



## **Adding the TL895 to the Enterprise Backup Solution**

**TechNote**

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**Adding the TL895 to the Enterprise Backup Solution**

**TechNote**

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# About This Guide

## Symbols in Text

These 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 loss of life.

---



**CAUTION:** Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

---

**IMPORTANT:** Text set off in this manner presents clarifying information or specific instructions.

---

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

## Where to Go for Additional Help

In addition to this guide, the following information sources are available:

- User Documentation
- *Compaq Service Quick Reference Guide*
- Service Training Guides
- Compaq Service Advisories and Bulletins
- Compaq QuickFind
- Compaq Insight Manager
- Compaq Download Facility: Call 1-281-518-1418

## Integrated Management Display

Some Compaq server models include a Compaq Integrated Management Display (IMD), an integrated, 16x4 character display mounted on the front of the server. This display provides easy-to-use menu-driven access to server information, including model number, LCD firmware revision, and POST operations.

## Telephone Numbers

For the name of your nearest Compaq Authorized Reseller:

- In the United States, call 1-800-345-1518
- In Canada, call 1-800-263-5868

For Compaq technical support:

- In the United States and Canada, call 1-800-386-2172
- For Compaq technical support phone numbers outside the United States and Canada, visit the Compaq website at: <http://www.compaq.com>.



# *Chapter 1*

## **Introduction**



**Figure 1-1. The TL895, offering Low cost, High Performance, Reliable Automated Mass Storage for Departmental and Enterprise Management.**

## Overview

According to the Strategic Research, storage requirements are on their steepest ramp ever and the result is that data protection continues to grow in importance. The Novell and Windows NT data centers are taking on a higher level of corporate data responsibilities. The trend for corporations to centralize their servers will continue, while storage requirements become more critical.

The cost-effective, Compaq StorageWorks TL895 DLT Tape Library helps ensure enhanced productivity and data protection across the enterprise. By integrating automated backup, archiving, and Hierarchical Storage Management (HSM) for departmental and enterprise operations, it keeps pace with other storage schemes.

Targeting the secondary storage needs, adding the TL895 to the Enterprise Backup Solution (EBS) product mix provides three primary enhancements:

1. **Increased performance**—The TL895 offers up to seven DLT 35/70 drives for transfer rates above 180 GB/hr for 2:1 compressed data.
2. **Increased capacity**—The TL895 supports up to 7 TB of data assuming 2:1 compression. The TL895 is based on industry leading Digital Linear Tape (DLT) technology, featuring 96 data media slots and four portal slots, allowing customers to retain more data.
3. **Increased Scalability**—The TL895 is available in two to seven drive configurations to match performance and retention needs, allowing lights out operations.

Other TL895 benefits include:

- **Simpler management**—The TL895 simplifies management by offering high performance, capacity, and tape retention in one integrated system. Compaq Insight Manager provides a complete suite of tools to enhance enterprise management.
- **Enhanced cabling system**—The TL895 offers differential SCSI attachments for cabling requirements up to 20 meters from the Fibre Channel Tape Controller (FCTC). Fibre Channel cable connections are available up to 500 meters on 50  $\mu$ m Multimode Fiber.
- **Compact**—With a footprint of 6 sq. ft. (1.8 sq. m), this compact form factor integrates well with standard rack environments, utilizing a front load port and drive access door for normal maintenance and operation.
- **Ease of Use**—The TL895 is designed with an integrated bar-code reader for automated media inventory and offers automatic calibration of the robotic arm with respect to drives, slots and the I/O port. A user-friendly GUI control panel with multi-functional capabilities makes management and troubleshooting easy.
- **Reliability**—The TL895 has extremely high robotic reliability, with greater than two million mean swaps between failure.
- **Increased Investment Protection**—This new architecture ensures investment protection by allowing upgrades from existing direct attached solutions to the EBS.

The TL895 will be used as a component of the EBS to provide a centralized data repository for the backup data. The library will be connected to the Fibre Channel loop via Fibre Channel Tape Controllers (FCTC) and SCSI differential cabling. The FCTCs are connected to a Compaq Fibre Channel Hub 12 through Fibre Channel cables. Multiple Compaq servers will also be

Exec version 8.0 or later for NetWare, running on Compaq servers. Computer Associates ARCserveIT will be qualified in the near future.

Customers implementing backups and restores of large databases, File & Print servers, On-line Transaction Processing (OLTP), and internets/intranets ideally do so at a departmental level. The maximum supported configuration for the TL895, in an EBS environment, will be up to eight homogeneous (Windows NT or NetWare) Intel servers. Future enhancements will address the addition of more servers, different server platforms, and different Fibre Channel fabric structures that will allow greater customer configurations.

## Chapter 2

# Component Summary

Compaq has enhanced the StorageWorks Enterprise Backup Solution (EBS) with support for a larger Tape Library called the Compaq StorageWorks TL895 DLT Tape Library. The TL895 supports up to seven DLT 35/70 tape drives and up to ninety-six data cartridges for a compressed capacity of 6.6 TB. The TL895 is a vast improvement in performance and capacity over the current Compaq DLT 15 Cartridge Library Model 35/70 that has fifteen cartridges. Combining the high-powered TL895 DLT library with the functionality of the Enterprise Backup Solution (EBS) makes data management:

- **Easier** through centralization.
- **Faster** through multiple backup and restores concurrently executing on all seven drives.
- **Scaleable** because two to seven drive configurations allow sizing both speed and volume to meet individual enterprise data zone needs.

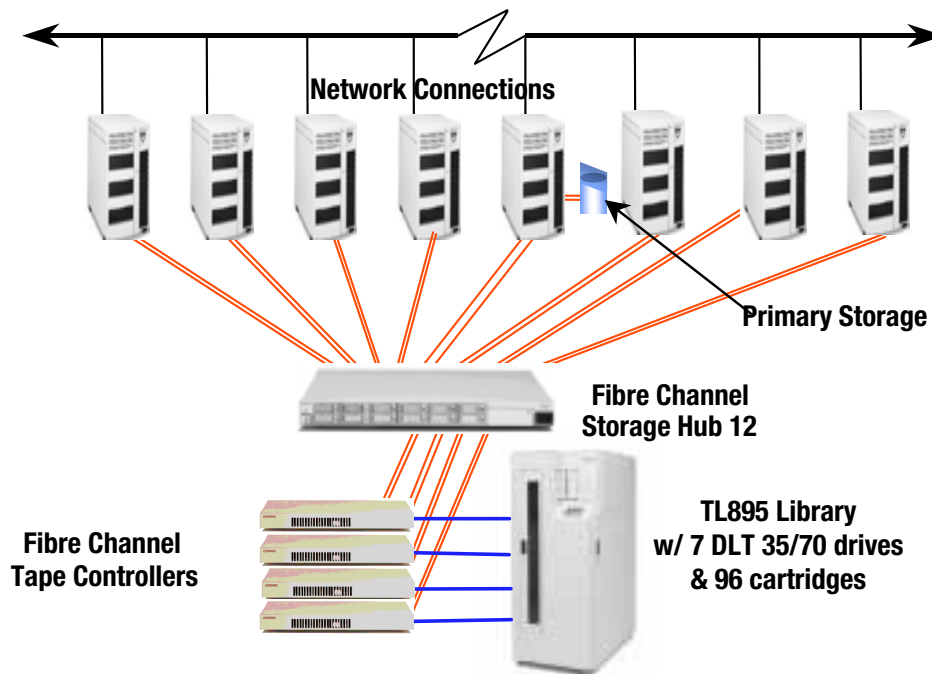
## The Enterprise Backup Solution

After examining a broad range of technologies, Compaq developed the Enterprise Network Storage Architecture (ENSA) to take customers well into the 21<sup>st</sup> century. Working closely with industry-leading independent software vendors (ISVs), Compaq created a fully integrated and seamless solution--the Compaq StorageWorks Enterprise Backup Solution (EBS). This solution consists of the following:

- **An independent Fibre Channel loop** capable of transferring data at 100 Megabytes per second (MB/s).
- **Fibre Channel Host Controllers and a Fibre Channel Storage Hub 12**, linking the server to the Fibre Channel loop.
- **Fibre Channel Tape Controllers (FCTCs)** that convert Fibre Channel Protocol to Differential SCSI protocol for the tape libraries. The FCTC also allows autonomous control of the tape unit.
- **The Compaq StorageWorks TL895 DLT Tape Library** with seven DLT drives and up to 6.6 TB of storage.
- **Storage management software** that takes advantage of the added bandwidth of Fibre

These components are engineered to provide the EBS with efficient backup of massive amounts of data without adversely affecting network utilization. This architecture offers the best method to protect large volumes of data and the component integration supports customer needs for reduced administrative costs, greater manageability, and minimization of network traffic. This new architecture ensures investment protection by allowing upgrades from existing direct SCSI attached solutions to the EBS.

The figure below represents a typical Fibre Channel configuration showing how the Compaq StorageWorks EBS overlays a traditional network.



**Figure 2-1. The Compaq StorageWorks Enterprise Backup Solution, using the Compaq StorageWorks TL895 DLT Library**

For more information on the Enterprise Backup Solution see the tech note *The Compaq StorageWorks Enterprise Backup Solution* (Part Number ECG105/0398) at: <http://www.compaq.com/support/techpubs/technotes/>.

## Fibre Channel Technology

Fibre Channel is a media-independent, industry-standard interconnect and high-performance serial I/O protocol that supports simultaneous transfers of multiple protocols. Its Gigabit speed throws open the door to storage networks of the future. Compaq has partnered with Hewlett Packard to develop the Fibre Channel Host Bus Adapter (HBA), based on the HP Tachyon chip that allows high-performance SCSI protocol transmission through a Fibre Channel medium. Multimode fiber optic cable allows greater transmission distance—500 meters presently and 10 kilometers in the near future—perfect where disaster recovery or centralized storage is a priority.

An integrated set of standards for Fibre Channel is being developed by committees accredited by the American National Standards Institute (ANSI), defining new protocols for flexible information transfer. For additional information on the Fibre Channel protocol, see the Technology Brief *Strategic Direction for Compaq Fibre Channel-Attached Storage* (Part Number **ECG009/1097**) at <http://www.compaq.com/support/techpubs>.

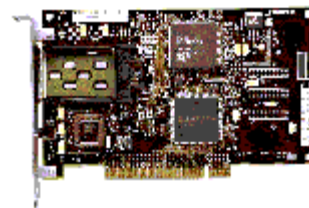
## Fibre Channel Network

Fibre Channel is the next generation in storage technology, combining the reliability and low latency of a serial channel with a network's flexibility and connectivity. The result is a 100 Megabytes per second (MB/s) storage network that supports simultaneous transfer of many different data protocols, including SCSI, IP, and others. Fibre Channel supports an architecture that separates data and communications traffic. The Compaq vision of the Enterprise Network Storage Architecture (ENSA) is one that provides benefits such as: increased system performance, resource consolidation resulting in greater efficiency, manageability, and control, optimized solution management design and integration with recognized industry partners in software development.

For more information on Fibre Channel technology, please refer to the technology brief *Strategic Direction for Compaq Fibre Channel-Attached Storage* (Part Number ECG009.1097) available at: <http://www.compaq.com/support/techpubs/whitepapers>.

## Fibre Channel Host Controller

A Fibre Channel Host Controller is installed in each server and provides the PCI to Fibre Channel interface for connecting the Fibre Channel Storage Hub 12 to the servers.



## Fibre Channel Gigabit Interface Converter (GBIC)



(GBIC) Fibre Channel GBICs are optical-to-electrical converters that enable Fibre Channel cables to easily connect the Host Bus Adapter and Storage Hub 12. These hot-pluggable devices add flexibility and reliability to the EBS.

## Fiber Optic Cables

Compaq fiber optic cables are available in 2, 5, and 15 meter lengths. Fibre Channel cables are thin, flexible and easy to install. Industry Standard SC connectors can be installed by contractors to meet enterprise design requirements. The EBS has been tested to support 500 meter lengths of 50 micron multimode fiber and 300 meter lengths of 62.5 micron multimode fiber.



## Fibre Channel Tape Controller



A Fibre Channel Tape Controller (FCTC) translates the Fibre Channel protocol to a SCSI protocol between the Fibre Channel Network and the Differential SCSI devices. This allows sharing of the tape libraries. The controller handles single-port fiber channel in/single-bus out SCSI. The FCTC is a rack-mountable unit in a 1U form factor. To maximize throughput, Compaq recommends attaching up to two DLT drives per FCTC.

## Fibre Channel Storage Hub 12

A Fibre Channel Storage Hub 12 enables multiple servers and tape devices to connect to a Fibre Channel loop. A single storage hub allows up to 12 GBIC direct Fibre Channel connections for a centralized backup solution. For example, eight servers can be connected to the storage hub, leaving four available ports for connections to Fibre Channel Tape Controllers. The storage hub is a rack-mountable unit with a 1U form factor.



## **The Compaq StorageWorks TL895 Cartridge DLT Tape Library**

One of the most important components of the Enterprise Backup Solution is the tape library. The TL895 is offered with any number of DLT 35/70 drive combinations starting with a minimum of two drives and a maximum of seven. Backup performance can range from 52 GB/hr with two drives to over 180 GB/hr with seven drives. This flexibility allows customers to match their performance requirements and add drives as their performance requirements increase. The maximum capacity of the TL895 is 6.6 TB (2:1 compression) using ninety-six DLT data cartridges.

The TL895 Library automates the tape handling process, freeing valuable administrative resources and providing 24x7 hours of continuous dedicated service.





## Integrated Software Solutions

The backup management software is a crucial component of the EBS that allows the hardware components to work together. Compaq has partnered with Seagate Software Inc. and Computer Associates Inc. to deliver an integrated, centralized, Fibre Channel storage solution for Microsoft Windows NT 4.0 and Novell NetWare 4.11 or later. The EBS enables multiple servers to share libraries.

### Seagate Software Backup Exec



Seagate Software's Backup Exec solution combines the benefits of centralized data storage with a distributed fault-tolerant architecture. Multiple backup servers share common tape storage devices, yet all backup servers operate independently and can initiate backups and restores regardless of the state of other servers. Seagate Software provides many additional features designed to increase fault tolerance and data reliability.

### Computer Associates ARCserveIT

Computer Associates ARCserveIT solution within the Enterprise Backup Solution is designed around a centralized primary server. A primary ARCserveIT server manages and controls all tape device access and coordinates task distribution. This primary server will automatically allocate shared devices to queued backup/restore jobs. In the event a device is unavailable, the primary ARCserveIT server will automatically assign another available device to the queued backup job.



## Chapter 3

# Installation and Configuration

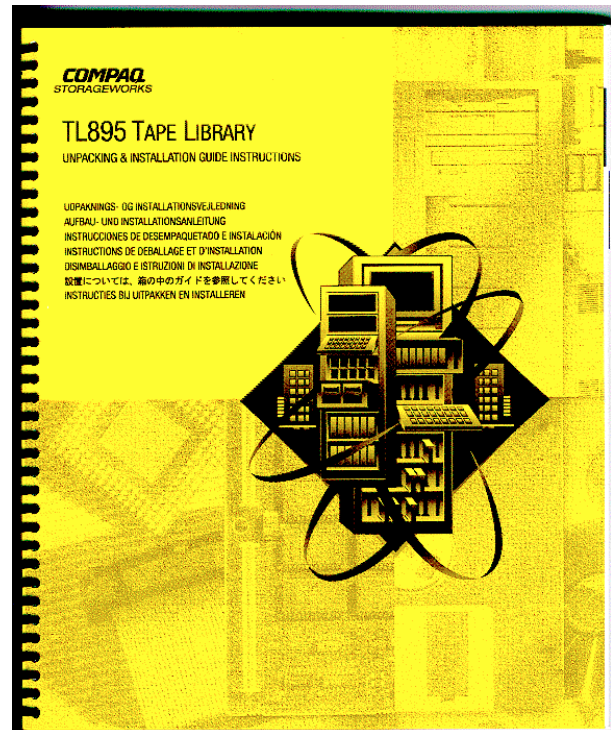
## Unpacking and Installing the TL895 Tape Library

The TL895 Tape Library is a precision instrument that can provide years of dependable service if care and planning are applied during handling and setup. Detailed documentation and instructions are included with each library in multiple languages.

The *TL895 Tape Library Unpacking & Installation Guide Instruction* manual provides step-by-step instructions to:

- Inspect the shipping box
- Choose an installation site
- Unpack and move the library
- Store the packing materials

Careful planning for mechanical, power, and environmental requirements are essential. When the library is successfully installed the library can be powered up for calibration and testing.



