IBM Ultrium Device Drivers

Installation and User's Guide

GA32-0430-00.1

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Note!
Before using this information and the product that it supports, be sure to read the general information under "Notices" on page 231.

Second Edition (March 2001)

This edition obsoletes and replaces GA32-0430-00. Changes or additions are indicated by a vertical line in the left margin.

This edition applies to the following tape drive, medium changer, and library device drivers:

Contents

Figures

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Preface

Related Publications

The following publications provide related information about the IBM® Ultrium™ tape drive, medium changer, and library device drivers:

- *IBM Ultrium Device Drivers: Programming Reference*, WB1304
- *IBM 3580 Ultrium Tape Drive Setup, Operator, and Service Guide*, GA32-0415
- *IBM 3581 Ultrium Tape Autoloader Setup, Operator, and Service Guide*, GA32-0412
- *IBM 3583 Ultrium Scalable Tape Library Setup and Operator Guide*, GA32-0411
- *IBM 3583 Ultrium Scalable Tape Library Service Guide*, GA32-0425
- *IBM 3584 UltraScalable Tape Library Planning and Operator Guide*, GA32-0408
- *IBM 3584 UltraScalable Tape Library Maintenance Information Manual*, GA32-0408
- *StorageSmart by IBM Ultrium External Tape Drive TX200 Machine Type 3585 Setup, Operator, and Service Guide*, GA32-0421
- *IBM 3580 Ultrium Tape Drive and StorageSmart by IBM Ultrium Tape Drive TX200 SCSI Reference*, WB1109
- *StorageSmart by IBM Ultrium External Tape Drive TX200 Machine Type 3585 Quick Reference*, GX35-5061
- *StorageSmart by IBM Ultrium Tape Autoloader SL7 Machine Type 3586 Setup, Operator, and Service Guide*, GA32-0423
- *StorageSmart by IBM Ultrium Tape Autoloader SL7 Machine Type 3586 SCSI Reference*, WB1105
- *StorageSmart by IBM Ultrium Tape Autoloader SL7 Machine Type 3586 Quick Reference*, GX35-5058
- *StorageSmart by IBM Ultrium Scalable Tape Library SL72 Machine Type 3587 Setup, Operator, and Service Guide*, GA32-0425
- *StorageSmart by IBM Ultrium Scalable Tape Library SL72 Machine Type 3587 SCSI Reference*, WB1106
- *StorageSmart by IBM Ultrium Scalable Tape Library SL72 Machine Type 3587 Maintenance Information*, SA37-0427
- *StorageSmart by IBM Ultrium Scalable Tape Library SL72 Machine Type 3587 Quick Reference*, GX35-5059
- *American National Standards Institute Small Computer System Interface*

  X3T9.2/86-109 X3.180, X3B5/91-173C, X3B5/91-305, X3.131-199X Revision 10H, and X3T9.9/91-11 Revision 1

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Summary of Changes

This summary of changes includes specific release updates to this publication.

Second Edition (March 2001)

This release includes the following new information:

- Support for IBM @server pSeries

This release also includes changes to correct errors or omissions in the previous edition.

Part 1. Introduction to IBM Ultrium Device Drivers

Chapter 1. Ultrium Device Drivers

This publication describes the IBM Tape and Medium Changer Device Drivers for the following devices:

on AIX®, Solaris, HP-UX, Windows NT®, and Windows 2000® that are provided with the IBM Ultrium products.

Purpose

The IBM Ultrium tape and medium changer device drivers are designed specifically to take advantage of the features provided by the IBM Ultrium tape drives and medium changer devices. The goal is to give applications access to the functions required for basic tape functions (such as backup and restore) and medium changer operations (such as cartridge mount and demount), as well as to the advanced functions needed by full tape management systems. Whenever possible, the driver is designed to take advantage of the device features transparent to the application.

Platform Support

"Part 2. AIX Tape and Medium Changer Device Driver" on page 9 describes the installation and configuration of the AIX Enhanced Tape and Medium Changer Device Driver for IBM Ultrium products.

"Part 3. Solaris Tape and Medium Changer Device Driver" on page 57 describes the installation and configuration of the Solaris Tape and Medium Changer Device Driver for IBM Ultrium products, also known as IBMtape.

"Part 4. HP-UX Tape and Medium Changer Device Driver" on page 97 describes the installation and configuration of the HP Enhanced Tape and Medium Changer Device Driver for IBM Ultrium products.

"Part 5. Microsoft Windows Tape Device Drivers" on page 137 describes the installation and configuration of Microsoft® Windows®-based Tape and Medium Changer Device Drivers for IBM Ultrium products.

Information in the “Appendixes” covers accessing updated drivers, microcode, and documentation online. It also addresses attachment testing of IBM Ultrium devices to the host computer.

Introduction

The IBM Ultrium product family provides an excellent solution for customers with small to large storage and performance requirements.

Figure 1 illustrates the attachment of various Ultrium products to an open systems server.

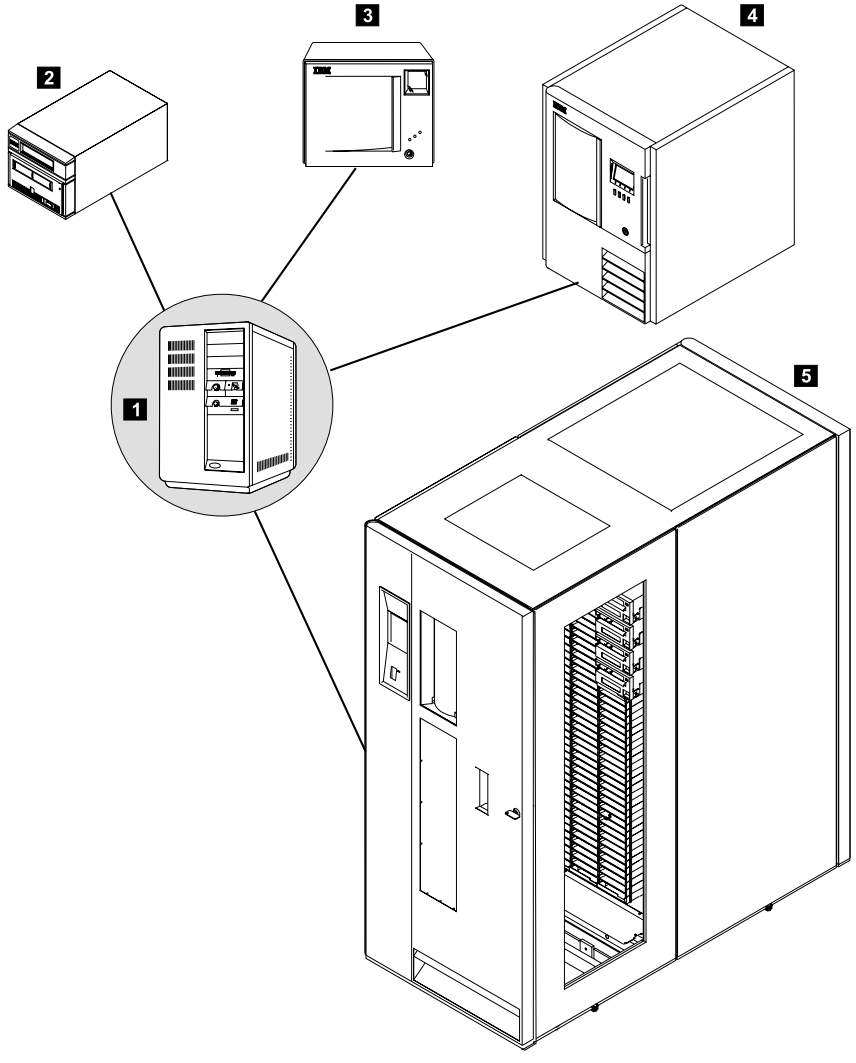


Figure 1. Attachment Array

The following are the Ultrium Device Driver attachments:

- 1 Open Systems Server
- 2 IBM 3580 Ultrium Tape Drive
- 3 IBM 3581 Ultrium Tape Autoloader
- 4 IBM 3583 Ultrium Scalable Tape Library
- 5 IBM 3584 UltraScalable Tape Library

Figure 2 illustrates an Ultrium environment that could include an IBM 3583 Ultrium Scalable Tape Library and an IBM 3584 UltraScalable Tape Library.

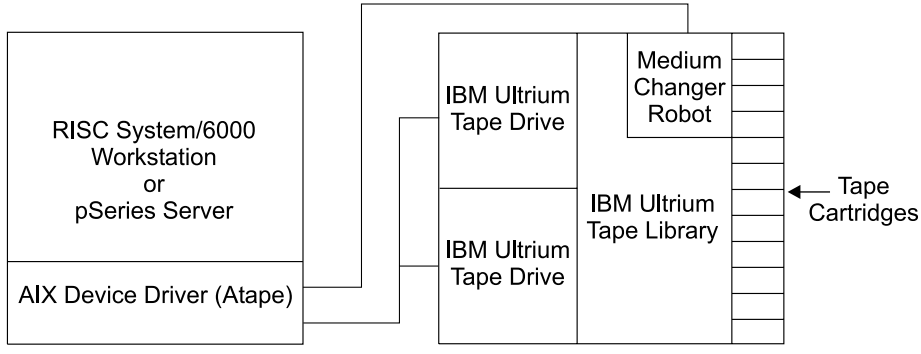


Figure 2. Example of an Ultrium Environment

IBM 3580 Ultrium Tape Drive

The IBM 3580 Ultrium Tape Drive is a stand-alone, large capacity, high performance tape drive that adheres to the Linear Tape-Open (LTO) specifications and supports the IBM Ultrium-format tape. The drive supports native tape capacities of up to 100 GB with uncompressed data transfer rates of up to 15 MB/sec. With both Low-Voltage Differential (LVD) Ultra-2 SCSI and High-Voltage Differential (HVD) Ultra SCSI attachments, this device is suitable for a variety of save/restore and archiving requirements for PC and Open Systems platforms.

IBM 3581 Ultrium Tape Autoloader

The IBM 3581 Ultrium Tape Autoloader is an external, stand-alone or rack-mounted tape autoloader that incorporates one IBM Ultrium Tape Drive. The autoloader has seven storage slots giving the autoloader up to 700 GB of uncompressed data storage. The autoloader can be used with compatible software applications to automate backup/recovery or other data storage activities.

IBM 3583 Ultrium Scalable Tape Library

The IBM 3583 Ultrium Scalable Tape Library is an automated tape library that incorporates IBM Ultrium tape drives in either a stand-alone or optional

rack-mount configuration. Three different library models are available with storage capacities of 18 through 72 slots and one to six Ultrium tape drives. The IBM 3583 Ultrium Scalable Tape Library can be used for save/restore and mass storage archives where multi-terrabyte capacities are required.

IBM 3584 UltraScalable Tape Library

The IBM 3584 UltraScalable Tape Library provides a highly scalable mid-range tape library that supports logical partitioning (multi-path architecture) and can house up to 72 IBM Ultrium tape drives. With scalability of one to six frames, the IBM 3584 UltraScalable Tape Library provides native storage capacity from 14 TB to 248.1 TB with a wide range of host attachment configurations.

StorageSmart™ by IBM Ultrium Products

The StorageSmart by IBM Ultrium family of products is compatible with the IBM-branded versions of the Ultrium family products. In this manual, where there is no specific mention of the StorageSmart branded set of products, the documentation pertaining to the IBM-branded family of products should be used. The following table cross-references the StorageSmart Ultrium product set to the IBM Ultrium product set.

Table 1. Ultrium Product Comparison

StorageSmart by IBM Ultrium	IBM Version of Ultrium
StorageSmart by IBM Ultrium External Tape Drive TX200	IBM 3580 Ultrium Tape Drive
StorageSmart by IBM Ultrium Tape Autoloader SL7	IBM 3581 Ultrium Tape Autoloader
StorageSmart by IBM Ultrium Scalable Tape Library SL72	IBM 3583 Ultrium Scalable Tape Library
No equivalent in the StorageSmart by IBM product set	IBM 3584 UltraScalable Tape Library

Part 2. AIX Tape and Medium Changer Device Driver

Chapter 2. Introduction and Product Requirements

This chapter describes the IBM AIX Enhanced Tape and Medium Changer Device Driver for the following Ultrium products:

- IBM 3580 Ultrium Tape Drive
- IBM 3581 Ultrium Tape Autoloader
- IBM 3583 Ultrium Scalable Tape Library
- IBM 3584 UltraScalable Tape Library
- StorageSmart by IBM Ultrium External Tape Drive TX200
- StorageSmart by IBM Ultrium Tape Autoloader SL7
- StorageSmart by IBM Ultrium Scalable Tape Library SL72

Purpose

The IBM AIX Enhanced Tape and Medium Changer Device Driver is designed specifically to take advantage of the features provided by the IBM Ultrium tape drives and medium changer devices. The goal is to give applications access to the functions required for basic tape operations, such as backup and restore, and medium changer operations, such as mount and demount the cartridges, as well as to the advanced functions needed by full tape management systems. Whenever possible, the driver is designed to take advantage of the device features transparent to the application.

Data Flow

The software described in this chapter covers the AIX Enhanced Device Driver (Atape device driver) and the interface between the application and the tape device. Figure 3 illustrates a typical Ultrium data flow process.

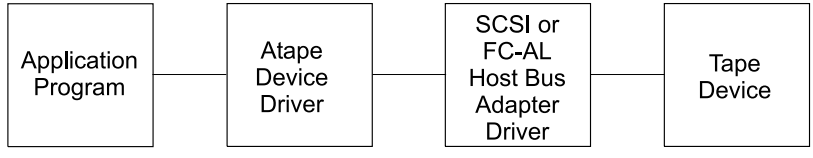


Figure 3. Data Flow Process

Product Requirements

The following software and hardware components are required to use the tape device driver.

Software Requirements

The AIX Enhanced Device Driver (Atape device driver) supports the following AIX operating system levels for operation of IBM Ultrium tape drives and automation products:

- AIX 4.3.2 or AIX 4.3.3 (this is dependent on the host bus adapter being used) with AIX APARs IY10452 and IY15766. See "Hardware Requirements".

Note: The Atape device driver supports AIX Version 4.3.2 (and later releases) in an MP Safe (multiprocessing) mode.

Hardware Requirements

The Atape device driver supports the following IBM Ultrium tape drives and automation products:

- One or more of the following IBM Ultrium tape devices:
  - IBM 3580 Ultrium Tape Drive Models L11 (LVD attach), H11 (HVD attach)
  - IBM 3581 Ultrium Tape Autoloader Models L17 (LVD attach), H17 (HVD attach)
  - IBM 3583 Ultrium Scalable Tape Library Models L18, L36, L72
  - IBM 3584 UltraScalable Tape Library Models L32 (base frame), D32 (expansion frame)
- One or more of the following StorageSmart by IBM devices:
  - StorageSmart by IBM Ultrium External Tape Drive TX200 - Models L11 (LVD attach), H11 (HVD attach)
  - StorageSmart by IBM Ultrium Tape Autoloader SL7 - Models L17 (LVD attach), H17 (HVD attach)
  - StorageSmart by IBM Ultrium Scalable Tape Library SL72 - Models L18, L36, L72
- One or more of the following IBM RS/6000® or pSeries SCSI host adapters:
  - PCI Dual Channel Ultra-2 SCSI Adapter (LVD) (RS/6000 or pSeries FC 6205), AIX 4.3.3 and later
  - PCI Differential Ultra SCSI Adapter (HVD) (RS/6000 or pSeries FC 6207)
  - PCI Universal Differential Ultra SCSI Adapter (HVD) (RS/6000 or pSeries FC 6204), AIX 4.3.3 and later
  - Integrated LVD port - RS/6000 or pSeries 7044 Models 170 and 270, AIX 4.3.3 and later, IBM 3580, 3581, and 3583 only
- One or more of the following IBM RS/6000 or pSeries host adapters:

- Gigabit Fibre Channel Adapter (PCI) (RS/6000 or pSeries FC 6227)

Chapter 3. Tape Drive, Media, and Device Driver Parameters

This chapter describes the parameters that control the operating modes of the tape drive, media, and device driver.

Configuration Parameters

The operating parameters for the tape drive and device driver can be set and changed by the configuration procedures. The installation defaults are provided for all parameters initially. The AIX *smit* command can be used to set these parameters when configuring a device or to change these parameters. The AIX *chdev* command can also be used to change the configuration parameters.

The configuration parameters are used to set the operating mode of the tape drive and device driver when a device is opened. These parameters can be queried by an application. Some parameters can be changed temporarily during the *open* subroutine by an application, but they are always restored to the configuration values when a device is closed. The configuration parameters are:

- Block size
- Compression
- Logging
- Maximum size of the log file
- Record space mode
- Rewind immediate
- Trailer labels

Block Size

This parameter specifies the block size used for read and write operations. A value of zero is the variable block size. Any other value is a fixed block size.

The installation default is zero (use variable length).

Compression

Hardware compression is implemented in the device hardware. This parameter turns the compression feature on and off. If compression is enabled, then the effective performance can increase based on the compressibility of the data.

The installation default is on (use compression).

Logging

This parameter turns the volume information logging on and off. If logging is set to on, then the statistical information about the device and media is saved in a log file when a tape is unloaded. If logging is set to off, then the information is not saved. This parameter has no effect on error logging because error logging is always enabled. For more information, see "Chapter 10. Device and Volume Information Logging" on page 51.

The installation default is off (no logging).

Maximum Size of the Log File

This parameter specifies the number of entries made before the log file starts to wrap. Each entry is approximately 2 KB (2048 bytes). After the log file starts to wrap, the number of entries remains constant. Each time a new entry is made, the oldest entry is overlaid. For more information, see "Chapter 10. Device and Volume Information Logging" on page 51.

The installation default is 500.

Record Space Mode

This parameter specifies how the device driver operates when a forward or backward space record operation encounters a filemark. The two modes of operation are SCSI and AIX.

The SCSI mode is the default mode of operation. When a forward or backward space record operation is issued to the driver and a filemark is encountered, the device driver returns -1 and the *errno* variable is set to EIO. The tape is left-positioned after the filemark (the end-of-tape side of the filemark on the forward space and the beginning-of-tape side of the filemark on the backward space).

The AIX mode returns the same EIO *errno* value as the SCSI mode when a filemark is encountered, except that the tape is left-positioned before the filemark (the beginning-of-tape side of the filemark on the forward space and the end-of-tape side of the filemark on the backward space).

The installation default is SCSI mode.

Rewind Immediate

This parameter turns the immediate bit on and off in rewind commands. If it is set to on, then the rewind tape operation executes faster, but the next command takes a long time to finish unless the rewind operation is physically complete. Setting this parameter reduces the amount of time that it takes to close a device for a Rewind on Close special file.

The installation default is off (no rewind immediate).

Trailer Labels

If this parameter is set to on, then writing a record past the early warning mark on the tape is allowed. The first write operation to detect EOM fails and the *errno* variable is set to ENOSPC. No data is written during the operation. All subsequent write operations are allowed to continue until the physical end of the volume is reached and EIO is returned.

This parameter can also be selected by using one of three device special files that allow trailer-label processing. The special files are *rmtx.40, rmtx.41,* and *rmtx.60,* where *x* is the name of the device (for example, *rmt0.40*).

The installation default is off (no trailer labels).

Media Parameter

The media parameter can be queried and set by the *tapeutil* application using the **Query/Set Parameters** option on the menu. This parameter cannot be set or changed by the configuration procedures. The media parameter is:

- Volume ID for logging

Volume ID for Logging

This parameter is the volume ID of the currently loaded tape. It is used in the log file entry (if volume logging is active) to identify the entry with a particular volume. The device driver sets the volume ID to UNKNOWN initially and when the tape is unloaded.

Chapter 4. Installation and Configuration Instructions

The standard set of AIX tools and methods is available for installation and configuration. Use the *installp* utility for installation. Use the *smit* command or the *chdev*, *rmdev*, and *mkdev* commands for configuration.

You must have *root* authority to proceed with the installation of the driver.

Attention: A reboot of the host system will be required to complete the installation.

Installation Procedure

Enter the following command to list the currently installed *Atape.driver* version:

```
lslpp -l Atape.driver
```

If you have the IBM Ultrium Device Drivers CD, use the following instructions to install and configure the device driver:

1. For an installed Atape device driver, deconfigure all existing tape devices that use the Atape driver by following the instructions shown in "Deconfiguring the IBM 3580 Tape Device" on page 22 or "Deconfiguring the IBM 3581, 3583, 3584 Medium Changer Device" on page 22.
2. Place the CD into the CD-ROM drive on your AIX system.
3. Mount the CD over an empty directory. For example, if your CD-ROM drive is defined at */dev/cd0* and you have an empty directory at */cdrom*, issue the following command to mount the CD:

   ```
   mount -frv cdrfs /dev/cd0 /cdrom
   ```

   You can create an empty directory using the *mkdir* command, for example:

   ```
   mkdir /cdrom
   ```

   Subsequent instructions assume that you mounted the CD at mount point */cdrom*.
4. Enter the following command:

   ```
   cd /cdrom/AIX
   ```
5. Consult the *Atape.Readme* file on the CD for any important information pertaining to the device driver. Information in this file takes precedence over information in the manual.
6. Execute the *install_atape* script. This script uninstalls any previous versions of Atape, installs and commits the latest version of Atape, then runs *cfgmgr*

to define your devices.

7. Enter the following command:

   ```
   unmount /cdrom
   ```

8. Remove the CD from the CD-ROM drive and store it in a safe place.

If you have the Atape device driver on a diskette, use the following instructions to install and configure the device driver:

1. For an installed Atape device driver, uninstall the Atape driver by following the instructions shown in "Uninstallation Procedure" on page 23.
2. Place the diskette into the diskette drive on your AIX system. The following steps assume that your diskette drive is defined as */dev/rfd0*.
3. Enter the following command:

   ```
   installp -acXd /dev/rfd0 Atape.driver
   ```

   This installs and commits the Atape driver on your system.
4. Remove the diskette from the diskette drive and store it in a safe place.
5. Follow the instructions in "Configuring Tape and Medium Changer Devices".

Configuring Tape and Medium Changer Devices

After the driver software is installed and a tape device is connected to the adapter, the device can be configured and made available for use. Access to the device is not provided until the device is configured.

Note: If the tape device was configured previously by another SCSI device driver, such as OST (Other SCSI Tape), remove the device definition (see step 22) before performing the following steps.

Configure a tape device by using **one** of the following procedures:

- Enter the following command with no parameters:

  ```
  cfgmgr
  ```

  The command configures all devices automatically (including any new tape or medium changer devices).

  or

- Power off your subsystem and reboot the system to configure it automatically and make available any new tape or medium changer devices on the system.

Deconfiguring the IBM 3580 Tape Device

Note: In the following examples, replace the letter *n* with the appropriate number for the chosen device.

Deconfigure the tape device by using **one** of the following procedures:

- The first method leaves the tape device defined in the configuration database. It is similar to bringing the device offline (not in use).

  Enter the following command to bring the */dev/rmtn* tape device offline but leave it defined in the device database:

  ```
  rmdev -l rmtn
  ```

  or

- The second method brings the tape device offline and removes its definition from the device database.

  Enter the following command:

  ```
  rmdev -l rmtn -d
  ```

  The device driver is not unloaded from the kernel until the last device is deconfigured.

Deconfiguring the IBM 3581, 3583, 3584 Medium Changer Device

Note: In the following examples, replace the letter *n* with the appropriate number for the chosen device.

Deconfigure the medium changer device by using **one** of the following procedures:

- The first method leaves the device defined in the configuration database. It is similar to bringing the device offline.

  Enter the following command to bring the */dev/smcn* medium changer device offline but leave it defined in the device database:

  ```
  rmdev -l smcn
  ```

  or

- The second method brings the medium changer device offline and removes its definition from the device database.

  Enter the following command:

  ```
  rmdev -l smcn -d
  ```

  The device driver is not unloaded from the kernel until the last device is deconfigured.

Uninstallation Procedure

Note: All tape devices that use the Atape driver must be closed and cannot be in use when Atape is uninstalled or the uninstall will fail.

You can uninstall the Atape device driver by using the *smit* command menu to uninstall software and selecting *Atape.driver* or by using the installp command:

```
installp -u Atape.driver
```

Chapter 5. Special Files

After the driver is installed and a tape device is configured and made available for use, access is provided through the special files. These special files, which consist of the standard AIX special files for tape devices (along with other files unique to the Atape driver), are in the */dev* directory.

Special Files for IBM 3580 Tape Device

Each tape device has a set of special files that provides access to the same physical drive but to different types of functions. As shown in Table 2, in addition to the tape special files, a special file is provided for IBM 3580 tape devices that allows access to the medium changer as a separate device.

Note: The asterisk (*) represents a number assigned to a particular device, such as *rmt0*.

For tape drives with attached medium changer devices, the *rmt*.smc* special file provides a separate path for issuing commands to the medium changer. When this special file is opened, the application can view the medium changer as a separate device.

Both this special file and the *rmt** special file can be opened at the same time. The file descriptor that results from opening the *rmt*.smc* special file does not support the following operations:

- Read
- Write
- Open in diagnostic mode
- Commands designed for a tape device

If a tape drive has a medium changer device attached, then all operations (including the medium changer operations) are supported through the interface to the *rmt** special file.

Table 2. Special Files for IBM 3580 Tape Device

Special File Name	Rewind on Close	Retension on Open	Bytes per Inch	Trailer Label	Unload on Close
/dev/rmt*	Yes	No	N/A	No	No
/dev/rmt*.1	No	No	N/A	No	No
/dev/rmt*.2	Yes	Yes	N/A	No	No
/dev/rmt*.3	No	Yes	N/A	No	No
/dev/rmt*.4	Yes	No	N/A	No	No
/dev/rmt*.5	No	No	N/A	No	No
/dev/rmt*.6	Yes	Yes	N/A	No	No
/dev/rmt*.7	No	Yes	N/A	No	No
/dev/rmt*.10	No	No	N/A	No	No
/dev/rmt*.20	Yes	No	N/A	No	Yes
/dev/rmt*.40	Yes	No	N/A	Yes	No
/dev/rmt*.41	No	No	N/A	Yes	No
/dev/rmt*.60	Yes	No	N/A	Yes	Yes
/dev/rmt*.null	Yes	No	N/A	No	No
/dev/rmt*.smc	N/A	N/A	N/A	N/A	N/A

Notes:

1. The Rewind on Close special files write filemarks under certain conditions before rewinding. See the *IBM Ultrium Device Drivers: Programming Reference*.
2. The Retension on Open special files rewind the tape only on open. Retensioning is not performed because these tape products perform the retension operation automatically when needed.
3. The Bytes per Inch options are ignored for the tape devices that this driver supports. The density selection is automatic.
4. The *rmt*.null* file is a pseudo device similar to the */dev/null* AIX special file. The *ioctl* calls can be issued to this file without a real device attached to it, and the device driver will return a successful completion. Read and write system calls will return the requested number of bytes. This file can be used for application development or debugging problems.
5. The *rmt*.smc* file can be opened independently of the other tape special files.
6. The *rmt*.10* file bypasses normal close processing, and the tape is left at the current position.

Special Files for the IBM 3581, 3583, or 3584 Medium Changer Device

After the driver is installed and a medium changer device is configured and made available for use, access to the robotic device is provided through the *smc** special file in the */dev* directory.

Table 3 shows the attributes of the special file. The asterisk (*) represents a number assigned to a particular device, such as *smc0*. The term *smc* is used for a SCSI medium changer device. The *smc** special file provides a path for issuing commands to control the medium changer robotic device. This same terminology is extended for medium changers, which are attached by way of a fibre channel.

Table 3. Special Files

Special File Name	Description
/dev/smc*	Access to the medium changer robotic device
/dev/smc*.null	Pseudo medium changer device
Note: The *smc*.null* file is a pseudo device similar to the */dev/null* AIX special file. The commands can be issued to this file without a real device attached to it, and the device driver will return a successful completion. This file can be used for application development or debugging problems.	

The file descriptor that results from opening the *smc* special file does not support the following operations:

- Read
- Write
- Commands designed for a tape device

Chapter 6. Using the Dump Support

Dump support is provided through the dump entry point in the driver. See the appropriate AIX manuals for a description of how to use the dump devices and how to read the dump data. Review the *sysdumpdev* and *sysdumpstart* commands.

To list the current dump devices, enter the following command:

```
sysdumpdev -l
```

To establish the *rmt1* tape device as a secondary dump device, enter the following command:

```
sysdumpdev -s /dev/rmt1
```

To perform a dump operation, use the *sysdumpstart* command. To send the dump data to the secondary dump device, enter the following command:

```
sysdumpstart -s
```

Note: This command stops the system. Use the *sync* command to ensure that the cache is flushed before issuing the *sysdumpstart -s* command.

To list the last dump data, enter the following command:

```
sysdumpdev -z
```

After the dump data is placed on the tape, copy it to a file on the disk before using the *crash* command to process it. For example:

```
dd if=/dev/rmt1 of=tapedump1 ibs=4096 obs=512
crash tapedump1
```

Note: The *ibs* value is the input block size.

If the block size of the tape device is larger than the block size sent during the dump process, then the dump operation fails. Set the block size to zero on the tape device and experiment with the *ibs* value for the *dd* command.

Chapter 7. Tape Utility Program (tapeutil)

Installed with the device driver is a tape utility program (*tapeutil*) that exercises or tests the functions of the tape device and the device driver. It also performs basic tape and medium changer operations. The tape utility program provides two versions (the interactive menu and the AIX command line) with a syntax similar to the *tctl* and *mt* commands.

The C source code for the *tapeutil.c* program can be found in the */usr/lpp/Atape/samples* directory. The program contains a sample of the interface to the device driver and the *ioctl* commands supported by the device driver.

Menu Version

The menu version of the tape utility program can be called from the AIX command line by using the *tapeutil* command. A list of general subcommands, medium changer subcommands, and tape subcommands is displayed. You must open a device before using these commands and operations (except for the tape drive service aids).

To open a device:

1. Select **Open a Device** from General Commands.
2. Enter the name of the device special file. Use any special file that exists for the device, for example, */dev/rmt0*, */dev/rmt0.1*, */dev/rmt1.smc*, or */dev/smc0*.
3. Enter the Read / Write, Read Only, Write Only, or Append mode to open a device. These modes apply to the tape devices only.

After you open a device, select a command by using the appropriate number for the command from the menu. Some commands require additional information after they are selected from the menu. If an error occurs for the command, then the error number, the error text, and the device sense data (if applicable) are displayed.

Command-Line Interface

The command-line interface of the tape utility program (*tapeutil*) has a syntax similar to the AIX *tctl* and *mt* commands and provides the same basic tape commands. The program also supports tape device, device driver, SCSI, and medium changer subcommands that use the additional functions of the tape device and device driver.

Call the *tapeutil* command from the AIX command line or from within a shell script. If you enter the *tapeutil* command without any arguments, the menu version is called.

The syntax for the command-line interface of the tape utility program is:

```
tapeutil -f Device Subcommand [Subcommand ...]
```

Notes:

1. The *Device* is the name of the device special file (for example, */dev/rmt0*).
2. The *Subcommand* is any valid command for the device.

Multiple subcommands can be combined in a single command to perform more than one operation. The subcommands are processed one at a time in the order specified on the command line. For help information about the subcommands and their syntax, enter the *tapeutil ?* command on the AIX command line. The following help information is displayed:

General subcommands:

```
devinfo      inquiry [Page]  print "Text"
reserve      release         reqsense
reset        logpage "Page"  modepage "Page"
qrypath      resetpath       disablepath "Primary|Alternate"
tur          vpd             fuser
passthru
```

Medium Changer subcommands:

```
allow         prevent         audit [Address[Count]]
inventory     mount [Slot]    position "Destination"
elementinfo   ummount [Slot]  move "Source" "Destination"
devids                        exchange "Source" "Dest1' "Dest2"
```

Tape subcommands:

```
append      bsf [Count]   bsr [Count]
autoload    eof [Count]   weof [Count]
compress    fsf [Count]   fsr [Count]
nocompress  erg           logsense
load        erase         display "Message"
mtdevice    rewind        read -d Destination  [-c Count]
qrypos      retension     write -s Source
seod        status        rtest [-b Blocksize] [-c Count] [-r Repetition]
offline     parms         wtest [-b Blocksize] [-c Count] [-r Repetition]
rewoffl     sync          rwtest [-b Blocksize] [-c Count] [-r Repetition]
unload      volid "Name"  setpos [Blockid]
noautoload  sdp "Number"  chgpart "Number" [Blockid]
list        idp           qrypart
density     prevent       allow
sili        nosili
```

Service Aid subcommands:

```
dump [Filename]  fmrtape  resetdrive  ucode "Name"
```

Note: Not all subcommands listed in the online help are supported by IBM 358x devices. Only the supported subcommands are described in the "General Subcommands", "Medium Changer Subcommands" on page 35 and "Tape Subcommands" on page 37.

General Subcommands

The following general subcommands are available for the tape and medium changer devices:

- **devinfo**

  This subcommand displays the device information returned from the IOCINFO *ioctl* command.

- **fuser**

  This subcommand is similar to the AIX fuser command. If the device special file is open currently by a process, it displays the process id; otherwise, it will indicate that the device special file is not open currently.

- **inquiry [Page]**

  This subcommand issues the SCSI Inquiry command to the device for either standard inquiry data if the page parameter is omitted, or for the specified page, and displays the inquiry data. The page parameter must be specified as a hex value.

  Example:

  ```
  # Get standard inquiry data
  tapeutil -f/dev/rmt0 inquiry

  # Get inquiry page x'83'
  tapeutil -f/dev/rmt0 inquiry 83
  ```

- **logpage "Page"**

  This subcommand issues the SCSI Log Sense command to the device for the specified page and displays the log sense data. The page parameter must be specified as a hex value.

  Example:

  ```
  # Get log page x'2E'
  tapeutil -f/dev/rmt0 logpage 2e
  ```

- **modepage "Page"**

  This subcommand issues the SCSI Mode Sense command to the device for the specified page and displays the mode sense data. The page parameter must be specified as a hex value.

  Example:

  ```
  # Get mode page x'1D'
  tapeutil -f/dev/rmt0 modepage 1d
  ```

- **passthru**

  This subcommand opens the device special file using the SC_PASSTHRU mode. This mode bypasses normal open/close processing, and no SCSI commands are issued to the device during open or close.

- **print "Text"**

  This subcommand prints the associated text to standard output. It can be used at any time to display the progress of the subcommands.

  Example:

```
# Set volume id, erase current tape and backup myfile.tar
tapeutil -f/dev/rmt0 volid "My Volume"           \
                     rewind                      \
                     erase                       \
                     print "Writing myfile.tar"  \
                     write -s myfile.tar
```

- **qrypath**

  This subcommand displays information about the device and SCSI paths, such as logical parent, SCSI IDs, and status of the SCSI paths.

- **release**

  This subcommand releases a device explicitly and makes it available for other hosts. See "Reserve and Release Commands" on page 43 for more information.

- **reqsense**

  This subcommand issues the SCSI Request Sense command to the device and displays the sense data.

- **reserve**

  This subcommand reserves a device explicitly. See "Reserve and Release Commands" on page 43 for more information.

- **reset**

  This subcommand opens the device special file by using SC_FORCED_OPEN mode and causes a bus device reset to be sent to the device.

  Note: You must have *root* authority to use this subcommand.

- **tur**

  This subcommand issues the SCSI Test Unit Ready command to the device.

- **vpd**

  This subcommand obtains the vital product data (VPD) from a SCSI tape device. It opens the device special file in SC_DIAGNOSTIC mode and uses the SCSI pass-through *ioctl* command to obtain the inquiry data from the device.

Medium Changer Subcommands

The following medium changer subcommands are available for the integrated and independent medium changer devices:

- **allow**

  This subcommand allows medium removal by an operator. It is used normally after the prevent subcommand to restore the device to the default state.

- **audit [Address[Count]]**

  This subcommand with no parameters issues the SCSI Initialize Element Status command to the device.

  Using the optional parameters Address and Count issues the SCSI Initialize Element Status With Range command to the device. The Address parameter specifies the starting element address and the Count parameter, if used, specifies the number of elements to initialize. If Count is omitted, it defaults to 1.

  Example:

  ```
  # Initialize all elements
  tapeutil -f/dev/smc0 audit

  # Initialize element 32
  tapeutil -f/dev/smc0 audit 32

  # Initialize elements 36 to 40
  tapeutil -f/dev/smc0 audit 36 5
  ```

- **devids**

  This subcommand issues the SCSI Read Element Status command to the device with the read device id option for all drive elements and displays the element status information, which includes the device id field.

- **elementinfo**

  This subcommand displays the information returned from the SMCIOC_ELEMENT_INFO *ioctl* command that contains the number and addresses of each element type.

- **exchange “Source” “Dest1” “Dest2”**

  This subcommand issues the SCSI Exchange Medium command to the device by using the *Source*, *Dest1*, and *Dest2* addresses specified. This command performs the equivalent function of two Move Medium commands that first move the cartridge from the element address specified by the *Dest1* parameter to the element address specified by the *Dest2* parameter, then move the cartridge from the element address specified by the source parameter to the element address specified by the *Dest1* parameter.

  Example:

```
# Exchange cartridge in slot 34 with cartridge in drive address 16
# and return that cartridge to slot 40 (drive must be unloaded first)
tapeutil -f/dev/smc0 exchange 34 16 40

# Use move medium commands to perform exchange
tapeutil -f/dev/smc0 move 16 40 move 34 16
```

- **inventory**

  This subcommand issues the SCSI Read Element Status command for each element type and displays the element status information.

- **mount [Slot]**

  This subcommand mounts a tape from the specified slot into the drive or from the first full slot into the drive if the slot is omitted.

  Example:

```
# Mount cartridge from slot 3
tapeutil -f/dev/smc0 mount 3

# Mount cartridge from first full slot
tapeutil -f/dev/smc0 mount
```

- **move “Source” “Destination”**

  This subcommand issues the SCSI Move Medium command by using the source and destination addresses specified. The element addresses can be obtained by using the *elementinfo* subcommand.

  Example:

```
# Get slot and drive addresses
tapeutil -f/dev/smc0 elementinfo

# Move cartridge in slot 20 to drive at address 16
tapeutil -f/dev/smc0 move 20 16
```

- **position “Destination”**

  This subcommand issues the SCSI Position to Element command by using the destination specified.

  Example:

```
# Position to slot at address 20
tapeutil -f/dev/smc0 position 20
```

- **prevent**

  This subcommand prevents medium removal by an operator until the allow subcommand is issued or the device is reset.

- **unmount [Slot]**

  This subcommand moves a tape from the drive to the specified slot or the first empty one if the slot is omitted. The tape is rewound and unloaded automatically from the drive first when this command is issued to the tape device special file.

  Example:

```
# Move tape from drive to slot 4 (tape is already unloaded)
tapeutil -f/dev/smc0 unmount 4

# Unload tape and move to the first empty slot
tapeutil -f/dev/rmt0 unmount
```

Tape Subcommands

The following tape subcommands are available for the tape devices:

- **allow**

  This subcommand issues the SCSI Prevent Allow Medium Removal command to the device to allow medium removal by an operator. It is used normally after the prevent subcommand to restore the device to the default state.

