hp StorageWorks Library and Tape Tools

HP Internal Version

Product Version: 3.3

HP StorageWorks Library and Tape Tools (L&TT) is a comprehensive application that provides functions for identifying, testing, updating, and troubleshooting a wide variety of data storage hardware and media.

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About This Guide

This user guide provides information to help you:

■ Understand features and functionality of L&TT

■ Effectively use the full functionality of L&TT to obtain maximum performance from your storage hardware, and to test, diagnose, and resolve hardware issues

About this Guide topics include:

■ Overview

■ Conventions

■ Getting Help

Overview

This section covers the following topics:

■ Intended Audience

■ Prerequisites

Intended Audience

This book is intended for use by:

■ Users who want to use L&TT to conveniently update firmware in their storage hardware

■ Users who need to test, diagnose, and resolve storage hardware issues

■ Support technicians

■ Call center personnel

Prerequisites

Before you attempt to use L&TT, you should have a basic understanding of the following technologies:

■ Storage hardware functionality and operation

■ SCSI operation

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Conventions

Conventions consist of the following:

- Document Conventions
- Text Symbols

Document Conventions

The document conventions included in Table 1 apply in most cases.

Table 1: Document Conventions

Element	Convention
Cross-reference links	Figure 1
Key and field names, screen names, menu items, buttons, and dialog box titles	**Bold**
File names, application names, and text emphasis	*Italics*
User input, command names, directory names, and system responses (output and messages)	`Monospace font`
Variables	`<monospace, italic font enclosed in angle brackets>`
Website addresses	Underlined sans serif font text: http://www.hp.com

Text Symbols

The following symbols may be found in the text of this guide. They have the following meanings.

WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or death.

Caution: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

Note: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Getting Help

If you still have a question after reading this guide, contact an HP authorized service provider or access our website: http://www.hp.com.

HP Technical Support

Telephone numbers for worldwide technical support are listed on the following HP website: http://www.hp.com/support/. From this website, select the country of origin.

Note: For continuous quality improvement, calls may be recorded or monitored.

Be sure to have the following information available before calling:

■ Technical support registration number (if applicable)

■ Product serial numbers

■ Product model names and numbers

■ Applicable error messages

■ Operating system type and revision level

■ Detailed, specific questions

HP Authorized Reseller

For the name of your nearest HP authorized reseller:

■ In the United States, call 1-800-345-1518

■ In Canada, call 1-800-263-5868

■ Elsewhere, see the HP website for locations and telephone numbers: http://www.hp.com.

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Introduction

1

HP StorageWorks Library and Tape Tools (L&TT) is a collection of storage hardware management and diagnostic tools for Nearline Tape, Nearline Tape Automation, and Nearline Archival products. L&TT assembles these tools into a single, convenient program.

Software Features

L&TT offers the following features:

- **Installation Check**—L&TT guides you through a basic installation check of your product. The software assists the user in choosing an appropriate HBA and SCSI ID(s), ensuring that the device is detected by the system, and verifying key device functionality. The installation check feature is essentially HTML documentation that helps with the most common generic installation issues while also describing how to use L&TT to verify the device installation.

- **Device Identification**—L&TT clearly identifies the storage products connected to the system, along with key information on product configuration and status.

- **Troubleshooting Tests**—L&TT provides various tests to verify product functionality or to isolate product issues. Tests include device self-tests, read/write tests on drives, exerciser tests for autoloaders and libraries, and specific device utilities.

- **Firmware Upgrades**—L&TT provides a convenient way of updating product firmware, enabling users with an Internet connection to take advantage of ongoing enhancements. The software can be configured to check the Web automatically for firmware updates for connected devices, or users can manually check the Web for updates if the automatic update feature is not desired. If updated firmware is available, the program notifies the user, and the updates can easily be copied to the system. With libraries, users can

upgrade the library and the embedded drive firmware in the same operation. Wherever possible, the embedded drives are updated in parallel to reduce time.

■ **Support Ticket Generation**—If you experience a problem with a storage product, L&TT can generate a support ticket that includes essential information for troubleshooting the problem. As an alternative to phone support, you can e-mail the support ticket to a support center for assistance. This information streamlines the support process and enables the support staff to better serve you if a support call is made later.

When a support ticket for a device is generated, L&TT performs a Device Analysis test on the device. The support ticket contains generic information about a device, as well as the results of the Device Analysis test. The Device Analysis test can be performed by itself, but HP recommends generating a support ticket because the resulting data is presented in a more useful format.

■ **Automatic Notification of Web Updates**—If a connection to the Internet is present and web updates are enabled in the tool preferences, L&TT automatically informs you of the following updates, if available, each time the program is started:

— New versions of L&TT

— New firmware files for connected devices

— New device-specific functionality (such as new or updated tests) for connected devices

Supported Products and Operating Systems

For a complete listing of compatible products, refer to the L&TT Compatibility Matrix found at http://www.hp.com/support/lttcompatibility.

The level of functionality that L&TT offers for each device varies depending on features of the device, and the degree of device integration into L&TT.

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Finding Additional Information

The HP website provides the current version of L&TT for download, and general information about the tool. Access the website at:

http://www.hp.com/support/tapetools

In addition to the external HP website, HP support personnel can access the internal website (accessible to HP employees only) at:

http://hpcrlib1.gr.hp.com/customercare/Technicalsupport/diagnostics/ltt.htm

The internal site provides the current version of L&TT for download, change lists, known issues, and documentation (including updated versions of this manual). You can also generate temporary passwords for customers and obtain support personnel passwords (which change every six months).

Getting Support

E-mail support is available from ltt_team@hp.com. You can expect a response within 24 hours (usually sooner) during a normal business week.

Use this address to obtain support for L&TT, to report bugs, to provide feedback on this manual, to report any issues with the L&TT website, or to provide enhancement suggestions. HP appreciates feedback on how to make improvements for future versions of L&TT.

Note: This address is intended to provide support for L&TT software. This address is NOT for assistance in troubleshooting hardware products. Refer to the documentation that comes with your hardware for support options for that product.

Installation

2

This chapter outlines the procedure for installing L&TT on a Microsoft ®
Windows ®, Novell NetWare, HP-UX, HP Tru64, or Linux platform. The
Windows version of L&TT uses a graphical user interface (GUI), whereas the
NetWare, HP-UX, Tru64, and Linux versions of the program use a command
screen interface (CSI).

The information in this chapter and in subsequent chapters is presented for both
the GUI and CSI versions of L&TT. When using an electronic version of this
documentation, click the appropriate GUI or CSI icon at the beginning of the
chapter to quickly jump to the section of documentation that applies to your
operating system (OS) or user interface:

Select your OS:

GUI Windows

CSI NetWare

CSI HP-UX, Tru64, and Linux

GUI Installing L&TT for Windows

The Windows version of L&TT uses the InstallShield application. InstallShield lets you choose the installation directory and select other options. It also sets up shortcuts to launch the application in the Start menu and on the desktop. The Start menu shortcuts provide access to the online help, the readme file, the report viewer, and the uninstaller.

Installation Procedure

To install the Windows version of L&TT:

1. Download or copy the self-extracting executable file to a temporary location.

2. Double-click the self-extracting executable file to launch the installer. The **InstallShield Wizard** screen is displayed.

3. Click **Next**. Read the program license agreement. If you agree to the terms, select **I accept the terms in the license agreement** and click **Next >**. The **Customer Information** screen is displayed.

4. Enter your customer information and click **Next**. The **Setup Type** screen is displayed.

5. Select the desired setup type.

IMPORTANT: Windows 9x users must select the "Custom" type and select the ASPI component for installation. This component is required for Windows 9x installations, but it is not automatically installed, and it is not installed with the "Typical" setup type.

If you select "Custom," you can specify the installation directory along with other installation options. Windows NT 4.0, 2000, and XP users can optionally install Advanced SCSI Programming Interface (ASPI) support. With Windows 9*x* installations, the ASPI component is required and must be manually selected using the Custom setup type. Unless you are using Windows 9x, HP recommends that you not install ASPI support. ASPI support is beneficial, however, when installed storage applications cannot be shut down and those applications have locked access to the device through the Miniport driver. If ASPI is installed, it is generally not necessary to shut down these applications to access devices through L&TT (although the applications should not be accessing the devices while L&TT is running). ASPI lets you run L&TT on a locked device without rebooting; however, a reboot is required after installing ASPI.

After selecting the setup type and appropriate options, click **Next**.

6. On the **Ready to Install the Program** screen, click **Install**. If you need to review or change installation settings, click **Back**.

7. When installation is complete, click **Finish** to close the InstallShield wizard.

Reboot Criteria

A reboot is required only if your system requires ASPI or an upgrade to the currently installed version. On systems that require ASPI, if the installer detects a previously installed version of ASPI older than v4.57, it will install a more recent version of ASPI, which will require a reboot.

On Windows NT and 2000, ASPI is not installed as part of the operating system. If a reboot is unacceptable, do not select the check box for this option in the installation process. If you choose not to install ASPI, you must use the Miniport driver (Miniport I/O mode) to scan for devices.

Issues may arise, however, when using the Miniport I/O mode with devices that use non-standard OS drivers, or are "claimed" by other applications or the OS. When using the Miniport I/O mode when a device is claimed, it may be necessary to shut down any running backup/storage application services to make the device accessible to L&TT. Alternatively, using the ASPI I/O mode may make the device accessible without requiring any further action.

CSI Installing L&TT for NetWare

To install the NetWare version of L&TT:

1. Download the L&TT for NetWare file to a temporary directory.

2. From a client workstation, use any standard unzip utility* to extract the file to the *SYS:System* directory on the NetWare server. Make sure that the option to create a directory is enabled in the archiving software.

Note: * The unzip NLM that comes with later versions of NetWare has not been tested and should not be used to unzip the archive.

CSI Installing L&TT for HP-UX, Tru64, and Linux

To install L&TT for HP-UX, Tru64, or Linux:

1. Log in as root.

2. Navigate to the temporary directory:

   ```
   cd /tmp
   ```

3. Download or copy the L&TT tar file, *hp_ltt<xx>.tar* (where *<xx>* is the version number) to this directory. If you are copying the file from a different location, enter the following (substitute the directory in which the file currently resides for *<directory name>*):

   ```
   cp /<directory name>/hp_ltt<xx>.tar /tmp
   ```

4. Untar the L&TT tar file:

   ```
   tar -xvf hp_ltt<xx>.tar
   ```

5. Run the install script in the /tmp directory:

   ```
   ./install_hpltt<xx>
   ```

6. After the software is successfully installed, enter the following commands to remove the /tmp/ltt directory and its contents:

   ```
   cd /tmp
   rm -rf ltt
   rm -rf install_hpltt
   ```

Basic Operation

3

This chapter describes how to start L&TT and the basic operation of the software. This chapter is divided into two sections: one for using L&TT in a GUI environment (Windows) and one for using L&TT in a CSI environment (NetWare, HP-UX, Tru64, and Linux). To quickly jump to the appropriate section, click one of the following graphics:

GUI Windows

CSI NetWare, HP-UX, Tru64, Linux

`GUI` Starting L&TT

To start L&TT:

■ Double-click the L&TT icon on the desktop (if present)

- or -

■ Click **Start > Programs > HP StorageWorks Library and Tape Tools > HP StorageWorks Library and Tape Tools**

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GUI Using the Splash Screen

When L&TT is started, the splash screen is displayed. The splash screen gives you the opportunity to exit the application before any SCSI bus activity has taken place. This feature lets you exit the application if it was started unintentionally. This prevents the program from interfering with any backup or other storage applications that may currently be running.

The splash screen also lets you select the SCSI I/O mode (if more than one option is available). If you are installing a hardware device, the **Installation Check** feature displays an HTML help screen that provides instruction on common setup and device verification steps.
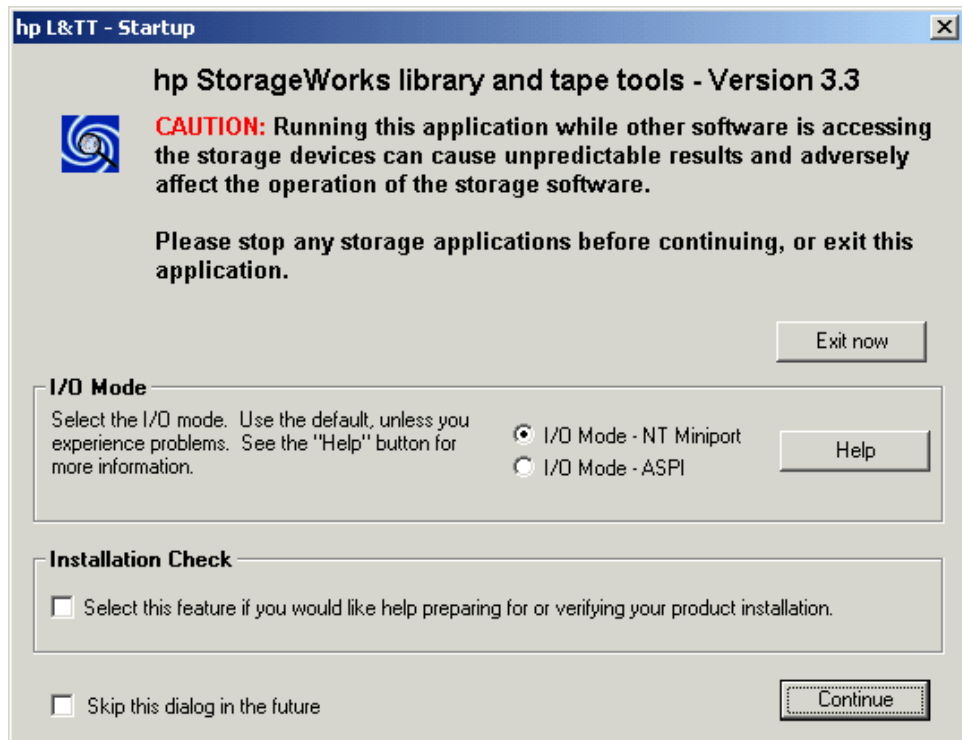
Figure 1: L&TT splash screen

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I/O Mode

L&TT selects the input/output (I/O) mode that is most appropriate for the system it is running on. However, this initial screen allows for manual selection of the I/O mode in certain cases. L&TT currently operates in the following two I/O modes:

■ **NT Miniport**—uses an interface that is native to Windows NT 4.0, 2000, XP, and Windows Server 2003. This is the preferred I/O mode on systems where it is available because it does not require the installation of the ASPI interface. However, there are some limitations to the Windows NT Miniport I/O mode related to using devices that are "claimed" by other applications, or that are used with non-standard OS drivers. In those cases, selecting the ASPI I/O mode can make a device accessible.

Note: The Windows NT Miniport I/O mode is not available on Windows 9x.

■ **ASPI**—uses an optional I/O programming interface that is available on all versions of Windows. This I/O mode can be used with any Windows operating system. It may require the installation or update of additional OS components, possibly requiring a reboot of the system during installation.

Installation Check

If this check box is selected when you click **Continue**, L&TT opens a browser window displaying an HTML file that provides advice on how to do the following:

■ Select an HBA and SCSI target ID for the device
■ Verify installation and operation of the device

Skip This Dialog in the Future

If this check box is selected when you click **Continue**, the splash screen is not displayed on subsequent uses of L&TT. The program will continue to use the settings that you selected the last time the splash screen was viewed.

To re-enable the splash screen, select **Preferences** from the **Options** menu. Check the option **Display initial dialogue at Startup to choose I/O mode etc**.

GUI Application Window Layout

After the I/O mode is selected, click **Continue** on the splash screen. The L&TT main screen is displayed. Figure 2 shows the L&TT main screen divided into three sections.
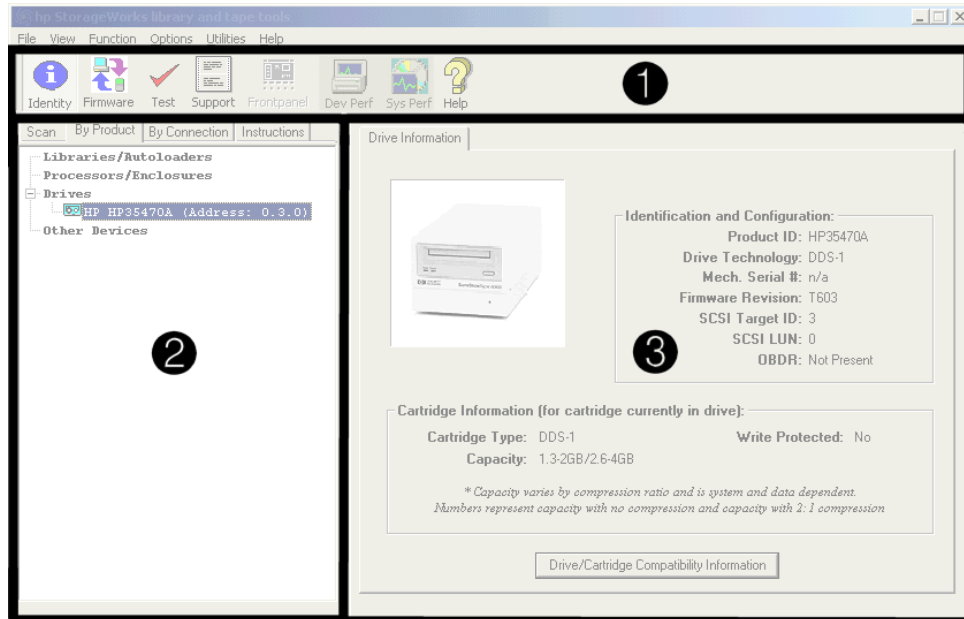
Figure 2: L&TT main screen

The three sections of the L&TT main screen are:

1. **Taskbar**—This section contains buttons that provide quick access to the main functions of L&TT and to the online help system.

Note: Above the Taskbar is the standard Windows menu bar that provides alternate navigation to tool functions, as well as access to a number of other features.

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2. **Device List**—This is a multi-function window that offers several options on the following tabs:

   ■ **Scan**—This option provides either a summary status or detailed information (depending on whether **Show Details** or **Hide Details** is selected) about the bus scanning process. If a problem is encountered during the scan, this information may help in determining the cause. When the scan completes successfully, the device list automatically switches to the **By Product** tab.

   The **Scan** tab also lets you rescan the bus. If any devices have been hot-swapped or powered on after the OS has booted, in most cases, the rescan feature can discover those devices without requiring a reboot of the system.

   > **Caution:** Swapping SCSI devices, including connecting and disconnecting cables and/or terminators, can cause the system to hang or crash.

   > **Caution:** On Windows NT 4.0, 2000, XP, and Windows Server 2003, changing devices at a specific SCSI address can cause unpredictable behavior. Parts of the operating system may not detect that the device or device type has changed.

   ■ **By Product**—This option shows a list of all the products connected to the system. The list is grouped into the following four categories:

   — Libraries and autoloaders

   — Drives

   — Enclosures and processors

   — Other devices

   The three number fields listed after the device represent the device address. Each field in the address is separated by a period: the first field represents the HBA channel, the second field represents the SCSI ID, and the third field represents the LUN.

> **Note:** When using the Miniport I/O mode, the HBA channel field is shown as "A/B," where A is the channel and B is the subchannel.

- ■ **By Connection**—This option shows all products connected to the system, grouped by the HBA they are connected to. This view makes it easy to see which devices are connected to the same bus as the device in question, and may help in understanding system I/O performance issues.

- ■ **Instructions**—This window contains brief instructions on how to use the selected screen. This view can be disabled in the software preferences.

3. **Device Information screen—**All the main functions of the program are displayed in this window. The content of this window depends on the device and tool function selected.

GUI Using the Device Information Screen

When you select a product from the **Device List**, the **Device Information** screen displays information relevant to the device. The **Device List** also changes to display instructions on this page (if the instructions preference is enabled). If another tool function is currently active, then clicking the **Identity** button on the toolbar opens the **Device Information** screen.

The **Device Information** screen provides an overview of the selected hardware device and its current configuration and status.