## TL895 Tape Library Features

The *TL895 Tape Library User Guide* provides a library overview and detailed features for operations. New users should study the manual before connecting the library to the Enterprise Backup Solution and fully understand these features and operations:

- Load Port Operations
- Control Panel Operations
- Access Doors and Functions
- Robot and Gripper Operations
- Tape Drives and Cartridges
- Configuring the Library
- Run Library Self-Tests



## Compaq Storage Options Documentation Library

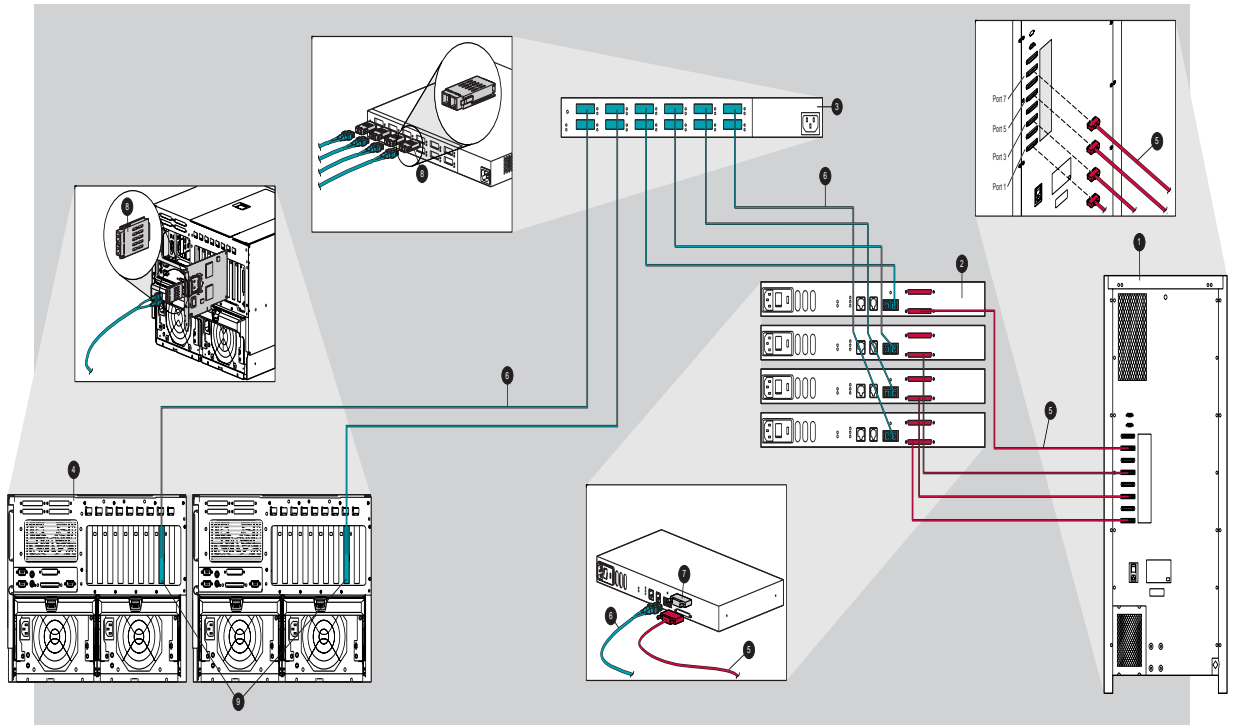
Compaq Product Quality Statements, Important Information advisories, and the CD-based *Compaq Storage Options Documentation Library* are included for more in-depth information with support for the following languages:

- English
- French
- Italian
- German
- Spanish
- Japanese
- Danish
- Netherlands



## Adding a TL895 to the Enterprise Backup Solution

### Connecting the Compaq StorageWorks TL895 Tape Library to the Enterprise Backup Solution



Bubble Number	Component Name
①	TL895 Tape Library
②	Fibre Channel Tape Controllers (FCTC)
③	Storage Hub 12
④	Server
⑤	Differential SCSI Cables
⑥	50 $\mu$ m Multimode Optical Cables
⑦	External differential terminator
⑧	GBIC Modules
⑨	Fibre Channel Host Bus Adapters

## Installation Instructions

Choose a suitable location and unpack the components according to the unpacking instructions included with each component.



**WARNING:** Make sure the power is off to each component and power cords are unplugged before making any of these connections.

**IMPORTANT:** Read the documentation included with each component for additional operating instructions before installing.

### Installing the Fibre Channel Host Bus Adapter into each Server

Install a Fibre Channel Host Adapter in each server to be connected to the Enterprise Backup Solution. Refer to the documentation provided in the Fibre Channel Host Adapter Kit.

### Connecting the TL895 Library to the FCTC

1. Connect the TL895 library to the FCTC(s) using SCSI cables.
2. The other SCSI port on the FCTC must be terminated with the Differential Terminator supplied.

Refer to the table below to perform Steps 1 and 2. The number of cables and Fibre Channel Tape Controller(s) (FCTC) used varies depending upon the number of drives in each library.

**Table 3-1**  
**Hardware Reference Table**

Number of Drives	Number of FCTC(s) & SCSI Cables	Library Port Connectors
2	1	—
3	2	1 and 3
4	2	1 and 3
5	3	1,3, and 5
6	3	1,3,5, and 7
7	4	1,3,5, and 7

**NOTE:** Do not connect to or externally terminate SCSI Ports 2, 4, 6, & 8.

### Connecting the FCTC(s) to the Storage Hub 12

Connect the FCTC(s) to Storage Hub 12 using Fibre Channel cables.

1. Connect one end of a Fibre Channel cable to each FCTC.

## Connecting Each Server to Storage Hub 12

The Storage Hub 12 is connected to the server's Fibre Channel Host Adapter using Fibre Channel cables and GBIC modules.

1. Install one end of a Fibre Channel cable into a GBIC module in Hub 12.
2. Install the other end of the cable into a GBIC module within each server's Host Adapter.

## Applying Power

Make sure the power switch is off to each component.

1. Install each component's power cord and then plug it into the AC power source.
2. Apply power to each component in the following sequence:
  - a. Fibre Channel Storage Hub 12
  - b. TL895 Tape Library
  - c. Fibre Channel Tape Controllers
  - d. Servers

## Upgrade ISV Software

Refer to the specific documentation delivered with any ISV software supporting the EBS and upgrade if necessary.

## Prepare the TL895 for Operation

After the TL895 is installed and connected to the host, perform the procedures listed below.

**Table 3-2**  
**Post Installation Procedures**

Procedure	Information Location
1. Load the library with cartridges	Chapter 4 of the <i>TL895 Tape Library User's Guide</i> , "Tape Drives and Cartridges," or the <i>35/70 DLT Tape Drive Installation Instructions Manual</i> .
2. Define the library power-up state	Chapter 5 of the <i>TL895 Tape Library User's Guide</i> , "Control Panel."
3. Enable/disable the Auto Clean option	
4. Enable/disable the Auto Load option	
5. Set the number of bar code retries	
6. Enable/disable the Auto Drive Unload option	
7. Perform an inventory	

### **Place the Library On-line**

With the library ON and the control panel displaying “System Off-line,” press the Control Panel Standby button to place the library on-line.

## **More Information**

Refer to the *Compaq StorageWorks TL895 Tape Library User Guide* (Part Number **340968-001**) or the *Compaq StorageWorks TL895 Diagnostic Software Program User Guide* (Part Number **340967-001**) for complete instructions on configuring and testing the library.



## Upgrading from Direct Connect to the Enterprise Backup Solution Using the TL895

This section will assist with the migration from a Compaq TL895 Tape Library connected directly to a server to one connected through an enterprise environment with Fibre Channel Tape Controllers (FCTCs).

### Hardware Connections

1. Remove the power cord from the SCSI converter devices located between the server and the TL895 library.
2. Remove each converter unit and the SCSI cables that are attached to the server. Leave the other SCSI cables attached to the TL895 library.
3. Install the required number of Compaq FCTCs to the Storage Hub 12. For TL895 connection procedures, see the Quick Setup Guide called *Connecting the Compaq StorageWorks TL895 Tape Library to the Enterprise Backup Solution* (Part Number 330558-001).

**Table 3-3**  
**Hardware Connection Reference Table**

Number of Drives	Number of FCTC(s) and SCSI Cables	Library Port Connectors
2	1	1
3	2	1 and 3
4	2	1 and 3
5	3	1,3 and 5
6	3	1,3 and 5
7	4	1,3,5 and 7

4. Connect the SCSI cables between the TL895 library and the FCTCs.
5. Install or upgrade the backup software that will be used in the EBS environment.
6. Power off the servers that had the direct connections.

**NOTE: The SCSI Host Bus Adapter (HBA) that was used for the direct connection may remain in place or be removed from the server. However, if the HBA is removed, the system configuration utility, found on the system partition or the SmartStart CD, must be run to ensure proper system recognition.**

7. For instructions on applying power, refer to Step 5 of the Quick Set-up Guide called *Connecting the Compaq StorageWorks TL895 Tape Library to the Enterprise Backup Solution* (Part Number **330558-001**).

For further information, refer to the documentation delivered with the Fibre Channel

## Upgrading from the DLT 15 Cartridge Library Model 35/70 to the TL895

Current Enterprise Backup Solution configurations support the DLT 15 Cartridge Library Model 35/70 or the TL895 Tape Library, **not** both simultaneously. This section assists with the removal of a DLT 15 Cartridge Library Model 35/70 prior to installing a TL895 Tape Library to the EBS. It also provides information on compatibility with previous releases of the TL895.



**WARNING: Before making any changes, make sure power is off to the DLT 15 Cartridge Library Model 35/70 and the power cord is removed. Also turn power off to the Fibre Channel Tape Controller (FCTC).**

---

### Removing a Compaq DLT 15 Cartridge Library Model 35/70 from the EBS

1. Turn off power and remove the power cord from the DLT 15 Cartridge Library Model 35/70. Turn off the FCTC power.
2. To remove the DLT 15 Cartridge Library Model 35/70 from the EBS:
  - If using a new SCSI cable, unplug the SCSI cable from the FCTC.
  - If reusing the existing SCSI cable, unplug the SCSI cable from the DLT 15 Cartridge Library Model 35/70.

**NOTE: A SCSI cable and differential terminator must be used.**

3. Refer to the Quick Setup Guide called *Connecting the Compaq StorageWorks TL895 Tape Library to the Enterprise Backup Solution* (Part Number **330558-001**) to connect a TL895 Tape Library to the EBS.
4. Reboot the primary server to recognize the new device.
5. Consult backup application documentation to configure the new library to the EBS.

## Enterprise Backup Solution Compatibility

The serial numbers indicated below require TL895 revisions.

**Table 3-4  
Upgrade Requirements**

Series Version:	A01 DS-TL895-BA	A01 DS-TL895-H2	B01 DS-TL895-BA	C01 DS-TL895-BA or DS-TL895-H2 <i>EBS Compatible</i>
S/N Start	5J80500006	5J83400001	5J83400001	2G91CBB5T001
S/N End	5J83200010	5J90400005	5J90400005	2G91CBB5X014
Robotic FW Version	N2.20	N2.30	N2.30	N2.31
Robotic FW Upgrade Method	Tapelib Diag. and N2.31	Tapelib Diag. and N2.31	Tapelib Diag. and N2.31	None Required
Tape Library S/N	N/A	N/A	N/A	12 Digit
Upgrade Method	EBS Label	EBS Label	EBS Label	N/A
GUI FW Version	1.2	1.22	1.23	1.23
Upgrade Method	Tapelib Diag. and 1.23	Tapelib Diag. and 1.23	None Required	None Required
Drive FW Version	V55 DGL	V80 CPA-2	V80 CPA-2	V80 CPA-2
Upgrade Method	FUP Tapes	None Required	None Required	None Required

**NOTE:** If your system is a Series A01 or B01, contact your Compaq Services Representative for on-site revision information. Phone support may be accessed by calling 1-800-OKCOMPAQ.

**IMPORTANT:** Only certified service representatives are qualified to implement these system revisions.

## More Information

### Compaq StorageWorks TL895 Tape Library Reference Guide

For detailed information on upgrading your EBS environment by adding the Compaq StorageWorks TL895 Tape Library, see the *Compaq StorageWorks TL895 Tape Library Reference Guide* (Part Number **138244-001**). Included in the upgrade kit, this document explains how to properly operate the TL895 in the Enterprise Backup Solution (EBS) and configure it with the latest drive, robotic, and GUI firmware revisions.

### Compaq recommends visiting the following sites for additional information:

- Websites for TL895 documents and EBS information:
  - On the Compaq Intranet: <http://qicvax.shr.dec.com>
  - <http://www.compaq.com/storageworks/>
- For robotic serial number configuration:

Customer Advisory at: [http://www.compaq.com/support/techpubs/customer\\_advisories](http://www.compaq.com/support/techpubs/customer_advisories)
- Latest drivers, diagnostic tools, documentation and software:
  - <http://www.compaq.com/storageworks/>

To install backup applications from independent software vendors (ISVs), reference their solutions CD.

**NOTE:** SmartStart version 4.22 or later and Storage Management Solutions 3.20 or later support EBS.

## Chapter 4

# Performance and Sizing

The TL895 Tape Library adds scalability for tape retention and performance demands. This powerful tape library is available in models using from two to seven drives, featuring high performance DLT 35/70 drives to fit any lights out enterprise backup solution needs.

Compaq also developed industry leading performance tests that analyze the affects automated tape libraries have on enterprise based lights out backup solutions.

The tech note called *Compaq StorageWorks Enterprise Backup Solution* (Part Number **ECG105/0398**) found at: <http://www.compaq.com/support/techpubs/technotes> contains in-depth details of factors affecting performance (Chapter 4: Performance) and factors to consider in calculating tape retention (Chapter 8: Sizing). This tech note introduced the Backup and Restore formulas that allow easy estimation of performance at varying rates of compression. Benchmark testing and additional calculations of performance impacted by tape changes, controller feed speeds, and backup job type are described and tested.

With the integration of the TL895 Tape Library into the Compaq StorageWorks Enterprise Backup Solution, new performance levels exceeding 180 Gigabytes per hour can now be reached.

The enhanced Compaq StorageWorks Backup Sizing Tool allows either the TL895 or the DLT 15 Cartridge Library Model 35/70 libraries to be selected for performance solutions in an EBS environment. This state of the art tool applies all the calculations to real world solutions, yielding realistic performance estimates.

## Lights Out Tests

Lights out tests were designed to consider factors that would affect backup rates when automated tape libraries are connected to the EBS. Tape retention policies determined the number of tapes needed to maintain several sets of backups that can be overwritten after the retention period has expired. Full, Incremental, and Differential backups were analyzed to find factors that would affect performance when large quantities of data were processed.

## Calculating Tape Retention

How you store the backup data on tape and how long you keep the tapes before they are erased greatly impacts the total number of tapes needed to maintain the desired backup schedule. Follow the procedure below to determine the amount of storage you will need.

### Definition

There are three basic types of tape rotation within each backup cycle. Each method offers advantages and disadvantages in cartridge use and restore time.

- **(F) Full Backups Only**--All data is backed up every time a backup is conducted.
- **(I) Full/Incremental Backups**--Each backup cycle will include one full backup and multiple incremental backups. Incremental backups back up all data that has changed since the last backup of any type.
- **(D) Full/Differential Backups**--Each backup cycle will include one full backup and multiple differential backups. Differential backups back up all the data that has changed since the last full backup.

### Procedure

1. **Calculate data sets.** Determine the number of full, incremental, and/or differential data sets to be retained.
2. **Assign percentages** to each backup set for a given number of days. For example:
  - ❑ Full (F) = 100%
  - ❑ Incremental (I) = 20%\*
  - ❑ Differential (D) = 20%\*

**\*NOTE: Actual Incremental and Differential percentages vary for every backup set, based on the actual amount of data changed.**

3. **Total** the percentages.
4. **Calculate total storage** needed:  
$$\text{Total Percentage} * \text{Data Set (in GB)} = \text{Total Storage Needed (in GB)}$$

5. **Calculate storage capacity** of each tape:

$$35 \text{ GB} * \text{Compression Rate} = \text{Tape Capacity}$$

## Calculating Backup Windows

- **Volume Calculations**--Backup windows can be set at virtually 24 hours per day with the EBS due to the use of a separate Storage Area Network (SAN) for data movement. However, many administrators prefer to schedule backups at off hours for management reasons. To calculate the time needed to perform various backup jobs, the backup rate, as defined in the Backup Formula section, must be compared to the data sets being backed up.
- **Tape Change Adjustment**--Backup windows are determined by the total elapsed time required to backup sets of data. The number of DLT Drives can be increased by adding Tape Libraries to the EBS to meet the most demanding needs. A 3% reduction in performance should be applied to all backups that exceed the volume of one tape.
- **Incremental or Differential Adjustment**--Incremental and differential backups must compare archive bits of all files in the 180 GB data set and only back up the files that have changed since the last differential or full backup. A 14% reduction in performance should be applied to all Incremental and Differential backups.

---

**IMPORTANT: Real world effects on Incremental and Differential backups will vary depending on the percentage of changed files in each data set.**

---

## More Information

For detailed information and data for Lights Out testing see the whitepaper entitled *Sizing the Compaq StorageWorks Enterprise Backup Solution* (Part Number **ECG551/0399**) at: <http://www.compaq.com/support/techpubs/whitepapers/>.

## Sizing Calculations

Before you can begin the sizing process, you must have a thorough understanding of the network, the type of data to be backed up, and the back-up window parameters. The easiest and most precise way to size an Enterprise Backup System is to use the Compaq StorageWorks Enterprise Backup Solution sizer software, which may be obtained from the Internet at <http://www.compaq.com/products/storageworks/ebs/ebstoolsbackupsizing.html>.

