unix configuration

hp dds drives technical reference manual

volume 5: unix configuration guide

HP C1537A & HP C1554A DDS-3 Drive (24 GB)
HP C1557A & HP C5648A DDS-3 Autoloader (144 GB)
HP C5683A DDS-4 Drive (40 GB)
HP C5713A DDS-4 Autoloader (240 GB)
HP C7438A DAT 72 Drive (72 GB)

Edition 9 Draft 1, February 2003

Notice

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Revision History

Version	Date	Changes
Edition 1	Nov 1994	All
Edition 7	May 1999	Addition of DDS-4 drives
Edition 8	Feb 2003	Removal of DDS-1 and DDS-2 drives. Inclusion of DAT 72 drives. Manual restructured and reformatted.
Edition 9 Draft 1	Jul 2003	Change of HP (Compaq) Tru64 to HP Alpha

Note

As far as this manual is concerned:

- the HP C1554A is identical to the HP C1537A
- the HP C5648A is identical to the HP C1557A

The inclusion of a particular drive or autoloader in this document does not imply that that drive or autoloader is currently available.

The Purpose of this Manual

This is one of a six-volume set which documents HP DDS drives. This volume provides basic information on configuring the following drives with various operating systems:

- HP C1537A (HP C1554A) DDS-3 drive, capacity: 24 gigabytes
- HP C1557A (HP C5648A) DDS-3 autoloader, capacity: 144 (6x24) gigabytes
- HP C5683A DDS-4 drive, capacity: 24 gigabytes
- HP C5713A DDS-4 autoloader, capacity: 144 (6x24) gigabytes
- HP C7438A DAT 72 drive, capacity: 72 gigabytes

Capacities assume 2:1 data compression.

Note This manual contains information on connecting to various operating systems. The information is given in good faith, but since the operating systems and any upgrades that are made to them are outside Hewlett-Packard's control, HP cannot guarantee that the details are correct. Please consult the operating system documentation in conjunction with this manual.

Related Documents

The following documents provide additional information:

Documents Specific to HP DDS Drives

The HP DDS Technical Manual also includes the following volumes:

- **Hardware Integration Guide**, volume 1
- **Software Integration Guide**, volume 2
- **The SCSI Interface**, volume 3
- **Specifications**, volume 4
- **Background to DDS Products**, volume 6

Please contact your HP supplier for copies.

General Documents and Standardization

- Enhanced Small Computer System Interface (SCSI-2)

  X3T9.2-1993 Rev. 10L, available through ANSI
- DDS-3
  - ECMA-236, 1st Edition
- DDS-4
  - ECMA-288, 1st Edition

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
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contents

Introduction

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Drivers and Backup Software

Drivers

Check your operating system documentation to see whether a driver for DDS drives is provided. If no operating system driver is available, you can use various software applications to connect DDS drives.

Even operating systems which do support DDS drives directly only provide a very basic level of support, so it is still a good idea to use software applications to provide friendly user interfaces and to make full use of DDS features.

UNIX Applications

You can write scripts to control DDS drives in UNIX using standard backup utilities such as `cpio` and `tar`. To achieve more sophisticated control of the drives, and to exploit the full range of DDS features, it is worth considering software applications specifically designed for the task.

Application Software Availability

Most backup software companies provide applications for HP DDS products. Contact your software supplier for details. Alternatively, contact your HP supplier, who can provide you with details of a wide range of compatible software.

For details of software for autoloaders, please contact your support center.

Configuring a Drive

When the drive is powered on, it reads a set of configuration switches on the underside of the drive (see Chapter 9, "Introduction to Configuration Switches").

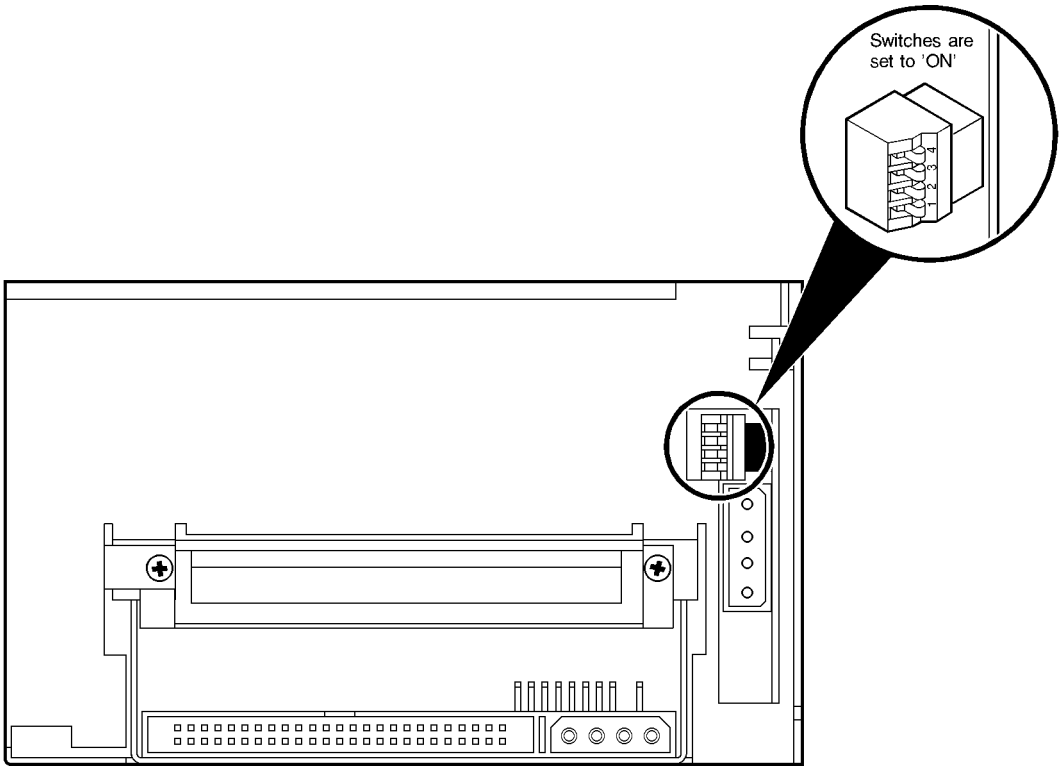
To change the configuration:

1. Switch the drive off.
2. Select the correct configuration for your system. See "Configuration Switches" on page 41 for details of which setting to use for your system.
3. Switch the drive on again.
4. Ensure that the appropriate drivers and application software are installed on the host computer.

