

# hp StorageWorks DAT tape drive

getting started guide

removable model



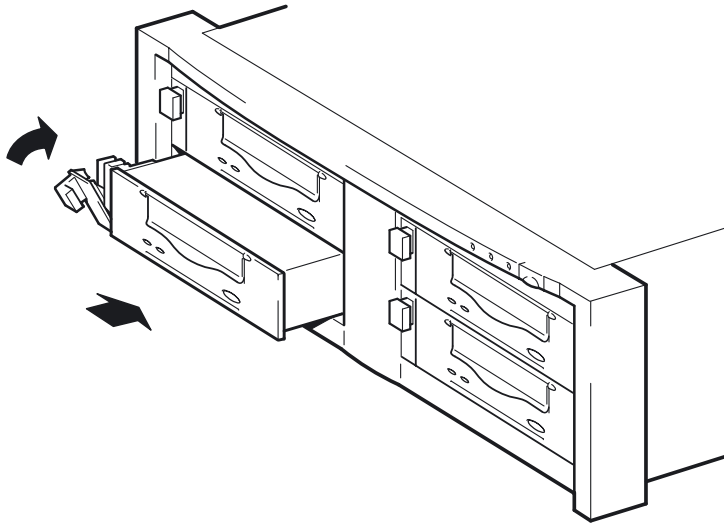
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Data  
Storage

DAT 40m, DAT 72m



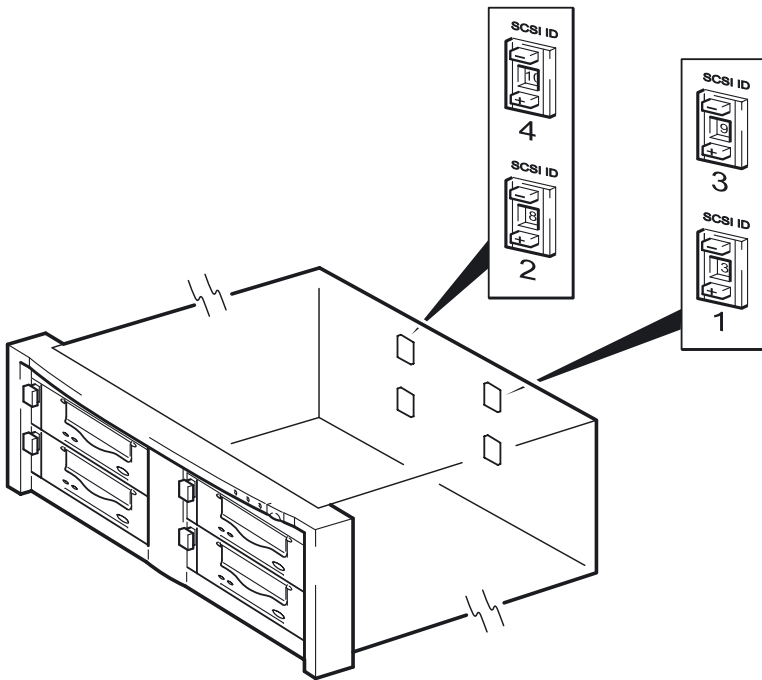
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hp tape array 5300

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hp tape array 5300

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## Product Details

Write your tape drive details here so you can find them easily if you need them. The model name is on the front of the drive and the product and serial numbers are on a label on the bottom of the drive.

<b>Model (type of drive):</b>	
<b>Model (number):</b>	
<b>Serial (number):</b>	
<b>Warranty Serial (number):</b>	
<b>Date purchased/installed:</b>	
<b>SCSI ID:</b>	

# Before you start

## HP StorageWorks DAT models

This guide describes how to install and operate the following HP StorageWorks DAT rack-mount tape drive models:

- HP StorageWorks DAT 72
- HP StorageWorks DAT 40

## Which operating systems are supported?

HP StorageWorks DAT drives can be connected to servers running under Windows®, NetWare, UNIX, Tru64 and Linux. Refer to the “HP StorageWorks Tape Software Compatibility” topic on our World Wide Web site ([www.hp.com/go/connect](http://www.hp.com/go/connect)) for more information about the operating system versions that are supported.

## Which rackmount systems can I use?

HP StorageWorks DAT removable tape drives are used in conjunction with the HP Tape Array 5300 system, which can be used with both full-height and half-height tape drives. It will hold up to four HP StorageWorks DAT tape drives. The tape array is designed to be installed into HP, IBM and other compatible 19” rackmount systems. It must be properly installed and configured. Refer to your tape array documentation for further details.

### Airflow requirements

The HP Tape Array 5300 is designed to provide adequate airflow for up to four half-height or up to two full-height tape drives. As long as the tape array is fully populated, it will provide adequate airflow for your HP StorageWorks DAT tape drives. If you have unused bays in the tape array, you must install the blanking plates provided with the tape array. This ensures that there is adequate airflow to the drives. See the documentation with the tape array for details on installing blanking plates.

