HP Ultrium tape drives technical reference manual

Generation 3 drives

volume 5: UNIX configuration guide

Legal and notice information

Revision history

Version	Date	Changes
Edition 6	September 2004	Generation 3 SCSI and FC drive version
Edition 6.2	May 2005	Reformatted and updated
Edition 6.3	November 2005	Small change to IBM configuration procedure
Edition 6.4	May 2006	Modifications to the HP-UX chapter

This document is frequently revised and updated. To find out if there is a later version, please ask your HP OEM Representative.

HP Ultrium drives technical reference manual, volume 5: UNIX configuration guide

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Related documents

The following documents provide additional information:

Documents specific to HP Ultrium drives

- *Hardware Integration Guide*, volume 1 of the HP Ultrium Technical Reference Manual
- *Software Integration Guide*, volume 2 of the HP Ultrium Technical Reference Manual
- *SCSI Interface*, volume 3 of the HP Ultrium Technical Reference Manual
- *HP Ultrium Configuration Guide*, volume 5 of the HP Ultrium Technical Reference Manual
- *Background to Ultrium Drives*, volume 6 of the HP Ultrium Technical Reference Manual

Please contact your HP supplier for copies.

- The features and benefits of HP Ultrium drives are discussed in the HP Ultrium Technology White Paper.
- For a general background to LTO technology and licensing, go to http://www.lto-technology.com.

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General documents and standardization

See http://www.t10.org/t10_main.htm for INCITS SCSI Primary Commands—3 (SPC-3) and other specifications

Copies of documents of other standards bodies can be obtained from:

INCITS	11 West 42nd Street New York, NY 10036-8002 USA	
ISO	CP 56 CH-1211 Geneva 20 Switzerland	
ECMA	114 Rue du Rhône CH-1204 Geneva Switzerland	Tel: +41 22 849 6000 Web URL: http://www.ecma.ch
Global Engineering Documents	2805 McGaw Irvine, CA 92714 USA	Tel: 800 854 7179 or 714 261 1455

1   Introduction

Purpose of this manual

This manual provides basic information on configuring the drives with various operating systems.

See the top-level release notes that accompany the drive for expected functionality and features.

Ultrium drives are supported on the following platforms:

- HP UNIX systems (HP-UX) (Chapter 2)
- HP Alpha UNIX (Chapter 3)
- IBM (AIX) (Chapter 4)
- Linux (Chapter 5)
- Sun Systems, Solaris 8, 9, 10 (Chapter 6)

For platforms not mentioned here, contact HP because there may be new connectivity details available that arrived after the release notes were published.

See Chapter 7 for details of how to verify the installation.

Ultrium drives in a library

Although Ultrium drives may also be used in a library, instructions about installing device drivers for automatic robotics are not included in this manual.

Backup applications

For optimum performance it is important to use a backup application that supports the drive's features within your system's configuration. See the *Getting Started Guide* for more information about usage models.

The following applications are suitable for use within an Enterprise environment and have been tested with Ultrium drives. They use the operating system's standard, built-in device drivers, as described in this manual. For further information about optimizing performance and making full use of the drive's functions, contact the software manufacturer or HP.

	HP-UX	AIX	Sun, Solaris	Linux
HP Omniback [1]	yes	yes	yes	yes
Legato Networker	yes	yes	yes	yes
Veritas NetBackup	yes	yes	yes	yes [2]

1. Cell Manager is only available on HP-UX or Windows
2. Redhat Server only (not Caldera, SUSE, and so on)

2 HP-UX systems

HP servers and workstations—HP-UX 11.*x*

> **NOTE:** HP-UX 10.*x* is only supported by Generation 1 Ultrium drives.

Introduction

Before you install your tape drive log on to the HP web site, www.hp.com, and download the latest hardware enablement patch bundle for your operating system. This ensures that you will have the correct device driver for your tape drive.

Determining attached devices

After you have installed the new tape drive, you can check it has been attached successfully. From a shell window (`hpterm/xterm`), execute `ioscan` to display the list of attached devices.

```
# /sbin/ioscan –C tape –fn
```