- **append**

  This subcommand opens the device in append mode and allows appending data to the end of the current tape. The subcommand can be used with a No Rewind on Close special file to set the tape position after the last file that was written.

  Example:

  ```
  # Append myfile.tar to the end of tape using dd command
  tapeutil -f/dev/rmt0.1 append
  dd if=myfile.tar of=/dev/rmt0
  ```

- **bsf [Count]**

  This subcommand backward spaces the filemarks. An optional count can be specified. The default is 1.

- **bsr [Count]**

  This subcommand backward spaces the records. An optional count can be specified. The default is 1.

- **compress and nocompress**

  These subcommands turn the compression on and off only for subsequent subcommands.

- **density**

  This subcommand issues the SCSI Report Density command for all supported media and also for the current media loaded in the drive and displays the results. If the drive is not loaded, the current media density is not reported, and a Drive Not Ready error is returned.

- **eof [Count] and weof [Count]**

  These subcommands write the filemarks. An optional count can be specified. The default is 1.

- **erase**

  This subcommand erases the tape.

- **fsf [Count]**

This subcommand forward spaces the filemarks. An optional count can be specified. The default is 1.

- **fsr [Count]**

  This subcommand forward spaces the records. An optional count can be specified. The default is 1.

- **list**

  This subcommand displays the content of a tape. The output lists filemarks and the size of each record found on the tape until the end of data is reached. The output generated from this subcommand can be large, depending on the amount of data on the tape, and should be directed to a file in most cases.

  Example:

  ```
  # List tape contents to file
  tapeutil -f/dev/rmt0 list > tape.list
  ```

- **load**

  This subcommand issues the SCSI Load command to load the next tape.

- **logsense**

  This subcommand issues the STIOC_LOG_SENSE *ioctl* command and displays the data. If volume logging is active, then the log sense data is also saved in the log file.

- **nosili**

  This subcommand turns off the SILI (Suppress Incorrect Length Indication) bit in variable length SCSI Read commands for all subsequent subcommands, such as rtest, rwtest, and read.

- **offline, rewoffl, and unload**

  These subcommands rewind and unload the tape.

- **parms and status**

  These subcommands issue the STIOCQRYP *ioctl* command and display the current tape drive, media, and device driver parameters.

- **prevent**

  This subcommand issues the SCSI Prevent Allow Medium Removal command to the device to prevent medium removal by an operator until the allow subcommand is issued or the device is reset.

- **qrypos**

  This subcommand issues the STIOCQRYPOS *ioctl* command for the logical and physical tape positions and displays the data. In addition, the current tape position is saved and can be restored by using a subsequent *setpos* subcommand.

  Example:

```
# Append myfile.tar to the end of tape and then read back
tapeutil -f/dev/rmt0.1 append                  \
                       qrypos                  \
                       write -s myfile.tar     \
                       setpos                  \
                       read -d temp.tar

# Verify myfile.tar was written correctly
diff myfile.tar temp.tar
```

- **read -d Destination [-c Count]**

  This subcommand reads a file or a specified number of records from the tape to the destination file name specified with the *-d* flag. If the optional count parameter is used, only the number of records specified with the *-c* flag will be read unless a filemark is encountered before the number of specified records. If the count parameter is not used, all records up to the next filemark on tape will be read.

  Example:

```
# Restore myfile.tar from tape
tapeutil -f/dev/rmt0 read -d myfile.tar

# Read 3 records from the tape into myfile
tapeutil -f/dev/rmt0 read -d myfile -c3
```

- **rewind and retension**

  These subcommands rewind the tape.

- **rtest [-b Blocksize] [-c Count] [-r Repetition]**

  This subcommand performs a read test by reading a random data pattern from the tape and verifying that it matches the written data. The *rtest* subcommand can be used after the *wtest* subcommand to verify the data.

  An optional block size, count, and repetition can be specified with the *-b*, *-c*, and *-r* flags, respectively. If the block size is fixed, then the count specifies the number of blocks to read on each repetition. If the block size is zero (variable), then the count specifies the number of bytes to read on each repetition. The default is a block size of 10240, a count of 20blocks, and a repetition of 1.

  Example:

```
# R/W test using 256KB blocks, 5 megabytes per write, 100 times
tapeutil -f/dev/rmt0 rewind                    \
                     wtest -b 262144 -c 20 -r 100 \
                     rewind                    \
                     rtest -b 262144 -c 20 -r 100
```

- **rwtest [-b Blocksize] [-c Count] [-r Repetition]**

  This subcommand performs a read and write test by writing a random data pattern on the tape, reading it, and verifying that it matches the written data.

An optional block size, count, and repetition can be specified with the *-b*, *-c*, and *-r* flags, respectively. If the block size is fixed, then the count specifies the number of blocks to write on each repetition. If the block size is zero (variable), then the count specifies the number of bytes to write on each repetition. The default is a block size of 10240, a count of 20 blocks, and a repetition of 1.

Example:

```
# R/W test using 256KB blocks, 5 megabytes per write, 10 times
tapeutil -f/dev/rmt0 rwtest -b 262144 -c 20 -r 10
```

- **seod**

  This subcommand spaces to the end of data on the tape.

- **setpos [Blockid]**

  This subcommand issues the SCSI Locate command to the device to set the tape position. If the optional blockid parameter is specified, the tape position is set to the blockid. Otherwise, if the blockid parameter is omitted, the tape position is set to the last position saved by using the *qrypos* subcommand. The blockid can be specified in decimal or in hex, with a leading "x".

  Example:

```
# Append myfile.tar to the end of tape and then read back
tapeutil -f/dev/rmt0.1 append                  \
                       qrypos                  \
                       write -s myfile.tar     \
                       setpos                  \
                       read -d temp.tar

# Verify myfile.tar was written correctly
diff myfile.tar temp.tar

# Set tape position to block 32 and leave positioned on close
tapeutil -f/dev/rmt0.1 append setpos 32

# Set tape position to block 32 and leave positioned on close
tapeutil -f/dev/rmt0.1 append setpos x20
```

- **sili**

  This subcommand turns on the SILI (Suppress Incorrect Length Indication) bit in variable length SCSI Read commands for all subsequent subcommands, such as rtest, rwtest, and read.

- **sync**

  This subcommand synchronizes or flushes the tape buffers to tape.

- **volid "Name"**

  This subcommand sets the volume ID for logging. See "Volume ID for Logging" on page 17 and "Volume ID for Logging" on page 44.

- **write -s Source**

  This subcommand writes the source file specified with th *-s* flag on the tape.

  Example:

```
# Backup myfile.tar to tape
tapeutil -f/dev/rmt0 write -s myfile.tar
```

- **wtest [-b Blocksize] [-c Count] [-r Repetition]**

  This subcommand performs a write test by writing a random data pattern on the tape. The *rtest* subcommand can be used after the *wtest* subcommand to verify the data that was written.

  An optional block size, count, and repetition can be specified with the *-b*, *-c*, and *-r* flags, respectively. If the block size is fixed, then the count specifies the number of blocks to write on each repetition. If the block size is zero (variable), then the count specifies the number of bytes to write on each repetition. The default is a block size of 10240, a count of 20 blocks, and a repetition of 1.

  Example:

```
# R/W test using 256KB blocks, 5 megabytes per write, 100 times
tapeutil -f/dev/rmt0 rewind                        \
                     wtest -b 262144 -c 20 -r 100 \
                     rewind                        \
                     rtest -b 262144 -c 20 -r 100
```

Service Aid Subcommands

The following service aid subcommands are available:

- dump [Filename]

  The dump subcommand reads a dump from the device. Only on the IBM 3580 Ultrium Tape Drive, a SCSI Send Diagnostic command is issued first to force a dump.

  This subcommand stores the dump in the specified *Filename* or, if *Filename* is omitted, in the system */var/adm/ras* directory. The device driver stores up to three dump files in this directory. The first dump file is named *Atape.rmtx.dump1*, where *x* is the device number, for example, *rmt0*. The second and third dump files are *dump2* and *dump3*, respectively. After a third dump file is created, the next dump starts at *dump1* again and overlays the previous dump file.

- resetdrive

  This subcommand issues a Send Diagnostic SCSI command to reset the device.

  Note: This subcommand is supported only on the IBM 3580 Ultrium Tape Drive.

- ucode “Name”

  This subcommand downloads microcode to the device. The “Name” parameter can specify a diskette drive, such as */dev/rfd0*, or a microcode file on the RS/6000 system.

  Example:

```
# download microcode from diskette
tapeutil -f/dev/rmt0 ucode /dev/rfd0

# download microcode from RISC file
tapeutil -f/dev/rmt0 ucode /etc/microcode/device.ucode
```

Block Size and SCSI Transfer Size

The minimum and maximum block sizes for the tape device and the maximum SCSI transfer size can be queried by using either the menu version of the tape utility program and selecting **Query/Set Parameters** under Tape Commands or the command-line version by issuing the *parms* or *status* subcommand.

Configuration Parameters

The configuration parameters can be queried by using either the menu version of the tape utility program and selecting **Query/Set Parameters** under Tape Commands or the command-line version by issuing the *parms* or *status* subcommand.

The configuration parameters can be changed temporarily by using the menu version of the tape utility program and selecting **Query/Set Parameters** under Tape Commands.

Note: The changes are effective only while the current device is open. All configuration parameters are reset to their current default values when the device is closed.

Reserve and Release Commands

When a device is shared by multiple initiators or hosts, the device can be reserved explicitly by a host while the backup or restore programs are processed and released explicitly when the programs are completed. This process ensures that another host cannot use the device until the first host is finished with it.

The device driver reserves the device automatically on the *open* call and releases the device on the *close* call. Some backup programs, such as *tar*, can open and close the device multiple times. The reservation must be retained explicitly between the *close* call and the next *open* call.

A device can be reserved and released explicitly by using either the menu version of the tape utility program and selecting **Reserve** or **Release** under General Commands or the command-line version by issuing the Reserve and Release subcommands.

Example:

```
# Reserve device, run tar, and then release device
tapeutil -f/dev/rmt0 reserve
tar    ... /dev/rmt0 ...
tapeutil -f/dev/rmt0 release
```

After the Reserve command is used, the device driver retains the reservation until a Release command is issued even if the device is deconfigured and reconfigured.

Tape Drive Service Aids

The service aids provided with the device driver can be called by using the menu version of the tape utility program and selecting **Tape Drive Service Aids** under General Commands or by using the Service Aid Subcommands in the command-line interface of the tape utility program. See “Service Aid Subcommands” on page 42.

Note: The AIX diagnostic subsystem must be installed in order to use **Tape Drive Service Aids** from the *tapeutil* menu.

Volume ID for Logging

The volume ID used in the log entry when volume logging is active can be set by using either the menu version of the tape utility program and selecting **Query/Set Parameters** under Tape Commands or the command-line version by issuing the *volid* subcommand.

Example:

```
# Unload tape, load next tape, and set volume id
tapeutil -f /dev/rmt0  unload  load  volid "VOLSER001"
```

Chapter 8. Tape Drive Service Aids

The following service aid utilities are installed with the device driver:

- Force Microcode Dump
- Read Dump
- Microcode Load
- Error Log Analysis
- Reset Drive

These service aids are accessible through the AIX diagnostic subsystem by using the AIX *diag* command or the menu and command-line interface of the *tapeutil* tape utility program installed with the device driver. See "Service Aid Subcommands" on page 42 and "Tape Drive Service Aids" on page 43.

To access the service aids by using the *diag* command:

1. Enter the *diag* command.
2. Select **Service Aids** from the Diagnostic Function Selection menu.
3. Select **IBM Tape Drive Service Aids** from the Service Aid Selection menu.

Note: You must have *root* authority to use the *diag* command.

To access the service aids by using the *tapeutil* tape utility:

1. Enter the *tapeutil* command.
2. Select **Tape Drive Service Aids** under General Commands from the menu.

Note: The AIX diagnostic subsystem must be installed in order to use **Tape Drive Service Aids** from the *tapeutil* menu.

Force Microcode Dump

This utility forces a dump operation on the tape drive. After the dump operation is performed, the dump data can be transferred from the tape drive by using the Read Dump utility. The Force Microcode Dump utility is supported only on the IBM 3580 Ultrium Tape Drive.

To access this utility:

1. Call the Service Aids menu.
2. Select **Force Microcode Dump** from the IBM Tape Drive Service Aids menu, then press Enter.

3. Select the device from the IBM Tape Drive Selection menu, then press Enter.

   The Force Microcode Dump operation starts. A window opens when the operation is completed.

Read Dump

This utility transfers the dump data from the device to a file, a diskette, or a tape cartridge.

To access this utility:

1. Call the Service Aids menu.
2. Select **Read Dump** from the IBM Tape Drive Service Aids menu, then press Enter.
3. Select the device from the IBM Tape Drive Selection menu, then press Enter.
4. Enter the destination file name or device on the Prompting for Destination menu. The default destination is the */dev/rfd0* diskette drive. To transfer the dump data to a tape cartridge, enter the device name of the tape drive (for example, */dev/rmt0*). To transfer the dump data to a file, enter the file name. Press F7 to commit.

   Note: On certain terminal types, it may be necessary to press the Esc key and the number 7 key instead of F7.

   The Read Dump operation starts. A window opens when the operation is completed.

Microcode Load

This utility downloads microcode to the device from a file or a diskette (AIX format only).

Note: To download the microcode from a DOS diskette, you must first use the AIX *dosread* command to transfer the file from the DOS diskette to the AIX file. Then you can use the Microcode Load utility to download the AIX file to the tape drive.

To access this utility:

1. Call the Service Aids menu.
2. Select **Microcode Load** from the IBM Tape Drive Service Aids menu, then press Enter.
3. Select the device from the IBM Tape Drive Selection menu, then press Enter.

4. Enter the source file name or device on the Prompting for Source File menu. The default source is the */dev/rfd0* diskette drive. To load from a file, enter the file name. Press F7 to commit.

   Note: On certain terminal types, it may be necessary to press the Esc key and the number 7 key instead of F7.

   The Microcode Load operation starts. A window opens when the operation is completed.

Error Log Analysis

This utility displays and analyzes the system error log entries for a specific tape drive and can be used for problem determination. The type of error, the SCSI command, and the sense data (if applicable) are displayed for each entry in the error log (one screen at a time).

To access this utility:

1. Call the Service Aids menu.
2. Select **Error Log Analysis** from the IBM Tape Drive Service Aids menu, then press Enter.
3. Select the device from the IBM Tape Drive Selection menu, then press Enter.
4. If entries are listed in the error log for the selected device, then the first entry is displayed. Press Enter to display the next entry.
5. After all entries are displayed, a window opens, and the operation is completed.

Reset Drive

This utility resets the tape drive. The Reset Drive utility is supported only on the IBM 3580 Ultrium Tape Drive.

To access this utility:

1. Call the Service Aids menu.
2. Select **Reset Drive** from the IBM Tape Drive Service Aids menu, then press Enter.
3. Select the device from the IBM Tape Drive Selection menu, then press Enter.

   The Reset Drive operation starts, and a window opens when the operation is completed.

Chapter 9. Performance Considerations

This chapter describes the parameters and issues that may affect the perceived performance of the tape drive. In general, AIX applications that operate at a file level to move data between disk storage devices and tape do not exploit the full capabilities of a high-end tape device. The goal of this discussion is to give an overview of the data path components involved in moving data between disk storage devices and tape. The following chapter describes basic techniques and common utilities in a specific environment that can be used to understand how a device is performing. Performance issues encountered by advanced application developers are beyond the scope of this document.

- See the hardware reference for the specific device for performance specifications.
- See the application documentation for information on device-specific application configuration.
- See the operating system documentation for information on disk storage device striping and other techniques for improving file system performance.

Data Path

The simplified model in Figure 4 shows the components involved in the data path for moving data at a file level between disk storage devices and tape.

Performance analysis must be approached by determining which component of the data path impacts performance. Typically, a performance problem can be isolated by looking at one leg of the data path at a time. The goal of this analysis is to confirm that the tape data path is not impacting the performance adversely.

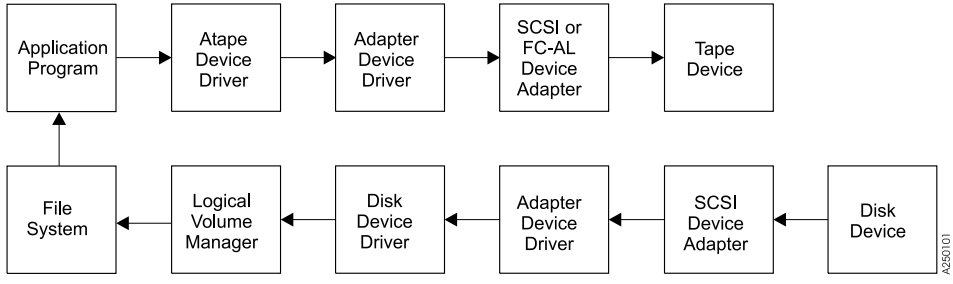


Figure 4. Data Path

Common AIX Utilities

The most commonly reported cause for poor tape performance is the use of small block sizes or the modification of the installation defaults for the tape device.

Note: The device parameters should not be changed from the defaults for most applications.

The following guidelines typically result in good tape path performance for use with AIX utilities:

1. Hardware compression should be enabled for maximum performance if the data sent to the device is uncompressed.
2. The block_size parameter should be set to variable (block_size=0) and command or application parameters specified to a block size appropriate for the device.
3. Block sizes of 128K or greater should be used to improve performance.

Before Calling Support

System performance tuning is not a support responsibility. If tests indicate that the raw tape performance is below specifications, record the exact failing command and collect the output from the commands in Table 4 before contacting support.

Table 4. Error Description

Information	Command
Configuration	lscfg -v
Device parameters	lsattr -E -l rmtN
Error log. Call hardware support if errors are found for TAPE_ERR* or SCSI* error labels.	errpt -a
Driver version	lslpp -l Atape.driver
Device microcode level (may not apply to all devices)	tapeutil -f /dev/rmtN reqsense
Trace of failing command	See “Trace Facility” on page 55

Chapter 10. Device and Volume Information Logging

An optional utility is provided to log the information about the device and the media. The information is extensive for some devices and limited for other devices. If it is set to on, the logging facility gathers all available information through the SCSI Log Sense command.

This process is a separate facility from error logging. Error logging is routed to the system error log. Device information logging is sent to a separate file.

The following parameters control this utility:

- Logging
- Maximum size of the log file
- Volume ID for logging

See "Chapter 3. Tape Drive, Media, and Device Driver Parameters" on page 15 for a description of these parameters.

Each time the rewind and unload sequence occurs or the STIOC_LOG_SENSE *ioctl* command is issued, an entry is added to the log. Each time a new cartridge is loaded, the values in the device log buffers are reset with the Log Sense command. The log data is gathered on a per-volume basis.

Log File

The data is logged in the */usr/adm/ras* directory. The file name is dependent on each device; therefore each device has a separate log. An example of the *rmt1* device file is:

```
/usr/adm/ras/Atape.rmt1.log
```

The files are in binary format. Each entry has a header followed by the raw Log Sense pages as defined for a particular device.

The first log page is always page 0x00. This page, as defined in the SCSI-2 ANSI specification, contains all of the pages supported by the device. Page 0x00 is followed by all of the pages specified in page 0x00. The format of each following page is defined in the SCSI specification and the device manual.

Tape Log Utility

A tape log utility is installed with the *tapelog* device driver that displays the contents of the log file in ASCII text. The log pages are displayed as hexadecimal values in dump format.

The C source code (*tapelog.c*) for the program is in the */usr/lpp/Atape/samples* directory. The program contains a sample of the interface to the log file and the structure used to read the file.

The syntax for the tape log utility is:

```
tapelog -l Name [-d] or tapelog -f File [-d]
```

Notes:

1. The "Name" is the logical name of the device, such as *rmt0*.
2. The "File" is the name of a log file, such as *Atape.rmt0.log*.
3. The *-d* parameter, if used, deletes the log file for the specified device.

The contents of the log file is displayed as standard output. To save the log in a file, use the AIX redirection function.

Example:

```
tapelog -l rmt0 > rmt0.log
```

Chapter 11. Problem Determination

A set of tools is provided with the device driver to determine if the device driver and the tape device are functioning correctly. The standard AIX interface is provided for problem determination.

Error Logging

The device driver provides logging to the AIX system error log for various errors. You can view the error log for specific devices by using the Error Log Analysis utility provided with the tape drive service aids. See “Error Log Analysis” on page 47. The error log can also be viewed by using the *smit* or the *errpt* command.

Error Log Templates

The error log templates used by the device driver follow the same format as the default AIX tape error log entries. Each error log entry is identified by an error label and contains detail data associated with the type of error. The following describes the error labels and detail data for the templates used for logging tape device, media, and SCSI adapter related errors in the AIX system error log.

Error Labels

Errors are logged with an associated error label and error ID. The error label indicates the basic type of error:

- TAPE_ERR1

  Tape media error
- TAPE_ERR2

  Tape hardware error
- TAPE_ERR4

  SCSI Adapter detected error
- TAPE_ERR5

  Unknown error
- RECOVERED_ERROR

  Temporary tape hardware or media error
- TAPE_DRIVE_CLEANING

  Tape drive needs cleaning

Detail Data

Detail data is logged with the associated error that identifies the cause of the error. All error log entries use the following format for detail data:

```
Detail Data
SENSE DATA
aabb xxxx ccdd eeee eeee eeee eeee eeee ffgg hhxx ssss ssss ssss ssss ssss
ssss ssss ssss ssss ssss ....
```

where:

aa Length of the command descriptor block (CDB)

bb SCSI target address

xx Unused or reserved

cc Start of CDB, cc is the operation code (byte 0)

dd Logical unit (byte 1) in the CDB

ee Bytes 2 through 12 in the CDB

ff Status validity field. If this field is 01, then a SCSI error was reported, and byte *gg* indicates the type of error. If this field is 02, then an adapter error was reported, and byte *hh* indicates the type of error.

gg This byte indicates the type of SCSI error that occurred:

02 CHECK CONDITION - Device reported a check condition.

08 BUSY STATUS - Target is busy.

18 RESERVATION CONFLICT - Target is reserved to another initiator.

22 COMMAND TERMINATED - Device terminated the command.

28 QUEUE FULL - Device's command queue is full.

hh This byte indicates the type of adapter error that occurred. For parallel SCSI adapters, this is the general_card status code as defined in */usr/include/sys/scsi.h*:

- 01 HOST IO BUS ERROR - Host I/O bus error during data transfer.
- 02 SCSI BUS FAULT - SCSI bus protocol or hardware error.
- 04 COMMAND TIMEOUT - Command timed out before completion.
- 08 NO DEVICE RESPONSE - Target did not respond to selection phase.
- 10 ADAPTER HARDWARE FAILURE - Adapter indicated a hardware failure.
- 20 ADAPTER SOFTWARE FAILURE - Adapter indicated a microcode failure.

- 40 FUSE OR TERMINAL PWR - Blown terminator fuse or bad termination.
- 80 SCSI BUS RESET - Adapter indicated SCSI bus has been reset.

For FCP adapters, this is the adapter_status code as defined in */usr/include/sys/scsi_buf.h*:

01 HOST IO BUS ERROR - Host I/O bus error during data transfer.

02 TRANSPORT FAULT - Failure in the transport layer.

03 COMMAND TIMEOUT - Command timed out before completion.

04 NO DEVICE RESPONSE - Target did not respond to attempts to select it.

05 ADAPTER HARDWARE FAILURE - Adapter indicated a hardware failure.

06 ADAPTER SOFTWARE FAILURE - Adapter indicated a microcode failure.

07 WW NAME CHANGE - Adapter detected a new world wide name for the device.

08 FUSE OR TERMINAL PWR - Blown terminator fuse or bad termination.

09 TRANSPORT RESET - Adapter detected an external SCSI bus reset.

0A TRANSPORT BUSY - The transport layer is busy.

0B TRANSPORT DEAD - The transport layer is currently inoperative.

ss If byte *gg* indicates a check condition, the *ss* byte is the sense data from the device. See the appropriate device reference manual for the specific format and content of these bytes.

Trace Facility

The AIX trace facility is supported for the device driver. The trace event is identified with a *hookword*. The hookword used by the device driver is 326. The trace can be started at any time before an operation on a tape device.

Enter the following AIX command to start the trace:

```
trace -a -j 326
```

This command starts the trace in the background and collects only the trace events with the 326 hookword (*Atape* device driver).

Enter the following AIX command to stop the trace:

```
trcstop
```

This command stops the trace after the tape operations are performed.

Enter the following AIX command to view the trace:

```
trcrpt > trace.out
```

This command formats the trace output into a readable form and places it into a file for viewing.

ATRC Utility

The *atrc* trace utility is also installed with the device driver to start, stop, and format a device driver trace. To start the trace, enter the *atrc* command. To stop and format the trace, enter the *atrc* command again. The trace is formatted to an *atrc.out* AIX file in the current directory.

Part 3. Solaris Tape and Medium Changer Device Driver

Chapter 12. Introduction and Product Requirements

This chapter provides an overview of the IBM SCSI Tape and Medium Changer Device Driver for Solaris, also known as *IBMtape*. *IBMtape* supports a number of IBM Magnetic Tape and Library Subsystem products (see "Hardware Requirements" for specific models):

- IBM 3580 Ultrium Tape Drive
- IBM 3581 Ultrium Tape Autoloader
- IBM 3583 Ultrium Scalable Tape Library
- IBM 3584 UltraScalable Tape Library
- StorageSmart by IBM Ultrium External Tape Drive TX200
- StorageSmart by IBM Ultrium Tape Autoloader SL7
- StorageSmart by IBM Ultrium Scalable Tape Library SL72

Purpose

IBMtape provides SCSI and FC-AL attachment for IBM Magnetic Tape and Library Subsystem products to Sun Microsystems SPARC and UltraSPARC platforms running the Solaris operating system, including the Ultra/Enterprise family of servers.

It is designed specifically to take advantage of the features provided by these IBM tape/library subsystems, including full control of the random access medium changer facility (move, element information, and inventory) present in some devices. The goal is to give applications access to the functions required for basic operations, such as backup and restore, and the advanced functions needed by full tape management systems. Whenever possible, *IBMtape* is designed to take advantage of the IBM tape subsystem features in a manner transparent to the application.

Product Requirements and Compatibility

IBMtape requires and supports the following hardware and software components.

Hardware Requirements

IBMtape requires and supports the following hardware components:

- One or more of the following IBM tape devices:
  - IBM 3580 Ultrium Tape Drive Models H11 (HVD attach)
  - IBM 3581 Ultrium Tape Autoloader Model H17 (HVD attach)

  - IBM 3583 Ultrium Scalable Tape Library Models L18, L36, L72
  - IBM 3584 UltraScalable Tape Library Models L32 (base frame), D32 (expansion frame)
- One or more of the following StorageSmart by IBM devices:
  - StorageSmart by IBM Ultrium External Tape Drive TX200 - Model H11 (HVD attach)
  - StorageSmart by IBM Ultrium Tape Autoloader SL7 - Model H17 (HVD attach)
  - StorageSmart by IBM Ultrium Scalable Tape Library SL72 - Models L18, L36, L72
- One or more of the following FC-AL host bus adapters:
  - QLogic QLA-2200F 64-bit PCI-to-Fibre Channel Adapter
- One or more of the following SCSI High Voltage Differential (HVD) host bus adapters:
  - Sun Microsystems Dual-channel Differential UltraSCSI Host Adapter, PCI (P/N X6541A)
  - Sun Microsystems SBus Ultra Differential Fast/Wide Intelligent SCSI-2 Host Adapter (UDWIS/S) (P/N X1065A)

Software Requirements

IBMtape requires and supports the following software components:

- Sun Microsystems Solaris (SPARC) operating system Version 2.6, 7, or 8

  For Solaris Version 2.6, Sun patch 105867-01 is required.
- SCSI Host Bus Adapter (HBA) driver as supplied by either Sun Microsystems or the HBA manufacturer.

  See the manufacturer's documentation for the HBA to determine which adapter driver is required.

Software Compatibility

IBMtape supports the following *optional* software:

- Tivoli® Storage Manager

Data Flow

Both data and commands flow between the application program and the tape subsystem through *IBMtape*. Figure 5 on page 61 shows the relationships between *IBMtape*, the application program, the adapter device driver, and the IBM tape subsystem.

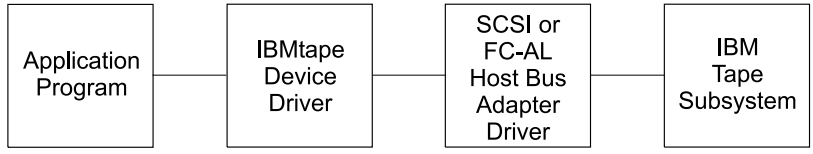


Figure 5. Data Flow

Software Interface to the Device Driver

IBMtape provides the following standard Solaris (UNIX) entry points for IBM tape subsystems:

- Open

  This entry point is driven by *open* and *creat* system function calls.
- Write

  This entry point is driven by *write* and *writev* system function calls.
- Read

  This entry point is driven by *read* and *readv* system function calls.
- Close

  This entry point is driven explicitly by the *close* system function call and implicitly by the operating system at program termination.
- IOCTL

  This entry point is driven by the *ioctl* system function call. It provides a set of tape device, medium changer device, and SCSI specific operations. It allows Solaris applications to access and control the features and attributes of IBM SCSI tape subsystems through the *IBMtape* Application Programming Interface (API).

Chapter 13. Installation, Removal, and Configuration

IBM SCSI Tape Drive and Medium Changer Device Driver for Solaris is an installable kernel module, supplied as a standard Solaris software package. When installed, its package name is *IBMtape*. The following sections describe installation, removal, configuration, and verification procedures for *IBMtape*. See the Solaris documentation for general information about installable packages.

The *IBMtape* package consists of the device driver and a number of associated files and utilities. For components created during *IBMtape* installation, see Table 5.

Table 5. IBMtape Components

Component	Description
/opt/IBMtape	Package subdirectory
/opt/IBMtape/tapeutil	Utility and service aid program
/opt/IBMtape/tapeutil.c	Utility/service program sample source code
/opt/IBMtape/IBMtape.conf	Configuration file, reference version
/usr/kernel/drv/IBMtape	32-bit Kernel device driver module
/usr/kernel/drv/sparcv9/IBMtape	64-bit Kernel device driver module
/usr/kernel/drv/IBMtape.conf	Configuration file, working version
/usr/include/sys/smc.h	Medium changer application programming interface (API) header file
/usr/include/sys/st.h	Tape drive API header file
/usr/include/sys/svc.h	Service aid API header file
/usr/include/sys/oldtape.h	Compatibility API header file

Note: When updating *IBMtape*, the working copy of *IBMtape.conf* located in */usr/kernel/drv* is not overwritten by the package file contents. This allows tape drive configuration options to be preserved across *IBMtape* updates. A reference copy of *IBMtape.conf* is always installed in the */opt/IBMtape* directory.

Examples of installation commands and their results throughout this chapter use a percent sign (%) to indicate the shell prompt.

Preventing Conflicts with Other Device Drivers

IBMtape attempts to claim and operate only the Ultrium devices described in "Hardware Requirements" on page 59. However, the Solaris operating system includes a SCSI tape device driver named *st*, which claims any SCSI-compliant tape drive it detects, including devices that *IBMtape* manages. In order to avoid conflicts between *IBMtape* and *st*, you must prevent *st* from claiming and attempting to operate *IBMtape*-owned devices. Likewise, other suppliers' SCSI tape device drivers that you have installed must be prevented from claiming *IBMtape*-owned devices.

Attention: Failure to prevent more than one device driver from operating the same SCSI tape drive may cause system panics or data loss on the tape drive.

The following installation and update steps describe how to prevent conflicts between *IBMtape* and other SCSI tape device drivers.

Installing or Updating *IBMtape*

Follow these steps to install or update *IBMtape*. Before starting the step-by-step procedure, note the following general considerations:

- Differential SCSI-2 support must already exist on the system before installing *IBMtape*. Install and configure one of the supported differential SCSI adapters first, then return to this section. See the HVD SCSI adapter documentation for instructions on installing the adapter and adapter driver.
- You must have root authority to install or remove *IBMtape*.
- You must reboot the system as part of the *IBMtape* installation. Take appropriate precautions that this does not affect users or active processes on the system adversely.
- As a consequence of installing or reinstalling *IBMtape*, device special file numbers under */dev/rmt* may change. These numbers are assigned by Solaris during the driver attachment process, and the sequencing cannot be specified by the device driver or installer.

Installation Steps

1. Notify users that system maintenance and a reboot will be performed.
2. Choose a time when all system activity can be stopped to perform the installation.
3. Log on to the target system as root.
4. Ensure that all user and tape drive activity on the system has halted.
5. If tape drives not controlled by *IBMtape* are installed on the system, list the low-density device special files and find the SCSI addresses with which they are associated currently.

```
% ls -l /dev/rmt/*l
lrwxrwxrwx   1 root     root          72 Aug 26 15:47 /dev/rmt/5l ->
../../devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,10000/st@2,0:l
```

The last portion of the results shows the controlling device driver and SCSI address. In the preceding example, */dev/rmt/5l* and the related *5m*, *5h*, and so on, are controlled by the *st* device driver and are associated with the device at SCSI address 2, LUN 0. Record the device type, */dev/rmt* special file number, owning driver, SCSI target address and LUN; you will need them later during the installation.

For example, suppose an installation has two non-IBM devices owned by *st* at SCSI addresses 2 and 8. The low-density devices are accessed as special files */dev/rmt/5l* and */dev/rmt/6l*. For the equipment listing after recording the device information, see Table 6.

Table 6. IBMtape Install or Update

Device	Old Special File	Old Driver	SCSI Address/LUN (Old)
QIC	/dev/rmt/5l	st	2/0
QIC	/dev/rmt/6l	st	8/0

6. If this is an update to *IBMtape*, there are already *IBMtape*-owned devices installed. In this case, list the primary device special files and find the SCSI addresses with which they are associated currently.

```
 % ls -l /dev/rmt/*st /dev/rmt/*smc
lrwxrwxrwx   1 root     other         46 Aug 26 16:36 /dev/rmt/0st ->
../../devices/pci@6,4000/scsi@3/IBMtape@b,0:st

lrwxrwxrwx   1 root     other         47 Aug 26 16:36 /dev/rmt/1smc ->
../../devices/pci@6,4000/scsi@3/IBMtape@b,1:smc
```

The last portion of the results shows the controlling device driver and SCSI address. In the preceding example, */dev/rmt/0st* (a SCSI tape drive) is controlled by *IBMtape* and is associated with the device at SCSI address b, LUN 0. The address is reported in hexadecimal: 0xb == 11 decimal. */dev/rmt/1smc* (a SCSI medium changer) is associated with the device at SCSI address b, LUN 1. Record the device type, */dev/rmt* special file number, owning driver, SCSI target address and LUN; you will need them later during the installation.

For example, suppose an installation has only an *IBMtape*-owned device installed, at SCSI address 8. The device consists of both a tape drive and SCSI medium changer. The tape drive is accessed as */dev/rmt/2st* and the medium changer as */dev/rmt/3smc*. For a similar equipment listing after recording the device information, see Table 7 on page 66.

Table 7. Equipment Listing

Device	Old Special File	Old Driver	SCSI Address/LUN (Old)
3580-H11 drive	/dev/rmt/2st	IBMtape	8/0
3581-H17 changer	/dev/rmt/3smc	IBMtape	8/1

7. Choose one of the following methods to prevent conflicts between *IBMtape* and other SCSI tape device drivers, depending on the equipment that is attached to your system.

Attention: Failure to prevent more than one device driver from operating the same SCSI tape drive may cause system panics or data loss on the tape drive.

   a. If the system has only *IBMtape*-owned devices attached, follow these steps to prevent *st* and other non-IBM SCSI tape device drivers from claiming the IBM devices.

      1) Edit */kernel/drv/st.conf* and comment out all SCSI target entries by placing a pound sign (#) in the first column of each target entry. The following example shows the entries for SCSI target addresses 0 and 1 commented out. Repeat this operation for all target entries.

```
#name="st" class="scsi"
#target=0 lun=0;

#name="st" class="scsi"
#target=1 lun=0;
```

      2) For other non-IBM SCSI tape device drivers that are installed, remove the drivers if they are not needed. If a driver is for SCSI tape devices only, it should not be needed. If a driver is for both tape and disk devices, follow the supplier's instructions to disable its access to all SCSI tape devices.

   b. If the system has a mixture of *IBMtape*-owned devices and other tape drives, follow these steps to configure *st* and other non-IBM SCSI tape device drivers so that they control a range of target addresses distinct from the range that *IBMtape* will use. These steps leave target addresses 7 and 15 unclaimed by all target device drivers, because SCSI adapters typically use one of those two addresses.

      1) Edit */kernel/drv/st.conf* and comment out SCSI target entries for addresses 7–15 by placing a pound sign (#) in the first column of each target entry. In the following example, the entries for SCSI addresses 7 and 8 have been commented out. Repeat this operation for all entries in the target address range 7–15.

```
#name="st" class="scsi"
#       target=7 lun=0;

#name="st" class="scsi"
# target=8 lun=0;
```

2) For other non-IBM SCSI tape device drivers that are installed, follow the suppliers' instructions to disable their access to all SCSI tape devices in the address range 7–15.

3) Later, after the *v* package has been installed, you will alter its configuration file so that it does not use SCSI target addresses in the range 0–7 or address 15.

Now *st* and other non-IBM SCSI tape device drivers have been configured to avoid conflicting with *IBMtape*.

8. Remove all special file entries under */dev/rmt*. This ensures that stale entries do not exist after the system is rebooted. New entries will be created when the system is rebooted.

```
% rm /dev/rmt/*
```

9. If you are updating the level of *IBMtape*, remove the currently installed *IBMtape* package. If this is a new installation of *IBMtape*, skip this step.

   a. Use **pkgrm** to remove the current level.

```
% /usr/sbin/pkgrm IBMtape
```

   Respond to the pkgrm prompts.

   b. Examine the results from pkgrm. If you find these messages:

```
...
Device busy
Cannot unload module: IBMtape
Will be unloaded upon reboot.
...
```

   Then one or more *IBMtape*-owned tape drives were still in use. Identify the drives and end the processes that are using them. If you cannot identify the processes, you must reboot the system to free the tape drive, then continue with the installation from this point.

10. Choose one of the following methods to install the *IBMtape* package, depending on the package distribution medium and the location of system resources.

