge is loading.	None
Locating	The drive is doing a high-speed seek.	None

Table 5-2. Operator-panel Display Messages (Continued)

Display	Meaning	Recommended Action
`Memory Err`	The IPL failed.	Initiate IPL again. If the problem persists, contact authorized service personnel.
`NTReady A (T9940B)`	A write-enabled VolSafe data tape cartridge is in the process of a manual unload.	None
`NTReady F`	A write-protected data tape cartridge is in the process of a manual unload.	None
`NTReady U`	A write-enabled data tape cartridge is in the process of a manual unload.	None
`Offline,` alternating with `*`	The drive is offline.	None
`Online`	The drive is online.	None
`OnLn Pend`	The online state is pending completion of IPL diagnostics.	None
`Power Fail`	The power supply failed.	Contact authorized service personnel.
`Reading`	The drive is reading data.	None
`Ready A` (T9940B)	The loaded VolSafe data tape cartridge is write-enabled, and the drive VolSafe configuration option is enabled (Yes).	None.
Note: Code level 1.32.423 or higher required for VolSafe support. `Load 5B15` displays with down-level code, or with a T9940A drive.		
`Ready F`	The loaded data tape cartridge is write-protected by the cartridge write-protect switch in the locked position. `Ready F` also displays with a VolSafe data tape cartridge when the drive VolSafe configuration option is disabled (No) (T9940B).	If read attempt fails on a T9940A drive, retry on a T9940B drive. **Note:** Write-protect switch position detection overrides data density format identification.
`Ready H` (T9940A)	The loaded data tape cartridge is write-enabled by the cartridge write-protect switch in the unlocked position and, contains data written in the high-density format by a T9940B drive.	Reload with low-density data tape cartridge; or, intentionally over-write from BOT. **Note:** High-density data files cannot be read by a T9940A drive.

Table 5-2. Operator-panel Display Messages (Continued)

Display	Meaning	Recommended Action
`Ready L` (T9940B)	The loaded data tape cartridge is write-enabled, and contains data written in the low-density format by a T9940A drive.	Use for read-only jobs; or, intentionally over-write from BOT. **Note:** Low-density data files can be read, but not revised or appended by a T9940B drive.
`Ready U`	The loaded data tape cartridge is write-enabled, and matches the data density format of the drive.	Operator discretion.
`Rewinding`	The drive is rewinding.	None
`Save Fails`	The new configuration cannot be saved because the read-access memory (RAM) may be defective.	This message is associated with changing the drive configuration, a task for authorized service personnel only.
`SavingDump`	A dump is being saved to non-volatile memory.	None
`Start Init`	Initialization has started.	None
`Trapped`	The IPL process is trapped in a loop.	Initiate IPL again. If the problem persists, contact authorized service personnel.
`Unloading`	A tape cartridge is unloading.	None
`UnWr` *xxxx*, where *xxxx* is an FSC	The Unload switch was pressed during a write operation. Some data remains unwritten.	To write the unwritten data, issue the command: `ESCON Swap` in VM/MVS environment `Recover Buffer Mode` in the SCSI environment. Or, Press the Unload switch again; the unwritten data will be lost.
`Write Prot`	The drive attempted to write to, or reformat a write-protected data tape cartridge. This message also appears if a reformat operation is attempted with a VoSafe data tape cartridge (T9940B only).	Change the switch on the tape cartridge to enable writing.
`Writing`	The drive is writing data.	None

Translated Messages

Table 5-3 shows operator panel display messages that are translated when the drive configuration Language setting is set to other than English.

