
HP Series 6400 Model 2000 and Model 2000 DC DAT Drives



User's Manual

The information contained in
this manual covers the C1520B
and C1521B DAT drives

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1992

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An Introduction to the HP Series 6400 Models 2000 and 2000DC

This manual explains how to unpack, set up, use and maintain your HP Series 6400 Model 2000 and 2000DC tape drives.

Both products incorporate the latest 3½-inch form factor Digital Audio Tape (DAT) technology, with a SCSI II interface, and HP's DATIO backup software utility for HP-UX based systems. Both tape drives store data in a format called DDS (Digital Data Storage) based on the DAT technology.

The Model 2000 and 2000DC can use both 60m and 90m DDS cassettes. On each 90m DDS cassette, the Model 2000 can store up to 2 gigabytes of data at transfer rates of up to 650 megabytes an hour.

The Model 2000DC can store up to 8 gigabytes of unattended backup on a 90m DDS cassette using a standard method of data compression (DCLZ*), which is described later in this chapter. The Model 2000DC has a transfer rate of up to 2.5 gigabytes an hour.

The Model 2000 and 2000DC can be used with a variety of computer systems and applications, and are fully compatible with those HP DAT drives which use 60m DDS cassettes (refer to the information on Media Compatibility contained in Chapter 3).

To find the commands which you should use with your particular system, consult your system manual, in conjunction with your DATIO backup utility manual (part number C1520-90951).

Data Compression and the Model 2000DC

The DDS-format of the Model 2000DC has been extended to include Data Compression. We call this enhancement DDS-DC. To ensure that the method of data compression we adopted would probably become an industry standard, and would have a high compression ratio, we adapted the popular Lempel-Ziv (LZ) algorithm. DCLZ* is implemented in the electronics of the Model 2000DC. This data compression process is resident in the tape drive and is transparent to the host system. The drive compresses data in real time, leaving the host free to manage other processes. The DCLZ algorithm can achieve a compression factor between 2 to 4, depending on the type of data being compressed. In the case of files containing lots of repetitive information, such as text and databases, a compression factor of four or more can be obtained.

Data compression also has the following advantages, although it should be noted that data compression factors are strictly dependent upon the type of data being compressed.

- It enables the Model 2000DC to achieve better transfer rates than drives that do not have data compression, though these transfer rates are host and operating system dependent. The drive's performance is therefore enhanced by allowing it to match the performance of higher transfer rate systems more closely.
- It allows the drive to store more data on the same length of tape.

Although DDS and DDS-DC are, in effect, two separate standards, the Model 2000DC maintains the full functionality of a DDS format drive, as it can also read and write data in a non-DC format.

The DDS format, as developed jointly by Sony Corporation and Hewlett-Packard, has been accepted as the industry standard for DAT technology by ISO and ECMA, and is pending ANSI approval. Model 2000DC data can therefore be read by other manufacturers' drives with the same standard.

* *Data Compression Lempel Ziv (DCLZ)*

1

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Setting Up

To check the drive after unpacking

Check that the box contains the following equipment with the HP Series 6400 Model 2000 and 2000DC tape drive:

- The tape drive**
- A power cord**
- A blank 90m DDS-format cassette**
- A head-cleaning cassette**
- DATIO cassette**
- A SCSI connector cable**
- A SCSI bus terminator**
- This User's Manual**
- A DATIO User's Manual**

Inspect the equipment for any physical damage which may have occurred during shipment.

If any equipment is missing or damaged, tell your Hewlett-Packard Sales Office and file a claim with the carrier. Keep the shipping carton for the carrier to inspect.

Save the shipping carton and packing for future use.

To position the drive

Choose a place for the drive which satisfies the following points:

- The ventilator grilles on each side of the drive must not be obstructed, so that the drive has adequate ventilation.
- The drive should be in a position where the temperature is relatively stable, for example, away from open windows, fan heaters, and doors. See Looking after Cassettes in chapter 3 for more details.

To change the SCSI ID

When the host computer needs to communicate with a peripheral device on the SCSI bus, it is essential that it can find the correct one, so each device must be allotted a unique number. This is called the SCSI ID.

- The Model 2000 and 2000DC is preset to SCSI ID 3 on delivery.
- You only need to change the preset ID if you already have a device with ID 3 connected to your computer.

If you need to, change the ID as follows:

- 1 Switch off the drive by the switch on the rear panel (see figure 1).
- 2 Choose an ID which is not already being used by a device on the SCSI bus, and use the push-button selector on the rear panel (see figure 1) to change the ID to the new setting.

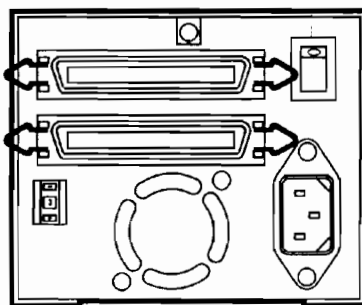
Figure 1

Power ON/OFF
switch

SCSI connector 1

SCSI connector 2

SCSI ID selector



Note

If you change the SCSI ID after the drive has been in use, cycle the power by switching the drive off and then on again after changing the address. The ID is only read when the drive is switched on.

To connect to the host computer

Only a single-ended SCSI configuration is supported. You must use shielded connectors. To ensure compliance with the SCSI standard, you must daisy-chain the drive, using both connectors. This means that all SCSI peripherals (tape drives, printers, plotters, and so on) must be connected in a chain with the computer at one end and a terminator at the other. A single-ended SCSI bus **must** be terminated at **both** ends of the bus.

- **If the Model 2000 or 2000DC is to be the middle of the chain, proceed as follows:**

- 1 Connect the end of the SCSI cable from the computer side of the chain to either socket, SCSI Connector 1 or 2 on the rear panel of the tape drive (see figure 1). Clip the connector securely in place.
- 2 Connect the end of the SCSI connector going to the next peripheral on the chain to the free socket on the rear panel of the tape drive. Clip this connector securely in place.