Note: If this is a new installation of *IBMtape*, IBM devices are not yet attached to the system, and you will see pkgadd error messages similar to the following:

```
...
drvconfig: Driverv) successfully added to system
but failed to attach
## The device driver was unable to detect any supported devices!
```

```
## Verify that the device(s) are properly connected and powered on.
## Ensure that the SCSI adapter device driver is installed/configured.
## Then try re-installing the device driver as follows:
##   -enter the command: rem_drv IBMtape
##   -enter the command: add_drv -m '* 0666 bin bin' IBMtape
## If problems persist, contact your IBM service representative.
pkgadd: ERROR: postinstall script did not complete successfully
...
```

Later, after you have cabled IBM drives to the system and rebooted, the driver will be attached normally.

a. If the distribution medium is a CD, follow these steps:

1) Determine if volume management is running by displaying the filesystem type for the */vol* directory. Volume management mounts an NFS filesystem on the */vol* directory. Use the "vol" command to display the filesystem type.

```
% df -n /vol
/vol         :nfs
```

In this example, the filesystem type is NFS; therefore volume management is running. If volume management is not running, the */vol* directory will be shown as a UFS file system.

2) Insert the distribution CD into the local CD-ROM drive.

3) If volume management is running, wait for the volume management services to detect and mount the CD-ROM filesystem. Typically, this completes within 30 seconds.

4) If volume management is not running, you must mount the CD-ROM filesystem manually. To do so, you must know the device special file name for your CD drive. For example, if your CD drive is on controller 1 at SCSI target 6, you would use this command:

```
% mount -o ro /dev/dsk/c1t6d0s0 /mnt
```

5) Review the contents of the *../Solaris/IBMtape.Readme* for any updated instructions.

6) Use **pkgadd** to install the driver. Depending on where the CD-ROM filesystem is mounted, use one of these commands:

```
%/usr/sbin/pkgadd -d /cdrom/cdrom0/Solaris/IBMtape.x.x.x.x
%/usr/sbin/pkgadd -d /mnt/Solaris/IBMtape.x.x.x.x
```

where *x.x.x.x* is the version number of *IBMtape* included on the CD.

7) If volume management is running, eject the CD:

```
% /usr/bin/eject cd
```

8) Otherwise, unmount the device, then eject the media manually:

```
% /usr/bin/unmount /mnt
```

b. If the distribution medium is a diskette and the system on which you are installing has a diskette drive, perform these steps:

   1) Insert the distribution diskette into the local diskette drive.

   2) Mount the diskette using volume management services:

      ```
      % /usr/bin/volcheck
      ```

   3) Use **pkgadd** to install the driver. In this example, *volcheck* mounted the diskette as */vol/dev/aliases/floppy0*. Use the appropriate name as assigned by your system.

      ```
      % /usr/sbin/pkgadd -d /vol/dev/aliases/floppy0
      ```

   4) Eject the diskette:

      ```
      % /usr/bin/eject floppy
      ```

c. If the distribution medium is a diskette and the system on which you are installing the package does not have a diskette drive but is connected to a network, follow these steps:

   1) Locate another system on the same network that has a diskette drive. Log on to that system.

   2) Insert the distribution diskette and mount it using volume management services:

      ```
      % /usr/bin/volcheck
      ```

   3) Use **dd** to transfer the installation package to a package file. In this example, *volcheck* mounted the diskette as */vol/dev/aliases/floppy0*. Use the appropriate name as assigned by your system.

      ```
      % /usr/bin/dd if=/vol/dev/aliases/floppy0 of=/tmp/image.pkg
      ```

   4) Eject the diskette:

      ```
      % /usr/bin/eject floppy
      ```

   5) FTP the package file to the target system. Use binary transfer mode. Place the package file in the target system's */tmp* directory.

   6) Log on to the target system as root.

   7) Use **pkgadd** to install the driver. In this example, the package file was FTPed to the */tmp* directory as *image.pkg*.

      ```
      % /usr/sbin/pkgadd -d /tmp/image.pkg
      ```

d. If the distribution medium is a package file in a UNIX® filesystem, follow these steps. You may have obtained a package file by extracting it from a distribution diskette or by downloading it from IBM's anonymous FTP site. This example presumes a package file named *IBMtape.4.0.2.7*, located in the */tmp* directory.

   1) If necessary, FTP the package file to the target system. Use binary transfer mode. Place the package file in the target system's */tmp* directory.

2) Use **pkgadd** to install the driver:

```
% /usr/sbin/pkgadd -d /tmp/IBMtape.4.0.2.7
```

11. If your system environment includes a mixture of *IBMtape*-owned devices and devices owned by *st* or another third-party SCSI tape device driver, you already modified the configuration files for the non-IBM device drivers and restricted them to target addresses in the range 0–6.

    Now you must restrict *IBMtape* to target addresses in the range 8–14. Edit *IBMtape.conf*, located in */usr/kernel/drv*, and comment out entries for SCSI target addresses 0–7 and 15 by placing a pound sign (#) in the first column of each line making up the entries. In the following example, the entries for address 0, LUN 0 and address 0, LUN 1 have been commented out. Repeat the operation for all stanzas in the address range 0–7, and address 15. Note that each SCSI target address has a stanza for both LUN 0 and 1.

```
#name="IBMtape" class="scsi"
# target=0 lun=0
# block_size=0
# buffering=1
# immediate=0
# trailer=0
# sili=0;

#name="IBMtape"  class="scsi"
# target=0 lun=1
# block_size=0
# buffering=1
# immediate=0
# trailer=0
# sili=0;
```

12. Shut down the system. One common method to perform a shutdown is shown here but use your installation's normal procedures.

```
% /usr/sbin/shutdown -y -g0 -i0
```

13. Address or readdress devices as determined by your installation:

    a. If the system has only *IBMtape*-owned devices attached, you may choose addresses in the range 0–6 or 8–14. Leave addresses 7 and 15 unused, because these addresses are used typically by the SCSI adapter.

       1) For each device, see the appropriate IBM hardware reference for any special instructions about addressing. Then set the address and record the device type, SCSI address, and LUN. For example, suppose an installation has only *IBMtape*-owned devices attached. An IBM device with tape drive and medium changer is added. It is addressed at target 4, and the information is recorded. For the results, see Table 8 on page 71.

Table 8. Equipment Listing

Device	Old Special File	Old Driver	SCSI Address/LUN (Old)	SCSI Address/LUN (New)
3580-H11 drive	–	–	–	4/0
3581-H17 changer	–	–	–	4/1

b. If you are using distinct address ranges to separate tape drives that are *IBMtape*-owned from devices that are owned by *st* or another supplier's driver, readdress the tape drives now.

1) For each device to be owned by *st* or another SCSI tape device driver, see the manufacturer's hardware reference for any special instructions about readdressing. Then readdress each device to an address in the range 0–6. For each tape drive that is readdressed, record the new SCSI address next to the special file number and old SCSI address that you recorded previously.

2) Readdress all tape drives that will be owned by *IBMtape* to addresses in the range 8–14. See the appropriate IBM hardware references for any special instructions about readdressing. For each tape drive that is readdressed, record the new SCSI address next to the special file number and old SCSI address, if any, that you recorded previously.

For example, suppose an installation has two non-IBM devices owned by *st* at SCSI addresses 9 and B (12 in decimal). An IBM device with tape drive and medium changer is added. To prevent conflicts between *IBMtape* and *st*, the non-IBM devices are all placed at addresses in the range 0–6. The new IBM device is addressed in the range 8–14, at address 10 (X'0A'). Depending on the addresses chosen for the non-IBM devices, after readdressing and recording device information, see Table 8 for the possible equipment listing.

Table 9. Equipment Listing

Device	Old Special File	Old Driver	SCSI Address/LUN (Old)	SCSI Address/LUN (New)
QIC	/dev/rmt/2l	st	9/0	3/0
QIC	/dev/rmt/3l	st	b/0	5/0
3580-H11 drive	–	–	–	a/0
3581-H17 changer	–	–	–	a/1

14. Cable the tape drives to the system, if not yet done. See the manufacturer's hardware references for any special instructions about cabling. Be sure to terminate each SCSI bus properly.

15. Boot the system according to your installation's normal procedures.
16. Log on as root and list the device special files in */dev/rmt* as you did earlier during the installation.

```
% ls -l /dev/rmt/*l
% ls -l /dev/rmt/*st /dev/rmt/*smc
```

Compare the SCSI addresses obtained from *ls* with the readdressed SCSI targets you recorded. Write the new device special file numbers and owning driver next to the matching new SCSI addresses.

For example, suppose an installation had two non-IBM devices owned previously by *st* at SCSI addresses 2 and 8. An IBM device with tape drive and medium changer is added. To prevent conflicts between *IBMtape* and *st*, the non-IBM devices are all placed at addresses in the range 0–6. The new IBM device is addressed in the range 8–14. Depending on the addresses chosen, after completing installation and recording device information, see Table 10 for sample equipment listing entries.

Table 10. Sample Equipment Listing

Device	Old Special File	Old Driver	SCSI Address/LUN (Old)	SCSI Address/LUN (New)	New Driver	New Special File
QIC	/dev/rmt/5l	st	2/0	2/0	st	/dev/rmt/0l
QIC	/dev/rmt/6l	st	8/0	0/0	st	/dev/rmt/1l
3580-H11 drive	–	–	–	8/0	IBMtape	/dev/rmt/2st
3581-H17 changer	–	–	–	8/1	IBMtape	/dev/rmt /3smc

Based on the listing, you can see that the tape drive accessed previously as */dev/rmt/5* will now be accessed as */dev/rmt/0*, the new medium changer is accessible as */dev/rmt/3smc*, and so on.

17. Verify operation of the newly installed or readdressed equipment.
18. Notify users of any changed device special files numbers.

Removing *IBMtape*

Use the **pkgrm** command to remove the *IBMtape* package from the system.

```
% /usr/sbin/pkgrm IBMtape
```

All active processes using any IBM devices supported by the IBM SCSI Tape and Medium Changer Device Driver for Solaris must be stopped in order for the removal procedure to complete successfully.

Note: Before Version 4.0.0.0 of the IBM SCSI Tape and Medium Changer Device Driver for Solaris, the driver consisted of two separate device driver components: **stdd** supported IBM SCSI tape drives, and **smcdd** supported IBM SCSI medium changers. The single *IBMtape* package now combines these two drivers and provides all of the function provided previously by the smcdd and stdd packages. You must remove both of these packages from your system before installing *IBMtape*.

To remove these packages, enter the following two commands:

```
% /usr/sbin/pkgrm smcdd
% /usr/sbin/pkgrm stdd
```

Configuration Parameters

When using devices that *IBMtape* controls , certain device characteristics, such as the default block size, can be controlled through the device driver configuration file. The *IBMtape* configuration file is named *IBMtape.conf*. The working copy of this file is located in the */usr/kernel/drv* directory.

During installation of *IBMtape*, the working copy of *IBMtape.conf* is preserved, if it exists. During removal of *IBMtape*, the working copy of *IBMtape.conf* is not deleted. These conventions allow configuration settings to remain across updates of *IBMtape*. A reference copy of *IBMtape.conf* with factory default settings is always installed in the */opt/IBMtape* directory.

Note: IBM requires that the Solaris native SCSI tape device driver *st* be configured so that it does not attempt to support SCSI targets that *IBMtape* controls. See “Preventing Conflicts with Other Device Drivers” on page 64 for more information about multiple driver access to a device.

Attention: Failure to prevent more than one device driver from operating the same SCSI tape drive may cause system panics or data loss on the tape drive.

Configuration settings are applied only at boot time or when *IBMtape* is unloaded manually from, then reloaded into, memory. If you change configuration settings in *IBMtape.conf*, you can make the changes effective by rebooting the system. As an alternative to rebooting, ensure that no *IBMtape*-owned devices are in use, then issue the following:

```
% /usr/sbin/rem_drv IBMtape
% /usr/sbin/add_drv -m '* 0666 bin bin' IBMtape
```

Default settings in *IBMtape.conf* can be overridden for a particular device (and only while the device is kept open) by using the *ioctl* application

programming interface (API) of the device driver. The parameter settings made through the API revert back to the default values in *IBMtape.conf* the next time that the device is opened. See the *IBM Ultrium Device Drivers: Programming Reference* for more information about changing configuration parameters under program control.

IBMtape.conf contains one stanza for each SCSI target address/LUN pair owned by *IBMtape*. The reference *IBMtape.conf* file supplied with the package contains a stanza for every possible SCSI target and LUN combination supported by IBM tape subsystems.

This example shows the stanza for target 0, LUN 0, with IBM's default configuration parameter values:

```
name="IBMtape" class="scsi"
target=0 lun=0
block_size=0
buffering=1
immediate=0
trailer=0
sili=0;
```

The **name** variable identifies *IBMtape* as the device driver, and **class** identifies the type of device supported as SCSI.

The **target** and the **lun** variables determine the target address and LUN of IBM devices that are controlled by that stanza. On systems with multiple SCSI adapters, a single target/LUN stanza controls the configuration settings for all devices addressed with that target address and LUN. Thus, two or more supported IBM devices on the system that have the same target and LUN settings but are attached to different SCSI buses will all be affected by the configuration parameters of the single stanza having that target address and LUN.

After installation of the *IBMtape* package is complete, you may eliminate unnecessary probing for devices by commenting out unused target and LUN pairs. In this example, the stanzas for target 0, LUN 0 and target 0, LUN 1 have been commented out. Those address and LUN combinations will not be probed, which saves time during a reboot or manual reload of *IBMtape*. However, if an IBM device is addressed at target 0, LUN 0 or target 0, LUN 1, it will not be detected.

```
#name="IBMtape" class="scsi"
# target=0 lun=0
# block_size=0
# buffering=1
# immediate=0
# trailer=0
# sili=0;
```

```
#name="IBMtape"  class="scsi"
# target=0 lun=1
# block_size=0
# buffering=1
# immediate=0
# trailer=0
# sili=0;
```

The remaining five configuration parameters affect the behavior of the device driver specifically for the IBM device or devices associated with that stanza (target and LUN). All of these parameters are specific only to tape drive device operation and have no effect on medium changer device behavior. The default configuration parameters are adequate for most purposes. However, the values in the configuration file can be modified to suit the specific requirements of the application or the user.

Remember that modifying a value in the configuration file determines the value of the parameter at device open time. While open, the value of a parameter can be altered using an ioctl function call, but the change is effective only while the device remains open. Working configuration parameters revert back to the default values (established by the configuration file) when the device is closed and reopened. See the *IBM Ultrium Device Drivers: Programming Reference* for more information about changing configuration parameters by way of program control.

The following list describes the set of configuration parameters recognized by the *IBMtape* device driver:

- block_size (0=variable length) This option specifies the device block size that is established with the SCSI Mode Select command during an open function call. Until this value is changed, it is the working block size. Variable block size is established using a value of zero. Any other positive value represents a fixed block size. The maximum supported block size varies for each tape device; see the appropriate hardware reference manual.

  Note: *IBMtape* does not allow odd-byte-count fixed block reads or writes. For instance, a fixed block size of 4096 or 4098 is allowed, but 4097 is not. If you attempt to read or write using an odd-byte-count fixed block size, the read or write will return -1, with errno set to 22, invalid argument. If you must read or write odd-byte-count blocks, set block size to 0 (variable block size), then transfer one block's worth of data per read or write.
- buffering (0=off, 1=on) When a write command is processed, the data is either stored directly on the physical tape or buffered in device hardware. Buffering can be turned on and off with this option. If buffering is disabled, the effective performance of the device may be seriously degraded, because the tape devices cannot take advantage of their buffering optimization.

Buffer flushing (or committing data to the tape) can be controlled by the application through the STIOC_SYNC_BUFFER ioctl function.

- immediate (0=off, 1=on) When a rewind command is issued to the tape drive, the status of the command can be returned immediately, or it can be returned after the physical rewind operation completes. If immediate is enabled, status for a rewind command is returned immediately to the application, but the tape drive will be in a device busy state for subsequent commands until the rewind operation actually completes.
- trailer (0=off, 1=on) If a tape drive encounters logical end-of-tape (EOT) during a write operation, it returns a check condition status. The driver returns 0 bytes written to notify the application of this EOT situation. A check condition will also be returned by the tape drive for every subsequent write operation when past EOT. If trailer is enabled, writing records past EOT will be allowed by the device driver. Following the first time the write operation notifies the application of EOT, all subsequent EOT notifications will be suppressed by the driver, and the actual number of bytes written will be returned. When the physical end of media is reached, all write operations will fail with a return code of -1, regardless of the trailer setting. When trailer is enabled, managing the media past EOT is the application's responsibility.
- sili (0=off, 1=on) Normally, during a read operation, if a larger block of data is requested than is actually read from the tape, the tape device raises a check condition. The *IBMtape* device driver must perform error handling procedures, which adds overhead to the read operation. The *IBMtape* driver does not surface this as an error condition to the application and ultimately returns the actual number of bytes read. However, this driver error processing does result in less than optimum read performance in some scenarios. When SILI mode is enabled, the tape device is forced to Suppress Illegal Length Indication during read operations. This eliminates the error processing performed by the driver and results in improved read performance for some scenarios. The actual number of bytes read is still returned to the application in SILI mode.

Adding or Removing Devices

To add support for a new IBM tape subsystem to the system or to remove support for a previously attached IBM tape subsystem, the following steps should be performed:

1. Edit the *IBMtape.conf* file in the */usr/kernel/drv* directory to reflect the change in IBM device support. Either add a new stanza to provide support for a device that is to be added, or remove (comment out) a stanza for a device that is no longer to be supported.
2. When adding support for a new device, ensure that the target and LUN values in the configuration file stanza match the target and LUN settings

of the IBM device. See “Configuration Parameters” on page 73 for more information about the *IBMtape.conf* configuration file.

3. Shut down and power off the host system.
4. Plug the new device into the SCSI bus, or unplug the existing device from the bus. Pay particular attention to proper SCSI cabling and termination.
5. Power on and boot the host system.

Note: It is possible to reinitialize the *IBMtape* device driver without rebooting the system. This is done by first unloading the device driver, then reloading the device driver into kernel memory.

The command to unload the device driver is:

```
% /usr/sbin/rem_drv IBMtape
```

The command to reload the device driver is:

```
% /usr/sbin/add_drv -m '* 0666 bin bin' IBMtape
```

When the *IBMtape* device driver is reloaded, it reads the *IBMtape.conf* file, and changes made in the file will be acknowledged by the device driver. This method can be used to modify configuration parameters.

Note: It is strongly suggested that you power off the host system and all devices attached to the SCSI bus before adding or removing devices from the SCSI bus. Hot plugging SCSI devices can cause hardware damage and disruption of reliable system operation.

Chapter 14. Special Files

After the *IBMtape* driver is installed, a set of special files is available for performing I/O operations to each supported device. The device special file names created by the *IBMtape* device driver are similar to the SCSI tape special files generally used on Solaris systems.

Each tape instance has a set of minor numbers that provides access to the same physical device, but each minor number provides a different function or behavior for the tape subsystem. These minor numbers are accessed through variations of the special file name for that device. The special files are created in the */dev/rmt* directory. These special files are actually symbolic links to files created within the */devices* subdirectory hierarchy.

Issuing the *ls -la /dev/rmt* command will present some useful information about these device special files. The following is a representative example of the entries returned by this command for a single IBM tape subsystem. This listing is system dependent; therefore entries will vary slightly in format, depending on the platform and the SCSI adapter support. There may also be entries included for other devices that are not supported by the *IBMtape* device driver.

```
lrwxrwxrwx root other 79 Aug 26 18:54 0smc   ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:smc
lrwxrwxrwx root other 78 Aug 26 18:54 0st    ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:st
lrwxrwxrwx root other 79 Aug 26 18:54 0stb   ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:stb
lrwxrwxrwx root other 80 Aug 26 18:54 0stbn  ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:stbn
lrwxrwxrwx root other 79 Aug 26 18:54 0stc   ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:stc
lrwxrwxrwx root other 80 Aug 26 18:54 0stcb  ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:stcb
lrwxrwxrwx root other 81 Aug 26 18:54 0stcbn ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:stcbn
lrwxrwxrwx root other 80 Aug 26 18:54 0stcn  ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
```

```
 10000/IBMtape@2,0:stcn
lrwxrwxrwx root other 79 Aug 26 18:54 0stn   ->
 /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,
 10000/IBMtape@2,0:stn
```

These entries show the device hierarchy established to support I/O for an IBM SCSI tape subsystem. The attachment path of the device special files spans from the system board, through the S-bus, to the Sun FW SCSI adapter (supported by the QLGC,isp SCSI adapter device driver), to the IBM device at SCSI target 2 and LUN 0 (supported by the *IBMtape* device driver). All nine of these special files are associated with the **same** IBM device (device number 0).

Certain device behaviors are determined by which special file in the set is opened for device access. The *smc* special file controls only the medium changer portion of the device and accepts only medium changer operations through the ioctl() entry point. The *smc* special file does not support the read() and write() entry points. Only one *st* type special file for a particular device may be opened at any one time. The *smc* special file may be opened concurrently with any one of the *st* special files.

The *IBMtape* device driver decides which types of special files to create during installation, based on the IBM device type being configured. For the IBM 3580-H11 Ultrium Tape Drive, only the eight *st* special files will be created. For the IBM 3581 Ultrium Tape Autoloader, IBM 3583 Ultrium Scalable Tape Library, and IBM 3584 UltraScalable Tape Library, all nine special files shown above will be created.

With the information from the previous command, issuing the *ls -la /devices/iommu@f,e0000000/sbus@f,e0001000/QLGC,isp@3,10000* command will present further information about the same special files, as shown in the following example. Again, the actual path information specified in the command will vary from system to system.

```
crw-rw-rw- 1 bin bin 109,1696 Aug 26 18:54 IBMtape@2,0:smc
crw-rw-rw- 1 bin bin 109,1664 Aug 26 18:56 IBMtape@2,0:st
crw-rw-rw- 1 bin bin 109,1728 Aug 26 18:54 IBMtape@2,0:stb
crw-rw-rw- 1 bin bin 109,1732 Aug 26 18:54 IBMtape@2,0:stbn
crw-rw-rw- 1 bin bin 109,1688 Aug 26 18:54 IBMtape@2,0:stc
crw-rw-rw- 1 bin bin 109,1752 Aug 26 18:54 IBMtape@2,0:stcb
crw-rw-rw- 1 bin bin 109,1756 Aug 26 18:54 IBMtape@2,0:stcbn
crw-rw-rw- 1 bin bin 109,1692 Aug 26 18:54 IBMtape@2,0:stcn
crw-rw-rw- 1 bin bin 109,1668 Aug 26 18:54 IBMtape@2,0:stn
```

These entries show the *major* and *minor* numbers associated with each special file. Here, the major number is 109 and identifies to the system that the *IBMtape* device driver is in support of these special files. Major numbers are assigned by the system at the time the driver is installed and will vary from system to system. The nine different minor numbers are specific to the special file names and are used by the device driver to determine which special file

was used to access the device and control the device behavior accordingly. For example, the minor number 1696 indicates to *IBMtape* that the device was opened through the smc special file. For more information on device special files and major/minor numbers, consult the Solaris *mtio* man pages.

Table 11 shows the special file-naming convention and the associated device attributes recognized by the *IBMtape* device driver.

Table 11. IBM SCSI Tape/Medium Changer Special Files for Solaris

Special File Name	BSD Compatibility	Rewind on Close	Compression
/dev/rmt/[0–255]smc	N/A	N/A	N/A
/dev/rmt/[0–255]stn	No	No	No
/dev/rmt/[0–255]stcn	No	No	Yes
/dev/rmt/[0–255]st	No	Yes	No
/dev/rmt/[0–255]stc	No	Yes	Yes
/dev/rmt/[0–255]stbn	Yes	No	No
/dev/rmt/[0–255]stcbn	Yes	No	Yes
/dev/rmt/[0–255]stb	Yes	Yes	No
/dev/rmt/[0-255]stcb	Yes	Yes	Yes

Notes:

1. The **BSD (b)** device special file modifies close() behavior for non-rewind devices. If the device is opened for **no rewind on close**, in **non-BSD** mode, if the last command before closing the device was a read, then the tape is positioned after the file mark immediately following the last block read. If the device is opened for **no rewind on close**, in **BSD** mode, if the last command before closing the device was a read, the tape is left positioned exactly where it was following the last block read. If the device is opened for **rewind on close**, the **BSD** mode is not relevant.
2. The **no rewind on close (n)** device special file does not rewind the tape during a close operation. Otherwise, the tape is rewound when the device is closed. If the last operation before closing the device was a write or write filemark, then a sufficient number of filemarks will be written so that two filemarks will follow the data.

   For the non-rewind special files, the tapes will be positioned between the trailing filemarks before closing. If the device is then reopened and more data is written, it will be separated by a single file mark from the previous data.
3. The **compression (c)** device special file determines whether the tape device will use built-in hardware compression while storing data on the tape. The compression mode of the device can also be set to the desired state

programmatically through the STIOC_SET_PARM ioctl, regardless of the default compression mode established by the special file used originally to open the device.

4. The **smc** special file is created only for IBM tape subsystems that provide medium changer capability. For the IBM 3580 Ultrium Tape Drive, no *smc* special file is created.
5. Only one *st* special file may be opened at any one time. The *smc* special file may be opened by itself or in conjunction with one of the *st* type files. The *smc* special file accepts only medium changer commands. Tape drive commands issued to the medium changer will fail with errno set to 22, invalid argument.

   Aside from the normal configuration with the medium changer answering as a distinct target and LUN pair, some supported devices can be configured with a nonstandard integrated medium changer reporting at the same target and LUN as the tape drive. In this case, both *st* and *smc* special files will accept a limited subset of medium changer commands. If you want to use this nonstandard mode, consult the appropriate hardware reference to determine whether the drive supports such a configuration.

Chapter 15. Service and Diagnostic Aids

The following section describes the service and diagnostic aids that are part of the *IBMtape* package. It discusses the procedure for verifying that the device driver was installed correctly, provides basic problem determination guidelines, and outlines the utility program included with the *IBMtape* package.

Functional Verification

To verify that the installation of the *IBMtape* package was successful, enter the following command:

```
/usr/bin/pkginfo IBMtape
```

The following information should be displayed:

```
system  IBMtape  IBM SCSI Tape & Medium Changer Device Driver x.x.x.x
```

where **x.x.x.x** is the version of the device driver.

To verify that device driver support for a specific IBM tape subsystem attached to the system is functioning correctly, enter the following command:

```
/opt/IBMtape/tapeutil -f /dev/rmt/nst -o chk -v
```

substituting for **n** the number associated with the device special file assigned to the IBM tape subsystem you want to check. Listing the contents of the */dev/rmt* directory (using the ls command) can be helpful in determining the proper special file name. For medium changer devices, the special file name */dev/rmt/***n***smc* should be used.

The following information should be displayed:

```
IBM xxxxxxxx configured at /dev/rmt/nst.
```

where **xxxxxxxxx** is the model number of the IBM tape subsystem and **n** is the same number specified in the verify command.

To verify that the *IBMtape* device driver is loaded in kernel memory, enter the following command:

```
/usr/sbin/modinfo | /usr/bin/grep IBMtape
```

The following information should be displayed:

```
165 f5f10000  15c0s 109   1  IBMtape (IBM SCSI Tape/Medium Changer DD)
```

The first five fields shown here will usually not match your specific output. This is not cause for concern. The fields indicate the ID, load address, size, major number, and revision for the *IBMtape* device driver and will vary from system to system.

Problem Determination

If you are experiencing problems with the installation of the IBM SCSI Tape and Medium Changer Device Driver for Solaris, the following information may be of assistance. If you cannot solve your problem after checking the following, contact the appropriate IBM service representative:

- If you receive the following message during installation:

```
drvconfig: System call 'modctl_modconfig' failed:
  No such device or address.
Warning: Driver (IBMtape) configuration failed.
  System could not install driver.
```

  it indicates that the *IBMtape* device driver was not loaded because it did not detect the presence of any supported IBM devices on the SCSI bus. Verify that SCSI adapter device driver support is installed and configured correctly. Verify that the IBM tape subsystem is connected to the SCSI bus properly, powered-on, and online. It is not necessary for the tape drive to have a cartridge loaded to be recognized by the *IBMtape* device driver.

- If you cannot open an IBM device, verify that you are using the correct special file. The IBM tape special files are of the form **st** in the */dev/rmt* directory. The IBM medium changer special files are of the form **smc* in the */dev/rmt* directory. Ensure that the Sun native tape device driver (st) is not contending for the same IBM device by consulting the *st.conf* file in the */kernel/drv* directory and commenting out conflicting stanzas.

Downloading Device Microcode

The IBM 3580 Ultrium Tape Drive supports downloading a new microcode image from the host system through the SCSI bus.

To download microcode to this device, perform the following steps:

1. Verify that the IBM tape subsystem is powered-on and online.
2. Verify that the tape drive does not have a tape cartridge loaded.
3. Determine the current version of microcode present on the device by entering the following command, substituting **n** with the actual value from the device special file associated with the target device:

   ```
   /opt/IBMtape/tapeutil -f /dev/rmt/nst -o qmc -v
   ```

4. Determine the source of the new microcode image file (that is, diskette, such as */vol/dev/aliases/floppy0*, or host file, such as */tmp/ucode_image.file*).

5. Enter the following command, substituting **file** with the actual path and filename of the microcode image file and substituting **n** with the actual value from the device special file associated with the destination device:

   ```
   /opt/IBMtape/tapeutil -f /dev/rmt/nst -o dmc -z file -v
   ```

Note: The microcode download procedure may also be performed using the menu-driven interface of the *tapeutil* program. To call the *tapeutil* program in this format, enter the following command, then select option 1 to open the device, followed by option 4 to query the current device microcode level and option 7 to download new microcode:

```
/opt/IBMtape/tapeutil
```

Forcing and Storing Device Diagnostic Dump

The IBM 3580 Ultrium Tape Drive supports forcing a diagnostic dump and storing that dump to a mounted tape cartridge or to a host system file through the SCSI bus.

To force and store a diagnostic dump on these devices, perform the following steps:

1. Verify that the IBM tape subsystem is powered-on and online.
2. Enter the following command to force the dump, substituting **n** with the actual value from the device special file associated with the target device:

   ```
   /opt/IBMtape/tapeutil -f /dev/rmt/nst -o fdp -v
   ```

3. Determine the location for the dump to be stored (that is, diskette, such as */vol/dev/aliases/floppy0* or host file, such as */tmp/diag_dump.file*).
4. Enter the following command, substituting **file** with the actual path and filename of the dump destination file, and substituting **n** with the actual value from the device special file associated with the dump device:

   ```
   /opt/IBMtape/tapeutil -f /dev/rmt/nst -o sdp -z file -v
   ```

5. The dump may also be written to a tape cartridge mounted in the dump device by using *tapedrive* for **file**.

Note: The diagnostic dump procedure may also be performed using the menu-driven interface of the *tapeutil* program. To call the *tapeutil* program in this format, enter the following command, then select option 1 to open the device, followed by option 5 to force a dump and option 6 to store the dump:

```
/opt/IBMtape/tapeutil
```

Tracing Facility

IBMtape incorporates a tracing facility that is useful for performing problem determination. The tracing facility logs diagnostic information to */var/adm/messages* based on the control variable IBM_trace. See “Setting the IBM_trace Level” on page 88 for instructions on how to set the trace value.

IBM_trace values range from 0–13 and result in posted messages as shown in Table 12. Postings are cumulative; trace level 3 also posts items for levels 2, 1, and 0. A trace value of 2 or 3 is suitable for most normal production environments with little or no degradation of throughput. IBM_trace values of 4 and higher will increasingly degrade performance and should generally be used only when directed by IBM support personnel.

Table 12. Tracing Facility

Trace Level	Items Traced
0	Hardware sense data and severe error conditions only.
1	Moderate error conditions
2	Device opens and closes. Decoded SCSI command, sense key, ASC and ASCQ for sense data.
3	Additional device open information. SCSI transport packet information for nonzero return codes.
4–13	Increasingly verbose tracing information. These tracing levels are generally useful only to *IBMtape* developers.

Note: *IBMtape* Versions before 4.0.2.7 had only IBM_trace values 0–4. Message content and selection differed significantly from present *IBMtape* versions.

By default, system error messages, including *IBMtape* trace messages, are placed in */var/adm/messages*. If your installation has modified */etc/syslog.conf* to redirect system error messages, *IBMtape* tracing will be handled as other kernel messages. See the *syslog.conf* man page and comments in *syslog.conf* for information about the system logging operation. Changes made to *syslog.conf* take effect after the next system reboot.

Following is a sample of trace level 2 output with system date and time stamps removed. Device instance 36 is opened on the first line. The device minor number 0x4C4 is decoded and shows that the SCSI tape drive (drv) special file was opened.

The second line decodes selected fields from the sense data, which immediately follows. Looking up the decoded Sense Key /ASC/ASCQ

combination in the 3580 hardware reference, we find that the command failed because a file mark was encountered during the space.

The actual sense data follows the decoded fields.

Note: Solaris, rather than printing multiple 16-byte lines of hex zeros, instead prints only the first such line, followed by a repeat count.

```
IBMtape( 36) _open: Ins36 Mnr0x4c4<BSD,NoRew>(drv)
                          Flg0x5<Ndelay,Read> TL24036
IBMtape( 36) check_sense: cmd 0x11(space) , key/asc/ascq 0x0/0/1,
                          defer 0, retry 0, rc 5
IBMtape( 36) ULTRIUM-TD1     S/N 1300015708 SENSE DATA
IBMtape( 36)  f0  0 80  0  0  0  1 1c  0  0  0  0  0  1  0  0
IBMtape( 36)   0  0  0  0
IBMtape( 36) _close: Inst 36, Minor 1220 (drv), Flags 0x5, exit(0)
```

The following sense data for device instance 36, a tape drive, occurred during a test unit ready and indicates that a tape is in the throat of the drive but requires an Initializing Command (that is, a SCSI Load command) to move the tape fully into the drive.

```
IBMtape( 36) _open: Ins36 Mnr0x4c4<BSD,NoRew>(drv)
                           Flg0x5<Ndelay,Read> TL24036
IBMtape( 36) check_sense: cmd 0x0(test_unit_ready) , key/asc/ascq 0x2/4/2,
                           defer 0, retry 0, rc 5
IBMtape( 36) ULTRIUM-TD1     S/N 1300015708 SENSE DATA
IBMtape( 36)  70  0  2  0  0  0  0 1c  0  0  0  0  4  2  0  0
IBMtape( 36)  10 12  0  0  0  0  0  0  0  0  0  0  0  0  0  0
IBMtape( 36)   0  0  0  0
IBMtape( 36)  10 12  0  0  0  0  0  0  0  0  0  0  0  0  0  0
IBMtape( 36)   0  0  0  0
IBMtape( 36) _close: Inst 36, Minor 1220 (drv), Flags 0x5, exit(0)
```

You can match an instance number with its corresponding device special files in two steps:

1. Find the instance number in */etc/path_to_inst*:

   ```
   $ grep 292 /etc/path_to_inst
   "/pci@6,4000/scsi@2,1/IBMtape@2,0" 292 "IBMtape"
   ```

2. List “long” the contents of */dev/rmt* and search for the path name you found in the previous step:

   ```
   $ ls -l /dev/rmt | grep "/pci@6,4000/scsi@2,1/IBMtape@2,0"
   lrwxrwxrwx   1 root     other         48 Aug  26 11:49 8st ->
      ../../devices/pci@6,4000/scsi@2,1/IBMtape@2,0:st
   lrwxrwxrwx   1 root     other         49 Aug  26 11:49 8stb ->
      ../../devices/pci@6,4000/scsi@2,1/IBMtape@2,0:stb
   .
   .
   .
   ```

In this example, */dev/rmt/8st*, */dev/rmt/8stb*, and so on, are symbolic links to the device special files that are associated with device instance 292.

Setting the IBM_trace Level

The default value for IBM_trace is zero (0). You can define another IBM_trace value by placing an entry in */etc/system*, so that IBM_trace will be set at each reboot. For example, this entry in */etc/system* will set IBM_trace to 2 at each reboot:

```
set IBMtape:IBM_trace = 2
```

When IBM_trace is set in */etc/system*, it affects tracing during driver loading, initialization, and operation.

You may also set or modify the IBM_trace value manually in an *adb* session. Because the driver must already be loaded and initialized before using this method, the trace value that is set will be active only during driver operation.

In this sample session, *ksh>* is a shell prompt, and *adb>* is the *adb* session prompt. Commands that you enter follow these prompts. Explanatory comments follow pound signs (#) or exclamation and pound sign pairs (!#). Text lines without a prefix are *adb* session responses to commands.

```
#
#  Start adb session and set session prompt.
ksh> adb -P "adb> " -k -w /dev/ksyms /dev/mem
physmem 7c5e
!#
!#  Set default for input values to base 10.
adb> a$d
radix=10 base ten
!#
!#  Display current IBM_tape value as unsigned decimal integer.
adb> IBM_trace/u
IBM_trace:
IBM_trace:      0
!#
!#  Set new IBM_trace value.
!#  adb will confirm the old and new values.
adb> IBM_trace/w 2
IBM_trace:      0       =       2
!#
!#  Quit session.
adb> $q
#
#  Back to the shell.
ksh>
```

Tape/Medium Changer Utility Program

A SCSI Tape and Medium Changer Utility Program called *tapeutil* is provided with the IBM SCSI Tape Drive and Medium Changer Device Driver for Solaris and is installed in the */opt/IBMtape* directory as part of the *IBMtape* package. This program fulfills several purposes:

- It provides the following service aids for IBM tape subsystems:
  - Query Device Type / Verify Device Attachment
  - Query Device Serial Number
  - Query Device Microcode Level
  - Force Device Diagnostic Dump
  - Store Device Diagnostic Dump
  - Download Device Microcode
- It provides a menu-driven test tool for exercising or testing IBM tape and medium changer devices with a full suite of supported operations:
  - Reading / Writing Data
  - Tape Motion Commands
  - Setting / Displaying Device Information / Status
  - Mounting / Demounting Cartridges
  - Cartridge Inventory
- In addition to the menu-driven front end, the *tapeutil* program provides a command-line interface that is convenient for use in shell scripts.

  Note: When using the command-line calls to the *tapeutil* program, the tape device is opened and closed for each invocation. Configuration parameters that are changed in one call to the *tapeutil* program are returned to default values when the device is closed.
- The source code for the *tapeutil* program is provided for example purposes and is installed in the */opt/IBMtape* directory during the *IBMtape* package installation. This source code is commented and demonstrates calls to all of the supported device driver entry points and *ioctl* commands, thus giving the application developer a starting point for interfacing to the *IBMtape* device driver.

The *tapeutil* program provides both an interactive menu-driven interface and a command-line interface. If the *tapeutil* program is called with no command-line parameters, the menu-driven version will be started. In the menu-driven version, the device to be operated on should first be opened using option 1. Other options may then be selected. The user will be prompted for additional information if required for the specific options selected. The results of a command are displayed after it is executed. If an error occurs for the command, error information and device sense data are displayed. The device can be closed using option 2, or it will be closed

automatically when the Quit option is selected. The menu is displayed once automatically when the program is first called. To prevent unnecessary scrolling of the screen, the menu is not displayed automatically again after each command but is instead refreshed only after the M (menu refresh) command is entered.