Table 5-3. Translated Display Messages

English	Espanol	Francais	Italiano	Deutsche
CLEANING	*LIMPIEZA*	*NETTOYAGE	*PULIZIA*	*REINIGEN*
CHK XXXX	ERR XXXX	ERR XXXX	ERR XXXX	PRUEF XXXX
ERASING	*BORRANDO*	EFFACEMENT	*CANCELLA*	*LOESCHEN*
LOAD XXXX	CARGA XXXX	CHARG XXXX	CARIC XXXX	LADEN XXXX
Loading	Cargando	Chargement	Carico	Laden
Locating	Localizar	Recherche	Ricerca	Suchen
NT Ready A	No Listo A	NPret A	No Prnt A	N Bereit A
NT Ready F	No Listo F	NPret F	No Prnt F	N Bereit F
NT Ready U	No Listo U	NPret U	No Prnt U	N Bereit U
Overtemp	*Caliente*	*Overtemp*	*Temperat*	* Heiss *
Processing	Procesar	Traitement	Processo	Verarbeitn
Reading	Leer	Lecture	Lettura	Lesen
Ready A	Listo A	Pret A	Pronto A	Bereit A
Ready F	Listo F	Pret F	Pronto F	Bereit F
Ready H	Listo H	Pret H	Pronto H	Bereit H
Ready L	Listo L	Pret L	Pronto L	Bereit L
Ready U	Listo U	Pret U	Pronto U	Bereit U
Rewinding	Rebobinar	Rebobinage	Riavvolgi	Spulen
Unloading	Descarga	Dechargemt	Scarico	Entladen
Writing	Escritura	Ecriture	Scrittura	Schreiben

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Specifications

A

This appendix contains the following information about the T9940 Tape Drive:

- Physical specifications
- Power specifications
- Environmental requirements
- Performance specifications
- Library attachments

Note: The specifications in this appendix can change. For current information, contact your StorageTek representative.

Physical Specifications

This section lists the physical specifications of the T9940 Tape Drive, its power supply, and its rack-mount and library-attached configurations.

Tape Drive

Table A-1 lists the physical specifications of the T9940 Tape Drive.

Table A-1. Tape Drive Physical Specifications

Width	146 mm (5.75 in.)
Depth	521 mm (20.5 in.)
Height	82.5 mm (3.25 in.)

Power Supply

Table A-2 lists the physical specifications of the T9940 power supply.

Table A-2. Power Supply Physical Specifications

Width	147 mm (5.77 in.)
Depth	204 mm (8.04 in.) plus 38mm (1.5 in.) for external fan
Height	48 mm (1.9 in.)
Weight	1.4 kg (3 lb)

Rack-mount Configuration

The T9940 Tape Drive rack-mount configuration consists of two drives mounted on shock absorbers and their power supplies in a rack-mount tray.

Table A-3 lists the physical specifications of the T9940 rack-mount configuration.

Table A-3. T9940 Tape Drive Rack-mount Physical Specifications

Width	483 mm (19.0 in.)
Depth	635 mm (25.0 in.) plus 76 mm (3 in.) for cables
Height	267 mm (10.5 in.)
Weight	36.5 kg (80.5 lb)

Library-attached Configuration

The T9940 Tape Drive library-attached configuration trays fit inside:

- The expanded 9741 and the 9741E drive cabinets that attaches to a StorageTek 9310, 9360, 9740, or L5500 library
- The StorageTek L700/L1400 library
- The StorageTek SL8500 library

Refer to the appropriate library System Assurance Guide for the physical dimensions and weights of the library and cabinet.

Table A-4 lists the weights of the library tape drives and accessories, including trays, power supplies, and cables.

Table A-4. Library Tape Drive and Accessory Weights

Library	Drive and Accessory Weight
9310/9360/9740/L5500	9.1 kg (20 lb)
L700/L1400	9.6 kg (21.2 lb)
SL8500	10.9 kg (24.0 lb)

Power Specifications

Table A-5 lists the power specifications of the T9940 Tape Drive.

Table A-5. Power Specifications

Characteristics	Value
Input voltage	100 to 240 VAC
Input frequency	50 to 60 Hz
Power consumption	82 VA
Power dissipation	280 Btu/hr

Environmental Requirements

This section describes environmental requirements for the tape drive, power supply, and tape cartridges for the T9940 Tape Drive.

Tape Drive and Power Supply

Table A-6 lists the environmental requirements for the tape drive and the power supply for the T9940 Tape Drive.

Table A-6. Tape Drive and Power Supply Environmental Requirements

Temperature	
Operating	15° to 32°C (60° to 90°F)
Storage	10° to 40°C (50° to 104°F)
Shipping	-40° to 60°C (-40° to 140°F)
Relative Humidity, Non-Condensing	
Operating	20% to 80%
Storage	10% to 95%
Shipping	10% to 95%
Wet Bulb Maximum	
Operating	29°C (84°F)
Storage	35°C (95°F)
Storage	35°C (95°F)
Altitude	
Operating	0 to 3.05 km (0 to 10,000 ft)
Storage	0 to 3.05 km (0 to 10,000 ft)
Shipping	0 to 15.24 km (0 to 50,000 ft)
Air Flow Requirements	
Maximum media temperature	49°C (120°F)
Maximum chip T_j	90°C (194°F) unless otherwise specified for a particular component

Tape Cartridges

Table A-7 lists the environmental requirements for tape cartridges for the T9940 Tape Drive.

