HP Ultrium tape drives
Technical reference manual

Generation 3 drives
Volume 5—Unix configuration guide

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Edition 6	September 2004	Generation 3 SCSI and FC drive version
Edition 6.1	December 2004	Reformatted and updated

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

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The purpose of this manual

This is one of six volumes that document HP Ultrium drives. This volume provides background information for driver and application developers. The following products are covered. Capacities are when the drive is using data compression with a compression ratio of 2:1, where applicable:

- HP Ultrium Generation 3 Full-Height SCSI Internal Drive
- HP Ultrium Generation 3 Full-Height FC Internal Drive

NOTE: Throughout this manual frequent reference is made to SCSI commands. For more information on SCSI commands for HP Ultrium drives see volume 3, The SCSI Interface, of the HP Ultrium Technical Reference Manual set. Ordering details are given below.

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
- The SCSI Interface, volume 3 of the HP Ultrium Technical Reference Manual
- Specifications, volume 4 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

- Small Computer System Interface (SCSI-1), ANSI X3.131-1986. This is the ANSI authorized standard for SCSI implementation, available through ANSI
- Enhanced Small Computer System Interface (SCSI-2), ANSI X3T9.2-1993 Rev. 10L, available through ANSI

Copies of General Documents can be obtained from:

ANSI	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

The Purpose of this Manual

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

Please 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, please 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

Ultrium drives may also be used in a library. However, 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. Please 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, please 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 the SCSI ID

Before you configure your system to support your new HP Ultrium drive, you need to determine what SCSI ID to use. The SCSI ID must be unique for each device attached to the SCSI bus. To list the existing devices, use the following command:

```
% /sbin/ioscan -f
```

The output of this should look similar to the following example:

```
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
```

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

For an HP Ultrium drive, execute the following:

```
% /sbin/ioscan -f | grep "Ultrium"
```

The new lines should look similar to the following, where the `4` in the `I` field represents the instance of the SCSI tape driver, not the SCSI ID:

```
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.

If you cannot find the Ultrium drive, this may be because the kernel does not contain the correct driver. Use the System Administration Manager (`sam`) to add `stape` to the kernel:

To add `stape` to the kernel using `sam`:

1. `% sam`
2. Select the following:

   `Kernel Configuration`

   `Drivers`
3. Highlight the `stape` 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`
6. The `stape` driver will now be added to the kernel and then the system will reboot.

Creating the Device Files

Once you have verified the tape drive connection, you will need to create the appropriate device files for the drive. Normally, you would have rebooted your system after attaching the tape drive, and this process runs `insf`. However, if you have not rebooted your system since attaching the drive, you can create device files by one of two ways, either through the System Administration Manager (`sam`), or by executing the `mksf` command.

To add device files using `sam`:

This is the recommended and simplest way to create device files.

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 an HP Ultrium Generation 3 drive is found, it will be displayed as:

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

3. Highlight the Ultrium 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
   ```

   where:

Device File	Description
<I>	is the instance number of the drive:
<I>m	AT&T encoding, rewind driver
<I>mn	AT&T encoding, non-rewind driver
<I>mb	Berkeley encoding, rewind driver
<I>mnb	Berkeley encoding, rewind driver
<X>	is the card number,
<Y>	is the target number,
<Z>	is the LUN number:
cXtYbZBEST	Best compression driver, AT&T encoding, with rewind
cXtYbZBESTb	Best compression driver, Berkeley encoding, with rewind
cXtYbZBESTn	Best compression driver, AT&T encoding, non-rewind
cXtYbZBESTnb	Best compression driver, Berkeley encoding, non-rewind

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

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

To create device files using `mksf`:

NOTE: This method is *not* recommended.

1. Run `insf` as follows:

   ```
   % /sbin/insf -C tape
   ```

2. Create the device files for the devices using the `mksf` command as follows:

   ```
   % /sbin/mksf -d stape -I <instance> [-n] [-u] /dev/rmt/X<name>
   ```

   where:

Argument	Description
`-d stape`	Specifies the SCSI tape driver
`-I <instance>`	Specifies the tape drive's hardware address via the instance of the SCSI tape driver. The first instance is `0`, the second `1`, and so on.
`[-n]`	Specifies no rewind; absence of this parameter indicates rewind mode
`[-u]`	Specifies Berkeley mode; absence of this parameter indicates AT&T mode. Berkeley and AT&T modes differ in their read-only close behavior: • In Berkeley mode, the tape position will remain unchanged by a device close operation. • In AT&T mode, a device close operation will cause the tape to be repositioned just after the next tape filemark (the start of the next file). In most cases, Berkeley mode should be used.
`/dev/rmt/X<name>`	Specifies the path of the device file, where: `X` Specifies the tape device identifier. Use the next available identifier. You can examine the contents of `/dev/rmt` using the `ls` command to determine which identifiers have already been used. `<name>` Specifies the short name (in HP-UX 9.x-style) of the device file: `mnb` No rewind, compression disabled, Berkeley-mode device `hnb` No rewind, compression disabled, Berkeley-mode device `mnb` No rewind, compression disabled, Berkeley-mode device `hnb` No rewind, compression enabled, Berkeley-mode device