Figure 6 shows the menu that is displayed by the *tapeutil* program.

```
+-------------------------------------------------------------+
|      IBM SCSI TAPE & MEDIUM CHANGER UTILITY PROGRAM         |
+-----------------------------+-------------------------------+
|   << GENERAL COMMANDS >>    |  << BASIC SCSI COMMANDS >>    |
|   1: Open Device            |   9: Test Unit Ready          |
|   2: Close Device           |  10: Inquiry                  |
|   D: Device Type            |  11: Request Sense            |
|   M: Menu Refresh           |  12: Reserve                  |
|   Q: Quit Program           |  13: Release                  |
+-----------------------------+-------------------------------+
|   << SERVICE COMMANDS >>    |<< MEDIUM CHANGER COMMANDS >>  |
|   3: Query Serial Number    |  14: Move Medium              |
|   4: Query Microcode Level  |  15: Position To Element      |
|   5: Force Dump             |  16: Element Information      |
|   6: Store Dump             |  17: Inventory                |
|   7: Download Microcode     |  18: Audit                    |
|   8: Format Cartridge       |  19: Lock/Unlock Door         |
+-----------------------------+-------------------------------+
|                << TAPE DRIVE COMMANDS >>                    |
|  20: Read Data                 32: Locate End Of Data       |
|  21: Write Data                33: Get Record Size          |
|  22: Write File Mark           34: Set Record Size          |
|  23: Erase Tape                35: Get Device Status        |
|  24: Rewind                    36: Get Device Info          |
|  25: Retension                 37: Get Media Info           |
|  26: Offline                   38: Get Position             |
|  27: Load/Unload Tape          39: Set Position             |
|  28: Forward Space File        40: Get Parameter            |
|  29: Backward Space File       41: Set Parameter            |
|  30: Forward Space Record      42: Sync Buffer              |
|  31: Backward Space Record     43: Display Message          |
+-------------------------------------------------------------+
```

Figure 6. TAPEUTIL Program Menu

If command-line parameters are provided when the program is called, the command-line mode will be started. For each command-line execution of the program, the device is first opened, the specific command is issued, then the device is closed. The program can be driven from within a shell script if desired. Results of the operation are displayed only when executed in verbose mode. No information is displayed when not in verbose mode. This is particularly useful for quiet shell script implementations. A completion code, as defined in */usr/include/sys/errno.h*, for the operation requested is always returned from the program upon exit (in both verbose and quiet mode).

The usage of the *tapeutil* program in command-line mode is as follows:

```
tapeutil -f device -o operation [options]
```

where **device** is the name of the tape device special file (for example: */dev/rmt/1st*) and **operation** is one of the following values. The device special file and the operation are required. The specific **options** associated with a particular operation are indicated. Parameters enclosed in square brackets are optional. All others are required.

Service Commands	
Query Serial Number	`tapeutil -f f -o qsn [-w w] [-v]`
Query Microcode Level	`tapeutil -f f -o qmc [-w w] [-v]`
Force Dump	`tapeutil -f f -o fdp [-w w] [-v]`
Store Dump	`tapeutil -f f -o sdp [-w w] [-v] -z z`
Download Microcode	`tapeutil -f f -o dmc [-w w] [-v] -z z`
Format Cartridge	`tapeutil -f f -o fmt [-w w] [-v]`
Query Device Type	`tapeutil -f f -o chk [-w w] [-v]`
Basic SCSI Commands	
Test Unit Ready	`tapeutil -f f -o tur [-w w] [-v]`
Inquiry	`tapeutil -f f -o inq [-w w] [-v] -t t -x x`
Request Sense	`tapeutil -f f -o req [-w w] [-v]`
Reserve	`tapeutil -f f -o res [-w w] [-v]`
Release	`tapeutil -f f -o rel [-w w] [-v]`
Medium Changer Commands	
Move Medium	`tapeutil -f f -o mov [-w w] [-v] -s s -d d`
Position To Element	`tapeutil -f f -o pos [-w w] [-v] -d d`
Element Information	`tapeutil -f f -o ele [-w w] [-v]`
Inventory	`tapeutil -f f -o inv [-w w] [-v]`
Audit	`tapeutil -f f -o aud [-w w] [-v]`
Lock/Unlock Door	`tapeutil -f f -o lck [-w w] [-v] -x x`
Tape Drive Commands	
Read	`tapeutil -f f -o rea [-w w] [-v] -b b -n n -m m`
Write	`tapeutil -f f -o wri [-w w] [-v] -b b -n n -m m`

	[-r **r**] [-z **z**]
Write File Mark	tapeutil -f **f** -o eof [-w **w**] [-v] -c **c**
Erase Tape	tapeutil -f **f** -o era [-w **w**] [-v]
Rewind	tapeutil -f **f** -o rew [-w **w**] [-v]
Retension	tapeutil -f **f** -o ret [-w **w**] [-v]
Offline	tapeutil -f **f** -o off [-w **w**] [-v]
Load/Unload Tape	tapeutil -f **f** -o lod [-w **w**] [-v] -x **x**
Forward Space File	tapeutil -f **f** -o fsf [-w **w**] [-v] -c **c**
Backward Space File	tapeutil -f **f** -o bsf [-w **w**] [-v] -c **c**
Forward Space Record	tapeutil -f **f** -o fsr [-w **w**] [-v] -c **c**
Backward Space Record	tapeutil -f **f** -o bsr [-w **w**] [-v] -c **c**
Locate End of Data	tapeutil -f **f** -o eod [-w **w**] [-v]
Get Record Size	tapeutil -f **f** -o grs [-w **w**] [-v]
Set Record Size	tapeutil -f **f** -o srs [-w **w**] [-v] -x **x**
Get Device Status	tapeutil -f **f** -o gds [-w **w**] [-v]
Get Device Information	tapeutil -f **f** -o gdi [-w **w**] [-v]
Get Media Information	tapeutil -f **f** -o gmi [-w **w**] [-v]
Get Position	tapeutil -f **f** -o gpo [-w **w**] [-v] -t **t**
Set Position	tapeutil -f **f** -o spo [-w **w**] [-v] -t **t** -x **x**
Get Parameter	tapeutil -f **f** -o gpa [-w **w**] [[-v] -t **t**
Set Parameter	tapeutil -f **f** -o spa [[-w **w**] [-v] -t **t** -x **x**
Sync Buffer	tapeutil -f **f** -o syn [-w **w**] [-v]
Display Message	tapeutil -f **f** -o msg [-w **w**] [-v] -t **t** -y **y1,y1**

Note: Calling the *tapeutil* program with the **-h** flag (for example, **tapeutil -h**) or the **-?** flag (for example, **tapeutil -?**) displays the usage help information.

The following are the supported flags, their meanings, their associated operations, and their acceptable ranges:

Flag	Description
-?	Usage Help (stand-alone flag) {no value required}

-b Block Size (rea, wri)

{0 < (block size x blocking factor) < 2097152}

-c Operation Count (eof, fsf, fsr, bsf, bsr) {0–65535}

-d Destination Address (mov)

{device specific, determine range from Element Info}

-f Device Special File Name (always required)

{/dev/rmt/1st or similar}

-h Usage Help (stand-alone flag) {no value required}

-m Multiples to Read or Write (rea, wri) {0–2097152}

-n Blocking Factor (rea, wri)

{0 > (block size x blocking factor) < 2097152}

-o Operation (always required) {see previous list}

-r Random Seed (wri) {0–65535}

-s Source Address (mov, pos)

{device specific, determine range from Element Info}

-t Type of Parameter Value

- (gpo) {1=logical block, 2=physical block}
- (spo) {1=logical block, 2=physical block}
- (gpa) {1=block size, 2=compression, 3=buffering, 4=immediate, 5=trailer, 6=write protect, 7=acf mode, 8=capacity, 9=sili}
- (spa) {1=block size, 2=compression, 3=buffering, 4=immediate, 5=trailer, 6=write protect, 8=capacity, 9=sili}
- (msg) {1=display msg0, 2=display msg1, 3=flash msg0, 4=flash msg1, 5=alternate msg1/msg2}
- (inq) {0=standard data, 1=page data}

-v Verbose Mode (optional for all commands, stand-alone flag)

{no value required, absence of flag means quiet mode}

-w Open Mode (optional for all commands)

{1=read/write, 2=read only (default), 3=write only, 4=append}

-x Parameter Value

- (lck) {1=lock, 2=unlock}
- (lod) {1=load, 2=unload}
- (inq) {oxo–oxFF}
- (srs) {0–65536}
- (spo) {0–65535}
- (spa) {0–65535}

-y Messages (msg) {message1,message2}

-z Input/Output File Name

- (sdp) {path and name of the file in which to store dump}
- (dmc) {path and name of the microcode image file}
- (wri) {path and name of the file containing write data pattern}

Notes:

1. For read and write operations, the size of one buffer of data transferred during a single SCSI read or write command is determined by the product of the *Block Size* value and the *Blocking Factor* value. The number of these buffers transferred is determined by *Multiplier* value. The actual total number of bytes transferred is then (Block Size) x (Blocking Factor) x (Multiplier). If the device is set to fixed block mode (block size not equal to zero), the product of *Block Size* and *Blocking Factor* must be a multiple of the device block size setting.
2. For further information about the Get Parameter (gpa) and Set Parameter (spa) operations, see the STIOC_GET_PARM and STIOC_SET_PARM ioctl commands described in the *IBM Ultrium Device Drivers: Programming Reference*.

The following examples should help to demonstrate and clarify the command-line usage of the *tapeutil* program. For all examples, substitute the actual value of the special file associated with the target device.

- To query the serial number of the device:

```
/opt/IBMtape/tapeutil -f /dev/rmt/0st -o qsn -v
```

- To request inquiry data from the device:

```
/opt/IBMtape/tapeutil -f /dev/rmt/0st -o inq -v
```

- To request inquiry page data from the device:

```
/opt/IBMtape/tapeutil -f /dev/rmt/0st -o inq -t 1 -x ox83 -v
```

- To move a cartridge from cell 32 to the tape drive (16):

```
/opt/IBMtape/tapeutil -f /dev/rmt/0smc -o mov -s 32 -d 16 -v
```

- To set the block size of the device to 64K:

```
/opt/IBMtape/tapeutil -f /dev/rmt/0st -o spa -t 1 -x 65535 -v
```

- To write 100 64K blocks of data to the tape device:

```
/opt/IBMtape/tapeutil -f /dev/rmt/0stn -w 1 -o wri -b 65535
-n 1 -m 100 -v
```

- To write two file marks to the tape device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0stn -w 1 -o eof -c 2 -v
  ```

- To rewind the tape device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0stn -o rew -v
  ```

- To read 100 64K blocks of data from the tape device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0stn -o rea -b 65535 -n 1 -m 100 -v
  ```

Part 4. HP-UX Tape and Medium Changer Device Driver

Chapter 16. Introduction and Product Requirements

This chapter provides an overview of the IBM SCSI Tape and Medium Changer Device Driver for HP-UX, which provides support for the following products (see “Hardware Requirements” on page 100 for specific models):

- IBM 3580 Ultrium Tape Drive
- IBM 3581 Ultrium Tape Autoloader
- IBM 3583 Ultrium Scalable Tape Library
- IBM 3584 UltraScalable Tape Library
- StorageSmart by IBM Ultrium External Tape Drive TX200
- StorageSmart by IBM Ultrium Tape Autoloader SL7
- StorageSmart by IBM Ultrium Scalable Tape Library SL72

Purpose

This device driver product provides SCSI-2 attachment for the IBM Ultrium products to selected Hewlett-Packard platforms running HP-UX 11.0.

It is designed specifically to take advantage of the features provided by the hardware, including full control of the random access medium changer facility (move, element information, and inventory) present in some models. The goal is to give applications access to the functions required for basic operations (such as backup and restore), as well as the advanced functions needed by full tape management systems. Whenever possible, the device driver is designed to take advantage of the IBM tape subsystem features transparent to the application.

The HP-UX installed name of this device driver is ATDD (Advanced Tape Device Driver). ATDD is used throughout this chapter to identify this driver.

Product Requirements

The following hardware and software components are required and supported by the IBM SCSI Tape and Medium Changer Device Driver for HP-UX (ATDD).

ATDD Device Driver Implementations

The ATDD device driver is supported for operation in the following HP-UX platform environment:

- HP PCI Bus - HP-UX 11.00 (64-bit) - Versions of this driver are identified by levels ATDD 1.x.x.x. Only A-, L-, and N-Class servers are supported.

Hardware Requirements

All versions of the ATDD device drivers configure and operate the following tape drives and libraries unless otherwise noted:

- IBM 3580 Ultrium Tape Drive Models L11 (LVD attach), H11 (HVD attach)
- IBM 3581 Ultrium Tape Autoloader Models L17 (LVD attach), H17 (HVD attach)
- IBM 3583 Ultrium Scalable Tape Library Models L18, L36, L72
- IBM 3584 UltraScalable Tape Library Models L32 (base frame), D32 (expansion frame)
- StorageSmart by IBM Ultrium External Tape Drive TX200 - Models L11 (LVD attach), H11 (HVD attach)
- StorageSmart by IBM Ultrium Tape Autoloader SL7 - Models L17 (LVD attach), H17 (HVD attach)
- StorageSmart by IBM Ultrium Scalable Tape Library SL72 - Models L18, L36, L72

The ATDD drivers support the following HP SCSI host adapters:

- HP A4800A PCI Ultra SCSI Host Bus Adapter (HVD)
- HP A5149A PCI to Ultra-2 SCSI Host Bus Adapter (LVD)
- HP A5150A PCI Dual Port Ultra-2 LVD/SE SCSI adapter (LVD)

Note: The ATDD driver does not support IBM Ultrium tape devices that are attached to the HSC/GSC bus or the Precision Bus (HP-PB) architectures.

Software Requirements

This product requires the following HP-UX patches. The patches listed may be superseded; therefore contact Hewlett-Packard to verify them:

```
HP-UX   Patch        Patch Description
-----   ---------    -----------------
11.00   NO PATCHES REQUIRED AT THIS TIME
```

Late-breaking driver information can be found on the distribution CD at *../HPUX/atdd.Readme*.

Data Flow

Both data and commands flow between the application program and the tape subsystem through the IBM SCSI Tape and Medium Changer Device Driver for HP-UX. Figure 7 shows the relationships between the IBM SCSI Tape and Medium Changer Device Driver for HP-UX, the application program, the SCSI adapter device driver, and the IBM tape subsystem.

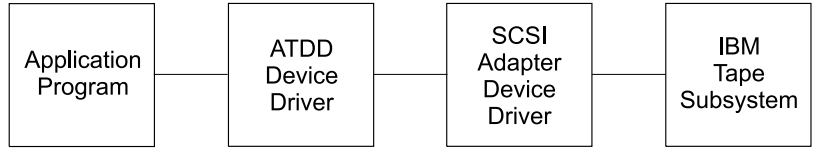


Figure 7. Data Flow

Software Interface to the Device Driver

The IBM SCSI Tape and Medium Changer Device Driver for HP-UX provides the following standard HP-UX (UNIX) entry points for IBM tape subsystems:

- Open

  This entry point is driven by the *open* system function call.
- Write

  This entry point is driven by the *write* system function call.
- Read

  This entry point is driven by the *read* system function call.
- Close

  This entry point is driven explicitly by the *close* system function call and implicitly by the operating system at program termination.
- IOCTL

  This entry point is driven by the *ioctl* system function call. It provides a set of tape device, medium changer device, and SCSI specific operations. It allows HP-UX applications to access and control the features and attributes of IBM SCSI tape subsystems programmatically.

For programming information, see the *IBM Ultrium Device Drivers: Programming Reference*.

Chapter 17. Installation, Uninstallation, and Configuration

This chapter describes how to install, manage, and uninstall the IBM SCSI Tape and Medium Changer Device Driver for HP-UX (ATDD). By default, the ATDD driver configures automatically all supported IBM tape drives that are attached and powered-on when the system starts. The driver does not configure IBM Medium Changer devices by default, because many applications use either their own changer drivers or the native 'schg' or 'sctl' drivers.

After the ATDD driver is installed, a kernel configuration parameter can be set to allow the ATDD driver to configure (CLAIM) all attached IBM Medium Changer devices. Additionally, selected IBM Medium Changer devices can be configured by modifying a system header file and rebuilding the HP-UX kernel. The installation process depends on whether it is desired that all IBM tape drives be configured by ATDD or only selected ones, and whether configured tape drives will exhibit default behavior or require specific configuration settings. Additionally, for IBM Medium Changers, post-installation configuration can determine whether all IBM Medium Changers should be configured, selectively configured, or not configured at all.

Options for installation of the ATDD driver:

- If you are configuring all IBM tape drives with the most recent ATDD driver using the default settings, and configuring no medium changer devices (as in the case of Tivoli Storage Manager), review the 'atdd.Readme' file on the driver distribution CD and start at "Install the Driver Using the CD Installation Script" on page 107.
- If you are configuring selected IBM tape drives or need to change the operational behavior of any IBM tape device under the control of ATDD, review the 'atdd.Readme' file on the driver distribution CD and start at "Create the Drive Configuration File (Optional)" on page 104.
- If you want to install a previous version of the ATDD driver that is available on the driver distribution CD, start at "Install Drivers Manually" on page 108.

Note the following facts about the command sequences described in this section:

- In some of the examples, filenames given on the command line must be made reference to with an absolute path. Using *'pwd'/filename* to make reference to a file instead of *filename* will ensure this.

- All of the SD commands (for example, *swinstall* or *swcopy*) can be run first with the *-p* flag to preview the command. After observing the preview output, you can reissue the command without the *-p* flag to perform the actual operation.
- The SD commands are moderately complex scripts that frequently proceed in several steps. The steps are typically *Selection*, *Analysis*, and *Execution*. Each step may produce useful information and error messages. It is a good idea to observe carefully the results of the installation process as it occurs.

If you encounter unexpected results during the installation, examine the associated log file.

While using the SD commands, you may encounter the following error about mounted file systems:

```
ERROR: "hostname/": One or more filesystems that appear in the
filesystem table are not mounted and cannot be mounted.
```

Many commands (*swinstall, swremove,*, and so on) attempt to mount all file systems in the */etc/fstab* file at the start of the analysis phase. This step ensures that all listed file systems are mounted before proceeding. This policy helps to ensure that files are not loaded into a directory that may be below a future mount point, but it often causes an error with NFS-mounted file systems.

This error can be overridden by using *'-x'* to set the *mount_all_filesystems* option to *false*. When this option is used, the command finishes with a warning indicating that no attempt will be made to mount all file systems.

For example:

```
# swinstall -x mount_all_filesystems=false -x autoreboot=true atdd
WARNING: "hostname:/": There will be no attempt to mount filesystems
that appear in the file system table.
```

Create the Drive Configuration File (Optional)

If you are **not** using the standard device driver defaults, you must create a configuration file that directs the device driver on how to customize driver behavior for particular IBM Ultrium devices. If all configured devices are to use the device driver configuration defaults, it is not necessary to create a configuration file before installing the driver for ATDD driver levels 1.7.1.0 and later.

The configuration file is named *etc/rc.config.d/atdd.cfg* and has the following syntax:

```
 ATDD_global_parameter=value
ATDD_device_parameter[index]=value
```

- Blank lines and lines starting with # are ignored.
- No spaces may be within each entry.
- No trailing comments may be on a variable definition line.

Determine the Drive Hardware Path for IBM 3580 Ultrium Tape Drive, 3581 Tape Autoloader

1. Run IOSCAN to determine the SCSI adapter to which the IBM Ultrium drive or autoloader is connected:

   # ioscan -f -C ext_bus

2. Record the hardware path entry of the adapter, for example, 56/40.
3. Determine the SCSI target address of the IBM Ultrium drive (3580) or the drive in the IBM 3581 Autoloader. The switch on the rear of the IBM 3580 Ultrium Tape Drive displays the selected SCSI target address.

   The LCD panel on the front of the unit can display the drive (and medium changer SCSI address) for the IBM 3581 Ultrium Tape Autoloader.

   HWPATH=***adapterpath.drivetargetaddress***.0 (3580 drive)

   or

   HWPATH=***adapterpath.drivetargetaddress***.0 (3581 drive)

   For an IBM 3581 Ultrium Tape Autoloader at SCSI target address 3, the drive device hardware path is: 56/40.3.0

Determine the Drive Hardware Paths for IBM 3583/3584 Ultrium Scalable Tape Libraries

1. Run IOSCAN to determine the SCSI adapter to which the IBM Ultrium Tape Library is connected:

   # ioscan -f -C ext_bus

2. Record the hardware path entry of the adapter:

   for example, 1/8/0/0

3. Determine the SCSI target addresses of the IBM Ultrium drives in the Tape Library. The LCD panel on the front of the unit can display the drive (and medium changer) SCSI addresses.

   HWPATH=***adapterpath.drivetargetaddress***.0 (3583 drive 1)
   HWPATH=***adapterpath.drivetargetaddress***.0 (3583 drive n)

   The drive hardware paths for an IBM Ultrium 3583 Tape Library with a drive at SCSI ID 3 and SCSI ID 5 are:

   1/8/0/0.3.0
   1/8/0/0.5.0

Create the Hardware Path Entry

If devices are to be configured with settings other than the defaults, entries defining the hardware device paths must be placed in the */etc/rc.config.d/atdd.cfg* configuration file. Create an entry for each device that requires further configuration settings. The format for the entries is *HW_PATH[index]=DeviceHardwarePath.* The *index* is used to identify the device for control of the configuration settings in the next section.

For example:

```
ATDD_HWPATH[0]=56/40.1.0
ATDD_HWPATH[1]=56/40.6.0
```

This example shows that two devices will be CLAIMED by the ATDD driver. The first device, at target address 1 LUN 0, has *index=0*. The second device, at target address 6 LUN 0, has *index=1*.

Create the Device Specific Configuration Entries (Optional)

The ATDD driver is shipped with default settings for all configuration parameters. If it is desired to alter these settings, an entry can be made in the configuration file, assigning an appropriate value to the desired configuration variable. Each drive may have a different value for each configuration variable. The index number associated with the configuration variable associates the parameter setting with the device at the hardware path with the same index.

Example 1:

```
ATDD_IMMEDIATE[0]=1
```

This allows application control back from the device before rewind is complete for the device at hardware path 56/40.1.0 (based on the previous hardware path entry in “Create the Hardware Path Entry”).

Example 2:

```
ATDD_TRAILER[1]=1
```

This allows writes after an early end-of-tape warning for the device at hardware path 56/40.6.0. See Table 14 on page 121 and Table 15 on page 122 for a description of all configuration parameters.

Note: If you are experiencing difficulties with your tape device, be sure to examine the /etc/rc.log for errors and correct the problems.

Power Off the Tape Drives

When the ATDD software is installed initially, it attaches itself to all tape drives that are in the CLAIMED state as shown by entering the command:

 # ioscan -fk -C tape

Before you continue, ensure that all devices that report CLAIMED with the this command are devices that you want to be managed by this device driver.

To get a tape drive out of the CLAIMED state so that it will not be configured by this driver, power off the tape drive and run *ioscan* without the '*-k*' argument as follows:

 # ioscan -f -C tape

Install the Driver Using the CD Installation Script

An installation script, (*install_atdd*), is provided to automate the driver installation and perform some checking. It copies the latest version of the driver to the software depot, installs the driver version, and reboots the system.

To install the *ATDD driver* with the script, insert the CD in the target system, mount the distribution CD, examine the README file, then run the install script.

For example:

 # mount -o ro /dev/*cdromdevicename* **/cdrom**
 # more /cdrom/HPUX/atdd.Readme
 # /cdrom/HPUX/install_atdd

Notes:

1. If a previous version of the ATDD driver is installed on your system, uninstall it before attempting to install the latest version. See "Uninstalling the Software" on page 115.
2. If the directory */cdrom* does not exist, create this directory using the mkdir command before issuing the **mount** command.
3. Typically, the special file for a CD-ROM drive has the form */dev/dsk/cxtydz* (for example: */dev/dsk/c1t2d0)*. The special file name may be different on your system.

To install the ATDD driver manually, you can use the procedures in "Install Drivers Manually" on page 108.

Install Drivers Manually

Installing the drivers manually requires three steps, which are detailed in the following sections.

1. "Copy the Software to the Software Depot".
2. "Review the atdd README File" on page 109.
3. "Install the Product" on page 110.

   If a previous version of the ATDD driver is installed on your system, uninstall it before attempting to install the latest version. See "Uninstalling the Software" on page 115.

Copy the Software to the Software Depot

> **Attention:** If you do not copy the ATDD software into a depot, you will not be able to uninstall the product readily.

If you are installing from a CD-ROM, mount the CD, examine the README file, then copy the appropriate driver to the Software Depot.

For example:

 # mount -o ro /dev/*cdromdevicename* **/cdrom**
 # more /cdrom/HPUX/atdd.Readme
 # swcopy -p -s /cdrom/HPUX/atdd.x.x.x.x atdd (preview option)
 # swcopy -s /cdrom/HPUX/atdd.x.x.x.x atdd

Notes:

1. If the directory */cdrom* does not exist, create the directory using the mkdir command.
2. Typically, the special file for a CD-ROM drive has the form */dev/dsk/cxtydz* (for example: */dev/dsk/c1t2d0)*. The special file name may be different on your system.
3. Unmount the CD-ROM before ejecting the CD. To unmount the CD-ROM, type:

   # /usr/sbin/umount /cdrom

If you are installing from an IBM diskette, enter:

 # swcopy -p -s /dev/*floppydevicename* atdd (preview option)
 # swcopy -s /dev/*floppydevicename* atdd

Note: Typically, the special file for a diskette drive has the form */dev/floppy/cxtydz*. The special file name may be different on your system.

If you do not have a diskette drive or a CD-ROM on your system, you must do the following:

1. Mount the CD-ROM on another system and copy the appropriate atdd.x.x.x.x file in the HPUX directory to a disk file.

   For example:

   # mount /dev/*cdromdevicename* **/cdrom**
   # cp /cdrom/HPUX/atdd.x.x.x.x atdd.depot

   or

   Use the *dd* command on another system to copy the diskette to a disk file.

   For example:

   # dd if=/dev/floppy of=atdd.depot bs=1k
2. Make the disk file accessible on the install system and use the *swcopy* command:

   # swcopy -p -s 'pwd'/atdd.depot atdd (preview option)
   # swcopy -s 'pwd'/atdd.depot atdd

   Note: You must unmount the CD-ROM before ejecting the CD. To unmount the CD-ROM, type:

   # /usr/sbin/umount /cdrom

Use *swlist* to verify that the ATDD software is in the depot:

 # swlist -d atdd

Review the atdd README File

After copying the ATDD software to the depot, use the *swlist* command to view the product's README file:

 # swlist -d -a readme atdd

The README file lists the system configuration requirements, including required system software patches and required tape-related firmware versions. The file also documents any changes in the installation, use, and administration of the software that occurred after this documentation was completed. It is therefore very important that you review it before proceeding with the software installation.

Install the Product

When the software is in the depot and only the appropriate drives are powered-on, the ATDD software can be installed to the root file system using the HP-UX *swinstall* command. If the target root file system is the primary, the ATDD software is configured automatically upon installation.

Configuration requires rebooting the system and rebuilding the kernel. This requires you to issue the *swinstall* command with the *-x autoreboot* option set to *true*, as described as follows.

If the target is an alternate root filesystem, then the ATDD software is not configured automatically.

Note: If an earlier version of the product is already installed on the target root filesystem, the existing version will be replaced. This is true even if the version already installed is more recent than the version being installed.

The following commands install ATDD from the depot to the default root file system:

 # swinstall -p atdd (preview option)
 # swinstall atdd

If you receive an error message stating that this product needs to reboot the system, then reissue the *swinstall* command with the *autoreboot* option set as follows:

 # swinstall -p -x autoreboot=true atdd (preview option)
 # swinstall -x autoreboot=true atdd

You can use *swlist* to list the software installed on the default root file system as follows:

 # swlist atdd

You can verify correct installation to the default root filesystem with the *swverify* command:

 # swverify atdd

Post Configuration of IBM Medium Changer Devices

After the ATDD driver is installed, two additional configuration choices determine whether all IBM medium changers should be configured, selectively configured, or not configured at all. If ATDD configuration for IBM medium changers is not desired, skip this section.

ATDD supports the following IBM Ultrium medium changers:

- Ultrium Tape Autoloader (3581)
- Ultrium Scalable Tape Library (3583)
- UltraScalable Tape Library (3584)

There are two options to control how the ATDD driver handles IBM medium changers:

- Configure all IBM medium changers using kernel configuration parameter. The default for this parameter is zero, allowing schgr or other drives to CLAIM IBM medium changers.
- Configure selective IBM medium changers by modification of ATDD header file and kernel build.

Configure All IBM Medium Changers Using Kernel Configuration Parameter

To allow the ATDD driver to CLAIM all attached IBM medium changer targets, the 'atdd_autoch' parameter must be enabled:

1. Call the HP System Administration Manager (SAM).
2. Select "Kernel Configuration".
3. Select "Configurable Parameters".
4. Scroll until you find configuration parameter 'atdd_autoch'. then select (double-click).
5. A window opens - change Formula/Value to '1', then select OK or press Enter.
6. The Pending Value is now '1'.
7. Exit SAM - A window opens asking to Create a New Kernel Now, defer Creation Until later, or Cancel the Modification.

When the 'atdd_autoch' parameter is enabled (value=1), the ATDD driver will CLAIM all IBM medium changer targets that respond during the boot process. If this parameter is changed, the HP host system kernel must be rebuilt and the system rebooted. When 'Create a New Kernel Now' is selected, the system will build a new kernel. This may take a few minutes. A second window will open that allows you to 'Move Kernel Into Place and Shutdown/Reboot System Now' or select an option to defer the activation of the new kernel.

If you select to defer activation of the new kernel, a note box will open to indicate that the new kernel can be found in '/stand/build/vmunix_test' and the configuration file used to create it can be found in '/stand/build/system/SAM'. To make the kernel change effective, you must execute 'usr/bin/kmupdate', then reboot the system. The configuration file should be moved to /stand/system at the same time.

Configure Selected IBM Medium Changers Using ATDD Header File

In addition to the preceding global option, individual IBM medium changers can be claimed by ATDD. The file:

/usr/conf/space.h.d/atdd.h

(not to be confused with the user interface /usr/include/sys/atdd.h)

can be modified by the administrator with root privileges. It is a C header file that will be built into the kernel. To define the IBM medium changer devices to be configured by ATDD, array entries of the form:

Product_ID_String:c#t#l#

must be inserted into the header file where 'Product_ID_String' is the product identifier (obtained through the ioscan command),

- 'c#' is the instance of the controller to which the changer device is attached,
- 't#' is the target ID of the device, and
- 'l#' is the LUN

must be inserted in the header file.

For an IBM 3581 Ultrium Tape Autoloader:

"**ULT3581-TA:c#t#l#**"

where "ULT3581-TL" is the product id, which can be obtained through ioscan. The description field from the ioscan is the combined vendor and product identifiers. We are interested only in the product id portion of this string (it must match exactly).

"c#"

The instance of the controller to which the device is attached. This is not the instance of the tape driver.

For example:

```
# ioscan -fknC autoch
    Class     I  H/W Path  Driver S/W State H/W Type  Description
    ===========================================================
    autoch    0  8/4.1.0   schgr CLAIMED   DEVICE    IBM     ULT3581-TA
                           /dev/rac/c0t1d0
```

The 8/4 is the controlling instance of this device. Use ioscan to get the instance of the controller.

For example:

```
# ioscan -fk -H 8/4
    Class     I  H/W Path  Driver S/W State H/W Type  Description
     ===================================================================
    ext_bus   0  8/4       c720  CLAIMED   INTERFACE GSC add-on Fast/Wide
                                           SCSI Interface
```

This instance is“0”.

“t#”

The target, unique id of the device. Using the first example of ioscan, 8/4.1.0, the target is “1”.

“1#”

The lun. From the first example, “0” is the lun.

The syntax for this example is:

“ULT3581-TA:c0t1l0”

The array looks like the following:

```
    char *atddBindLib[16] =
{       ″ULT3581-TA:c0t1l0″,
0      };
```

The contents of ‘usr/conf/space.h.d/atdd.h’ file are:

```
    /*
 * $Header$
 */

#ifndef _H_SPACE_ATDD
#define _H_SPACE_ATDD

#include ″/opt/OMImag/conf/atdd_cfg.h″

/*
 * atdd.h space definitions for atdd.
 * This file should NOT be included by user programs.
 * Before changing any value, know the ramifications of your change.
 */
```

```
#ifdef _KERNEL

/* INSERT CHANGER ARRAY ENTRIES HERE */

char *atddBindLib[16] = {
  0 /* Required - Do Not Remove */
};


int atdd_autoch          = ATDD_AUTOCH;

#endif /* _KERNEL */

#endif /* !_H_SPACE_ATDD */
```

Adding an IBM Ultrium Device Using the Currently Installed ATTD Driver

1. Modify the */stand/system* file, adding a stanza in the form of:

   driver 56/48.3.0 atdd

   with the *adapter/drive* path for your device.
2. Modify */etc/rc.config.d/atdd.cfg*, adding the hardware path and instance:

   ATDD_HWPATH[#]=56/48.3.0

   where # denotes the next instance and the *adapter/drive* path for your device.
3. Build the kernel as root:

   # mk_kernel -o /stand/vmunix -s /stand/system
4. Reboot the system:

   # shutdown -r now

   or

   # reboot
5. After the system is up, run */opt/OMImag/bin/atdd_cfg* to create the new special files for the device.

   # atdd_mksf -ti <instance>

   where instance is the number from the ioscan output for the newly installed device. This command echoes to console but does NOT create special files. To create the special files pipe the command to 'sh'.

   # atdd_mksf –ti <instance> | sh

Uninstalling the Software

> **Attention:** Do not try to uninstall the ATDD software by simply removing the files that make up the ATDD fileset. This causes a number of inconsistencies on the system. It is best to use the *swremove* command.

The SWREMOVE command with the AUTOREBOOT option must be used. This command rebuilds the kernel and removes the ATDD driver:

 # swremove -p -x autoreboot=true atdd (preview option)
 # swremove -x autoreboot=true atdd

Because of limitations in support for third-party drivers in the HP-UX operating system, the final steps of removal must be done manually. As a reminder of this, the *swremove* command will fail, and information about the required removal steps will be printed in the log file (*/var/adm/sw/swagent.log*).

The manual steps required include:

1. Rebuilding the kernel
2. Rebooting the system
3. Reinstalling special files for native drivers

Typically these steps are run as follows, but because the process may vary depending on details of the system installation, you are *strongly encouraged* to review the log file, which will account for the differences.

To rebuild the kernel, the command is:

 # mk_kernel -o /stand/vmunix -s /stand/system

To reboot, use the shutdown command:

 # shutdown -ry now

Other Administrative Tasks

To determine what versions of the ATDD software are currently installed on the default root filesystem:

 # swlist -a state atdd

To determine what versions of the ATDD software are stored in the default depot:

 # swlist -d state atdd

To view the set of files that are installed with the ATDD software:

 # swlist -l file atdd

To remove the ATDD software from the depot:

 # swremove -d atdd

Chapter 18. Special Files

For each 3580 Ultrium drive configured by the ATDD device driver, eight special files are created. For the 3581 Autoloader and 3583 Library, an additional special file is created for the medium changer. Depending on the configuration of logical libraries in the 3584 tape library, additional special files will be created for control ports associated with each logical library.

The ATDD device driver creates the eight tape device special files in two forms: the standard or long file name and an alternative short file name. Each set of special file names (long and short) contains four special files that have all combinations of n and b options as shown in Table 13. For more information, see the MT man pages.

Table 13. Special Files

Special File Name	BSD Compatibility	Rewind on Close
/dev/rmt/<instance#>m	No	Yes
/dev/rmt/<instance#>mb	Yes	Yes
/dev/rmt/<instance#>mn	No	No
/dev/rmt/<instance#>mnb	Yes	No
/dev/rmt/<instance#>t<target>d<LUN>BEST	No	Yes
/dev/rmt/<instance#>t<target>d<LUN>BESTb	Yes	Yes
/dev/rmt/<instance#>t<target>d<LUN>BESTn	No	No
/dev/rmt/<instance#>t<target>d<LUN>BESTnb	Yes	No
/dev/rmt/<instance#>chng	N/A	N/A

Chapter 19. Supported Configurations

This section describes the supported configuration values when multiple device types are being configured on the same system. The configuration parameters are global. Because the configuration parameters are global to all devices, it is necessary to use configuration values that perform reliably on all devices attached to your system. If you are experiencing difficulties, ensure that your driver is configured properly. You may examine your current configuration using the *atdd_cfg* program that is installed into */opt/OMImag/bin*. For program usage, execute as follows:

 # /opt/OMImag/bin/atdd_cfg -h

The configuration values for the IBM Ultrium drive are:

```
Device    SILI    FORCE_NARROW    DENSITY    COMPRESSION
IBM 3580  1           0             0            1
```

Modifying Configuration Parameters

If it is necessary to change a configuration parameter, you may do so using the *atdd_cfg* program located in */opt/OMImag/bin*. This program allows you to update the current value.

For example, to change the COMPRESSION parameter to 0 (no compression at drive) for the device at hardware path 56/40.1.0, issue the following command:

 # atdd_cfg -g INSTANCE 56/40.1.0
INSTANCE: 2

 # atdd_cfg returns the ATDD instance number for this device. The instance number is then used to set COMPRESSION to off for this device:

 # atdd_cfg -s COMPRESSION 0 2

To set a new BOOT default value for the configuration parameter, you **must** modify or add an entry in the *atdd.cfg* configuration file located in */etc/rc.config.d*. For example, if you want the COMPRESSION default set to 0 for the device at ATDD_HWPATH[0], add the following line to the *atdd.cfg* file:

ATDD_COMPRESSION[0]=0

Note: The configuration parameters are prefixed with *ATDD_* in the configuration file. For additional instructions about using the configuration program, use the *-h* option as follows:

 # atdd_cfg -h

Chapter 20. Configuration Parameter Definitions

This section describes the configuration parameters and values. It is not recommended that a user modify the default settings of these parameters, except as described in “Chapter 19. Supported Configurations” on page 119. The *atdd* driver is shipped with default values that allow the most reliable execution across various device types.

Device-Specific Parameters

Table 14. Device-Specific Parameter Definitions

Parameter	Meaning	Values
DENSITY	Density to use when writing/reading tape	In hexadecimal
SILI	Suppress Incorrect Length Indicator	• 0=Off (Do not suppress) • 1=On (Suppress)
BLOCKSIZE	Block Size	Size in bytes
COMPRESSION	Compression Mode	• 0=Off (Do not use Compression at drive) • 1=On (Use Compression at drive)
BUFFERING	Buffering Mode	• 0=Off (Do not buffer data) • 1=On (Buffer data to hardware buffers)
IMMEDIATE	Immediate Mode	• 0=Off (Wait for rewind completion) • 1=On (Return before rewind is complete)
TRAILER	Trailer Label Processing	• 0=Off (Do not allow writes past early EOT warning) • 1=On (Allow writes past early EOT warning)
ERRNO_LEOT	Error Number return for Logical End Of Tape	Value returned for writes past EOM

Driver-Specific Parameters

Table 15. Driver-Specific Parameters (Global)

Parameter	Meaning	Values
INSTANCE	ATDD Device Number	(Read Only)
DEVICES	Number of Configured Devices	(Read Only)
DBG	Debug Logging	• 0=No Debug logging • value=Mask value of desired debug level

Chapter 21. Troubleshooting

Read the system log file (typically */var/adm/syslog/syslog.log*) if you are having difficulties. The *atdd* driver logs messages to this file and can give you information regarding the problem.

Run the *support_info* script, which is located in the */opt/OMImag/bin* directory. This script gathers important system and configuration information. You should examine the output of this script. There are several sections with the keyword VERIFY indicating what information should be examined. This information should be verified for correctness.

Table 16 describes problems and possible solutions to errors that you may encounter.

Table 16. Troubleshooting (Problems and Solutions)

Problem	**Solution**
No special files found in */dev/rmt*	Execute the *atdd_mksf* script found in */opt/OMImag/bin*: atdd_mksf **Note:** The script prints out the commands that are necessary to create the special files. To create the files, you must pipe the output to shell (sh): atdd_mksf | sh
Missing special files	Verify that the hardware path for the device is listed in the configuration file: /etc/rc.config.d/atdd.cfg If the hardware path is missing, the driver was not installed properly.
Cannot open Special File, and the system log has the following message: `Invalid SCSI request in data at bit 7 of byte 4`	Wrong DENSITY setting. Verify the current value by: atdd_cfg -g DENSITY <atdd_inst> Try setting to 0 (zero): atdd_cfg -s DENSITY 0 <atdd_inst>

Table 16. Troubleshooting (Problems and Solutions) (continued)

Problem	Solution

An attempt to read data times out and returns an error. The system log has the following messages:
`A SCSI command timed out and was aborted.`
`LLIO: Detected PowerFail.`
 	
(probably caused by SCSI bus or device reset)
	Verify that the SILI configuration parameter is 1 by executing:
	
	atdd_cfg -g SILI <atdd_inst>
	
	If the SILI=0, try setting it to 1.
	
	atdd_cfg -s SILI 1 <atdd_inst>

An attempt to read data times out and returns an error. The system log has the following messages:
`A SCSI command timed out and was aborted.`
`scsi3: ....date code...`
`scsi3: ....timestamp...`
	Verify that the FORCE_NARROW parameter is valid for this device:
	
	atdd_cfg -g FORCE_NARROW <atdd_inst>
	
	If=1, try setting it to 0:
	
	atdd_cfg -s FORCE_NARROW 0 <atdd_inst>

Chapter 22. Tape Utility Program (tapeutil)

This chapter describes how to install and uninstall the HP-UX Tape Utility Program (*tapeutil*) for IBM Ultrium devices. Additionally, this software package installs the following header files for use with user-written applications:

- st.h (tape interface header file)
- smc.h (medium changer header file)
- svc.h (service aid interface header file)

These header files are placed in */usr/include/sys*. For programming information, see the *IBM Ultrium Device Drivers: Programming Reference*.

The installation process consists of the following steps:

1. Copy the software from the distribution medium to the depot.
2. Examine the README file and verify that your system is configured appropriately for installing the tape utility program.
3. Install the software.

Take note of the following facts about the command sequences described in this section:

- In some of the examples, filenames given on the command line must be made reference to with an absolute path. Using *'pwd'/filename* to make reference to a file instead of *filename* will ensure this.
- All of the SD commands (for example, *swinstall* or *swcopy*) can first be run with the *-p* flag to preview the command. After observing the preview output, you can reissue the command without the *-p* flag to perform the actual operation.
- The SD commands are moderately complex scripts that frequently proceed in several steps. The steps are typically *Selection*, *Analysis*, and *Execution*. Each step may produce useful information and error messages. It is a good idea to observe carefully the results of the installation process as it occurs.

If you encounter unexpected results during the installation, examine the associated log file.

Hardware Requirements

This version of the HP-UX Tape Utility Program operates the following tape devices:

- IBM 3580 Ultrium Tape Drive Models L11 (LVD attach), H11 (HVD attach)

- IBM 3581 Ultrium Tape Autoloader Models L17 (LVD attach), H17 (HVD attach)
- IBM 3583 Ultrium Scalable Tape Library Models L18, L36, L72
- IBM 3584 UltraScalable Tape Library Models L32 (base frame), D32 (expansion frame)
- StorageSmart by IBM Ultrium External Tape Drive TX200 - Models L11 (LVD attach), H11 (HVD attach)
- StorageSmart by IBM Ultrium Tape Autoloader SL7 - Models L17 (LVD attach), H17 (HVD attach)
- StorageSmart by IBM Ultrium Scalable Tape Library SL72 - Models L18, L36, L72

Install the Product Using the CD Installation Script

An installation script, (*install_tapeutil*), is provided to automate the utility installation and perform some checking. It copies the latest version to the software depot and installs it.

To install the *Tape Utility Program* with the script, insert the CD in the CD-ROM drive, mount the distribution CD, examine the README file, then run the install script. For example:

 # mount -o ro /dev/*cdromdevicename* **/cdrom**
 # more /cdrom/HPUX/tapeutil.hpux.Readme
 # /cdrom/HPUX/install_tapeutil

Notes:

1. If the directory */cdrom* does not exist, create the directory using the mkdir command.
2. Typically, the special file for a CD-ROM drive has the form */dev/dsk/cxtydz* (for example: */dev/dsk/c1t2d0)*. The special file name may be different on your system.
3. Unmount the CD-ROM before ejecting the CD. To unmount the CD-ROM, type:

   # /usr/sbin/umount /cdrom

To install the *tapeutil* utility manually, you can also use the procedures in “Install the Product Manually” on page 127.

Install the Product Manually

Installing the product manually requires three steps, which are detailed in the following sections:

1. "Copy the Software to the Software Depot"
2. "Review the tapeutil README File" on page 128
3. "Install the Product" on page 128

Copy the Software to the Software Depot

If you are installing from a CD-ROM, mount the CD, examine the README file, then copy the software to the Software Depot.

For example:

 # mount -o ro /dev/*cdromdevicename* **/cdrom**
 # more /cdrom/HPUX/tapeutil.hpux.Readme
 # swcopy -p -s /cdrom/tapeutil.hpux.x.x.x.x tapeutil (preview option)
 # swcopy -s /cdrom/tapeutil.hpux.x.x.x.x tapeutil

Notes:

1. If the directory */cdrom* does not exist, create the directory using the mkdir command.
2. Typically, the special file for a CD-ROM drive has the form */dev/dsk/cxtydz* (for example: */dev/dsk/c1t2d0)*. The special file name may be different on your system.
3. Unmount the CD-ROM before ejecting the CD. To unmount the CD-ROM, type: *# /usr/sbin/umount /cdrom*.

If you are installing from an IBM diskette, enter:

 # swcopy -p -s /dev/*floppydevicename* tapeutil (preview option)
 # swcopy -s /dev/*floppydevicename* tapeutil

Note: Typically, the special file for a diskette drive has the form */dev/floppy/cxtydz*. The special file name may be different on your system.

If you do not have a diskette drive or a CD-ROM on your system, you must do the following:

1. Mount the CD-ROM on another system and copy the appropriate *tapeutil.hpux.x.x.x.x* file in the HPUX directory to a disk file.

   # mount /dev/*cdromdevicename***/cdrom**
   # cp /cdrom/HPUX/tapeutil.hpux.x.x.x.x tapeutil.depot

or, use the *dd* command on another system to copy the diskette to a disk file:

 # dd if=/dev/floppy of=tapeutil.depot bs=1k

2. Make the disk file accessible on the install system and use the *swcopy* command:

 # swcopy -p -s 'pwd' tapeutil.depot tapeutil (preview option)
 # swcopy -s 'pwd' tapeutil.depot tapeutil

Note: You must unmount the CD-ROM before ejecting the CD. To unmount the CD-ROM, type:

 # /usr/sbin/umount /cdrom

Use *swlist* to verify that the *tapeutil* software is in the depot:

 # swlist -d tapeutil

Review the tapeutil README File

After copying the *tapeutil* software to the depot, use the *swlist* command to view the product's README file:

 # swlist -d -a readme tapeutil

The README file lists the system configuration requirements, including required system software patches and required tape-related firmware versions. The file also documents any changes in the installation, use, and administration of the software that occurred after this documentation was completed. It is therefore very important that you review it before proceeding with the software installation.

Install the Product

When the software is in the depot, the tapeutil software can be installed to the root file system using the HP-UX *swinstall* command.

The following commands install tapeutil from the depot to the default root file system:

 # swinstall -p tapeutil (preview option)
 # swinstall tapeutil

You can use *swlist* to list the software installed on the default root file system as follows:

 # swlist tapeutil

You can verify correct installation to the default root filesystem with the *swverify* command:

 # swverify tapeutil

Uninstalling the Software

Attention: Do not try to uninstall the *tapeutil* software by simply removing the files that make up the *tapeutil* fileset. It is best to use the *swremove* command.

To remove the *tapeutil* software from the root filesystem, enter:

 # swremove -p tapeutil (preview option)
 # swremove tapeutil

Other Administrative Tasks

To determine which version of the *tapeutil* software is currently installed on the default root filesystem:

 # swlist -a state tapeutil

To determine which version of the *tapeutil* software is stored in the default depot:

 # swlist -d state tapeutil

To view the set of files that is installed with the *tapeutil* software:

 # swlist -l file tapeutil

To remove the *tapeutil* software from the depot:

 # swremove -d tapeutil

Tape/Medium Changer Utility Program Operation

A SCSI Tape and Medium Changer Utility Program called *tapeutil* is provided with the IBM SCSI Tape and Medium Changer Device Driver for HP-UX and installed in the */usr/bin* directory. The *tapeutil* program fulfills several purposes:

- It provides the following service aids for IBM tape subsystems:
  - Query Device Type / Verify Device Attachment

  - Query Device Serial Number
  - Query Device Microcode Level
  - Force Device Diagnostic Dump
  - Store Device Diagnostic Dump
  - Download Device Microcode
- It provides a menu-driven test tool for exercising or testing IBM tape and medium changer devices with a full suite of supported operations:
  - Reading/Writing Data
  - Tape Motion Commands
  - Setting/Displaying Device Information/Status
  - Mounting/Demounting Cartridges
  - Cartridge Inventory
- In addition to the menu-driven front end, the tapeutil program provides a command-line interface, which is convenient for use in shell scripts.
- The source code for the tapeutil program is provided for example purposes and is installed in the */opt/tapeutil* directory during the tapeutil package installation. This source code is commented and demonstrates calls to all of the supported device driver entry points and *ioctl* commands, thus giving the application developer a starting point for interfacing to the HP-UX device driver.

The tapeutil program provides both an interactive menu-driven interface as well as a command-line interface. If the tapeutil program is called with no command-line parameters, the menu-driven version will be started. In the menu-driven version, the device to be operated on should first be opened using option 1. Other options may then be selected. The user will be prompted for additional information if required for the specific options selected. The results of a command are displayed after it is executed. If an error occurs for the command, error information and device sense data are displayed. The device can be closed using option 2, or it will be closed automatically when the Quit option is selected. The menu is displayed once automatically when the program is first called. To prevent unnecessary scrolling of the screen, the menu is not displayed automatically again after each command but is instead refreshed only after the M (menu refresh) command is entered.

Figure 8 on page 131 shows the menu that is displayed by the *tapeutil* program.

```
+-------------------------------------------------------------+
|      IBM SCSI TAPE & MEDIUM CHANGER UTILITY PROGRAM         |
+-----------------------------+-------------------------------+
|   << GENERAL COMMANDS >>    |  << BASIC SCSI COMMANDS >>    |
|   1: Open Device            |   9: Test Unit Ready          |
|   2: Close Device           |  10: Inquiry                  |
|   D: Device Type            |  11: Request Sense            |
|   M: Menu Refresh           |  12: Reserve                  |
|   Q: Quit Program           |  13: Release                  |
+-----------------------------+-------------------------------+
|   < SERVICE COMMANDS >>     |<< MEDIUM CHANGER COMMANDS >>  |
|   3: Query Serial Number    |  14: Move Medium              |
|   4: Query Microcode Level  |  15: Position To Element      |
|   5: Force Dump             |  16: Element Information      |
|   6: Store Dump             |  17: Inventory                |
|   7: Download Microcode     |  18: Audit                    |
|   8: Format Cartridge       |  19: Lock/Unlock Door         |
+-----------------------------+-------------------------------+
|                < TAPE DRIVE COMMANDS >>                     |
|  20: Read Data                32: Locate End Of Data        |
|  21: Write Data               33: Get Record Size           |
|  22: Write File Mark          34: Set Record Size           |
|  23: Erase Tape               35: Get Device Status         |
|  24: Rewind                   36: Get Device Info           |
|  25: Retension                37: Get Media Info            |
|  26: Offline                  38: Get Position              |
|  27: Load/Unload Tape         39: Set Position              |
|  28: Forward Space File       40: Get Parameter             |
|  29: Backward Space File      41: Set Parameter             |
|  30: Forward Space Record     42: Sync Buffer               |
|  31: Backward Space Record    43: Display Message           |
+-------------------------------------------------------------+
```

Figure 8. TAPEUTIL Program Menu

If command-line parameters are provided when the program is called, the command-line mode will be started. For each command-line execution of the program, the device is first opened, the specific command is issued, and the device is then closed. The program can be driven from within a shell script if desired. Results of the operation are displayed only when executed in verbose mode. No information is displayed when not in verbose mode. This is particularly useful for quiet shell script implementations. A completion code, as defined in */usr/include/sys/errno.h*, for the operation requested is always returned from the program upon exit (in both verbose and quiet mode).

The usage of the *tapeutil* program in command-line mode is as follows:

```
tapeutil -f device -o operation {options}
```

where **device** is the name of the tape device special file (for example, */dev/rmt/1m*) and **operation** is one of the following values. The device special file and the operation are required. The specific **options** associated with a particular operation are indicated. Parameters enclosed in square brackets are optional. All others are required.

Service Commands	
Query Serial Number	`tapeutil -f` **f** `-o qsn [-w` **w**`] [-v]`
Query Microcode Level	`tapeutil -f` **f** `-o qmc [-w` **w**`] [-v]`
Force Dump	`tapeutil -f` **f** `-o fdp [-w` **w**`] [-v]`
Store Dump	`tapeutil -f` **f** `-o sdp [-w` **w**`] [-v] -z` **z**
Download Microcode	`tapeutil -f` **f** `-o dmc [-w` **w**`] [-v] -z` **z**
Format Cartridge	`tapeutil -f` **f** `-o fmt [-w` **w**`] [-v]`
Query Device Type	`tapeutil -f` **f** `-o chk [-w` **w**`] [-v]`
Basic SCSI Commands	
Test Unit Ready	`tapeutil -f` **f** `-o tur [-w` **w**`] [-v]`
Inquiry	`tapeutil -f` **f** `-o inq [-w` **w**`] [-v]`
Request Sense	`tapeutil -f` **f** `-o req [-w` **w**`] [-v]`
Reserve	`tapeutil -f` **f** `-o res [-w` **w**`] [-v]`
Release	`tapeutil -f` **f** `-o rel [-w` **w**`] [-v]`
Medium Changer Commands	
Move Medium	`tapeutil -f` **f** `-o mov [-w` **w**`] [-v] -s` **s** `-d` **d**
Position To Element	`tapeutil -f` **f** `-o pos [-w` **w**`] [-v] -d` **d**
Element Information	`tapeutil -f` **f** `-o ele [-w` **w**`] [-v]`
Inventory	`tapeutil -f` **f** `-o inv [-w` **w**`] [-v]`
Audit	`tapeutil -f` **f** `-o aud [-w` **w**`] [-v]`
Lock/Unlock Door	`tapeutil -f` **f** `-o lck [-w` **w**`] [-v] -x` **x**
Tape Drive Commands	
Read	`tapeutil -f` **f** `-o rea [-w` **w**`] [-v] -b` **b** `-n` **n** `-m` **m**
Write	`tapeutil -f` **f** `-o wri [-w` **w**`] [-v] -b` **b** `-n` **n** `-m` **m** `[-r` **r**`] [-z` **z**`]`
Write File Mark	`tapeutil -f` **f** `-o eof [-w` **w**`] [-v] -c` **c**
Erase Tape	`tapeutil -f` **f** `-o era [-w` **w**`] [-v]`
Rewind	`tapeutil -f` **f** `-o rew [-w` **w**`] [-v]`
Retension	`tapeutil -f` **f** `-o ret [-w` **w**`] [-v]`

Offline	`tapeutil -f` **f** `-o off [-w` **w**`] [-v]`
Load/Unload Tape	`tapeutil -f` **f** `-o lod [-w` **w**`] [-v] -x` **x**
Forward Space File	`tapeutil -f` **f** `-o fsf [-w` **w**`] [-v] -c` **c**
Backward Space File	`tapeutil -f` **f** `-o bsf [-w` **w**`] [-v] -c` **c**
Forward Space Record	`tapeutil -f` **f** `-o fsr [-w` **w**`] [-v] -c` **c**
Backward Space Record	`tapeutil -f` **f** `-o bsr [-w` **w**`] [-v] -c` **c**
Locate End of Data	`tapeutil -f` **f** `-o eod [-w` **w**`] [-v]`
Get Record Size	`tapeutil -f` **f** `-o grs [-w` **w**`] [-v]`
Set Record Size	`tapeutil -f` **f** `-o srs [-w` **w**`] [-v] -c` **c**
Get Device Status	`tapeutil -f` **f** `-o gds [-w` **w**`] [-v]`
Get Device Information	`tapeutil -f` **f** `-o gdi [-w` **w**`] [-v]`
Get Media Information	`tapeutil -f` **f** `-o gmi [-w` **w**`] [-v]`
Get Position	`tapeutil -f` **f** `-o gpo [-w` **w**`] [[-v]] -t` **t**
Set Position	`tapeutil -f` **f** `-o spo [-w` **w**`] [-v] -t` **t** `-x` **x**
Get Parameter	`tapeutil -f` **f** `-o gpa [-w` **w**`] [-v] -t` **t**
Set Parameter	`tapeutil -f` **f** `-o spa [-w` **w**`] [-v] -t` **t** `-x` **x**
Sync Buffer	`tapeutil -f` **f** `-o syn [-w` **w**`] [-v]`
Display Message	`tapeutil -f` **f** `-o msg [-w` **w**`] [-v] -t` **t** `-y` **y1,y1**

Note: Calling *tapeutil* with the **-h** (tapeutil -h) or **-?** (tapeutil -?) flag simply displays the usage help information.

The supported flags, their meanings, their associated operations, and their acceptable ranges are as follows:

Flag	Description
-?	Usage Help (stand-alone flag) {no value required}
-b	Block Size (rea, wri)
	{0 < (block size x blocking factor) < 2097152}
-c	Operation Count (eof, fsf, fsr, bsf, bsr, srs) {0–65535}
-d	Destination Address (mov)
	{device specific, determine range from Element Info}
-f	Device Special File Name (always required)

{/dev/rmt/1st or similar}

-h Usage Help (stand-alone flag) {no value required}

-m Multiples to Read or Write (rea, wri) {0–2097152}

-n Blocking Factor (rea, wri)

{0 > (block size x blocking factor) < 2097152}

-o Operation (always required) {see previous list}

-r Random Seed (wri) {0–65535}

-s Source Address (mov, pos)

{device specific, determine range from Element Info}

-t Type of Parameter Value

- (gpo) {1=logical block, 2=physical block}
- (spo) {1=logical block, 2=physical block}
- (gpa) {1=block size, 2=compression, 3=buffering, 4=immediate, 5=trailer, 6=write protect, 7=acf mode, 8=capacity, 9=sili}
- (spa) {1=block size, 2=compression, 3=buffering, 4=immediate, 5=trailer, 6=write protect, 8=capacity, 9=sili}
- (msg) {1=display msg0, 2=display msg1, 3=flash msg0, 4=flash msg1, 5=alternate msg1/msg2}

-v Verbose mode (optional for all commands, stand-alone flag)

{no value required, absence of flag means quiet mode}

-w Open mode (optional for all commands)

{1=read/write, 2=read only (default), 3=write only, 4=append}

-x Parameter value

- (lck) {1=lock, 2=unlock}
- (lod) {1=load, 2=unload}
- (spo) {0–65535}
- (spa) {0–65535}

-y Messages (msg) {message1,message2}

-z Input/Output File Name

- (sdp) {path and name of the file in which to store dump}
- (dmc) {path and name of the microcode image file}
- (wri) {path and name of the file containing write data pattern}

Notes:

1. For read and write operations, the size of one buffer of data transferred during a single SCSI read or write command is determined by the product of the *Block Size* value and the *Blocking Factor* value. The number of these buffers transferred is determined by *Multiplier* value. The actual total number of bytes transferred is then (Block Size) x (Blocking Factor) x (Multiplier). If the device is set to fixed block mode (block size not equal to zero), the product of *Block Size* and *Blocking Factor* must be a multiple of the device block size setting.
2. For further information on the Get Parameter (gpa) and Set Parameter (spa) operations, see the STIOC_GET_PARM and STIOC_SET_PARM *ioctl* commands described in the *IBM Ultrium Device Drivers: Programming Reference*.
3. The Force Dump option forces a dump operation on the tape drive. After the dump operation is performed, the dump data can be transferred from the tape drive by using the Store Dump option. The Force Microcode Dump operation is supported only on the IBM Ultrium tape drive.
4. For the IBM Ultrium Medium Changer, the dump data can be transferred from the device by using the Store Dump option directly. The dump data can be viewed with any text editor.

The following examples should help to demonstrate and clarify the command-line usage of the *tapeutil* program. For all examples, substitute the actual value of the special file associated with the target device.

- To query the serial number of the device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0m -o qsn -v
  ```

- To request inquiry data from the device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0m -o inq -v
  ```

- To move a cartridge from cell 32 to the tape drive (16) for Magstar® 3590:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/4chng -o mov -s 32 -d 16 -v
  ```

- To write 100 64K blocks of data to the tape device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0mn -w 1 -o wri -b 65535 -n 1 -m 100 -v
  ```

- To write two file marks to the tape device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0mn -w 1 -o eof -c 2 -v
  ```

- To rewind the tape device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0mn -o rew -v
  ```

- To read 100 64K blocks of data from the tape device:

  ```
  /opt/IBMtape/tapeutil -f /dev/rmt/0mn -o rea -b 65535 -n 1 -m 100 -v
  ```

Part 5. Microsoft Windows Tape Device Drivers

Chapter 23. Introduction and Product Requirements

Windows NT

Hardware Requirements

The Windows NT device driver supports the following IBM Ultrium tape drives and automation products :

- One or more of the following IBM Ultrium tape devices:
  - IBM 3580 Ultrium Tape Drive Models L11 (LVD attach), H11 (HVD attach)
  - IBM 3581 Ultrium Tape Autoloader Models L17 (LVD attach), H17 (HVD attach)
  - IBM 3583 Ultrium Scalable Tape Library Models L18, L36, L72
  - IBM 3584 UltraScalable Tape Library Models L32 (base frame), D32 (expansion frame)
- One or more of the following StorageSmart by IBM devices:
  - StorageSmart by IBM Ultrium External Tape Drive TX200 - Models L11 (LVD attach), H11 (HVD attach)
  - StorageSmart by IBM Ultrium Tape Autoloader SL7 - Models L17 (LVD attach), H17 (HVD attach)
  - StorageSmart by IBM Ultrium Scalable Tape Library SL72 - Models L18, L36, L72
- One or more of the following SCSI host adapters:
  - Adaptec 2940U2W (LVD)
  - Adaptec 2944UW (HVD)
  - Adaptec SCSI Adapter 29160 - Single Port LVD
  - Adaptec SCSI Adapter 39160 - Dual Port LVD
  - IBM Netfinity® 'Ultra-2 SCSI PCI Adapter' (LVD)
  - Symbios SYM22910 64 bit PCI-to-Ultra-2 SCSI Dual Channel Host Adapter (LVD) from LSI Logic Corporation
- One or more of the following FC-AL host bus adapters:
  - QLogic QLA-2200F 64-bit PCI-to-Fibre Channel Adapter

The IBM Ultrium tape drives and automation products are supported on Intel-compatible processors with a minimum processor level of Intel 486DX or Pentium® with sufficient RAM and disk space for operation of the Microsoft Windows NT operating system.

Software Requirements

The software requirements are:

- SCSI or FC-AL adapter device driver (typically shipped with the adapter or resident in Windows NT)
- Microsoft Windows NT Version 4.0 with Service Pack 6 or later installed

To obtain the most current service and documentation for this software, see "Appendix A. Accessing Documentation and Software Online" on page 217.

Installation Notes

- To determine the Windows NT Version and Service Pack level, open the Control Panel, click **Help**, then click **About Windows NT**.
- The system bus is scanned for devices only at boot time. In order to use your Ultrium devices, they must be connected, powered-on, and enabled when the system is booted.
- To verify your connection during boot, you should see the IBM Ultrium device being detected by the SCSI or FC-AL adapter. A message such as one of the following should be displayed:

```
Adaptec SCSI Card 39160 Bios V2.57.0(c) 2000 Adaptec, Inc.  All Rights Reserved.
Ch A, SCSI ID:0       IBM Ultrium:Td1            80.0
```

or