Table A-7. Tape Cartridge Environmental Requirements

Temperature	
Operating[1]	15° to 32°C (60° to 90°F)
Storage (up to four weeks)	5° to 32°C (41° to 90°F)
Storage (archival)	18° to 26°C (65° to 79°F)
Shipping[2]	4° to 40°C (40° to 104°F)
Relative Humidity, Non-Condensing	
Operating[1]	20% to 80%
Storage (up to four weeks)	5% to 80%
Storage (archival)	40% to 60%
Shipping[2]	5% to 80%
Wet Bulb Maximum	
Operating[1]	26°C (78.8°F)
Storage (non-archive)	26°C (78.8°F)
Storage (archival)	26°C (78.8°F)
Shipping[2]	26°C (78.8°F) with no condensation

1. The conditioning time before use is 24 hours.
2. The shipping environment must not exceed the limit of the storage environment, archive or non-archive, for longer than 10 days.

Performance Specifications

This section describes the T9940 Tape Drive and Tape Cartridge performance.

Tape Drive

Table A-8 lists performance specifications of the T9940 Tape Drive.

Table A-8. T9940 Tape Drive Performance Specifications

Characteristic	Value	
	T9940A	**T9940B**
Capacity and Performance		
Capacity, native	60 GB	200 GB[1]
		VR2
Data buffer size	16 MB	64 MB
Tape speed, read/write	2 m/sec	3.4 m/se
Performance, native (head-to-tape)		
(uncompressed)	10 MB/sec	30 MB/sec[1]
(compressed, maximum)	35 MB/sec	70 MB/sec
Burst (FC / FICON)	100 MB/sec	200 MB/sec
Burst (ESCON)	19 MB/sec	19 MB/sec
Interface data		
Fibre Channel	1 Gb	2 Gb
Ultra-SCSI HVD	40 MB/sec	N/A
ESCON	20 MB/sec	20 MB/sec
FICON	NA	2 Gb
Access times		
Tape load and thread to ready	18 sec	18 sec
File access, first (average)	59 sec	59 sec
Rewind (maximum/average)	90/45 sec	90/45 sec
Unload	18 sec	18 sec
Reliability		
Mean time between failure (MBTF)		
Power on @ 100% duty cycle	290,000 hr	290,000 hr
Tape load @ 10/day (100K loads)	240,000 hr	240,000 hr
Tape path motion (TPM)	196,000 hr	196,000 hr
@ 70% duty cycle		
Head life @ 70% TPM duty cycle	8.5 yr.	8.5 yr.
Uncorrected bit error rate	1 x 10^{-18} 1 x 10^{-33}	1 x 10^{-18}
Undetected bit error rate		1 x 10^{-33}

1. VR2 is a trademark of Overland Storage.
   VR2 technology is used to achieve T9940B capacity and performance.

Tape Cartridge

Table A-9 lists physical and performance specifications of the 9940 Tape Cartridge.

Table A-9. 9940 Tape Cartridge Specifications

Characteristic	Value
Cartridge physical data	
Drive compatibility	T9940A, T9940B
Form factor	1/2 in. cartridge, 3490/3490E
Width	109 cm (4.29 in.)
Length	125 cm (4.92 in.)
Height	25.4 cm (1.00 in.)
Weight	262 g (9.17 oz)
Drop strength	1.00 m (39.4 in.)
Tape media data	
Capacity, native (uncompressed)	60 GB (Low density, T9940A) 200 GB[1] (High density, T9940B)
Tracks	288 (Low density, T9940A) 576 (High density, T9940B)
Track-following servo	Factory pre-recorded **CAUTION: Bulk-erase will destroy pre-recorded servo tracks. DO NOT DEGAUSS T9940 TAPE CARTRIDGES.**
Formulation	Advanced metal particle (AMP)
Physical thickness	9 microns (µm)
Physical length	700 m (2,296 ft)
Recordable length (including MIR)	650 m (2,134 ft)
Reliability	
Archival life	15 - 30 years
Short-length durability	80,000 write/read passes minimum
Long-life durability	3,000 write/read passes minimum
Load/unloads	10,000 minimum
Uncorrected bit error rate	1×10^{-18}
Permanent errors	Zero

1. VR[2] is a trademark of Overland Storage.
   VR[2] technology is used to achieve T9940B capacity.

Glossary

This glossary defines abbreviations and new or special terms used in this publication.