If you do not have access to the software, the whitepaper entitled *Sizing the Compaq StorageWorks Enterprise Backup Solution* (Part Number **ECG551/0399**) found at: <http://www.compaq.com/support/techpubs/whitepapers/> will walk you through the manual sizing process. The basic steps are:

1. Calculate the Base Rate
2. Adjust the Base Rate
3. Calculate Number of DLT Drives Needed
4. Determine the Retention Parameters
5. Determine Number of Tapes Required
6. Determine Number of Libraries Needed



## Sizing the Enterprise Backup Solution

### Speed Tests

Determining the speed of Backup and Restore processes in a real-world environment is the most important factor in designing and implementing the Compaq StorageWorks EBS. Fibre Channel is designed to produce a theoretical maximum of 1.0625 Gigabits per hour. This equates to 100 Megabytes per second or 360 Gigabytes per hour. (Test results are expressed in GB/H for clarity).

---

**IMPORTANT: A single DLT 7000 drive is rated at a theoretical maximum of 18 GB/H.**

---

To determine the approximate speed of backup and restore jobs in an EBS environment, Compaq began testing non-compressible (1:1) data.

---

**IMPORTANT: Compaq tested both the Seagate Backup Exec and Computer Associates (CA) ARCserveIT in an EBS environment to benchmark the DLT performance. Both Seagate and CA generated consistent throughput of approximately 15 GB/H.**

---

Tests were performed with each job configured to write to a single DLT drive. Tests show near-linear scalability. The TL895 supports seven DLT 7000 tape drives.

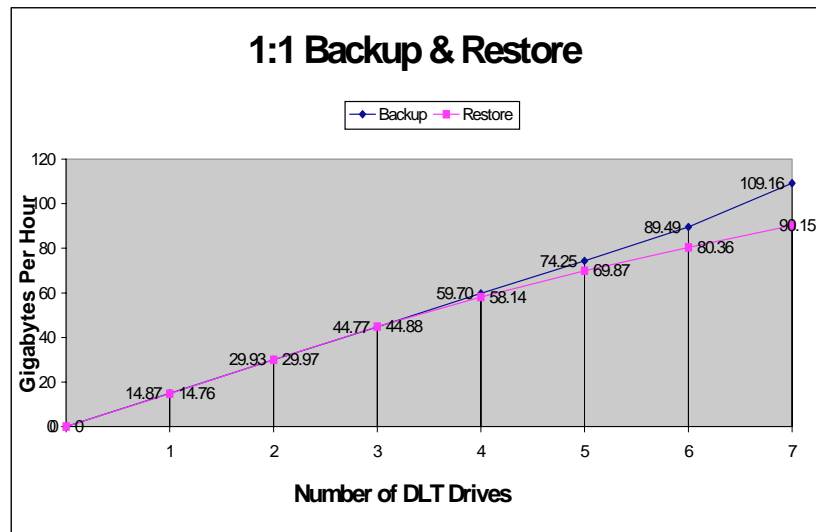


Figure 4-1. Test Results of Backup and Restore Jobs.

### Compression Tests

---

**IMPORTANT: The amount of compression has a direct impact on the rate that a DLT 7000 tape drive can write data.**

---

Tests showed the number of DLT drives and compression scaled near 1:1, but the total rate of

Restore rates also scaled near 1:1 with the same effect of compression and one additional factor. The maximum combined restore rate topped out at 90 GB/H for various numbers of drives and compression rates.

**NOTE: The test results were based on a controlled set of variables, but real-world data compression varies from file to file. The EBS Tech Note details test variables and other factors that can affect performance.**

A formula was derived that closely approximates the backup performance for various levels of compression. The formula was compared to actual backup and restore jobs at all tested compression rates.

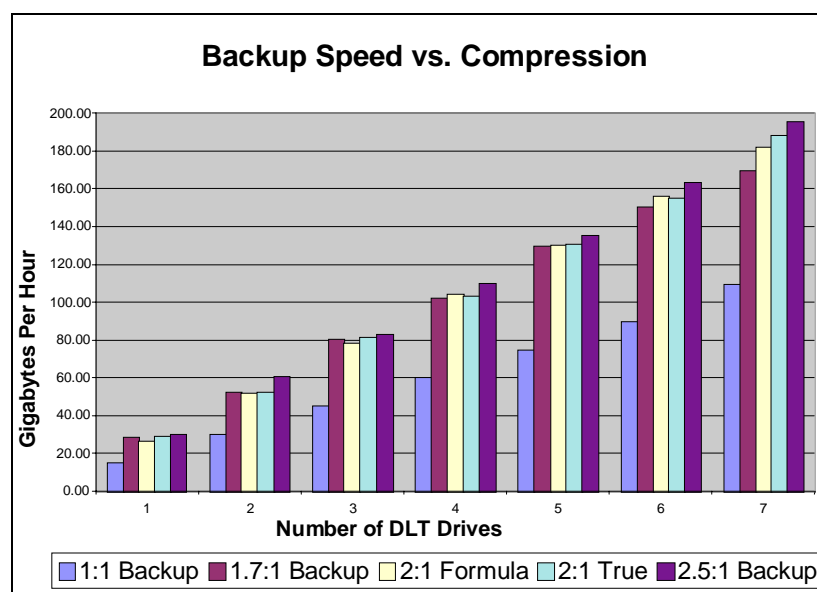


Figure 4-2. Comparisons of actual compressed jobs and the formula

### Backup Formula

If  $((\text{Base Rate} * \text{Compression}) - (\text{Compression}^2)) < 43$

Then  $((\text{Base Rate} * \text{Compression}) - (\text{Compression}^2)) * \text{Drives} = \text{Backup Rate}$

Else  $(43 * \text{Drives}) = \text{Backup Rate}$

- The Base Rate for 1:1 Backups is 15 GB/H
- The Drives equal the number of DLT Drives backing up data
- The Compression Loss (CL) is equal to Compression Squared

---

**IMPORTANT: The formula can approximate backup and restore rates for the EBS, but every backup or restore job in the real world is subject to performance variables. The formula and Sizer Tool are only estimates, designed to be as close as possible to real world conditions.**

---

## Compaq StorageWorks Backup Sizing Tool

Compaq developed a sizing tool that:

- Allows easy input of the many variables that affect backup performance.
- Calculates the number of tapes and libraries necessary to allow Lights Out operations.
- Speeds calculations to ensure that backup windows are not exceeded.

The tool allows selection of server configurations that can be replicated or modified to represent enterprise zones. Detailed calculations and equipment required are presented, showing quantities and part numbers necessary to deploy the Compaq StorageWorks Enterprise Backup Solution. The Compaq StorageWorks EBS Sizer Tool is available at:

<http://www.compaq.com/products/storageworks/ebs/ebstoolsbackupsizing.html>.

### Parameter Screen

The Parameters view collects information about the tape management implementation. First choose the operating system your solution will support, then add a server to be supported in the solution. After completing the interview session for that server, the Parameters view displays again. At this time, you can choose to copy, edit, or delete that server. You can also add another server.

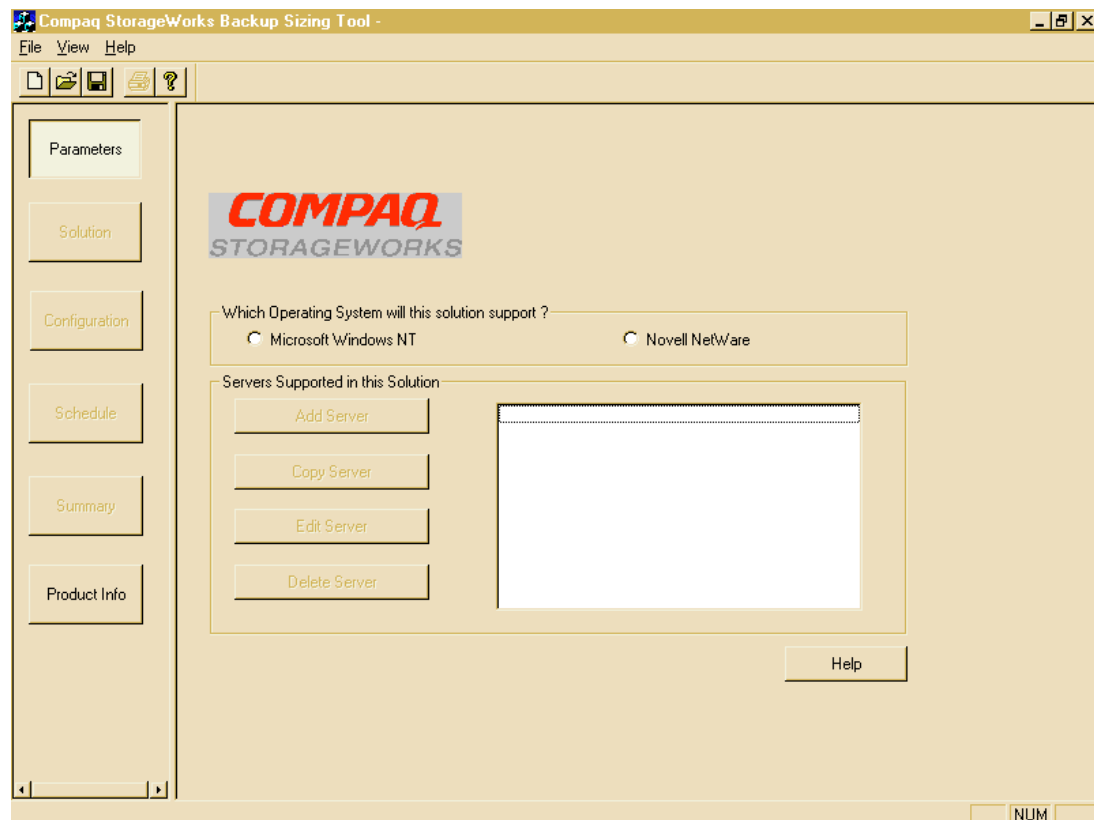


Figure 4-2 Parameter Selection screen

## Server Information

Enter a server name and the estimated total Gigabytes of data to be backed up.

The screenshot shows a 'Server' configuration window with the following elements:

- Server Information:** A text box for 'Name' and a spinner box for 'GB of data to be backed up:' set to 20.
- Select disk drive controller on this server:** A dropdown menu showing '----- Select a Controller -----', radio buttons for 'Manual' and 'Automatic' (selected), a dropdown for 'D', a 'Detect' button, and a spinner for '0' GBPH.
- Please select one of the options below:** Radio buttons for 'First time user of Tape Management Software.', 'Upgrading from previous version of Backup Exec Software.', and 'Upgrading from different Tape Management Software.' (selected).
- Options for Windows NT:** Radio buttons for 'Backing up Servers only on Fibre Channel Loop', 'Backing up other Servers on LAN', and a checked checkbox for 'Netware Agent for Windows NT'.
- Options for NetWare:** Radio buttons for 'Backing up Servers only on Fibre Channel Loop with one user.', 'Backup up Servers only on Fibre Channel Loop with upto 25 users.', and 'Backing up other Servers on LAN'.
- Navigation:** Buttons for '< Back', 'Next >', 'Cancel', and 'Help'.

Figure 4-4. Server Information screen

## Determining the Configured Primary Storage System

The primary storage configuration is an important link in the backup performance calculation. It has a direct effect on the speed at which the server can send data to the tape device. Select the type and configuration that most closely matches your server's primary storage system. Pull down the menu selections for various hard disk controllers to select the approximate feed speed of the primary storage system. You may also select Automatic to test the performance of disk drives physically connected to the machine the sizer tool is running on.

Ideal primary storage feed speed would be above three times the backup rate (3:1) of each DLT drive. This will allow the data to stream to the DLT drive and achieve near 100% performance. If the feed speed is 2:1 but less than 3:1, the backup performance is reduced by approximately 20%. If the feed speed is less than 2:1, the backup performance is reduced by approximately 50%. The sizer tool uses the reduction ratios to better estimate the actual performance for various primary storage controller systems.

---

**IMPORTANT:** These percentages are only estimates and individual performance may vary.

---

## Compressibility

The compressibility screen allows specification of the type of backup data. Tests have shown that not all data can be compressed equally. The compression ratio will affect the amount of data that can be stored on each tape cartridge, as well as the speed at which the tape drives can read/write the data. If you have been performing tape backups on servers with DLT tape drives, you should already have a good idea of the expected compression ratio for your data. Select the type of data that most closely matches your environment, or enter this information in the Other field. If your server has multiple types of data, select the anticipated composite average compression ratio.

The screenshot shows a window titled "Data on Server" with a yellow header. Inside, there is a section titled "What type of data is on Server ?" with a sub-header "Estimated Compression ratio:". Below this is a list of radio button options, each with a corresponding ratio. The "Typical File / Print Server" option is selected. At the bottom of the list is an "Other" option with an empty text input field. Below the list is a "Compression ON" checkbox, which is currently unchecked. At the bottom right of the window are four buttons: "< Back", "Next >", "Cancel", and "Help".

What type of data is on Server ?	Estimated Compression ratio:
<input type="radio"/> Oracle Database	1.2
<input type="radio"/> Microsoft Exchange Database	1.4
<input type="radio"/> Microsoft SQL Server Database	1.4
<input type="radio"/> Lotus Notes Database	1.6
<input checked="" type="radio"/> Typical File / Print Server	2
<input type="radio"/> MPEG or JPEG image / video data	1
<input type="radio"/> SAP Database	1.2
<input type="radio"/> Other	<input type="text" value=""/>

Compression ON

< Back   Next >   Cancel   Help

**Figure 4-5. Data Compressibility Information screen**

A compression ON/OFF check box allows you to calculate performance with Compression turned off. For data sets with low compressibility, turning Compression OFF may increase performance.

## Selecting Software Options

Choose the appropriate options for the server being configured. This information is used to select the software modules that are detailed in the solution. These options do not affect the performance calculations. The part numbers for selected items are displayed in the Solution and Summary screen. When selecting Oracle, Exchange, SQL, or SAP, the appropriate agent software and part numbers will be included in the Solution and Summary Screens.

Software on Server

What type of Software is on the Server ?

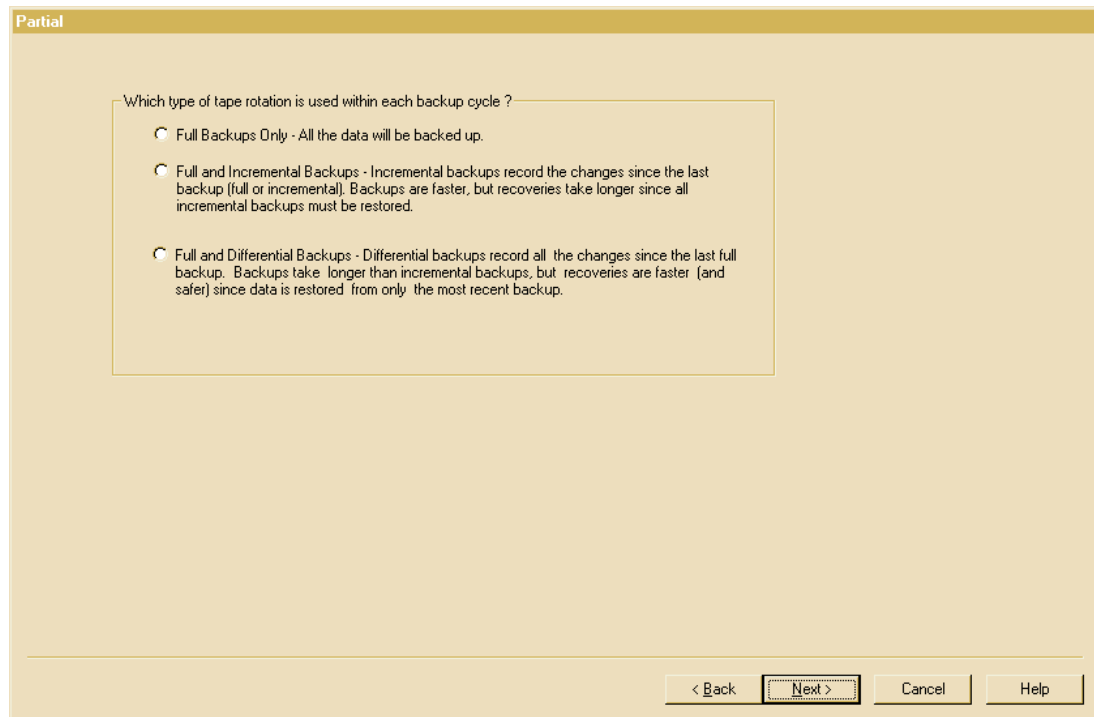
- Backup Exec v7.2 for Windows NT, Intelligent Disaster Recovery (DR) Option v1.0
- Backup Exec v7.2 for Windows NT, Open File Option
- Backup Exec v7.0 for Windows NT, Small Business Server Suite
- Replication Exec v1.0 for Windows NT
- Backup Exec for NW, Intelligent Disaster Recovery Option v1.0b
- Backup Exec v8.0 for NetWare, Open File Option

< Back   Next >   Cancel   Help

Figure 4-6. Software Information screen

## Specifying Tape Rotation and Partial Backups

The Partial Backups screen allows you to enter the type of tape rotation to be used within each backup cycle. There are three basic types of tape rotation within each backup cycle. Each method offers advantages and disadvantages in cartridge use and restore time.