- **If the Model 2000 or 2000DC is to be at the end of the chain, proceed as follows:**

- 3 Connect the end of the SCSI cable from the computer side of the chain to either socket, SCSI Connector 1 or 2, on the rear panel of the drive. Clip the connector securely in place.
- 4 Connect a SCSI External Terminator to the free socket on the rear panel of the tape drive. Clip the connector securely in place. An External Terminator is provided with the tape drive.

Note

The total length of all SCSI cabling must be less than 6 meters. This includes cabling inside each peripheral *and* the computer. The SCSI cable (K2291) shipped with your Model 2000 or 2000DC can be connected to the majority of HP systems. Please consult your host system configuration guide to identify the recommended SCSI cable.

To connect to the power supply

Note The Model 2000 and 2000DC will operate using any voltage between 100–240 volts. No adjustment is needed.

To connect the drive to the power supply, proceed as follows:

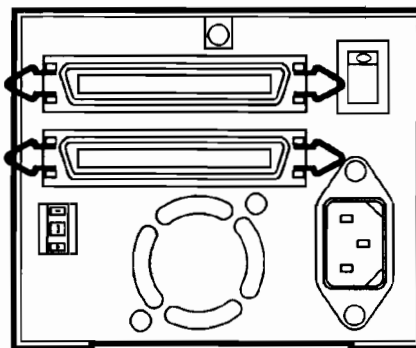
- 1 Ensure that the tape drive is switched off using the Power ON/OFF switch on the rear panel (see figure 2).
- 2 Plug the power cord securely into the socket labeled ~ AC Line on the rear panel of the drive.
- 3 Plug the other end of the power cord into the power supply outlet.

Figure 2

Power ON/OFF switch

~ AC Line socket

The Power Supply



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Using the Model 2000 and 2000DC

Using the Model 2000 and 2000DC Tape Drive

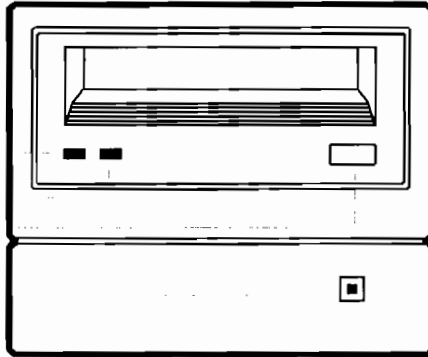
This chapter covers the operation of the drive, the care of cassettes, the front panel lights, and warning signals.

Note Because of the variety of applications and systems available, this manual **does not** describe the commands you will use to back up and transfer your data. See your **DATIO User's Manual and backup software and systems manuals for this information.**

Switching On

Once you have completed the steps in Chapter 1, you can switch the drive on using the ON/OFF switch on the rear panel. The power indicator on the front panel lights up when the drive is switched *on* (see figure 3).

Figure 3



Cassette light

Drive light

Unload button

Power indicator

The Front Panel

The tape drive now performs a self-test routine, during which both front panel lights pulse amber. When the lights go out, the drive is ready to accept a DDS cassette.

Front Panel Displays

The front panel has two bi-color lights (LEDs). Green is used to show normal operation, while amber is used to imply warning conditions. Pulsing indicates drive activity—the light goes on and off regularly, twice a second. If the Cassette light (left) shows steady amber, this indicates that the cassette is write-protected. If the Drive light (right) shows steady amber, this indicates a fault condition.













Normal Operation

Figure 4

	Cassette	Drive	Meaning	Key
Writing is allowed (no write protection)			Cassette loading or unloading	Off
			Cassette loaded/Drive online	Green
			Cassette loaded/Activity occurring	Amber
			Cassette loaded/Drive offline	Pulse Green
Writing not allowed (cassette is write-protected)			Cassette loading or unloading	Pulse Amber
			Cassette loaded/Drive online	
			Cassette loaded/Activity occurring	
			Cassette loaded/Drive offline	
Front Panel lights during normal operation			Cassette loaded/Drive offline	

Warning Conditions and Error States

Figure 5

	Cassette	Drive	Meaning	Key
			Caution Signal	 Off
			High humidity or no termination	 Green
Front panel error and warning states			Self-test (normal)	 Amber
			Self-test (failure)	 Pulse Amber

Caution Signal

The Model 2000 and 2000DC monitors the number of read-after-write (RAW) retries when writing or third level errors (C3 ECC) it has to correct when reading a tape. If the numbers grow excessive, it can mean the tape heads need cleaning, or that the tape is nearing the end of its useful life. This is indicated by the Caution signal. A Caution signal will also be issued in the event of a hard read or write error. In this case a failure message will appear on the system console.

As shown in figure 5, the Caution signal is displayed by the Cassette light on the front panel showing green and the Drive light pulsing green and amber alternately.

This condition could be caused by dirty heads. If the pattern appears, first clean the tape heads as described in chapter 3. Next, repeat the operation you were performing with the tape and see if the Caution signal occurs again. If it does, you should copy the data from the tape onto a new tape as follows:

- 1 Copy the data from the existing cassette onto disk.
- 2 Copy the data from the disk onto a new cassette.
- 3 Discard the old cassette.

The Caution signal will also be cleared upon inserting a cleaning cassette or powercycling the drive.

High Humidity

If the humidity rises too high, both front panel lights show a steady amber. The drive will not perform any operations requiring movement of the tape until the humidity has dropped again. Any commands currently being executed are aborted, and no commands which access the tape are allowed. In addition, the tape is unthreaded to prevent tape and head damage. As soon as the drive detects that the humidity is at an acceptable level, it will once again respond to commands which access the tape.

Note

Steady amber on both front panel lights can also mean that no terminating resistor has been fitted. If the drive is the last device on the SCSI bus, a terminator must be fitted to allow normal operation.

Fault Warning

The Model 2000 and 2000DC contains a diagnostic capability to test the electronics for functionality. During power-up, the drive executes a self-test diagnostic sequence. This is shown by both front panel lights pulsing amber. If the self-test fails, the Drive light changes to steady amber. If this happens, contact your Service Engineer.

