HEWLETT PACKARD

Using The Model 4000DC with HP Systems

Important Information Please Read

Application Note

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Contents

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Connectivity

The Series 4000DC is supported on the majority of HP systems. The following table gives details of system compatibility.

Systems Supported	
System	**Series 4000DC**
HP 9000 Series 300	Not planned
HP Apollo 9000 Series 400	Not planned
Series 700	HP-UX 9.07 or later*
F/G/H/I Class	HP-UX 9.04 version A.B9.04.3B or later
E Class	HP-UX 9.04 version A.B9.04.3B or later
HP 9000 Model T500	HP-UX 9.04 version A.B9.04.3B or later
HP 3000 Series 900	HP MPE/iX 5.0
HP 1000 RTE	Not planned

** Late summer 1995. For other Series 700 O/Ss, contact your Hewlett-Packard Sales Representative*

Assuming that your tape drive is correctly installed (refer to the Model 4000DC User's Manual), the kernel should already have the tape drivers configured. If you have any doubts, use SAM to check the configuration.

Device files tell your host computer system which system hardware path to use when communicating with a specific device, and what kind of device it is. The device files for HP DDS drives are located in the directory `/dev/rmt`.

A device file is made up of a Major and Minor number. Major number recommendations are as follows:

- **121** is recommended as the preferred major number for Series 700 for HP-UX releases before 10.0. (**54** is **not** recommended but will function satisfactorily from HP-UX 9.01 upwards).

- **205** is recommended as the preferred major number for using a GSC+ bus (for example, Series 700) with HP-UX 10.0 and later.
- 5 is the recommended major number for Series 800 for HP-UX releases before 10.0.
- **212** is the recommended major number for Series 800 for HP-UX 10.0 and later.

Note

Future releases of HP-UX (10.0 and above) may use different major numbers.

Corresponding minor number format

The Series 700 Minor Number Format for Major Number 121

The minor number format is **0x[BBB][T][L][D]**, where:

[BBB] Bus (Interface)

201 = Core SCSI

[T] Target (SCSI ID)
7 = Invalid (reserved for host system or initiator)

[L] Logical Unit Numbers (LUN)
For tape drives only, add 8 to LUNs to select partition one.

[D] Device type specific configuration parameters.

0—Low density, AT&T, rewind on close
1—Low density, AT&T, no rewind on close
2—Low density, Berkeley, rewind on close
3—Low density, Berkeley, no rewind on close
4—Medium density, AT&T, rewind on close
5—Medium density, AT&T, no rewind on close
6—Medium density, Berkeley, rewind on close
7—Medium density, Berkeley, no rewind on close
8—High density, AT&T, rewind on close
9—High density, AT&T, no rewind on close
A—High density, Berkeley, rewind on close
B—High density, Berkeley, no rewind on close
C—Very high density, AT&T, rewind on close
D—Very high density, AT&T, no rewind on close
E—Very high density, Berkeley, rewind on close
F—Very high density, Berkeley, no rewind on close

The DDS drive is normally configured as SCSI ID = 3. Make sure that this address does not conflict with other peripherals connected onto the same SCSI bus. For example, to create a device file on SCSI ID 3 using:

—major number **121** with data compression for the Model 4000 DC
—a connection onto the core SCSI bus
—very high density, Berkeley, no rewind on close option

proceed as follows:

```
mknod /dev/rmt/3hcn c 121 0x20130F
```

The Series 700 Minor Number Format for Major Number 54

The minor number format is **0x[BBB][T][X][Y]**, where:

[BBB] Bus (Interface)
201 = Core SCSI

[T] Target (SCSI ID)
7 = is reserved for host system (initiator)

[X] Density and Partition

0—Low density, partition zero
1—Low density, partition one
2—Not supported
3—Not supported
4—Medium density, partition zero
5—Medium density, partition one
6—Not supported
7—Not supported
8—High density, partition zero
9—High density, partition one
A—Not supported
B—Not supported
C—Very high density, partition zero
D—Very high density, partition one
E—Not supported
F—Not supported

[Y] Device type specific cofiguration parameters

0—Variable, buffering, AT&T, rewind on close
1—Variable, buffering, AT&T, no rewind on close
2—Variable, buffering, Berkeley, rewind on close
3—Variable, buffering, Berkeley, no rewind on close
4—Variable, no buffering, AT&T, rewind on close
5—Variable, no buffering, AT&T, no rewind on close

6—Variable, no buffering, Berkeley, rewind on close
7—Variable, no buffering, Berkeley, no rewind on close
8—Fixed, buffering, AT&T, rewind on close
9—Fixed, buffering, AT&T, no rewind on close
A—Fixed, buffering, Berkeley, rewind on close
B—Fixed, buffering, Berkeley, no rewind on close
C—Fixed, no buffering, AT&T, rewind on close
D—Fixed, no buffering, AT&T, no rewind on close
E—Fixed, no buffering, Berkeley, rewind on close
F—Fixed, no buffering, Berkeley, no rewind on close

Note

Only SCSI tape devices with zero-valued logical unit numbers are accessible through major number **54**.