The screenshot shows a window titled "Partial" with a light beige background. Inside the window, there is a question: "Which type of tape rotation is used within each backup cycle ?". Below the question are three radio button options:

- Full Backups Only - All the data will be backed up.
- Full and Incremental Backups - Incremental backups record the changes since the last backup (full or incremental). Backups are faster, but recoveries take longer since all incremental backups must be restored.
- Full and Differential Backups - Differential backups record all the changes since the last full backup. Backups take longer than incremental backups, but recoveries are faster (and safer) since data is restored from only the most recent backup.

At the bottom right of the window, there are four buttons: "< Back", "Next >", "Cancel", and "Help". The "Next >" button is highlighted with a dashed border.

**Figure 4-7. Tape Rotation and Partial Backups screen**

For additional tape rotation information, see the sizer tool help screens.

## Schedule Information Screen

The Schedule Information screen allows you to enter your backup schedule.

### Data to be Backed Up

For each day of the week, specify the type of backup that will be performed. Selecting the only data that has changed option will refer to either differential or incremental backups as defined on the previous screen. Differential backups back up all data that has been changed since the last full backup, while incremental backups back up all data that has been changed since the last backup of any type.

### Percentage Changed

Estimate the percentage of data that will have changed for this backup. This will help estimate the amount of data being backed up during this operation.

### Backup can Occur

Specify the beginning and ending time for the backup window for this server. You can specify a different backup window for each day of the week, or you can specify one single backup window that will apply to all days.

The screenshot shows the 'Schedule' window with the following configuration:

Day	Backup Type
Sunday	Full (20GB)
Monday	Partial (25%)
Tuesday	Partial (25%)
Wednesday	Partial (20%)
Thursday	Partial (15%)
Friday	Partial (10%)
Saturday	Partial (5%)

**Data to be backed up:**

- Do not back up.
- All the data.
- Only the data that has changed.

Percent changed:  %

GB to be backed up:

**This backup can occur:**

Anytime AFTER:

But must be complete BEFORE:

Window Duration:

The backup window is the same for every day.

**Restore Details**

Threshold Time for Restore:

Navigation buttons: < Back, Next >, Cancel, Help

Figure 4-8. Schedule Information screen



## Retention Screen

**Retention**

Full Backup Retention  
How many full backups should be kept ?

Tapes  
Tapes Required 10

Keep Partial Backups

- On the same tape set as the full backup.
- Together on a different tape set from the full backup.
- On individual tape sets.

Erase Partial Backups:

- When the full backup is erased.
- After this many full backups have been taken:

Between Full Backups:

- Keep all differential backups.
- Keep no more than this many differential backups.

< Back Finish Cancel Help

Figure 4-9. Tape Retention Information screen

### Full Backup Retention

Specify how many cycles of full backups you will want stored within the tape library.

### Keeping Partial Backups

This allows you to define the way tape sets are managed between the full and partial backups. There are three options:

1. **On the same tape set as the full backup**--Full and partial backups for one cycle (usually one week) are all part of a single tape set. The retention schedules for these cartridges must be equal. With this option, all partial backups are retained as long as the preceding full backup is retained.
2. **Together on a different tape set from the full backup**--Partial backup data is written to a dedicated tape set that is separate from the full backup tape set. Each day's partial backup is "appended" to the end of the last partial backup. One retention period is defined for the entire partial backup tape set. This is the most common option since most users choose to define a longer retention period for full backup tape sets than the partial backup tape sets.
3. **On individual tape sets**--Each day's partial backup is written on a separate tape set. Any excess capacity remaining on the last tape of the day's partial backup is wasted since the next day's backup is written to a new tape set.

### Erase Partial Backups

This allows you to define the retention procedure and erase schedule for your partial backups. This option does not appear if you selected "On the same tape set as the full backup" on the previous question.

### Between Full Backups

This only appears if you choose to perform differential backups and also choose to keep each partial backup on a separate tape set. There are two options:

1. **Keep all differential backups**--Each differential backup within a cycle is retained until the time stated within the "Erase partial backups."
2. **Keep no more than this many differential backups**--Differential backup tape sets will be recycled after there are the specified number of differential backups or when the time stated within the "erase partial backups" is reached. For example, if you are performing differential backups on M-F and specify "2" for this question, you will perform differential backups on Monday and Tuesday. On Wednesday, Monday's tape set will be deleted. On Thursday, Tuesday's tape set will be deleted.

### Tape Sets

This shows the number of tapes required for this server.

## Solution Information

The Solutions view displays the list of solutions that support the performance and business requirements specified for the tape management implementation. General information displays, including the necessary software type, version and number of servers, tape libraries, and tapes you will need for the solution.

All of the suggested components are listed to create the solution recommendations, including quantity needed, part number, and description. Part numbers shown are based on US Domestic product descriptions. Consult your Compaq Authorized Dealer or reseller for specific configurations.

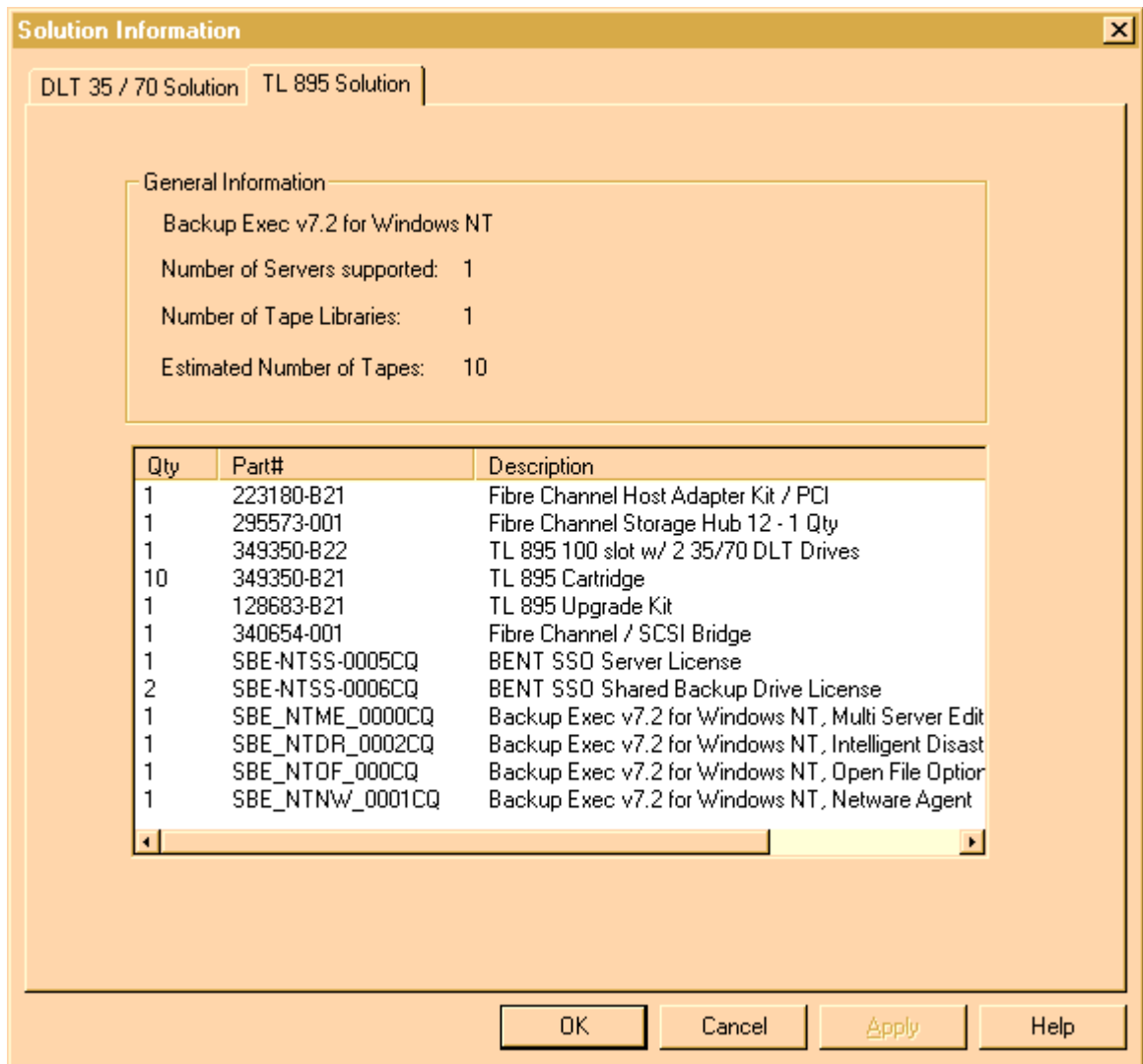


Figure 4-10. Solution Information screen--TL895

## Configuration Information

This view graphically displays each component necessary for the configured solution. Each selection can be expanded to show detailed configuration information.

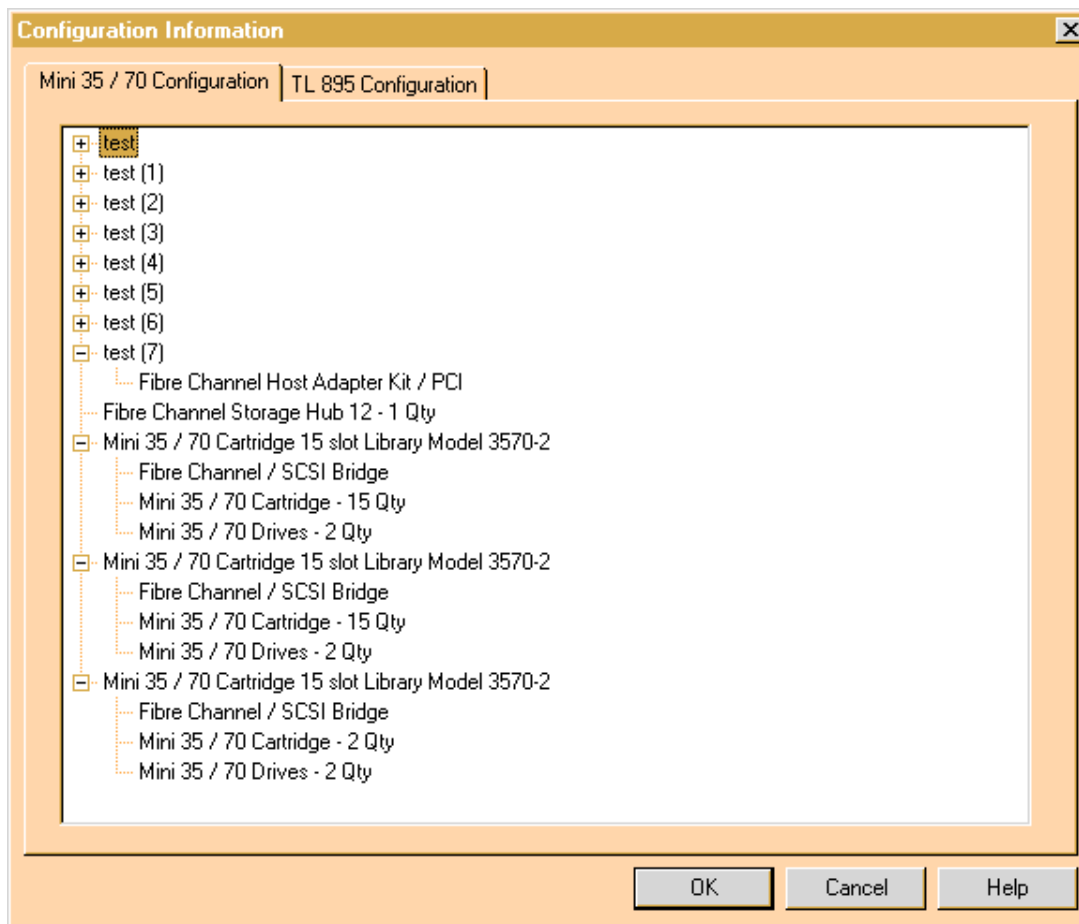


Figure 4-11. Configuration Information screen--DLT 15 Cartridge Library Model 35/70

## Graphical and Text Schedule Information

The Schedule screens allow you to view your backup schedule. The Schedule view displays the complete backup schedule you have selected through the interview session dialog. Elapsed times are based on the formulas described in the Summary View Help Screen. For detailed information, refer to the tech note called *Compaq StorageWorks Enterprise Backup Solution* (Part Number **EGG1050398**) at:

<http://www.compaq.com/products/storageworks/ebs/ebswhitepaper.html>.

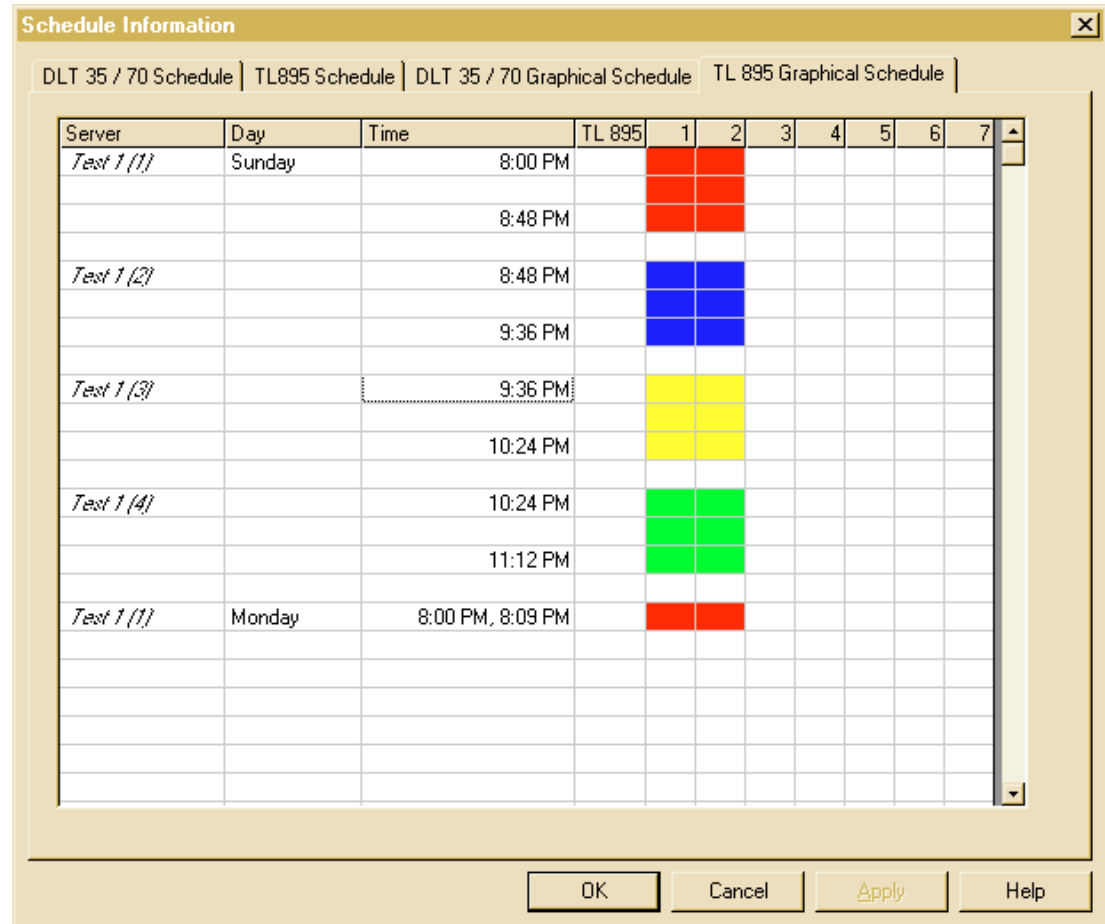
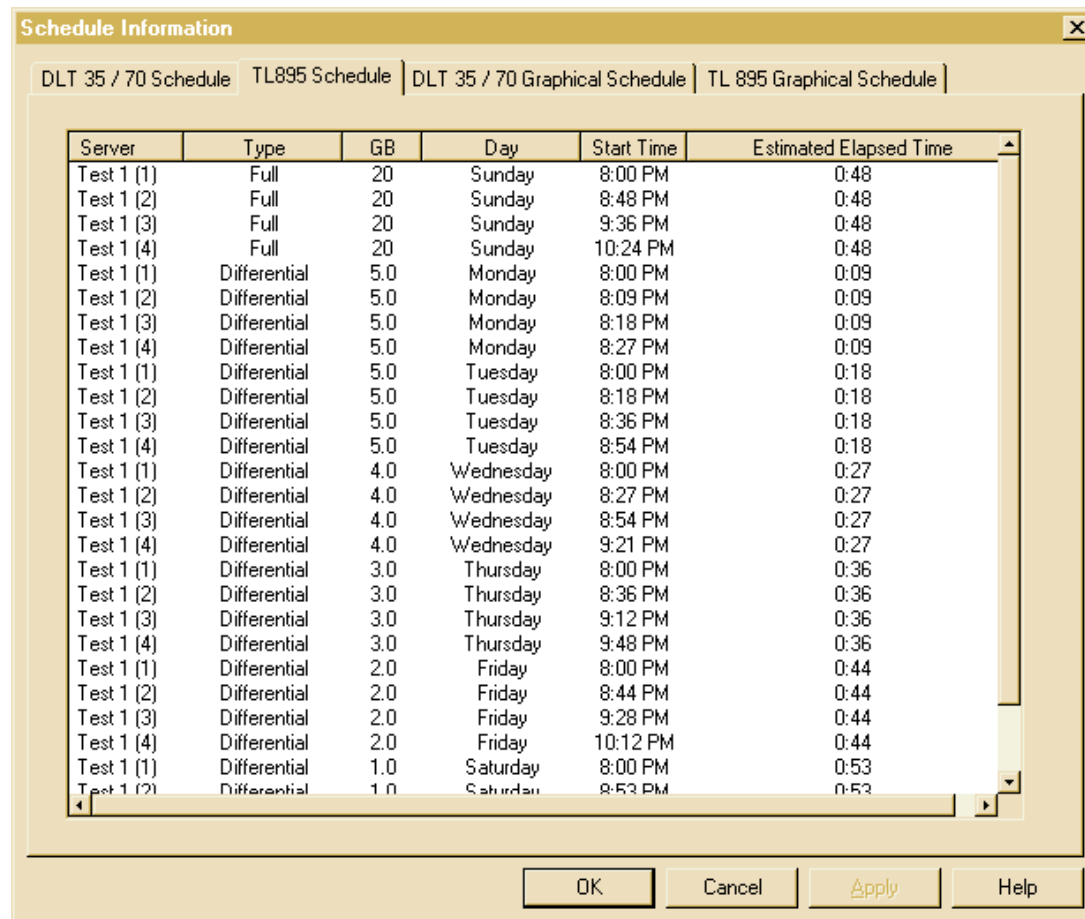


Figure 4-12. Graphical Schedule Information screen--TL895

#### 46 Adding TL895 Libraries to the Compaq Enterprise Backup Storage System

The text schedule Information Screen shows start times and detailed elapsed times of each job configured.