It is also possible for the host to initiate diagnostic tests of the drive. These are displayed on the front panel of the drive as drive and cassette mechanism activity. The results of these tests are reported to the host through the SCSI bus.

Data Compression and the Model 2000DC

The DDS-format of the Model 2000DC has been extended to include data compression (DDS-DC). By using the industry standard DCLZ* algorithm, which is implemented in the electronics of the DAT drive, the drive compresses data in real time. This leaves the host free to manage other processes.

* *Data Compression Lempel Ziv*

Data compression may be turned on and off using system commands issued from the host operating system—please consult your systems configuration guide for further details. The user is then able to store data using the Model 2000DC in either compressed or uncompressed mode on a DDS cassette.

If a cassette containing compressed data is placed in the Model 2000 (or any first generation DAT drive), the host will inform the user that an unrecognised tape has been used. The Model 2000 will be unable to access the data, but neither the data nor the cassette will be harmed.

If a cassette containing non-compressed data is placed in the Model 2000DC, the drive can read from cassettes produced on the Model 2000 (or first generation DAT products) without the user having to turn the data compression algorithm off. However, if the user wishes to write in uncompressed mode, the compression algorithm must be turned off.

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Media Compatibility

Choosing Cassettes

The Model 2000 and 2000DC benefit from the use of both 60m and 90m DDS cassettes.

DDS Media Compatibility	Non-DC Format		DC Format
	Read/Write		Read/Write
	60m	90m	60m/90m
HP Series 6400 Model 1300H and 1300S	Yes	No	No
HP Series 6400 Model 2000	Yes	Yes	No
HP Series 6400 Model 2000DC	Yes	Yes	Yes

Caution

To avoid loss of data and damage to your drive, use only cassettes labeled DDS.

Media Usage

Under optimum environmental conditions (50% relative humidity, 22°C), Hewlett-Packard 60 meter and 90 meter DDS cassettes are currently specified to 2000 passes over any part of the tape. In operational terms this can be translated into approximately 200-300 backup operations. This takes into account that, during a backup, an area of tape may have several passes because streaming cannot be maintained, or because the backup software package being used repeatedly accesses certain areas of tape.

Under certain conditions the recommended number of backup operations will need to be derated. These conditions are as follows:

- **Environmental Conditions**

Sustained use at the low end of the humidity specification will reduce the media life.

- **Computer Performance**

The lower the performance of the computer, the more likely that streaming cannot be maintained and that an increase in the number of passes over given areas of tape will occur.

- **Backup Software Package**

The design of the backup package may be such that certain areas of tape may be accessed frequently, or there may be a high system overhead which may cause streaming to stop. Both these factors increase the number of tape passes in a given area.

Because the above parameters vary from system to system, it is difficult to give a definitive statement of the number of backup operations achievable using a given piece of media.

As a guideline we recommend that in worst case conditions of:

- sustained low humidity
- streaming failures
- backup software package design

the number of backup operations should be limited to around 100.

DDS and DAT Cassettes

It is often thought that all DAT and DDS tapes are of a standard that can be used for computer data storage. This is *not* the case.

The way tapes are used for data storage is fundamentally different from audio use. Audio tapes only play in streaming mode; that is, the drive reads the tape continuously. It does not go back and try a piece of tape again if it has trouble reading it. As a result, repositions (sequences of stop-rewind-play) are very infrequent.

In data storage use, however, repositions are far more frequent, particularly if the host computer is only capable of slow data transfer. In such a case, the drive is constantly having to stop or reposition while waiting for the drive to transfer more data. Even when the host is fast enough to maintain streaming, if the drive has difficulty reading a section of tape, it will try the section again, involving at least one reposition. Fast-searching for data can also cause several passes over an area of tape.

These repositions are the greatest cause of physical strain on the tape. Because computer data storage involves so many more repositions, it is vital to ensure that the tapes can stand this extra strain and will have a reasonable working life.

In order to provide this extra guarantee of quality and ruggedness for computer use, a standard for DDS media was developed. This stipulates more stringent mechanical, environmental, reliability and durability specifications than the DAT standard.

For these reasons, it is vital that you use only properly certified DDS tapes in your drive, not DAT tapes which are only tested for audio use.

In order to identify data-grade tapes, look for the DDS logo on the cassette shell. There are two variants:

Figure 6



The DDS logo and its variant form

The logo may be used by any media manufacturer, provided that its tapes meet the DDS specification. Hewlett-Packard recommends that you use Hewlett-Packard DDS cassettes with your DDS-format drive. Hewlett-Packard cassettes have been designed and tested to give maximum data reliability and mechanical durability.

The Quality of Cassettes

DDS labeled cassettes will ensure the integrity of your data, so you will not need to check the quality of the cassettes. However, if you need to verify the quality of an unlabeled cassette, we suggest you follow this procedure:

- 1 Clean the tape heads in the cassette drive.
- 2 Store live data onto one of the cassettes from the batch, and then immediately verify the data.
- 3 Repeat step 2 with another cassette from the batch.
- 4 Leave the cassettes for one week and then verify the data again.
- 5 If the verifications have proved fault-free, use the cassettes for your usual backup routine.

If you only buy cassettes at long intervals, test a sample from each batch when you buy them, even if you always buy from the same vendor.

DDS Cassette Part Numbers

Hewlett-Packard cassettes can be ordered through the following part numbers:

Hewlett-Packard DDS Cassettes (60 meter, box of 5)	HP 92283A
Hewlett-Packard DDS Cassettes (90 meter, box of 5)	HP 92283B
Hewlett-Packard Cleaning Cassette	HP 92293K
DDS Storage Box (holds 12 cassettes)	HP 92283L

Loading and Unloading Cassettes

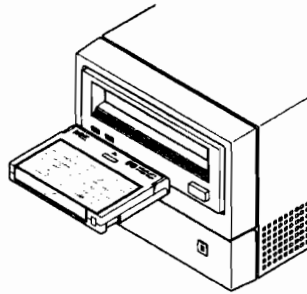
Inserting a Cassette

Caution

Only cassettes labeled "DDS" should be used in the drive. *Do not* use cassettes labeled "DAT", because the media is not DDS certified and therefore integrity cannot be guaranteed. Also, DAT cassettes have a different mechanical specification which may cause them to jam in the mechanism. *The warranty does not cover damage caused to the drive by the use of DAT cassettes.* You should also ensure that only one label is stuck to the label area of the cassette. Never use non-standard labels, and never stick anything to the cassette other than in the label area.