The output should look similar to the following:

```
Class     I H/W Path   Driver      S/W State H/W Type  Description
===============================================================================
bc        0            root        CLAIMED   BUS_NEXUS
bc        1 8           bc          CLAIMED   BUS_NEXUS Psudo Bus Converter
ba        0 8/0         GSCtoPCI    CLAIMED   BUS_NEXUS GSCtoPCI Bridge
ext_bus   1 8/0/2/0     c720        CLAIMED   INTERFACE SCSI C895 Ultra2 Wide LVD
target    0 8/0/2/0.7   tgt         CLAIMED   DEVICE
ctl       1 8/0/2/0.7.0 sctl        CLAIMED   DEVICE    Initiator
lan       0 8/0/20/0    btlan3      CLAIMED   INTERFACE PCI(10110019) -- Built-in #1
ba        1 8/16        bus_adapter CLAIMED   BUS_NEXUS Core I/O Adapter
tty       0 8/16/4      asio0       CLAIMED   INTERFACE Built-in RS-232C
ext_bus   2 8/16/5      c720        CLAIMED   INTERFACE Built-in SCSI
target    1 8/16/5.5    tgt         CLAIMED   DEVICE
disk      0 8/16/5.5.0  sdisk       CLAIMED   DEVICE    SEAGATE ST34573N
target    2 8/16/5.7    tgt         CLAIMED   DEVICE
ctl       2 8/16/5.7.0  sctl        CLAIMED   DEVICE    Initiator
processor 0 62          processor   CLAIMED   PROCESSOR Processor
memory    0 63          memory      CLAIMED   MEMORY    Memory
tape      4 2/0/1.5.0   stape       CLAIMED   DEVICE    HP Ultrium 3-SCSI
```

> **NOTE:** If you are installing the drive onto a Storage Area Network (SAN), the fibre channel/SCSI bridge will also appear in the list of attached devices.

Adding stape and schgr (autoloader driver) to the kernel using sam

Run the `sam` utility from the command line. Sam runs as a mouse driven GUI (fig. 1) on a system with full graphics capability, or as a console text-based interface (fig. 2). If using the text-based interface, use the tab and arrow keys to navigate, and the return key to select.
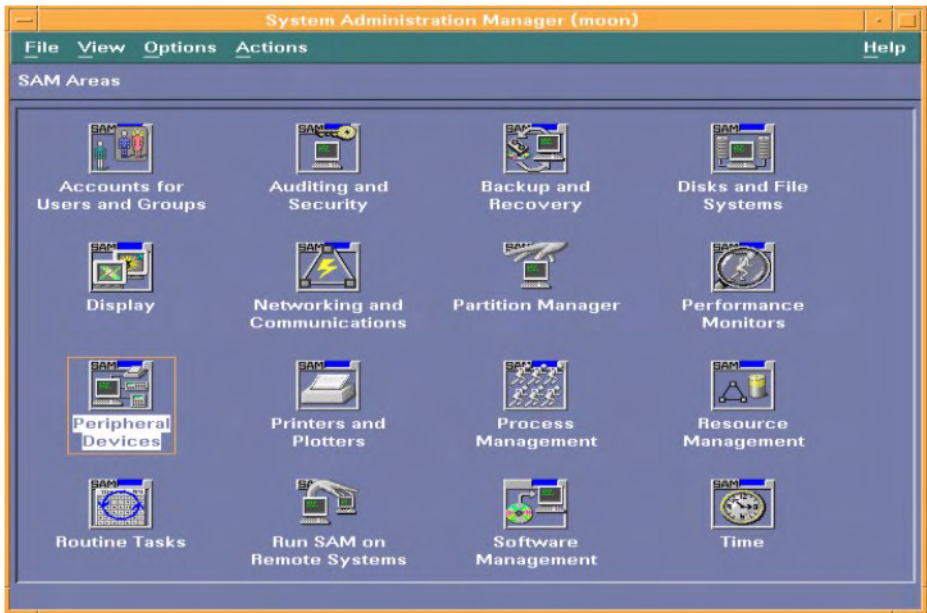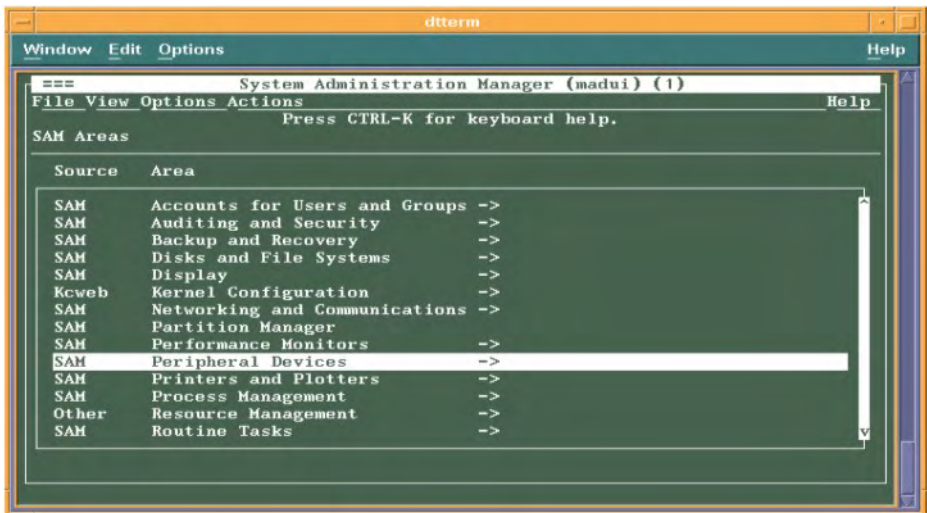
Figure 1 SAM GUI