Configuring an Autoloader

Note Autoloaders only exist in DDS-3 and DDS-4 versions, not DAT 72.

Figure 1 Internal autoloaders: option switches



To configure an autoloader:

Note See "Autoloader Option Switch Settings" on page 51 for details of the settings you need for different systems.

1. Switch the autoloader off.
2. Set the drive configuration on the switches on the underside.

3 Set the autoloader configuration as follows:

Internal built-in autoloaders: set the switches on the rear of the autoloader mechanism (see Figure 1).

External standalone autoloaders: the value of the option switch settings is the number on the *right* when looking at the rear of the autoloader. To change the number, click on the little buttons marked '–' and '+' above and below the number with a ball-point pen or similar.

4 Switch the autoloader on again.

5 Ensure that the appropriate drivers and application software are installed on the host computer.

HP Alpha UNIX 5.1x *(DAT 72 drives only)*

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Note Only DAT 72 drives are currently supported on HP Alpha.

Updating the Tape Driver

1 Modify the SCSI Tape Density Table to include:

```
scsi_tape_density[0x47] =   "163000_bpi"       163000      0 (DAT72)
```

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

```
SCSIDEVICE
   Type = tape
   Name = "HP" "C7438A"
   #
PARAMETERS:
   TypeSubClass         = rdat
   TagQueueDepth        = 0
   MaxTransferSize      = 0x0ffffff      # (16MB - 1)
   ReadyTimeSeconds     = 120            # seconds

MODESELECT:
   ModeSelectNumber = 0
   SavePage = No
   PageFormat = scsi2
   BlockDescriptor = yes
   TransferLength = 16
   Hdr.Tape.BufferMode = 0x1
   Data.UBYTE[0] = 0x3D  #Vendor Unique Page Code 0x3D
   Data.UBYTE[1] = 0x02
   Data.UBYTE[2] = 0x01

DENSITY:
   DensityNumber = 0,3,4,5,6,7
   DensityCode = default
   CompressionCode = 0x0
```

```
    Buffered = 0x1

DENSITY:
    DensityNumber = 1,2
    DensityCode = default
    CompressionCode = 0x1
    Buffered = 0x1
```

3. Rebuild the kernel by running:
   `/sbin/ddr_config -c /etc/ddr.dbase`
   then reboot the system with the tape drive attached. The device files for the DAT 72 drive will be generated in `/dev/tape` and `/dev/ntape` when you reboot.
4. 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`

   where:

   `X` is the instance of the drive
   `n` is the density number

   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 8, "Verifying the Installation" provides instructions on backing up and restoring a sample file to test your installation.

HP Servers and Workstations — HP-UX 10.20 and 11.*x*

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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 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:

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

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       XXXXXX
```

where `XXXXX` is `C1537A`, `C1557A`, `C5683A`, `C5713A` or `C7438A` depending on the type of drive.

If you cannot find the 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 a drive is found, it will be displayed as:

```
Hardware Path       Driver          Description
=======================================================

8/0/2/0.3.0         stape           HP      XXXXXX
```

   where `XXXXX` is `C1537A`, `C1557A`, `C5683A`, `C5713A` or `C7438A` depending on the type of drive.

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
   ```

where:

Device File	Description
where <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
where <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

Argument	Description
[-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 a drive 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 8, "Verifying the Installation" provides instructions on backing up and restoring a sample file to test your installation.

IBM (AIX) Servers and Workstations

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Determining the SCSI ID

Before you configure your system to support your 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 00-00-0S-0 1.0 GB 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 a DDS-format drive on an IBM workstation you 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 DDS-format 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`.

What Next?

Once the device files have been created, you should confirm that your new tape drive is working properly. Chapter 8, "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/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

Filename	Rewind on Close	Retension on Open	Compression
/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.

Linux Servers and Workstations

5

Determining the SCSI ID

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 DDS-format drives 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
ncr53c8xx    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.
`ncr53c8xx`	This is a SCSI chipset driver for the LSI Logic family of HBAs (amongst others).
`aix7xxx`	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.

What Next?

Once the device files have been created, you should confirm that your new tape drive is working properly. Chapter 8, "Verifying the Installation" provides instructions on backing up and restoring a sample file to test your installation.

Silicon Graphics (SGI)

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Note DAT 72 drives do not support Silicon Graphics. This chapter only applies to DDS-3 and DDS-4 drives and autoloaders.

SGI DMA hardware requires that DMA starts on a 32-bit aligned address. HP DDS drives only limit disconnects to a 16-bit alignment. To account for this, the switch setting disables the data phase disconnect. You should also keep block transfers short to avoid tying up the bus:

- If you want `tar` to default to short block transfers, change the `512*512` in your `tpsc` or `scsi` HP entry to `128*512` (128-kilobyte blocks) or, better still, `64*512` (64-kilobyte blocks).

1. Select the name of the kernel configuration file for your version of IRIX from the list below and open it with a text editor:
   - In IRIX 5.1 or earlier: `/usr/sysgen/master.d/tpsc`
   - In IRIX 5.2: `/usr/sysgen/master.d/scsi`
   - In IRIX 5.3 or 6.3: `/var/sysgen/master.d/scsi`
2. Find the following entry in the kernel configuration file and copy it to a new location in the file where you can edit it as appropriate for your tape drive:

   For IRIX 5.x:

```
{DATTAPE, TPDAT,7,6,"ARCHIVE","Python",0,0,{0,0,0,0},
MTCAN_BSF|MTCAN_BSR|MTCAN_APPEND|MTCAN_SETMK|MTCAN_PART|
MTCAN_PREV|MTCAN_SYNC|MTCAN_SPEOD|MTCAN_CHKRDY|MTCAN_VAR|
MTCAN_SETSZ|MTCAN_SILI|MTCAN_AUDIO|MTCAN_SEEK|MTCAN_CMTYPEANY,
/*minimum delay to I/O is 4 minutes, because when a retry is
*performed, the drive retries a number of times, and then
*rewinds to BOT, repositions, and tries again.*/
40,4*60,4*60,5*60,512,512*512},
```