Standalone Devices

The **Device Information** screen, showing a standalone device, contains a single tab labeled **Drive Information**. The **Device Information** screen has four main sections, as shown in Figure 3.
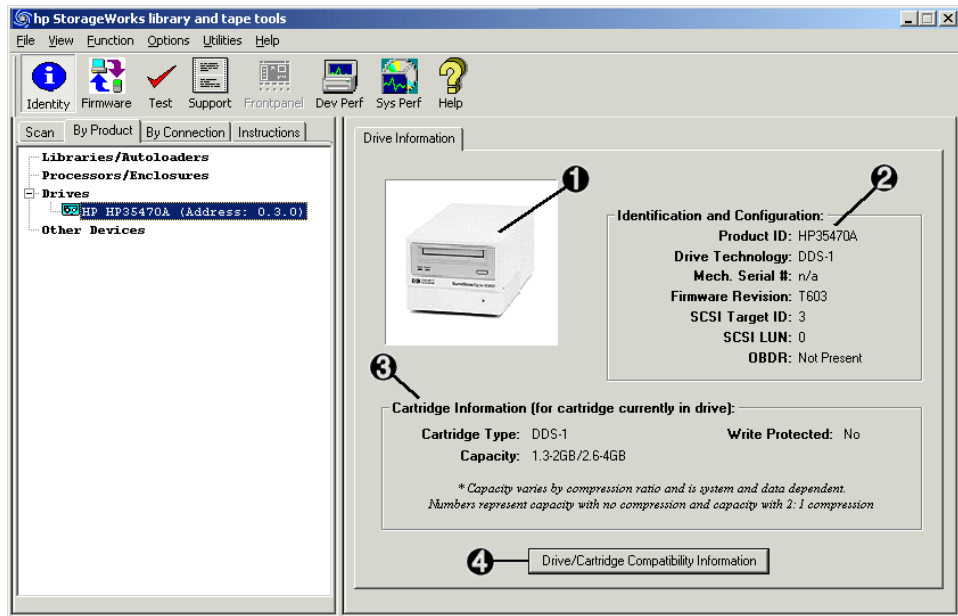
Figure 3: Device Information screen showing a standalone device

❶	This provides a visual representation of the selected product (the images are in grayscale).
❷	This provides the following general information on the product: ■ Product ID (Inquiry String) ■ Drive Technology (DDS/DL/LTO) ■ Mech Serial # (Drive serial number) ■ Firmware Revision ■ SCSI Target ID ■ SCSI LUN
❸	If a data cartridge was inserted in the drive when the identity tool was selected (or when the current screen was "refreshed"), information regarding cartridge type, capacity, and write protect status is shown here.
❹	Click this button to display a list of media that is compatible with the product.

Library and Autoloader Products

When a library or autoloader is selected in the **Device List**, the **Device Information** screen displays two tabs: one for library information and one for the drives contained within the library, as shown in Figure 4.
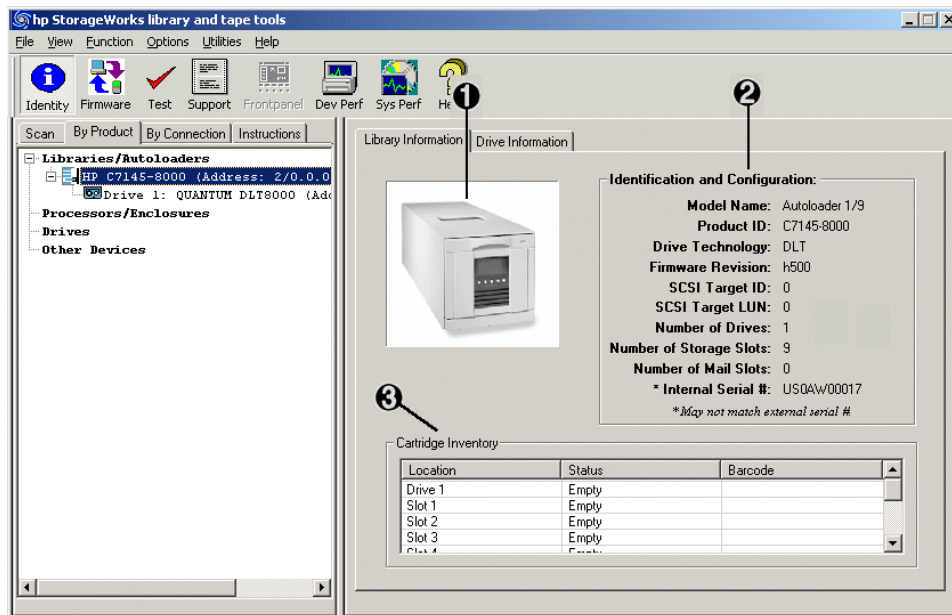
Figure 4: Device Information screen showing a library

❶	This provides a visual representation of the selected product (the images are in grayscale).
❷	As with a standalone drive, this area provides the relevant information on the selected library product.
❸	This provides a cartridge (media) inventory for all the drives and slots. The current status (full or empty) of all the storage elements and the barcode number (if barcode reading is available) is displayed here.

To see information for the drives within the library, select the **Drive Information** tab. This tab displays a screen very similar to the one for standalone products, with the addition of the **Selected Drive** dropdown menu.

Because a library can contain multiple drives, you can select and view information for each drive using the **Selected Drive** dropdown menu. All of the drives in the library are available in the dropdown menu.

Note: Selecting individual drives within a library from the By Product/By Connection device list displays the drive as though it were a standalone product. The recommended method of diagnosing embedded drives is to first select the library they belong to, and then select the specific drive within each tool window.

GUI Using the Firmware Management Screen

The firmware management functionality of L&TT allows easy upgrades to the storage product firmware. To access the **Firmware Management** screen, click the device you want to update in the device list, then click the **Firmware** button on the main toolbar. Figure 5 shows the **Firmware Management** screen.
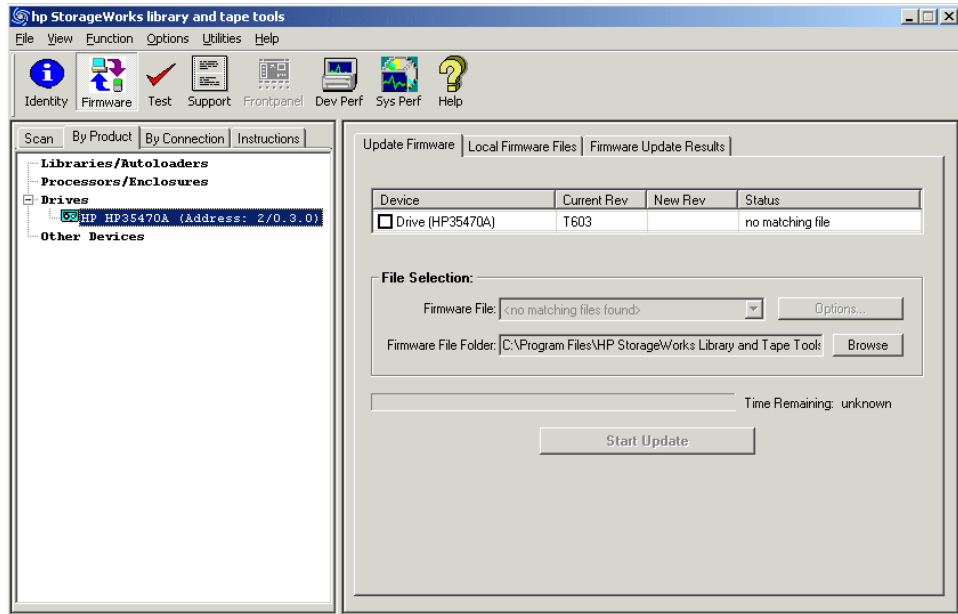
Figure 5: Firmware Management screen

For detailed information about the firmware management functionality of L&TT, see Firmware Management.

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GUI Using the Tests Screen

L&TT provides several standard and advanced tests that can be used to check the performance of or to diagnose issues with storage hardware. To access the **Tests** screen, click the device you want to test in the device list, then click the **Tests** button on the main toolbar. Figure 6 shows the **Tests** screen.
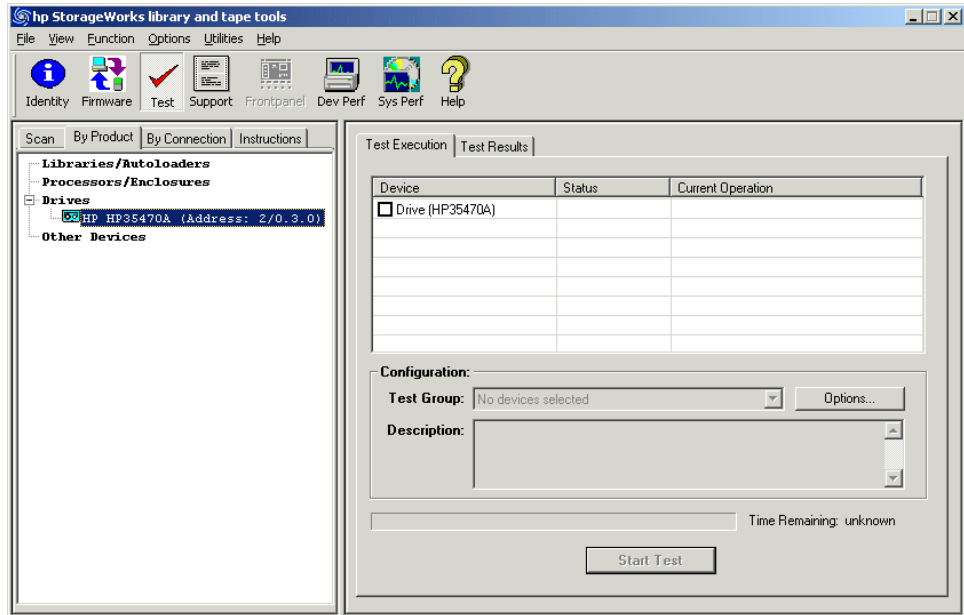
Figure 6: Tests screen

For detailed information about the **Tests** screen, as well as information about how to perform the tests and interpret test results, see Tests and Utility Functions.

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GUI Using the Support Ticket Generation Screen

L&TT can automatically generate a support ticket based on information that the program determines about the system. The information in this support ticket can then be used to diagnose storage hardware issues. L&TT can automatically e-mail the support ticket to the HP help desk to assist the help desk technician in resolving issues.

To access the **Support Ticket Generation** screen, click the device you want to generate the support ticket for in the device list, and then click the **Support** button on the main toolbar. Figure 7 shows the **Support Ticket Generation** screen.
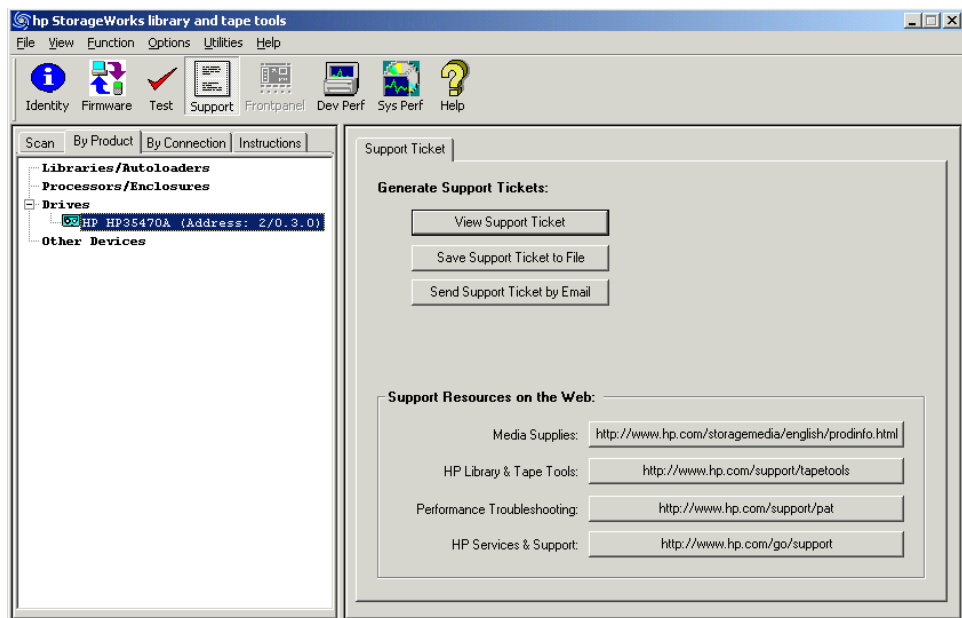
Figure 7: Support Ticket Generation screen

For detailed information about generating and using support tickets, see Support Ticket Generation.

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CSI Starting L&TT

To start L&TT:

■ For HP-UX, Tru64, and Linux:

Log on as root and execute the following commands:

```
cd /opt/ltt
./hp_ltt
```

■ For Novell NetWare

From the server console, execute the following command:

```
hp_ltt\hp_ltt
```

When the CSI version of L&TT is started, an information screen is displayed that offers basic information about navigating the screens. Press any key to bypass this screen and start the device scan. L&TT scans the system for connected devices. When the scan is complete, the **Main** screen is displayed, as shown in Figure 8.

```
Main >
------------------------------------------------------------------------------
Type the corresponding number to select a device, or enter a blank command for
a command list

Libraries/Autoloaders:

Processors/Enclosures:

Drives:
    1 HP HP35470A (Address: 0.3.0)

Other Devices:




Enter Command>
-------------------<Enter a blank command for command list>-------------------
```

Figure 8: CSI Main screen

CSI Navigating the Screens

The top line of each screen displays the current screen name in hierarchical format. Each "level" of screens is separated by the ">" character. On each screen, some of the available commands take you to a lower level in the hierarchy. To move back to the previous level, use the up command. To exit L&TT, use the exit command.

On most of the screens, entering a blank command (pressing **Enter** without typing any other text) displays a **Command Help** screen. This screen contains a list of valid commands that can be executed on the original screen from which the **Command Help** screen was accessed. Figure 9 shows the **Command Help** screen accessed from the **Main** screen.

```
Main > Command Help >
--------------------------------------------------------------------------------
You are in the command help menu. Within this menu (only) use the numbers as a
short cut for the corresponding command. Otherwise, type in the command.

    #   Command                         Description
    -   -------                         -----------
    1   exit                            Exit the tool
    2   options                         Show/Set the current options
    3   about                           Show Program version information
    4   device                          Selects the device by path
    5   load                            Load a support ticket
    6   preferences                     Change the global preferences
    7   review                          Review the scan details
    8   select                          Selects the device by number




Enter Command>_
---------------------<Enter a blank command to return>---------------------
```

Figure 9: Command Help screen accessed from the Main screen

It is possible to enter a command directly from the **Command Help** screen. To do this, type either the number of the command or the name of the command and press **Enter**. Entering the number of the command only works on the **Command Help** screen. From any other screen, you must type the full name of the command. To exit the **Command Help** screen, enter a blank command (press **Enter**).

Some commands require an argument. For example, the select command requires a number that corresponds to the device you want to select in the device list. To select the first device in the list, the syntax is:

```
select 1
```

If you enter a command with an invalid or missing argument, an error message is displayed.

CSI Using the Device Information Screen

When you first select a product from the **Main** screen, the **Device Information** screen is displayed, showing information relevant to the device.

The main purpose of the **Device Information** screen is to provide an overview of the configuration and status of the selected hardware device.

From the **Main** screen, type the following command to access the **Device Information** screen:

select <*n*> (where <*n*> is the number of the device to be examined)

Note: Alternatively, you can omit the select command and only enter the device number.

Standalone Devices

Figure 10 shows the **Device Information** screen for a standalone device.

Figure 10: Device Information screen for a standalone device

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The following general information is displayed:

- Product ID (inquiry string)
- Drive technology
- Mech. serial # (drive serial number)
- Firmware revision
- SCSI target ID
- SCSI LUN
- OBDR capability (if present)

If a data cartridge was inserted in the drive when the **Device Information** screen was displayed, information regarding cartridge type, capacity, and write-protect status is shown.

To see a list of compatible media that can be used with this device, use the inventory command.

Library and Autoloader Products

Figure 11 shows the **Device Information** screen for a library.


```
Main > Identity >
--------------------------------------------------------------------------------
The following is identity information for the selected device. You can use
commands to select functionality to perform on this device.

Product ID               : C7200
Model Name               : Tape Library 2/20
* Internal Serial Number : D01461M0279
Drive Technology         : LTO
Firmware Rev             : 1520
Target ID                : 0
Target LUN               : 0
Number of Drives         : 2
Number of Slots          : 19

* May not match external serial number




Enter Command>
--------------------<Enter a blank command for command list>--------------------
```

Figure 11: Device Information screen showing a library

Note: Selecting individual drives within a library from the device list displays the drive as though it were a standalone product. Embedded drives are best diagnosed by selecting the library they belong to, and then selecting the specific drive within each tool window.

From the **Device Information** screen for a library device, use the `inventory` command to display the slot inventory of the library. The `inventory` command shows which slots and drives currently have cartridges loaded, and the cartridge barcode if available and applicable.

Firmware Management

4

The Firmware Management functionality of L&TT provides a convenient way to easily upgrade the firmware of connected devices. Library firmware and firmware of drives within the libraries can be upgraded as well. In many cases, multiple drives within the library can be updated simultaneously to save time.

L&TT uses special firmware files that associate the firmware with a particular product. This feature prevents the user from downloading the wrong image and ensures that the downloaded firmware is the same or a newer revision than the current device firmware.

Click your operating environment:

GUI
CSI

[GUI] Acquiring Firmware Files

L&TT firmware files are stored in the `Firmware` directory. This directory is a subdirectory of the `HP Library & Tape Tools` installation directory. Before upgrading any firmware, you must first acquire the firmware image file or files and copy them to the `Firmware` directory. Firmware files can be obtained in three ways:

1. Select the device in the device listing and click the **Firmware** button on the main toolbar. On the **Firmware** screen, click the **Local Files** tab, and then click the **Get Files from Web** button at the bottom of the tab. The downloaded files are automatically placed in the `Firmware` directory.

2. From the L&TT menu bar, select **Get Files From Web** from the **File** menu. The software links to the L&TT firmware ftp site and allows the selected firmware files to be copied to your system. Downloaded files are automatically placed in the `Firmware` directory. This option is explained in detail in the following section.

3. Go to www.hp.com/support, choose the product family, then click **software updates and drivers**. The latest firmware file is available in L&TT format. For some products (such as standalone drives), firmware is available as a single file. For other products (such as tape libraries), the firmware is available in a self-extracting bundle that includes library and drive firmware.

Note: Do not use the **Get Firmware From Web** functionality within L&TT without an Internet connection. Doing so can cause the system to lock up until it has timed out in the operating system. This timeout value is operating system-specific.

Note: If **Check for Updates on Web** is enabled in the tool preferences, L&TT automatically informs the user when new firmware is available for any of the connected storage products. L&TT performs this check each time it is started (but not more than once per 24-hour period).

Using the Get Files from Web Functionality

The Windows version of L&TT offers comprehensive firmware management functionality that finds and downloads firmware from the HP website. This functionality obtains the most up-to-date information about all available firmware files directly from the HP website. It then compares this data set against the list of devices connected to the system and the current firmware revisions present in those devices. Depending on the selected filter options on the top of the screen, different subsets of firmware files are presented. Firmware files that are needed to bring the connected devices up to the latest firmware revisions are automatically selected.

Note: L&TT scripts are also obtained using the **Get Files from Web** dialog box. For more information on scripts, see Downloading New and Updated Scripts.

Accessing the Get Files from Web Dialog Box

You can access the **Get Files from Web** dialog box in two ways:

■ Select **Get Files from Web** from the **File** menu

- or -

■ Click the **Get Firmware** button on the **Firmware Update** screen

The **Get Files from Web** dialog box is displayed. Click the **Firmware (New Files Available)** tab if it is not already selected. Figure 12 shows the **Get Files from Web** dialog box for firmware.