The screenshot shows a window titled "Schedule Information" with a close button (X) in the top right corner. Below the title bar are four tabs: "DLT 35 / 70 Schedule", "TL895 Schedule", "DLT 35 / 70 Graphical Schedule", and "TL 895 Graphical Schedule". The "TL895 Schedule" tab is selected. The main area contains a table with the following data:

Server	Type	GB	Day	Start Time	Estimated Elapsed Time
Test 1 (1)	Full	20	Sunday	8:00 PM	0:48
Test 1 (2)	Full	20	Sunday	8:48 PM	0:48
Test 1 (3)	Full	20	Sunday	9:36 PM	0:48
Test 1 (4)	Full	20	Sunday	10:24 PM	0:48
Test 1 (1)	Differential	5.0	Monday	8:00 PM	0:09
Test 1 (2)	Differential	5.0	Monday	8:09 PM	0:09
Test 1 (3)	Differential	5.0	Monday	8:18 PM	0:09
Test 1 (4)	Differential	5.0	Monday	8:27 PM	0:09
Test 1 (1)	Differential	5.0	Tuesday	8:00 PM	0:18
Test 1 (2)	Differential	5.0	Tuesday	8:18 PM	0:18
Test 1 (3)	Differential	5.0	Tuesday	8:36 PM	0:18
Test 1 (4)	Differential	5.0	Tuesday	8:54 PM	0:18
Test 1 (1)	Differential	4.0	Wednesday	8:00 PM	0:27
Test 1 (2)	Differential	4.0	Wednesday	8:27 PM	0:27
Test 1 (3)	Differential	4.0	Wednesday	8:54 PM	0:27
Test 1 (4)	Differential	4.0	Wednesday	9:21 PM	0:27
Test 1 (1)	Differential	3.0	Thursday	8:00 PM	0:36
Test 1 (2)	Differential	3.0	Thursday	8:36 PM	0:36
Test 1 (3)	Differential	3.0	Thursday	9:12 PM	0:36
Test 1 (4)	Differential	3.0	Thursday	9:48 PM	0:36
Test 1 (1)	Differential	2.0	Friday	8:00 PM	0:44
Test 1 (2)	Differential	2.0	Friday	8:44 PM	0:44
Test 1 (3)	Differential	2.0	Friday	9:28 PM	0:44
Test 1 (4)	Differential	2.0	Friday	10:12 PM	0:44
Test 1 (1)	Differential	1.0	Saturday	8:00 PM	0:53
Test 1 (2)	Differential	1.0	Saturday	8:53 PM	0:53

At the bottom of the dialog box are four buttons: "OK", "Cancel", "Apply", and "Help".

Figure 4-13. Text Schedule Information Screen--TL895

## Summary Information

The Summary Information screen recaps all data collected and the solution developed by the Sizer tool, based on the calculation information presented in the beginning of this chapter.

### Adding Additional Servers

By returning to the Parameters screen, you can add, copy, or delete additional servers to develop the Enterprise Backup Solution that represents your environment. You can navigate forward and backward through the dialog screens to vary volume, conditions, tape rotation schemes and view the results.

Warning messages pop up when the configured solution exceeds the capacity of the maximum configuration currently supported.

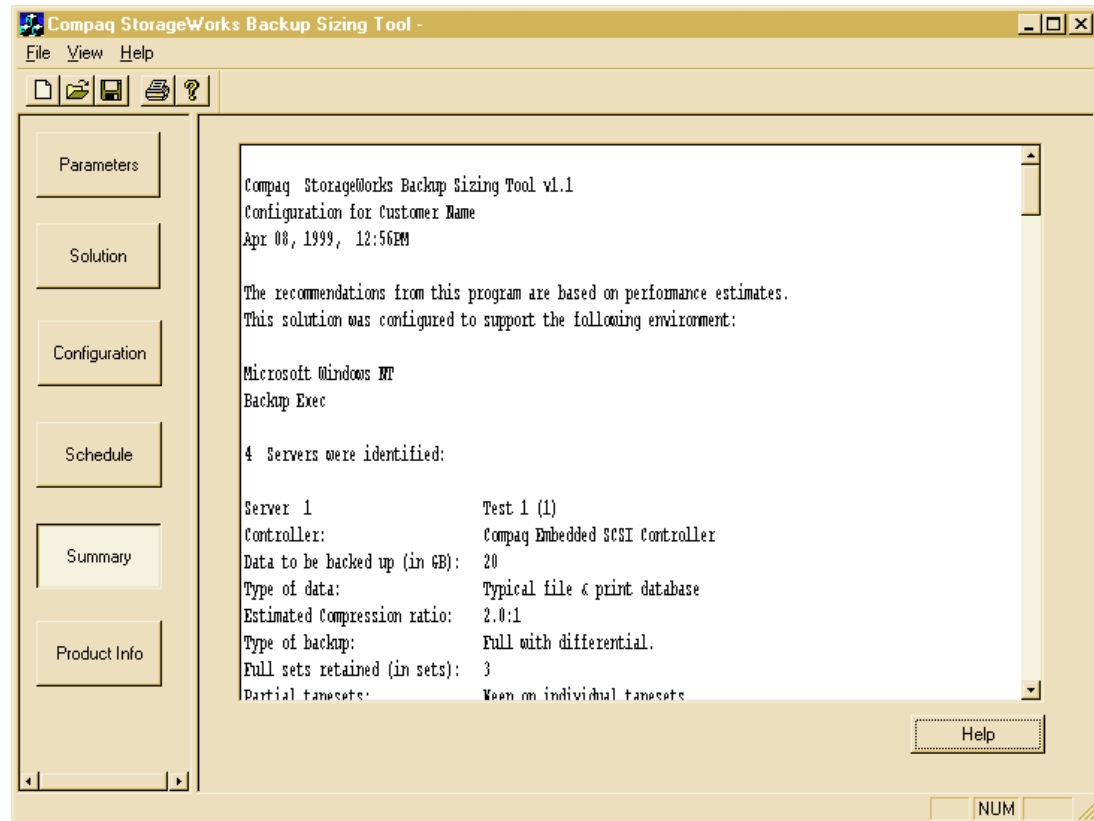


Figure 4-14. Summary Information screen

## Software Product Information

This screen lists available software products and describes their function and capabilities.

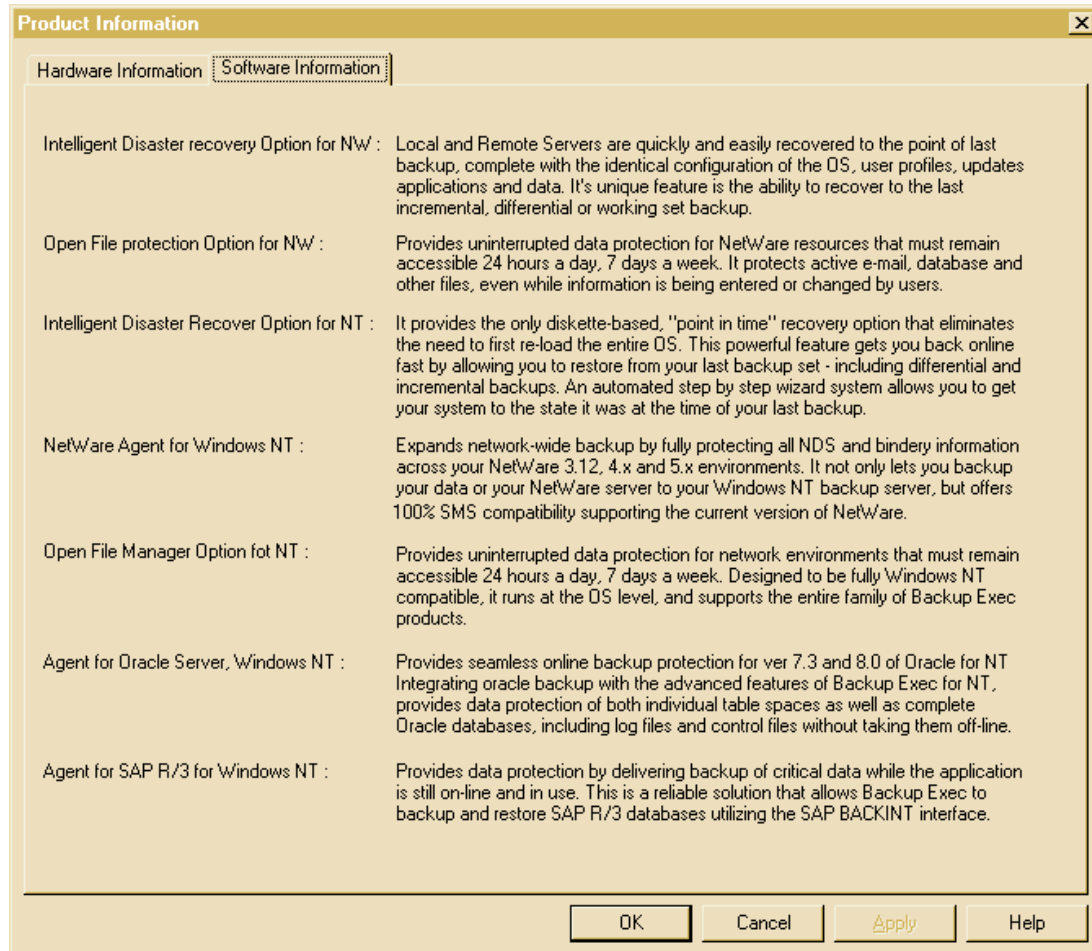
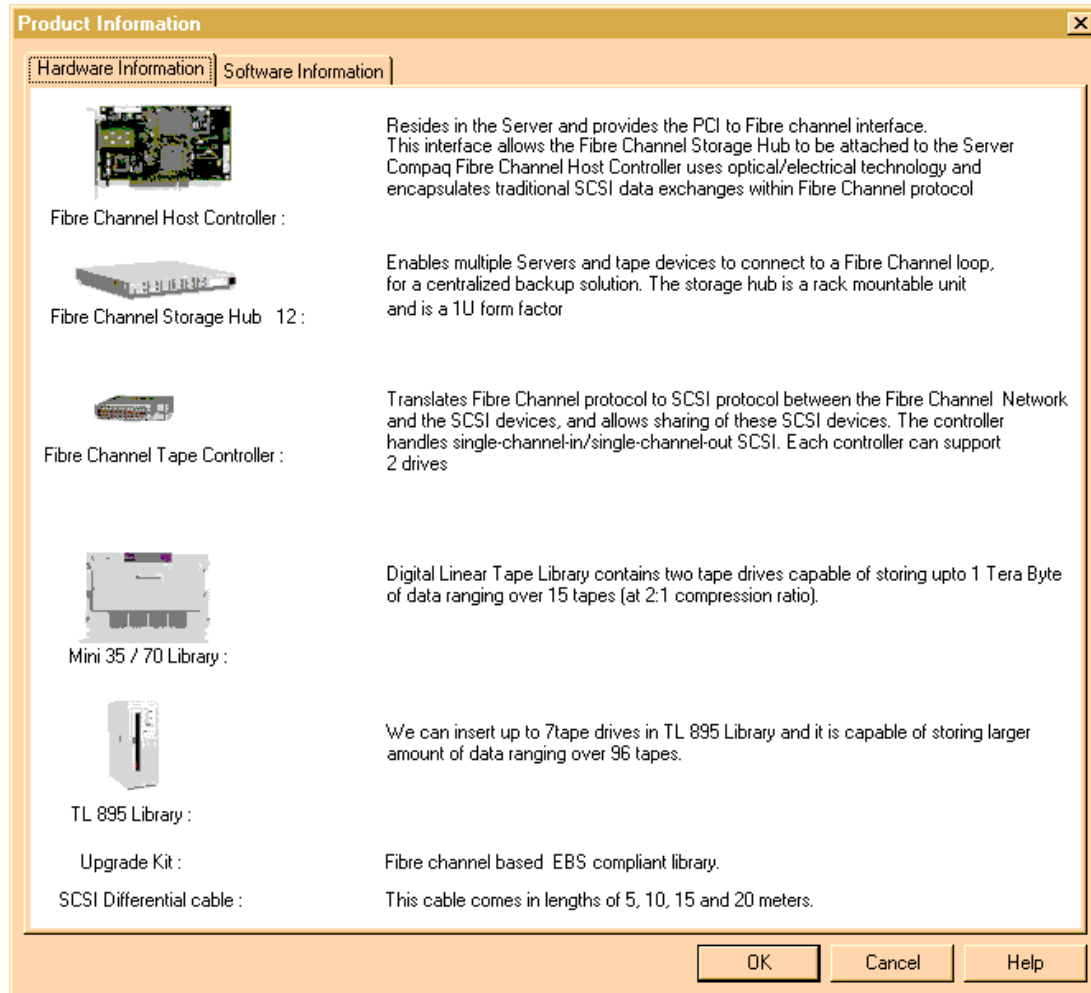


Figure 4-15. Software Product Information screen



## Hardware Product Information

This screen lists all pertinent hardware product information.



**Figure 4-16. Hardware Product Information screen**

## **Information and Tools**

For more information on sizing your system, entitled *Sizing the Compaq StorageWorks Enterprise Backup Solution* (Part Number **ECG551/0399**) at:  
<http://www.compaq.com/support/techpubs/whitepapers/>.

# *Chapter* **5**

## **Management**

### **Introduction**

Management of distributed enterprise environments is a prominent benchmark in today's competitive business world. To address this need, Compaq has developed a plan that integrates systems and storage-management software. Compaq provides Compaq Insight Manager as a server management tool, controlling storage as an extension of the server. Compaq Insight Manager provides Element Management and other utilities to manage configurations of subsystems.

The impending introduction of Compaq Insight Manager XE, a Web-based Enterprise Management (WBEM) application, will build an infrastructure for the integration of all storage management software components. The StorageWorks Command Console (SWCC) management utility will be included to manage and configure StorageWorks subsystems.

Partnering with Seagate Software Inc. and Computer Associates Inc., Compaq is developing key software to integrate their management consoles into this architecture. Although Enterprise Backup Solution (EBS) components are transparent to the server and the tape library, additional management features will be implemented in the Storage Hub 12 and the Fibre Channel Tape Controller (FCTC) components in future product releases.

Tape management is progressing through continuous industry-standard efforts to address the new virtual enterprise storage networks. Tape Alert is a major effort to put advanced device management and reporting functions in the hands of Network Administrators. Compaq uses software applications created together with Seagate Software Inc. and Computer Associates Inc., both who

support Tape Alert. The DLT drive firmware passes information from the drives to the application. For more information on Tape Alert, consult: <http://www.hp.com/tape/tapealert/tawg.html>.

While aggressively developing standards-based storage management solutions, Compaq consistently researches new ways to improve storage management. Cooperation with industry leaders has allowed Compaq to deliver on its promise to manage and control accelerating information needs by providing innovative and comprehensive solutions for enterprise storage.

# Compaq Insight Manager

## Overview

Today's distributed enterprise networks are some of the most complex ever constructed. As companies deploy more and more business-critical applications, networks continue to rapidly expand, becoming more sophisticated and difficult to manage. In this fast-changing environment, manageability and management have become one of the leading success criteria for today's highly competitive business environment.