```
Symbios, Inc SDMS™ V4.0 pci scsi bios, pci rev. 2.0.2.1
Copyright 1995, 1998 Symbios, Inc
PCI-4.14.00
HBA  LD   LUN    Vendor  PRODUCT      Rev    SYNC   Wide
 0    0    0      IBM    Ultrium-TDI  0610   Yes    16
```

Note: The IBM 3584 UltraScalable Tape Library will not be displayed on the Adaptec SCSI cards list of detected devices during the boot.

- After the device driver is installed:

  If your devices are not connected, powered-on, and online when the system is booted, a **Service Control Manager** window will open. You will receive this message:

  At least one service or driver failed during system startup. Use Event Viewer to examine the event log for details.

- When the Windows NT device driver and media mover device drivers start, they manage all IBM Ultrium devices and changers exclusively. Other device drivers on the system that access IBM Ultrium devices may cause conflicts and indeterminate behavior. Before installing and starting the Windows NT device driver and media mover device drivers, ensure that all other device drivers are uninstalled or disabled. Rebooting the system after removal of the other device drivers is recommended.

A customer in an environment where more than one device driver is required with Ultrium devices and changers may want to start and stop these device drivers manually at the appropriate times rather than install and remove the device drivers. See “Manual Starting and Stopping Procedures” on page 158 for details.

Windows 2000

Hardware Requirements

The Windows 2000 device driver supports the following IBM Ultrium tape drives and automation products:

- One or more of the following IBM Ultrium tape devices:
  - IBM 3580 Ultrium Tape Drive Models L11 (LVD attach), H11 (HVD attach)
  - IBM 3581 Ultrium Tape Autoloader Models L17 (LVD attach), H17 (HVD attach)
  - IBM 3583 Ultrium Scalable Tape Library Models L18, L36, L72
  - IBM 3584 UltraScalable Tape Library Models L32 (base frame), D32 (expansion frame)
- One or more of the following StorageSmart by IBM devices:
  - StorageSmart by IBM Ultrium External Tape Drive TX200 - Models L11 (LVD attach), H11 (HVD attach)
  - StorageSmart by IBM Ultrium Tape Autoloader SL7 - Models L17 (LVD attach), H17 (HVD attach)
  - StorageSmart by IBM Ultrium Scalable Tape Library SL72 - Models L18, L36, L72
- One or more of the following SCSI host adapters:
  - Adaptec 2940U2W (LVD)
  - Adaptec 2944UW (HVD)
  - Adaptec SCSI Adapter 29160 - Single Port LVD
  - Adaptec SCSI Adapter 39160 - Dual Port LVD
  - IBM Netfinity ‘Ultra-2 SCSI PCI Adapter’ (LVD)
  - Symbios SYM22910 64-bit PCI-to-Ultra-2 SCSI Dual Channel Host Adapter (LVD) from LSI Logic Corporation
- One or more of the following FC-AL host bus adapters:
  - QLogic QLA-2200F 64-bit PCI-to-Fibre Channel Adapter

The IBM Ultrium tape drives and automation products are supported on Intel-compatible processors with sufficient RAM and disk space to run Microsoft Windows 2000 Build 2195 or later.

Software Requirements

The software requirements are:

- SCSI or FC-AL adapter device driver (typically shipped with the adapter or resident in Windows 2000)
- Microsoft Windows 2000 Build 2195 or later installed

To obtain the most current service and documentation for this software, see "Appendix A. Accessing Documentation and Software Online" on page 217.

Installation Notes

These procedures assume that a supported host bus adapter has been installed and configured already.

The recommended procedure is to install the device drivers before installing any Ultrium devices on the SCSI bus.

There may be a noticeable delay before the Windows 2000 plug-and-play manager recognizes new devices.

For information on the Removable Storage Manager and Windows 2000 Media Services:

1. Click **My Computer**.
2. Click **Control Panel**.
3. Click **Administrative Tools**.
4. Open the **Computer Management** window.
5. Click **Storage**.
6. Click **Actions**.
7. Click **Help** in the pulldown menu.
8. Click **Removable Storage** in the **Help** window that opens.

These drivers conform to the Microsoft SDK Tape and NTMS APIs, as described in Microsoft Platform SDK Windows 2000 documentation, dated December 13, 1999.

Tape functions are described in the SDK documentation:

- Base Services
- Files and I/O
- Tape Backup

NTMS Services are described in the SDK documentation:

- Base Services
- Removable Storage Manager

Changer functions are described in the DDK documentation:

- Kernel Mode Drivers (Reference Part 1, Section 5)

Utilization of these drivers requires specific knowledge of the operation of Ultrium devices as described in the appropriate Hardware Reference Manuals.

This device driver allows the Windows 2000 Removable Storage Manager to manage Ultrium devices. It may cause conflicts and indeterminate behavior if used with other device drivers that manage Ultrium devices or with products that use other device drivers for Ultrium.

Chapter 24. Windows NT Device Driver Management

This chapter describes how to install, remove, start, and stop the Windows NT Tape Device Driver for the Ultrium devices.

Installation Overview

The installation process consists of the following steps:

1. Verify that the prerequisites have been satisfied.

   Note: See "Software Requirements" on page 140.
2. Install the SCSI or FC-AL adapter.
3. Install the SCSI or FC-AL adapter device driver.
4. Connect the Ultrium device to the adapter.
5. Power on the Ultrium device.
6. Reboot the system.
7. Create an emergency repair disk (optional) by using the following procedure:
   a. Select **Start**, **Help**, and **Find** from the Windows NT desktop.
   b. Type **Emergency** in box 1.
   c. Select **Using the Repair Disk utility to make an emergency repair disk**.
   d. Click **Display**, then follow the instructions to make an emergency repair disk (ERD).

   This step is highly recommended.
8. Install the Ultrium Tape device driver.

Installation Procedure

1. Log on as Administrator.
2. Insert the **IBM Ultrium Device Drivers CD** in the CD-ROM drive.
3. Go to the **WinNT** directory and double-click **IBMUltrium.WinNT.exe**.
4. Follow the *InstallShield* direction to install the package.
   a. If you select **compact** installation, the program will copy the system files of the latest IBM Ultrium Device Driver (**Device Driver System Files** component) to your system directory. This provides all the latest support necessary for Magstar devices.

      Note: This option overwrites previous versions of Ultrium device driver installed on your system.

   b. If you select **typical** installation, all support included in the **compact** installation will be done. Also, the **Device Driver Depot** component will be installed, which includes copying all available versions included in the InstallShield package to a user-defined directory.

      Note: This option overwrites previous versions of Ultrium device driver installed on your system.

c. If you select **custom** installation, the program will allow you to select the components to install (see Figure 9).

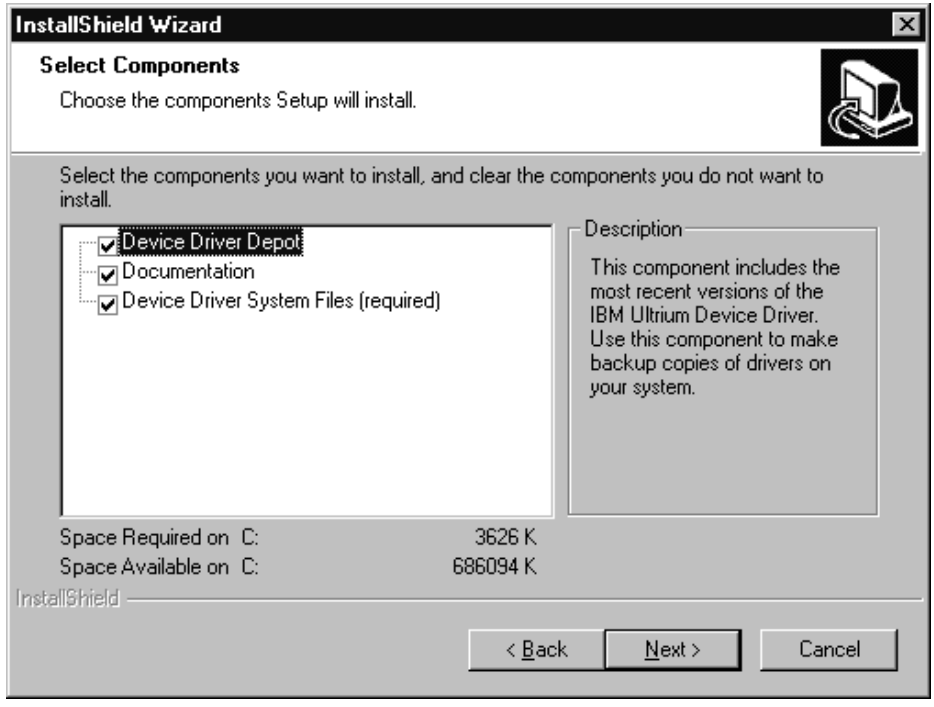


Figure 9. Select Components Menu

The **Device Driver Depot** component includes copying the most recent versions of device drivers to your hard drive. If you install this component, you will be able to install the device drivers without the installation CD.

The **Documentation** component copies the PDF version of the *IBM Ultrium Device Drivers: Installation and User's Guide* and the *IBM Ultrium Device Drivers: Programming Reference* to your hard drive.

The **Device Driver System Files** component copies all the files needed for device driver support to the system directory.

5. After you have completed installing *IBM Ultrium Device Driver for Microsoft Windows NT 4.0*, proceed to enable the driver. Click **Start**, move to **Settings**, then click **Control Panel**. See Figure 10.

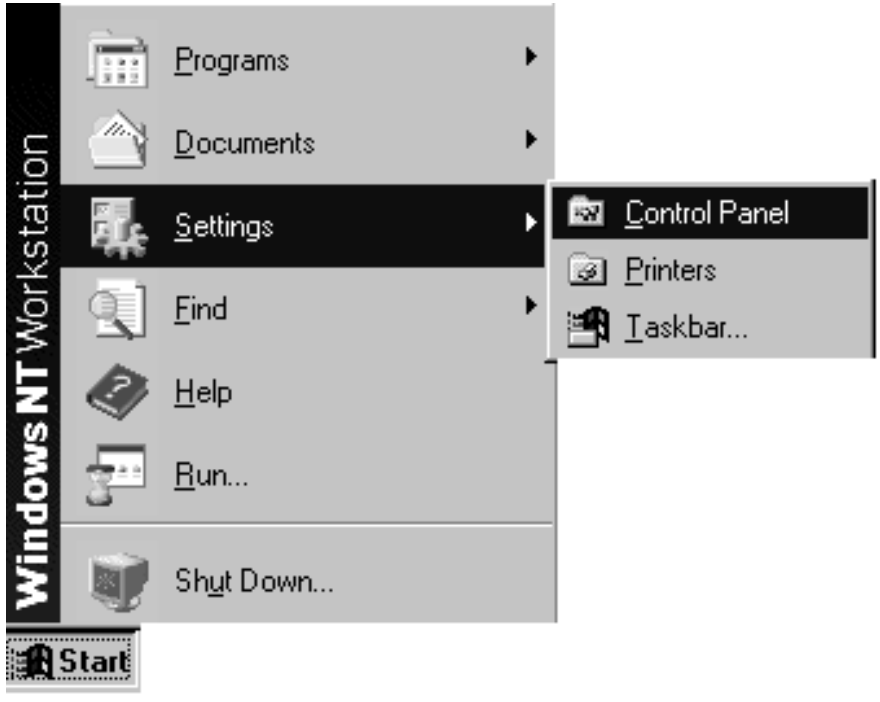


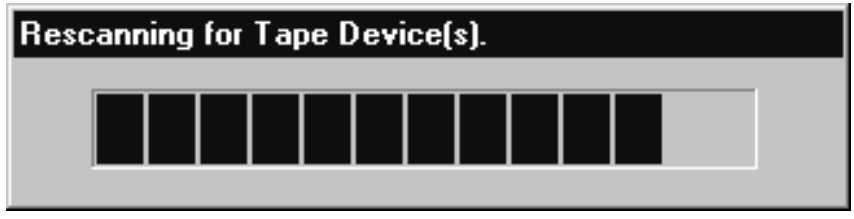
Figure 10. Start Menu

6. Double-click **Tape Devices**. If the Ultrium tape or changer device was already powered-on and attached to the system during boot up, the devices should be in the box, and Windows NT should start to create the driver list. See Figure 11.

A250119

Figure 11. Start Driver List

If Windows NT did not detect the attached Ultrium device, click **Detect** to select the device, and Windows NT will rescan the bus. See Figure 12.



A250120

Figure 12. Rescan for Tape Device

If you still cannot see the device, ensure that the cable is attached properly. Also, ensure that the device is terminated properly, the device is powered-on, and the adapter driver is enabled.

If you have more than one IBM Ultrium device attached on the same host system, the operating system will prompt you multiple times for the same driver. **Cancel** the multiple driver installation requests, click the **Drivers** tab, then click **Add...**. See Figure 13.

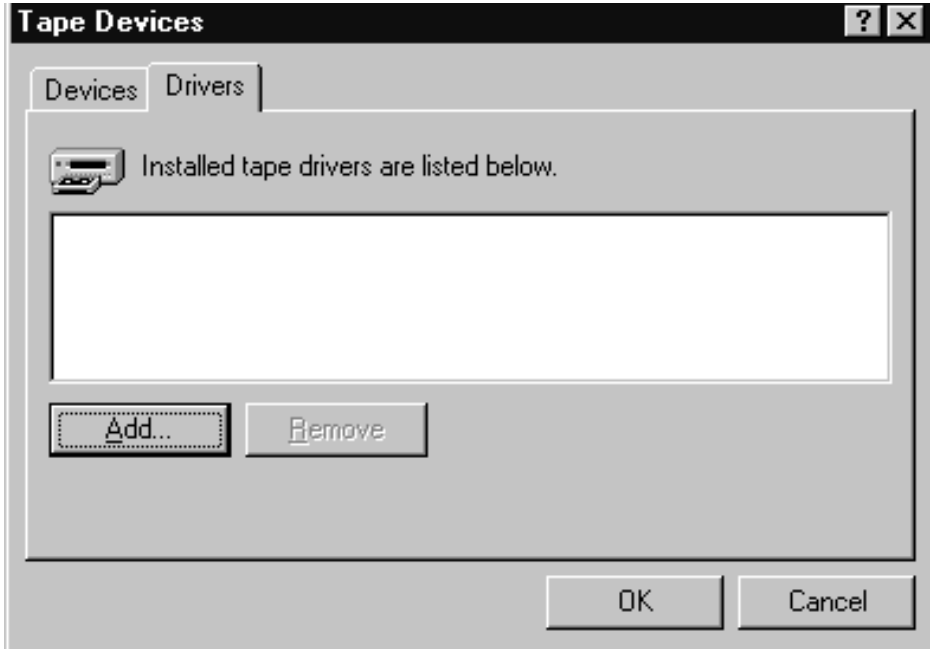


Figure 13. Tape Devices Menu

7. If you installed the **Device Driver System Files** component in step 4 on page 146 , **skip to step** 8 on page 152. If you did not install the **Device Driver System Files** component, click **Have Disk...** and enter the directory where your device driver setup file (*IBMUltrium.inf*) is located in the **Copy manufacturer's files from:** box. You may also click **Browse...** to select the directory. See Figure 14.

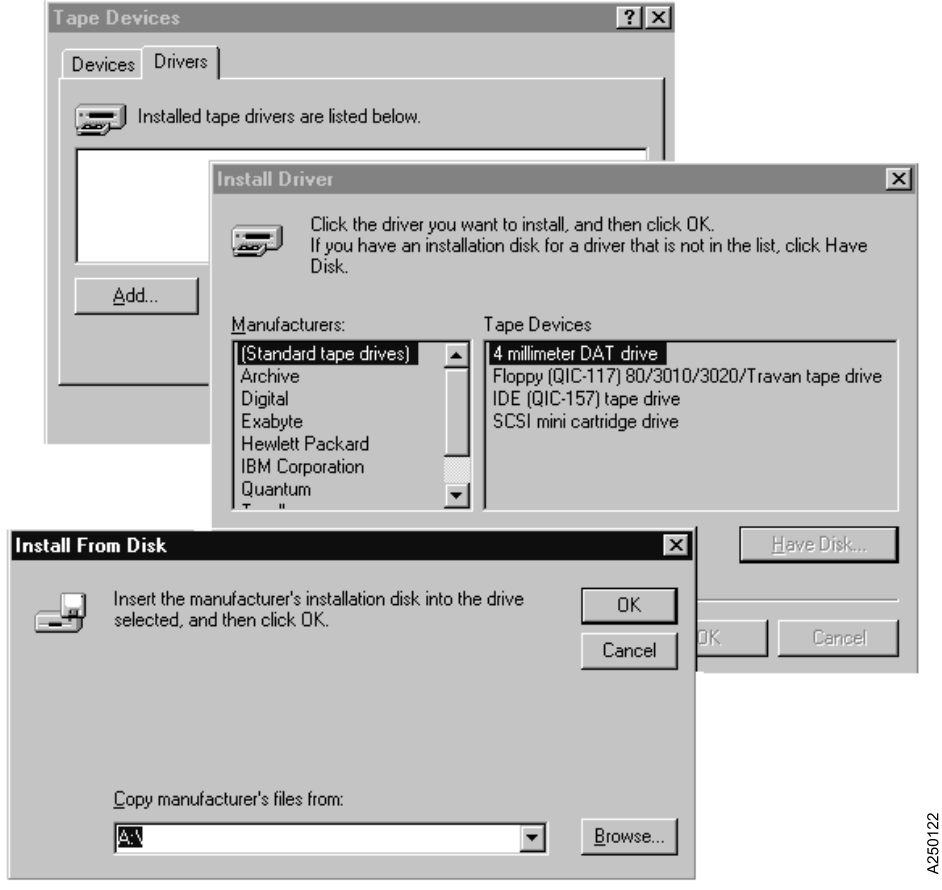


Figure 14. Have Disk Menu

8. Click **IBM Corporation**, select the device driver that matches your tape device, then click **OK**. See Figure 15.

   Note: The **IBM Ultrium Tape Libraries** selections install the IBM Ultrium Tape Drive driver as well as the IBM Ultrium Changer driver.

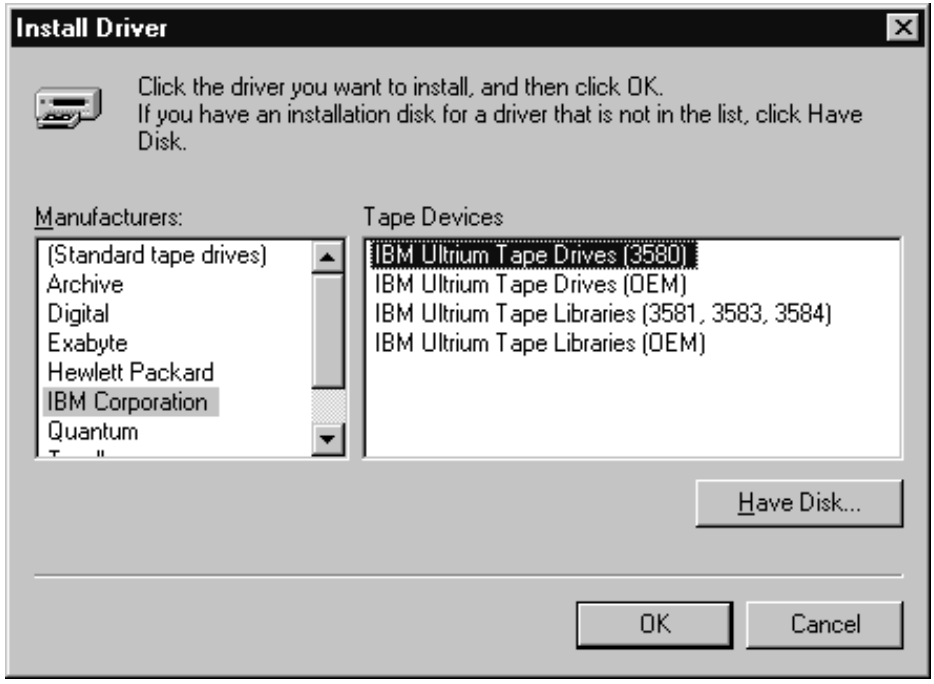


Figure 15. Install Driver Menu

9. If you installed the **Device Driver System Files** component in step 4 on page 146 , Windows NT might ask the question shown in Figure 16. Click **Yes**, then skip to step 11. If the system prompts you for *ibmtape.sys*, browse to select the drivers directory (*c:\winnt\system32\drivers*). The system may also prompt you for *ntutil.exe*. Browse to the system32 directory (*c:\winnt\system32*).

Figure 16. Windows NT Statement

10. If you **did not** install the **Device Driver System Files** component in step 4 on page 146, click **No** to the question in Figure 16. The operating system will prompt you for the location of the driver files.
11. Reboot the system for the operating system to start the drivers.

Removal Procedure

The Windows NT device driver and media mover device drivers manage all Ultrium devices and changers exclusively. If you use applications that have their own device drivers that access Ultrium devices and changers, you must remove the Windows NT device driver and media mover device drivers before installing and configuring those other applications.

1. Log on as Administrator.
2. Click **Start**, move to **Settings**, then click **Control Panel**.
3. Double-click **Tape Devices**.
4. Click the **Drivers** tab.
5. Highlight **IBM Ultrium Device Driver**, then click **Remove**. When you see the message **Are you sure you want to remove this driver?**, click **Yes**. See Figure 17.

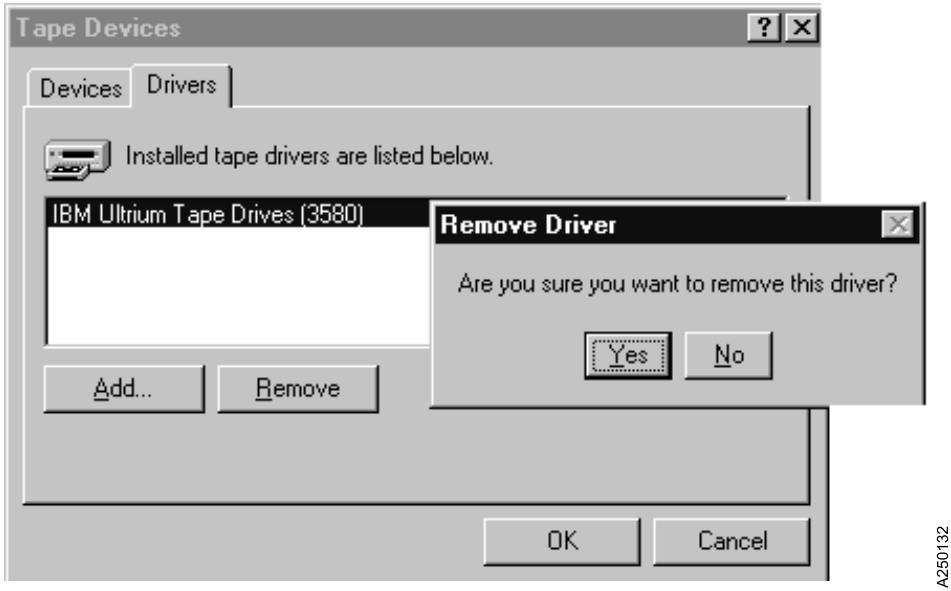


Figure 17. Remove Driver Menu

6. Click **Add/Remove Programs** in the **Control Panel**. See Figure 18 .

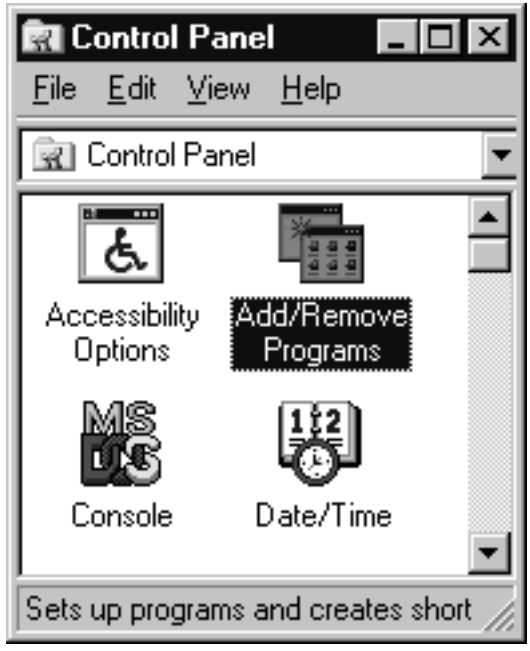


Figure 18. Control Panel Selection

7. Highlight **IBM Ultrium Device Drivers**, then click **Add/Remove...**. See Figure 19.

Figure 19. Add/Remove Properties

8. Select the **Remove** option, then follow the *InstallShield Wizard*™ to uninstall the drivers. See Figure 20.

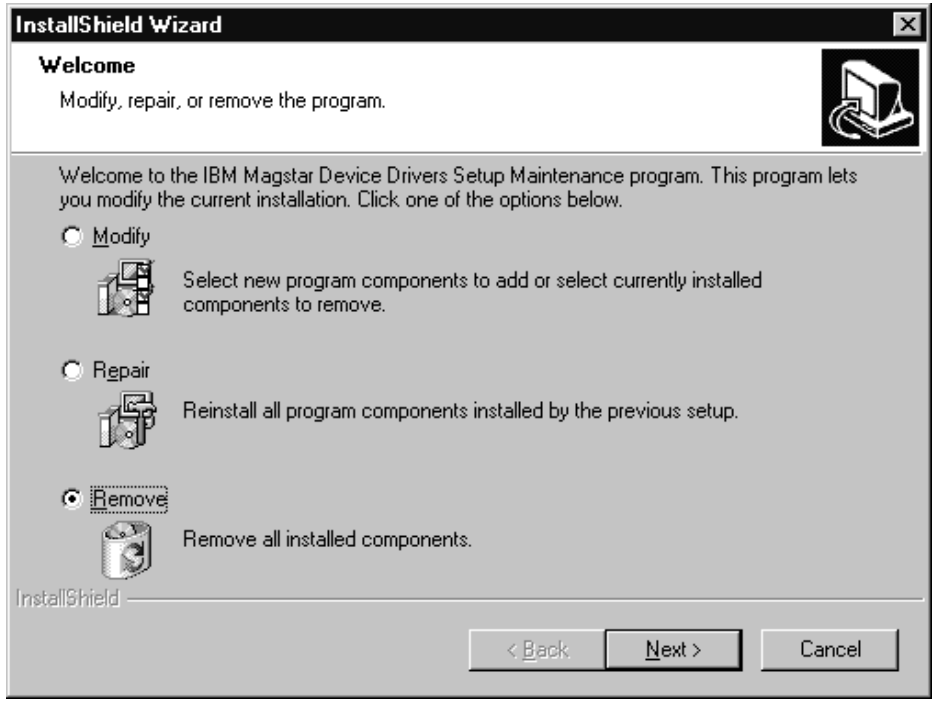


Figure 20. Drive Removal Menu

Note: Uninstalling the drivers removes all Ultrium device driver files as well as registry settings and other components, such as the *IBM Ultrium Device Drivers: Installation and User's Guide* and the Device Driver Depot.

9. Shut down and reboot the system.
10. Click **Next >**.

Manual Starting and Stopping Procedures

The IBM Ultrium device and changer drivers support being stopped and started without a reboot. If the Ultrium device and changer drivers are used in conjunction with other drivers that support being stopped and started without a reboot, you will be able to switch between device drivers without rebooting the system.

To control manually when either or both of the Ultrium device drivers start or stop, set the start-up mode to **Manual**, then start the device driver manually when required.

To set the start-up mode to **Manual**:

1. Log on as Administrator.
2. Click **Start**, move to **Settings**, then click **Control Panel**.
3. Double-click **Device**.
4. The changer driver and the device driver are named IBM Ultrium Changer Driver and IBM Ultrium Device Driver, respectively. Scroll down until they are visible in the window.

5. Select the driver, click **Startup...**, select **Manual**, then click **OK**. See Figure 21.

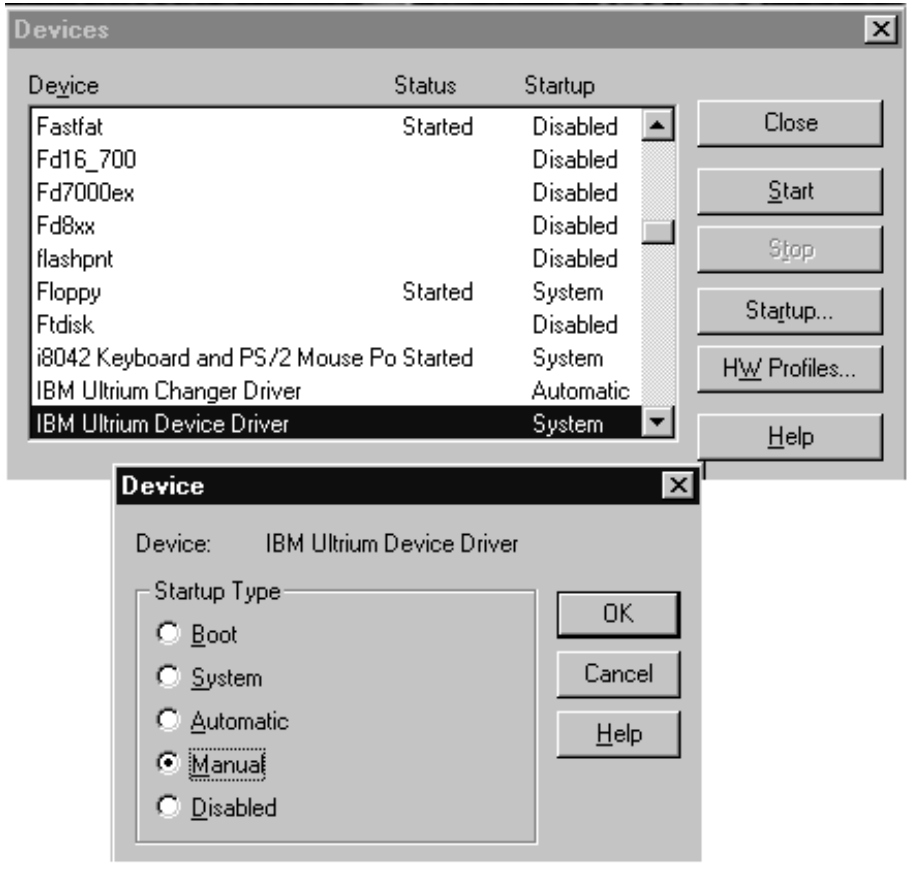


Figure 21. Manual Starting and Stopping Menu

6. If required for other drivers, repeat steps 4 and 5 of this procedure for each driver.

To start a driver manually:

1. Ensure that other drivers that may conflict are not started.
2. Perform steps 1 through 4 on page 158.
3. Select the driver, then click **Start**.
4. If necessary, repeat for the other driver.

To stop a driver manually:

1. Perform steps 1 through 4 on page 158.
2. Select the driver, then click **Stop**.

Chapter 25. Windows 2000 Device Driver Management

This chapter describes how to install, remove, and disable the Windows 2000 Tape Device Driver for the Ultrium devices.

Installation Overview

The installation process consists of the following steps:

1. Verify that the hardware and software requirements have been met.
2. Install the SCSI and FC-AL adapters and drivers.
3. Install the Ultrium device drivers.
4. Shut down the system.
5. Connect the Ultrium devices to the SCSI and FC-AL adapters.
6. Power on the Ultrium devices.
7. Set the Ultrium device addresses and enable the interface.
8. Reboot the system.
9. Log on as Administrator.
10. Configure the devices using the Device Manager.

All drives accessible from a medium changer must be on the same physical SCSI bus as the changer.

Installation Procedures

1. Log on as Administrator.
2. Insert the **IBM Ultrium Device Drivers CD** in the CD-ROM drive.
3. Go to the **Win2000** directory and double-click **IBMUltrium.Win2k.exe**.
4. Follow the *InstallShield Wizard* directions to install the package.
   a. If you select **compact** installation, the program will copy the system files of the latest IBM Ultrium Device Driver (the **Device Driver System Files** component) to the system directories. This provides all the latest support necessary for Ultrium devices.

      Note: This option overwrites previous versions of Ultrium device driver installed on your system.

   b. If you select **typical** installation, all support included in the **compact** installation will be done. Also, the **Device Driver Depot** component will be installed, which includes copying all available versions included in the InstallShield package to a user-defined directory.

      Note: This option overwrites previous versions of Ultrium device driver installed on your system.

c. If you select **custom** installation, the program will allow you to select the components to install. See Figure 22.

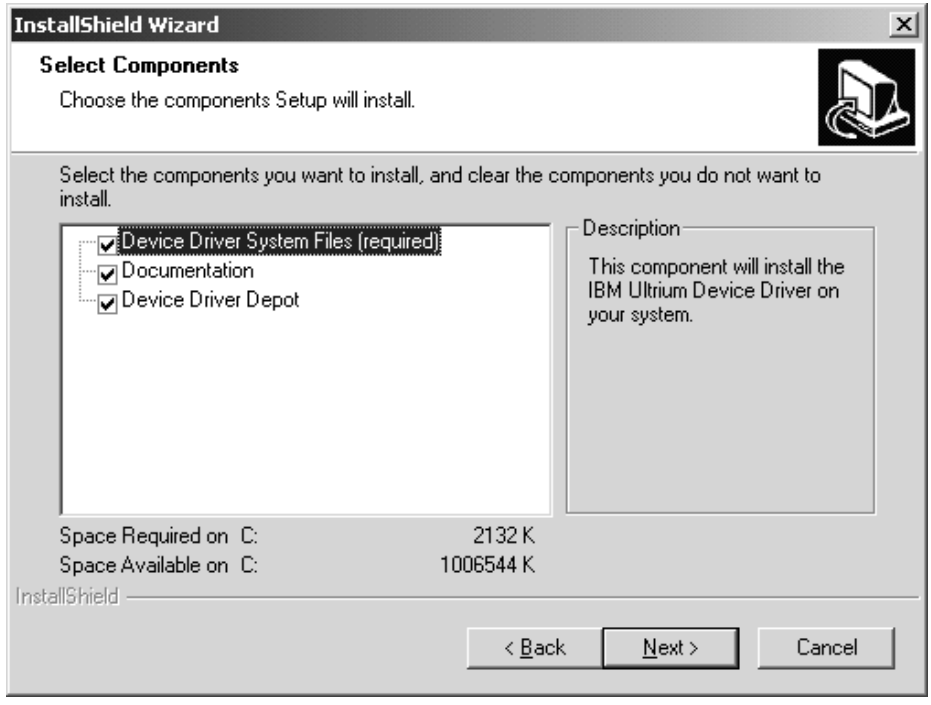


Figure 22. Select Components Menu

The **Device Driver System Files** component copies all the files needed for device driver support to the system directories.

The **Documentation** component copies PDF versions of the *IBM Ultrium Device Drivers: Installation and User's Guide* and the *IBM Ultrium Device Drivers: Programming Reference* to your hard drive.

The **Device Driver Depot** component includes copying the most recent versions of the device drivers to your hard drive. If you install this component, you will be able to install the device drivers without the installation CD.

5. The drivers are now installed. Instructions for configuring the drivers follow. Right-click **My Computer**, then click **Manage**. See Figure 23.

Figure 23. My Computer Menu

6. A **Computer Management** window opens. Double-click **Device Manager** under the **System Tools** tree. See Figure 24.

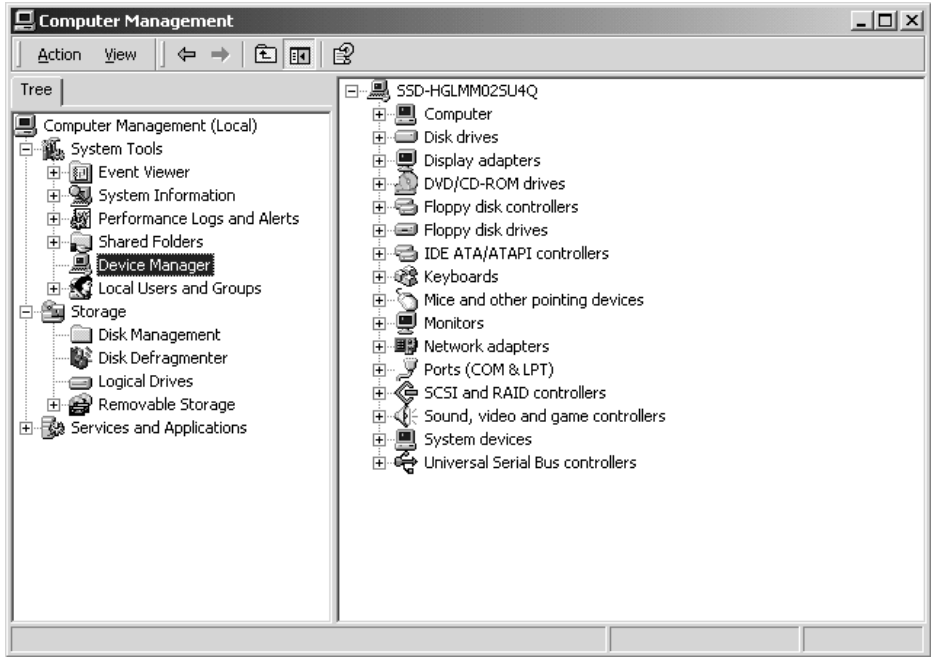


Figure 24. Device Manager Menu

7. If the Ultrium devices were powered-on and attached to your computer before you installed the Ultrium device driver, you may see them listed under Other devices. They will be marked by a question mark in the rightmost Computer Management window that follows. See Figure 25.

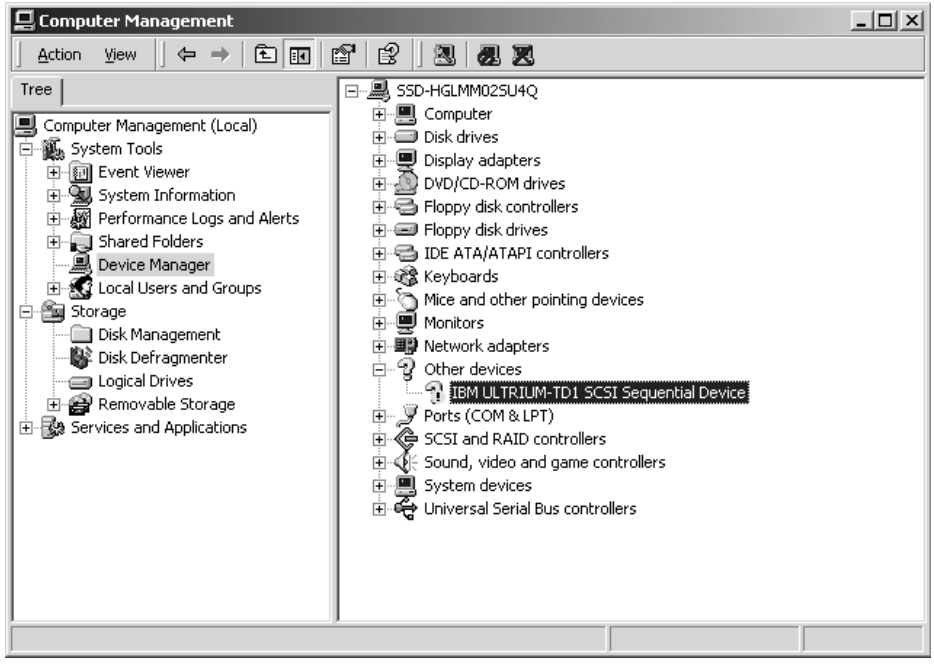


Figure 25. Computer Management Menu

If no Ultrium devices are listed under Other devices, skip to step 15 on page 174.

Note: Medium changers may be listed as **unknown Medium Changer** under the **Medium Changer** tree. These instructions are also applicable for changer devices.

8. Right-click the Ultrium device (labeled with a question mark), then click **Properties**. See Figure 26.

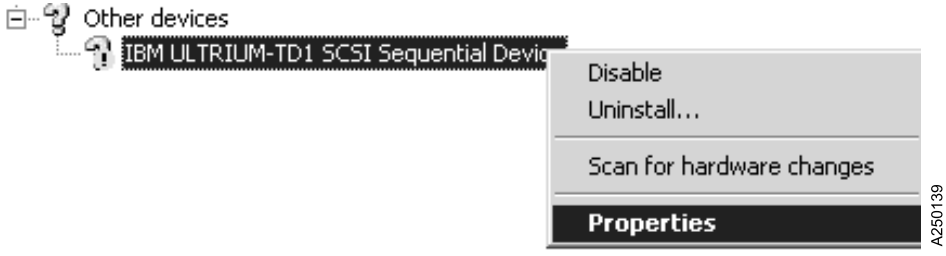


Figure 26. Other Devices Menu

9. A window should open. Click **Reinstall Driver...**. See Figure 27.

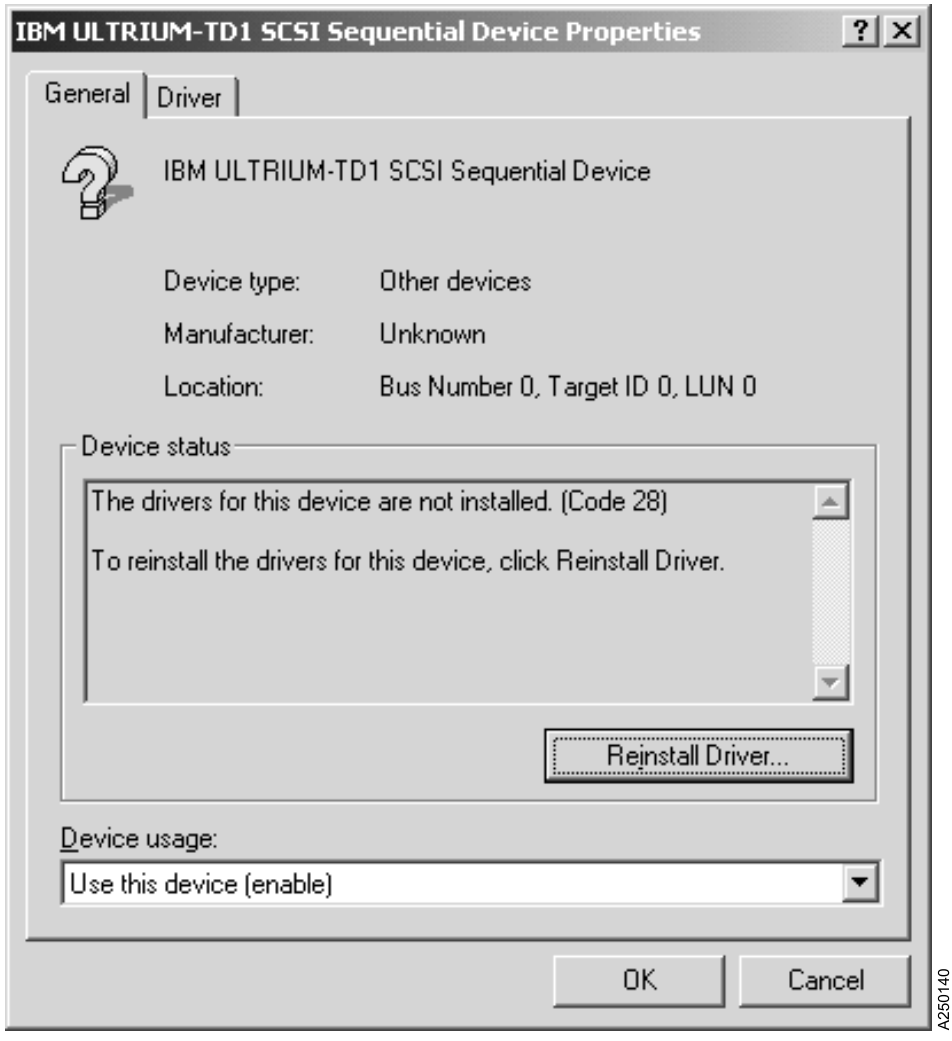


Figure 27. Reinstall Driver Menu

10. An **Update Device Driver Wizard** window opens. Click **Next >** to open the window shown in Figure 28. Select **Search for a suitable driver for my device (recommended)**, then click **Next >**.

Figure 28. Install Hardware Device Drivers Menu

11. If you have completed steps 2 through 4 on page 162, the Ultrium device drivers files should already be copied to your hard drive. Clear **Floppy disk drives** and **CD-ROM drives**, then click **Next >**. See Figure 29.

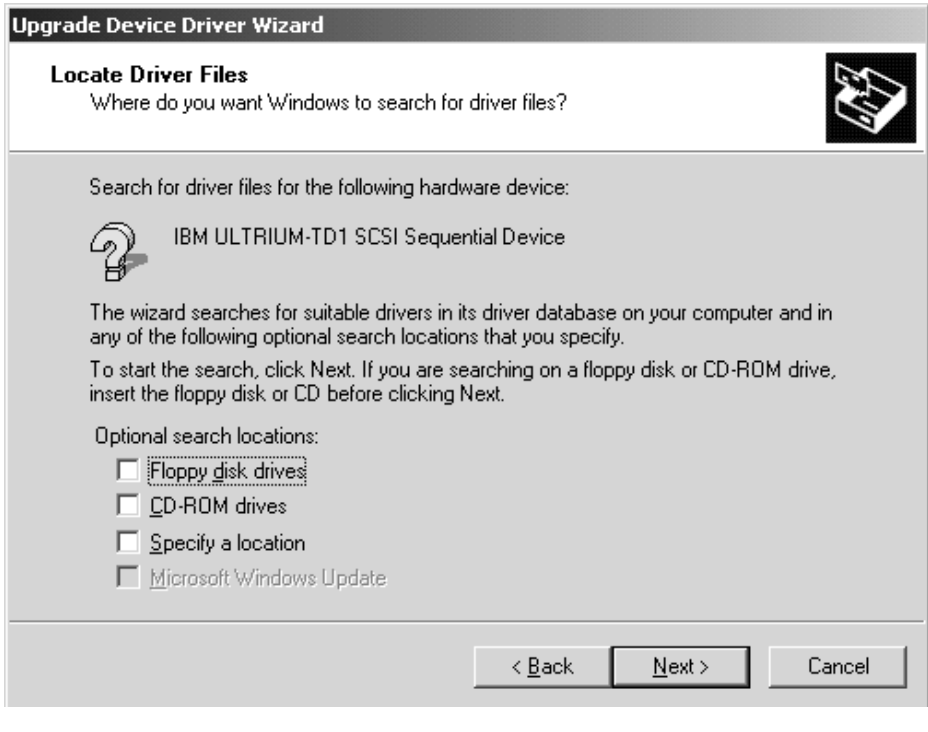


Figure 29. Locate Driver Files Menu

12. The operating system should be able to resolve your device type now that the device driver files are in place. Click **Next >**. See Figure 30.

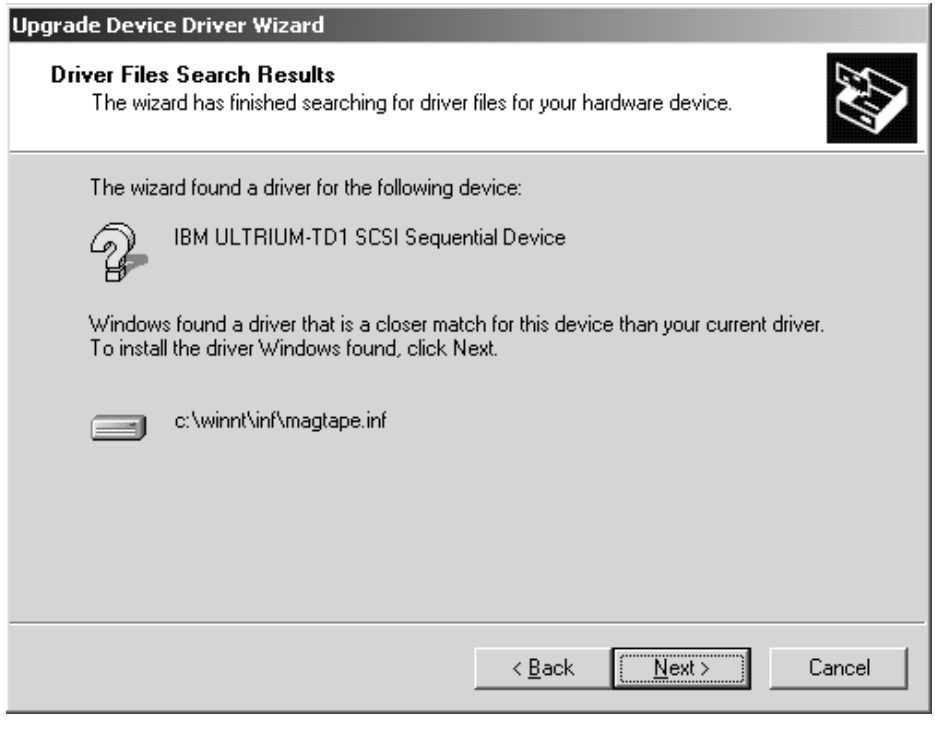


Figure 30. Driver Files Search Results Menu

13. Windows 2000 should now ask for the location of your Ultrium device driver files. Enter the location of your device driver files in the **Copy files from:** box in the Files Needed window. See Figure 31.

    Notes:

    a. The **Files Needed** window may not always be displayed on top.

    b. If you installed the required Device Driver System Files component in step 4 on page 162, the current version of device driver files should be located in the drivers folder under your system directory. For example, **c:\winnt\system32\drivers**.

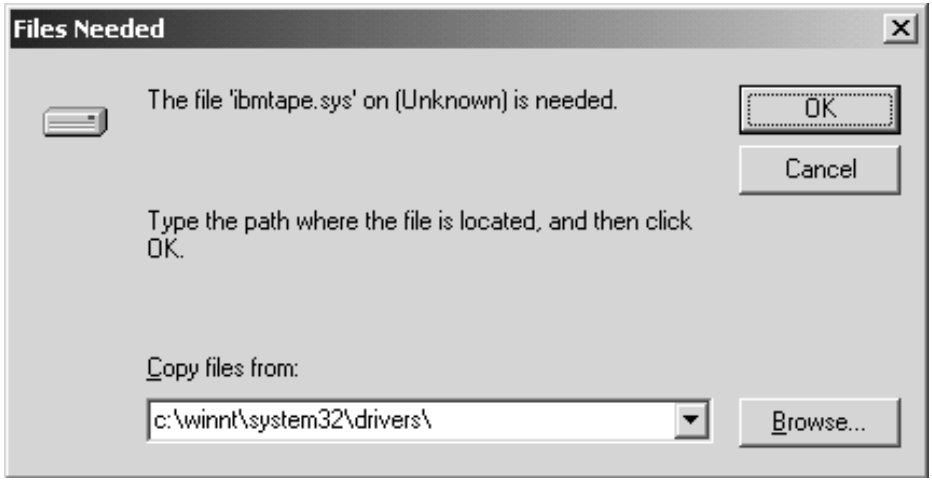


Figure 31. Files Needed Menu

14. If step 13 on page 172 was successful, then the operating system has enabled the device driver for the device. A window as shown in Figure 32 opens. Click **Finish** to continue. Enable all Ultrium devices by repeating step 7 on page 166 through step 14. If the device driver is working correctly, skip to step 17 on page 176.

Figure 32. Upgrade Device Driver Wizard

15. If Ultrium devices are not listed, right-click your computer name in the rightmost window, then click **Scan for hardware changes**. See Figure 33.

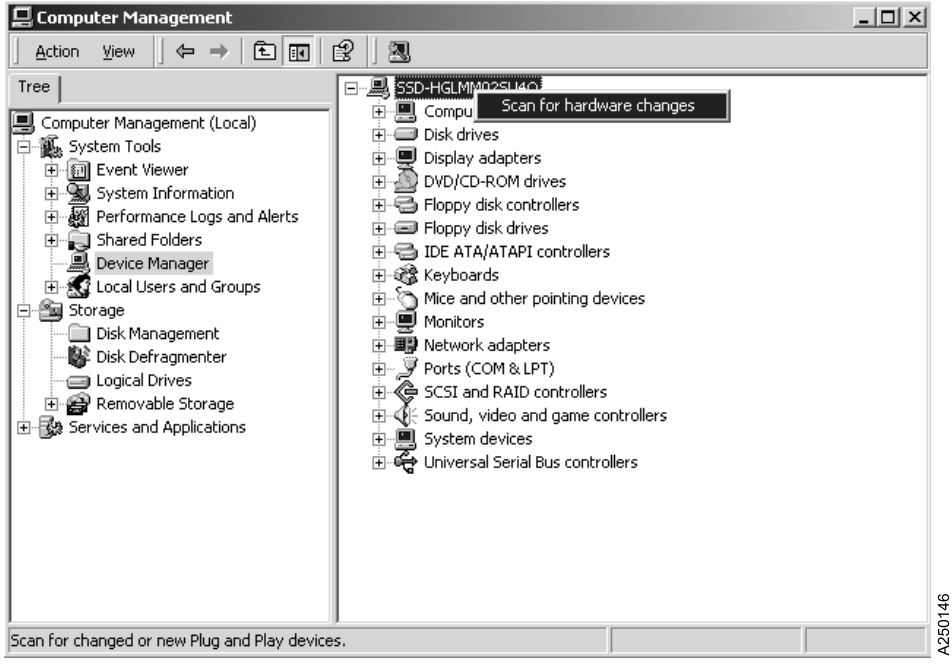


Figure 33. Scan for Hardware Changes Menu

If your system cannot detect Ultrium devices (such as no Ultrium device displayed in the rightmost window) after the operating system scans for hardware changes, ensure that the following conditions are correct for your system:

- The cable is attached properly.
- The device is terminated properly.
- The device is powered-on.
- The adapter driver is enabled.

Note: *Hot plugging* is the process adding devices on the SCSI bus with power enabled. Hot plugging is not recommended and may disrupt other devices on the bus. The recommended procedure is to shut down Windows 2000, power off your computer, attach the Ultrium devices, power on the Ultrium devices, then power on your computer.

16. If Windows detected new devices either during reboot or rescanning manually for hardware changes, then it will ask for the location of the device driver files. A **Files Needed** window opens. Enter the device driver files location in the **Copy files from:** box. See Figure 34.

    Notes:

    a. The **Files Needed** window may not always be displayed on top.

    b. If you installed the required Device Driver System Files component in step 4 on page 162, the current version of device driver files should be located in the drivers folder under your system directory.

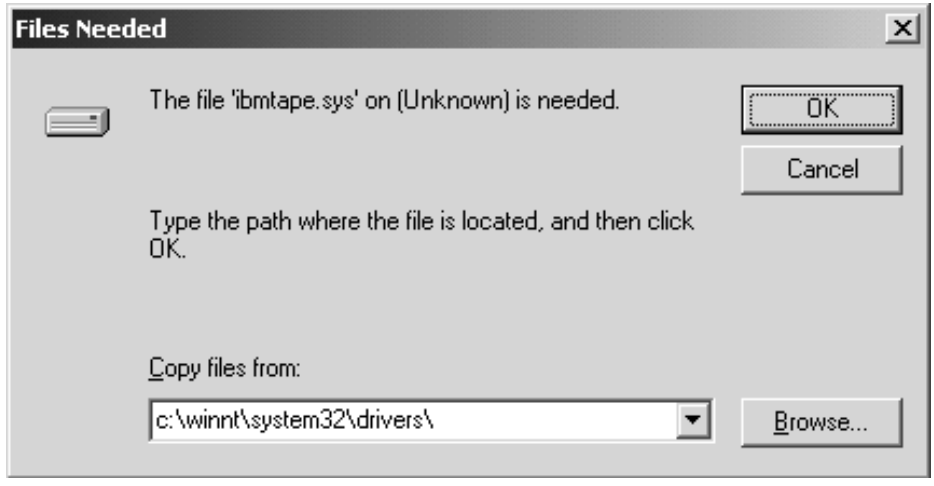


Figure 34. Files Needed Menu

17. Verify that the Ultrium devices are working properly when the device driver is enabled. The Ultrium devices should be listed under either **Tape drives** or **Medium changers**. See Figure 35.

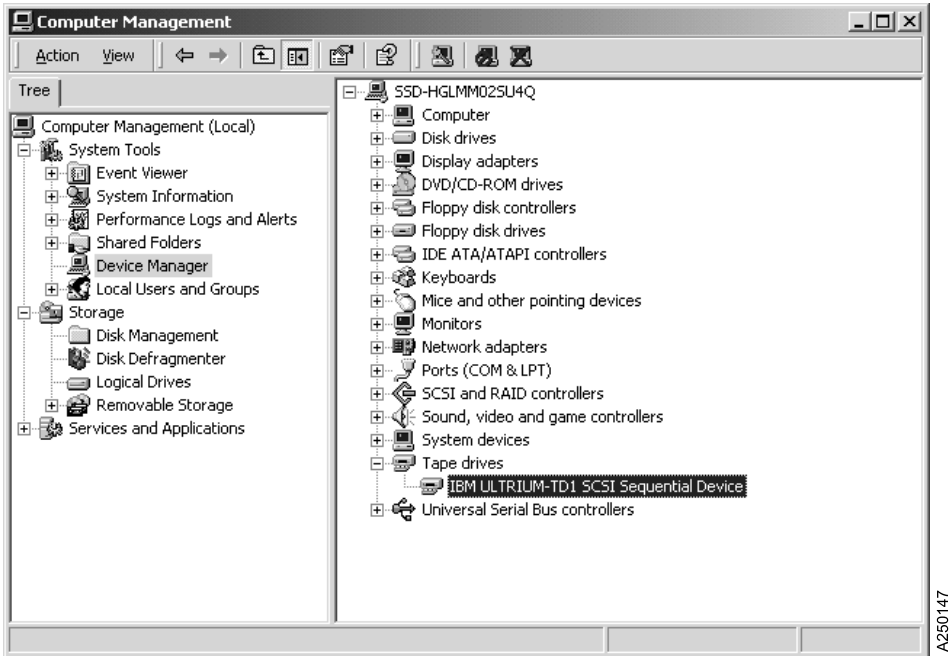


Figure 35. Drive and Changer Menu

18. The device settings and status will display. See Figure 36.

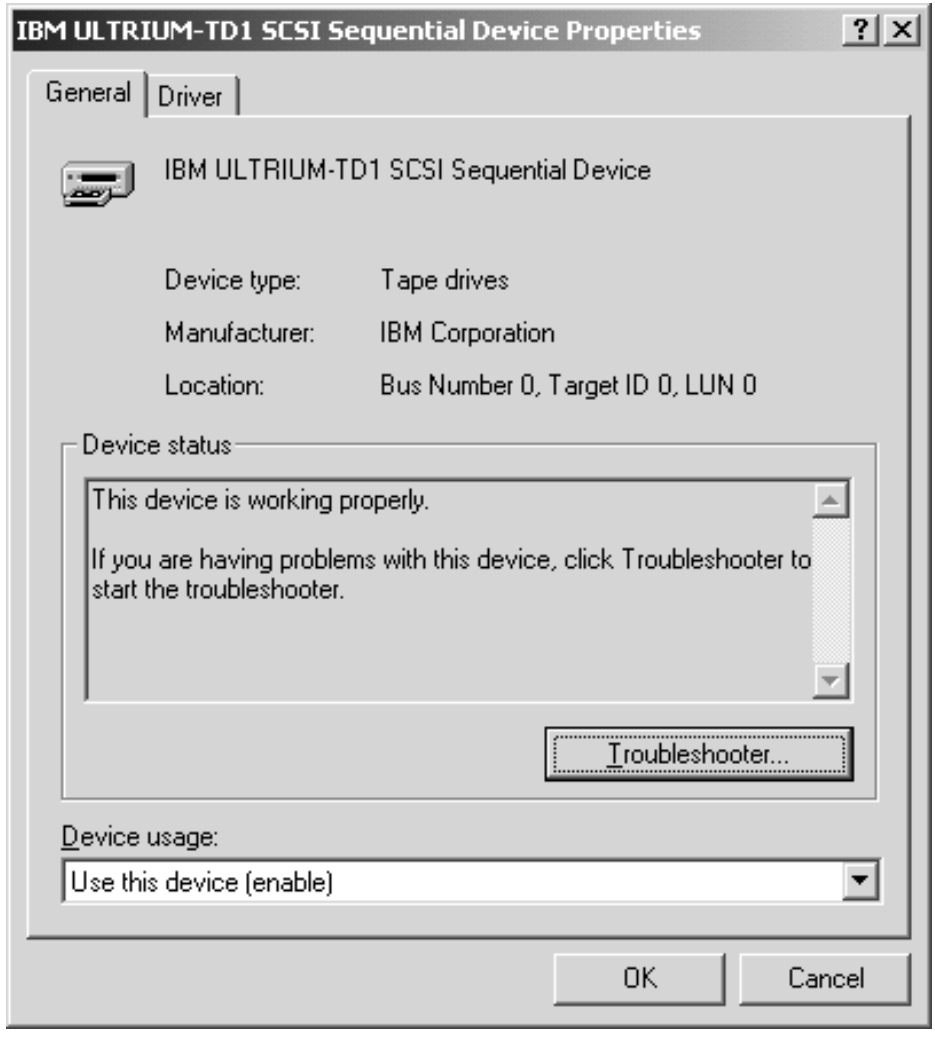


Figure 36. Driver Files Search Results Menu

Removal Procedure

1. Close all applications that are accessing Ultrium devices.
2. Double-click **Add/Remove Hardware** on the **Control Panel**. See Figure 37.

Figure 37. Control Panel Menu

3. An **Add/Remove Hardware Wizard** window opens. Select the **Uninstall/Unplug a device** option, then click **Next >**. See Figure 38.

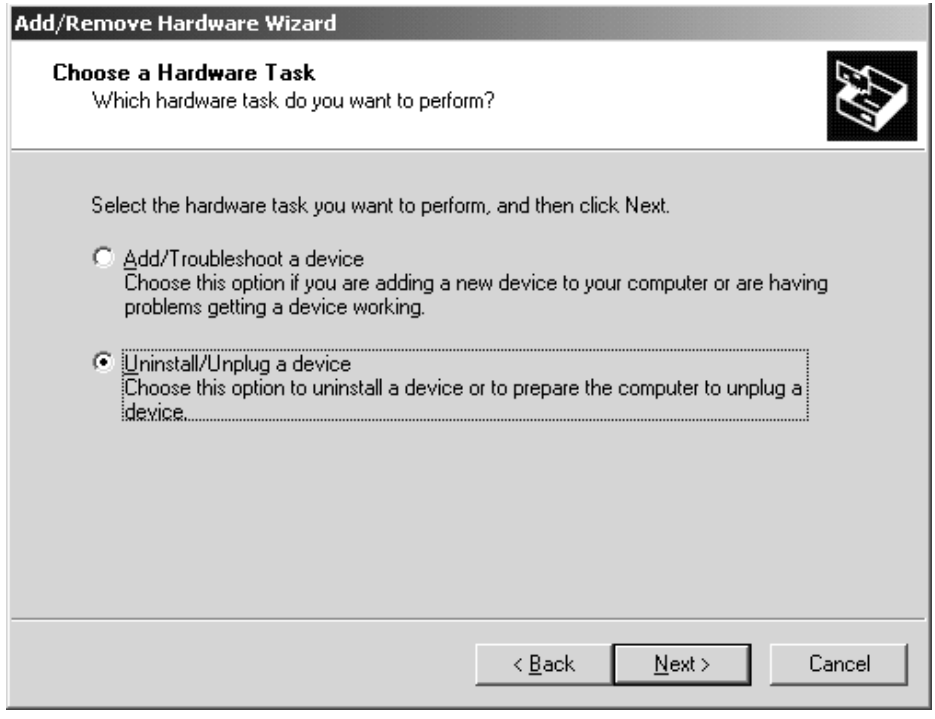


Figure 38. Control Panel Menu

4. Select **Uninstall a device**, then click **Next >**. See Figure 39.

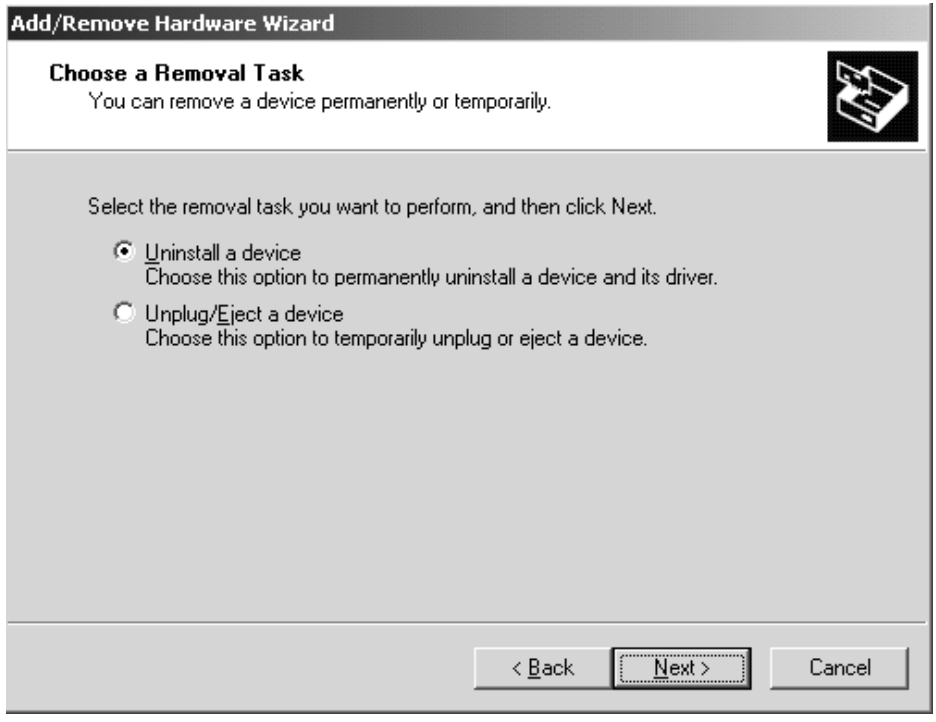


Figure 39. Uninstall a Device Menu

5. A window display list of installed devices opens. Select the correct device, then click **Next >**. See Figure 40.

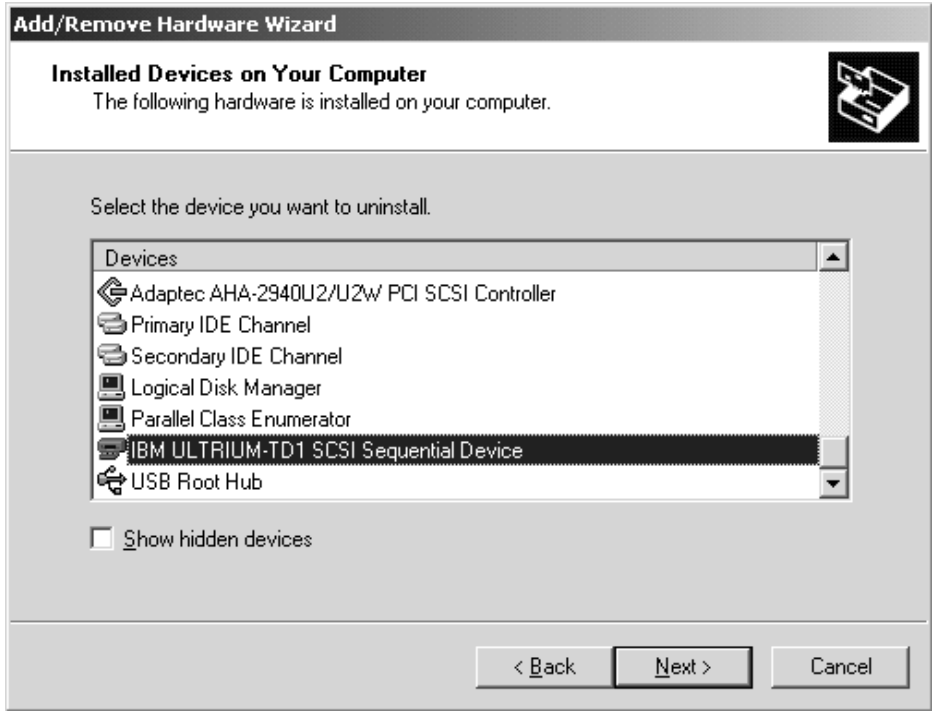


Figure 40. Add/Remove Menu

6. Confirm your selection by selecting the **Yes, I want to uninstall this device** option. Click **Next >**. For each Ultrium device, repeat step 2 on page 178 through step 6. See Figure 41.

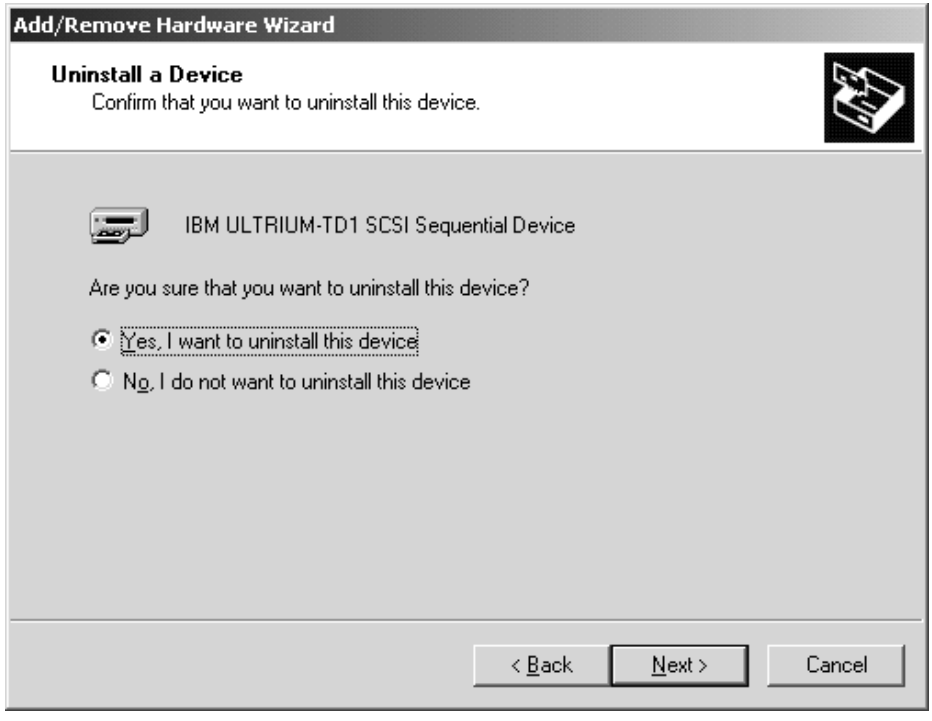


Figure 41. Yes, Uninstall a Device Menu

7. After all Ultrium devices are uninstalled, double-click **Add/Remove Programs** on the **Control Panel**. See Figure 42.

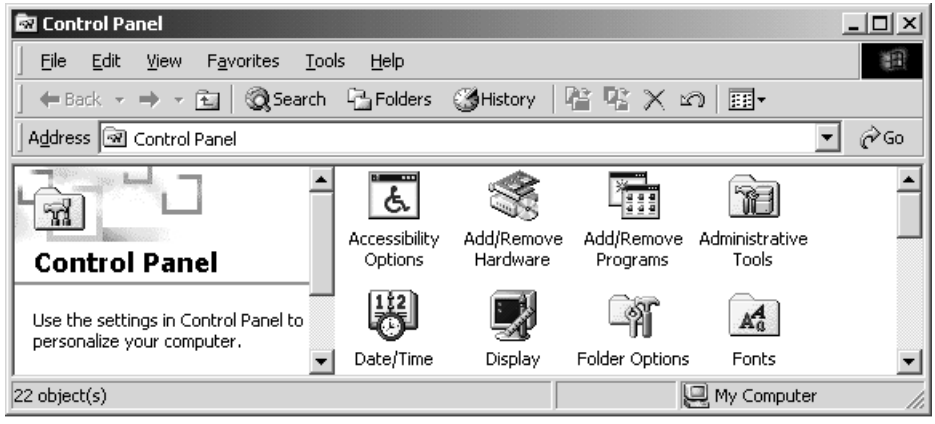


Figure 42. Control Panel Menu

8. Select **IBM Ultrium Device Drivers**, then click **Change/Remove**. See Figure 43.

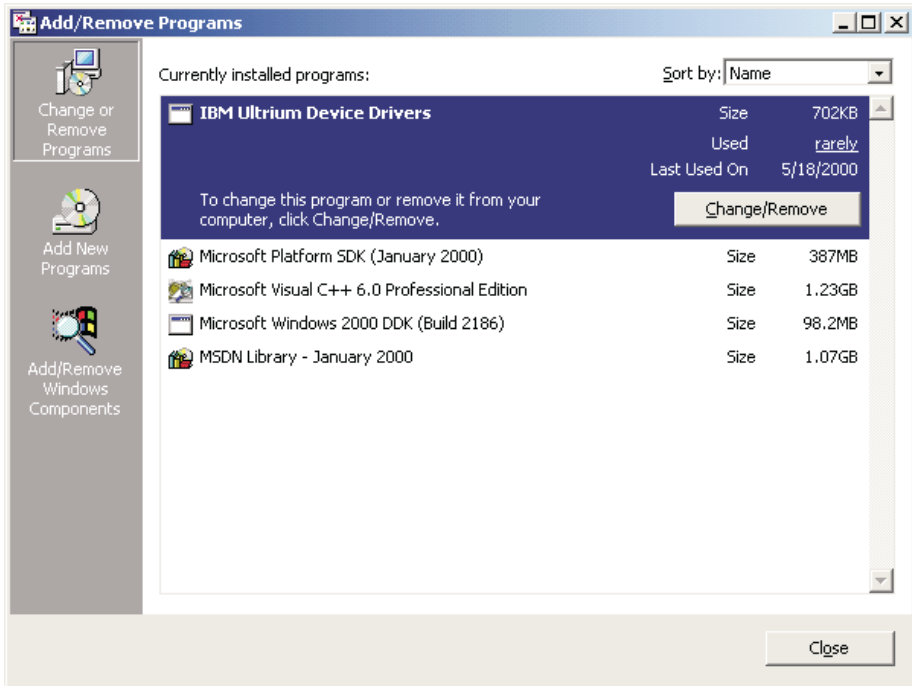


Figure 43. Add/Remove Programs Menu

9. The InstallShield Wizard window opens. Select **Remove**, then click **Next >**. See Figure 44.

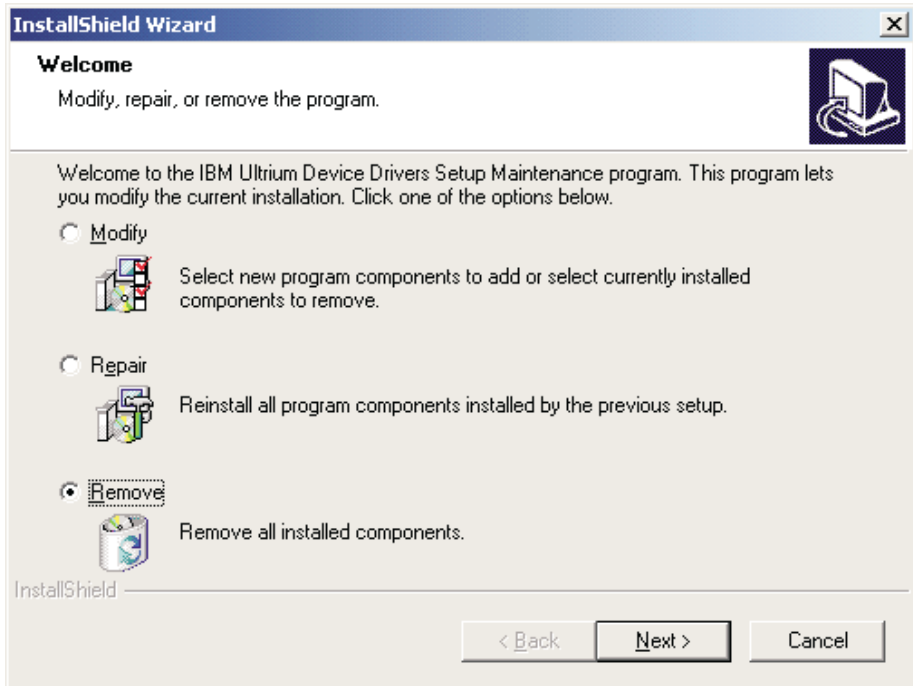


Figure 44. InstallShield Wizard Menu

10. Follow the InstallShield Wizard instructions to uninstall your IBM Ultrium device drivers. During the uninstall process, the InstallShield Wizard may ask you a question. See Figure 45.

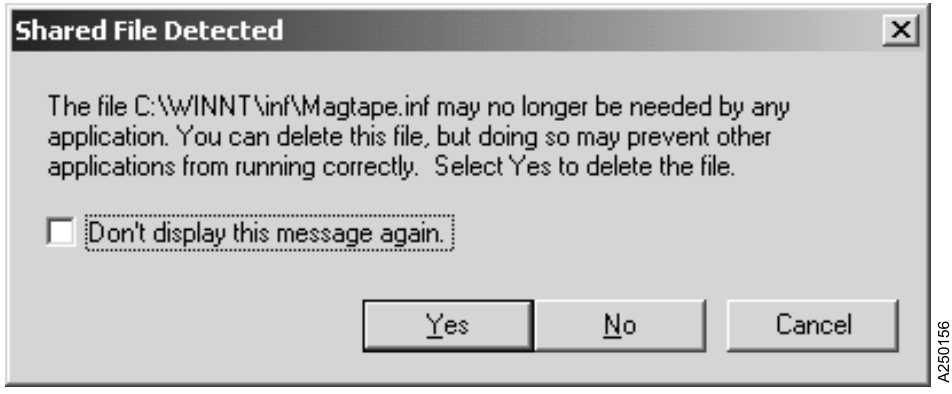


Figure 45. Shared File Detected Menu

IBM Ultrium device drivers for Windows 2000 use the same information setup files (*Magtape.inf* and *Magchgr.inf*) as IBM Magstar device drivers for Windows 2000. If you have IBM Magstar device drivers installed on your system, click **No** to skip the removal of those shared files. If you do not have IBM Magstar device drivers installed on your system, select **Don't display this message again.**, then click **Yes** to delete those shared files.

Note: Uninstalling the drivers removes all Ultrium device driver files as well as registry settings and other components, such as the *IBM Ultrium Device Drivers: Installation and User's Guide* and the Device Driver Depot.

Disable Procedure

1. Right-click **My Computer**, then click **Manage**. See Figure 46.

Figure 46. My Computer Menu

2. A **Computer Management** window opens. Double-click **Device Manager** under the **System Tools** tree. Right-click the device you want to disable under either **Medium changers** or **Tape drives** trees. Click **Disable**. See Figure 47.

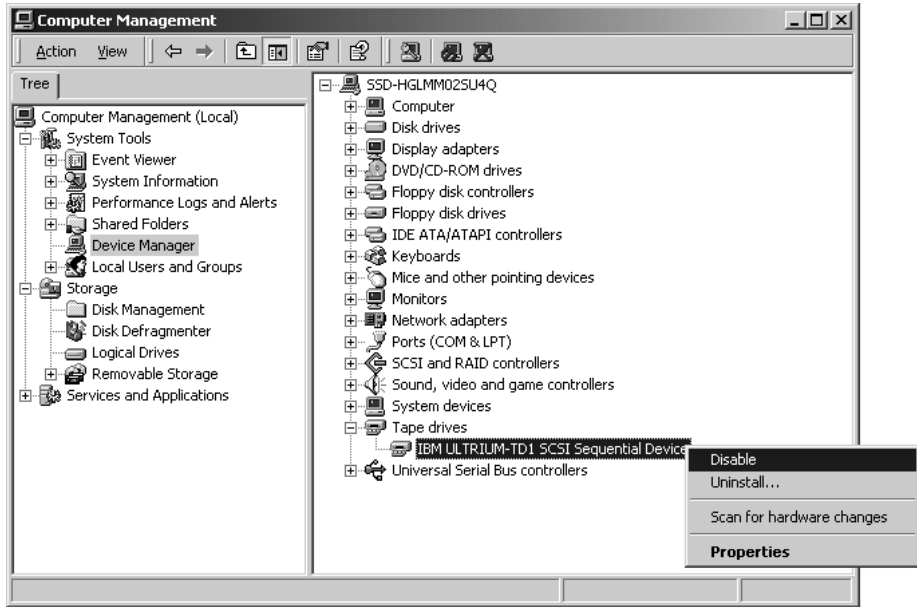


Figure 47. Changer and Drives Menu

3. Click **Yes** to disable the device. See Figure 48.

   Note: The device will remain disabled until you enable it from the **Computer Management** window.

Figure 48. Disable Device Menu

Chapter 26. Windows Utility Program (ntutil)

The Utility program provides a facility with which you can easily operate your Ultrium devices and changers. It is supported only with the Ultrium device driver (*IBMtape.sys*) and the Ultrium changer driver (*ultchgr.sys*) for Windows NT, and *IBMchgr.sys* for Windows 2000.

You can use the NTUTIL program for the following:

- Helping you determine if there is a problem with your hardware or connections
- Determining which devices are recognized by the device and changer drivers
- Forcing a driver dump
- Loading new microcode on your drive
- Sending SCSI commands to the hardware
- Receiving the status of SCSI commands
- Obtaining sense data for SCSI commands that encounter errors

The tool can be run in interactive mode or batch mode. When it is in interactive mode, a menu is presented to the customer and the customer issues one command at a time and is presented with the results of that command. In batch mode, the customer uses an editor to create a file that contains NTUTIL commands, which are presented to the tool one by one.

Calling NTUTIL

The tool can be called as a command from the command line or from within a shell script:

```
ntutil <-f input-file> <-o output-file> <-t tape-path-special-file-name>
       <-c changer-path-special-file-name> <-l >
       <-d >
```

The options are:

```
-f input-file
                    Specifies the input file for batch mode.
                    If a file is specified, NTUTIL will execute in
                    batch mode and read input from this file.
                    The default for this file is NTUTIL.in.

-o output-file
                    Specifies the output file for batch mode.
```

```
                    The default for this file is NTUTIL.OUT.

-t tape-special-file-name
                     Specifies the tape device special file value
                     (for example, tape0) to substitute when
                     executing an open (for both batch and
                     interactive mode).

-c changer-special-file-name
                     Specifies the changer device special file value
                     (for example, lb0.1.2.3 for Windows NT,
                     Changer0 for Windows 2000) to substitute when
                     executing an open (for both batch and
                     interactive mode). The special value
                     def_lun_1 specifies that an open uses the
                     default lun 1 associated with the
                     tape-special-file-name.

-l
                    Specifies that an open will open both the
                    tape path special file and the changer path
                    special file (for both batch and interactive mode).

-d
                    Turns on internal tracing printouts in the
                    output. Used only for tool debugging.
```

Note: If no parameters are specified, NTUTIL will operate in interactive mode.

Interactive Mode

When NTUTIL is called without the *-f* flag, it defaults to running in Interactive (or Manual) mode. This mode allows a developer to interactively determine the kind of testing to be done. When in Interactive mode, NTUTIL provides a menu of functions that can be performed.

For a description of interactive modes, see “Batch Mode” on page 193.

The two modes are:

- Base mode (LUN0) commands, such as open/close/read/write
- Library mode (LUN0 and LUN1), which supports open/close/read/write plus media mover commands, such as read element status and move media.

Note: On Windows 2000 platforms, library functions are available if the Removable Storage Management component of Windows 2000 is stopped.

Base mode (only LUN 0 of the device specified by the tape-path-special-file-name, for example, tape0, is accessed) is shown in Figure 49 on page 192.

Library mode (LUN 0 specified by the tape-path-special-file-name, for example, tape0, and LUN 1 specified by the changer-path-special-file-name, for example, lb0.1.0.0, are accessed) is shown in Figure 50 on page 193.

To issue SCSI commands, the device must be open. Open a SCSI device by issuing option 20 (Open). The device names can be obtained from command 88 (Find Devices). Tape devices names are of the format *tapen*, where *n* is a digit, 0, 1, and so on. If the device driver is stopped, then started without a reboot, the name will not be the same as it was previously. Rather it will be the next unused name in the operating system. For example, if there is one tape device defined on the Windows system, that device will be named *tape0* when the device driver is started the first time. If the device driver is stopped, then restarted, the name will be *tape1*. This behavior continues until the system is rebooted.

```
Test tool version x.x.x.x
Variable settings
=================== BASE MODE ========================================
tape-special-file-name: tape0
gp->fd0=-1  gp->fd1=-1 block size=1024  block count=1
hex block id = 0000000000000000
return_error_when_fail 1  exit_on_unexpected_result 0  trace_flag 0

manual test menu:
=====================================================================
  1: set device special file             2: display symbols
  3: set block size R/W (now !0 fixed)
  5: set return error when fail          6: set/reset trace
  7: set exit on unexpected result       8: Library Mode
=====================================================================
  20: open                               21: close
  22: read                               23: write
  24: read and display block             25: flush (buffer->media)
  26: read block id                      27: erase
  28: locate block id                    29: display block data
=====================================================================
 30: write filemark(s)                  31: rewind
 32: forward space filemark(s)          33: unload
 34: reverse space filemark(s)          35: load
 36: forward space record(s)            37: return error
 38: reverse space record(s)            39: test unit ready
 43: set media parms (block size)       44: set dev parms (compression)
 46: get device information             47: restore data
 48: get medium information             49: inquiry
 50: poll registered devices
 53: space EOD
=====================================================================
 70: system command
=====================================================================
 80: Force Dump                         81: Read Dump
 82: Update MicroCode                   83: Log Sense
 84: Get Last Sense                     85: Get Version
                                        87: Read/Write Test
 88: List registered devices
=====================================================================
 99: return to main menu
=====================================================================
enter selection:
```

Figure 49. Base Mode

```
Test tool version x.x.x.x
Variable settings
=================== LIBRARY MODE ====================================
tape-special-file-name: tape0, changer-special-file-name: lb0.1.2.3
gp->fd0=-1  gp->fd1=-1 block size=1024  block count=1
hex block id = 0000000000000000
return_error_when_fail 1  exit_on_unexpected_result 0  trace_flag 0

manual test menu:
=====================================================================
  1: set device special file             2: display symbols
  3: set block size R/W (now !0 fixed)
  5: set return error when fail          6: set/reset trace
  7: set exit on unexpected result       8: Base Mode
=====================================================================
 10: ioctl return library inventory      11: ioctl move medium
 12: ioctl initialize element status     13: ioctl get changer parameters
=====================================================================
 20: open                                21: close
 22: read                                23: write
 24: read and display block              25: flush (buffer->media)
 26: read block id                       27: erase
 28: locate block id                     29: display block data
=====================================================================
 30: write filemark(s)                   31: rewind
 32: forward space filemark(s)           33: unload
 34: reverse space filemark(s)           35: load
 36: forward space record(s)             37: return error
 38: reverse space record(s)             39: test unit ready
 43: set media parms (block size)        44: set dev parms (compression)
 46: get device information              47: restore data
 48: get medium information              49: inquiry
 50: poll registered devices
 53: space EOD
=====================================================================
 70: system command
=====================================================================
 80: Force Dump                          81: Read Dump
 82: Update MicroCode                    83: Log Sense
 84: Get Last Sense                      85: Get Version
                                         87: Read/Write Test
 88: List registered devices
=====================================================================
 99: return to main menu
=====================================================================
enter selection:
```

Figure 50. Library Mode

Batch Mode

Batch input files can contain the following kinds of statements:

- comments
- command
- set
- type
- pause
- delay

- system
- symbols
- exit

Each type of statement is described in the following section.

Comments

Any line starting with a pound sign (#), any line starting with a space, or any blank line is a comment and is ignored.

Command Statements

Device driver function is exercised by command entries in the input file. Command statements must be on a single line of the input file. The command and command text are case sensitive, but leading or embedded blanks are ignored.

```
command  command-text <result-text>
```

This statement is used to execute a tape command and to test the command completion status for an expected result.

Supported Command-Text Fields

The command text is used to specify the tape operation to perform. The following section describes the possible values for this field.

close

```
 SYNTAX: close

        for example, close

FUNCTION Tested:
```

This command calls the device driver CloseHandle() entry point and closes the tape device special file opened previously. The RC is always 1.

device_info

```
 SYNTAX: device_info

        for example, device_info

FUNCTION Tested:
```

This command calls the device driver GetTapeParameters() entry point with an operation of GET_TAPE_DRIVE_INFORMATION. If the command is successful, the information returned is in a TAPE_GET_DRIVE_PARAMETERS structure, described in the Microsoft SDK. The information will be formatted and printed. This includes information such as ECC, compression, default block size, and features.

display_block (data)

```
 SYNTAX: display_block

        for example, display_block

FUNCTION Tested:
```

This command displays the data buffer contents for the last read or write transfer.

dump_blocks (read and display blocks)

```
 SYNTAX: dump_blocks
        dump_blocks records = n

        for example, dump_blocks records = 2

FUNCTION Tested:
```

This command calls the device driver ReadFile() entry point and attempts to read from the tape device special file opened previously. The amount of data to be read will depend of the current settings of the block_size and block_count variables and on the number of records specified. The first 16 bytes of each record will be printed.

This command transfers **n** records. A record will have a length of block_size*block_count for fixed block mode and block_count for variable mode. For example, if block_size=1024, block_count=2 and records=3, then three 2048 transfers will be done. If the operation succeeds, the RC will show the total number of bytes transferred.

erase

```
 SYNTAX: erase

        for example, erase

FUNCTION Tested:
```

This command calls the device driver EraseTape() entry point with an operation of TAPE_ERASE_LONG. This attempts to erase, then leave at load point the tape device special file opened previously.

find_devices

```
 SYNTAX: find_devices

        for example, find_devices

FUNCTION Tested:
```

This command (which corresponds to the *List registered devices* command on the interactive menu) searches the following registry key and looks for Ultrium identifiers:

```
"HARDWARE\\DEVICEMAP\\Scsi\\Scsi Port W\\Scsi Bus X\\Target Id Y\\Logical Unit Id Z"
```

It then prints a list of the SCSI devices supported by the IBM Ultrium device drivers.

flush (buffer to media)

```
 SYNTAX: flush

        for example, flush

FUNCTION Tested:
```

This command calls the device driver WriteTapemark() entry point with an operation of TAPE_FILEMARKS and a count of 0. This writes the data buffer contents to the tape media of the tape device special file opened previously.

force_dump

```
 SYNTAX: force_dump

        for example, force_dump

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an operation of IOCTL_SCSI_PASS_THROUGH and a CDB[0] of SCSIOP_SEND_DIAGNOSTIC. This forces a microcode dump.

forward_filemark

```
 SYNTAX: forward_filemark n

        for example, forward_filemark 2

FUNCTION Tested:
```

This command calls the device driver SetTapePosition() entry point with an operation of TAPE_SPACE_FILEMARKS and a count of **n**. This attempts to forward space **n** files on the cartridge in the tape device special file opened previously.

forward_record

```
 SYNTAX: forward_record n

        for example, forward_record 2

FUNCTION Tested:
```

The forward_record command calls the device driver SetTapePosition() entry point with an operation of TAPE_SPACE_RELATIVE_BLOCKS and a count of **n**. This attempts to forward space **n** records on the cartridge in the tape device special file opened previously.

get_last_sense

```
SYNTAX: get_last_sense

        for example, get_last_sense

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an operation of OBTAIN_SENSE. This displays the last sense data returned by a sense command.

get_version

```
SYNTAX: get_version

        for example, get_version

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an operation of OBTAIN_VERSION. This displays the Ultrium Device Drivers Version Id string.

init_element_status

```
SYNTAX: init_element_status

        for example, init_element_status

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an opcode of LIBRARY_AUDIT that will issue an Initialize Element Status command to the device.

inquiry

```
SYNTAX: inquiry n

        for example, inquiry 0

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an operation of IOCTL_SCSI_PASS_THROUGH and a CDB of SCSIOP_INQUIRY. If the command is successful, the information returned will be displayed.