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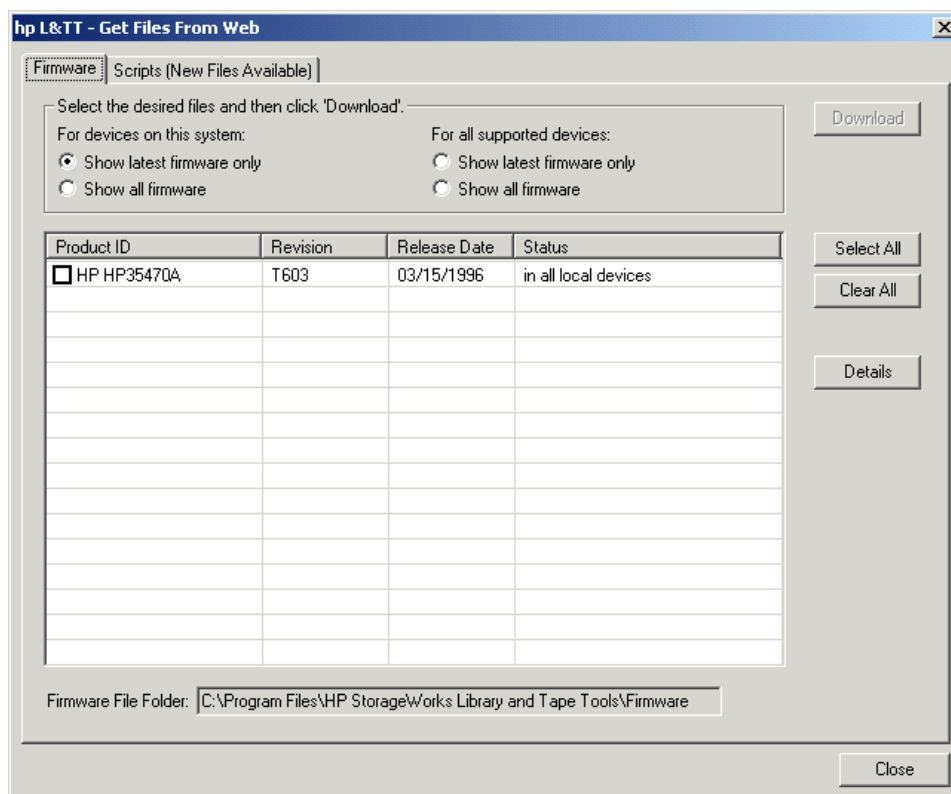
Figure 12: Get Files from Web dialog box—Firmware tab

Selecting and Downloading Updated Firmware Files

The **Get Files from Web** dialog box has four filter options:

- **For devices on this system**—These two options only show firmware files matching devices that are currently connected to the system.

  — **Show latest firmware only** shows the most recent firmware revision for each device.

  — **Show all firmware** shows all firmware revisions for each of these firmware files.

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■ **For all supported devices**—These two options show firmware files for all devices supported by LTT, even if not currently connected to the system.

— **Show latest firmware only** shows the most recent firmware revision for each device.

— **Show all firmware** shows all firmware revisions for each of these firmware files.

Select the appropriate option, and then verify that the correct firmware files are selected. To download the selected files, click **Download**. The files are automatically downloaded to the current firmware directory on the local system. You can now use the firmware update functionality of L&TT to upload the latest firmware to your devices.

Viewing Firmware Revision History

In addition to downloading firmware files, the **Get Files from Web** dialog box provides revision history detail for firmware files. To view the firmware revision history of a device, select a device and click **Details**.

GUI Uploading Firmware to Devices

Before attempting to update any firmware files, you must first acquire the latest firmware files and ensure that they are placed in the `Firmware` directory. If you have not yet done this, see Acquiring Firmware Files.

To upload firmware to a device:

1. Click the device to update in the device list.

2. Click the **Firmware** button on the main toolbar.

3. On the **Update Firmware** tab, click the checkbox next to the device name to select it. If firmware is currently available for that device, it is shown in the **Firmware File** dropdown box in the **File Selection** section of the screen.

Note: You can select multiple devices and update them simultaneously.

---

4. Click the **Start Update** button at the bottom of the screen to begin the update.

⚠ **Caution:** Make sure that no other programs attempt to access the device while the firmware is being updated. Do not interrupt the firmware update. If the firmware update is interrupted, the device may not operate and require physical repair.

L&TT creates a log of all firmware update activity. To view this log, click the **Firmware Update Results** tab. Set the **Current Detail Level** setting to the appropriate level. The default is **Normal**. The firmware log is displayed in a standard tree-view format. If you want to clear the log, click the **Clear Log** button.

GUI Advanced Options

It is sometimes necessary to disable L&TT safeguards to perform more advanced operations. These operations (options) are only available after the necessary password has been entered. To obtain this password, contact HP support. After a password has been entered, the **Options** button on the **Update Firmware** tab becomes available. When you click this button, the **Factory Firmware Overrides** dialog box is displayed (this dialog box varies slightly between drives and libraries):
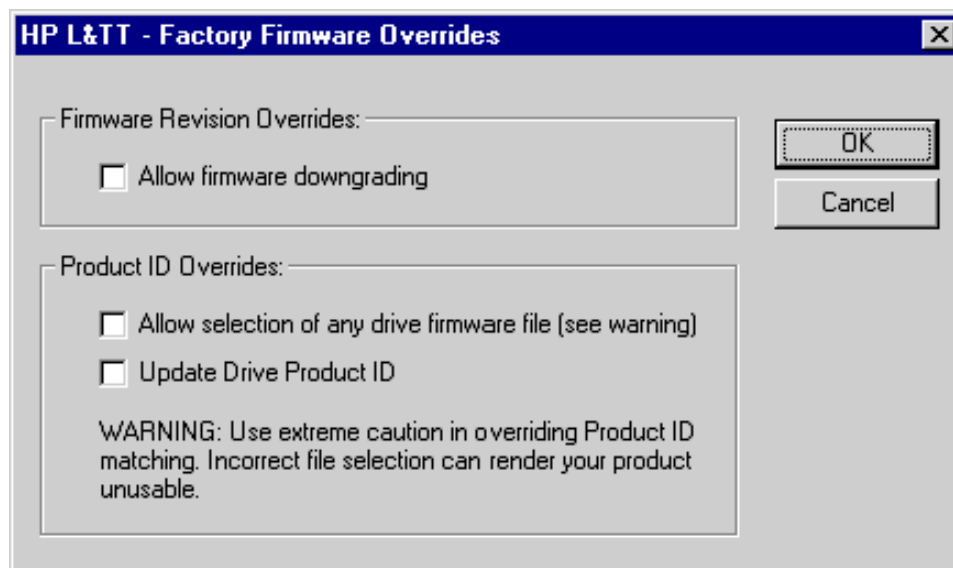
Figure 13: Factory Firmware Overrides dialog box

The **Factory Firmware Overrides** dialog box presents the following three options:

■ **Allow firmware downgrading**—By default, L&TT does not show files with older revision levels as selectable. On the **Local Firmware Files** tab, the comment field displays the message "downgrade password required." In most cases, you should use the latest firmware. However, if software incompatibilities or other customer limitations require the use of older firmware revisions, this check box lets you downgrade to older firmware revisions.

- **Allow selection of any [drive or library] firmware file**—This option allows mapping of the device firmware to a product, irrespective of the device's product ID. There are a few cases in which the product ID does not match the desired firmware file (and the ID may also need to be updated). One case is when a library is being updated from one drive technology to another. Another case is when the device has a firmware revision string format that differs from that in the firmware file, and the tool cannot determine whether it is newer or older. If incompatible firmware is sent to a device, an error message is displayed.

- **Update [drive or library] product ID**—This writes the product ID from the firmware file to the drive.

Note: A number of products may not support updating the product ID, so use this feature only when you know the device supports it. The most common use of this feature is when updating drive technologies in optical libraries.

CSI Acquiring Firmware Files

L&TT firmware files are stored in the `firmware` directory, which is a subdirectory of the `HP Library & Tape Tools` installation directory. Before upgrading any firmware, you must first acquire the firmware image file or files and copy them to the `firmware` directory.

To download the latest firmware files:

1. Go to www.hp.com/support, choose the product family, then click **software updates and drivers**. The latest firmware file is available in L&TT format. For some products (such as standalone drives), firmware is available as a single file. For other products (such as tape libraries), the firmware is available in a self-extracting bundle that includes library and drive firmware.

2. Download the file or files to the `firmware` directory.

3. If the downloaded files are self-extracting bundles, extract the contents to the `firmware` directory.

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CSI Uploading Firmware to Devices

To upload firmware to one or more devices:

1. From the **Main** screen, type the number corresponding to the device to be updated and press **Enter** to display the **Device Information** screen.

2. From the **Device Information** screen, enter the `firmware` command to display the **Firmware Update** screen. Devices that are available for update are listed on this screen.

3. Type the corresponding number of the device you want to update and press **Enter** to mark the device "selected." If there are multiple devices, repeat this step for each device that you want to update.

4. When all the required devices are selected, enter the `start` command to begin the update process.

> △ **Caution:** Make sure that no other programs attempt to access the device while the firmware is being updated. Do not interrupt the firmware update. If the firmware update is interrupted, the device may not operate and require physical repair.

L&TT creates a log of all firmware update activity. To view this log, enter the `review` command from the **Firmware Update** screen.

CSI Advanced Options

Sometimes it is necessary to disable L&TT safeguards to perform more advanced operations. These operations (options) are only available after the necessary password has been entered. To obtain this password, contact HP support. To view the **Options** screen, from the **Firmware Update** screen, enter the options command.

Before any of the options can be changed, the current password must be set. To set the password:

1. Type the number that corresponds to the password option and press **Enter**. L&TT prompts you to enter a value for "Current password entered."

2. Type the password and press **Enter**. If the correct password is entered, the remaining options on this screen become available.

Note: All of the options are visible regardless of whether a proper password is entered or not. However, the options are not available without the proper password. After a proper password has been entered, it is not required to re-enter it later.

The following options are available:

■ **Allow firmware downgrading**—By default, L&TT does not allow firmware downgrading. In most cases, you should use the latest firmware. However, if software incompatibilities or other customer limitations require the use of older firmware revisions, this option lets you downgrade to older firmware revisions.

■ **Allow any firmware file for [drives or libraries]**—This option allows mapping of the device firmware to a product irrespective of the device's product ID. There are a few cases in which the product ID does not match the desired firmware file (and the ID may also need to be updated). One case is when a library is being updated from one drive technology to another. Another case is when the device has a firmware revision string format that differs from that in the firmware file, and the tool cannot determine whether it is newer or older. If incompatible firmware is sent to a device, an error message is displayed.

■ **Allow Product ID updates on [drives or libraries]**—This writes the product ID from the firmware file to the drive.

■ **Current password entered**—This option lets you enter the factory password. The currently entered password is displayed to the right of the option. If no password has been entered, Not Set is displayed.

Note: A number of products may not support updating the product ID, so use this feature only when you know the device supports it. The most common use of this feature is when updating drive technologies in optical libraries.

Tests and Utility Functions

5

L&TT provides numerous tests for analyzing storage hardware. These tests are grouped into two categories: diagnostic tests and performance tests. The performance tests are hardcoded into the program, but several of the diagnostic tests are SCSI script-based. A SCSI script is a sequence of SCSI commands sent to a device, usually for the purpose of testing the device's functionality. SCSI scripts can also be used to perform non-diagnostic utility functions, such as rewinding a tape, recalibrating a tape head, or "exercising" a tape-moving robot arm. A main advantage of SCSI script-based tests is that they can be updated with new functionality and new tests can be added.

> **Note:** New and updated scripts are obtained using the **Get Files from Web** dialog box. For more information, see Downloading New and Updated Scripts.

L&TT uses the following types of SCSI scripts:

■ **Script-based tests** are tests based on scripts that are stored in the `scripts` directory in the L&TT installation directory. The script-based test files have the *.tst* extension. Users can download new and updated scripts. With the Windows version of L&TT, the management of script files is accomplished through the **Get files from Web** item on the **File** menu.

HP is constantly adding scripts for new devices and updating scripts to enhance the testing functionality of older devices. As new scripts are developed, they are published to the external website in the scripts section.

■ **SCSI utility scripts** provide access to generic SCSI operations. These scripts are accessed by selecting **Run Script...** from the **Utilities** menu and have the *.scc* extension. For more information, see Using the Utility Functions.

Note: Each script file contains information that tells L&TT which devices it is designed to support. When a device is selected, the **Tests** screen displays only tests that are applicable to that particular device.

Note: All scripts have a digital signature and cannot be altered. If they are altered in a text editor, L&TT displays an error message stating that the digital signature is not correct.

Test Descriptions

This section lists the available tests.

Caution: Some tests are destructive to data on the media. When a test is destructive to data, this is indicated in the test description. To prevent data loss, use media that is either new or that contains unimportant data that can be erased. Do not attempt to perform a test unless you are thoroughly familiar with its usage, or have been instructed to do so by HP support personnel.

Note: Some tests listed here are documented in more detail in a separate section. If more information is available, a hyperlink to that section is provided.

Built-In Tests

- **Drive Performance Test** writes and reads data from a tape drive and calculates performance data for the drive. Use a blank tape when performing this test because this test is destructive to data on the tape. This test is available for all tape drives. For more information, see Using the Drive Performance Test.

- **System Performance Test** writes and reads data from the specified directory and calculates performance data for the server. For more information, see Using the System Performance Test.

- **Connectivity Test** examines the ability of the host to communicate with the device. This is a test of the SCSI communication path only; no media is required. This option is useful when trying to establish that the SCSI cables and adapters are working correctly. This test is available for DLT, LTO, and DDS drives only.

- **Device Self-Test** executes the internal self-test of the device and reports any failures. This test is useful in confirming that the device itself is operating properly. Not all devices support an internal self-test.

- **Device Analysis Test** runs a device-specific script that carries out a detailed examination of the device. The test examines all available logs from the device to look for any known issues, customer use issues, and common error patterns. The test also provides summary information and presents suggestions as to the cause of certain errors and any remedial actions the user should take. This option is particularly useful if you suspect that there may be a problem with the device. For more information, see Using the Device Analysis Test.

- **Read/Write Test** writes and reads data from tape and checks for accuracy. For more information, see Using the Read/Write Test.

- **Media Validation Test** determines if the drive can read the data on any media currently in the drive. The test is used to determine the quality of the media. The test reads data from the media and calculates the error rate. If the error rate exceeds the maximum allowable threshold, the test will require a cleaning cartridge and a second tape to determine if the problem is with the drive or the tape. The amount of data read depends on the drive type and coverage level of the test, but it generally varies between a few megabytes and one gigabyte. No data is written to tape and the test is not destructive to data. This test is useful if the user suspects that a backup failed because of a bad tape. This test is available for all tape drives.

Note: This test requires that a minimum amount of data is already written on the tape, otherwise the test will fail. This amount of data varies depending on drive technology and options.

- **Library Exerciser Test** takes a test cartridge from a mail slot and performs random slot-to-slot moves. The test then moves the test cartridge into every available drive and performs a short drive test. This test is intended to exercise the robotics and robot drive hardware. For more information, see Using the Library Exerciser Test.

Script-Based Tests

- **Data Compression Test** writes a data pattern of known compressibility to tape. The test then rewinds the tape and reads the file just written. The read and write hardware compression ratios are calculated to ascertain that the hardware compression is enabled and working. If the script finds that hardware compression has been disabled by the host or by switch configuration, it reports this to the user. The compression ratios are displayed to the user and should be approximately 2:1. This test is useful if tape capacity or hardware compression is in doubt. This test is available for DLT, LTO, and DDS drives only.

- **DLT Firmware Tape Creator Test** takes a firmware image and writes it to a tape cartridge for use as a firmware update (FUP) tape. This test is available for DLT, DLT1, SDLT, and VS-80 drives.

- **LTO Firmware Tape Creator Test** takes a firmware image and writes it to a tape cartridge for use as a FUP tape. This test is only available for LTO drives.

- **DLT SRAM Check Tests (short and long versions)** check drive logs for existing evidence of SRAM chip corruption, and they perform a read/write test to check the drive for susceptibility to SRAM corruption problems. The test is destructive to data on the cartridge in the drive. These tests are only available for DLT drives.

- **Initalize Element Status Test** executes an `initialize element status` command on the library. This test is available for all libraries.

- **Full Sweep Test** moves the robotics through the full range of motion to help prevent reliability issues with the brush tracks. This test is available for the C7200 and C7145 library models.

- **Restore Factory Settings** checks the configuration parameters of the MO drive and identifies configurations that differ from the factory default settings. If settings differ, the test can reset the drive to the factory defaults. This test is only available for MO drives.

- **LTO Cooling Check** monitors the temperature sensors of an LTO drive while writing data to ensure that the drive is cooling properly when installed in a server.

- **DLT, VS-80, and SDLT Acceptance Tests** correlate with testing currently done on returned drives. If the acceptance test fails, this same drive would probably fail testing within the return process. If the acceptance test passes,

this same drive would probably pass testing within the return process. Correlation testing between these tests and the test used within the return process has shown good results.

The acceptance tests are available for the following drives:

— **DLT Acceptance Test**: DLT4000, DLT7000, and DLT8000 drives

— **VS-80 Acceptance Test**: VS-80 and DLT1 drives

— **SDLT Acceptance Test**: 110/220 and 160/320 SDLT drives

The acceptance tests perform the following tests:

— SCSI interconnect test

— Review event log entries (which were present prior to running this test)

— Load the test tape

— Quick write/read test

— Soft unload/load test (DLT acceptance test only)

— Minimum block size test

— Diagnostic self test (built-in drive function)

— Read/write tests, using various data patterns

— Bit error rate test

— Review new event log entries added during the test

— Unload the test tape

■ **Ultrium Tape Erase Test** converts a (LTO) data tape into a blank tape. This test has the following two options:

— **Quick erase**—This option, which takes approximately one minute to complete, removes the tape directory and writes EOD at the start of the tape, but it does not overwrite the data on the remainder of the tape.

— **Full erase**—This option, which takes between two to four hours to complete, erases the tape directory and also overwrites all data on the tape.

■ **ESL Vendor ID** toggles the vendor ID between HP and COMPAQ on ESL libraries having firmware revision 3.40 and later. This may be necessary because firmware revision 3.40 and later has a vendor ID of HP, and there may be some applications that require the vendor ID to be COMPAQ.

Using the Drive Performance Test

The Drive Performance test writes and reads data to/from the specified tape drive and calculates performance data for that drive. The results of the test are shown on the **Drive Performance Results** tab and also written to the event log.

GUI

To start the Drive Performance test (Windows version):

> ⚠ **Caution:** This test is destructive to data on the tape. To avoid loss of data, use a blank tape when performing this test.

1. In the device listing (either the **By Product** or **By Connection** tab), click the drive to test.

2. Click **Dev Perf** on the main toolbar. The **Drive Performance** screen is displayed and the **Tape Drive Performance** tab is selected by default.
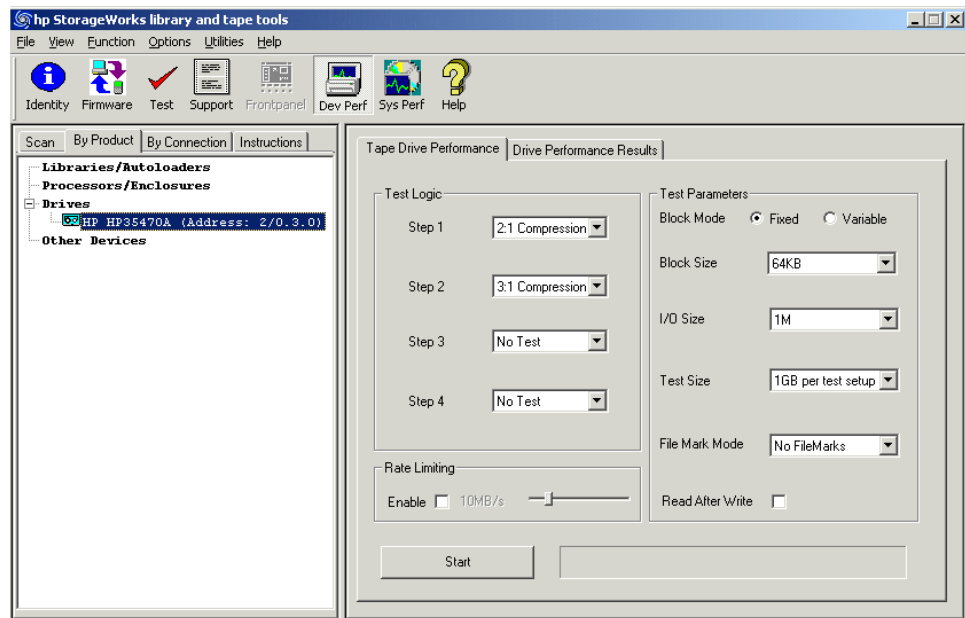
Figure 14: Drive Performance screen

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3. In the **Test Logic** section of the screen, use the drop down boxes to select a data type for each of the four tests. The Drive Performance test is actually a series of four write/read subtests (labeled Step 1-4 on the **Drive Performance** screen) that measure performance using different types of data that you can specify.