Compaq Insight Manager is a comprehensive management tool used to monitor and control the operation of Compaq servers and clients and DIGITAL X86 and Alpha-based servers.

Compaq Insight Manager consists of two components:

- A Windows-based console application.

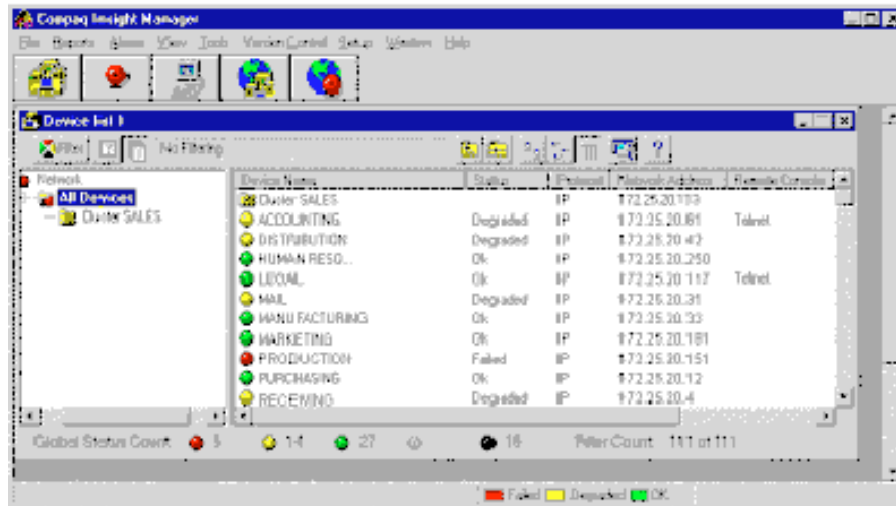
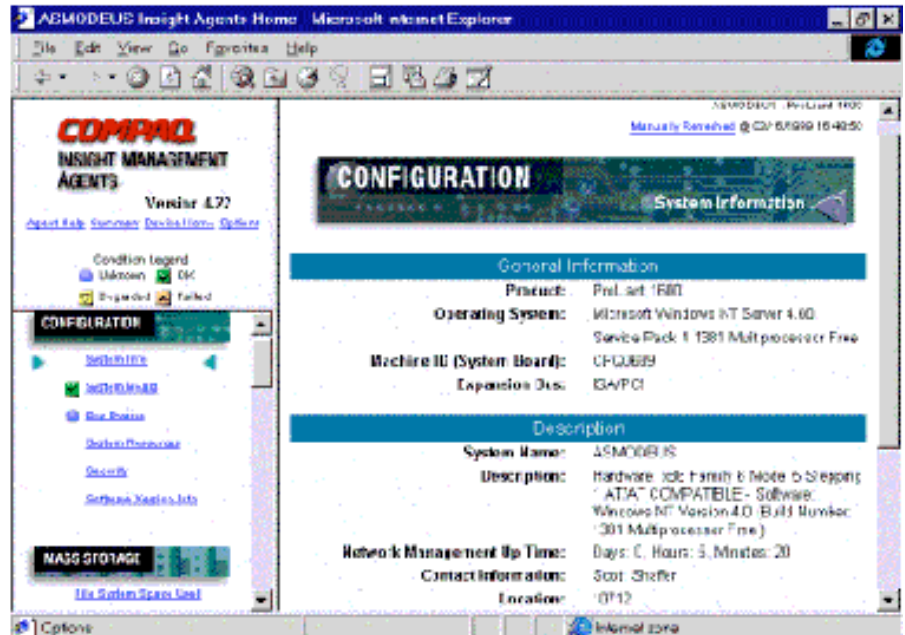


Figure 5-1. Compaq Insight Manager Console screen

- Server or client-based management data collection agents.



**Figure 5-2. Compaq Insight Manager Agents screen**

Management agents monitor over 1,000 administrative parameters. Key subsystems are instrumented to make health, configuration, and performance data available to the agent software. The agents act upon that data, by initiating alarms in the event of faults, and by providing updated management information, such as network interface or storage subsystem performance statistics.

Compaq Insight Manager provides real-time control over systems, with monitoring and alerting capabilities for the critical systems in a distributed enterprise.

Compaq Insight Manager continues the Compaq tradition of delivering industry-leading scalability and management functionality by taking advantage of the pervasive web style of computing to provide access to Insight Manager Device and Configuration information from everywhere there is network access.

## Key Features

- **Comprehensive fault management** allows proactive management of the distributed enterprise by providing advance notice of system failures. Alarms can be sent to systems administrator via electronic mail or pager. In addition, Windows NT monitoring capability allows faster determination of the root cause determination of system and application faults by being able to quickly determine if hardware or software causes the failure event.
- **Broad configuration management** gives detailed inventory collection, Insight Version Control and Integration Server Maintenance enable effective deployment and maintenance of consistent, manageable configurations.
- **Performance management/resource utilization** helps to determine how servers are utilized. Does this line go with the next? he ability to monitor and report on exceeded thresholds helps identify performance bottlenecks and keep systems running at peak levels
- **Remote management** minimizes costly downtime by supporting a full complement of remote maintenance and control facilities that assist in quick recovery from critical failures.

## Benefits at a Glance

- **Reduces system management cost** by providing centralized fault, configuration and performance information.
- **Improves operational efficiency** through extensive remote management capabilities.
- **Decreases server downtime** through proactive fault management and version control.
- **Enhances information provided** by existing enterprise management products such as HP OpenView and IBM NetView.

## **Compaq Advantage**

- **Most comprehensive systems management** across the widest range of operating systems.
- **Web based management** for anytime - anywhere access to management information.
- **Breadth of remote management capabilities** from in-band to out-of-band and configuration to diagnostics.
- **Predictive fault management** and Pre-Failure Warranty for storage, memory and CPU.
- **Ability to provide up-to-date version control information** for server and workstation firmware, drivers and utilities.
- **UPS management** and multi-server shutdown capabilities.
- **Extensive online help documentation.**
- **Integration with management software products** such as BMC Software's PATROL, Boole & Babbage Ensign, Cabletron SPECTRUM, CA Unicenter TNG, HP OpenView, IBM NetView, Microsoft Systems Management Server, Seagate Nervecenter Pro, SunNet Manager and Tivoli TME 10.



# *Chapter 6*

## **Diagnostics**

Compaq has developed a three-tier suite of tools to assist in troubleshooting and diagnosing problems.

- **Tier 1:** Enterprise Server View—Compaq User Diagnostics
- **Tier 2:** Storage Area Network View—Fibre Channel Fault Isolation Utility
- **Tier 3:** TL895 Library View—Compaq Library Diagnostics C 1.01

## Tier 1: Enterprise Server View Compaq User Diagnostics

With the introduction of Compaq User Diagnostics XE Web Based element level diagnostics is available throughout the enterprise. A new version 2.03H incorporating the TL895 Tape Library is available for download at <http://www.compaq.com/storageworks>.

This browser or control panel-based utility provides a quick check of storage devices including serial numbers, firmware versions, status checks, and even firmware downloading for future enhancements.

### Compaq Diagnostics for Windows Web Enabler Utility

The Compaq Diagnostics Utility is a service tool designed to allow you to view information about your computer's hardware and software configuration and perform diagnostic testing.

Compaq Diagnostics also takes advantage of the Internet and Intranet technologies prevalent in the industry and participates as part of the Web Based Enterprise Management (WBEM) initiative. Currently, the Compaq Diagnostics Utility provides the following executable components: For Microsoft Windows NT and Windows 95/98:

- **CPQDiag.Exe**—Windows based inspect and diagnostic utility.
- **CPQDiagR.Exe**—on-line configuration tool and Hyper Media Managed Object (HMMO).

The hardware and software configuration of the computer provides insight into potential system issues. The Compaq Diagnostics Utility delivers this critical data, and addresses customer requirements for enhanced service tools and higher computer availability through its comprehensive feature design:

- **On-line installation and operation**—No requirement to take the computer off-line or reboot the server in order to use the Compaq Diagnostics Utility
- **Hardware and Software configuration capture under a single tool**—Gathers detailed hardware and operating system configuration information under a single tool.
- **Perform hardware diagnostics**—Performs detailed hardware diagnostics to identify failing computer components.

The Compaq Diagnostics Utility now includes a web browser interface in addition to the command-line interface. This enables remote control of the utility and facilitates easy transfer of Compaq Diagnostic's information from remote machines to a service provider.

The information the Compaq Diagnostics Utility gathers is accessible from two locations:

- **locally** on the computer's console
- **remotely** or locally from a browser

This combination of features simplifies the service process and minimizes downtime. Versions of the Compaq Diagnostics Utility are available for Microsoft Windows 95/98 and NT. The utility is supported on all Compaq computer products.

Compaq Diagnostics is just one part of a larger architecture that will enhance problem resolution and support of Compaq computers. It also demonstrates the capabilities of the WBEM initiative.

## Installation

Compaq Diagnostics Utility can be installed through the SmartStart setup process (except Windows 95/98), from the Compaq Softpaq Utility, or the software pre-install process in the factory. The Compaq Diagnostics Utility can only be installed on computers running Windows 95/98 or NT. The utility is installed on the same drive as the operating system in the <WINDIR>\CPQDiag directory.

### Installation Through SmartStart

To install the Compaq Diagnostics Utility through the SmartStart setup process, refer to the *SmartStart Installation Poster* (Part Number 298138-008) included with the SmartStart kit. This method installs operating system and Compaq products on a server. Do not use this method to add the Compaq Diagnostics Utility to an existing system.

### Installation Through Compaq Softpaq Utility

To install the Compaq Diagnostics Utility from the Compaq Softpaq Utility, run SETUP.BAT from the Compaq Diagnostics diskettes created from Softpaq.

**NOTE: The Compaq Diagnostics for Windows NT installation methods (except SmartStart) are also used for Windows 95/98 installation.**

## Program Functionality

### Sample Device Home Page for Compaq Diagnostics

This web-based browser screen allows administrators to view and diagnose devices from any Internet or Intranet console.



Figure 6-2. Compaq WBEM Device Home screen

## Compaq Diagnostics Device Test Selection

The Device Test screen allows individual components to be tested.

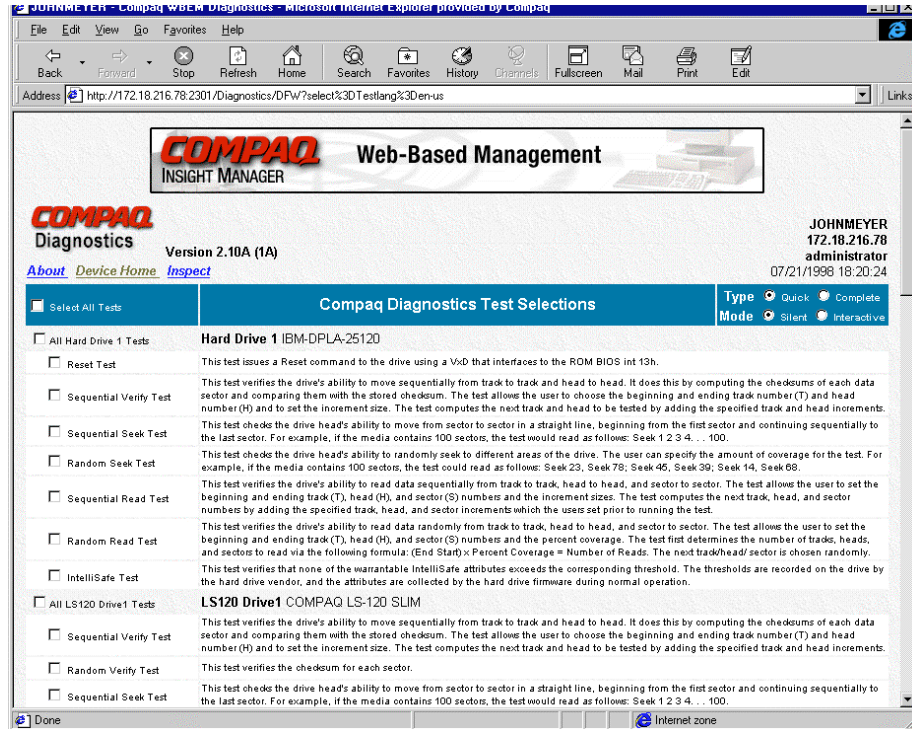


Figure 6-4. Device Test screen

## Compaq Diagnostics Device Test Results

Test results are immediately available to view or print.

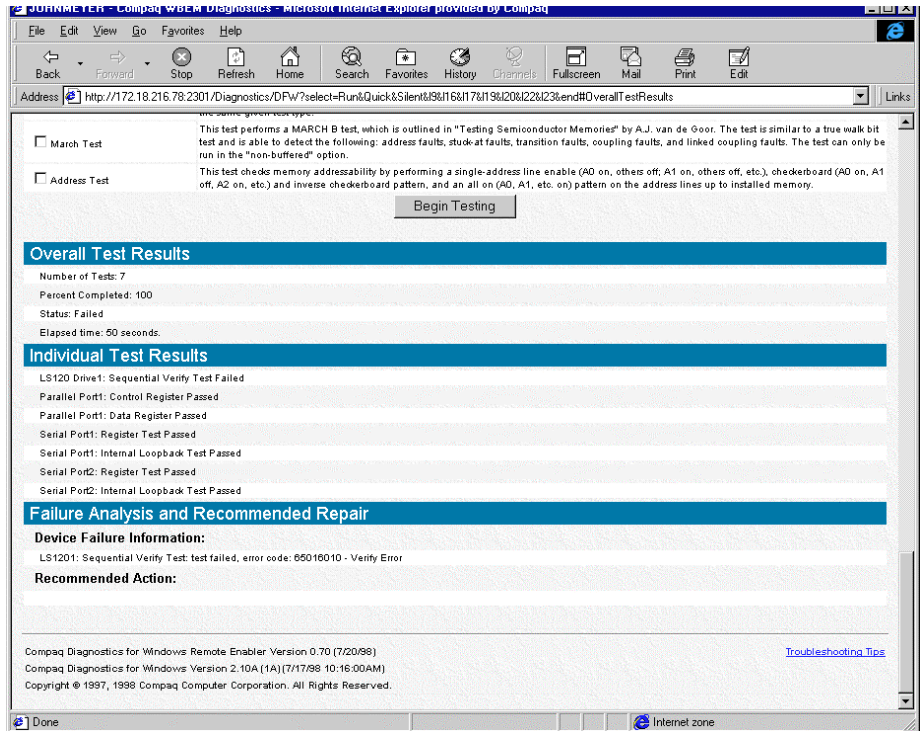


Figure 6-6. Device Test Results screen

## User Diagnostics from the Server Control Panel

### Introduction Screen

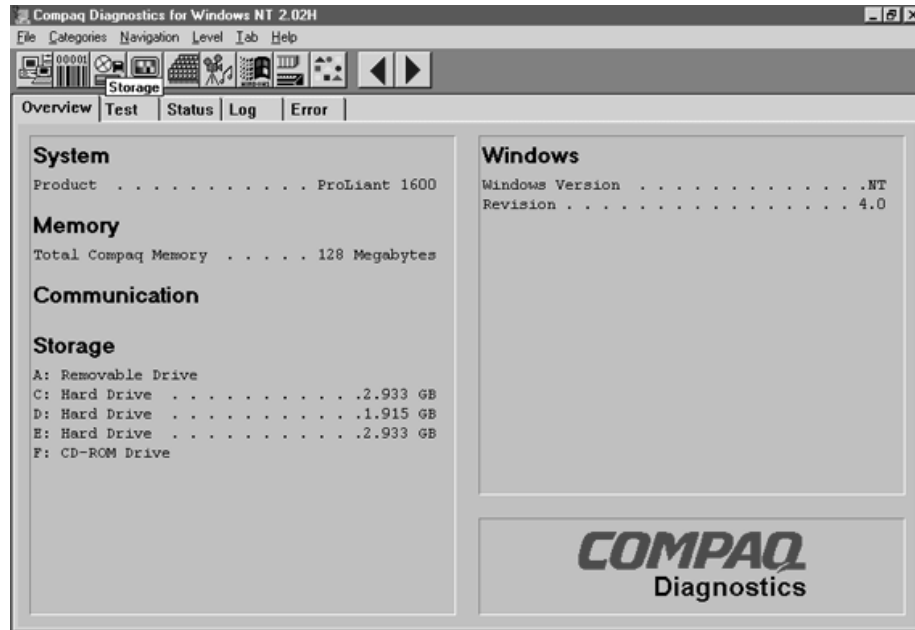
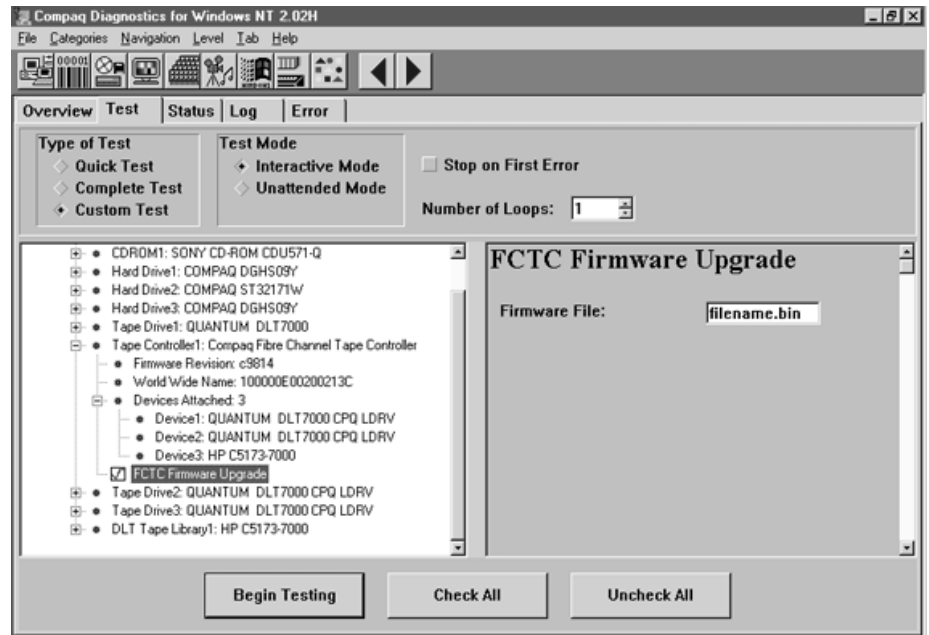


Figure 6-9. Display of Compaq Diagnostics for Windows NT

## Storage Screen

The Storage Screen displays all SCSI devices that appear to the server whether they are Fibre Channel attached or directly attached with conventional SCSI controllers and cables. The figure below shows the expanded view of a Fibre Channel Tape Controller (FCTC).