Some of the definitions are taken from the *IBM Dictionary of Computing*. 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 Electrotechnical 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

ACS *See* automated cartridge system.

ACSLS *See* Automated Cartridge System Library Software.

automated cartridge system (ACS) A system that consists of five components: host software, a library management unit, a library control unit, library storage modules, and tape drives. These components provide automatic mounting and dismounting of tape cartridges into a drive, cartridge access port, or pass-through port.

Automated Cartridge System Library Software (ACSLS) The software within a UNIX-based server that interfaces the server and hosts; it also maintains a list of all tapes within a library storage module.

C

cartridge A storage device that consists of magnetic tape on supply and take-up reels, in a protective housing. (IBM)

tape cartridge A composite of the plastic housing and the magnetic tape.

config *See* configuration.

configuration (config) The manner in which the hardware and software of an information processing system is organized and interconnected. (T)

D

drive (1) A device for moving magnetic tape and controlling its movement. (IBM) (2) A device that moves magnetic tape and includes the mechanisms for writing and reading data on the tape.

dump To copy the contents of all or part of virtual storage to collect error information. (IBM)

E

Enterprise Systems Connection (ESCON) An IBM-patented set of products and services that provide a dynamically connected environment, over fiber-optic cable, within a mainframe or client server enterprise.

error A discrepancy between a computed, observed, or measured value or condition and the true, specified, or theoretically correct value or condition. (I) (A)

ESCON *See* Enterprise Systems Connection.

F

fault symptom code (FSC) A four-character hexadecimal code generated in response to a subsystem error to help isolate failures within the device.

FC *See* Fibre Channel.

FCC *See* Federal Communications Commission.

Federal Communications Commission (FCC) A board of commissioners appointed by the President under the Communications Act of 1934 with the power to regulate all interstate and foreign communications by wire and radio originating in the United States. (IBM)

Fibre Channel (FC) The National Committee for Information Technology Standards standard that defines an ultra high-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 *See* Fibre Connection.

field replaceable unit (FRU) An assembly that is replaced in its entirety when any one of its components fails. (IBM)

file-protect To prevent the destruction or overwriting of data stored on tape cartridge. *See also* write-protect.

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

FRU *See* field replaceable unit.

FSC *See* fault symptom code.

G

GB *See* gigabyte.

gigabyte (GB) One billion (10^9) bytes. When referring to memory capacity, 1,073,741,824 in decimal notation. (IBM)

H

host (1) The primary computer on a network, with which other computers interact. (2) A processor, usually composed of a central processing unit and memory, that typically communicates with peripheral devices over channels or networks, to perform input/output operations such as network control. It also provides end users with computation services and database access.

host interface An interface between a network and host computer. (T)

I

ID (1) Identification. (2) Identifier.

initial program load (IPL) A process that activates a machine reset and loads system programs to prepare a computer system for operation. Processors having diagnostic programs activate these programs at initial program load execution. Devices running firmware usually reload the functional firmware from a diskette or disk drive at initial program load execution.

initialization The operations required for setting a device to a starting state, before the use of a data medium, or before implementation of a process. (T)

initialization routine A startup-diagnostic routine performed automatically by the library when it is powered on or reset. *See also* wake-up diagnostic tests.

input/output (I/0) Pertaining to a device, process, or channel involved in data input, output, or both. (IBM)

interface Hardware, software, or both, that links systems, programs, or devices. (IBM)

I/O *See* input/output.

IPL *See* initial program load.