- 1 To load the cassette, insert it into the slot in front of the drive with the label uppermost—see figure 7.

Figure 7



The orientation for inserting a cassette

- 2 Apply steady pressure on the rear of the cassette until the autoloading mechanism takes the cassette and loads it into the drive.

Do not try to force the cassette if it does not load properly. The drive will eject the cassette after about 10 seconds, so you can load it again.

Once inserted, the drive threads the tape and performs a short load sequence. This examines and tests the tape and read/write circuitry. The load sequence takes about 25 seconds. During the load sequence, both front panel lights pulse green (see table 1).

When the load sequence is finished, both front panel lights show steady green.

Removing the Cassette

A cassette can be unloaded by either pressing the Unload button on the front panel (see figure 3), or in response to a SCSI UNLOAD command from the host computer.

This starts a sequence which winds the tape to the beginning, unthreads the tape, and ejects the cassette. The sequence takes about 10 seconds, but can take longer depending on the tape position.

During the unload sequence, both front panel lights pulse green.

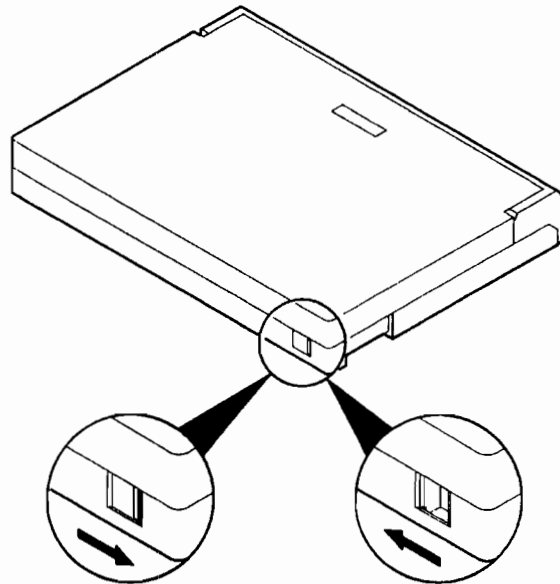
Store the cassette in its plastic case after use.

Write-Protecting Cassettes

If you want to protect the data on a cassette from being altered or overwritten you can write-protect the cassette.

To write-protect a cassette, slide the tab on the rear of the cassette so that the recognition hole is open, as shown in figure 8.

Figure 8



UNPROTECTED
To allow a cassette to be written to, slide the tab so that the hole is closed

WRITE-PROTECTED
To write-protect the cassette slide the tab so that the hole is open.

Caution

Write-protection will not prevent a cassette being erased by bulk-erasure or degaussing.

The tape log, which contains a history of usage of the tape, cannot be updated if the tape is write-protected. It follows that the tape log becomes inaccurate if a cassette is used when write-protected. This means that the drive cannot reliably tell you that the cassette is nearing the end of its useful life and needs replacing.

Looking After Cassettes

We recommend that you only use Hewlett-Packard DDS cassettes. These conform to Hewlett-Packard's high standards for ensuring data integrity. Chapter 4 gives ordering details.

- Do not touch the tape, or attempt to clean the tape path or tape guides inside the cassette.
- Do not leave cassette tapes in excessively dry or humid conditions.
- Do not leave cassettes in direct sunlight or in places where magnetic fields are present (for example, under telephones or near transformers).
- Do not drop cassettes or handle them roughly.
- Do not stick more than one label onto cassettes; extra labels could cause the cassettes to jam in the tape drive.
- Store cassettes in their plastic cases when not in use.
- Always keep the cassettes in a clean environment.
- Do not use cassettes beyond their useful life. See the Caution Signal figure on page 2-4.

Temperature

Only use cassettes at temperatures between 5°C (40°F) and 40°C (113°F). You can, however, store them at temperatures down to -40°C (-40°F), although we do not recommend this course of action.

If you expose cassettes to temperatures outside the operating limits, stabilize them before you use them. To do this, leave the cassettes in the operating temperature for a minimum of two hours.

To avoid temperature problems, observe these guidelines:

- Position the drive according to the recommendations in chapter 1.
- Avoid leaving cassettes in severe temperature conditions, for example in a car standing in bright sunlight.
- Avoid transferring data (reading from and writing to cassettes) when the temperature is changing by more than 10°C per hour.

Cleaning the Tape Heads

You should clean the tape heads at the following times:

- After every 25 hours of use.
- When the Caution signal is displayed.

Caution

Only use an HP Cleaning Cassette (HP 92283K) to clean the tape heads. Do not use swabs or other means of cleaning the heads.

Clean the heads as follows:

- 1 Insert the cleaning cassette into the drive. The tape drive automatically loads the cassette and cleans the heads. At the end of the cleaning cycle, the drive ejects the cassette.
- 2 Note the date on the label on the cleaning cassette so that you know how many times you have used it. Discard the cassette after you have used it 25 times.

Backup Routines

How you organise backup depends very much on how frequently the data changes, how extensive it is, and how valuable you consider it. What is essential is that you follow a routine, so that backup is regular and trouble-free. The following three models present routines which are commonly used. In each, a "set" of cassette tapes is the smallest number of tapes that will hold a full backup or partial backup.

Keep a record of the number of times each set is used, so that when the recommended write-life is reached (300 insertions), a set can be replaced by new cassettes. The set can still be kept for read-only use, but should not be used for writing.

Model 1: Daily Backup

This is the simplest backup model, in which you have one set of tapes on which you back up all your data at the end of each working day. If you lose data, you simply restore it from the previous day's backup. It is the least secure model of backup, because if the cassette is lost, destroyed or damaged, the data is lost forever.