   For IRIX 6.2:

```
{DATTAPE, TPDAT,2,6,"HP","C1557A",0,0,{0},
MTCAN_BSF|MTCAN_BSR|MTCAN_APPEND|MTCAN_SETMK|MTCAN_PART|
```

```
MTCAN_PREV|MTCAN_SYNC|MTCAN_SPEOD|MTCAN_CHKRDY|MTCAN_VAR|
MTCAN_SETSZ|MTCAN_SILI|MTCAN_SEEK|MTCAN_CMTYPEANY|MTCAN_COMPRESS,
/*minimum delay to I/O is 4 minutes, because when a retry is
*performed, the drive retries a number of times, and then
*rewinds to BOT, repositions, and tries again.*/
40, 4*60, 20*60, 5*60, 512, 64*512, 0, (u_char*)0 },
```

For IRIX 6.4/6.5:

```
{ DATTAPE, TPDAT, 2, 6, "HP", "C1537A", 0, 0, {0},
MTCAN_BSF|MTCAN_BSR|MTCAN_APPEND|MTCAN_SETMK|MTCAN_PART|
MTCAN_PREV|MTCAN_SYNC|MTCAN_SPEOD|MTCAN_CHKRDY|MTCAN_VAR|
MTCAN_SETSZ|MTCAN_SILI|MTCAN_AUDIO|MTCAN_SEEK|MTCAN_CHTYPEANY,
/* minimum delay on i/o is 4 minutes, because when a retry is
* performed, the drive retries a number of times, and then
* rewinds to BOT, repositions, and tries again. */
40, 4*60, 4*60, 5*60, 3*3600, 512, 512*512,
tpsc_default_dens_count, tpsc_default_hwg_dens_names,
tpsc_default_alias_dens_names,
{0}, 0, 0, 0,
0, (u_char *)0 },
```

For an explanation of the functions of the `MTCAN` values and constants, see "MTCAN and Constants Values" on page 30.

3. Edit the first line of the entry to suit your tape drive:

   For the HP C1537A, change the first line to read:

   ```
   {DATTAPE, TPDAT,2,6,"HP","C1537A",0,...
   ```

   For the HP C1557A, change the first line to read:

   ```
   {DATTAPE, TPDAT,2,6,"HP","C1557A",0,...
   ```

   For the HP C5683A, change the first line to read:

   ```
   {DATTAPE, TPDAT,2,6,"HP","C5683A",0,...
   ```

   For the HP C5713A, change the first line to read:

   ```
   {DATTAPE, TPDAT,2,6,"HP","C5713A",0,...
   ```

4. For IRIX 5.*x*, remove `MTCAN_AUDIO` from the fourth line of the entry (shown in bold above).
5. For IRIX 5.*x*, change the blocking factor from `512*512` to `64*512` (64 KB blocks) on the last line of the entry. This will keep data transfers short an avoid tying up the bus.

6 Recompile the kernel by running `autoconfig` and then reboot the system. When you reboot, the device files for the DAT drive will be created automatically.

The following device files will be created in `/dev/rmt`:

```
tps0d3          tps0d3cnrv   tps0d3nrns     tps0d3s
tps0d3c         tps0d3cns    tps0d3nrnsv    tps0d3sv
tps0d3cnr       tps0d3cnsv   tps0d3nrs      tps0d3v
tps0d3cnrns     tps0d3cs     tps0d3nrsv     tps0d3stat
tps0d3cnrnsv    tps0d3csv    tps0d3nrv
tps0d3cnrs      tps0d3cv     tps0d3ns
tps0d3cnrsv     tps0d3nr     tps0d3nsv
```

These device file names can be interpreted as follows:

Device Name	Function
`c`	Compression
`nr`	No rewind on close
`v`	Device supports variable block sizes
`ns`	Device does not byte-swap
`s`	Device does byte-swap
`stat`	Allows the device to be used when one of the other device files specifying the same physical device is already opened

For example, the device file `tps0d3` indicates a device on controller card 0 at SCSI ID 3, and the device file `tps0d3nrv` indicates a device on controller card 0 at SCSI ID 3 that does not rewind on close and supports variable block sizes.

Note Some versions of IRIX 6.x (depending on how the OS was installed and which patches are installed) may not create the compression device files using the procedure above. If this is the case:

1 Locate the file `/dev/MAKEDEV.d/TPS_base`.

2 After the line starting `*Device:*Python*`, add the following new entry:

```
*Device:*HP*C15*)              # HP DDS with DC
mdev=`expr $mdev + 8`;
mknod ${prf}$1c c ${C_TPS} $node;
;;
```

Note that this only applies for HP C1537A and HP C1557A drives.

3 For IRIX 6.2 only, the entry should end with:

```
0, (u_char *)0 },
```

What Next?

Once the device files have been created, you should confirm that your new tape drive is working properly. Chapter 8, "Verifying the Installation" provides instructions on backing up and restoring a sample file to test your installation.

MTCAN and Constants Values

The `MTCAN` values have the following functions:

MTCAN value	Capability Enabled
`APPEND`	Append to existing tape data
`BSF`	Backspace file
`BSR`	Backspace record
`CHKRDY`	Determine if a tape cartridge is present
`CHTYPEANY`	Change density and/or fixed to variable at points other than beginning of tape
`COMPRESS`	Compression
`PART`	Multiple partitions
`PREV`	Prevent media removal
`SEEK`	Seek to a particular block
`SETMK`	Setmarks
`SETSZ`	Fixed block size can be set
`SILI`	Suppress illegal length indicators
`SPEOD`	Space to EOD (end of data)
`SYNC`	Synchronous mode SCSI

MTCAN value	Capability Enabled
VAR	Variable block sizes

The constants have the following functions:

Constant	Description
40	Transfer time-out in “inverse ticks”
4*60	Minimum time-out in seconds for any command
4*60	Space command time-out in seconds
5*60	Time-out in seconds for long operations (such as rewinds)
512	Default block size in bytes for fixed block size mode
64*512 ***or*** 512*512	Recommended blocking factor in bytes for the upper limit of read/write commands

Sun Workstations—Solaris 2 (SunOS 5.x)

7

Determining the SCSI ID

Before you configure your system to support a DDS-format drives, 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.

   — For FAS or ESP devices:

   ```
   % modinfo | grep "SCSI Host"
   ```

   This will produce output similar to the following:

   ```
   18 501a4000 c3b8 61 1 esp (ESP SCSI Host Bus Adapter Drive)
   21 501c8000 9e70 6 1 fas (FAS SCSI Host Bus Adapter Drive)
   ```

   This indicates that there are two SCSI controllers on the system, an ESP-based adapter and a FAS-based adapter. For the adapter to which the new tape drive is attached, you will need to determine what SCSI IDs are already used.