    The following data types can be selected:

    ■ Zeros

    ■ 1.6:1 Compression

    ■ 2:1 Compression

    ■ 3:1 Compression

    ■ 4:1 Compression

    You must specify a data type for Step 1, but you can choose not to perform Steps 2 through 4 by selecting **No Test** in the corresponding dropdown box.

4. Specify the following additional parameters:

    ■ **Block Mode**—choose one of the following:

        — **Fixed**—the test uses a fixed block size (length) that can be specified in the **Block Size** dropdown box.

        — **Variable**—the test uses a different mode of data transfer. When this option is selected, the **Block Size** dropdown box is disabled.

    ■ **Block Size**—if Block Mode is set to **Fixed**, then specify the size of the data blocks used in the test. Data blocks can be from 16K to 256K. This dropdown box is disabled if Block Mode is set to **Variable**.

    ■ **I/O Size**—the maximum amount of data to be transferred by a single read/write operation. This length is typically a multiple of the Block Size and ranges from the specified Block Size to 1MB.

    ■ **Test Size**—the maximum amount of data written/read by the test. Valid choices range from 1GB to 15GB. Larger values increase the time required to perform the test, but they produce more accurate test results.

    ■ **File Mark Mode**—instructs the test to write a filemark at the specified interval (1MB to 1GB). You can also instruct the test not to write any filemarks.

    ■ **Read After Write**—when enabled, data is written to the tape and then the tape is read back. When disabled, only write performance is measured. The test evaluates two sets of metrics when enabled, and one when disabled.

■ **Rate Limiting**—if rate limiting is enabled, the I/O rate is limited to the specified value.

5. Click **Start** to perform the test. Progress of the test is displayed in the status bar to the right of the **Start** button, and a dialog box will inform you when the test is complete.

6. Click the **Drive Performance Results** tab to view the results of the test. The results are also written to the event log. See Using the Event Log for more information.

CSI

To start the Drive Performance test (CSI version):

1. From the **Main** screen, enter the following command to display the **Device Performance Tool** screen:

   devperf

```
Main > Drive Information > Device Performance Tool >
-----------------------------------------------------------------------
The purpose of this tool is to measure the tape drive performance by checking
how fast the server can access the tape drive independent of the disk
subsystem. It works by transferring pre-loaded data with different compression
ratios directly from the memory of the server to the tape drive.

   1.      Set the blocksize to write to tape (blocksize) - 32768
   2.      Set the no. of writes/reads to perform (reps) - 4096
   3. [ ] Enables the readback test after writing data to the device (readback)
   4.      Set the no. of blocks to write to tape/write (count) - 16
   5.      Set data pattern to write to tape (pattern) - 2




Enter Command>start
----------------<Enter a blank command for command list>------------------
```

Figure 15: Device Performance Tool screen

The Device Performance Tool screen displays several test options with their default settings.

2. If necessary, change the settings for one or more options. To change the settings, enter the number that corresponds with the option that you want to change. Enter the new value at the prompt. The five available options for this test are:

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- ■ **Blocksize**—specify the blocksize, in bytes, to be written to the tape. Typical values are 32768 (32KB), 65536 (64KB). The default is 65536.

- ■ **Repetitions**—specify how many write/read operations to perform. The default is 4096.

- ■ **Readback**—specify whether to enable the readback test after writing data to the device. This option measures read performance in addition to write performance in MB/sec. This option is disabled by default.

- ■ **Count**—specify how many blocks to write to the tape device per write operation. The default is 16.

- ■ **Pattern**—specify the data pattern to be written to tape. Enter 2 for 2:1 compression ratio or 3 for 3.1:1 compression ratio. The default is 2.

3. Use the `start` command to start the test.

Using the System Performance Test

The System Performance test writes and reads data to/from the specified directory and calculates performance data for the backup server. The Restore Pre-Test (write) and Backup Pre-Test (read) portions of the tests are actually separate tests and are executed separately.

GUI Performing the System Performance Restore Pre-Test (GUI)

1. Click **Sys Perf** on the main toolbar. The **System Performance** screen is displayed.

2. Click the **Restore Pre-Test** tab.
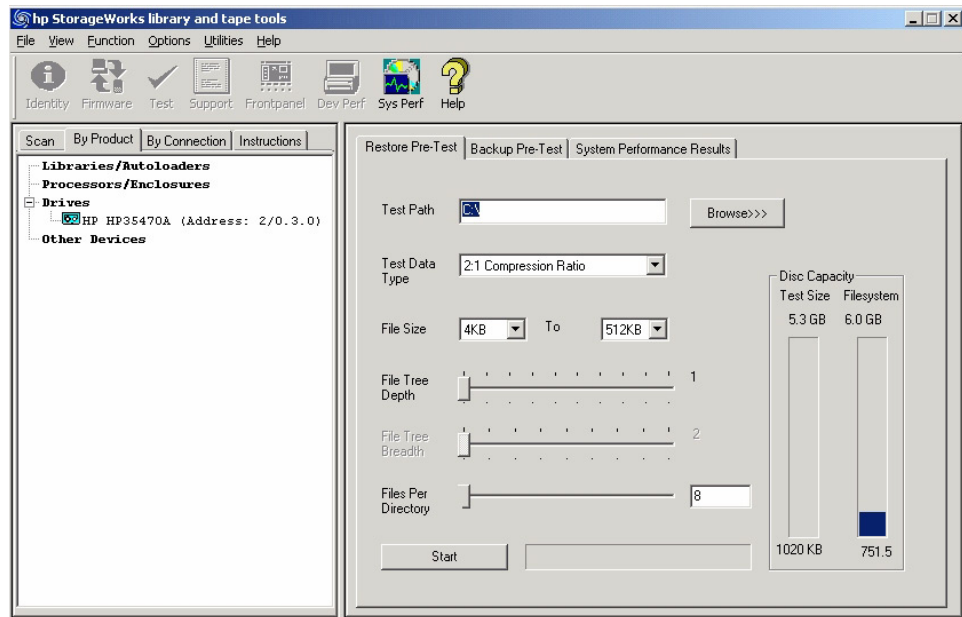
Figure 16: Restore Pre-Test tab of the System Performance screen

3. Specify the following parameters:

   ■ **Test Path**—enter the destination directory (or use the **Browse>>>** button to browse to the directory) that the test will write data to. This should be a directory on the backup server being tested.

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■ **Test Data Type**—select the type of data pattern to be written. Choose from the following options:

— Fixed Byte

— Incrementing

— Random

— Uncompressable Data

— 2:1 Compression Ratio

— 3:1 Compression Ratio

— 4:1 Compression Ratio

■ **File Size**—use the two dropdown boxes to specify a range of possible file sizes for the test data.

■ **File Tree Depth**—specify the number of levels of subdirectories the program will create from the specified directory.

■ **File Tree Breadth**—specify the number of directories to be created within each subdirectory.

■ **Files Per Directory**—specify the number of files to be created within each subdirectory.

Note: The gauges in the **Disc Capacity** section of the screen show the amount of disk space required for the System Performance test using the current settings, and the amount of space available in the indicated filesystem. If the required space exceeds the available space, the Test Size gauge displays OVERFLOW, and you will be unable to start the test.

4. Click **Start** to perform the test. Progress of the test is displayed in the status bar to the right of the **Start** button, and a dialog box will inform you when the test is complete.

5. Click the **System Performance Results** tab to view the test results. The test results are also written to the event log. See Using the Event Log for more information.

GUI Performing the System Performance Backup Pre-Test

This test reads the sample data files that were written in the System Performance Restore Pre-Test. You must perform the Restore Pre-Test before performing the Backup Pre-Test. If you have not yet performed the Restore Pre-Test, see Performing the System Performance Restore Pre-Test (GUI).

1. Click **Sys Perf** on the main toolbar. The **System Performance** screen is displayed.

2. Click the **Backup Pre-Test** tab.
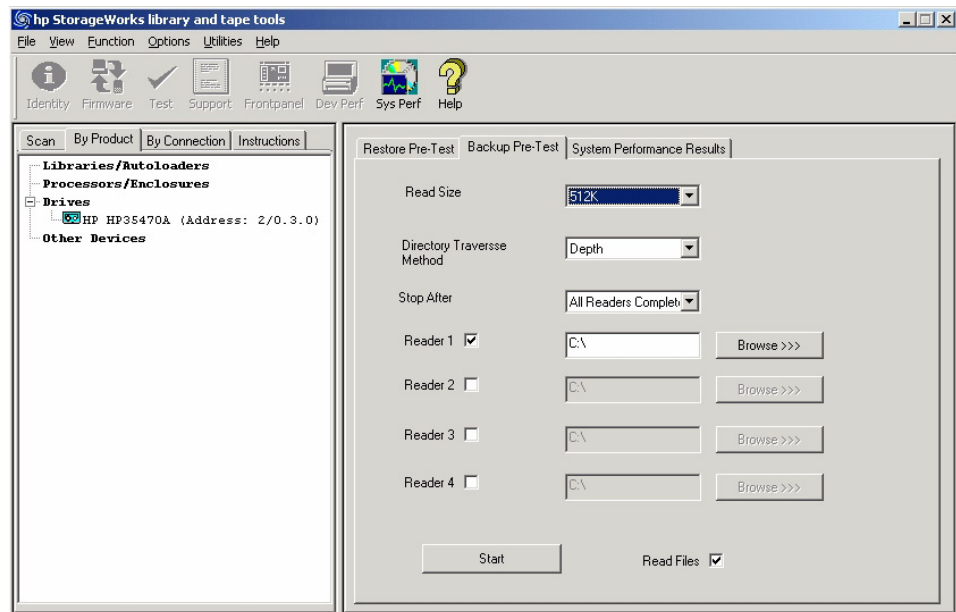
Figure 17: Backup Pre-Test tab of the System Performance screen

3. Specify the following parameters:

   - **Read Size**—enter the maximum block size (in bytes) to transfer.

   - **Directory Traverse Method**—specify one of the following options:

     — Specify **Depth** to have the test read as far down the directory structure as possible before moving laterally to the next directory.

     — Specify **Breadth** to read all directories at the same level before moving down to the next subdirectory level.

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- **Stop After**—specify a time limit for the test, or select "All Readers Complete" to continue testing until the test is complete.

- **Reader [1-4]**—enter up to four target directories (use the **Browse>>>** button to browse to each directory) that the test will read data from. For each Reader, you must have first performed a Restore Pre-Test. Use the same directory or directories that you specified in the Restore Pre-Test(s).

- **Read Files**—specifies whether the files must be read back from the tape after the write completes.

4. Click **Start** to perform the test. A dialog box will inform you when the test is complete.

5. Click the **System Performance Results** tab to view the test results. The test results are also written to the event log. See Using the Event Log for more information.

CSI Performing the System Performance Pre-Tests (CSI)

To start the CSI version of the System Performance Pre-Test:

1. From the **Main** screen, enter the following command to display the **System Performance** screen:

    sysperf

2. Enter one of the following commands (depending on which pre-test you want to run):

    ■   backup—runs the Backup Pre-Test

    ■   restore—runs the Restore Pre-Test

3. If necessary, change the settings for one or more options. To change the settings, enter the number that corresponds with the option that you want to change. Enter the new value at the prompt.

    Figure 18 shows the **Backup Pre-Test** screen.

```
Main > System Performance Tools > Backup Pre-Test >
----------------------------------------------------------------------------
The purpose of this tool is to measure the actual read transfer rate from the
disk subsystem by file-by-file or sequential method. This gives the data rate
in MB/sec.

    1.      Set blocksize to read files (blocksize) - 32768
    2.      Set path to read files (path) - /tmp

Enter Command>start
-----------------<Enter a blank command for command list>-----------------
```

Figure 18: Backup Pre-Test screen (CSI)

The two options available for the Backup Pre-Test are:

■   **Blocksize**—specify the blocksize, in bytes, to be read. Typical values are 32768 (32KB), 65536 (64KB). The default is 65536.

■   **Path**—specify the path to the directory to be read from.

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Figure 19 shows the **Restore Pre-Test** screen.

```
Main > System Performance Tools > Restore Pre-Test >
--------------------------------------------------------------------------
The Performance of the disk subsystem can be measured using this tool. This
creates a directory structure based on file size, directory depth, blocksize
and compression ratio and measures the data rates it achieves. Type the
corresponding number to select/set each option.

    1.      Set each file size (filesize) - 4096
    2.      Set no. of files to create (nofile) - 5
    3.      Set dir where to create dataset (dirpath) - /var/tmp
    4.      Set compressibility pattern to create files (pattern) - 5




Enter Command>start
-----------------<Enter a blank command for command list>------------------
```

Figure 19: Restore Pre-Test screen (CSI)

The following options are available for the Restore Pre-Test:

- **Filesize**—specify the size, in bytes, of the test files to be created.

- **Number of Files**—specify the number of files to be created.

- **Directory path**—specify the path of the directory where the test files will be written.

- **Pattern**—specify one of the following data patterns:
    - 1   Fixed byte
    - 2   Incrementing byte
    - 3   Random data
    - 4   1.6:1 compressible data
    - 5   2:1 compressible data
    - 6   3.1:1 compressible data
    - 7   4.3:1 compressible data

4. Use the start command to start the test.

Using the Device Analysis Test

The Device Analysis test can be executed manually through the **Tests** screen or automatically whenever a support ticket is generated. The Device Analysis test is unique among all the tests offered by L&TT. In addition to performing SCSI operations directly on a device, the Device Analysis test uses a set of predefined, device-specific rules to analyze device logs and configurations. If any known issues are discovered during the analysis, the user is notified of the problem and the program suggests an appropriate course of action.

The Device Analysis test automates failure analysis of a device by determining whether a known or unknown problem with a device exists, if the problem can be resolved in the field through maintenance or simple repair, and whether a device needs to be returned or serviced.

Using the Read/Write Test

The Read/Write test writes and reads data from tape and checks for accuracy. In addition to verifying that the data read back matches the data written, the read/write error rates are also checked. The test fails if the error rates exceed allowable limits. This test can be used to verify the ability of the drive to read and write data independent of the storage application. This test is available for all tape drives.

> ⚠️ **Caution:** Use a blank tape when performing this test because this test is destructive to data on the tape.

The following options are available for this test:

- **Test Time Limit**—specify the time limit in minutes. Enter 0 for no time limit.
- **Data Limit Type**—specify one of the following options to limit the amount of data written/read in each phase:
  - **Time**—limits the amount of data tested based on the time specified in Data Time Limit.
  - **Size**—limits the amount of data tested based on the size specified in Data Size Limit.
  - **Whole tape**—limits the amount of data tested based on the size of the tape.
- **Data Size Limit**—specify the size limit in megabytes of data to be written/read in each phase.
- **Data Time Limit**—specify the time limit, in minutes, for each phase of the test.
- **Block Size**—specify the block size, in kilobytes, to be used in the test.
- **Transfer Size Limit**—specify the maximum data transfer limit, in kilobytes, per command.
- **Block Transfer Type**—specify whether to use a fixed or variable block length.

- **Data Pattern Type**—indicates the type of data pattern used in the test. Specify one of the following data pattern types:

  — **Pattern File**—uses a preset pattern

  — **Random**—generates random patterns

  — **User defined**—uses a user-defined string

- **Data Pattern**—specify a string value to use as a data pattern if the Data Pattern Type is set to "User Defined."

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Using the Library Exerciser Test

The Library Exerciser test takes a test cartridge from a mail slot and performs random slot-to-slot moves. The test then moves the test cartridge into every available drive and performs a short drive test. This test is intended to exercise the robotics and robot drive hardware.

The following options are available for this test:

■ **Test Time Limit**—specify the time limit in minutes. Enter 0 for no time limit. The default setting is 0.

■ **Move Command Timeout**—specify the maximum time alloted, in seconds, for each move command before failure. The default is 600 seconds.

■ **Active Slot Range**—specify a range of slots to be tested. Enter a range of slot numbers separated with a dash (for example: 2-5), or enter all to specify all slots. The default is "all."

■ **Active Drive Range**—specify a range of drives to be tested. Enter a range of drives separated with a dash (for example: 2-5), or enter all to specify all drives. The default is "all."

■ **Drive Type Option**—specify the type of drives to be tested (in libraries that have mixed drive types). Enter the type of drive (for example: LTO or DLT), or enter all to test all drive types. The default is "all."

■ **Check Inventory Mode**—specify whether to perform an active inventory check at beginning of the test. The active inventory check can take a long time to perform. The default is "on."

■ **Barcode Mode**—specify how barcodes are handled. Choose one of the following options:

— **Show all**—shows all barcodes

— **Show suspect**—shows only suspect barcodes (default)

— **Off**—does not show barcodes

■ **Slot-to-Slot Moves**—select one of the following options for the slot-to-slot test:

— **All**—moves all cartridges

— **Random**—moves randomly selected cartridges (default)

— **Off**—no cartridges are moved

■ **Random Coverage**—when Slot-to-Slot Moves is set to "Random," specify the percentage of units covered during random test. The default is 20%.

■ **Drive Load Test**—specify whether or not to perform the Drive Load test. The default setting is "on."

■ **Drive Test Option**—if the Drive Load test is enabled, specify one of the following options:

— **Off**

— **Data loop back** (default)

— **Read-only**

— **Read/write**

■ **Cartridge Load Test**—specify one of the following options for the Cartridge Load test:

— **Off** (default)

— **Single drive**

— **Multiple drives**

— **All drives**

■ **CM Integrity Test**—specify whether to enable the CM integrity check option for LTO drives. The default setting is "on."

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[GUI] Running the Tests (GUI Environment)

To select and run a test manually:

1. In the device listing (either the **By Product** or **By Connection** tab), click the device to test.

2. Click **Test** on the main toolbar. The **Tests** screen is displayed and the **Test Execution** tab is selected by default.

3. Click the checkbox to the left of the device name that you want to test. The **Test Group** dropdown box is enabled, listing all the tests available for the selected device.

4. In the **Test Group** dropdown box, select the test to perform. A description of the selected test is displayed in the **Description** text box.

5. If any options are available for the selected test, the **Options** button is enabled. Click the **Options** button to review and set the desired options.

6. Click the **Start Test** button to start the test.

Viewing Test Results

After the test has completed, click the **Test Results** tab to view the results. The results of the test are displayed in the **Test** text box. A more detailed Test Operation Log is displayed in the bottom section of the screen. The information is presented as a report in a standard tree-view format. Click the "**+**" or "**–**" signs to expand or collapse a section of the report. Select an option in the **Current Detail Level** dropdown box to display more or less information in the Test Operation Log.

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CSI Running the Tests (CSI Environment)

To select and run a test manually:

1. On the **Main** screen, enter the number corresponding to the device that you want to test. The **Device Information** screen is displayed.

2. On the **Device Information** screen, enter the `test` command. The **Test** screen is displayed. The **Test** screen displays the currently selected test and lists the available devices to be tested.

3. To select a different test, enter the `picktest` command. On the **Selector** screen, enter the number of the test you want to perform. The **Test** screen is redisplayed and the currently selected test is updated.

4. To select or deselect devices to be tested, enter the corresponding device number to toggle the selected status of the device. To deselect all devices, enter the `clear` command.

5. Enter the `start` command to start the test.

6. When the test is complete, a dialog is displayed showing preliminary results of the test. Press any key to return to the **Test** screen.

Viewing Test Results

To view detailed test results, enter the `review` command. Test results are displayed in a hierarchichal format.

Use the `detail` command without any arguments to view the current detail level of the report. Use the `detail` command with a numeric argument to set the detail level. The available detail level arguments are as follows:

- **1** — highlights only
- **2** — normal
- **3** — more details
- **4** — everything
- **5** — factory only (requires a factory password. To enter a password, use the `options` command.)

If necessary, use **Ctrl+U** and **Ctrl+D** to scroll up and down through the results. Use the `find` and `page` commands to quickly locate information in the report.

GUI Using the Utility Functions

The utility functions are only available with the Windows version of L&TT. Utility functions execute the SCSI utility scripts (files with a *.scc* extension) stored in the scripts directory. These scripts send various SCSI commands to the selected device, but they generally do not return any results.

Many of the utility functions are device-specific and intended only to remedy specific problems that may occur with a particular device. For detailed descriptions of available scripts, see Hardware Considerations.

> **Caution:** Using a script improperly or when it is not required can cause more harm than good—possibly rendering a device inoperable. Do not attempt to use these utility functions unless you are very familiar with SCSI operation, or you have been advised to do so by a technical support representative or a Device Analysis script.