The DDS drive is normally configured as SCSI ID = 3. Make sure that this address does not conflict with other peripherals connected onto the same SCSI bus. For example, to create a device file on SCSI ID 3 using:

—major number **54** with data compression for the Model 4000DC
—SCSI ID 3 on core SCSI bus
—no rewind on close option

proceed as follows:

```
mknod /dev/rmt/3m c 54 0x201342
```

The Series 700 Major Number 205 and Series 800 Major Number 212

Description

For the new HP-UX release 10.0, it is not recommended to use the `mknod` command to create tape device files. Instead, use the `mksf` (make a special (device) file) command. As of release 10.0, there are more configuration options than will fit in the device file's minor number. Prior to the 10.0 release it was possible to select configuration options by directly setting the bits in the device special file's minor number using `mknod` command. These options are no longer valid with the 10.0 release.

With the HP-UX 10.0 release, a base set of configuration options are contained in the minor number. Extended configuration options are stored in a table of configuration properties. The minor number can contain an index into the property table, which is maintained by the

tape driver and is not directly visible to the user. The `mksf` command sets the minor number and modifies the property table as needed based on mnemonic parameters passed to the command.

If the device configuration requirements are limited to the base set of options, the property table should be correct. The base set of options are:

- hardware address (card instance, target and unit number)
- density (from the set of pre-defined options listed in mksf)
- compression (using the default compression algorithm)
- rewind or no rewind
- Berkeley or AT&T mode

All other configuration options are extended options that result in use of the property table.

It is recommended all tape device files be put in the `/dev/rmt` directory. All tape device files using extended configuration options ***must*** be put in the `/dev/rmt` directory. This is required for proper maintenance of the property table. Device files using extended configuration options located outside the `/dev/rmt` directory may not provide consistent behavior across system reboots.

Note

Use the `rmsf` command to clean up the unused device files. Otherwise, the property table may overflow and cause the `mksf` command to fail.

Naming Conventions

There are two naming conventions for device special files.

- The standard (preferred) convention is used on systems that support long file names. The following standard convention is recommended because it allows for all possible configuration options in the device name and is used by the `mksf` command.

```
/dev/rmt/c#t#d#[o] [z] [e] [p] [s[#]] [w]density[c[#]] [n] [b]
```

- An alternate convention is provided for systems limited to short file names. The following alternate naming convention is provided to support systems in which the `/dev/rmt` directory requires short file names. These device special file names are less descriptive, but guarantee unique device naming and are used by the `mksf` command where required.

```
/dev/rmt/c#t#d# [f#] [i#] [n] [b]
```

For each tape device present, eight device files are automatically created for regular use when the system is initialized. (A ninth file can be created especially for use by system diagnostics.) Four of these device files utilize either the standard or alternate naming conventions. When the standard naming convention is used, these four files contain the density specification "BEST". When the alternate is used, these four files contain the density specification "f0". There are four such files because each of the four different permutations of the "n" and "b" options is available.

The remaining four files automatically created when the system is initialized utilize the pre-HP-UX 10.0 device file naming convention. This includes an arbitrary number to distinguish this tape device from others in the system, followed by the letter m. There are four such files because each of the four different permutations of the "n" and "b" options is available.

Each of the automatically created four device files which utilize the standard or alternate naming conventions is linked to a device file which utilizes the pre-HP-UX 10.0 naming convention. Thus, the device files which utilize the pre-HP-UX 10.0 naming convention typically provide the same functionality as the device files which contain the density specification "BEST" or "f0".

Options

The options described here are common to all HP-UX 10.0 tape drivers. The c#t#d# notation in the device special file name drives from ioscan output and is described in the manpages for ioscan and intro. Options unique to stape, tape1 and tape2, are described later in the "Dependencies" section manpage for mksf.

c# Instance number assigned by the operating system to the interface card.

t# Target address on a remote bus (for example, SCSI or HP-IB address).

d# Device unit number at the target address (for example, SCSI LUN).

w Writes wait for physical completion of the operation before returning status. The default behavior (buffered mode or immediate reporting mode) requires the tape device to buffer the data and return immediately with successful status. (This

option is not recommended as it increases head wear and decreases performance dramatically.)