Number of cassettes needed: 1 set for full backup

Model 2: Weekly Rotation with Daily Backup

In this model, you perform a full backup every Friday, and a partial backup on each of Monday, Tuesday, Wednesday and Thursday. A partial backup is only of those files which have changed since the previous backup.

Two sets of tapes, A and B, are used in rotation for the weekly full backup. On the first Friday, you make a full image copy of your disks on Set A. On the second Friday, use Set B for a full backup. On the third Friday, use Set A again. This way, there are always two generations of full backup in existence. Store the sets off-site, preferably in a fire-proof safe, so that if there is a fire or equipment is stolen from the site, the backup is unaffected.

Four sets of tapes are used for the daily partial backups, one set for each day. Because only changed files are saved, these backups are very quick.

Total number of cassettes needed: 2 sets for full backup
4 sets for partial backup

Model 3: Monthly and Weekly Rotation with Daily Backup

The backup model which offers optimum data protection uses six full backup sets (three monthly and three weekly), and four sets of partial backup daily. This model is recommended if you compile large quantities of data where loss would be disastrous. It also provides the best method of securing data from software viruses.

The four sets of tapes for daily partial backup are labeled Monday, Tuesday, Wednesday and Thursday as in model 2.

Three sets of tapes are used in rotation for weekly full backup on Fridays. Two of the sets are stored off-site. After a full backup is made on Friday,

the set of tapes is taken off-site and exchanged for the oldest backup set in storage. Next Friday, the backup is made using this oldest set of tapes. In this way, at any moment three generations of full weekly backup exist; the two most recent are off-site, the oldest is on-site ready for the next backup.

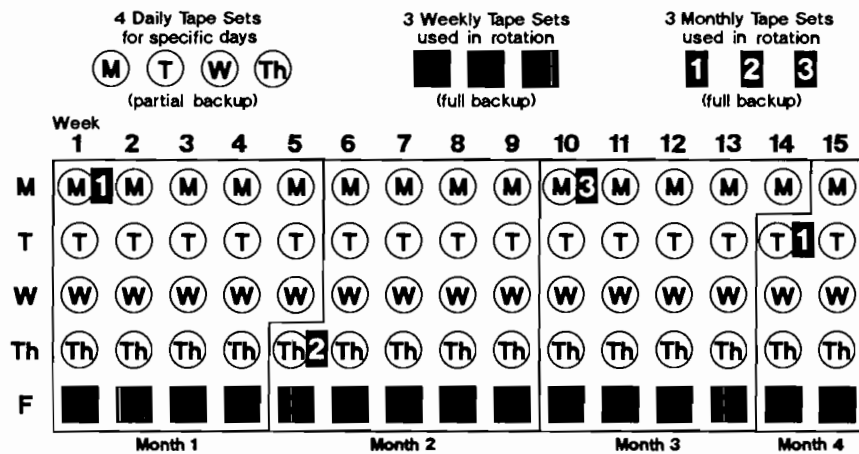
The final three sets of tapes are used for full backup on the first working day of each month, again in rotation. This is in addition to the usual backup that would be made that day, so that the normal weekly routine is maintained. As with the weekly tapes, the monthly sets should be stored off-site.

The figure shows how this model works over a typical fifteen-week period.

Total number of cassettes needed:

6 sets for full backup

4 sets for partial backup



Number of Cassettes Needed

The total number of cassettes needed depends on your backup routine, as described in the preceding models. In addition to the number mentioned there, it is advisable to keep extra cassettes, as follows:

- A spare set for full backup
- A spare cassette for use for diagnostics by your Service Engineer
- Cassettes for file transfers
- Cassettes for any archival storage you may require

Storage Life

Tests show that data can successfully be stored on DDS cassettes for a period of 10 years. You should give each cassette a full pass in the drive at least once a year to prevent sticking. Store the cassettes according to the environmental specifications given in Chapter 4.

Head-Cleaning Routine

Once your backup routine has been established, you should have an idea of the number of hours the tape drive is used each day. Remember that it is recommended to clean the drive's tape heads after every 25 hours of use, or if the drive displays a Caution signal. From this, you can estimate how often the heads will need cleaning and build the cleaning operation into the backup routine.

For example, if it happens that you use the drive about 8 hours each week, then cleaning is required every three weeks. In that case, if you are using backup model 3, you could store a cleaning cassette with one particular set of weekly full backup cassettes, so that the heads are cleaned every time that set is used.

Success with DDS Media

Because of the crucial importance of data integrity in computer environments, we strongly recommend that you only use cassettes labeled "DDS", which meet our exacting high standards. Ordering Information in chapter 4 tells you how to order these cassettes. We also recommend that you pay particular attention to the media handling and drive cleaning instructions set out in this chapter.

4

Product Specification 4-2
Supplies and Accessories 4-4
Ordering Information 4-5

Reference

Product Specification

Physical

<i>Net Weight:</i>	2.2 kg (4.8 lb)
<i>Height:</i>	95 mm (3.7 in)
<i>Width:</i>	116 mm (4.5 in)
<i>Depth:</i>	220 mm (8.6 in)

Performance

<i>Interface:</i>	SCSI II
<i>Format:</i>	DDS (Digital Data Storage) and DDS-DC
<i>Capacity:</i>	Model 2000: Up to 2 gigabytes on a 90 meter DDS cassette. 1.3 gigabytes on a 60 meter DDS cassette. Model 2000DC: Up to 8 gigabytes on a 90 meter DDS cassette.
<i>Sustained Transfer Rate:</i>	Model 2000: Up to 11 megabytes/minute (183 KB/sec) Model 2000DC: Up to 44 megabytes/minute (732 KB/sec)

Power Requirements

100-240 volts, 0.5A maximum
50-60 Hertz



Environmental Specifications

Operating Limits

<i>Temperature:</i>	5°C to 40°C (41°F to 104°F)
<i>Humidity:</i>	20% to 80% RH, non-condensing. Maximum wet bulb temperature 26°C (79°F)
<i>Altitude:</i>	0 to 4.6 km (0 to 15,000 ft)
<i>Vibration:</i>	0.21 g rms
<i>Noise Level:</i>	Less than 5.0 Bel soundpower

Non-operating Limits

<i>Temperature:</i>	- 40°C to 70°C (- 40°F to 158°F)
<i>Humidity:</i>	5% to 95% RH
<i>Altitude:</i>	0 to 15.2 km (0 to 50,000 ft)
<i>Vibration:</i>	2.1 g rms
<i>Shock survival:</i>	90 g for 3 ms duration

Acoustics

< 70 dB at Bystander Position, tested as per ISO 7779.