**Figure 6-10.** Expanded view of the FCTC

The firmware revision and World Wide Name are displayed to easily identify each device. The devices attached to each FCTC are also displayed. A unique feature of Compaq User Diagnostics is the ability to upgrade firmware in the FCTC. By selecting the Firmware Upgrade check box, the Firmware File dialog box appears with the ability to enter the path and file name of the appropriate firmware revision. By selecting Begin Testing, the firmware upgrade procedure will commence.

**NOTE:** A qualified technician should perform firmware upgrades. Abnormal interruption of the process can render the FCTC unusable.



## Tape Drive Diagnostics

By expanding the DLT Tape Drive section, the firmware revision is available, including descriptions of SCSI Bus, Target and LUN information. This information is very important when troubleshooting or identifying devices in complex enterprise environments. Physical tests can also be performed by selecting Test Unit Ready and Buffer Tests. These tests are non-destructive, do not require moving media to the DLT Tape drives, and can quickly determine the health of drives. For in-depth diagnostics of a suspect drive in the TL895 Tape Library, consult the *TL895 Tape Library Diagnostic Software Program User Guide* (Part Number 340967-001).

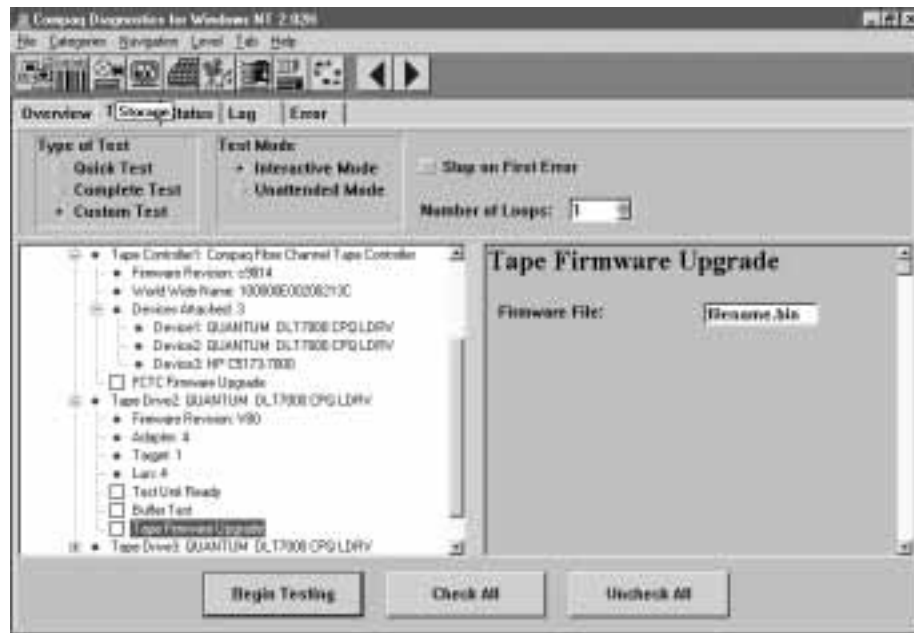


Figure 6-11. Expanded view of a DLT Tape Drive

## DLT Tape Library Diagnostic Screen

By expanding the DLT Tape Library section, firmware versions, SCSI Identification information, and Library Element Status are displayed. In addition to Test Unit Ready commands, a Force Inventory and Move Media Command are available. These diagnostic routines will verify existence of tapes and allow the testing of the robotic controller and mechanical mechanisms within the library. Firmware upgrades are available for the robotic controller, and should be used with extreme caution.

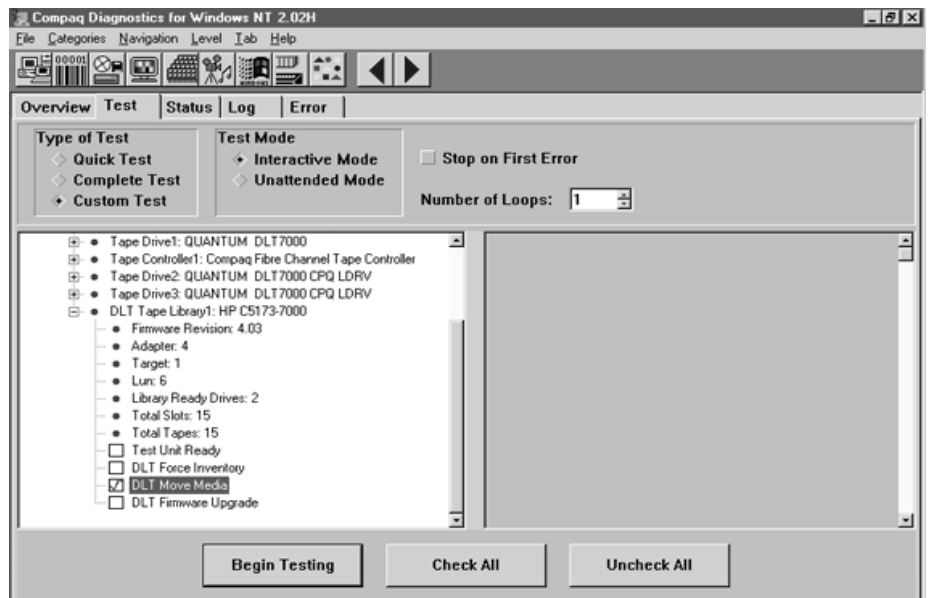


Figure 6-12. Expanded view of the DLT Tape Library Diagnostics screen

## Move Media Screen

The Move Media command is a good way to access the DLT Tape Library from remote locations to determine the health of the robotic controller, mechanical mechanisms and the Load & Unload ability of the DLT Drives. Caution should be taken to ensure that scratch media is used in testing the Move Media commands. Any time a tape is loaded and unloaded in a DLT drive, there is the possibility of destroying stored data or the actual media itself. Selections can be made to return the media to its original position or leave it in the drives. Care should be taken to return media to its original position to ensure the integrity of bar code element status and application software inventory requirements.

Select the desired media source and destination. Select "Leave Media" to leave the media in the destination or "Return Media" to return the media to the source.

Source: [Empty dropdown]

Destination: Drive1 (0001h)

Slot1 (001Fh) AAL850  
 Slot2 (0020h) AAL851  
 Slot3 (0021h) AAL852  
 Slot4 (0022h) AAL853  
 Slot5 (0023h) AAL854

Media Status

Leave Media  
 Return Media

Ok Exit

Figure 6-13. Move Media command screen

## **Information Screens**

Additional Status, Log, and Error screens are available for review of test results. Information Icons display general system information. Full versions of Compaq User Diagnostics and additional information are available at:  
<http://saturn.wins.compaq.com/Revolution/Default.htm>.

## Tier 2: Storage Area Network View

### Fibre Channel Fault Isolation Utility

The Fibre Channel Fault Isolation Utility (FFIU) verifies the integrity of a new or existing FC-AL installation. When used with troubleshooting flow charts, this utility provides fault detection and help in locating a failing device on the FC-AL.

Each device on the FC-AL has an Arbitrated Loop Physical Address (ALPA). The ALPA is allocated dynamically—it can change with each power-up or as new devices are added to the loop. The fault isolation utility indicates all devices that are active on the FC-AL. The utility dynamically updates the screens to show the current ALPA of each component. Additionally, a Loop Error Histogram is displayed when specific servers or components are highlighted to further analyze the health of individual components. The utility analyzes Fibre Channel components including the Host Bus Adapter and the Fibre Channel Tape Controller. The Fibre Channel Storage Hub 12 is logically transparent to the operations of the FC-AL, but even a failed Storage Hub 12 can be detected when the Fault Isolation Utility is used in combination with the Troubleshooting Flow Charts.

Details and Flow Charts are available in the *Fibre Channel Troubleshooting Guide* (Part Number 297877-004).

### Installing the Utility

The latest files for the Fibre Channel Fault Isolation Utility, as well as information about installing the utility, are located on the Compaq SmartStart and Support Software CD. To access these files, create a set of Compaq diskettes from the Compaq SmartStart and Support Software CD.

### Running the Utility

#### CD Operations

To run the Fibre Channel Fault Isolation Utility:

1. **Insert** the SmartStart CD in the CD ROM drive.
2. **Select** Run Fibre Channel Diagnostics.
3. **Select** Next. The Windows-based utility will load automatically.

## Program Displays

The utility's main display is shown below. It displays each FC-AL from the perspective of the server. All Fibre Host Controllers in the server are shown with a slot number and indicate a PCI (/P) or EISA (/E)

**NOTE: The Enterprise Backup Solution only supports PCI Host Bus Adapters to ensure adequate performance.**

Each Fibre Channel Array and Fibre Channel Tape Controller is shown as a branch of the Fibre Host Controller that it is connected to. The Arbitrated Loop Physical Address (ALPA) is shown for each Fibre Channel Controller.

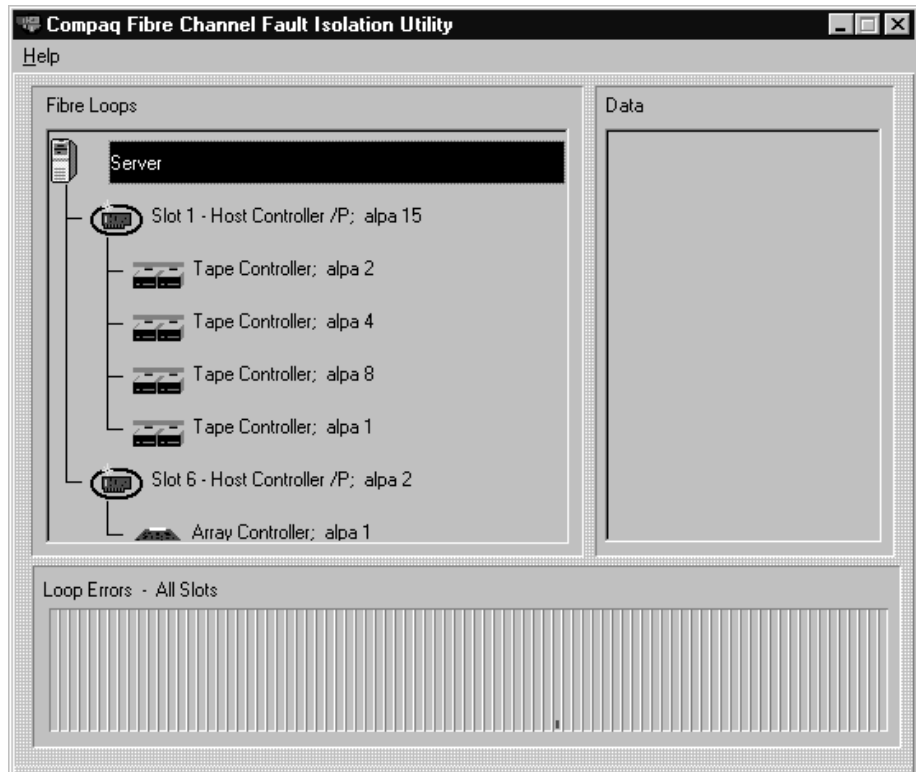
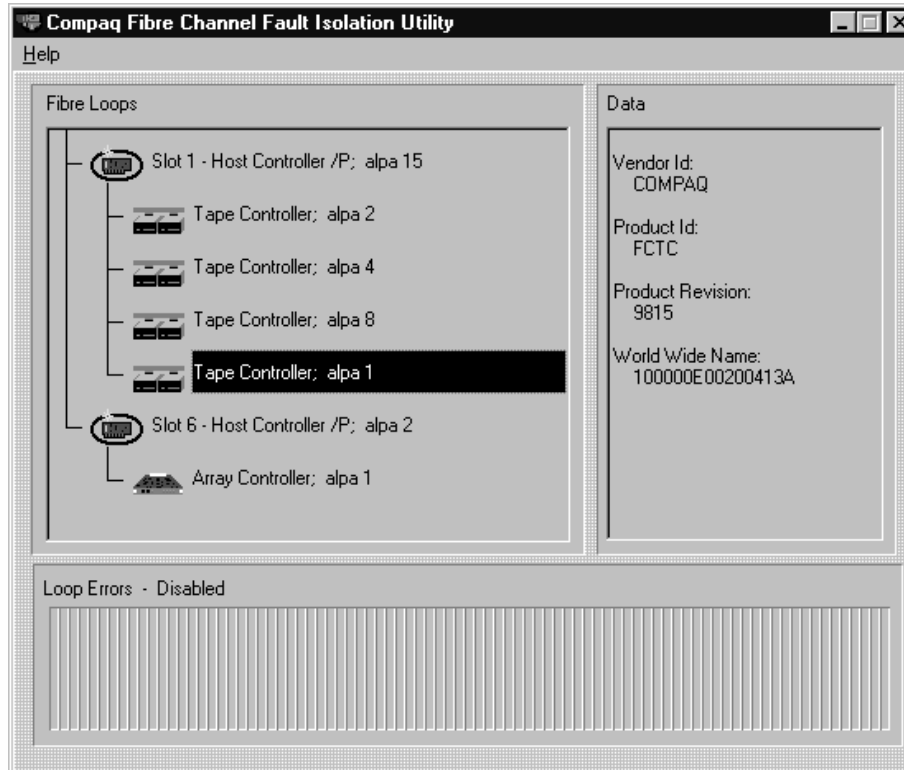


Figure 6-14. The Fibre Channel Fault Isolation Utility's Main Display

## Display of a Fibre Channel Tape Controller

The Fibre Channel Fault Isolation Utility displays detailed information about any Fibre Channel Tape Controller connected to the FC-AL. The figure below shows a Fibre Channel Tape Controller selected, with detailed information about this tape controller displayed to the right. A Fibre Channel Disk Array Controller is also shown on a separate FC-AL.



**Figure 6-15. Detailed information Displayed about a Tape Controller**

The information displayed in the data field includes:

- **Vendor ID:** Identifies the vendor of the target controller
- **Product ID:** Identifies the product
- **Product Revision:** Revision level of the product
- **World Wide Name:** A unique identifier in a Fibre Channel system, different for each Fibre Channel Component.

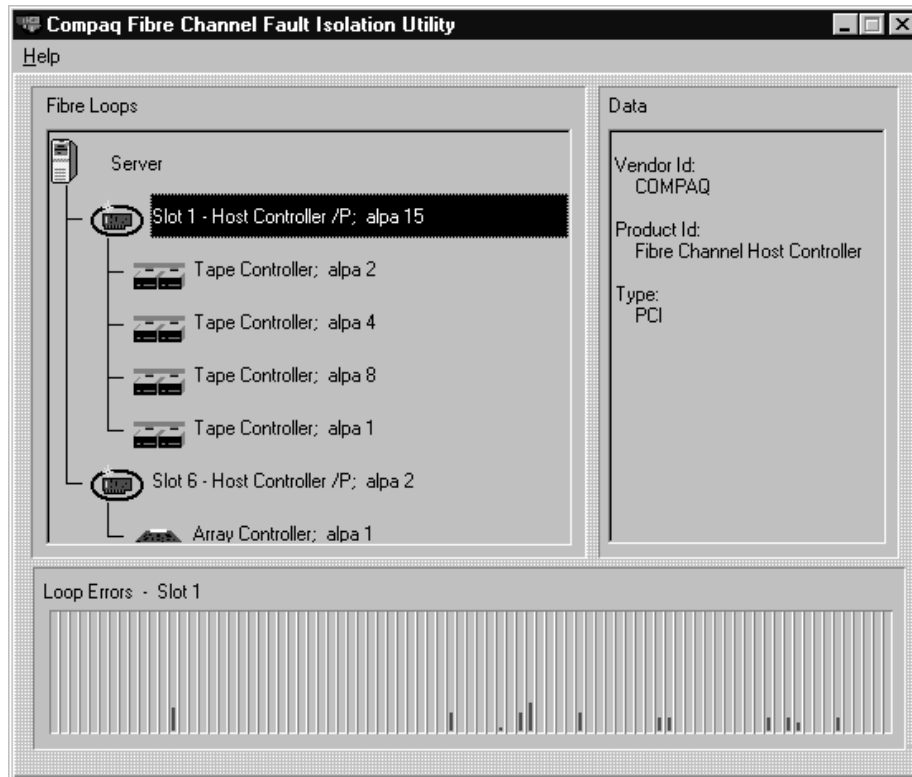
## **72** *Adding TL895 Tape Drives to the Compaq Enterprise Backup Solution*

There is no correspondence between the order in which Fibre Channel target controllers appear on this screen and how they are physically connected on the FC-AL. The display shows the Fibre Channel target controllers are connected to the same FC-AL as the Fibre Channel Controller indicates.