Density Density or format used in writing data to tape. This field is designated by the following values:

- BEST — Highest capacity density or format will be used, including data compression, if the device supports compression.
- NOMOD — Maintains the density used for data previously written to the tape. Behavior using this option is dependent on the type of device. This option is only supported on DDS and 8 mm drives.
- DDS — Selects one on the known DDS formats; can be used to specify DDS 1 or DDS 2, as required.

C[#] Write data in compressed mode, on tape drives that support data compression. If a number is included, use it to specify a compression algorithm specific to the device.

Note

Compression is also provided (if possible) when the density field is set to BEST.

n No rewind on close. Unless this mode is requested, the tape is automatically rewound upon close.

b Specifies Berkeley-style tape behavior. When the `b` is absent, the tape drive follows AT&T-style behavior. For further details refer to the `mt (7)` manpage in the "Tape behavioral characteristics" section or the "Device file configuration parameters" section of this manual.

f# Used for short filename notation only. Specify format (or density) value encoded in the minor number. The meaning of the value is dependent on the type of tape device in use.

i# Used for short filename notation only. Specify an internal Property Table index value maintained by the tape driver, containing an array of configuration options. The contents of this table are not directly accessible. Use the `lssf` command to determine which configuration options are invoked.

Sample device special file name

For a device at card instance 1, target 2, LUN 3, with exhaustive mode enabled (see "Dependencies" section), fixed block size of 512 bytes, DDS 1 density with compression, AT&T-style with no rewind on close, the standard device file special name would be:

```
/dev/rmt/c1t2d3es512DDS1Cn
```

For a system requiring short file names, the same device special file would be named:

```
/dev/rmt/c1t2d3i<#>n
```

Where <#> is an index value selected by the tape driver.

Use the `lssf` command to determine which configuration options are actually used with any device file. The naming convention defined above should indicate the options used, but device files may be created with any user-defined name.

Dependencies

Driver-specific options for `stape` (major number 205)

The following options (available only through the property table) can be used in creating device special files for tape drives that access the `stape` driver:

e Exhaustive mode is enabled (default is disabled). When exhaustive mode is enabled, the driver will, if necessary, attempt several different configuration options when opening a device. The first attempt follows the minor number configuration exactly, but if that fails, the driver attempts other likely configuration values.

With exhaustive mode disabled, the driver makes only one attempt to configure a device using the configuration indicated in the minor number.

p Specifies a partitioned tape whose currently active partition is partition 1 (closest to BOT (beginning of tape). Optional partition 1 is closest to BOT for possible use as a volume directory. The default partition without this option is partition 0. If partitioning is unsupported, the entire tape is referred to as partition 0.

s[#] Specifies fixed-block mode; the optional number indicates the block size. If the number is present, the driver selects a default block size appropriate to the device type.

Driver-specific options for `tape1` and `tape2` (major number 212)

The following options may be used in creating device special files for tape drives that access the `tape1` and `tape2` driver:

o Diagnostic messages to the console are suppressed.

z The tape driver will attempt to mimic the behavior of RTE systems; that is, the driver will not do any tape alteration or movement when the device is closed.

Media usage

However, for DDS devices, the density that data is written to the tape is restricted and determined by the combination of device type and tape length, rather than by the density specified in the device file name. These restrictions are specified in the following table.

The device file naming convention is a generalized scheme that permits a high degree of flexibility in specifying the density that data will be written to tape for several different tape technologies.

Tape Length	Device Type (Product Number)			
	HP 35470/80		A3324A	
	Write	Read	Write	Read
60 m	DDS-1	DDS-1	DDS-1*	DDS-1*
90 m	DDS-1	DDS-1	DDS-1*	DDS-1*
120 m	EJECTED	EJECTED	DDS-2	DDS-2

* Automatically attempts to write DDS 1 at 510 Kbytes/sec.

If a density is specified in the device file name which is inconsistent with this table, no error will be reported. However, the density in the device file name will be ignored and the density specified in this table will actually be used.