Safety and Electromagnetic Compatibility

- CSA Certification to C22.2, No. 950
- UL Listed UL 1950 1st Edition
- GS Mark
- FCC Level "B" Verified
- FTZ 1046 Level "B"
- VCCI Class 2

Supplies and Accessories

It is advisable to keep a supply of cassettes and cleaning materials in stock at all times. The following HP products are recommended for use with the HP Series 6400 Model 2000 and 2000DC drive. They are listed with their part numbers.

Cassettes

Box of five DDS cassettes (60 m)	HP 92283A
Box of five DDS cassettes (90 m)	HP 92283B
Cleaning Cassette	HP 92283K
DDS Storage Box (holds 12 cassettes)	HP 92283L

Cables (SCSI)

SCSI Interface 0.5 m Cable	HP 92222A
SCSI Interface 1 m Cable	HP 92222B
SCSI Interface 2 m Cable	HP 92222C
SCSI Interface 0.9 m Cable	K2286
SCSI Interface 0.9 m Cable*	K2296
SCSI Interface 1.5 m Cable	K2297
SCSI Extender Cable	HP 92222D
Active External Terminator*	K2291

** These products are supplied with the Model 2000 and Model 2000DC drives*

Ordering Information

The list below gives addresses and telephone numbers of the main Hewlett-Packard Sales Offices.

Australia/New Zealand

Hewlett-Packard (Australia) Ltd.
31-41 Joseph St.
Blackburn, Victoria 3130
Melbourne
Tel: (61) 3-895 2895

Canada

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA
Ontario L4V 1M8
Tel: (416) 678 9430

Denmark

Hewlett-Packard A/S
Datevej 52
DK-3460 BIRKERØD
Tel: (45) 2-81 66 40

Europe/Africa/Middle East

Hewlett-Packard Company
Central Mailing Department
P.O. Box 529
1180 AM Amstelveen
The Netherlands
Tel: (31) 20 547 9999

Far East

Hewlett-Packard Asia Ltd.
47/F China Resources Building
26 Harbour Road
Hong Kong
Tel: (5) 5 833-0388

Japan

Yokogawa-Hewlett-Packard Ltd.
29-21, Takaido-Higashi 3-chome
Suginami-ku, Tokyo 168
Tel: (03) 331-6111

Latin America

Hewlett-Packard de Mexica
Sp.A. de C.V.
Monte Pelvoux No. 111
Lomas de Chapultapec
11000 Mexico D.F., Mexico
Tel: (905) 596-7933

United Kingdom

Hewlett-Packard Ltd.
Cain Road, Bracknell
BERKSHIRE RG12 1HN
Tel: (44) 344-369369

USA

Hewlett-Packard Company
4 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 670-4300

Hewlett-Packard Company
5161 Lankershim Boulevard
NORTH HOLLYWOOD, CA 91601
Tel: (818) 505-5600

Hewlett-Packard Company
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800

Hewlett-Packard Company
2015 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500

5

Basic Troubleshooting Process 5-2
Common Problems and Answers 5-3
Common Questions and Answers 5-4

Troubleshooting

Basic Troubleshooting Process

If a problem occurs, the first step is to try to establish whether the problem lies with the tape, the drive, the host computer and connections, or with the way the system is being operated.

- Are you using new cassettes, or a different brand of cassettes? Is the Caution signal being displayed by the drive? Have you been using the particular cassette for a very long time? Then the problem could lie with the cassette.*

If you suspect the problem is the cassette:

- 1 Check that you are using a DDS labeled cassette—not a DAT cassette.
- 2 Clean the tape heads with the cleaning cassette.
- 3 Try the operation again.
- 4 If the problem still occurs, try using a different cassette.
- 5 If the problem is still there, the problem probably lies with the drive or the host computer.

- Has the tape drive been moved recently? Has the environment changed—unusually hot, cold, damp or dry? Has there been dust or dirt near the drive? Have reasonable precautions against static been taken? Then the problem could lie with the drive.*

If you suspect the problem is with the drive:

- 1 Clean the tape heads and try the operation again.
- 2 If the problem persists, check the environmental conditions against the drive's specified limits, and try to correct the conditions if they are outside the limits. Perhaps move the drive to a more suitable site.
- 3 If the problem is still there, call a service engineer.

- Has a new operating system been installed in the host computer? Have any cables been disconnected and reconnected? Then the problem could lie with the host or the connections.*

If you suspect the problem lies with the host, consult the computer's operating manuals or seek help from a service engineer.

- Is someone new operating the system? Has the operator just returned after a long absence? Then the problem may lie with incorrect operation.*

In this case, ask the person to repeat the operation while you watch, to check that they are not omitting some vital step.

Common Problems and Answers

This section presents common problems and their remedies. Where appropriate you will be referred to another reference document for particular error conditions.

Problems with the Model 2000 or 2000DC

Model 2000 or 2000DC does not power on

When you set the power switch to on, nothing happens.

Make sure that the power cord is connected properly to the drive and to a working AC power socket. If the power is connected properly, the device has probably failed. Call for service.

Cannot backup or restore

Check the front-panel display for any error conditions (see Chapter 2 of this manual). Check that the SCSI cable is connected properly. Make sure that the SCSI terminator is installed and secure.

If you are using DATIO, refer to your DATIO Utility Manual.

Model 2000 will not access data

Make sure that the cassette you have inserted is *not* data compressed.

Common Questions and Answers

❑ **How do I recognise a Caution signal on Hewlett-Packard DDS-format drives?**

The Caution signal is indicated by the Cassette (upper) light alternating green for 4.5 seconds and off for 0.5 seconds. It means the drive has to correct an excessive number of errors while reading or writing.