   — For newer LSI/Intraserver LVD SCSI controllers:

   ```
   % modinfo | grep "Interserver"
   ```

   This will produce output similar to the following:

   ```
   100 78054000 11898 207  1 ithps (ITHPS-5.02.00 Intraserver)
   100 78054000 11898 207  1 ithps (ITHPS-5.02.00 Intraserver)
   ```

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` 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.

Driver Configuration

Note Use the switch settings shown in Chapter 9. Drives should then work well with Solaris 2 without modifications to the kernel, and you are recommended to try this.

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 (the spaces are significant in the strings):

```
tape-config-list =
 "HP      C1537A", "HP DDS3 4mm DAT", "HP-data2",
 "HP      C1557A", "HP DDS3 4mm DATloader", "HP-data2",
 "HP      C5683A", "HP DDS4 4mm DAT, "HP-data2";
 "HP      C7438A", "HP DAT72 4mm DAT, "HP-data2"
HP-data1 = 1,0x34,1024,0x639,3,0x00,0x13,0x03,2;
HP-data2 = 1,0x34,1024,0xd639,4,0x00,0x13,0x24,0x3,3;

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

6 spaces

For variable block size mode, use 0 instead of 1024. This does not apply to Solaris 2.3. where you should *never* use 0.

Only add these lines for an autoloader

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

"`HP-data2`" is intended to provide an 8 mm emulation mode, where the density figures ("`0x0,0x13,0x24,0x3`") in the SCSI MODE SELECT Mode Parameter Block Descriptor are used to switch compression on and off. For descriptions of all the HP-data values, see "HP-Data Values" on page 35.

HP autoloaders with firmware revision 9503 or later only: To allow random access to tapes within the autoloader, you must add the "`lun=1`" entry for each autoloader.

You may also like to make the following addition to your standard configuration just above the `tape-config-list` entries:

```
tape-driver-buffering = 4;
```

This may improve the ability of your system to keep the drive streaming, depending on your form of backup.

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.

HP-Data Values

The values for `HP-data1`, `HP-data2` and `name`, which provide normal DDS mode, have the following meanings:

Value	Meaning
`1`	This value should be 1.
`0x34`	Value for a DAT drive in `/usr/include/sys/mtio.h`.
`1024`	Default block size. For variable block size, use 0 instead of 1024 (except with Solaris 2.3, where you should not use 0).

Value	Meaning
`0x639` *or* `0xd639`	A 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 `0x639`. The features are as follows: `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. `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.
`0x00`	Default density setting. Creates a device file with compression disabled.
`0x03`	Creates a device file with compression enabled if configuration switches are set appropriately.
`0x13`	Creates a DDS-1 format device file for use with a 60m or 90m DDS-1 tape.
`0x24`	Creates a DDS-2 device file for use with a 120m DDS-2 tape. (No special DDS-3, DDS-4 or DAT 72 device file is required.)
`target=X`	`X` specifies the SCSI ID (target) of the device.
`lun=0` *or* `lun=1`	Specifies the LUN for the device. A standard tape drive requires only the `lun=0` line. An autoloader requires `lun=0` for the embedded tape drive and `lun=1` for the changer mechanism.

What Next?

Once the device files have been created, you should confirm that your new tape drive is working properly. Chapter 8, "Verifying the Installation" provides instructions on backing up and restoring a sample file to test your installation.

Verifying the Installation

8

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. Write test data to a tape.
2. Read the test data from the tape.
3. 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 <archive name> rewind
      ```
   If you do not see the Tape light flash as the tape rewinds, the hardware installation may be faulty. Check the troubleshooting section of the User's Guide for help in identifying the problem.
4. Write a sample file to tape, using '`tar`':
   ```
   % cd /
   % tar cvf <archive name> <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 archive name explicitly.

The arguments follow the `cvf` options in the command line. Their values depend on the operating system; suggested values are given in "System-Specific Arguments" on page 39. The arguments are as follows:

`<archive name>` The name of the archive name to be created.
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.

5 Read the file back from tape:

```
% cd /tmp
% tar xvf <archive name>
```

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

Use the same value for the `<archive name>` argument as in step 2.

6 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 DDS-format tape drive on an HP-UX 10.X system. The procedure would be as follows. See "System-Specific Arguments" below for the choice of `<archive name>` and `<file>` arguments:

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 '**.**'.

System-Specific Arguments

The following table lists suggested values for the arguments `<archive name>` and `<file>` in the verification procedure described above. If any of the suggested files are symbolic links on your system, choose another file appropriate for your system.

System	File Name	Description	Archive Name	Notes
HP Alpha	`vmunix`	OSF kernel	`/dev/tape/tapeX.dn`	`X` is the instance of the drive `n` in the density code
HP-UX 10.20 and 11.*x*	`stand/vmunix`	HP-UX kernel	`/dev/rmt/Ym`	`Y` is the instance of the drive
IBM AIX	`unix`	AIX kernel	`/dev/rmtY.1`	`Y` is the device ID reported back as available when you ran '`smit -C tape`' to create the device files.
Linux	`/boot/vmlinux`	Kernel 2.4.x	`/dev/[n]stX`	`n` means no rewind `X` is the instance of the drive
Silicon Graphics (SGI) IRIX	`unix`	IRIX kernel	`/dev/rmt/tpsCdX`	*C* is the SCSI card *X* is the SCSI ID of the drive
SUN Solaris 2 (SunOS 5.x)	`bin/csh`	C shell	Determine the archive name as described below.	