The Series 800 Minor Number Format for Major Number 5

The minor number format is **0x[A][B][C][D][EF]**, and is shown below:

A				B			C	D	EF
8	9	10	11	12	13 14	15	16-20	21-23	24-31
Trans-parency	RTE Mode	Buffered Mode Inhibit	Berkeley Mode	No Rewind on Close	Density	Data Compression	Not Used	SCSI ID	Not Used*
0=Normal 1=Diagnostic	0=Off 1=On	0=No 1=Yes	0=Off 1=On	0=No 1=Yes	00=800 01=1600 10=6250	0=Off 1=On	0	0-7	

[A] 0—Enable Buffered Mode, Berkeley mode off
1—Enable Buffered Mode, Berkeley mode on
2—Disable Buffered Mode, Berkeley mode off
3—Disable Buffered Mode, Berkeley mode on

[B] 0—Rewind on close, data compression off
1—Rewind on close, data compression on

[C] Not used.

[D] SCSI ID.

[EF] * Not used (for DDS devices).

SCSI ID 7 is reserved for the host system (initiator).

For example:

- Create a non-compressed device file for SCSI ID = 1, with a no rewind on close, Berkeley style close:

```
mknod /dev/rmt/1nmb c 5 0x180100
```

Note

When the operating system boots on a Series 800, it automatically configures any new peripheral attached to it. Certain core device files are also created automatically, except for "compressed device files" which are *not*.

Device File Configuration Parameters

Rewind and No Rewind Modes

Normally the tape media is repositioned to Beginning of Tape (BOT) when the device file is closed. Device file minor numbers identified by "rewind on close" cause this mode of operation. Device file minor numbers identified by "no rewind on close" do not cause tape media to be repositioned to BOT when the device file is closed. This mode of operation is useful when creating and reading multiple file tape media.

Berkeley and AT&T Modes

Berkeley and AT&T functional modes differ in "read only" close functionality alone. If Berkeley identifies a "read only" close on a device file minor number, the tape media position will remain unchanged by the device close operation. If AT&T identifies a "read only" close on a device file minor number, the tape media will be repositioned just after the next tape filemark (the start of the next file). Normally, Berkeley mode should be used.

Data Compression

Some tape devices can read and write data using multiple data formats. Typically, these different formats use differing data densities. The SCSI tape driver (prior to HP-UX 10.0) supports four distinct data density values in device file minor numbers: low density, medium density, high density and very high density. DDS Drives operate in two modes only: Data Compression "on" and Data Compression "off": Very high density is used to enable data compression. The following table shows the specific meaning of data densities with respect to DDS Tape Devices.

	Low	Medium	High	Very High
Data Compression	Off	Off	Off	On

Buffered and Unbuffered Modes

Write buffering (also known as immediate reporting) allows tape devices to indicate write completion as soon as data is received. Device file minor numbers identified by "buffering" cause write buffering to be enabled. Write buffering is generally necessary so that a tape device can achieve continuous media motion (streaming).

Device file minor numbers identified by "no buffering" cause write operations to be unbuffered (write completion is not indicated until data is committed to media). This mode is likely to reduce I/O performance and media capacity, and cause the tape to make more passes over the tape head. These additional tape passes reduce tape and head life. Device file minor numbers identified by "no buffering" should not normally be used. Unbuffered mode is only available through device major number **54** and **205** through the property table.

Variable and Fixed Block Modes

Data is written on tape media in data blocks. Device file minor numbers identified by "variable" cause data block sizes to be determined by write system calls (each write system call causes one data block to be written to the tape media). Device file minor numbers identified by "fixed" cause data blocks of a consistent size to be written. The specific data size is determined by the tape device and the driver. Write system calls to a device file in fixed block size mode must be an integral number of blocks in length. Normally, variable sized blocks are used. Fixed block size mode can increase or decrease I/O performance and capacity (depending on the tape device and the specific fixed block size). Fixed block size is only available through major number **54** and **205** through the property table.

Partition Zero and Partition One

Normally, tape media contains a single partition (identified as partition zero). HP DDS tape devices support dividing a single tape medium into two partitions (two separate logical volumes). Media may be partitioned by using the `mediainit` command with "`-p`" option. The partition identified as partition one is located nearest to the beginning of the tape (BOT) The partition identified as partition zero is located nearest to the end of the tape (EOT).

If the last tape access was to partition zero, the tape media is unchanged on an "open" to partition zero. Device file minor numbers

identified by "partition one" cause the tape media to reposition to the beginning of partition one on an "open" when the tape contains multiple partitions and the last tape access was to partition zero.

If the last tape access was to partition one, the tape media is unchanged on an "open" to partition one.

Partitioning tape media and access to partition one requires the use of major number **54** and **205** through the property table.

Testing the DDS Drive

Make sure that the DDS drive is powered on. Insert a data (write enabled) cartridge and wait until the drive has completed its load sequence (with the "Tape" LED steady green). The sequence takes approximately 15 seconds.