Alternatively, it could mean that a hard read or write error has occurred, in which case the error will be displayed by the system console. Clean the tape heads and see if the signal is still displayed. If it is, discard the tape.

❑ **How often should I clean the tape drive heads?**

You should clean the tape heads after every 25 hours of use, or if the Caution signal is displayed. Only use the HP Cleaning Cassette to clean the heads.

❑ **What should I avoid when positioning the tape drive?**

Do not place the drive in a dirty environment, for example on the floor, or near a door or walkway. See chapter 1.

❑ **How many times can I use a DDS cassette?**

The recommended number of tape passes is 2000 under ambient conditions (25°C 50% RH). This is equivalent to approximately 300 insertions of the cassette, given that on each insertion the tape is likely to pass the heads an average of six times. Under worst case conditions, this can be reduced (see chapter 3).

❑ **What is the correct way to handle the cassettes?**

Handle cassettes with care. DDS-format drives have an auto-load mechanism which will automatically take the cassette when you gently insert it the correct way round. Unlike quarter-inch cartridge drives, you do not need to push tapes in forcefully. See chapter 3.

❑ **For how long can I archive tapes?**

Ten years is the maximum recommended storage time for DDS cassettes. You should give the cassettes a full pass in the drive at least once a year during storage to prevent the tape sticking.

❑ **How many tapes do I need?**

This really depends on your requirements. See the backup models in chapter 3.

❑ **Can I use my cassettes with future Hewlett-Packard DDS-format products?**

Yes. All Hewlett-Packard DDS-format products will be backwards compatible, so they will be able to read previously recorded data.

Can I use DDS cassettes for audio?

Yes, DDS cassettes will work with DAT players. DDS cassettes are certified to a higher specification than DAT cassettes, so while DDS cassettes can be used for DAT, do not use DAT cassettes in DDS-format drives.

What length tapes can I use?

You can use either 60 m or 90 m length tapes with your Model 2000 or Model 2000DC drive.

Can I do more than one backup to a cassette?

No. The DATIO utility only supports one backup per tape.

What happens if I insert a compressed data cassette into a Model 2000 drive?

The host will report that an unrecognised tape has been used. Although the Model 2000 will be unable to access the data, no harm will be caused to your data or cassette.

What happens if I insert a non-compressed data cassette into a Model 2000DC drive?

Your Model 2000DC will read any cassette produced on the Model 2000 (or any first generation DAT product) without the need to turn the data compression algorithm off. However, if you want to write in uncompressed mode on the Model 2000DC, you must turn off the data compression algorithm.

6

A Quickstart Guide for Hewlett-Packard Operating Systems

Introduction

This section of the manual covers the basic steps for connecting your DAT drive to HP 9000 series computers, as well as the basic utilities supplied with the system and how best to use them. The section is therefore aimed at those users who do not have access to a complete HP-UX documentation set, and need to be up and running with their Model 2000 or Model 2000DC DAT drive. If you need additional information, you should refer to the specific system documentation.

This chapter is divided into the following sections:

- 5.1 HP 9000 Series 700
- 5.2 HP 9000 Series 300 and 400
- 5.3 HP 9000 Series 8x7
- 5.4 HP 9000 Series 9x7

Take the following steps:

- 1 Shut down your system and connect your DAT drive to the SCSI bus.
- 2 Check the SCSI ID.

You must make sure that you do not have another peripheral residing on the SCSI bus that has the same SCSI ID as your DAT drive, that is SCSI ID 3. All DAT drives are pre-set to this ID before leaving the factory, so if you already have a DAT drive check the ID carefully. If you have a SCSI ID conflict, you can change the ID of your drive by following the instructions in chapter 1 of this User's Manual.

- 3 Connect the DAT drive to your workstation and system, as described in chapter 1 of this User's Manual and your system manual.
- 4 Power on your DAT drive and boot up your system.
- 5 Set up device files and the kernel.
 - 5.1 **An HP 9000 Series 700 system running HP-UX 8.07 or greater**, has a kernel with the SCSI tape driver already configured.

Note: The HP 9000 Series 700 supports both the Model 2000 and 2000DC.

The device files for HP DAT drives are located in `/dev/rmt`. A device file for a drive operating in uncompressed mode is already set up (assuming a SCSI ID of 3). If you have a DAT drive supporting

compression, or are using a different SCSI ID, set up a device file, executing the `mknod` command, as follows:

```
mknod filename c 54 0x2011CM
```

- where `filename` is device filename. By convention, this comprises 2 or 3 characters. The first character specifies the tape drive number. This number indicates the order in which tape drives are connected. The first device connected should have a tape drive number of 0, the second should be 1, and so on. The second and third characters specify the mode of operation, for example:

0m Drive 0, rewind on close
0mn Drive 0, no rewind on close
1c Drive 1, compressed, rewind on close
1cn Drive 1, compressed, no rewind on close

- where `c` specifies character device.
- **54** is the major number associated with the tape driver.
- **0x201CM** is the minor number which is built up as follows:

0x201xxx is the select code for tape devices on S700 systems

I is the SCSI ID of the drive (0–6)
C indicates whether to use compression or not
 (Set = `0xC` for compression. Set = `0x0` for non-compression)
M is driver mode, rewind/no rewind on close
 (Set = `0x2` for rewind on close.)
 (Set = `0x3` for no rewind on close).

Note: These steps are only a partial description of the process, using recommended values. For full details consult your system manual.

Examples:

- Create a device file for a drive at ID3, no rewind on close, uncompressed.

```
mknod 0mn c 54 0x201303
```

- Create a device file for a drive at ID 0, rewind on close, uncompressed.

```
mknod 1m c 54 0x201002
```


mkdev -t 0x54 0x00 0x00

- * Create a device file for a drive at ID 3, no rewind on close, compressed.

mkdev -t 0x54 0x00 0x00

5.2 An HP 9000 Series 300 or 400 running HP-UX 8.0 or greater

Note: The HP 9000 Series 300 and 400 currently only support the Model 2000.