Determining the Archive Name for SUN Solaris 2

Determine the archive name 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
```

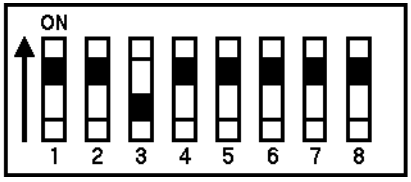
Here you could use `/dev/rmt/0m` (shown underlined above) as the archive name.

Introduction to Configuration Switches

9

Configuration Switches

When the drive is powered on, it reads a set of configuration switches on the underside of the unit. The following diagram shows their default positions.



On On Off On On On On On

To change the configuration, switch the drive off, select the correct configuration for your system, and switch the drive on again.

Note For the drive to operate correctly, appropriate drivers and application software must be loaded on the host computer.

Switches 1 and 2 control Data Compression. Switch 3 usually controls the Media Recognition System (MRS). Switches 4–8 control other functionality.

Switches 1–3 are described below. See Chapter 10 for a full list of settings for switches 3–8.

The following table shows typical Configuration Switch settings:

	1	2	3	4	5	6	7	8
Default	On	On	Off	On	On	On	On	On
HP Alpha	On	On	Off	On	On	On	On	Off
HP HP-UX	On	On	Off	On	On	On	On	On
IBM AIX	On	On	Off	Off	On	On	Off	Off
Linux	On	On	Off	On	On	On	On	On

	1	2	3	4	5	6	7	8
Silicon Graphics SGI	On	On	Off	On	On	Off	Off	On
Sun Solaris	On	On	Off	Off	On	On	Off	Off

Data Compression—Switches 1 and 2

Switches 1 and 2 are used to configure the way in which data compression is set for the drive. The following table shows the available options; whether data compression is enabled or disabled at power-on, and whether the host can subsequently control compression:

Switch 1	Switch 2	Data Compression at Power-On	Control of Compression
On	On	Enabled	Host control
On	Off	Enabled	No host control
Off	On	Disabled	Host control
Off	Off	Disabled	No host control

Switch 1 controls the default state of the drive at power-on:

- If it is ON, the default is compression enabled, which means that data will be compressed without the knowledge of the host.
- If it is OFF, the default is compression disabled.

Switch 2 controls whether or not the host can change the drive's data compression status:

- If it is ON, data compression can be set on or off using appropriate SCSI commands sent from the SCSI tape driver or your backup software.
- If it is OFF, the host cannot change the default compression setting.

Note By default, the drives and autoloaders will decompress data when reading a compressed tape, regardless of the settings of switches 1 and 2. Decompression can be turned off through the DC Characteristics Page of the SCSI MODE SELECT command.

Media Recognition System (MRS)—Switch 3 or 8

Note The Media Recognition System is described in the **Hardware Intergration Guide**, Volume 1 of the HP DDS Technical Manual (see the Introduction).

Switch 3 is usually used to configure the drive to respond to DDS Media Recognition System tapes:

Switch 3	Meaning
On	The Media Recognition System is disabled. All DDS tapes will be treated the same, whether they possess the Media Recognition stripes or not.
Off	The Media Recognition System is active. This is the default. Non-MRS tapes are treated as if they are write-protected.

Switch 8 is used with HP Alpha and SUN Solaris systems. Here switch 8 ON *enables* MRS, and OFF *disables* MRS.

Switches 3 through 8

Switches 3 through 8 are used to specify connectivity and functionality according to host or customer requirements. The default setting is switch 3 *OFF*, and all the other switches *ON*.

Configuring an Autoloader

Note Only DDS-3 and DDS-4 autoloaders currently exist. There is none for DAT 72.

- For *internal* autoloader mechanisms, the option switches are on the rear-panel of the autoloader (see figure 1 on page 9). They are used to set different configurations for the autoloader mechanism, and are read at power-on.
- For *external* (standalone) autoloaders, the value of the option switch setting is shown on the rear panel. It can be adjusted by clicking on the little buttons above and below the number with a ball-point pen or similar.

With the autoloader switched off, you can set the configuration switches. See "Autoloader Option Switch Settings" on page 51 for the various settings.

Tables of Switch Settings

10

Configuration Switch Settings

The following table shows the possible settings for Switches 3–8.

- **Functions**: for details of the various functions, see "Special Function Definitions" on page 47.
- In the **Switches** columns, "1" corresponds to "on" and "0" to "off".

Functions

Asynch REQUEST SENSE	Attention after Load	Caution Clean	Caution for Hard Error	DC Control by Density	Default Fixed Mode	EW-EOM on Read Error	Fast Reset	Fixed 512 Bytes	Forced Eject	Immediate Mode	Infinite Flush	Inquiry C1533/C1553	Inquiry 35480	MRS on	No Data Disconnect	No EW-EOM Residue	Parity off	SDCA Enabled	Signed Residue	Switch Buffered Mode	Truncate INQUIRY by 3	Truncate REQ SENSE	Write Zero Filemarks	Switches 3	4	5	6	7	8
✓	✓	✓	✓			✓			✓							✓				✓			✓	1	1	1	1	1	1
		✓	✓				✓		✓									✓	✓	✓	✓			1	1	1	1	1	0
✓	✓	✓	✓			✓			✓	✓		✓				✓				✓				1	1	1	1	0	1
		✓	✓			✓			✓											✓				1	1	1	1	0	0
✓	✓	✓	✓			✓			✓	✓	✓					✓				✓			✓	1	1	1	0	1	1
		✓	✓				✓		✓	✓	✓							✓	✓	✓	✓			1	1	1	0	1	0
		✓	✓			✓			✓	✓	✓			✓						✓				1	1	1	0	0	1
		✓	✓			✓			✓	✓	✓									✓				1	1	1	0	0	0
✓	✓	✓				✓			✓							✓				✓			✓	1	1	0	1	1	1
		✓	✓		✓	✓			✓					✓						✓				1	1	0	1	0	1
		✓	✓		✓	✓			✓											✓				1	1	0	1	0	0

Functions																									Switches					
Asynch REQUEST SENSE	Attention after Load	Caution Clean	Caution for Hard Error	DC Control by Density	Default Fixed Mode	EW-EOM on Read Error	Fast Reset	Fixed 512 Bytes	Forced Eject	Immediate Mode	Infinite Flush	Inquiry C1533/C1553	Inquiry 35480	MRS on	No Data Disconnect	No EW-EOM Residue	Parity off	SDCA Enabled	Signed Residue	Switch Buffered Mode	Truncate INQUIRY by 3	Truncate REQ SENSE	Write Zero Filemarks	3	4	5	6	7	8
✓	✓	✓	✓			✓			✓							✓				✓			✓	1	1	0	0	1	1
		✓	✓			✓		✓	✓	✓	✓									✓				1	1	0	0	0	0
✓	✓	✓	✓			✓			✓							✓				✓		✓	✓	1	0	1	1	1	1
		✓	✓	✓		✓			✓	✓	✓				✓					✓				1	0	1	1	0	0
✓	✓	✓	✓			✓			✓			✓				✓				✓			✓	1	0	1	0	1	1
		✓	✓				✓		✓	✓	✓				✓			✓	✓	✓	✓			1	0	1	0	1	0
		✓	✓			✓			✓	✓	✓			✓			✓			✓				1	0	1	0	0	1
		✓	✓			✓			✓	✓	✓						✓			✓				1	0	1	0	0	0
✓	✓	✓	✓			✓			✓						✓	✓				✓			✓	1	0	0	1	1	1