Execute a drive command as follows:

```
mt -t /dev/rmt/xx rew
```

where `xx` is the device file name corresponding to the previously configured drive.

Note

If the `t` option is omitted, the device file `/dev/rmt/0mn` (`0mnb` for 10.0) will be used as default.

If the command returns no error, the installation has worked correctly. If not, check the following:

- Are the cables connected correctly? Make sure that the SCSI bus is terminated at both ends. The last device in the chain should have an active termination resistor fitted.
- Is the drive turned on?
- Is the data cartridge inserted and the "Tape" light steady green? (Only if the data cartridge is write-protected.)
- Are the device files correct?
- Is the relevant tape driver configured?
- On Series 800 systems, has the system autoconfigured on booting?

How To Make a Recovery Tape

The most important requirement of a backup system is its ability to recover from a system crash. In the event of a serious system crash, you cannot boot the system from the root disk because the data on the disk is corrupted, or the disk itself may be damaged. In this situation, the computer can be booted from the DDS drive.

The system cannot be booted from a backup; it can only be restarted from a bootable image. A Recovery System contains a bootable image, along with a small subset of the file system which is enough to start the system after a disk failure. Unlike a backup, a recovery system can be used to start the system. Once operating, all files can be restored from a backup.

A Recovery System can be created using the `mkrs` command, when logged in as `root`. `mkrs` has the following form:

```
/etc/mkrs [-v] [-q] [-s] [-f rcdev] [-r rootdev] [-m seres]
```

For example, to make a recovery system of a root disk on `/dev/dsk/c201d6s0` to a DDS drive on `/dev/rmt/c201d3m`, enter the following command:

```
/etc/mkrs/ -v -q -s -f /dev/rmt/c201d3m -r
/dev/dsk/c201d6s0
```

How to Make a Backup

HP-UX is very rich in features that provide great flexibility, although it also provides many non-optimal ways of performing tasks. In general, the HP DDS drive operates best when you use the largest block size (or blocking factor) available with any of the utilities. For example:

`fbackup` Use the "`-c`" option with blocksperrecord set to 128 and checkpointfreq set to 512.

`cpio` Use the "`-B`" option.

`dd` `bs` = 32k.

Note

This section gives general information on the utilities available. It is not intended to give a full description of how to use the system in any particular situation.

These HP-UX utilities are available for use:

fbackup sophisticated general-purpose backup program. It supports the fast file recovery feature of the drive.

dump easier to use, general-purpose archive program.

cpio industry standard, hardware independent archiving program. Suitable for file interchange, although the maximum block size of 5 Kbytes inhibits performance.

fit faster tape backup program.

tar standard tape archiving program. This is the most common file interchange program in the industry (on most UNIX (TM) systems).

dd provides a raw backup feature.

The following information gives some examples of how to use your DDS drive:

Note

For additional information on HP-UX commands refer to the manual pages by typing the following:

```
man command
```

where `command` is the name of the command, for example: `tar`, `cpio`, `fbackup`, and so on.

Simple tar examples

Writing

Enter the following command line to write to the tape:

```
tar -cvf /dev/rmt/3m pathname
```

where `pathname` is the pathname of the file or directory containing the files that you want to write to the tape.

Note

If the `-f` option is omitted, then `/dev/rmt/0m` will be used as the default tape device drive.

Restoring

Use cd to change to the directory you want to restore the files to. Enter the following command line to restore data:

```
tar -xvf /dev/rmt/3m pathname
```

where pathname is the pathname of the file or directory containing data that you want to restore from the tape. If pathname is not specified, everything on the tape is restored.

Listing the files held on the tape

Enter the following command line to get a full listing of the data stored on tape:

```
tar -tvf /dev/rmt/3m
```

Simple cpio examples

Writing

Enter the following command line to write the contents of a directory to tape:

```
cd /xx ; find . | cpio -ocB >/dev/rmt/3m
```

where xx is the name of the directory to be backed up.

Note

A full backup from your root disk must include the hidden and special device files.

Restoring

Use cd to change to the directory you want to restore the files to. Enter the following command to restore data:

```
cpio -icvdxumB </dev/rmt/3m
```

Listing the files on the tape

Enter the following command line to get a full listing of the data stored on tape:

```
cpio -itcvB < /dev/rmt/3m
```

To create an index, enter the following command:

```
cpio -itcvB < /dev/rmt/0m > /tmp/index
```

Note

Do not use software compression with the data compression device file. The DDS drive uses the Lempel-Ziv compression in hardware, and a second software compression will extend your data size by extra overhead data.

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A3324-96001

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Manual Part Number
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