L

library (1) A library is composed of one or more automated cartridge systems (ACSs), attached tape drives, volumes placed into the ACSs, host software that controls and manages the ACSs and associated volumes, and the library control data sets that describe the state of the ACSs. (2) A robotic system that stores, moves, mounts, and dismounts cartridges that are used in data read or write operations. (3) A hardware component in an automated tape cartridge system.

library storage module (LSM) A housing that contains tape cartridges and a robot that moves the tapes between storage cells and the attached tape drives. *Synonymous with* tape library.

load a cartridge The process by which a drive prepares a tape cartridge for read and write operations.

M

magnetic tape A tape with a magnetizable layer on which data can be stored. (T) *Synonymous with* tape.

main menu The top-level menu on an operator panel display.

manual operation A mode of operation for a tape drive in which an operator manually loads and unloads the drive.

microcode A code, representing the instruction of an instruction set, that is implemented in a part of storage that is not program-addressable. (IBM) *See* firmware.

Multiple Virtual Storage (MVS) IBM's Multiple Virtual Storage, consisting of MVS/System Product Version 1 and the MVS/370 Data Facility Product operating on a System/370 processor. (IBM)

MVS *See* Multiple Virtual Storage.

N

Nearline A registered trademark of StorageTek, this term is used in association with StorageTek's family of tape-library information storage and retrieval products.

O

offline Neither controlled by, nor communicating with, a computer. (IBM) *Contrast with* online. (Some SCSI status commands are possible in an offline state.)

online Pertaining to the operation of a functional unit when under the direct control of the computer. (T) *Contrast with* offline.

operator panel (1) A panel that enables users to configure and diagnose the library or drive. (2) The user interface for libraries or drives. *Synonymous with* operator control panel. (3) A panel that enables users to configure, diagnose, or receive status information about the library or drive.

P

PowderHorn Part of the StorageTek's Nearline family of automated cartridge systems that features robotics technology in a large library.

R

reclaim In some tape drives, the process of reformatting a tape as a data tape.

recoverable error An error condition that can be automatically corrected (for example, by initiating a retry operation) and, when corrected, allows continual processing of a job, program, or hardware function.

rewind To move tape from the take-up hub to the supply hub. (IBM)

S

SCSI *See* small computer systems interface.

SL8500 *See* StreamLine™ SL8500 Modular Library System.

SLC *See* StreamLine™ Library Console™.

small computer systems interface (SCSI) A local interface operating over a wide range of transfer rates using a common command set for all devices attached to the interface. It connects host computer systems to a variety of peripheral devices.

StreamLine™ Library Console™ The operator panel software application used for the SL8500.

StreamLine™ SL8500 Modular Library System An automated tape library comprised of:

- Customer interface module
- Robotics interface module
- Drive and electronics module
- Storage expansion module (optional)

T

tape drive (TD) An electromechanical device that moves magnetic tape and includes the mechanisms for writing and reading data to and from the tape.

TCP/IP *See* Transmission Control Protocol/ Internet Protocol.

TimberWolf Part of the StorageTek's Nearline family of automated cartridge systems that features robotics technology for smaller libraries.

Transmission Control Protocol/Internet Protocol (TCP/IP) A set of communications protocols that support peer-to-peer connectivity functions for both local and wide area networks. (IBM)

U

unload a cartridge The process by which a drive finishes read and write operations and makes the cartridge ready to remove from the drive.

V

vary offline To change the status of a device from online to offline. When a device is offline, a data set cannot 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 machine (VM) (1) A virtual data processing system that appears to be at the exclusive disposal of a particular user, but whose functions are accomplished by sharing the resources of a real data processing system. (T) (2) A functional simulation of a computer and its associated devices. Each virtual machine is controlled by a suitable operating system; for example, the conversational monitor system. VM/ 370 controls concurrent execution of multiple virtual machines on a single System/370 computing system (IBM).

VolSafe VolSafe (volume safe) is a special StorageTek 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.

VM *See* virtual machine.

VOLSER *See* volume serial number.

volume serial number (VOLSER) (1) 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. (2) A number in a volume label assigned when a volume is prepared for use in a system. (IBM)

W

write-enabled A setting on a tape cartridge that allows data to be written on the tape.

write operation An output operation that sends a processed record to an output device or output file. (IBM)

write-protect (WP) (1) To restrict the writing onto a data set, file, or storage area of a user or program not authorized to do so. (2) To set the switch on a tape cartridge to prevent data from being written on the tape. Reading data is still possible. *See also* file-protect.

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