To use a utility function:

1. Select **Run Script...** from the **Utilities** menu to display the **Run Script** dialog.

2. In the **Devices** section, click the check box next to the device on which the script will be run.

3. Click **Browse** to select a script file to execute. The utility scripts are located in the scripts directory and have a *.scc* extension. Select a script and click **Open** to return to the **Run Script** dialog.

4. Click **Run Script** at the bottom of the dialog box to run the script. When the script has completed, relevant information is displayed in the **Script Output** and **Script Execution Log** text boxes.

# GUI Downloading New and Updated Scripts

The Windows version of L&TT provides a convenient way to download the latest scripts to the scripts directory of the local system. This functionality is similar to the procedure for downloading firmware, except that the purpose is to manage the script files on the local system. The function displays a list of all available script files and compares this list to the list of scripts currently on the local system. The function automatically selects scripts that are not on the local system, or that are newer than their locally installed equivalents.

Note: Firmware files are also obtained using the **Get Files from Web** dialog box. For more information on downloading firmware, see Using the Get Files from Web Functionality.

To access this functionality, select **Get Files from Web** from the **File** menu. The **Get Files from Web** dialog box is displayed. Click the **Scripts (New Files Available)** tab if it is not already selected.
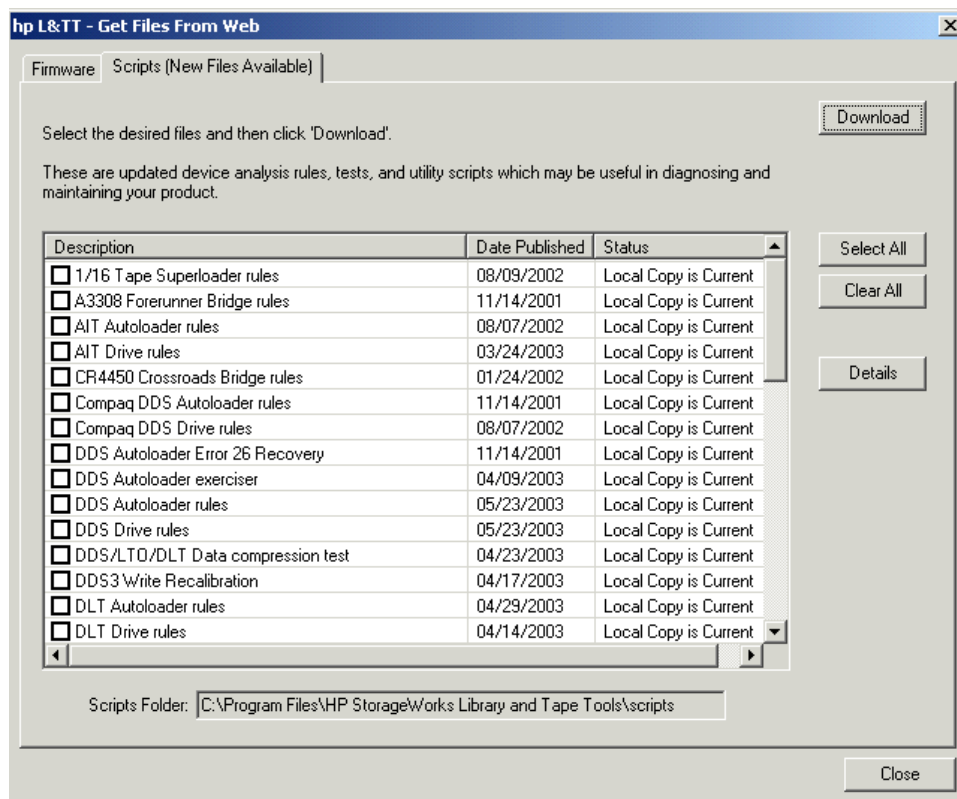
Figure 20: Get Files from Web dialog box—Scripts tab

Verify that the correct scripts are selected and click **Download**. The selected script files are copied into the scripts directory of the local system.

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Support Ticket Generation

6

A major feature of L&TT is the ability to generate a support ticket. In the event of a hardware problem, a support ticket can provide vital information to help in diagnosing and resolving the problem.

When a support ticket is generated, L&TT collects configuration information and executes a Device Analysis test on the selected device. This information can then be viewed, saved, printed, compared to another support ticket, or e-mailed. A support ticket is saved as a log file having the *.ltt* extension. By default, log files are saved to the `log` directory.

The support ticket viewer is built into the L&TT application. The viewer enables viewing of detailed device information and general information on the system it is connected to. This information is displayed in a standard treeview format. The user (or support technician) can change the detail level of the support ticket, browse through the support ticket information, and expand or collapse specific sections of the support ticket as required.

Note: Regardless of the selected detail level, the log file always contains all of the information collected from the product. The support ticket viewer filters this information, depending on the detail level.

L&TT support tickets are saved in a proprietary format and therefore require the support ticket viewer. However, with the Windows version of L&TT, a support ticket can be converted to HTML format using the currently selected detail level. The HTML version can easily be printed or viewed by other users without the support ticket viewer.

Note: After an HTML support ticket has been generated, the detail level within the HTML file cannot be changed. Make sure that the detail level is set to the desired level before generating the HTML report.

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> **Note:** In the Windows version of L&TT, right-clicking on any of the text in the support ticket viewer displays a context menu with more options. A quick way to see the entire support ticket is to set the detail level to **everything** or **factory only**, right-click the top support ticket entry, then select **Expand All**.

GUI Generating and Viewing a Support Ticket

To open the **Support** screen:

1. Click a device in the device list (**By Product** or **By Connection** tab) to select it.

2. Click the **Support** button on the main toolbar to display the **Support** screen.

The bottom section of the screen provides resources for finding support on the Web. Clicking any of the buttons in the **Support Resources on the Web** section of the screen opens a browser window to display the corresponding website.

Generating a Support Ticket

The **Support** screen presents three options for generating a support ticket. Each of the following three options has a corresponding button in the **Generate Support Ticket** section of the screen.

■ **View Support Ticket**—Click this button to generate the support ticket and immediately view it in the support ticket viewer. The support ticket can later be saved or sent via e-mail. For more information, see Viewing a Support Ticket.

■ **Save Support Ticket to File**—Click this button to generate and save the support ticket. The support ticket is saved as a log file with the *.ltt* extension. The support ticket can later be viewed or sent via e-mail. To view a saved support ticket, open it through Windows Explorer, or use the **Load** command on the **File** menu.

■ **Send Support Ticket by E-mail**—Click this button to generate the support ticket and immediately send it via e-mail to an HP support center (or other destination). Clicking this button opens a form that allows you to provide all the necessary information. Complete the form and click the **Send** button to send the e-mail. Using this option does not save a copy of the support ticket locally, so you are advised to click **Save Support Ticket to File** to save a copy for future reference. For more information, see Sending a Support Ticket by E-mail.

Viewing a Support Ticket

After a support ticket is generated, it is displayed in the support ticket viewer. This viewer is built into the L&TT program. Information is displayed in a standard tree-view format. Click the "+" and "−" signs to expand and collapse sections of the support ticket. Use the standard navigation keys (**Home**, **End**, **Page Up**, **Page Down**, and the arrow keys) and the Windows scroll bars to navigate through the document.

To print the support ticket, select **File > Print** from the menu within the support ticket viewer.

Using the Tabular View

Items in the support ticket that are preceded with the Tabular View icon (⊞) have additional information that can be displayed in Tabular View. To view the additional information in Tabular View, click the icon. One of the following occurs:

- ■ If only one view is available for the item you clicked, then a Tabular View window immediately opens.

- ■ If more than one view is available for the item you clicked, a shortcut menu is displayed. Select the desired option and click **OK**. The Tabular View window opens.

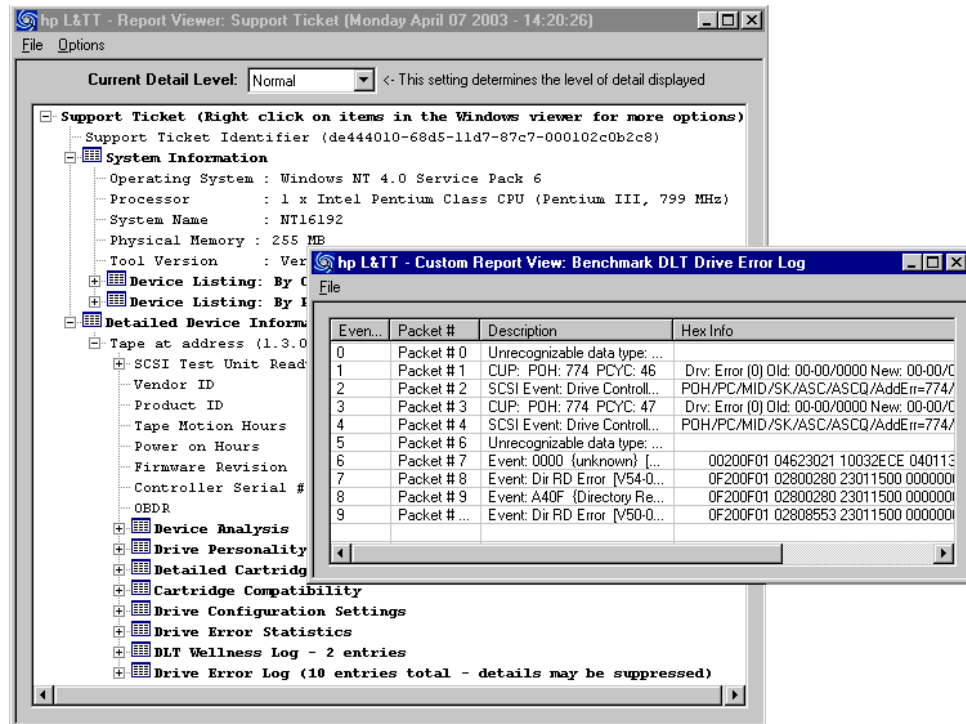Figure 21 shows an example of a typical Tabular View window.

Figure 21: Tabular View window

The Tabular View window supports the following operations:

■ **Sorting columns**—Click a column header to sort by that column. Repeatedly clicking the same column header toggles between ascending and descending sort order.

■ **Filtering columns**—Right-click a column header and choose **Filter** from the context menu to filter a column. A dialog box prompts you for the filter value. Enter a value and click **Filter**. To remove the filter, right-click the column header again and choose **Clear Filter** from the context menu.

■ **Exporting data**—The Tabular View data can be exported as a CSV (comma separated value) file. A CSV file is a text file in which values are separated by a comma (or other specified separator). Data in a CSV file can be imported by a variety of popular spreadsheet and database applications such as Microsoft Excel and Access.

To export Tabular View data to a CSV file, choose **Export** from the **File** menu. Enter the path and filename for the CSV file in the dialog box and click **Save**.

Setting the Detail Level

The support ticket can display information in several different levels of detail, depending on the setting displayed in the **Current Detail Level** dropdown box. The following detail level settings are available:

■ Highlights only

■ Normal

■ More detail

■ Everything (the highest level the end user can view)

■ Factory only (requires a factory password)

Note: The "factory only" detail level is only visible after the factory password has been entered into the software, either from the menu function in the report viewer or in the menu item within the main application. If the factory password is entered via the main application, it is saved in the registry and will not require subsequent re-entry.

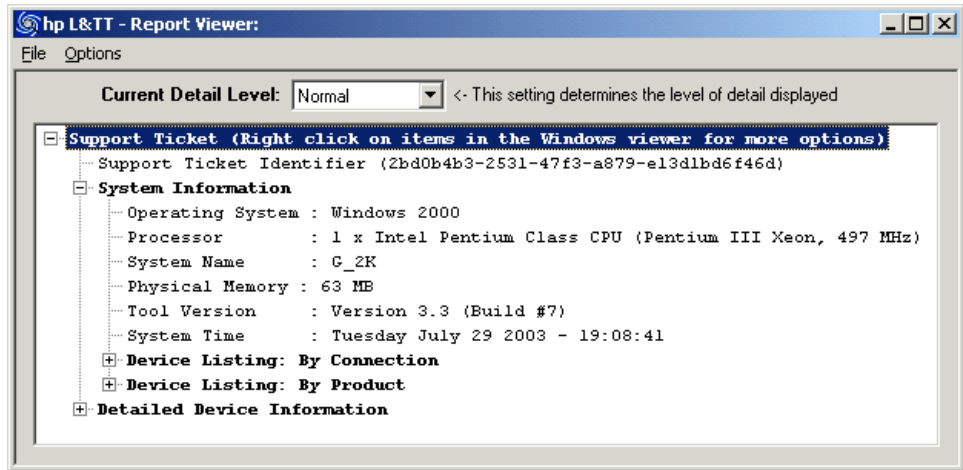Figure 22 shows an example of the information contained in a report with the detail level set to "Normal."

Figure 22: Example support ticket with normal detail (Windows version)

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Sending a Support Ticket by E-mail

From the **Support** screen, click **Send Support Ticket by E-mail** to generate the support ticket and immediately send it via e-mail to an HP support center (or other destination). When you click **Send Support Ticket by E-mail,** the **E-mail Support Ticket** dialog box is displayed.

Figure 23: E-mail Support Ticket dialog box

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Before L&TT can email a support ticket, you must either have a MAPI-compliant e-mail program (such as Microsoft Outlook or Outlook Express), or you must set up an email account through the Windows Control Panel or Internet Explorer. For more information about setting up an e-mail account, see How do I configure e-mail to send support tickets?.

The **E-mail Support Ticket** dialog box is divided into three steps:

1. In **Step 1**, indicate whether this is a new support request or an existing case.

   ■ If this is a new support request, select the **Send to support provider to request support by e-mail** option (this option is the default). Enter the product number and product serial number in the appropriate fields.

   ■ If this is an ongoing support case, select the **Send to support provider in reference to an open case** option and enter the case reference number in the appropriate field.

2. In **Step 2**, enter the destination e-mail address. Use the dropdown box to select from a list of HP support providers, or enter the e-mail address manually.

3. In **Step 3**, specify the following additional information:

   ■ **Contact information**—Enter your company name, contact name, contact phone, and contact e-mail address.

   ■ **Attach Result Log**—Select this option to attach the support ticket to the e-mail for analysis by HP service personnel.

   ■ **Attach additional Event Log (only if requested)**—Select this option if you have been requested by HP service personnel to send the event log. For more information about using the event log, see Using the Event Log.

   ■ **Problem description**—Enter a detailed description of the problem you are having.

When you have completed the form, click **Send**.

Comparing Support Tickets

L&TT can compare two support tickets and generate a report of the differences. To compare two support tickets:

1. Generate or open the first support ticket to be compared.

2. In the support ticket viewer, select **File > Compare**. The **Open** dialog box is displayed.

3. Select the support ticket to which you want to compare and click **Open**. The comparison results are displayed in a separate window as shown in Figure 24.
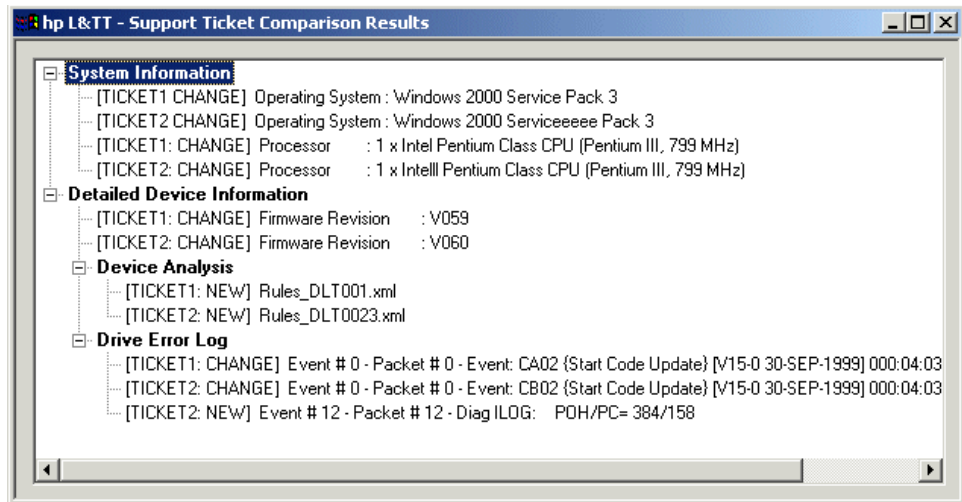

Figure 24: Support ticket comparison results

CSI Generating and Viewing a Support Ticket

To generate and view a support ticket in the CSI environment:

1. From the **Main** screen, select the device for which to create a support ticket. The **Device Information** screen is displayed.

2. Enter the support command to access the **Support** screen.

3. From the **Support** screen, do one of the following:

   ■ Enter the view command to view the support ticket.

   ■ Enter the save *<filename>* command to save the support ticket with the specified filename. The support ticket can be viewed later using the load command from the **Main** screen.

When viewing the support ticket, use **Ctrl+U** and **Ctrl +D** to scroll up and down through the results. You can also use the find and page commands to quickly locate information.

Common Information Reported for All Products

> **Note:** For standalone devices (such as DDS drives), HP recommends that you generate the support ticket when the drive still contains the media with which the drive may have failed. This allows error rate and other information relevant to that cartridge to be examined. When media is removed, many products automatically clear this information. However, for most SureStore tape libraries it is better to have the drives empty; this forces the library drive/media log to be updated.

The following information is included in the support ticket regardless of what products are being analyzed:

- **System information** provides basic host system information such as operating system, processor type, system name, physical memory size, and the current version of L&TT being used. This information also includes a snapshot of the SCSI bus configuration determined by the I/O scan, showing connected devices listed physically and logically.

- **L&TT history** provides a brief history of the L&TT functions the user has accessed such as whether ASPI was installed, how many times L&TT has been run, and which functions have been used.

Device-Specific Information Reported

The support ticket also contains device-specific information that varies by device family.

Using the Event Log

L&TT can generate a detailed event log that captures all L&TT diagnostic interaction with the product, all SCSI commands sent and received by the program, and any software interactions or issues. By default, the event log is not accessible until the factory password has been entered. The information it contains is intended for use by L&TT programmers as a tool for debugging software issues within the program itself.

If you experience a software problem with L&TT:

1. Run L&TT and select **Preferences** from the **Options** menu.

2. Check the **Add I/O history to event log** option and click **OK**.

3. Exit L&TT and then restart it.

4. Replicate the problem encountered.

5. Using Windows Explorer, navigate to the `logs` directory in the L&TT installation directory. Locate the *Eventlog.ltt* file.

6. Attach the *Eventlog.ltt* file to an e-mail and send it to the L&TT team for diagnosis.

7. Return to L&TT and select **Preferences** from the **Options** menu.

8. Uncheck the **Add I/O history to event log** option and click **OK**. This option should not be left enabled because it can potentially use hundreds of megabytes of disk space.

In the log directory you may also see other event log entries such as *EventLog_backup1.ltt*, *EventLog_backup2.ltt*, *EventLog_backup3.ltt*, and so on. The versions of the event log are numbered in historical order.

Because the event log stores a SCSI trace of the interaction between the product and the L&TT software, it can be used as a simple SCSI analyzer. To do this, select the **Add I/O history to event log** option (as described in steps 1 and 2 previously) and make sure that you view the event log at the "factory only" detail level.

In escalations or integration situations, this can sometimes eliminate the need for a SCSI analyzer. All SCSI commands and responses can be found in the event log if the **Add I/O history to event log** option is enabled.

Additional Functionality

7

This chapter describes additional features of the program that are not covered elsewhere in this guide.