See the man page (`man 1m mksf`) for other options of the `mksf` command. The `stape` section covers the SCSI tape driver options. The man page `man 7 mt` describes the long filenames used in HP-UX 10.*x* and later.

Example:

To create a device file with the following characteristics:

- A hardware address specified by instance 5 (`-I 5`)
- No rewind (`-n`)
- Berkeley mode tape positioning on close (`-u`)
- A filename of `4mnb`, where `4` is the tape device identifier (`/dev/rmt/4mnb`)

You would execute the following:

```
% /sbin/mksf -d stape -I 4 -n -u /dev/rmt/4mnb
```

You can check that the appropriate device file was created using the `lssf` command as follows:

```
% /sbin/lssf /dev/rmt/4mnb
```

This should produce the following output to show that the device file now exists:

```
stape card instance 0 SCSI target 6 SCSI LUN 0 berkeley no rewind
BEST density at address 2/0/1.6.0 /dev/rmt/4mnb
```

To create a device file for Ultrium in uncompressed mode, you should use a command such as:

```
mksf -H -a -b U_18
```

and for compressed mode (default):

```
mksf -H -a -b U_18C
```

The hardware path can be found from previous `ioscan` output.

What Next?

Once the device files have been created, you should confirm that your new tape drive is working properly. Chapter 7, “Verifying the Installation” 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. The 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 do a 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 the device files have been created, you should confirm that your new tape drive is working properly. Chapter 7, “Verifying the Installation” 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 your Ultrium drive, you need to determine which SCSI ID to use. IDs must be unique for each device attached to the SCSI bus. To list the existing devices, use the following command:

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

This will produce output that looks 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 you will need to 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, then 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. Select from the window: "`change/show characteristics of a tape drive`"
4. From the pop-up window, select "`ost`" or "`Other SCSI tape drive`" as the tape drive you wish to change. Do *not* choose "`4mm2gb`".
5. 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 the device files have been created, you should confirm that your new tape drive is working properly. Chapter 7, "Verifying the Installation" 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/rmtn`	Yes	No	enabled
`/dev/rmtn.1`	No	No	enabled
`/dev/rmtn.2`	Yes	Yes	enabled
`/dev/rmtn.3`	No	Yes	enabled
`/dev/rmtn.4`	Yes	No	disabled
`/dev/rmtn.5`	No	No	disabled
`/dev/rmtn.6`	Yes	Yes	disabled
`/dev/rmtn.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 an `lsmod` command, this will give output like:

```
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` This is the tape driver. Its presence in the output of the `lsmod` command shows that the tape driver is loaded.

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

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

Latest SCSI controller drivers for Linux will be 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: In order 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 is the instance number of the device file. (If only one drive is connected to the system, this will be 0.)
- n indicates that this is a no-rewind driver.

In order 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 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

In order to use the seek and tell features of mt, you must tell the st driver that HP Ultrium drives use logical block addressing.

You can do this by using the command:

```
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 the device files have been created, you should confirm that your new tape drive is working properly. Chapter 7, "Verifying the Installation" 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, you need to 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 will produce 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 will need to determine what SCSI IDs are already used.

2. Determine the SCSI IDs of the 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. In this situation, you would use 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.

Only if necessary, 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 29 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/Xcb` if you require a compression rewind device file, where `X` is the relevant device address.

   — Use `/dev/rmt/Xcbn` 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, "Verifying the Installation" 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`.

Parameter	Value	Meaning
<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.
<no. of densities>	4	There are four densities following in the parameter list.
<density *n*>	0x00	Creates a device file with compression disabled.
<density 3>	0x40, 0x42 *or* 0x44	The density code for data compression enabled by default.
<default density>	3	Density 3 (0x44) is the default for Generation 3 drives.
<X timeout>		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 that 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 doing a rewind operation:

   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 step compares the retrieved file and the original file byte by byte. If they are the same, there should be no output, and this verifies that the installation is correct. The arguments are as follows:

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

`<retrieved file>` 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 '.'.

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 for speed of retrieval, but is significantly more costly.

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