Figure 2 SAM text-based interface

For HP-UX 11.11 (11i version 1)

1. Enter `sam` at the command line.
2. Select the following:

```
Kernel Configuration
Drivers
```

3. Highlight the `stape` or `schgr` driver. If the driver has not been added to the kernel, both Current State and Pending State will read "Out".

4. Select the following:

```
Actions
Add Driver to Kernel
```

The Pending State will now read "In".

5. To add the new driver to the kernel, select:

```
Actions
Create a New Kernel
```

The `stape` or `schgr` driver is added to the kernel.

6. Reboot the system.

For HP-UX 11.23 (11i version 2)

1. Enter sam at the command line.

2. Select the following:

```
Kernel Configuration
Kernel Configuration
Modules
```

3. Highlight the `stape` or `schgr` driver. If the driver has not been added to the kernel, both Current State and Planned State will read "unused".

4. Type "`m`" to modify the stape driver and "`s`" to set it to "static". The Planned State will now read "static".

5. Change `schgr` to "static" if you are going to attach an autoloader.

6. The `stape` and `schgr` drivers are now added to the kernel.

7. Reboot the system.

Add device files using sam

This is the recommended and simplest way to create device files. To add devices, proceed as follows:

1. `# sam`

This will bring up the graphical user interface for the utility.

2. Select the following:

```
Peripheral Devices
Tape Drives
```

`sam` will then scan the system for any tape drives connected.

When a HP Ultrium Generation 3 drive is found, for example, it will be displayed as:

```
Hardware Path        Driver        Description
==============================================================
8/0/2/0.3.0          stape         HP Ultrium 3-SCSI
```

3. Highlight the drive and select the following from the tool bar:

```
Actions
Create Device Files
Create Default Device Files
```

This will create default device files for the drive. To view the device files that have been created, select:

```
Actions
Create Device Files
Show Device Files
```

4. When you have exited `sam`, run `ioscan` to see the tape drive:

```
%/sbin/ioscan -C tape -fn
```

All default device files displayed have **compression enabled**.

NOTE: HP recommends the 'Berkeley' device files of most applications:
`cXtYdZBESTnb` = Berkeley, no rewind, best available density
`cXtYdZBESTb` = Berkeley, with rewind, best available density
where:
`X` = card number
`Y` = target number
`Z` = LUN number

What next?

Once device files have been created, you should confirm that your new tape drive is working properly. provides instructions on backing up and restoring a sample file to test your installation.

3 HP alpha UNIX

HP alpha UNIX 5.*x*

1. Add the following entry to your `/dev/ddr.dbase` file:

```
SCSIDEVICE
    Type = tape
    Name = "HP" "Ultrium"
#
PARAMETERS:
    TypeSubClass        = lto        # Linear Tape Open
    BlockSize           = 262144
    TagQueueDepth       = 0
    MaxTransferSize     = 0xffffff   # 16Mb - 1
    ReadyTimeSeconds    = 120        # Seconds
    SyncTransfers       = enabled
    WideTransfers       = enabled
    InquiryLength       = 0x20
DENSITY:
    DensityNumber       = 0,1,2,3,4,5,6,7
    OneFileMarkOnClose  = yes
    DensityCode         = 0x44
    Blocking            = 0
    CompressionCode     = 1
    Buffered            = 1
    Speed               = 0
MODESELECT:
    ModeSelectNumber    = 0
    SavePage            = No
    PageFormat          = scsi2
    BlockDescriptor     = yes
    TransferLength      = 16
    Hdr.Tape.BufferMode = 0x1
    Hdr.MediumType      = 0
    Data.UBYTE[0]       = 0x3D # Vendor Unique Page Code 3D
    Data.UBYTE[1]       = 0x02
    Data.UBYTE[2]       = 0x01
    Data.UBYTE[3]       = 0x00
```

2. Rebuild the kernel by running `/sbin/ddr_config`, then reboot the system with the tape drive attached. Device files for the Ultrium drive will be generated in `/dev/tape and /dev/ntape` when you reboot.

3. The names of the device files can be interpreted as follows:

   Devices in the `/dev/ntape` directory are "no-rewind" devices. Those in `/dev/tape` will perform rewind on close.