- Setting Software Preferences
- Using the Internet Update Functionality
- Using Passwords
- Using the Front Panel Function
- Using the Move Media Function
- Performing Manual Product Identification
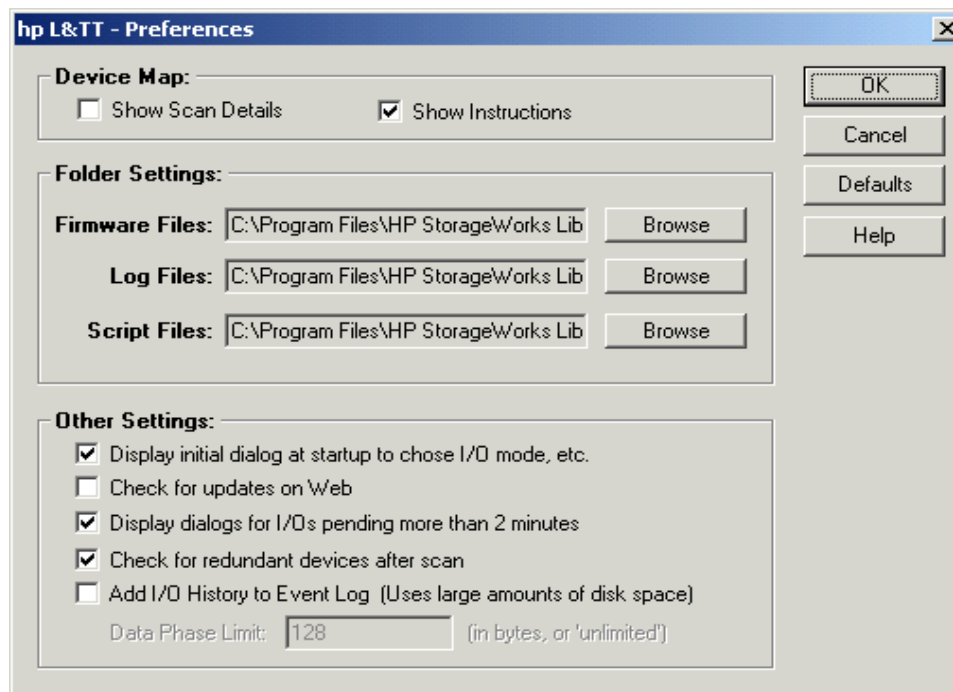- Using the Skipscan Feature
- Using the Quiet Mode Feature

Setting Software Preferences

L&TT has many user-definable preferences that control various elements of the program. To access the L&TT preferences:

GUI

To set the preferences in the Windows version of L&TT:

Select **Preferences** from the **Options** menu. The preferences dialog is displayed as shown in Figure 25.

Figure 25: L&TT Preferences dialog box (default settings shown)

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| CSI |

To set the preferences in the CSI version of L&TT:

From the **Main** screen, use the `preferences` command to display the **Preferences** screen.

```
Main > Preferences >
--------------------------------------------------------------------------------
List of all valid options (Main):
Type the corresponding number to select or deselect each option

   1.      Firmware file path (fwpath) - C:\...\firmware
   2.      Log file path (logpath) - C:\...\logs
   3.      Script file path (scriptpath) - C:\...\
   4. [ ] Add IO History to EventLog (iohistenabled)
   5.      Data Phase Limit for IO History (iohistlimit) - 128
   6. [ ] Current password entered (password) - Not Set
```

Enter Command>
```
-------------------<Enter a blank command for command list>-------------------
```

Figure 26: L&TT preferences dialog box (CSI version)

Available Options

The following list describes the available options. Some options are not available with CSI versions of L&TT.

■   **Show Scan Details (Windows only)**—Enabling this option causes L&TT to show the SCSI bus scanning process in the **Device List** screen when the program is first started. This option is disabled by default.

■   **Show Instructions (Windows only)**—Enabling this option causes L&TT to display instructions in the **Device List** screen. These instructions provide information corresponding to the function displayed in the **Main** screen. More experienced users may want to disable this option.

■   **Firmware File Path**—This is the location where L&TT stores and accesses firmware files on your local system. When using the "Get Firmware From Web" feature, firmware files are automatically downloaded to this directory.

■   **Log File Path**—This is the location where L&TT stores and accesses log files on your local system. The logs that are stored here are the support and event logs.

■ **Script File Path**—This is the location where L&TT stores and accesses device analysis rules files. This is also the default location for SCSI scripts.

Note: For all of the previous three options, the default location of the directory is the L&TT Installation directory.

■ **Display initial dialog at startup to choose I/O mode etc. (Windows only)**—Enabling this option causes the L&TT splash screen to be displayed when the program is started. From the splash screen, you can select the I/O mode and other options.

■ **Check for updates on the Web (Windows only)**—When this option is enabled, L&TT uses an available Internet connection to look for product updates such as firmware upgrades, new device analysis rules, and new versions of L&TT. The software performs this check once every 24 hours. This functionality is only available if you have an Internet connection. For more information, see the "Internet Update Functionality" section later in this chapter.

■ **Display dialogs for I/O pending more than 2 minutes (Windows only)**—When this option is enabled, L&TT displays a status update dialog box during long SCSI operations.

■ **Add I/O history to Event Log**—Enabling this option causes L&TT to log all SCSI commands that are sent or received into a log file.This option requires a large amount of disk space and should only be used when requested by L&TT development personnel to aid in the debugging of a potential issue with L&TT. For more information, see Using the Event Log.

■ **Data Phase Limit for I/O History**—When the **Add I/O History to Event Log** option is enabled, this option limits the amount of data recorded to the log file for each SCSI command to the number of bytes specified. The default is 128 bytes. To specify a data phase limit, enter any positive number in this field. If you do not want to specify a limit, enter unlimited.

■ **Current password entered**—This option lets you enter the factory password. The currently entered password is displayed to the right of the option. If no password has been entered, Not Set is displayed.

GUI Using the Internet Update Functionality

The Windows version of L&TT can automatically notify the user of the following conditions each time the program is started:

- A new version of L&TT has been released
- A new version of firmware is available for a connected storage device
- A new version of device analysis rules is available for a connected storage device

This notification only occurs if the user has the **Check for updates on web** option enabled in the preferences dialog (this option is enabled by default).

If the **Check for updates on web** option is not enabled, select **Get Files from Web** from the **File** menu to manually check for and download updates.

Note: L&TT will only check for updates on the Web once in a 24-hour period.

Using Passwords

A number of tool features are available only when enabled with a password. The password is intended to prevent inexperienced users from accessing functionality that may be particularly harmful to their system if used inproperly. These features include:

- **Firmware Downgrade** lets you downgrade firmware revisions. The device product ID and revision string sequence must match.
- **Override/Update Product ID** allows selection of any firmware file (which matches the same device type) and updating of the product ID string (for devices which support this capability).
- **Manual Product Identification** allows overriding of the tool mapping to associate a specific device (independent of Product ID) to a specific device family supported by the tool. This is most often used when the Product ID (SCSI Inquiry) string is incorrect because it has been changed, corrupted, or the device is running on boot code.
- **Factory Details** lets you select factory details anywhere that it is an option. The most common use is in viewing additional device details in the support ticket.
- **Advanced Scripting** disables signature checking and allows you to select "unsupported" devices and run scripts on them.
- **View Event Log** lets you load (and view) an event log.

There are two types of passwords that are used with L&TT. Temporary passwords enable users to downgrade firmware, override/update product ID, and override device mapping. Support personnel passwords (for internal HP use only) enable all of the above options. To obtain a password, contact your support provider or call center.

Setting Passwords

GUI

To set the password in the Windows version of L&TT:

1. Select **Enable Factory Overrides** from the **Options** menu. The **Factory Password** dialog box is displayed.
2. Enter the password and click **OK**. Assuming the password is valid, you are now able to access the password-protected functions of L&TT.

CSI

To set the password in the CSI version of L&TT:

1. From the **Main** screen, enter the `preferences` command. The **Preferences** screen is displayed.

2. Enter the number that corresponds to the password option. L&TT prompts you for the current password.

3. Enter the password. If the password is valid, then L&TT returns you to the **Preferences** screen. You are now able to access the password-protected functions of L&TT.

GUI Using the Front Panel Function

L&TT provides remote control of the front panel of selected library devices. L&TT reads the contents of the front panel at regular intervals and displays the contents of the L&TT window either in graphic or text form. In addition, L&TT displays a representation of the library's front panel buttons. Clicking a button simulates the user pressing the corresponding button on the library's front panel.

To access this functionality, select the library in the device list and click **Frontpanel** on the main toolbar. The **Front Panel** screen is displayed as shown in Figure 27.
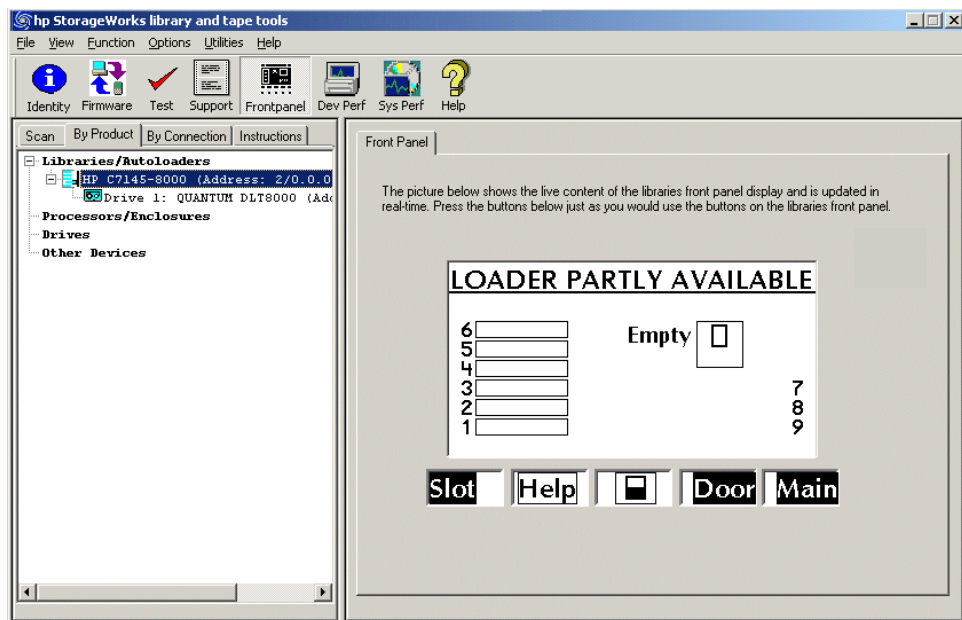
Figure 27: Front panel screen

Using the *Move Media* Function

Most supported libraries and autoloaders support a set of commands for moving media from one location to another within the device. Whenever possible, L&TT takes advantage of this functionality to provide a convenient way to move media within a library or autoloader. This functionality is supported in both the GUI and CSI versions of L&TT.

GUI

With the Windows version of L&TT, the Move Media functionality is incorporated into the **Front Panel** screen. To access this functionality:

1. Select a supported library or autoloader from the device list and click **Frontpanel** on the main toolbar (the **Frontpanel** button is grayed out if both the Move Media and Front Panel functions are not supported for the selected device).

2. On the **Front Panel** screen, click the **Move Media** tab (this tab is not available if the Move Media function is not supported for the selected device). The **Move Media** screen is displayed.
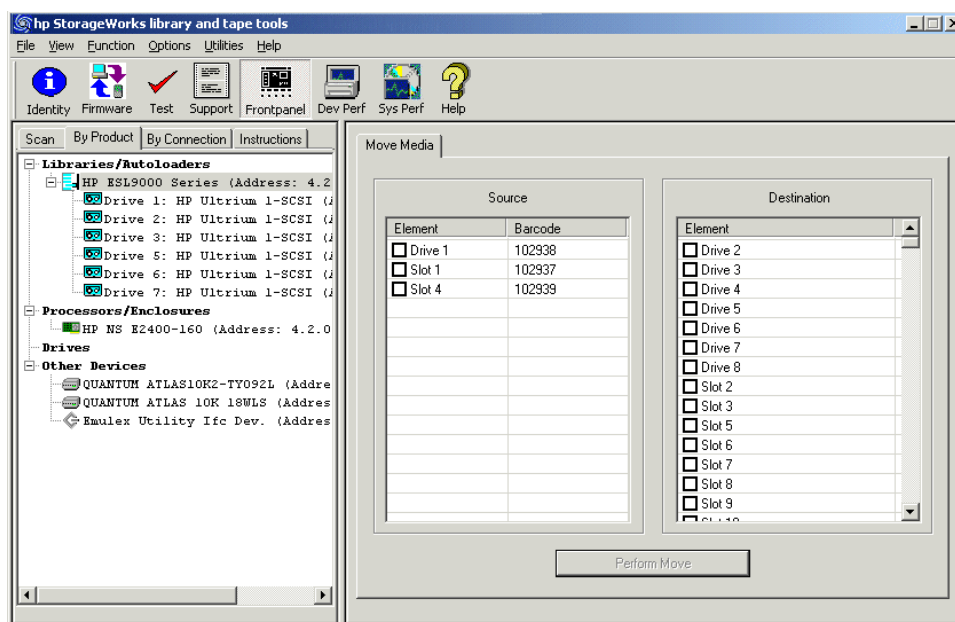
Figure 28: Move Media screen

The **Move Media** screen is divided into two sections showing all available source and destination drives, slots, and mailslots. To move media from one location to another, selected the desired source and destination locations and click **Perform Move**.

Note: Only one item can be moved at a time, so it is not possible to select multiple source or destination locations. The **Perform Move** button is grayed out until a valid source and destination have been selected.

CSI

With the CSI version of L&TT, from the **Device Information** screen for a supported library or autoloader, use the movemedia command to access the **Move Media** screen. This screen is identical to the Cartridge Inventory screen accessed with the inventory command with the exception of the screen name shown in the top line. Use the standard keyboard commands (**Ctrl+U**, **Ctrl+D**) to scroll through the list. To perform the move, use the move command.

```
move <source> <destination>
```

The values used for *<source>* and *<destination>* are a combination of the letter s for slot, d for drive, or m for mailslot, and the number of the device. Two examples are given to illustrate this.

■   Example 1

```
Main > Identity > Move Media >
-------------------------------------------------------------------------------
Location    Status   Barcode
---------   ------   -------
Drive 1     Full     102938
Drive 2     Empty
Drive 3     Empty
Drive 4     Empty
Drive 5     Empty
Drive 6     Empty
Drive 7     Empty
Drive 8     Empty
Slot 1      Full     102937
Slot 2      Empty
Slot 3      Empty
Slot 4      Full     102939
Slot 5      Empty
Slot 6      Empty
Slot 7      Empty
Slot 8      Empty
Slot 9      Empty
Slot 10     Empty
Enter Command>
--------------<Enter a blank command for command list>-------------   1/  18
```

Figure 29: Move Media screen - example 1a

In the example shown in Figure 29, to move media from Slot 4 to Slot 3, enter the
following command:

```
move s4 s3
```

The following screen results:

```
Main > Identity > Move Media >
-------------------------------------------------------------------------------
Location    Status   Barcode
---------   ------   -------
Drive 1     Full     102938
Drive 2     Empty
Drive 3     Empty
Drive 4     Empty
Drive 5     Empty
Drive 6     Empty
Drive 7     Empty
Drive 8     Empty
Slot 1      Full     102937
Slot 2      Empty
Slot 3      Full     102939
Slot 4      Empty
Slot 5      Empty
Slot 6      Empty
Slot 7      Empty
Slot 8      Empty
Slot 9      Empty
Slot 10     Empty
Enter Command>_
--------------<Enter a blank command for command list>-------------   1/  18
```

Figure 30: Move Media screen - example 1b

■   Example 2

```
Main > Identity > Move Media >
-----------------------------------------------------------------------------
Location     Status  Barcode
---------    ------  -------
Drive 1      Empty
Drive 2      Empty
Drive 3      Empty
Drive 4      Empty
Drive 5      Empty
Drive 6      Empty
Drive 7      Empty
Drive 8      Empty
Slot 1       Full    102937
Slot 2       Empty
Slot 3       Full    102939
Slot 4       Empty
Slot 5       Empty
Slot 6       Empty
Slot 7       Empty
Slot 8       Empty
Slot 9       Empty
Slot 10      Empty
Enter Command>
---------------<Enter a blank command for command list>-------------  1/  18
CTRL-U = pgup, CTRL-D = pgdn
```

Figure 31: Move Media screen - example 2a

In the example shown in Figure 31, to move media from Drive 1 to Mailslot 3, enter the following command:

```
move d1 m3
```

The following screen results:

```
Main > Identity > Move Media >
-----------------------------------------------------------------------------
Slot 314     Empty
Slot 315     Empty
Slot 316     Empty
Slot 317     Empty
Slot 318     Empty
Slot 319     Empty
Slot 320     Empty
Slot 321     Empty
Slot 322     Empty
Mailslot 1   Empty
Mailslot 2   Empty
Mailslot 3   Full    n/a
Mailslot 4   Empty
Mailslot 5   Empty
Mailslot 6   Empty
Mailslot 7   Empty
Mailslot 8   Empty


Enter Command>
---------------<Enter a blank command for command list>-------------  18/  18
CTRL-U = pgup, CTRL-D = pgdn
```

Figure 32: Move Media screen - example 2b

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Possible Move Media Error Situations

The following errors may be encountered when attempting to move media through L&TT:

Note: These errors are less common with the Windows version of L&TT because the user interface reduces the number of possible error situations.

---

1. The source is empty.
2. The destination is full.
3. The picker is full with some other media.
4. The source and destination are the same.
5. Invalid arguments were provided (for example, the slot number is too high or no mail slots on the system).
6. Slot to slot is not supported with this device (you must move slot to drive or drive to slot).
7. The command was acceptable, but there was a SCSI error performing the move. L&TT provides the SCSI error message along with the sense data.

Performing Manual Product Identification

This feature (which requires a password) allows an arbitrary device to be mapped as a specific device family within L&TT. This feature is most commonly used when the product ID (SCSI inquiry) string does not match the string expected by L&TT. The string may have been changed or corrupted, or the product is operating in "boot code" mode.

To manually identify a device:

1. Select a product in the device list.

2. Select **Manual Product Identification** from the **Function** menu.

3. Choose the product family that best matches the selected device.

Note: For L&TT versions prior to 2.7 SR2a, manual product identification (previously called override mapping) was performed by right-clicking the device in the device list and choosing the appropriate product family.

Select the product family that best matches the device. The choices are:

- DDS Drive
- DDS Autoloader
- Ultrium Drive
- DLT/SDLT/DLT1 Drive
- DLT/Ultrium Library
- 1/8 DLT Autoloader
- 1/8 Ultrium Autoloader
- AIT Drive
- AIT Library
- AIT Autoloader
- ESL Library
- MSL Library
- TL89x Library
- MO Drive
- MO Library

- STK 9840 Drive
- STK Library
- SCSI-FC Bridge
- 4Runner Bridge
- Interface Manager

When manual product identification is enabled, L&TT automatically operates in a restricted mode. In this mode, the firmware update options are pre-selected to enable selection of firmware for any product ID and also set the "update product ID" option. To update the product ID, select the proper firmware file and click the **Start Update** button.

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Using the Skipscan Feature

GUI

When this feature is enabled, L&TT scans only for the device that you specify. The Skipscan feature must be enabled using the command line argument -o skipscan. Enabling Skipscan displays a dialog box when L&TT opens. Enter the hardware address of the device for which you want to scan. If the device is found, L&TT displays the device in the device list. If the device is not found, the dialog box is displayed again, allowing you to re-enter the hardware address or cancel out of the dialog box.

To enable the skipscan feature:

1. From a command prompt, launch L&TT using the -o skipscan argument. To launch the Windows version of L&TT with the skipscan feature, click **Start > Run** and enter the following into the **Run** dialog box:

   ```
   "C:\Program Files\HP StorageWorks Library Tape and
   Tools\HP_LTT.exe" -o skipscan
   ```

   When this feature is specified, the following dialog box is displayed when L&TT opens:
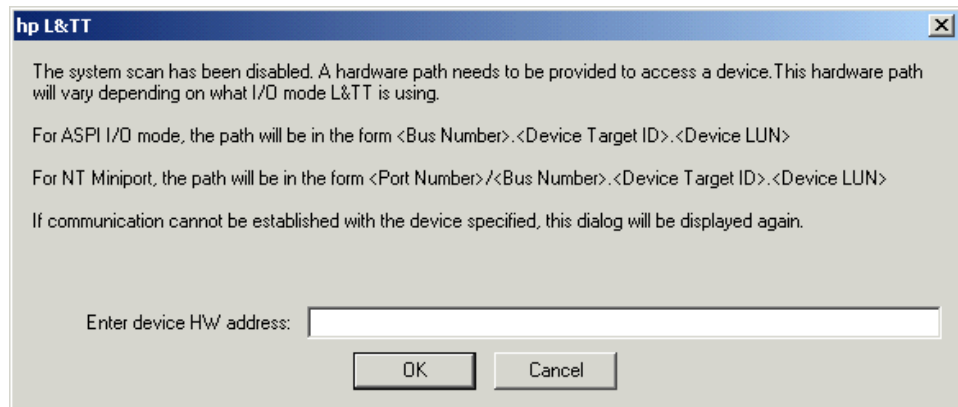
Figure 33: Skipscan dialog box

2. Enter the hardware address of the device you want to scan for in the **Skipscan** dialog box.

   - For ASPI I/O mode, the path will be in the form *<Bus Number>.<Device Target ID>.<Device LUN>*

   - For NT Miniport, the path will be in the form *<Port Number>/<Bus Number>.<Device Target ID>.<Device LUN>*

CSI   The skipscan feature is also available with the CSI versions of L&TT:

1. Launch L&TT as you normally would, but add the `-o skipscan` argument as follows:

   ■ For HP-UX, Tru64, and Linux, log on as root and execute the following commands:

   ```
   cd /opt/ltt
   ./hp_ltt -o skipscan
   ```

   ■ For Novell NetWare, from the server console, execute the following command:

   ```
   hp_ltt\hp_ltt -o skipscan
   ```

2. Enter the hardware address of the device you want to scan for at the prompt.

   ■ For ASPI I/O mode, the path will be in the form *<Bus Number>.<Device Target ID>.<Device LUN>*

   ■ For NT Miniport, the path will be in the form *<Port Number>/<Bus Number>.<Device Target ID>.<Device LUN>*

Using the Quiet Mode Feature

When L&TT is run in quiet mode, warning and error dialog boxes are not displayed, depending on the quiet mode argument that you specify. Quiet mode has two possible arguments:

■ **Warning**—When the warning argument is specified, L&TT does not display any warning dialogs. L&TT assumes a **Yes** response to all warning dialogs and proceeds with execution.