		✓	✓			✓			✓	✓	✓									✓		✓		1	0	0	1	0	0
✓	✓	✓	✓			✓			✓				✓			✓				✓			✓	1	0	0	0	1	1
✓	✓	✓	✓			✓			✓					✓		✓				✓			✓	0	1	1	1	1	1
		✓	✓				✓		✓					✓				✓	✓	✓	✓			0	1	1	1	1	0
		✓	✓			✓			✓					✓	✓					✓				0	1	1	1	0	1
		✓	✓			✓			✓						✓					✓				0	1	1	1	0	0
✓	✓	✓	✓			✓			✓	✓	✓			✓		✓				✓			✓	0	1	1	0	1	1
		✓	✓				✓		✓	✓	✓			✓				✓	✓	✓	✓			0	1	1	0	1	0
		✓	✓			✓			✓	✓	✓			✓	✓					✓				0	1	1	0	0	1
		✓	✓			✓			✓	✓	✓				✓					✓				0	1	1	0	0	0
✓	✓	✓				✓			✓					✓		✓				✓			✓	0	1	0	1	1	1
		✓	✓	✓		✓			✓	✓	✓									✓				0	1	0	1	0	0
		✓	✓		✓	✓			✓	✓	✓			✓	✓					✓				0	1	0	0	0	1
		✓	✓		✓	✓			✓	✓	✓				✓					✓				0	1	0	0	0	0
		✓	✓	✓		✓			✓	✓	✓									✓				0	0	1	1	0	0
		✓	✓				✓		✓	✓	✓			✓	✓			✓	✓	✓	✓			0	0	1	0	1	0
		✓	✓			✓			✓	✓	✓			✓	✓		✓			✓				0	0	1	0	0	1

Functions																							Switches					
Asynch REQUEST SENSE	Attention after Load	Caution Clean	Caution for Hard Error	DC Control by Density	Default Fixed Mode	EW-EOM on Read Error	Fast Reset	Fixed 512 Bytes	Forced Eject	Immediate Mode	Infinite Flush	Inquiry C1533/C1553	Inquiry 35480	MRS on	No Data Disconnect	No EW-EOM Residue	Parity off	SDCA Enabled	Signed Residue	Switch Buffered Mode	Truncate INQUIRY by 3	Truncate REQ SENSE	Write Zero Filemarks	3	4	5	6	7	8
		✓	✓			✓			✓	✓	✓				✓		✓			✓				0	0	1	0	0	0
✓	✓	✓	✓			✓			✓					✓	✓	✓				✓			✓	0	0	0	1	1	1
		✓	✓			✓			✓											✓		✓		0	0	0	1	0	0
✓	✓	✓	✓			✓										✓				✓			✓	0	0	0	0	1	1
		✓	✓		✓	✓			✓	✓	✓			✓	✓		✓			✓				0	0	0	0	0	1
		✓	✓		✓	✓			✓	✓	✓				✓		✓			✓				0	0	0	0	0	0

Special Function Definitions

In the following definitions, "✗" corresponds to a blank in the table above.

Asynchronous Sense

This feature is used on some HP-UX systems where the drivers "forget" if they are at a filemark, and send REQUEST SENSE (without a preceding CHECK CONDITION) to find out where they are. This feature should not affect systems that do not want asynchronous sense.

- ✓ The Mark bit may be set on asynchronous REQUEST SENSE.
- ✗ The Mark bit will never be set on asynchronous REQUEST SENSE.

Attention after Load

Some HP-UX (and possibly MPE) drivers expect UNIT ATTENTION sense after a tape is loaded even though the host issued the load command.

- ✓ UNIT ATTENTION and additional sense of 2800h (not ready to ready transition) are posted for a command following a load, including those which just perform rewinds, or do nothing.
- ✗ UNIT ATTENTION is only posted when loading a new tape.

Caution on Hard Error

- ✓ If a hard error occurs on a read or write resulting in additional sense of 1100h (unrecovered read error) or 0C00h (write error), the front panel will display a Media Caution signal indicating that the drive requires cleaning.
- ✗ No special front panel displays are used to report hard errors.

DC Control by Density	This enables device-based control of data compression for SUN and Exabyte drivers, and also for Exabyte drives, which control data compression through the Density Code. In other words, depending on the device filename or device Minor Numbers, the driver sends a Density Code of 0 or 3 on device open. ✓ Data compression on writes is enabled by MODE SELECT Density Code (byte 0 of the Mode Block Descriptor) of 3, and disabled by a Density Code of 0. ✗ The Density Code indicates drive/tape density and has no effect on data compression.
Default Fixed Mode	Some applications (particularly PC-based), designed originally for use with QIC drives, expect a SCSI fixed block length of 1 KB. SCSI states that they should configure this through MODE SELECT, but some applications simply assume that the drive is pre-configured for 1KB fixed-size blocks. ✓ Defaults to fixed block mode with block size set to 1 KB (1024 bytes). ✗ The default block size is 0 (variable block mode).
EW-EOM on Read Error	✓ The EOM bit is set for read errors resulting from read commands meeting the EW-EOM mark. ✗ The EOM bit is only set if the tape is at physical EOP/M.
Fixed 512 Bytes	Some applications (particularly PC-based), designed originally for use with QIC drives, expect a SCSI fixed block length of 512 bytes. SCSI states that they should configure this through MODE SELECT, but some applications simply assume that the drive is pre-configured for 512-byte fixed-size blocks. ✓ Defaults to fixed block mode with block size set to 512 bytes. ✗ Default block size depends on the Fixed mode setting.
Forced Eject	✓ The Forced-Eject function is enabled. ✗ The Forced-Eject function is disabled.
Full Reset	✓ The drive performs a **firm** reset initialization in the event of a SCSI reset, or on receipt of a BUS DEVICE RESET message. ✗ The drive performs a **soft** reset initialization in the event of a SCSI reset, or on receipt of a BUS DEVICE RESET message.

Immediate Mode	Immediate mode for filemarks can significantly improve the performance of systems which do not set the Immediate bit when sending WRITE FILEMARKS commands. On the other hand, data is not flushed to tape in response to a filemark command ✓ Immediate mode is selected and carried out on all commands. "Switched Buffer" = False (✗) is also enforced. The Immediate flags on commands are silently ignored and assumed to be set to 1. ✗ Immediate mode is not selected. Immediate flags are used, and "Switched Buffer" is left as it is.
Infinite Flush	By default, the buffer is flushed every 5 seconds. Infinite flush avoids frequent starting and stopping of the mechanism by very slow applications. 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. ✓ Infinite Flush is selected. The Write Delay is cleared to 0 (infinite buffer flush time-out). Write Delay timing in MODE SELECT is silently ignored. ✗ Infinite Flush is not selected. The default Write Delay time is used. MODE SELECT may be used to re-specify the time-out.
Inquiry C1533/ C1553	✓ The product ID field in the returned INQUIRY data will be "C1533A" regardless of the identity of the drive itself, or "C1553A" in the case of an autoloader. ✗ The drive's product ID will correspond to its genuine HP model number, such as "C1537A" or "C1557A".
Inquiry 35480	✓ The product ID field in the returned INQUIRY data will be "HP35480A" regardless of the identity of the drive itself. This enables some drivers with hard-coded Product IDs to work with newer drivers. ✗ The drive's product ID will correspond to its genuine HP model number, such as "C1537A".