The device files then have the syntax: `tapeX_dn`

For example, `/dev/ntape/tape66_d1` is a device file for device 66, no-rewind using density number 1. Since all density numbers have the same parameters it does not matter which density number file is used.

What next?

Once device files have been created, you should confirm that your new tape drive is working properly. provides instructions on backing up and restoring a sample file to test your installation.

4 IBM (AIX)

Determining the SCSI ID

Before you configure your system to support Ultrium drives, determine which SCSI ID to use. IDs must be unique for each device attached to the SCSI bus. To list existing devices, use the following command:

```
% lsdev -C |grep SCSI
```

This produces output similar to:

```
scsi0 Available 00-00-0S Standard SCSI I/O Controller
hdisk0 Available 10-60-00-0,0 16 Bit LVD SCSI Disk Drive
rmt1 Defined 00-00-0S-2,0 Other SCSI Tape Drive
```

The SCSI ID is in the series $00-00-0S-X$, 0, where X is the SCSI ID. Review the list of existing SCSI IDs and choose an available ID to assign to the new tape drive.

Configuring the device files

To install an HP Ultrium drive on an IBM workstation, create the appropriate device files for the drive.

📝 **NOTE:** Do *not* choose the `smit` option of "`4mm2gb`" as the Tape Device Type. This is reserved for Connor drives. If you use it with HP drives, you will get the error "`Device to be configured does not match the physical device at the specified connection location`".

To change to variable block mode, use the following procedure:

1. *If you are using a graphics terminal* running X-Windows, at a Windows terminal, type:
   `smit tape`
   If you are using a non-graphics terminal, at the command line type:
   `% smit -C tape`
2. If no device has been configured at this address before, select "`add a tape drive`" to set up the address. From the pop-up window, select "`ost`" or "`Other SCSI tape drive`" as the tape drive you wish to change and choose connection addresses as appropriate.
3. Set maximum delay for the READ/WRITE command=1200.
4. Change the block size field to 0, and click on the "`DO`" button or press [Enter] to apply the change.

HP Ultrium drives will work with `tar`, `cpio`, `backup`, `restore` and `dd`. For systems other than the 43P, the drive is also boot-capable, provided a boot tape is generated using `mkszfile` and `mksysb`.

Once device files have been created, you should confirm that your new tape drive is working properly. provides instructions on backing up and restoring a sample file to test your installation.

Device filenames under AIX

Use device filenames as listed below for the combination of Rewind on Close, Retension on Open, and Compression that you want:

Filename	Rewind on Close	Retension on Open	Compression
/dev/rmt$n$	Yes	No	enabled
/dev/rmt$n$.1	No	No	enabled
/dev/rmt$n$.2	Yes	Yes	enabled
/dev/rmt$n$.3	No	Yes	enabled
/dev/rmt$n$.4	Yes	No	disabled
/dev/rmt$n$.5	No	No	disabled
/dev/rmt$n$.6	Yes	Yes	disabled
/dev/rmt$n$.7	No	Yes	disabled

The n in the filename is the instance number assigned to the drive by the operating system, where 0 is the first device, 1 is the second and so on.

Rewind on Close   Normally, the drive repositions the tape to BOT (Beginning of Tape) when the device file is closed. Using the no rewind option is useful when creating and reading tapes that contain multiple files.

Retension on Open   Retensioning consists of winding to EOT (End of Tape) and then rewinding to BOT, in order to reduce errors. If this option is selected, the tape is positioned at BOT as part of the open process.

Compression   Compression can be disabled or enabled.

5 Linux

Determining the SCSI ID (Linux)

Look at the output of `dmesg` to find out what SCSI channel number is used for each connection.

To find out the SCSI IDs in use on each channel, type:

```
cat /proc/scsi/scsi
```

This will produce output similar to the following for each device:

```
Attached Devices
Host: SCSI0 Channel: 00 Id:00 Lun:00
Vendor: HP Model ------------
Type: Direct-Access ANSI SCSI Revision 02
```

Look at the ID information to establish which IDs are in use.

Configuring on Linux systems

No changes are needed to support Ultrium on Linux platforms, however you should ensure that you have the relevant drivers loaded.

To see the device drivers loaded currently, execute `lsmod`. This will give output similar to:

```
Module       Size      Used by
sgm          4376      1
ide-scsi     7200      0
lockd        30792     1
sunrpc       53316     1
st           24656     0
sym53c8xx    52096     1
aic7xxx      136184    2
```

The lines of interest here are:

`st`   The tape driver. Its presence shows that the tape driver is loaded.

`sym53c8xx` The SCSI chipset driver for the LSI Logic family of HBAs (amongst others).