■ **Error**—When the error argument is specified, L&TT does not display warning or error dialogs. L&TT assumes a **Yes** response to all warning and error dialogs and proceeds with execution.

> **Caution:** Quiet mode makes using L&TT more convenient by suppressing warning, error, and confirmation dialogs. However, these same warning, error, and confirmation dialog are intended to provide an extra level of security to prevent you from accidentally doing something that you did not intend to do. Using quiet mode sacrifices this extra level of security for convenience. HP does not recommend using quiet mode unless you are thoroughly familiar and experienced with L&TT.

To enable the quiet mode feature launch L&TT from a command prompt using the `quitemode=[error|warning]` argument.

■ To launch the Windows version of L&TT with quiet mode enabled, click **Start > Run** and enter the following into the **Run** dialog box:

```
"C:\Program Files\HP StorageWorks Library Tape and
Tools\HP_LTT.exe" -o quietmode=[error|warning]
```

■ For HP-UX, Tru64, and Linux, log on as root and execute the following commands:

```
cd /opt/ltt
./hp_ltt -o quietmode=[error|warning]
```

■ For Novell NetWare, from the server console, execute the following command:

```
hp_ltt\hp_ltt -o quietmode=[error|warning]
```

Advanced Installation Topics

8

GUI Windows Installation Topics

Installation Types

There are currently two main Library & Tape Tools InstallShield bundles:

1. **L&TT Installer, English, End-User Type** (only catalogs for current version)—This is an end-user bundle for customers that has been optimized for size, so downloads are quick. This version can be found on the HP customer websites and allows viewing of support tickets from the same tool version only.

2. **L&TT Installer, English, Support Type** (catalogs for current and all legacy versions)—This is an internal HP support personnel bundle. This version contains the catalogs (files that contain all the strings used in the application) for the current and all previously released versions (back to 2.5). Support personnel can read support tickets generated by the current or any previous version of L&TT.

Other Changes to the System

The L&TT installation adds the following keys to the Windows registry:

```
HKEY_LOCAL_MACHINE\Software\Hewlett-Packard\HP Library
& Tape Tools
```

```
HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentV
ersion\Uninstall
```

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Reboot Criteria

A reboot is required only if your system requires ASPI or an upgrade to the currently installed version. On systems that require ASPI, if the installer detects a previously-installed version of ASPI older than v4.57, it will install a more recent version of ASPI requiring a reboot.

On Windows NT and 2000, ASPI is not installed as part of the operating system. If a reboot is unacceptable, do not select the check box for this option in the installation process. If you choose not to install ASPI, then you must use the Miniport driver (Miniport I/O mode) to scan for devices.

Issues may arise, however, when using the Miniport I/O mode with devices that use non-standard OS drivers, or are "claimed" by other applications or the OS. When using the Miniport I/O mode when a device is claimed, it may be necessary to shut down any running backup/storage application services to make the device accessible to L&TT. Alternatively, using the ASPI I/O mode may make the device accessible without requiring any further action.

Running L&TT from a CD-ROM

It is possible to create a version of L&TT that can run directly from a CD-ROM without the need for installation or alteration of registry settings. This feature is most useful on Windows NT and Windows 2000. On other Windows platforms, it requires WINASPI to be installed.

To create a version of L&TT that can run from a CD-ROM drive:

1. Fully install L&TT to your computer. If desired, also install any desired firmware files into the firmware subdirectory.
2. Remove the logs directory from the L&TT install directory.
3. Write the contents of the L&TT install directory to the root directory of the CD-ROM and close the CD-ROM.
4. Put this CD-ROM into any Windows system and run *HP_LTT.exe* from the root directory.

GUI CSI Files Installed on the System

During installation, L&TT files are installed in the following directories:

Table 2: L&TT installation directory locations

Operating System	Directory Location
HP-UX, Linux, and Tru64	`/opt/ltt` (main executable is *hp_ltt*)
Netware	`SYS:System\hpltt` (main executable is *hp_ltt.nlm*)
Windows	`C:\Program Files\HP Library & Tape Tools` (main executable is *hp_ltt.exe*)

Several sub-directories are created under the main installation directory. These sub-directories are as follows:

■ **Catalogs**—This is the location where the message strings for the software are kept. The end-user version has only the catalogs for the latest version of code. With the support personnel installation, catalogs are included for previous versions (back to version 2.5), so support tickets generated by these versions can be viewed.

■ **Firmware**—This is the default directory where firmware files are kept. When L&TT is first installed, this directory is usually empty (unless specific firmware images were bundled - such as the 2.7 SR2 release that includes firmware for DDS3 write recalibration). The name and location of the firmware directory can be changed from **Options** >> **Preferences**.

■ **Logs**—This is the default directory where L&TT saves event logs and support tickets. This directory is also used to store any script-generated files such as baseline files, results files, and so on.

■ **Misc**—This directory is used to hold test data files and L&TT history for the specific devices on the system. These files are used by L&TT itself and not intended for direct viewing.

■ **Scripts**—This directory contains all the device analysis rules, add-on tests, and SCSI script files. For more information, see Chapter 5, "Tests and Utility Functions."

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With Windows installations, in addition to the files installed in the main installation directory, some files are installed outside of the main installation directory. If ASPI installation is selected or required, the following files are added/updated (assuming that the Windows system directory is `C:\WINNT`):

- *C:\WINNT\System\winaspi.dll*
- *C:\WINNT\System32\wnaspi32.dll*
- *C:\WINNT\System32\drivers\aspi32.sys*

CSI Other Changes to the System

The same information that the Windows version of L&TT stores in the Windows registry is stored as a text file for the Unix versions. This text file is located in the following directory:

- HPUX & Tru64:

  `/.lttreg`
- Linux:

  `/root/.lttreg`

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Frequently Asked Questions

9

This chapter addresses several of the most common questions regarding L&TT software.

GUI
CSI

GUI Windows Environment

How do I run L&TT from a CD-ROM?

It is possible to create a version of L&TT that can run directly from a CD-ROM without the need for installation or alteration of registry settings. This feature is most useful on Windows NT and Windows 2000. On other Windows platforms, it requires WINASPI to be installed.

To create a version of L&TT that can run from a CD-ROM drive:

1. Fully install L&TT to your computer. If desired, also install any desired firmware files into the firmware subdirectory.

2. Remove the logs directory from the L&TT install directory.

3. Write the contents of the L&TT install directory to the root directory of the CD-ROM and close the CD-ROM.

4. Put this CD-ROM into any Windows system and run *HP_LTT.exe* from the root directory.

How do I shut down the application in the taskbar?

Under certain circumstances, L&TT may not completely shut down. To completely terminate the application:

1. Press **Ctrl+Alt+Del**.

2. Select **Task Manager.**

3. Click the **Processes** tab.

4. Select the process named *HP_LTT.exe* and click **End Process**.

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Why can't I uninstall L&TT or install a new version?

If you have problems uninstalling L&TT or cannot install a new version after installing or uninstalling a previous version:

⚠ **Caution:** The following procedure involves editing the Windows registry. HP recommends backing up the registry before attempting this procedure.

1. Use Windows Explorer to delete the entire Library & Tape Tools directory from the original location (the default location is *c:\program files*).

2. Do the following to start the registry editor:

   a. Click **Start**.

   b. Click **Run**.

   c. In the **Open** text box, enter regedit or regedit32, depending on which OS you are using.

3. In the registry editor, navigate to the following folder:
   HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Uninstall

4. Locate the following folder:

   {EFD6AEDA-AD95-4A68-862C-FBABA8C3EE4D}

Note: The actual name of the subfolder in Step 4 may differ, depending on the current machine and the current version of L&TT being used.

5. Right-click the folder and click **Delete** from the popup menu to delete the folder.

6. Close the registry editor.

How do I configure e-mail to send support tickets?

To successfully send a support ticket via e-mail directly from L&TT, you must have a MAPI-compliant e-mail client set up for outgoing e-mail. Even if e-mail software (such as Outlook or Outlook Express) is not installed, you can configure a simple e-mail account using the Internet Connection Wizard that comes with Internet Explorer. To access the Internet Connection Wizard:

1. Launch Internet Explorer. If this is the first time to launch Internet Explorer on this machine, the Internet Connection Wizard is displayed automatically. Follow the instructions until you reach the step that asks whether an Internet e-mail account should be set up. Answer **Yes** and skip to Step 5. If this is not the first time to launch Internet Explorer on this machine, proceed with Step 2.

2. Select **Internet Options** from the **Tools** menu.

3. Select the **Connections** tab.

4. Click **Setup** at the top of the dialog to start the Internet Connection Wizard.

5. Enter a display name (this is the "From" name in the e-mail) and click **Next**.

6. Enter the return e-mail address and click **Next**. If there are no e-mail accounts on this system that will be monitored, use your regular e-mail address at which you can be contacted by the recipient of the support ticket.

7. Enter **bogus** as the address for the incoming mail server.

8. In the SMTP mail server field, enter the address of any SMTP mail server within the firewall of your organization that accepts SMTP send requests and click **Next**. If you do not know which address to use, contact your local system administator or check the mail account settings on your regular e-mail account.

9. If your SMTP server requires a login to send e-mail (most sites only require a login for incoming mail), you must provide proper account information. Otherwise, you can enter **bogus** in both fields. Click **Next**.

Your e-mail is now configured for outgoing mail delivery.

Does L&TT use any system resources in the background?

L&TT is an application, not a service. No part of the application uses any system resources unless the application is manually launched by the user.

I am using an authenticated proxy at my site. How do I configure L&TT to connect to the HP website to download firmware updates?

L&TT uses the same connection properties as Internet Explorer. If you are unable to download from L&TT, you can manually download the latest version of the firmware from the ftp site and place it in the *firmware* directory found in the L&TT program directory.

You can access the L&TT firmware ftp site at:

ftp://ftp.hp.com/pub/information_storage/software/ltt/firmware

The firmware files are named using the following convention:

LTT_*<product ID>_<firmware version>*.frm

For example:

LTT_A5617A_0200.frm

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CSI CSI Environment

How do I set the password?

With a few exceptions, you may at any time enter the `options` command to display the **Options** dialog. The password may be set from this dialog.

Notable exclusions:

■ You may not enter the **Options** dialog when you are already in the **Options** dialog.

■ You may not enter the **Options** dialog when you are past the first screen in either the **Firmware** dialog or the **Test** dialog.

For instructions on setting the password, see Setting Passwords.

Why does my display not show any text or only a single line of text on my HP-UX system?

Display problems can happen for two reasons:

■ If TERM, COLS, and ROWS are set incorrectly there can be problems. Execute the following command:

`/opt/ltt/hp_ltt -o displaytest`

Follow the prompts to let L&TT analyze your settings.

■ If the patch level of the host machine is too low, curses may not function properly (10.20 systems only). Be sure to apply patch B6378DA or higher.

Why doesn't L&TT for HP-UX "see" some of my devices?

Several things can prevent L&TT from seeing a device in HP-UX:

- If a device shows up in an I/O scan as "NO_HW," this means that the device was previously visible to the system, but currently is not. This could be because the device was unplugged from the SCSI bus or powered down.

- L&TT does not support the NIO bus type. If your system has an HSC or PCI bus, connect your device to that bus. If your system does not have an HSC or PCI bus, unfortunately, L&TT will not work for you.

- The device is connected to an unsupported HBA. Connect the device to an HBA with a supported driver. L&TT supports HBAs with the following drivers:

  — c720

  — c8xx

  — fcpdev

  — fcpmux

- If a device shows up in the I/O scan as "unclaimed," you may have to install or enable the tape driver kernel module using the SAM tool.

Why doesn't L&TT for Tru64 "see" some of my devices?

Whenever you connect or remove a device, you must reconfigure the CAM and hardware manager layers. Furthermore, Tru64 does not support hot swapping of SCSI devices. To reconfigure the CAM and hardware manager layers:

1. Close L&TT.

2. Use the following command to check for stale devices:

    `/sbin/hwmgr show scsi -full | grep stale`

3. Remove any stale devices. If you are not sure whether a device is stale or not, remove it anyway. Devices can be rediscovered later. Use the following command to remove a device:

    `/sbin/hwmgr -delete scsi -did <SCSI ID>`

4. Rescan the SCSI bus.

    `/sbin/hwmgr scan scsi`

5. Rescan the CAM layer.

    `/sbin/scu scan edt`

6. Run the following commands to verify the SCSI devices:

    `/sbin/hwmgr show scsi`

    `/sbin/scu show edt`

7. Restart L&TT.

Why doesn't L&TT for Linux "see" some of my devices?

To detect a surrogate SCSI device, you must configure the *modules.conf* file for the new device you have connected. After modifying this file, reboot the computer so that the new device is recognized by the *scsi/sg* layer. Linux does not support hot swapping of SCSI devices. To reconfigure the *modules.conf* file:

1. Login as root.

2. Edit the following file:

    `vi /etc/modules.conf`

3. Add the following line as appropriate:

    `add options scsi_mod max_scsi_luns=128`

4. Reboot the computer.

How do I disconnect a SCSI device in Tru64?

1. Locate the SCSI device in hardware manager:

   ```
   /sbin/hwmgr -show scsi
   ```

2. Use the following command to delete the SCSI device.

   ```
   /sbin/hwmgr -del scsi -did <SCSI ID>
   ```

3. Disconnect the device.

4. Make sure that you have removed the corresponding SCSI cable from the HBA.

How do I connect/disconnect a SCSI device in Linux without rebooting?

■ To add a new device, connect the device and run the following command:

   ```
   echo "scsi add-single-device <hostid> <busid> <targetid>
   <lunid>" >/proc/scsi/scsi
   ```

■ To remove a device, run the following command and disconnect the device.

   ```
   echo "scsi remove-single-device <hostid> <busid> <targetid>
   <lunid>" >/proc/scsi/scsi
   ```

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Hardware Considerations

10

This chapter covers additional, hardware-specific information that is not covered elsewhere in this guide. The chapter is divided into two sections: one for drives and one for autoloaders. The information presented in this chapter is not intended to provide details on every piece of hardware that can be used with HP StorageWorks Library and Tape Tools. Rather, it presents well-established information and known issues for general classes of the most common hardware. As more information is made available, this chapter will be expanded and updated in subsequent releases of this user guide.

Using Device Analysis Rules

When you execute a Device Analysis test on a device, the test uses information provided in the appropriate rules file to analyze the device for any known issues or conditions. Using the Device Analysis test can often pinpoint the source of hardware problems, allowing remedial action to be taken in the field so that hardware is not unnecessarily returned for inspection and/or repair. These rules are divided into four main categories:

- **A rules** (avoidable returns)
- **U rules** (unavoidable returns)
- **X rules** (unknown)
- **I rules** (information rules)

Drive Information

This section defines AUX and information rules for drives.

DDS Drive Rules (DDSDrv.rul)

Note: These descriptions apply to the DDS Drive rules released with LTT 2.7 Sr2 or later.

AUX Rules

These rules check the contents of the Fault EEPROM log. An extensive examination of repaired drive fault logs has identified certain patterns and sequences of fault codes that can indicate whether a drive should be returned for repair or alternatively that this drive can remain in service. These are classified as (A)voidable returns, (U)navoidable returns, and Unknown (X). This rule reads and classifies the contents of the Fault EEPROM log into these categories and offers the user advice on appropriate action to take.

These rules check the drive fault log and give the user advice. This can aid the user/agent to make a better root cause diagnosis of a customer problem and reduce avoidable returns.

- **AUX A1 (avoidable rule 1)**—This rule checks to see if any errors are logged in the drive. If the error log is empty, indicating that the drive has not experienced any problems, then this rule is activated. Because this indicates no errors, nothing is displayed.

- **AUX A2 (avoidable rule 2)**—This rule looks at the most recent error logged and the next most recent error logged. If these two errors indicate that a successful cleaning operation was the most recent error event, an AUX A2 is logged. If no subsequent errors are found, one of the following AUX codes is displayed:

  — **FD**—An expired cleaning cartridge has been inserted. The following message is displayed:

    ```
    Non Critical (AUX: A2_FD) warnings detected.
    Your cleaning cartridge appears to have expired.
    To maintain drive operation, please obtain a new
    cleaning cartridge.
    ```

- — **F4**—A cleaning sequence has occurred. The user has inserted a cleaning cartridge. The following message is displayed:

  ```
  Please clean the drive 5 times in succession.
  This should help solve your problem.
  ```

- — **Other**—The following message is displayed:

  ```
  Non Critical (AUX: A2_FD) warnings detected.
  ```

  ```
  We could not find any errors; you are though
  strongly advised to update the drive firmware as
  this may help the problem.
  ```

- ■ **AUX A3 (avoidable rule 3)**—If the last error entered in the fault log is an F4 (the drive has been cleaned), this rule is triggered and the following message is displayed:

  ```
  Non critical (AUX: A3) warnings detected.
  ```

  ```
  There are a number of non-critical warnings
  stored in the drive history log, these do not
  indicate a problem with the drive. The error logs
  indicate that this drive has been cleaned in the
  past.
  ```

  ```
  Please clean the drive 5 times in succession.
  This should help solve your problem.
  ```

- ■ **AUX A4 (avoidable rule 4)**—If the last error code entered in the fault logs is an FD (expired cleaning cartridge inserted), this rule is triggered and the following message is displayed:

  ```
  Non critical (AUX: A4) warnings detected.
  ```

  ```
  Please clean the drive 5 times in succession.
  This should help solve your problem.
  ```

  ```
  Your cleaning cartridge appears to have expired.
  To maintain drive operation, please obtain a new
  cleaning cartridge.
  ```

- ■ **AUX A5 (avoidable rule 5)**—This checks the fault log for the following errors:

- — **8x**—All read/write error codes

- — **9x**—More read/write error codes

- — **24**—Buffer firmware does not know the logical tape position. Indicates a media problem

— **CD**—The target position has been missed; the position controller has gone past the desired position without achieving its objective. Indicates a media problem

— **E7**—Unable to find the target position on tape. Indicates a media problem

— **EE**—Failed to measure tracking calculation. There were not enough samples to calibrate time-tracking properly. Indicates a media problem

If any of the above errors are found in the log, the following message is displayed:

```
Non critical (AUX: A5) warnings detected.
```

```
Please clean the drive 5 times in succession. This
should help solve your problem.
```

```
There are a number of non-critical warnings stored
in the drive history log, these do not indicate a
problem with the drive.
```

■ **AUX A6 (avoidable rule 6)**—This checks the fault log for one occurrence of the following errors:

— **11**—The supply reel is stuck

— **13**—The take-up reel is stuck

— **A6**—No "frame ready" signal, implying that the drum is not spinning

— **C0**—A group has been found that does not comply with the DDS format

— **C1**—DDS format violation in EOD frames

— **C2**—Reference or system area DDS format violation

— **E4**—The tape is not in valid DDS format. Additional sense of 3002h (cannot read media, incompatible format) is reported

— **EA**—Media problem detected

— **F2**—Invalid tape length

— **F3**—An unsupported tape has been inserted

— **F4**—A cleaning sequence has occurred. Only logged in EEPROM for firmware earlier than version V10

— **F8**—Invalid tape format

— **F9**—No tape is present when one was expected

— **FA**—Device command aborted

— **FB**—The firmware tape is write-protected

— **FC**—A firmware upload tape has been detected

— **FD**—An expired cleaning cartridge has been inserted

If one occurrence of the above fault is found then the following message is displayed to the user:

```
Media problems detected. (AUX: A6).
```

```
There are a number of media related warnings stored
in the drive history log, you are strongly advised
to replace your media.
```

- **AUX A7 (avoidable rule 7)**—This checks the fault log for a last recorded error being one of the following:
  - **C0**—A group has been found that does not comply with the DDS format
  - **C1**—DDS format violation in EOD frames
  - **C2**—Reference or system area DDS format violation
  - **E4**—The tape is not in valid DDS format. Additional sense of 3002h (cannot read media, incompatible format) is reported
  - **EA**—Media problem detected
  - **F2**—Invalid tape length
  - **F3**—An unsupported tape has been inserted
  - **F8**—Invalid tape format
  - **11**—The supply reel is stuck
  - **13**—The take-up reel is stuck

If the one of the above errors is found to be the last recorded error in the fault log then the following message is displayed:

```
Media problems detected. (AUX: A7).
```

```
There are a number of media related warnings stored
in the drive history log, you are strongly advised
to replace your media.
```

- **AUX A8 (avoidable rule 8)**—Checks the fault log for any occurrence of the following errors:
  - **09**—A B-heads period has been produced that does not correspond to the present drum speed.
  - **41**—The DC read transfer is shorter than indicated in its header.
  - **54**—Defect in the DC task firmware. The drive will only respond to a `LOG SENSE` command to allow access to the trace logs.