MRS on	✓ The Media Recognition System capabilities of the drive are enabled, allowing the drive to write data to MRS tapes only, but to read from any DDS-format 4 mm tape. Non-MRS tapes are treated as if they are write-protected, and write commands will be rejected with a Sense Key of DATA PROTECT and additional sense of 3000h (incompati0ble medium). ✗ The drive is capable of reading and writing to any 4 mm media.

No Data Disconnect	✓ No disconnects in the data phase. A Save Data Pointers message may still be sent. This option is useful for hosts which cannot disconnect on Odd Byte boundaries. Some SGI hosts cannot disconnect on Odd Word (32 bit) boundaries, so this option should be enabled for SGI connect. *Note:* Avoid SCSI operations which exceed 64 KB, otherwise the bus could hang waiting for I/O from the device side. The drive can normally guarantee to have at least 64 KB of data or space before it starts the data phase. ✗ Disconnects are not regulated, and may occur in the data phase.
No EW EOM Residue	✓ If CHECK CONDITION is reported for EW EOM, the Sense data will not have the Valid bit set. ✗ The Valid bit will be set in the Sense data if CHECK CONDITION is reported for EW EOM.
Parity Off	✓ No parity checking of SCSI data is performed. This option is not recommended, particularly when operating a synchronous bus. ✗ Parity is checked.
SDCA Enabled	✓ The SDCA field in the device configuration mode page (10h) indicates the current state of data compression (1 = enabled, 0 = disabled). MODE SELECT can be used to alter the field to control data compression during writing. ✗ The SDCA field must be zero and cannot be used to control data compression.
Signed Residue	✓ The Residue is negative on a backspace. ✗ The Residue is absolute and positive, for all spacing.
Switch Buffered	✓ As a default, Buffered mode is used. The mode can be switched through the Mode Parameter Header of MODE SELECT. ✗ Buffered mode = 1 is enforced, and the Buffered Mode field in the Mode Parameter Header is silently ignored. This is enforced if the Immediate Mode option is selected.
Truncate INQUIRY by 3	This is needed for DECstation 4000/5000s, which will hang during boot if they find too much INQUIRY data. ✓ The standard INQUIRY page is truncated by 3 bytes to 40h bytes. ✗ The INQUIRY page remains at 43h bytes long.
Truncate Request Sense	✓ The REQUEST SENSE page is truncated to 19 bytes. ✗ The page remains at 22 bytes long.

Write Zero FM

SCSI recommends using Write Zero Filemarks to flush the data buffer to tape. Some HP drivers do this before closing, even if the tape is write-protected.

- ✓ Allows Write Zero Filemarks on a write-protected tape, and also when no tape is loaded.
- ✗ Write Zero Filemarks is treated as any other write command with respect to write-protected tapes, and when there is no tape present.

Autoloader Option Switch Settings

With the autoloader switched off the following configurations can be set. Other settings are currently not used. LUN 0 is the embedded drive, LUN 1 is the autochanger mechanism.

Switches					Auto-Stack	Auto-Eject	LUN 1 Tape	Allow Resequencing	LUN 1 Magazine Ready	LUN 0 Drive Inquiry
1	2	3	4	Value						
On	Off	Off	Off	1h	Enabled	Enabled				
On	Off	On	Off	5h			Enabled	Enabled	Enabled	
Off	On	On	Off	6h				Enabled	Enabled	Enabled
On	On	On	Off	7h				Enabled	Enabled	

Switch 4 is ignored by the firmware.

Auto-Stack

Enabled: When a magazine is inserted, the autoloader will enter Stacker mode and automatically load the first cartridge.

Auto-Eject

Enabled: When the autoloader is in Stacker mode, it will eject the magazine when the last cartridge in the magazine is unloaded.

Allow Resequencing

Enabled: While the drive is in Stacker mode, the Load and Select buttons are available to select a different cartridge.

Not Enabled: The Load and Select buttons are ignored in Stacker mode.

LUN 1 Magazine Ready

Enabled: A SCSI TEST UNIT READY command to LUN 1 will report GOOD status whenever a magazine is present in the autoloader and magazine census data is available. This provides a way of detecting the presence of a magazine.

Not Enabled: A TEST UNIT READY command will receive a GOOD status report whenever the unit has completed the power-on self-tests.

LUN 1 Tape	*Enabled:*	If you direct an INQUIRY command at LUN 1, the Peripheral Device Type on the Standard Inquiry Data Format Page will be 1, identifying the device as a *tape drive* at LUN 1, instead of an autoloader. This allows tape access on SUN Solaris 2.3 and 2.4.
	Nor Enabled:	The Peripheral Device Type is set to 8, identifying the device as an autoloader.
LUN 0 Drive Inquiry	*Enabled:*	The Product ID sent in response to a SCSI INQUIRY command to LUN 0 will be "C1537A" or "C5683A", the DDS drive mechanism. The LUN 1 Product ID will always be "C1557A" or "C5713A".
	Not Enabled:	The Product ID sent in response to a SCSI INQUIRY command to LUN 0 will be "C1557A" or "C5713A", the DDS-2 autoloader mechanism. The LUN 1 Product ID will always be "C1557A" or "C5713A".

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).

autoloader A device embodying a DDS-format tape drive and a cartridge changer mechanism, together with a magazine holding six cartridges, all housed in a single case.

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.

block A logical unit of information. Called "record" in the DDS-format specification.

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.

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 done by representing strings of bytes with codewords.

DAT Digital Audio Tape

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

DDS Digital Data Storage is a recording format that builds on the DAT format to support the storage of computer data. It was developed originally by Hewlett-Packard and Sony as an industry standard. The first generation standard was DDS-1 (or simply DDS), to which was added data compression to produce the DDS-DC standard.

Further enhancements, notably narrower tracks and thinner tape, led to DDS-2, which can typically provide double the capacity of DDS-1.

DDS-3 uses a new magnetic coating on the tape that allows twice the recording density. Together with the use of time-tracking, this gives a DDS-3 tape approximately three times the capacity of a DDS-2 tape.

DDS-4 uses longer tapes (150m). HP's DDS-4 drives, which are ultra-wide SCSI devices, allow transfer rates from 3 to 4 times greater than DDS-3 and capacities that are two-thirds as much again.