`aic7xxx`   The SCSI chipset driver for the Adaptec 7*xxx* chipset family (such as Adaptec 29160LP).

Latest SCSI controller drivers for Linux are available from the manufacturer's web site.

In order to communicate with a tape device, the operating system needs to have drivers for the tape and the underlying transport mechanism (the host bus adaptor) loaded. Ensure that both are available as either loadable modules (for example, usable with `insmod` and visible with `lsmod`) or are statically built into your kernel.

> **NOTE:** To add drivers to the statically built kernel you need the Linux source code available on disk and knowledge of how to use the kernel building tools that ship with various Linux distributions. This should not be attempted by novice users.

In order to determine if the drive has been detected by the tape driver at module load time, execute:

```
dmesg | grep "st"
```

This should find a number of lines. One should look like:

```
Detected SCSI tape st0 at scsi1, channel 0, id 5, lun 0
```

To load the tape driver module if it is not loaded as above, execute:

```
insmod st
```

to load it. This should happen naturally if your system is rebooted after attaching the drive.

When the `ST` driver module has been added, a list of tape device files will be created automatically. They reside in the `/dev/` directory and have the syntax:

```
/dev/stp or dev/nstp
```

where:

p Instance number of the device file (if only one drive is connected to the system, this will be 0)

n Indicates this is a no-rewind driver.

To enable large transfers under Linux (>64 KB per write), edit the file `/usr/src/linux/drivers/scsi/st_options.h` and change the definition of `ST_BUFFER_BLOCKS`.

If you want requests to space to end of data (EOD) to be faster, you should also enable `ST_FAST_MTEOM` in the same file. After changing this file, rebuild the modules and install the new binary. At the very least, this requires:

```
make modules
make modules_install
```

from the `/usr/src/linux` directory. See your kernel documentation.

Using the seek and tell features of mt

To use the seek and tell features of `mt`, you must tell the `st` driver that HP Ultrium drives use logical block addressing:

```
mt -f <device file> stsetoptions scsi2logical
```

where `/dev/stp` is the device file.

Note however that this information is not preserved across reboots, so you need to execute this command each time the system comes up. The `stinit` utility offers a convenient way of handling this; see the relevant `man` page for more information. If you use this approach, set the manufacturer parameter to `HP` and the model to "`Ultrium 3-SCSI`".

What next?

Once device files have been created, you should confirm that your new tape drive is working properly. Chapter 7 on page 27 provides instructions on backing up and restoring a sample file to test your installation.

6 Sun Systems, Solaris 8, 9, 10

Determining the SCSI ID

Before you configure your system to support an HP Ultrium drive, determine which SCSI ID to use. IDs must be unique for each device on attached to the SCSI bus.

1. Use the `modinfo` command to identify SCSI controller drivers installed on the system:

```
% modinfo | grep "HBA Driver"
```

This produces output similar to the following:

```
106 780a0000   102b3  50   1  glm (GLM SCSI HBA Driver)
110 780b4000   1272c  228  1  qus (isp10160 HBA Driver)
```

For the adapter to which the new tape drive is attached, you need to determine what SCSI IDs are already used.

2. Determine the SCSI IDs of existing devices attached to the SCSI controller:

For all adapters:

```
% dmesg | egrep ".*xxx.*target" | sort | uniq
```

where xxx = the type of adapter (`esp`, `glm`, `fas`, `qus` or `isp`), as appropriate.

For example, for an ESP-based adapter:

```
% dmesg | egrep ".*esp.*target" | sort | uniq
```

This produces a list similar to:

```
sd0 at esp0: target 0 lun 0 sd6 at esp0: target 6 lun 0
```

This indicates that SCSI IDs 0 and 6 are used for existing devices. SCSI ID 7 is generally used for the adapter itself. Here, you would choose a SCSI ID from 1 to 5 for the new tape drive.

Configuring the Device Files

Determine the device file by typing:

```
% ls -l /dev/rmt/*m | grep "st@X"
```

where X is the SCSI ID. Identify the line for the tape drive. For example, if the drive was at SCSI ID 2, look for the line containing "`st@2,0`". This might be as follows (but on a single line):

```
lrwxrwxrwx 1 root root 63 Mar 1 00:00 /dev/rmt/0m
../../devices/sbus@1f,0/espdma@e,8400000/esp@e, 8800000/st@2,0:m
```

Here you could use `/dev/rmt/0m` (shown underlined above) as the device file.