If any of the errors above are logged in the drive then the following message will be displayed to the user:

```
Firmware upgrade required. (AUX: A8).
```

```
There is a firmware related error stored in the
drive history log, you are strongly advised to
update the drive's firmware.
```

- **AUX A9 (avoidable rule 9**)—Verifies that the drive has the most recent firmware revision. If the firmware is not up to date, the following message is displayed:

```
Firmware upgrade required. (AUX: A9).
```

```
Your drive's firmware is out of date
```

- **AUX A11 (avoidable rule 11)**—Verifies that the error log is not full (less than 30 entries). If the error log has 30 entries, then the following message is displayed:

```
Error logs full. (AUX: A11). Please update the
firmware in your drive with the latest version.
Please insert a cleaning cartridge 5 times in a row
to ensure that the drive heads are clean.  If your
drive is still failing, please re-run the device
analysis test.
```

- **AUX U1 (unavoidable rule 1)**—Checks the fault log for any occurrence of the following errors:

  — **01**—12V supply fault. The voltage is too low.

  — **03**—Mode sensor fault: the sensor has identified a mechanism mode (stop, eject or unthread) that is unexpected.

  — **19**—Servo ROM has a checksum failure.

  — **DE**—The buffer controller has detected underflow.

  — **DF**—The buffer controller has detected overflow.

  — **E0**—The buffer controller has detected a parity error.

If any occurrence of the above is discovered in the fault log then the following message is displayed:

```
(AUX: U1).
```

```
Return drive to HP.  Fatal error seen.
```

■ **AUX X1 (unknown rule 1)**—Checks the fault log to determine if the five most recent errors include any of the following:

— **8x**—All read/write error codes

— **9x**—More read/write error codes

— **24**—Buffer firmware does not know the logical tape position. Indicates a media problem

— **CD**—The target position has been missed; the position controller has gone past the desired position without achieving its objective. Indicates a media problem

— **E7**—Unable to find the target position on tape. Indicates a media problem

— **EE**—Failed to measure tracking calculation. There were not enough samples to calibrate time-tracking properly. Indicates a media problem

— **F4**—A cleaning sequence has occurred. Only logged in EEPROM for firmware earlier than version V10

If this sequence of errors is found, the following message is displayed:

```
(AUX: X1). Your drive may require re-calibration.
If you are still having problems please contact
support for details on how to recalibrate your
drive."
```

■ **AUX X2 (unknown rule 2)**—There are only cleaning errors or other errors not covered previously. The following message is displayed:

```
(AUX: X2). Your drive logs do not indicate that
there are any serious problems with your drive.
Please insert a cleaning cartridge 5 times in a row
to ensure that the drive heads are clean.  If you
are still having problems please contact support.
```

Information Rules

These rules are run when L&TT discovers a DDS tape drive and the user selects **Device analysis** on that device. L&TT extracts life and error data from the selected device and interprets the stored information.

Note: The information rules are based on the internal EEPROM log of the drive. Sometimes this log can be corrupted, as evidenced by the following message displayed under the **Device Analysis** section of the support ticket:

```
Serial EEPROM Data is not accessible on this drive.
```

If the internal EEPROM log is corrupted, no rules are run or displayed in the **Device Analysis** part of the support ticket, or under the **Test** tab. If corruption is suspected, information under the **TapeTools1 Compatibility** section, and any other data that is taken from the EEPROM, cannot be trusted. A drive can continue to operate successfully with a corrupt serial EEPROM, but some information logs will not be valid.

■ **Information Rules 1&2: Duty cycle**—The definition of duty cycle assumes that the drive is powered on all the time. For example, if the user switches the drive on to do backups and then switches it off again, the following definitions become inaccurate. Duty Cycle is an expression of the time the drive is pulling tape (reading or writing) against the time the drive is not pulling tape.

This rule retrieves life history data from the Serial EEPROM memory and calculates the duty cycle by comparing the tape pulling time to the power on time and expressing the result as a percentage. Exceeding drive design thresholds triggers a warning to reduce the duty cycle of the drive to maintain the reliability of the drive. Use the drive less intensively and within the drive's design limits to prolong the life of the drive. The recommended duty cycle allows for one or two full tapes to be written or read for every 24 hours. The reported duty cycle may be inaccurate if the drive is powered off between backup operations. The first part of the rule checks the integrity of the Serial EEPROM contents as a corrupted EEPROM will report invalid pulling and power hours. The following message is displayed for this rule:

```
Your drive may be exceeding its Duty Cycle
specification…
```

■ **Information Rule 3: Unsupported tapes**—This rule checks for the number of insertions of unsupported tapes. An unsupported tape could, for example, be a DAT audio tape or a DDS4 tape inserted in a DDS3 drive. Use only recommended tape types. The following message is displayed for this rule:

```
You appear to be using tapes not designed for this
drive.
```

- **Information Rule 4: Non-MRS tapes (Media Recognition System)**—This rule checks for the number of insertions of non-MRS tapes. A non-MRS tape does not have the required optical identification marks at the very start of the spool of media. Only audio DAT tapes or very old 60m DDS1 tapes do not have the MRS marks. 60m DDS1 tapes will be treated as write protected in DDS3 drives, and rejected by DDS4 drives. Use only recommended tape types. The following message is displayed for this rule:

```
You appear to be using very old tapes not designed
for this drive.
```

- **Information Rule 5: Cleaning**—This rule verifies that the user is cleaning the tape drive at least once every 20 tape-pulling hours. If the cleaning frequency is less than recommended, the user is advised to clean the drive after every 20 tape-pulling hours. The following message is displayed for this rule:

```
You appear not to be cleaning this drive often
enough
```

- **Information Rule 6: Streaming efficiency**—This rule looks at the number of stream fails reported by the drive. The drive will go into stream fail mode when data is sent from the host at a slower rate than the drive is able to write the data. A common cause of stream failing is a slow or busy host server. The user is offered advice about tuning the host and operating system to maximize performance. The following message is displayed for this rule:

```
Your server does not appear to be streaming data to
the drive.
```

- **Information Rule 7: Media use**—This rule checks the relative number of insertions of each of the supported tape types. A DDS3 drive should use mainly DDS3 tapes, and a DDS4 drive should use mainly DDS4 tapes. Mixing different tape types in the same drive is detrimental to the reliability and performance of the drive. The user is offered advice about using the recommended tapes for that drive. The following message is displayed for this rule:

```
You appear to be using DDS1/2 tapes in a drive
designed for DDS3 tapes…
```

■ **Information Rule 8: DIP switches**—This rule examines the current state of the drive configuration switches. Any deviation from the standard setting is noted. On certain hosts (PC UNIX and other non-WINTEL platforms) it may be entirely appropriate that the switches are set to an alternate setting. The following message is displayed for this rule:

```
You do not appear to have the standard DIP switch
settings. This may be appropriate for…
```

■ **Information Rule 9: Compression ratio (DDS 4 only)**—This rule checks the Log Sense page to retrieve the compression values from the most recent read-write operation. This is informational only, but if the compression ratio is 1:1 it is likely that the user has compression disabled and this may not be appropriate. The following message is displayed for this rule:

```
During the last backup your drive achieved the
following hardware compression…
```

LTO (Ultrium) Drive Rules (LTODrv.rul)

This rules script is run when L&TT discovers an LTO tape drive and the user performs a Device Analysis test on that device. The following rules are performed:

■ Check power-on self test failures

■ EEPROM calibration errors check

■ Fatal reel fault errors check

■ Write unsafe errors check

■ Servo framing errors check

■ Operating temperature errors check

■ Unrecoverable read errors and poor read error-rate test

■ Unrecoverable write errors and poor write error-rate test

■ Host-reported errors check

■ Servo calibration errors check

■ Mechanical sensor errors check

■ Media cartridge memory errors check

■ Write/read operational errors check

■ Head selection timeout errors check

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- Automation interface errors check
- Cleaning tape check
- Firmware revision checking

DLT Drive Rules (DLTDrv.rul)

This device analysis rules script is run when L&TT discovers a DLT tape drive and the user performs a Device Analysis test on that device. HP StorageWorks Library and Tape Tools extracts life and error data from the selected device and interprets the stored information.

- **Information Rule 1: Read error rate**—This information rule retrieves the stored error rate from the last read/write operation and displays it for information purposes. A warning is displayed if the error rate is above the threshold. The following message is displayed:

  ```
  Drive reports xx  corrected read errors

  Drive reports xx corrected write errors
  ```

- **Information Rule 2: Log page 7 checks**—This information rule checks for specific error in the drive 'Log Page 7' which may indicate a serious problem warranting a drive return. The following message is displayed:

  ```
  This drive has logged one or more 'Log Page 7'
  errors, this drive may need exchanging…
  ```

- **Information Rule 3: A400 (Read error log)**—Read Error is a recorded event indicating the tape drive detected a condition in which the drive was not successfully able to read the data from a particular location on the media. This could be due to a bad spot on the media, a failure of the drive to determine the data read from the tape was good due to bad CRC, other indicators used by the drive to insure data integrity, or the data originally written was not written correctly. The following message is displayed:

  ```
  This drive has logged more than 5 'Error events'
  with Error Code A400…
  ```

- **Information Rule 4: A401 (Write error log)**—Write Error is an event in which the tape drive detected a condition that the drive was not successfully able to write data to the media. This could be due to conditions like a bad spot on the media or a failure of the drive to determine the data written was good during the read after write. Multiple Media IDs may indicate the drive while similar media ID may indicate the media. The following message is displayed:

```
This drive has logged more than 5 'Error A401'
events, if you have already tried new...
```

■ **Information Rule 5: A402 (Drive error log)**—This event indicates the drive has detected something out of the ordinary during normal operations. This could be items such as a dropped leader or an error internal to the drive. If this is a hard error, the drive will not be functional for reading, writing, or successfully loading or unloading the media. This event may be a recoverable event indicating something at that time was not correct. Multiple events of this type would be a better indicator that there may be a problem with the drive or the piece of media being used. The following message is displayed:

```
This drive has logged more than 5 'Error A402'
events, if you have already tried new...
```

■ **Information Rule 6: A403 (Loader error log)**—This Event log entry is used by drive loader/Library OEM suppliers in which the library/loader supplier should provide additional details. The following message is displayed:

```
This drive has logged more than 5 'Error A403'
events, there is a Library/Autoloader...
```

■ **Information Rule 7: A404 (Calibration error 1)**—This Event log packets contain 20 long words. The data in the Cal Fail are is critical to determine if the drive failed calibration. If the drive does a write from BOT this failure is no longer important as the calibration information is over written with new data. The Media ID is invalid if the calibration failed. This event can be used to help understand why a drive may be getting multiple cleaning lights and are the cleaning lights all related to calibration errors. A cleaning light will come on if a drive gets a Hard Read or Write Error as well. If it is the same media, replace it or try a write from BOT to see if it will clear. The script checks for the total number of A404 errors logged, and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Error A404'
events, you may have bad media...
```

■ **Information Rule 8: SCSI error ASCQ00 (Calibration error 2)**—Recommend using a cleaning tape or try a different piece of media. If this persists, it may be a drive problem. Look at the other drive logs to understand the failure action. Cleaning light should be on when this is reported. The script checks for the total number of media calibration errors logged and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Media calibration
error' events, you have bad media...
```

- **Information Rule 9: SCSI error ASCQ02 (Bad read heads)**—This rule checks for occurrences of the Additional Sense Code Qualifier, which indicates that the drive is having severe read error rate problems that cleaning tapes have not affected. The probable cause is bad read heads; the drive should be exchanged. The script checks for the total number of ASCQ02 errors logged, and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Failed head
cleaning' events, the drive may need…
```

- **Information Rule 10: SCSI error ASC0C (Bad write heads)**—This rule checks for occurrences of the Additional Sense Code Qualifier, which indicates that the drive is having severe write error rate problems that cleaning tapes have not affected. The probable cause is bad read heads; the drive should be exchanged. The script checks for the total number of ASC0C errors logged and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Failed write'
events, the drive may need exchanging…
```

- **Information Rule 11: SCSI error ASCQ8A (Overheating)**—This rule checks for occurrences of the Additional Sense Code Qualifier, which indicates that the drive is overheating. Verify that all fans are operational. If condition persists, replace the drive. The script checks for the total number of ASCQ8A errors logged, and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Overheating'
events, the enclosure fans may have stopped…
```

- **Information Rule 12: SCSI error ASC47 (SCSI Terminators)**—This rule checks for occurrences of the Additional Sense Code Qualifier, which indicates that the drive is having SCSI problems related to SCSI termination. The script checks for the total number of ASC47 errors logged and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Bad termination'
events, the SCSI bus may not be terminated properly…
```

- **Information Rule 13: BugCheck B810 (Library port comms)**—This rule checks for occurrences of the BugCheck code that indicates that the drive is having library port communications problems—library or drive problems. The script checks for the total number of B810 errors logged and alerts the user with the following message if more than five occurrences are logged:

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```
This drive has logged more than 5 'Error events'
with Error Code B810, check the cabling to the
Library controller…
```

■ **Information Rule 14: BugCheck EE09 (Power supply glitches)**—This rule checks for occurrences of the BugCheck code, which indicates that the drive is experiencing spurious power failure or power supply problems. The script checks for the total number of EE09 errors logged, and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Error events'
with Error Code EE09, check power supply to the
drive…
```

■ **Information Rule 15: BugCheck EE08 (SCSI bus problem)**—This rule checks for occurrences of the BugCheck code, which indicates that the drive is having Watch Dog Timer Expired - SCSI bus problems, host controller problems, or drive electronics problems. The script checks for the total number of EE08 errors logged and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Error events'
with Error Code EE08, check the SCSI cabling…
```

■ **Information Rule 16: BugCheck 8008 (Controller error)**—This rule checks for occurrences of the BugCheck code, which indicates that the drive is having controller electronics problems. The script checks for the total number of 8008 errors logged, and alerts the user with the following message if more than five occurrences are logged:

```
This drive has logged more than 5 'Error events'
with Error Code 8008, please replace this drive…
```

Trace Logs and Error Logs

Some logs for LTO drives are stored in the Device Analysis section. These logs are pulled as soon as a product is selected from the scan window. The logs that are stored in this area are mainly for the use of firmware and debug engineers in the division. To access these logs, double-click the entry and then save to a file.

The logs this provides are as follows:

- Firmware trace logs:
  — Bank 0
  — Bank 1
  — Bank 2
  — Bank 3
  — ARM log (Ultrium 2 only)
- Fault logs:
  — Non Volatile Fault Log (Ultrium 1 only)
  — Volatile Fault Log (Ultrium 1 only)

Autoloader Information

This section defines AUX and information rules for drives.

DDS Autoloader Rules (DDSAL.rul)

These rules are run to check the performance of the autoloader mechanism. Other rules are available that check the actual drive itself (see the Drive Information section earlier in this chapter). Together, these rules completely check the health of a DDS autoloader.

■ **AUX Rule /AL1: Sticky Slots**—The rule checks the mechanism Fault EEPROM log for any stored 49h, 4Fh, 70h, and 84h errors originated from the autoloader. This class of error is stored when the autoloader robotics detect any physical resistance moving tapes in or out of the magazine slots. The robotic motor drivers are monitored for any over current conditions. The advice to the user relates to checking for stickers peeling off the tapes or contamination on the inside of the magazine slots. The following message is displayed:

```
Tapes may be sticking inside the magazine, check for
labels peeling off tapes and clean the…
```

■ **AUX Rule /AL2: Stuck tapes**—The rule checks the mechanism Fault EEPROM log for any stored 78h or A8h errors originated from the autoloader. This class of error is stored when the autoloader robotics detects any physical resistance moving tapes in or out of the mechanism. The robotic motor drivers are monitored for any over current conditions. The advice to the user relates to trying forced eject of the tape and changing the media. The following message is displayed:

```
Tapes are sticking inside the drive, try a forced
eject (hold the eject button down for 5-10 seconds)
and…
```

- **AUX Rule /AL3: Stuck Magazine**—The rule checks the mechanism Fault EEPROM log for any stored 14h errors originated from the autoloader. This class of error is stored when the autoloader robotics detects any physical resistance moving magazines in or out of the mechanism. The robotic motor drivers are monitored for any over current conditions. The advice to the user relates to checking for stickers peeling off the magazine or contamination on the outside of the magazine. The following message is displayed:

```
Magazines are sticking inside the autoloader, check
position of labels is correct or replace the
magazine…
```

- **AUX Rule /AL4: Restricted carousel rotation**—The rule checks the mechanism Fault EEPROM log for any stored errors in the range 20h to 2Eh originated from the autoloader. This class of error is stored when the autoloader robotics detects any physical resistance rotating the magazines within the mechanism. The robotic motor drivers are monitored for any over current conditions. The advice to the user relates to checking for anything resting on top of the rotating carousel that could restrict rotation (if an internal drive). The following message is displayed:

```
Autoloader magazine carousel is not fully rotating,
check that all the tapes are inside the magazine,
if...
```

- **AUX Rule /AL5: Restricted X,Ypicker platform movement**—The rule checks the mechanism Fault EEPROM log for any stored 40h errors originated from the autoloader. This class of error is stored when the autoloader robotics detects any physical resistance moving the platform up or down inside the mechanism. The robotic motor drivers are monitored for any over current conditions. The advice to the user relates to checking for mechanism mounting screws that are longer than the recommended 4mm. Any mounting screws longer than 4mm would interfere with the movement of the platform mechanism. The following message is displayed:

```
Autoloader platform is not fully traveling up and
down, if this is an internally mounted autoloader...
```

Tape Rack 5300 Rules (TR5300.rul)

- **Information Rule 1: PSU health status**—This information rule retrieves the Power Supply status from the enclosure. If PSU 1 reports problems, check the left hand power cord at the rear of the enclosure. If PSU 2 reports problems, check the right hand power cord at the rear of the enclosure. If the power cord is powering the power supply, the green LED should be illuminated. The following message is displayed:

  ```
  Power supply 1 is reporting problems…
  ```

- **Information Rule 2: Fan speed status**—This information rule retrieves the fan status from the enclosure. If a fan is stopped or running slowly, the status will be reported as "Faulty." Check that the fan is seated properly in the enclosure, and that the retaining screws are finger tight. Fan 1 is at the right hand side of the rear of the enclosure, Fan 2 is at the left hand side. The following message is displayed:

  ```
  Fan 1 is reporting problems…
  ```

- **Information Rule 3: Internal temperatures**—This information rule retrieves the internal temperature values. If temperatures exceed the internal threshold set by the enclosure, the rule is triggered. Check that the air inlets to the fan ports are not blocked or restricted by dust. The following message is displayed:

  ```
  The internal temperatures are too high…
  ```

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