## Loop Error Histogram Display

The Loop Error Histogram indicates errors detected on the FC-AL when a Fibre Channel Host Controller is highlighted. Each bar represents a 3 second period of activity. The histogram scrolls from right to left. The figure below shows a single error period. Notice that FC-AL errors do not update the histogram unless a Fibre Channel Host Controller is highlighted. This occurs because the server's only view of the FC-AL is through the Fibre Channel Host Controller, yielding no real indication of where the source of errors may be. When errors are displayed, individual components may be disconnected from the FC-AL to determine the failing cable, GBIC, or component. The flow charts in the Troubleshooting Guide help you through this process.



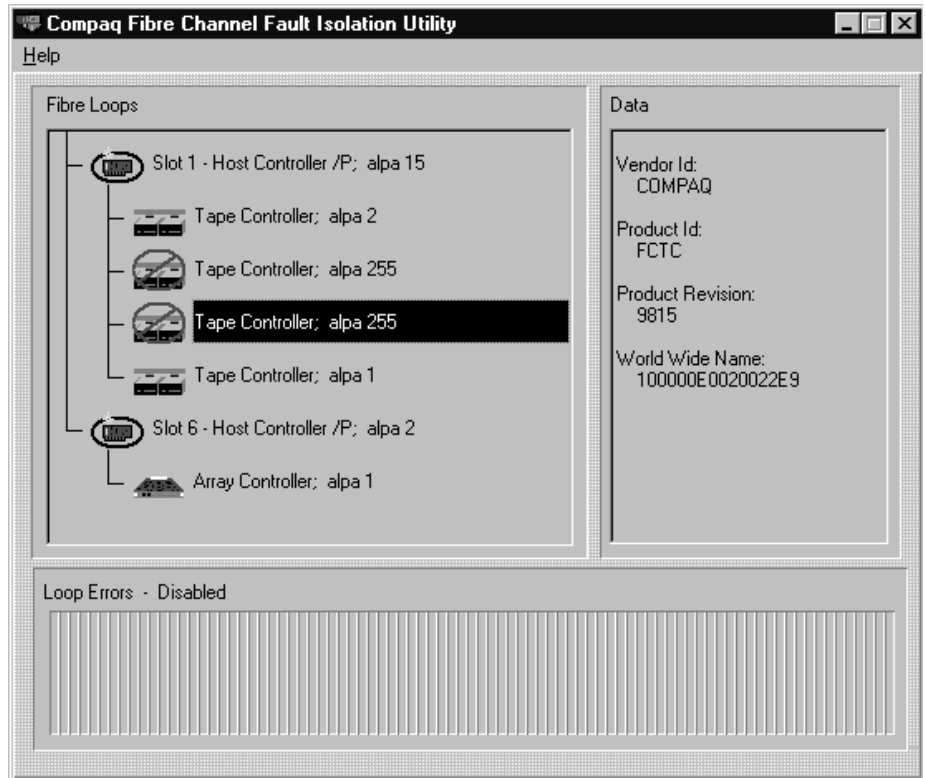
**Figure 6-16. The Loop Error Histogram, showing a single 3 second error interval**

Selecting the server causes the sum of all errors on all FC-ALs to be displayed. Selecting a different Fibre Channel Host Controller will display the errors associated with that FC-AL.

## Display of a FC-AL with a Missing Fibre Channel Tape Controller

The figure below shows a Fibre Channel Host Controller highlighted with a Fibre Channel Tape Controller missing. This indicates that while the Tape Controller has become inactive on the FC-AL since the utility was started. This could mean that it has been physically disconnected or that errors are occurring on the FC-AL at a great enough frequency to prevent the device from maintaining login.

If there are a large number of errors occurring in the FC-AL, the Fibre Channel Host Controller may not be able to communicate with the Fibre Channel Tape Controllers on the FC-AL. In this case, the Fibre Channel Controllers may appear to be offline in the program, although in reality they are physically connected to the FC-AL. When a FC-AL shows errors, the Fibre Channel Array and Tape Controllers may alternate between being logged-on the FC-AL or missing.



**Figure 6-17. Display of a FC-AL with a Fibre Channel Tape Controller shown as missing**

## Uninitialized Fibre Channel Arbitrated Loop Display

In the figure below, the FC-AL connected to the Fibre Channel Host Controller in Slot 1 has not initialized. This can be derived from the Fibre Channel Host Controller having the default ALPA of 255. If this controller was already initialized as part of an FC-AL, it would have a valid ALPA.

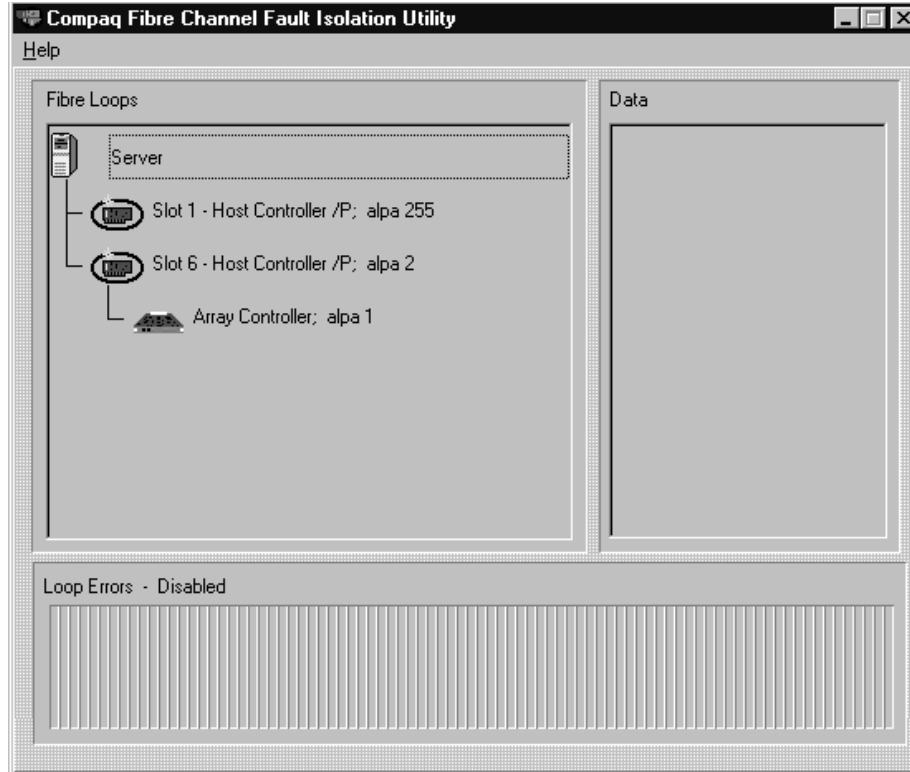


Figure 6-18. Display showing uninitialized FCTC in Slot 1

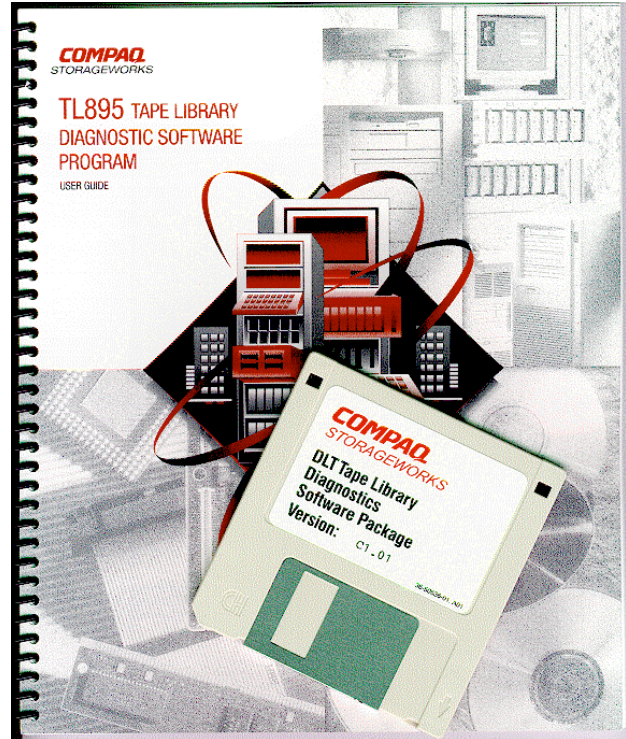
## Information and Updates

For more information on Fibre Channel Arbitrated Loop, see additional whitepapers at: <http://www.compaq.com/support/techpubs/whitepapers>.

## Tier 3: TL895 Library View Compaq Library Diagnostics C1.01

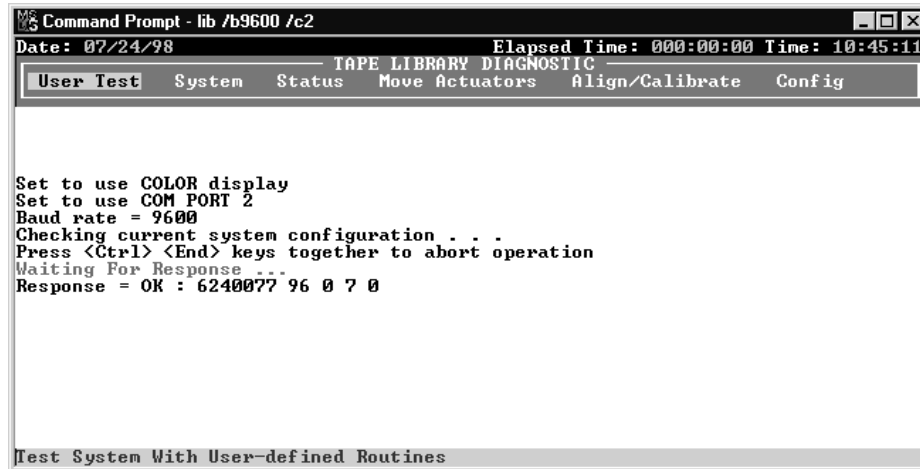
The TL895 Tape Library is shipped with a diskette containing an advanced diagnostic program. The program is DOS-based and can be run from any laptop or from a DOS Window from any NT server. A serial cable is supplied with the library to connect to a port at the rear of the library.

This detailed diagnostic program allows calibration, configuration and individual component testing of the TL895 Tape Library.



## Compaq Library Diagnostics Program Functionality

### Main Menu



```
Command Prompt - lib /b9600 /c2
Date: 07/24/98 Elapsed Time: 000:00:00 Time: 10:45:11
TAPE LIBRARY DIAGNOSTIC
User Test System Status Move Actuators Align/Calibrate Config

Set to use COLOR display
Set to use COM PORT 2
Baud rate = 9600
Checking current system configuration . . .
Press <Ctrl> <End> keys together to abort operation
Waiting For Response . . .
Response = OK : 6240077 96 0 ? 0

Test System With User-defined Routines
```

Figure 6-19. Diagnostic Software main menu

The main menu screen displays six categories of diagnostic functions:

- User Test
- System
- Status
- Move Actuators
- Align/Calibrate
- Config

To navigate the main menu:

1. Use the left and right arrows to highlight one of the diagnostic categories.
2. When the category is highlighted, press **Enter** to select it. A drop-down menu appears listing the available options. See the menu structure on the next page.
3. To execute an option, highlight it and press **Enter**. Press **Esc** to exit any submenu or popup window.

## Menu Structure

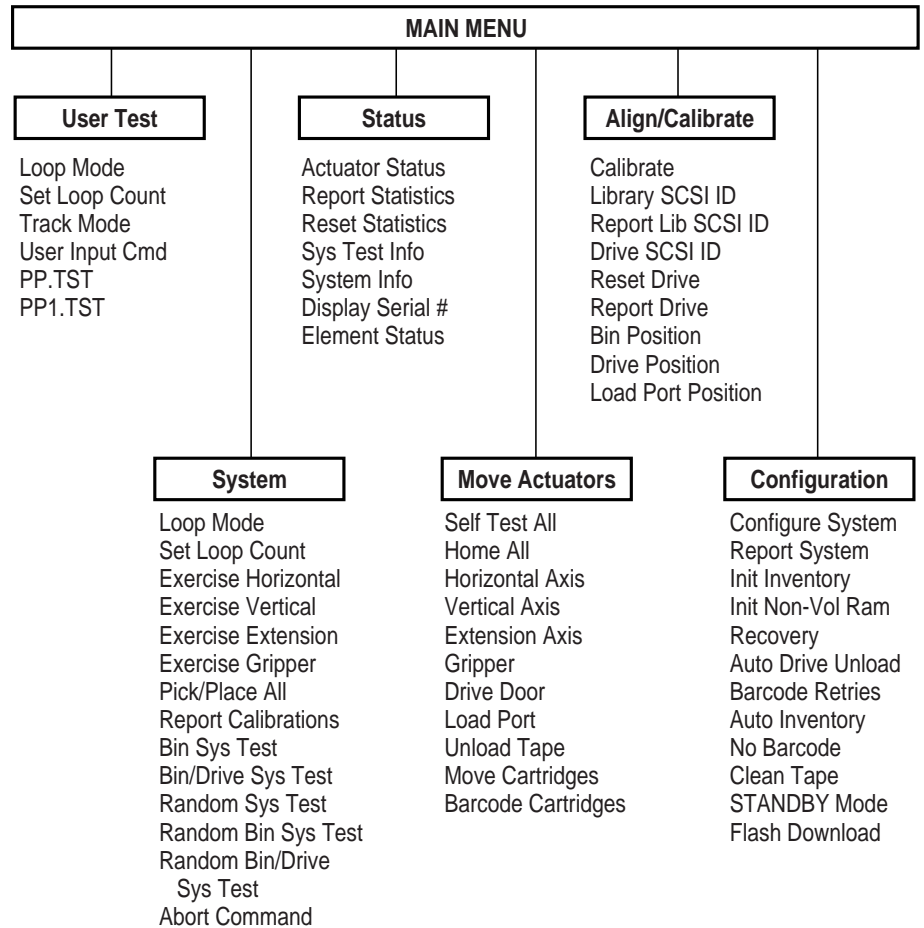


Figure 6-20. Diagnostic Software menu options

## Configuration Screen

The Config menu lets you:

- Set or display the overall library configuration
- Initialize an inventory sequence, NVRAM, or the bar code scanner
- Enable or disable recovery options or the tape cleaning feature
- Perform a flash download
- Enable or disable bar code reading and set number of retries
- Enable or disable Autodrive Unload feature
- Go into Standby Mode or Line Mode

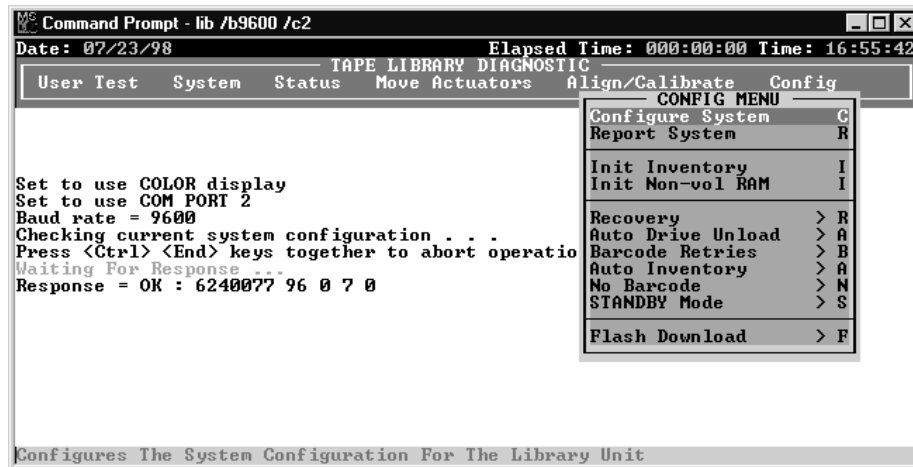


Figure 6-21. Configuration menu

## More Information

For detailed information on Compaq Library Diagnostics, see the *TL895 Tape Library Diagnostic Software Program and User Guide* (Part Number 340967-001).

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