For optimal performance, ensure that you have the following minimum patch number:

	Minimum patch
Solaris 8	108725-18
Solaris 9	113277-27

If for some reason you cannot upgrade to the minimum patch level, you can make the following file modifications to enhance performance:

1. In the file `/kernel/drv/st.conf`, after these lines:

```
########
# Copyright (c) 1992, by Sun Microsystems, Inc.
#ident  "@(#)st.conf   1.6     93/05/03 SMI"
```

   add the following depending on which version of operating system you are installing (there are 6 significant spaces between HP and Ultrium in line 2):

for Solaris 8 without st patch:

```
tape-config-list =
 "HP      Ultrium 3","HP Ultrium LTO 3","HP_LTO_GEN_3";
 HP_LTO_GEN_3  = 1,0x36,0,0xd639,4,0x44,0x44,0x44,0x44,3;
name="st" class="scsi"
        target=X lun=0;
```

   where X is the SCSI target address of the device you have attached.

for Solaris 9 and 10 (and 8 with st patch):

```
tape-config-list =
 "HP      Ultrium 3","HP Ultrium LTO 3","HP_LTO_GEN_3";
 HP_LTO_GEN_3  = 2,0x3B,0,0x18659,4,0x44,0x44,0x44,0x44,3,60,1200,
600,1200,600,600,18000;
name="st" class="scsi"
        target=X lun=0;
```

   where X is the SCSI target address of the device you have attached.

   See "HP-Data Values" on page 25 below for the values of the parameters in these lines.

2. If you are replacing an existing tape device on the same SCSI ID, remove the contents of the `/dev/rmt` directory as follows:

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

3. Do a reconfigure boot:

```
% cd /
% touch  /reconfigure
% sync;halt
```

4. When the system is down, reboot:

```
% boot -r
```

   Make sure you include the `-r` switch, so that the device directory is reconfigured using the new data.

5. You should now be able to use the drive.

   - Use `/dev/rmt/X`cb if you require a compression rewind device file, where X is the relevant device address.
   - Use `/dev/rmt/X`cbn when you require a compression non-rewind device.

Once the device files have been created, you should confirm that your new tape drive is working properly. Chapter 7 on page 27 provides instructions on backing up and restoring a sample file to test your installation.

HP-Data Values

The values for `HP_LTO_GEN_n` and `name`, which provide normal LTO mode, have the following meanings:

The syntax for `HP_LTO_GEN_n` on Solaris 9 is:

```
<drive type> = <version>, <type>, <bsize>, <options>, <no. of densities>,
   <density 0>, <density 1>, <density 2>, <density 3>, <default density>,
   <non-motion timeout>, <read/write timeout>, <rewind timeout>,
   <space timeout>, <load timeout>, <unload timeout>, <erase timeout>
```

where:

Parameter	Value	Meaning
`<version>`	1 or 2	Indicates the format of the following parameters.
`<type>`	0x36 or 0x3B	The value for an Ultrium drive in `/usr/include/sys/mtio.h`. For Solaris 8, `0x36` indicates a type of `MT_ISOTHER`. Later versions of Solaris support the value `0x3B` which indicates a type of `MT_LTO`.
`<bsize>`	0	Indicates variable block size.
`<options>`	0xd639 or 0x18659	This value is derived from constants provided in `/usr/include/sys/scsi/targets/stdef.h`. The value determines which operations the driver can perform with the attached device by using a unique value for each feature and then adding them together to form the options value. Supported features will vary with OS revision, and may include the following:

	`0x001`	Device supports variable length records.
	`0x008`	Device can backspace over files (as in the 'mt bsf' option).
	`0x010`	Device supports backspace record (as in 'mt bsr').
	`0x020`	Device requires a long time-out period for erase functions.
	`0x040`	Device will automatically determine the tape density.
	`0x0200`	Device knows when end of data has been reached.
	`0x0400`	Device driver is unloadable.
	`0x1000`	Time-outs five times longer than normal.
	`0x4000`	Driver buffers write requests and pre-acknowledges success to application.
	`0x8000`	Variable record size not limited to 64 KB.
	`0x10000`	Device determines which of the two mode pages the device supports for selecting or deselecting compression.

So `0xd639` indicates variable record length, bsf and bsr enabled, long timeouts for erase, EOD recognition, Unloadable device driver, 5 x longer timeouts, buffer writes and pre-acknowledge sucess, variable records not limited to 64 KB, auto-density over-ride and MODE SELECT compression.

Parameter	Value	Meaning
`<no. of densities>`	4	There are four densities following in the parameter list.
`<densityn>`	`0x00`	Creates a device file with compression disabled.
`<density3>`	`0x44`	The density code for data compression enabled by default.
`<default density>`	3	Density 3 (`0x44`) is the default for Generation 3 drives.
`<Xtimeout>`		All timeouts are in seconds

Values for the parameters for `name` are as follows:

Parameter	Value	Meaning
`target`	*X*	*X* specifies the SCSI ID (target) of the device.
`lun`	0	Specifies the LUN for the device.