When the system boots, make a note of SCSI card select code. Using SAM(1M), check that the scsitape is included (this is normally the case).

Now, create a device file for the DAT drive, executing a command of the following format:

```
mkdev -t filename
```

- * where filename is device filename. It is normally created in the directory /dev/rmt (you may need to create this directory).

By convention, this is formed from 2 or 3 characters. The first character specifies the tape drive number. The second and third characters specify the mode of operation. For example:

0m Drive 0, rewind on close.
0mn Drive 0, no rewind on close.

- * **c** specifies character device.
- * **54** is the major number associated with the tape driver.

0xSS0l0M is the minor number which is built as follows:

SS is the select code of the SCSI card expressed in hex.
l is the SCSI ID of the drive (0-6).
M refers to driver mode, rewind/no rewind on close

Note: The above is only a partial description, using the recommended values. For full details refer to your system manual.

Examples:

- Create a device file for a drive on select code 14, ID 3, no rewind on close.

```
mknod /dev/rmt/0m c 54 0x0e0303
```

- Create a device file for a drive on select code 14, ID 0, rewind on close.

```
mknod /dev/rmt/1m c 54 0x0e0002
```

5.3 An HP 9000 Series 8x7 System running HP-UX 8.02 or greater

Note:

The HP 9000 Series 8x7 currently only supports the Model 2000.

When the system boots, it autoconfigures any new peripheral which has been connected onto the system. Device files are therefore created automatically.

For a Model 2000 DAT Drive

In order to use the **datio** utility, it will be necessary to create "Berkeley" style device files for *each* DAT drive on the system as follows:

Change directory to /dev/rmt.

No rewind device file

```
/etc/mksf -d tape 2 -H <HWPATH> -l <LUN> -b 600 -r -v <DEVFILE NAME>
```

Rewind device file

```
/etc/mksf -d tape 2 -H <HWPATH> -l <LUN> -b 1800 -r -v <DEVFILE NAME>
```

where:

<HWPATH> is the physical Hardware Path to which the DAT drives are connected. If unknown, this information can be obtained by running the SAM utility, selecting:

- Peripheral Devices
- Tape Drives
- View Tape Drives

<LUN> is the logical unit of the device and is usually the same as the SCSI ID number.

<DEVFILE NAME> For example, a drive at SCSI ID 3, on Hardware Path 52.3.0 would have a no rewind Berkeley style device file name of 3bn. The rewind device file could be named 3b.

This then enables datio to use device files /dev/rmt/3bn or /dev/rmt/3b.

Use of Model 2000DC

Normal device files should be specified for data requiring interchange with non-data compressed DAT drives. For example:

3b, 3bn

Device files with a "c" option included should be used for data requiring compression. For example:

3bc, 3bnc

- 5.4 On HP 9000 S9x7 systems (MPE-IX) Model 2000 only—Refer to System Startup, Installation and Configuration Manual, part number 32650-90042.

Use the system utility to configure in the Model 2000, using the following information:

NIO Controller	ID = HP 28642A-SCSI (for example, ap 52 HP 28642A-SCSI)
Transparent Path for SCSI ID = 2	HP 27251Z (OR) PSEUDO (for example, ap 52.2 PSEUDO)
DEVICE	HPC 1520B (for example, md x path = 52.2.0 id = HPC 1520B) where x = ldev numbers associated with this device

6 Test the DAT drive

Make sure that the drive is powered on. Insert a cassette and wait until the drive completed its load sequence (with both LEDs steady green). The sequence takes approximately 25 seconds.

Execute a drive command as follows:

```
mt -t /dev/rmt/3bn c
```

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 cassette inserted and both lights steady green?
- Are the Series 700 device files correct?
- On Series 300 and 400 systems, is the scsitape in the kernel and device files correct?
- On Series 800 systems, has the system autoconfigured on booting?

Using your DAT Drive with HP-UX

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 DAT drive operates best when you use the largest block size (or blocking factor) available with any of the utilities. For example:

```
cpio -oB,  
dd bo = 64k,  
ftio -B 5k, etc.
```

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:

- fbbackup** sophisticated general-purpose backup program. It supports the fast file recovery feature of HP DAT drives from HP-UX 8.0.
- dump** easier to use, general-purpose archive program.
- cpio** industry standard, hardware independent archiving program. Suitable for file interchange.
- ftio** 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).

datio Fast, easy to use, DAT specific tape handling for cpio. It supports the fast file recovery feature of HP DAT drives.

dd provides a raw backup feature.

For information on use and calling syntax, refer to your HP-UX documentation.

Glossary

- DAT** Digital Audio Tape is a method of recording audio signals digitally on cassette tapes, giving quality comparable with that of Compact Discs. It uses helical scan, where the recording heads are on a revolving drum, producing diagonal tracks of recorded information across the tape. The DDS format overlays DAT to produce a means of storing computer data based on DAT technology.
- DC** Data compression is a technique which removes redundancy from the data, therefore allowing the drive to store more data on the same length of tape.
- DCLZ** The Data Compression Lempel Ziv is the algorithm used to achieve data compression in the Model 2000DC.
- DDS** Digital Data Storage is a format developed by Hewlett-Packard and Sony for storing computer data on cassette tapes.
- host** The computer or computer system which controls the tape drive.
- interface** The method of joining computer equipment and peripherals together to allow them to communicate with each other. In the case of the Model 2000 and 2000DC, the interface is SCSI.
- peripherals** Devices connected to and controlled by a host computer, usually through cables, but not physically part of the host computer (for example, printers, plotters, disk and tape drives).
- pulse** A regular pulsing of a front panel light, 2 times per second.
- SCSI** Small Computer System Interface
- self-test** A sequence of tests which the drive runs when you switch it on in order to check that it is functioning correctly.

stabilizing The process of leaving tapes in a new environment for a minimum of two hours before using them, so that they adapt to the new temperature and humidity. This helps avoid problems of condensation.

write-protect A method of preventing information being erased from a tape or being added to the tape.



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PACKARD



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