DAT 72 uses longer tape again (170m) with narrower tracks to achieve a greater data density leading to capacity of 72 MB (with 2:1 data compression).

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.

group A fixed capacity set of tracks written to or read from tape, defined in the DDS format.

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.

Media Recognition System (MRS) A method by which a drive can recognize data-grade tape. The tape has a series of stripes on its transparent leader tape that the drive can detect. By default, the drive treats a non-Media Recognition System tape as read-only and will not write data to it. However, it is possible to switch the recognition system off using the Configuration switches in the underside of the drive. If this is done, the drive will treat all DDS tapes the same.

partition A part of a tape that can be treated as a complete and independent whole. A tape can have one or two partitions.

random mode *Autoloaders only:* In random mode, cartridges are used in order dictated by the host or the user, rather than sequentially, as in stacker mode. For each cartridge to be used, the host must issue a SCSI MOVE MEDIUM command to instruct the autoloader to move the cartridge from the magazine to the drive. When the cartridge is full, or when no further use is to be made of it, the host must again use the MOVE MEDIUM command to return the cartridge to the magazine and load another.

SCSI Small Computer System Interface.

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.

stacker mode *Autoloaders only:* In stacker mode, cartridges are used sequentially from the autoloader magazine. The cartridge selected by the user (by pressing the front panel Select button, and then loaded by pressing the Load Cartridge button) is used first. When the cartridge is full, the changer mechanism automatically moves it back to the magazine, and then moves the cartridge in the next highest numbered slot to the drive. This continues until all the cartridges have been used. To load cartridges under host control, the device must be in random mode.

ANSI American National Standards Institute, which sets standards for, amongst other things, SCSI and the safety of electrical devices.

BOM Beginning Of Media. 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* or *2* 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.

compression ratio A measure of how much compression has occurred, defined as the ratio of the amount of uncompressed data to the amount of compressed data into which it is transformed. The LTO-DC algorithm can typically achieve a compression ratio of between 2:1 and 4:1 depending on the nature of the data.

decompression A procedure in which the original data is generated from compressed data.

ECMA European Computer Manufacturers Association. The European equivalent of ANSI.

EOD End Of Data. An area that signifies the end of the valid data. If new data is written over a larger quantity of old data, it is possible for data to exist after EOD, but because it is after EOD, this old data is no longer valid.

EOM End Of Media format. The last usable point on the tape.

EW-EOM Early Warning End Of Media. A physical mark or a device-computed position on the tape that tells the drive that it is approaching EOM.

filemark A mark written by the host. It does not necessarily separate files; it is up to the host to assign a meaning to the mark.

filemark count A mark written by the host. It does not necessarily separate files; it is up to the host to assign a meaning to the mark.

FRU Field Replaceable Unit, an assembly or group of components that is replaced in its entirety by Service Engineers when it contains a fault.

hard error An uncorrectable data error.

host The host computer system acting as controller for the drive.

load The process in which the drive takes in an inserted cartridge and goes online.

LUN Logical Unit Number, by which different devices at a particular SCSI ID can be addressed individually. The drive has a fixed LUN of 0.

LVD Low-Voltage Differential. *See* SCSI.

offline The drive is offline if the tape is currently unloaded or not in the drive. The host has limited access, and cannot perform any commands that would cause tape motion. The host can, however, load a tape, if one is inserted, and can execute any diagnostic tests that do not require tape motion.

online The drive is online when a tape is loaded. The host has access to all command operations, including those that access the tape, set configurations and run diagnostic tests.

RAW *see* read-after-write

read-after-write RAW improves data integrity by reading data immediately after it is written and writing the data again if an error is found.

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 specifications (see Chapter 1, "Interface Implementation" in Volume 3, The SCSI Interface, of the HP Ultrium Technical Manual) and support all features required by those 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 20 MB/s wide, using a cable of up to 6 meters total length.

Ultra SCSI can transfer data at up to 40 MB/s wide, but the cable length cannot exceed 3 meters (it is also known as “Fast20”).

Ultra2 SCSI can transfer data at up to 80 MB/s wide, using a cable of up to 25 meters total length for a single device, or up to 12 meters for two or more devices (it is also known as “Fast40”).

Ultra3 or *Ultra160* can transfer data at up to 160 MB/s wide. Cable lengths are as for Ultra2.

Ultra4 or *Ultra320* will transfer at up to 320 MB/s.

Ultra SCSI supports both SE and LVD interfaces. In normal situations, slower devices can coexist with faster devices, and narrow devices can be used on the same SCSI bus as wide devices using a suitable adapter.

HP’s Generation 1 Ultrium drives are Ultra2, wide SCSI-3 compatible devices. They can be used with both LVD and SE host bus adapters.

Generation 2 Ultrium drives are Ultra160, wide SCSI-3 compatible.

single-ended *see* SCSI

TapeAlert A set of 64 flags is held in the TapeAlert log that indicate faults or predicted faults with the drive or the media. By reading this log, host software can inform the user of existing or impending conditions, and can, for example, advise the user to change the tape.

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