7 Verifying the Installation

Verifying the Installation of the Drive (UNIX)

As part of the installation process, you will have installed the appropriate device driver for your UNIX system, and created device files to communicate with the tape drive.

This section describes how you can verify the installation has been performed correctly.

In outline, the procedure is as follows:

1. Check the tape drive responds to a rewind command.
2. Write test data to a tape.
3. Read the test data from the tape.
4. Compare the data read from the tape with the original data on disk.

To verify the installation:

1. Test the SCSI connection to the tape drive by performing a rewind:
   a. If there is a tape cartridge already in the drive, remove it.
   b. Insert a tape cartridge.
   c. Rewind the tape using the command line:
   ```
   % mt -f <device file> rewind
   ```
   For example, on HP-UX:
   ```
   % mt -f /dev/rmt/0mnb rewind
   ```
   If the command completes successfully, there will be no feedback. If it fails, you will see an error message on the console. The hardware installation may be faulty. Check the troubleshooting section of the *User's Guide* for help in identifying the problem.

2. Write a sample file to tape, using 'tar':
   ```
   % cd /
   % tar cvf <device file> <file>
   ```
   The options to tar have the following meanings:

c	Create a new archive (backup file) on the device.
v	Operate in verbose mode.
f	Specify the device file explicitly.

   The arguments follow the cvf options in the command line. Their values depend on the operating system; suggested values are given the appropriate operating system chapter.The arguments are as follows:

<device file>	The name of the device file for the drive. *Example:* /dev/rmt/0m
<file>	The name of the file to archive, prefixed with './'. *Example:* ./stand/vmunix

NOTE: Make sure you prefix the file name with '.' when you back it up to tape. If you do not, the restore operation in step 3 will overwrite the original copy on disk.

3. Read the file back from tape:

```
% cd /tmp
% tar xvf <device file>
```

The 'x' option to `tar` here means "extract from the archive".

Use the same value for the `<device file>` argument as in step 2.

4. Compare the original with this retrieved file:

```
% cmp <original file> /tmp/<retrieved file>
```

This compares the files byte by byte. If they are the same, there should be no output, and this verifies that the installation is correct. The arguments are:

`<original file>` The name of the original file, prefixed with '/'.
   Example: `/stand/vmunix`

`<retrievedfile>` The name of the file retrieved from the archive.
   Example: `stand/vmunix`

Example

Suppose you are verifying the installation of an HP Ultrium tape drive on an HP-UX 11.X system. The procedure would be as follows.:

1. Change directory to root:

```
% cd /
```

2. Back up `/stand/vmunix` to tape:

```
% tar cvf /dev/rmt/0m ./stand/vmunix
```

Note the prefix of '.' to the filename.

3. Change to the temporary directory:

```
% cd /tmp
```

4. Extract the file from the tape:

```
% tar xvf /dev/rmt/0m
```

5. Compare the original with the restored version:

```
% cmp /stand/vmunix /tmp/stand/vmunix
```

Note that the original filename is *not* prefixed with '.'.

HP restricted

Glossary

AT&T mode Berkeley and AT&T functional modes differ in "read-only" close functionality. In AT&T mode, a device close operation will cause the tape to be repositioned just after next filemark on the tape (the start of the next file).

Berkeley mode Berkeley and AT&T functional modes differ in "read-only" close functionality. In Berkeley mode the tape position will remain unchanged by a device close operation.

BOT *Beginning Of Tape.* The first point on the tape that can be accessed by the drive.

buffered mode A mode of data transfer in write operations that facilitates tape streaming. It is selected by setting the Buffered Mode Field to 1 in the SCSI MODE SELECT Parameter List header.

compression A procedure in which data is transformed by the removal of redundant information in order to reduce the number of bits required to represent the data. This is basically done by representing strings of bytes with codewords.

In Ultrium drives, the data is compressed using the LTO-DC compression format which is based on ALDC (licensed from Stac/IBM) with two enhancements. One limits the increase in size of data that cannot be compressed that ALDC produces. The other is the use of embedded codewords.

data transfer phase On a SCSI bus, devices put in requests to be able to transfer information. Once a device is granted its request, it and the target to which it wants to send information can transfer the data using one of three protocols (assuming both devices support them): asynchronous, synchronous, and wide.

In asynchronous transfers, the target controls the flow of data. The initiator can only send data when the target has acknowledged receipt of the previous packet. All SCSI devices must support asynchronous transfer.

In synchronous data transfer, the initiator and target work in synchronization, allowing transmission of a packet of data to start before acknowledgment of the previous transmission.