Specify *n=0* to obtain inquiry information from the drive. Specify *n=1* to obtain inquiry information from the changer.

load

```
 SYNTAX: load

        for example, load

FUNCTION Tested:
```

This command calls the device driver PrepareTape() entry point with an operation of TAPE_LOAD. This attempts to load the tape media into the drive of the tape device special file opened previously.

locate_block_id

```
 SYNTAX: locate_block_id

        for example, locate_block_id

FUNCTION Tested:
```

This command calls the device driver SetTapePosition() entry point with an operation of TAPE_LOGICAL_BLOCK. This attempts to position to the last read_block_id value for the cartridge in the tape device special file opened previously, or the block ID set by the set block_id function.

log_sense page

```
 SYNTAX: log_sense page_code = xx

        for example, log_sense page_code = 00

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an operation of IOCTL_SCSI_PASS_THROUGH and a CDB[0] of SCSIOP_LOG_SENSE. This reads the log sense page specified by the page code and displays the data.

The page_code (xx) is two hex characters specifying the log sense page to be read.

medium_info

```
 SYNTAX: medium_info

        for example, medium_info

FUNCTION Tested:
```

This command calls the device driver GetTapeParameters entry point with an operation of GET_TAPE_MEDIA_INFORMATION. If the command is successful, the information returned is in the TAPE_GET_MEDIA_PARAMETERS structure described in the Microsoft SDK. The information is formatted and printed. The information returned is block_size, partition count, and write protect.

move_medium

```
 SYNTAX - Windows NT: move_medium saddr = n daddr = n

        where saddr = decimal source address (moving from)
              daddr = decimal destination address (moving to)

        for example, move_medium saddr = 11 daddr = 13

SYNTAX - Windows 2000: move_medium stype = n saddr = n dtype = n daddr = n
       where
         stype = decimal source address type
           2=SE(ChangerSlot), 3=IEE (ChangerIEPort), 4=DTE (ChangerDrive)
         saddr = decimal source address (moving from)
         dtype = decimal target address type (see stype for supported values)
         daddr = decimal destination address (moving to)

        for example, move_medium stype=2 saddr=1 dtype=4 daddr=0

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an opcode of MOVE_MEDIUM. This attempts to move a data cartridge from a source element location to a destination element location inside the library. If this command is successful, the information returned will be displayed. In Windows NT, the source and destination addresses are the decimal equivalents of the hex Element Addresses described in the appropriate hardware manuals. In Windows 2000, the addresses are remapped such that the first element of each type is mapped to 0, the second element is mapped to 1, and so on. Issue a return_lib_inventory_all command to obtain the mapping.

open

```
 SYNTAX: open <tape-special-file-name> <changer-special-file-name> RW
                                                                   RO

        where RW means read/write
              RO means read only

        The tape-special-file-name is in the form of tapen, and
        n is a numeric value from 0...x, the value is assigned by
        the device driver during the boot process and can be found
        by using the interactive modes option 50 poll registered devices.
        This value may be specified explicitly in the open statement
        or overridden by using the command-line -t option.
```

```
        The changer-special-file-name, on Microsoft Windows NT 4.0, is
        in the form of lbw.x.y.z, w is the device SCSI ID, x is the
        changer device LUN (usually 1), y is the adapter SCSI bus
        (usually 0), and z is the port number where the SCSI adapter
        resides.  These values are assigned during the boot process and
        can be found by using the interactive modes option 50 poll
        registered devices. This may also contain the value def_lun_1 in
        which case the utility will open LUN 1 associated with the
        tape-special-file-name.  This value may be specified explicitly
        in the open statement or overridden by using the command-line
        -c option. If this value is specified, the tape-special-file-name
        must be specified.

        The changer-special-file-name, on Microsoft Windows 2000, is in
        the form of Changern, and n is a numeric value from 0...x, the
        value is assigned by the device driver during the boot process
        and can be found by using the interactive modes option 50 poll
        registered devices.  This value may be specified explicitly in the
        open statement or overridden by using the command-line -t option.
        You must stop the Removable Storage Manager (RMS) before opening
        the changer device on Windows 2000.

        for example,
              open RW         means open the default tape-special-file-name
                              and changer-special-file-name if in library
                              mode or those special file names specified
                              by the -t and -c options

              open tapex RW   means open tapex and if in library mode
                              the default changer-special-file-name.
                              The -t and -c options will override tapex
                              and lbw.x.y.z. The mode will be RW.

              open tapex lbw.x.y.z RW
                              means open tapex and if in library mode
                              the changer special file lbw.x.y.z.
                              The -t and -c options will override  tapex
                               and lbw.x.y.z. The mode will be RW.

  FUNCTION Tested:
```

This command calls the device driver CreateFile() entry point and attempts to open a tape device special file for LUN0 and LUN1.

poll_devices

```
 SYNTAX: poll_devices

        for example, poll_devices

FUNCTION Tested:
```

This command searches the following registry key: "HARDWARE\\DEVICEMAP\\Scsi\\Scsi Port W\\Scsi Bus X\\Target Id Y\\ Logical Unit Id Z" for devices supported by the IBM Ultrium drivers. This command then attempts to open each of the devices found and issue INQUIRY and TEST UNIT READY SCSI commands to each open device. The status of all the devices will be printed on the screen. Executing this command will close all currently open devices. If another application is using the device, this command will not be able to query the status of that device.

read

```
 SYNTAX: read
        read records = n

        for example, read records = 2

FUNCTION Tested:
```

This command calls the device driver ReadFile() entry point and attempts to read from the tape device special file opened previously. The amount of data to be read will depend of the current settings of the block_size and block_count variables and on the number of records specified.

This command transfers **n** records. A record will have a length of block_size*block_count for fixed block mode and block_count for variable mode. For example, if block_size=1024, block_count=2 and records=3, then three 2048 transfers will be done. If the operation succeeds, the RC will show the total number of bytes transferred.

read_block_id

```
SYNTAX: read_block_id

        for example, read_block_id

FUNCTION Tested:
```

This command calls the device driver GetTapePosition() entry point with an operation of TAPE_LOGICAL_POSITION. This attempts to read the current block ID value for the cartridge in the tape device special file opened previously.

read_dump

```
 SYNTAX: read_dump
        read_dump dump_name = string

        for example, force_dump dump_name = fsc0000

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an operation of IOCTL_SCSI_PASS_THROUGH and a CDB[0] of SCSIOP_READ_DATA_BUFF. This reads the dump data and writes it to a file specified by dump name or to a dump0000.dmp default file (only the file name is specified). The dump is written into the directory where NTUTIL was started.

read_write (test)

```
 SYNTAX: read_write

        for example, read_write

FUNCTION Tested:
```

This command performs the following test on the cartridge in the tape device special file opened previously:

1. Rewind the tape.
2. Set Media Parameters to fixed block 32K.
3. Write a 32K random data block on tape.
4. Rewind the tape.
5. Read the block and compare the data to the data written in step 3.

restore_data

```
 SYNTAX: restore_data
        restore_data file_name=string

        for example, read_data file_name=fsc0000

FUNCTION Tested:
```

This command calls the device driver ReadFile() entry point. This attempts to perform 64 KB variable block read operations on the tape device special file until either a filemark or an end of data is detected. All the data read, regardless of error, is saved in the file specified. If there is no data on the tape, the command will fail, and no data will be saved. The RC should be ignored in most cases, because this operation always ends with an error (either filemark detected or end of data detected).

return_error

```
 SYNTAX: return_error_state

        for example, return_error_state

FUNCTION Tested:
```

This command calls GetLastError(). If the command is successful, the information returned will be displayed. There is no RC for this function.

return_lib_inventory_all

```
SYNTAX: return_lib_inventory_all

        for example, return_lib_inventory_all

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an opcode of LIBRARY_INVENTORY and attempts to return information about all the hardware components in a library. If this command is successful, the information returned will be displayed. For Windows NT, see the appropriate hardware manuals for a description of the information returned by a read element status command.

In Windows 2000, RSM must be stopped to issue this command. A remapped inventory is returned, where one element is returned per line.

Each line has the following format:

Type: n, Addr: hex-value, “Empty” or “Full”, access-type on a new line

- n is 2, 3, or 4, which indicate SE (ChangerSlot), IEE (ChangerIEPort), or DTE (ChangerDrive), respectively.
- hex-value is a hexadecimal value that indicates the mapped address of the item. This mapped address is used for medium operations on Windows 2000, which id differently from using the actual hardware element addresses on Windows NT.
- Empty or Full indicates whether the element is occupied. Note that if a cartridge is in the drive, “Empty” is returned.
- access-type will be set to “Access” if the element is accessible, blank if not.

If tracing is enabled, the flags field for the element will be displayed after the element address. Potential values for this field are documented in the ELEMENT_STATU_abc constants in *ntddchgr.h*.

reverse_filemark

```
SYNTAX: reverse_filemark n

        for example, reverse_filemark 2

FUNCTION Tested:
```

This command calls the device driver SetTapePosition() entry point with an operation of TAPE_SPACE_FILEMARKS and a count of **n** and attempts to backward space **n** files on the cartridge in the tape device special file opened previously.

reverse_record

```
SYNTAX: reverse_record n

        for example, reverse_record 2

FUNCTION Tested:
```

This command calls the device driver SetTapePosition() entry point with an operation of TAPE_SPACE_RELATIVE_BLOCKS and a count of **n** and attempts to backward space **n** records on the cartridge in the tape device special file opened previously.

rewind

```
 SYNTAX: rewind

        for example, rewind

FUNCTION Tested:
```

This command calls the device driver SetTapePosition() entry point with an operation of TAPE_REWIND and attempts to rewind the tape device special file opened previously. Status is presented when the rewind is complete.

set_device_parameters (compression)

```
 SYNTAX: set_device_parameters compression = n

        for example, set_device_parameters compression = 0

FUNCTION Tested:
```

This command calls the device driver SetTapeParameters() entry point with an operation of SET_TAPE_DRIVE_INFORMATION. The compression value is a required parameter with the command.

compression - device compression on or off (0 for off, any other value on).

set_media_parameters (block size)

```
 SYNTAX: set_media_parameters block_size = n

        for example, set_media_parameters block_size = 0

FUNCTION Tested:
```

This command calls the device driver SetTapeParameters() entry point with an operation of SET_TAPE_MEDIA_INFORMATION. The block_size value is a required parameter with the command.

block_size - device block size setting (0 for variable).

space_eod

```
 SYNTAX: space_eod

        for example, space_eod

FUNCTION Tested:
```

This command calls the device driver SetTapePosition() entry point with an operation of TAPE_SPACE_END_OF_DATA and attempts to space to the end of data on the cartridge in the tape device special file opened previously.

test_unit_ready

```
 SYNTAX: test_unit_ready n

        for example, test_unit_ready 1

FUNCTION Tested:
```

This command calls the device driver DeviceIoControl() entry point with an operation of IOCTL_SCSI_PASS_THROUGH and a CDB[0] of SCSIOP_TEST_UNIT_READY. If the operation is not successful, the sense data will be displayed. Specify 0 to send the command to the drive. Specify 1 to send the command to the changer.

unload

```
 SYNTAX: unload

        for example, unload

FUNCTION Tested:
```

This command calls the device driver PrepareTape() entry point with an operation of TAPE_UNLOAD. This attempts to rewind and unload the tape device special file opened previously.

update_code

```
 SYNTAX: update_code image_name = string

        for example, update_code image_name = d0i9_430

FUNCTION Tested:
```

This command is used to update the microcode and calls the device driver DeviceIoControl() entry point with an operation of IOCTL_SCSI_PASS_THROUGH and a CDB[0] of SCSIOP_WRITE_DATA_BUFF. The filename portion of the image name must be specified and is read from the directory where NTUTIL was started. The file extent must be **.fmr** for the file.

write

```
SYNTAX:  write
         write records = n
         write records = n  data = m

         for example, write records = 3 data = 888

FUNCTION Tested:
```

This command calls the device driver WriteFile() entry point and attempts to write to the tape device special file opened previously. The amount of data to be written will depend of the current settings of the block_size and block_count variables and on the number of records specified.

This command transfers **n** records. A record will have a length of block_size * block_count for fixed block mode, and block_count for variable mode. For example, if block_size=1024, block_count=2 and records=3, then three 2048 transfers will be done. If the operation succeeds, the RC will show the total number of bytes transferred.

If the records attribute is not specified, the default is 1.

Each record written will have random bytes preceded by an integer identifier. If the data attribute is not specified, the identifier will be a unique sequential counter. This can be overridden by specifying **data=**. You can look for this value on a read command by specifying, for example, result data=888. If data is specified, the record count **must** be specified. Data can be a decimal value from 0 to 4294967295.

write_filemark

```
SYNTAX: write_filemark n

        for example, write_filemark 2   (write 2 file marks)

FUNCTION Tested:
```

This command calls the device driver WriteTapemark() entry point with an operation of TAPE_FILEMARKS and a count of **n**. This attempts to write **n** filemarks on the tape media.

Supported Result-Text Fields

The result-text on a command statement tests the completion status for an expected result. Further execution of a test case is affected by the current settings of the return_error_when_fail and exit_on_unexpected_result variables. These can be set using a set statement.

If no result-text is specified, the command will always be treated as successful.

In the case of rc, except as noted in the command section, a failure will return -1, else the operation succeeded.

The syntax for result text is:

```
< rc <  n> <err <  n> <cc <  n>
    >          >         >
    <=         <=        <=
    >=         >=        >=
    ==         ==        ==
    !=         !=        !=
```

where:

```
 rc   = return code from the last command.
 err  = Operating System GetLastError() value for the last command.
 data = expected record identifier for a read command.
```

For example, consider this statement in the input file:

```
command write 1 result rc == -1 err == WRITE_PROTECT
```

This means we will try to write one record to tape and we expect this to fail with return code -1, err WRITE_PROTECT.

Note: Symbolic values or integers can be used for *err*. For a list of recognized symbolic values, see Figure 51 on page 210.

set

This statement allows setting of variables that affect how tests are executed. The syntax for a set statement is:

```
set variable = value
```

```
for example, set return_error_when_fail = 1
```

The following variables can be set:

return_error_when_fail
Can be set to 1 (true) or 0 (false). A setting of true means NTUTIL will end by returning an error at the end of the test if any command does not produce a correct expected result as specified in result text.

exit_on_unexpected_result
Can be set to 1 (true) or 0 (false). If set to true, the first occurrence of an unexpected result will terminate the test.

block_id
Can be set to a four-byte hex value (for example, 0001aa03). This value is used on a locate_block_id command.

block_size
Block size to be used for reading, writing, or set_mode. Can be set to 0 to indicate variable block mode.

type

Text following the word **type** is typed on the terminal. This can be used to show the progress of the test or to prompt for a subsequent pause statement.

```
type string
```

```
for example, type tell operator its lunch time
```

pause

The test stops until a character is typed at the terminal. This allows for tests that require manual intervention.

delay

The test stops for **n** seconds. This allows for tests that require delay for mechanical completion before continuing. The syntax for the delay statement is:

```
delay value
```

```
for example, delay 1
```

system

Text following the word system is passed to the system for execution. The syntax for the system statement is:

```
system operation
```

```
for example, system dir
```

symbols

This statement prints the symbol list that may be used in result-text fields.

exit

This statement causes immediate termination of the batch test. No further lines will be read from the input file.

Symbolic Values

Figure 51 shows the values (symbolic error or error number) that can be used for *err*.

Symbolic Error	NT/Win2000 Error Number
ERROR_SUCCESS	0
ERROR_INVALID_FUNCTION	1
ERROR_FILE_NOT_FOUND	2
ERROR_PATH_NOT_FOUND	3
ERROR_TOO_MANY_OPEN_FILES	4
ERROR_ACCESS_DENIED	5
ERROR_INVALID_HANDLE	6
ERROR_NOT_ENOUGH_MEMORY	8
ERROR_BAD_FORMAT	9
ERROR_INVALID_BLOCK	10
ERROR_BAD_ENVIRONMENT	11
ERROR_INVALID_ACCESS	12
ERROR_INVALID_DATA	13
ERROR_OUTOFMEMORY	14
ERROR_INVALID_DRIVE	15
ERROR_WRITE_PROTECT	19
ERROR_BAD_UNIT	20
ERROR_NOT_READY	21
ERROR_BAD_COMMAND	22
ERROR_CRC	23
ERROR_HANDLE_EOF	38
ERROR_NOT_SUPPORTED	50
ERROR_DEV_NOT_EXIST	55
ERROR_ALREADY_ASSIGNED	85
ERROR_INVALID_PARAMETER	87
ERROR_OPEN_FAILED	110
ERROR_INSUFFICIENT_BUFFER	122
ERROR_INVALID_NAME	123
ERROR_BUSY_DRIVE	142
DD_NO_SENSE	200
DD_DEVICE_DRIVER_FAILURE	201
DD_EEPROM_FAILURE	202

Figure 51. Symbolic Values (Part 1 of 3)

Symbolic Error	NT/Win2000 Error Number
DD_MANUAL_INTERVENTION	203
DD_RECOVERED_ERROR	204
DD_SCSI_ADAPTER_ERROR	205
DD_SCSI_ERROR	206
DD_SCSI_BUSY	211
DD_ILLEGAL_REQUEST	207
DD_COMMAND_ABORTED	208
DD_HARDWARE_MICROCODE	209
DD_UNIT_ATTENTION	210
ERROR_MORE_DATA	234
DD_CARTRIDGE_ENTRY_FAILURE	300
DD_CARTRIDGE_LOAD_FAILURE	301
DD_CARTRIDGE_IN_FAILED_DRIVE	302
DD_CAROUSEL_NOT_LOADED	303
DD_CHANGER_FAILURE	304
DD_DRIVE_FAILURE	305
DD_DRIVE_OR_MEDIA_FAILURE	306
DD_ENTRY_EXIT_FAILURE	307
DD_ENTRY_EXIT_NOT_PRESENT	308
DD_LIBRARY_AUDIT	309
DD_LIBRARY_FULL	310
DD_MEDIA_EXPORT	311
DD_SLOT_FAILURE	312
DD_SLOT_OR_MEDIA_FAILURE	313
DD_SOURCE_EMPTY	314
DD_DESTINATION_FULL	315
DD_CLEANER_INST	316
DD_MEDIA_NOT_EJECTED	317
DD_IOPORT_NOT_CONFIG	318
DD_FIRST_DEST_EMPTY	319
DD_END_PHYSICAL_MEDIA	400
DD_MEDIA_BLANK	401
DD_MEDIA_CORRUPTED	402
DD_MEDIA_FAILURE	403
DD_MEDIA_INCOMPATIBILITY	404
DD_SECTOR_RELOCATION	405
DD_SECTOR_OUT_OF_RANGE	406
DD_WRITE_PROTECT	407
DD_CLEAN_MEDIA	408
DD_MEDIA_FAULT	409
DD_CLEANING_COMPLETE	410
DD_LOGICAL_END_OF_MEDIA	411
DD_MEDIA_NOT_PRESENT	412
DD_BEGINNING_OF_MEDIA	413

Figure 51. Symbolic Values (Part 2 of 3)

Symbolic Error	NT/Win2000 Error Number
DD_ERASE_FAILURE	414
DD_WRITE_TO_WRITTEN_WORM	415
DD_WRONG_LENGTH_BLOCK	416
ERROR_IO_INCOMPLETE	996
ERROR_IO_PENDING	997
ERROR_NOACCESS	998
ERROR_CANTOPEN	1011
ERROR_CANTREAD	1012
ERROR_CANTWRITE	1013
ERROR_END_OF_MEDIA	1100
ERROR_FILEMARK_DETECTED	1101
ERROR_BEGINNING_OF_MEDIA	1102
ERROR_SETMARK_DETECTED	1103
ERROR_NO_DATA_DETECTED	1104
ERROR_PARTITION_FAILURE	1105
ERROR_INVALID_BLOCK_LENGTH	1106
ERROR_DEVICE_NOT_PARTITIONED	1107
ERROR_UNABLE_TO_LOCK_MEDIA	1108
ERROR_UNABLE_TO_UNLOAD_MEDIA	1109
ERROR_MEDIA_CHANGED	1110
ERROR_BUS_RESET	1111
ERROR_NO_MEDIA_IN_DRIVE	1112
ERROR_IO_DEVICE	1117
ERROR_TOO_MANY_LINKS	1142

Figure 51. Symbolic Values (Part 3 of 3)

Device Driver Diagnosis Information

There is a debug version of the device driver that can be used if you encounter difficulties with the device driver. The debug version of the driver issues DbgPrint messages at various places during device driver execution. To capture these messages, you will need to start a debugger or use a tool like DebugMon, available from Open Systems Resources, Inc. (http://www.osr.com).

To install and use the debug version of the device driver, perform the following steps:

1. Quiesce all activity on Ultrium devices.
2. Exit all applications using Ultrium devices.
3. Stop the Ultrium device driver (*IBMtape.sys*). See "Manual Starting and Stopping Procedures" on page 158 for details on stopping the driver.
4. Find the *...\checked* directory for the device driver level that you are running. If you chose the default installation location when you installed the drivers, the debug drivers will be found at *c:\Program files\IBM*

Corporation\IBM Ultrium Device Drivers\n.n.n.n\checked, where n.n.n.n are integers that indicate the driver level. To determine the driver level, find *c:\winnt\system32\drivers\ibmtape.sys* using Windows Explorer, right-click the file, select **Properties**, then select the **Version** tab. If you do not find a ...*checked* directory for your driver, you must install the **Device Driver Depot** component of the Ultrium Device Driver Installation Package.

5. c:
6. cd \winnt\system\drivers
7. copy IBMtape.sys ibmtape.orig
8. Copy *IBMtape.sys* from the appropriate ...*checked* directory to *c:\winnt\system32\drivers\ibmtape.sys*. For example, if you installed the device drivers at the default installation location and your driver level was 1.1.6.9, you would issue the following command: *copy c:\Program files\IBM Corporation\IBM Ultrium Device Drivers\1.1.6.9\checked\IBmtape.sys c:\winnt\system32\drivers\ibmtape.sys*.
9. Start the debugger or tool that captures the DbgPrint messages.
10. Start the Ultrium device driver. See "Manual Starting and Stopping Procedures" on page 158 for details on starting the driver.

Registry variable
HKEY_LOCAL_MACHINE/SYSTEM/CurrentControlSet/Services/Ultrium/MsgLevel
determines how many messages are issued by the debug version of the driver. When the debug version of the driver is started for the first time, it defines the registry variable and sets its value to 2. This variable is ignored by the non-debug version of the driver.

The customer may set the value of this variable, using regedt32, to any value from REG_DWORD 0x0 to REG_DWORD 0x5, inclusive. The greater the value, the more messages will be issued.

To restore the non-debug version of the driver, perform the following steps:

1. Quiesce all activity on Ultrium devices.
2. Exit all applications using Ultrium devices.
3. Stop the Ultrium device driver (*IBMtape.sys*). See "Manual Starting and Stopping Procedures" on page 158 for details on stopping the driver.
4. c:
5. cd \winnt\system\drivers
6. copy ibmtape.orig IBMtape.sys
7. Start the Ultrium device driver. See "Manual Starting and Stopping Procedures" on page 158 for details on starting the driver.

The link maps for the driver and the debug version of the driver are stored on the installation diskette in the maps directory. The *ibmtape.fre* file is the map

for the regular version of the driver. The *ibmtape.chk* file is the map for the debug version of the driver.

Part 6. Appendixes

Appendix A. Accessing Documentation and Software Online

IBM maintains the latest levels of its device and library drivers and documentation on the Internet. You can access this material from your favorite browser or through the IBM ftp site.

From a World Wide Web browser, use one of the following URLs:

```
ftp://ftp.software.ibm.com/storage/devdrvr
ftp://207.25.253.26/storage/devdvr
```

From an FTP session, use the following specifications:

```
FTP site:   ftp.software.ibm.com
IP Address: 207.25.253.26
User ID:    anonymous
Password:   (Use your current e-mail address.)
Directory:  /storage/devdrvr
```

We provide Postscript- and PDF-formatted versions of our documentation in the */storage/devdrvr* directory.

The *IBM_ultrium_tape_IUG.pdf* and *IBM_ultrium_tape_IUG.ps* files contain the current version of the *IBM Ultrium Device Drivers: Installation and User's Guide.*

The *IBM_ultrium_tape_PROGREF.pdf* and *IBM_ultrium_tape_PROGREF.ps* files contain the current version of the *IBM Ultrium Device Drivers: Programming Reference.*

Device and Library Drivers for each supported platform can be found beneath */storage/devdrvr/* in the following directories:

```
AIX/
HPUX/
Solaris/
WinNT/
Win2000/
```

There are numeric sequence numbers in each level of device and library driver, that is, *AIX/Atape.4.4.0.0.bin*. When a new level of a driver is released, a higher numeric sequence is assigned.

The following table documents each driver by name and description:

Note: The *n.n.n.n.* strings are replaced with digits on the FTP site to reflect the version of each driver.

AIX/Atape.n.n.n.n.bin	AIX Device Driver (Atape)
HPUX/atdd.n.n.n.n.bin	HP-UX Device Driver (ATDD)
Solaris/IBMtape.n.n.n.n.bin	Solaris Device Driver (IBMtape)
WinNT/IBMUltrium.WinNT.exebin	Windows NT device Driver (IBMtape)
Win2000/IBMUltrium.Win2k.exebin	Windows 2000 Device Driver (IBMtape)

Appendix B. Verifying Proper Attachment of Your Devices

Before you start to use your devices for production work with your applications, or if you encounter difficulties with your devices, you may want to verify that the hardware, connections, and device drivers are working together properly. Before you can do this, you must do the following:

1. Install your hardware as indicated in the appropriate hardware manuals.
2. Power on your hardware and verify that the hardware is functioning properly by executing commands from the front panel.
3. Attach your hardware to the host system as indicated in the appropriate hardware manuals and as indicated in the appropriate chapters from this manual.
4. Start your operating system as indicated in the appropriate chapters from this manual.
5. Log on the operating system as Administrator.
6. If your device is using device drivers other than the ones documented in this manual, disable the other device drivers and install or enable the drivers documented in this manual.
7. Follow the subsequent instructions for your host system.

AIX System

Tape Device Attachment Test

The following procedure tests the attachment of a tape device to an AIX system. The procedure assumes that your device is attached at */dev/rmt0* and that there is no cartridge in the drive.

When the **Hit <Enter> to Continue . . . ?** message is displayed or when you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Open an AIX window.
2. If you want to perform a more complete test and your device has an autoloader, use the instructions in “Medium Changer Device Attachment Test” on page 220 to mount a writable scratch cartridge in the drive. This is accomplished by following the steps in the procedure, except that in steps 11 and 12, select the element ID of a drive rather than the unoccupied slot ID.

If you want to perform a more complete test and your device does not have an autoloader, mount a writable scratch cartridge manually into the driver.

3. Enter *tapeutil*. A menu will be displayed.
4. Enter 1 (Open a Device).
5. Enter */dev/rmt0* when prompted for the device name.
6. Enter 1 (Read/Write).
7. Enter 3 (Device Info).
8. Enter 5 (Inquiry). Specify 0 when prompted for an inquiry page. This concludes a very basic test of the device, SCSI connection, and the device driver. You may stop the test here or continue to perform a more complete test.
9. Enter 6 (Test Unit Ready) until no error occurs.
10. Enter 22 (Rewind).
11. Enter 30 (Read and Write Tests).
12. Enter 1 (Read/Write). Press the **Enter** key three times to accept the defaults and run the test.
13. Enter 31 (Unload Tape).
14. Enter 2 (Close a Device).
15. Enter Q (Quit Program).

Medium Changer Device Attachment Test

The following procedure tests the attachment of a medium changer device to an AIX system. The procedure assumes that your device is attached at */dev/rmt0*. You also need a cartridge in at least one of the slots.

When the **Hit <Enter> to Continue . . .?** message is displayed or when you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Open an AIX window.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 1 (Open a Device).
4. Enter */dev/rmt0* when prompted for the device name.
5. Enter 1 (Read/Write).
6. Enter 3 (Device Info).
7. Enter 5 (Inquiry). Specify 0 when prompted for an inquiry page. This concludes a very basic test of the device, SCSI connection, and the device driver. You may stop the test here or continue to perform a more complete test.
8. Enter 6 (Test Unit Ready) until no error occurs.

9. Enter 18 (Initialize Element Status).
10. Enter 14 (Element Inventory).
11. From the output of the previous step, select a writable, scratch cartridge and determine its element ID. Also, select the element ID of an unoccupied slot.
12. Enter 16 (Move Medium), then supply the address of the cartridge, followed by the address of the unoccupied slot. Verify that the cartridge moved.
13. Enter 14 (Element Inventory). Verify that the inventory was updated properly.
14. Enter 2 (Close a Device).
15. Enter Q (Quit Program).

Solaris System

Tape Device Attachment Test

The following procedure tests the attachment of a tape device to a Solaris system. The procedure assumes that your device is attached at */dev/rmt/0st*. When you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Bring up a shell prompt.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 1 (Open a Device).
4. Enter */dev/rmt/0st* when prompted for the device name.
5. Enter 1 (Read / Write).
6. Enter D (Device Info).
7. Enter 10 (Inquiry).
8. Enter Q to quit *tapeutil*.

Autochanger Device Attachment Test

The following procedure tests the attachment of an autochanger device to a Sun Solaris system. The procedure assumes that your device is attached at */dev/rmt/0st*. You also need a cartridge in at least one of the slots.

When you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Bring up a shell prompt.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 1 (Open a device).

4. Enter */dev/rmt/0st* when prompted for the device name.
5. Enter 1 (Read / Write).
6. Enter D (Device Info).
7. Enter 5 (Inquiry). This concludes a very basic test of the device, SCSI connection, and the device driver. You may stop the test here or continue to perform a more complete test.
8. Enter 6 (Test Unit Ready) until no error occurs.
9. Enter 17 (Element Inventory).
10. From the output in the previous step, select a writable, scratch cartridge and determine its element ID. Also, select the element ID of an unoccupied slot.
11. Enter 14 (Move Medium), then supply the address of the cartridge and the address of the unoccupied slot. Verify that the cartridge moved.
12. Enter 17 (Element Inventory).
13. Verify that the inventory was updated properly.
14. Enter 2 (Close a Device).
15. Enter Q (Quit Program).

HP-UX System

Tape Device Attachment Test

The following procedure tests the attachment of a tape device to an HP-UX system. The procedure assumes that your device is attached at */dev/rmt/0m*.

When you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Bring up a shell prompt.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 1 (Open a Device).
4. Enter */dev/rmt/0m* when prompted for the device name.
5. Enter 1 (Read / Write).
6. Enter D (Device Info).
7. Enter 10 (Inquiry).
8. Enter Q to quit *tapeutil*.

Autochanger Device Attachment Test

The following procedure tests the attachment of an autochanger device to an HP-UX system. The procedure assumes that your device is attached at */dev/rmt/0m*. You also need a cartridge in at least one of the slots.

When you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Bring up a shell prompt.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 1 (Open a Device).
4. Enter */dev/rmt/0m* when prompted for the device name.
5. Enter 1 (Read / Write).
6. Enter D (Device Info).
7. Enter 5 (Inquiry). This concludes a very basic test of the device, SCSI connection, and the device driver. You may stop the test here or continue to perform a more complete test.
8. Enter 6 (Test Unit Ready) until no error occurs.
9. Enter 17 (Element Inventory).
10. From the output in the previous step, select a writable, scratch cartridge and determine its element ID. Also, select the element ID of an unoccupied slot.
11. Enter 14 (Move Medium), then supply the address of the cartridge and the address of the unoccupied slot. Verify that the cartridge moved.
12. Enter 17 (Element Inventory). Verify that the inventory was updated properly.
13. Enter 2 (Close a Device).
14. Enter Q (Quit Program).

Microsoft Windows System

Tape Device Attachment Test

The following procedure tests the attachment of a tape device to a Microsoft Windows system. The procedure assumes that your device is attached at *tape0* and that there is no cartridge in the drive.

When the **Return to continue:** message is displayed or when you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Open a Windows command shell window.
2. If you want to perform a more complete test and your device has an autoloader, use the instructions in “Autochanger Device Attachment Test - Windows NT only” on page 224 to mount a writable scratch cartridge in

the drive. This is accomplished by following the steps in the procedure, except that in steps 11 and 12, select the drive address rather than the unoccupied slot address.

If you want to perform a more complete test and your device does not have an autoloader, mount a writable scratch cartridge manually into the drive.

3. Enter *ntutil*.
4. Select 1 (Manual test).
5. Enter 50 (poll registered devices). Reply with 0 (zero) to the *Drive=0, Library=1* prompt. All devices detected by the SCSI Adapters (that were attached and powered-on at system boot time) should be displayed.
6. Enter 20 (open).
7. Enter 1 (RW).
8. Enter 49 (inquiry). Reply with 0 (zero) to the *Drive=0, Library=1* prompt. This step concludes a very basic test of the device, SCSI connection, and the device driver. You may stop the test here or continue to perform a more complete test.
9. Enter 39 (test unit ready) until no error occurs. Each time you are prompted with the *Drive=0, Library=1* prompt, reply with 0 (zero).
10. Enter 31 (rewind).
11. Enter 87 (Read / Write Test). Enter Y in response to the confirmation message.
12. Enter 33 (unload).
13. Enter 21 (close).
14. Enter 99 (return to main menu).
15. Enter 9 (Exit *ntutil*).

Autochanger Device Attachment Test - Windows NT only

The following procedure tests the attachment of an autochanger device to a Microsoft Windows system. The procedure assumes that your device is attached at *lb1.0.0.1* and that the tape device is attached at *tape0*. You also need a cartridge in at least one of the slots. If you are using Microsoft Windows 2000, you must stop RSM to do this test.

When the **Return to continue:** message is displayed or when you are told to enter information, press the **Enter** key after following the instruction. When the utility displays information, use the appropriate hardware manual to verify that the information is reasonable.

1. Open a Windows command shell window.
2. Enter *ntutil*.
3. Select 1 (Manual Test).

4. Enter 50 (poll registered devices). All devices detected by the SCSI adapters (that were attached and powered-on at system boot time) should be displayed. You should see *lb1.0.0.1* in the list of found devices.
5. Enter 8 (Library Mode).
6. Enter 20 (open).
7. Enter 1 (Read / Write).
8. Enter 49 (inquiry). Reply with 1 (one) to the *Drive=0, Library=1* prompt. This concludes a very basic test of the device, SCSI connection, and the device driver. You may stop the test here or continue to perform a more complete test.
9. Enter 39 (test unit ready) until no error occurs. Each time you are prompted with the *Drive=0, Library=1* prompt, reply with 1 (one).
10. Enter 12 (*ioctl* initialize element status).
11. Enter 10 (*ioctl* return library inventory).
12. From the output in the previous step, select a writable, scratch cartridge and determine its address. Also, select the address of an unoccupied slot.
13. Enter 11 (*ioct*l move medium), then supply the address of the cartridge and the address of the unoccupied slot. Verify that the cartridge moved.
14. Enter 10 (*ioctl* return library inventory). Verify that the inventory was updated properly.
15. Enter 21 (close).
16. Enter 99 (return to main menu).
17. Enter 9 (Exit *ntutil*).

Appendix C. Managing the Microcode on the IBM Tape Drive

Microcode is computer software that is stored in nonvolatile storage on your tape device or library hardware. It controls the operation of your hardware. When your tape device or library hardware was manufactured, a microcode load was installed and shipped with your device.

If you are having trouble with your hardware, IBM service personnel will ask you what level of microcode you have on your hardware. If they believe you need a new level of microcode, they may instruct you to install a newer level of microcode on your hardware. They will provide you with updated microcode.

You can query the current level of microcode by issuing commands on the front panel of your hardware. Consult the appropriate hardware reference manual for specific instructions on querying your microcode level.

You can also query the last four digits of the current level of microcode using software if your device is connected to a host system that has device or library support. The unit must be powered-on, configured properly, and ready. See the appropriate chapter in this book (based on the host system that your hardware is attached to) for details on how to have the device ready.

AIX	Use the *tapeutil* command with the vpd subcommand. See the Revision Level output field.
Sun Solaris	Use the *tapeutil -f drive -o qmc -v* command where *drive* is the device special file of the attached tape device.
HP-UX	Use the *tapeutil -f drive -o qmc -v* command where *drive* is the device special file of the attached tape device.
Microsoft Windows	Use the *ntutil* command with the inquiry subcommand. See the **Microcode Revision Level** output field.

The following instructions guide you to install another version of microcode on your tape drive:

1. Ensure that the tape drive is connected to a host system and that the tape device driver is powered-on and configured properly with no tape cartridge in the drive. Follow the instructions in “Appendix B. Verifying Proper Attachment of Your Devices” on page 219 to ensure that the drive is configured properly and ready.
2. Follow the platform-specific instructions.

AIX System

1. Open an AIX window.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 4 (Tape Drive Service Aids).
4. Select Microcode Load.
5. Select the device special file identifier for the device on which to load the microcode, then press the **Enter** key.
6. Specify the special file from where the microcode image is to be read, then press F7 (Commit) to load the microcode onto the drive. When the loading is complete, press F10 (Exit) to return to *tapeutil*.
7. Enter Q (Quit Program).

Sun Solaris System

This procedure assumes that the */dev/rmt/0st* tape device is being updated.

1. Bring up a shell prompt.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 1 (Open a Device).
4. Enter */dev/rmt/0st* when prompted for the device name.
5. Enter 1 (Read / Write).
6. Select 7 (Download Microcode).
7. Specify the special file from which the microcode image is to be read, then press the **Enter** key.
8. Enter Q (Quit Program).

HP-UX System

This procedure assumes that the */dev/rmt/0m* device is being updated.

1. Bring up a shell prompt.
2. Enter *tapeutil*. A menu will be displayed.
3. Enter 1 (Open a Device).
4. Enter */dev/rmt/0st* when prompted for the device name.
5. Enter 1 (Read / Write).
6. Select 7 (Download Microcode).
7. Specify the special file from which the microcode image is to be read, then press the **Enter** key.
8. Enter Q (Quit Program).

Microsoft Windows System

This procedure assumes that the new microcode is stored in *c:\mydata\d0i9_430.fmr* and that the drive at *tape0* is being updated. The name of the file containing the microcode must have the *fmr* extension.

1. Open a Windows command shell window.
2. Change to the *c:\mydata* directory.
3. Enter *ntutil*.
4. Select 1 (Manual test).
5. Enter 20 (open).
6. Enter 1 (Read/Write).
7. Enter 39 (test unit ready) until a *not ready* error is reported.
8. Enter 82 (Update MicroCode).
9. Enter *d0i9_430*.
10. Enter 21 (close).
11. Enter 99 (return to main menu).
12. Enter 9 (Exit *ntutil*).

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Readers' Comments — We'd Like to Hear from You

IBM Ultrium Device Drivers
Installation and User's Guide

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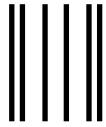

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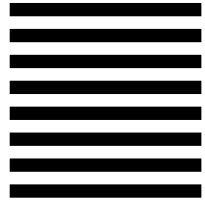

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