In wide (16-bit) data transfer, two bytes are transferred at the same time instead of a single byte.

HP Ultrium drives support asynchronous, synchronous and narrow (8-bit) wide transfers.

fibre channel   Fibre Channel provides an inexpensive yet expendable means of quickly transferring data between workstations, mainframes, supercomputers, desktop computers, storage devices, displays and other peripherals. Although it is called Fibre Channel, its architecture represents neither a channel nor a real network topology. It allows for an active intelligent interconnection scheme, called a fabric, to connect devices. All a Fibre Channel port has to do is to manage a simple point-to-point connection between itself and the fabric.

Several common ULPs (Upper Level Protocols) including IP and SCSI can run on Fibre Channel, merging high-speed I/O and network functionality in a single connectivity technology.

filemark   A mark written by the host to the tape that can be searched for, often using the drive's fast-search capability. It does not necessarily separate files. It is up to the host to assign a meaning to the mark.

immediate mode   A mode of responding to SCSI commands where the drive or other peripheral does not wait until the command has finished before returning status information back to the host. For writing filemarks, Immediate mode can significantly improve the performance of systems that do not set the Immediate bit when sending a SCSI WRITE FILEMARKS command. On the other hand, data is not flushed to tape in response to a filemark command.

infinite flush   By default, the buffer in the drive is flushed every 5 seconds. Infinite flush avoids frequent starting and stopping of the mechanism when using a very slow application. It also avoids losing capacity through the flushing of partly written groups. On the other hand, infinite flush means that data can remain in the buffer for very long periods of time, and could be lost in the event of a power failure.

LUN   *Logical Unit Number.* A unique number by which a device is identified on the SCSI bus. A tape drive has a fixed LUN of 0. In an autoloader, the changer mechanism is LUN1.

SAN   *Storage Area Network.* A dedicated, high-speed network that establishes a direct connection between storage elements and servers. The hardware that connects workstations and servers to storage devices in a SAN is referred to as a fabric. The SAN fabric enables any-server-to-any-storage device connectivity through the use of Fibre Channel switching technology.

SCSI   *Small Computer System Interface.* A standard command specification and command set that enables computers and peripherals to communicate with each other. HP's Ultrium drives adhere to the SCSI-3 specification and support all features required by that standard.

Single-Ended and Low Voltage Differential SCSI

These terms define how the signals are transmitted along the cable.

With *single-ended* (SE) SCSI, each signal travels over a single wire and each signal's value is determined by comparing the signal to a paired ground wire. Signal quality tends to decrease over longer cable lengths or at increased signal speed.

With *low voltage differential* (LVD) signaling, signals travel along two wires and the difference in voltage between the wire pairs determines the signal value. This enables faster data rates and longer cabling with less susceptibility to noise than SE signaling and reduced power consumption.

Narrow and Wide, Fast, Ultra and Ultra2 SCSI

- *Narrow* SCSI devices can transfer data one byte at-a-time (and are sometimes called "8-bit SCSI" devices). They can conform to either the SCSI-2 or SCSI-3 protocols. They have a 50-pin connection to the SCSI bus.
- *Wide* SCSI devices can transfer two bytes of data simultaneously ("16-bit SCSI"). They usually have a single, 68-pin connection to the SCSI bus. (This physical arrangement is part of the SCSI-3 specification.) They may support either SCSI-2 or SCSI-3 protocols. Wide and narrow devices can simultaneously be connected to the same bus without problem, provided certain rules are followed.
- *Fast* SCSI can transfer data at up to 10 MB/sec, using a cable of up to 6 meters total length.
- *Ultra* SCSI can transfer data at up to 20 MB/sec, but the cable length cannot exceed 3 meters (it is also known as "Fast20").
- *Ultra2* SCSI can transfer data at up to 80 MB/sec, using a cable of up to 12 meters.
- *Ultra160* SCSI can transfer data at up to 160 MB/sec, using a cable of up to 12 meters.
- *Ultra320* SCSI can transfer data at up to 320 MB/sec, using a cable of up to 12 meters.

Ultra SCSI supports both SE and LVD interfaces. Although Ultra2 SCSI and above can support SE devices, this is not recommended as the whole bus is slowed to Ultra speeds; instead, use LVD devices only.

HP's Ultrium drives are Ultra-320 compatible devices. They should be used only on LVD host bus adapters for maximum performance.

sequential access   Sequential access devices store data sequentially in the order in which it is received. Tape devices are the most common sequential access devices. Devices such as disk drives are *direct access* devices, where data is stored in blocks, not necessarily sequentially. Direct access allows speedy retrieval, but is significantly more costly.

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