You should ensure that ventilation is adequate at the front and rear of the tape array.

## How do I connect the drive to my server?

The following guidelines apply:

- For optimum performance the drive should be the only device on the SCSI bus.
- If you daisy-chain devices, make sure that devices are of the same SCSI type and that each device on the same SCSI bus has a unique SCSI ID and is terminated appropriately. Do not daisy-chain more than two devices on the same SCSI bus (for example, two LVD Wide Ultra drives).
- Always terminate the SCSI bus.
- Do not attach the drive to the same SCSI bus as a your disk drive or to a RAID controller.

The individual tape drives are connected to their host server via the high density LVD/SE SCSI connectors on the back of the tape array. They do not require any SCSI cables to plug into the tape array. However, suitably-rated cabling and terminators are required to connect the tape array with the SCSI host. You will need a properly installed and configured SCSI host bus

adapter (HBA) or a built-in SCSI controller on your SCSI host with a spare low voltage differential (LVD) SCSI port and LVDS-compatible cables and terminators. See “Checking the SCSI connection” on page 9.

## Why is the SCSI bus type important?

The SCSI bus type determines the speed at which data can be transferred between devices on the bus and the maximum length of cable that can be used. The drives support a burst transfer rate of 40 MB/sec. To benefit from this level of performance, it is important to ensure that the drives are connected to a SCSI bus of a similar or higher specification. This means that you need:

- **An Ultra Wide, Ultra2 Wide, Ultra3 (160) or Ultra4 (320) SCSI bus.** Ultra Wide SCSI supports the maximum bus speed of 40 MB per second, Ultra2, Ultra3 and Ultra4 SCSI exceeds this.
- **LVD-rated SCSI cabling and terminators.** The LVD interface enables the data to be transferred at the drive's maximum rate and provides a maximum cable length of 12 meters.

If you attach the drive to a lower specification SCSI bus, it may still work but data will not be transferred as quickly and you will need to use shorter cable lengths.

**Note** The drives are not compatible with high voltage differential (HVD) SCSI devices.

## How can I check the SCSI bus type and SCSI ID?

For many operating systems, you can install HP Library & Tape Tools from [www.hp.com/support/tapetools](http://www.hp.com/support/tapetools) and run the “Install Check” to check your server's current SCSI configuration (see page 29). This will provide information about the SCSI bus and the SCSI IDs in use. See also the SCSI topic in the electronic User's Guide on the HP StorageWorks Tape CD-ROM for other ways of checking the SCSI bus type.

## Do I need additional items for installation?

- You will need to order the correct size SCSI cables and terminators to suit the particular configuration of your tape array. Cable and terminator options are listed at the HP tape array support web site: [www.hp.com/go/tapearray](http://www.hp.com/go/tapearray), and can be ordered from your local HP sales office. Refer to your tape array's Getting Started Guide for details of how to install SCSI cables and terminators on the rear panel of the tape array. The latest version of this document can also be downloaded from [www.hp.com/go/tapearray](http://www.hp.com/go/tapearray).
- If you do not have a spare, suitably rated SCSI connector on your server, you must install a new HBA (also known as a SCSI card). This should be of an Ultra Wide or higher SCSI specification. We recommend that a 64-bit Ultra 3 (160) HBA is used. You will need to purchase and install the new HBA into an unused, 64-bit PCI expansion slot within your server before installing your tape drive. (The kit can also be installed in a 32-bit PCI expansion slot, but performance may be degraded.)

Refer to our World Wide Web site for recommended products, configurations and ordering information: [www.hp.com/go/connect](http://www.hp.com/go/connect) or [www.hp.com/support](http://www.hp.com/support).

# Backup software and drivers

## Backup software

For optimum performance it is important to use a backup application that is appropriate for your system's configuration. In a direct attach configuration, where the tape drive is attached to a standalone server, you can use backup software that is designed for a single server environment. In network configurations you will need backup software that supports enterprise environments. HP, Veritas, Legato, Yosemite and Computer Associates all provide suitable products. Further details about these and other products that may be appropriate can be found on our connectivity web site.

- 1 Go to our connectivity web site: [www.hp.com/go/connect](http://www.hp.com/go/connect) and select tape backup.
- 2 Select software compatibility.
- 3 Select your combination of operating system and tape drive model in the table. A list of supported backup applications is displayed. This will also tell you whether your configuration is compatible with HP One-Button Disaster Recovery, HP OBDR. (All HP StorageWorks DAT tape drives support HP OBDR. However, you can only use this feature if your system configuration and backup application also support it. See "Using HP OBDR" on page 27.)
- 4 Make sure you have a backup application that supports HP StorageWorks DAT tape drives and download any upgrades or patches, if required.

## Drivers

### Windows users

Before you install the tape drive, download the HP driver from our web site: [www.hp.com/support](http://www.hp.com/support). Refer to the accompanying README file for specific installation instructions for Windows NT, Windows 2000, Windows XP and Windows Server 2003 drivers. This will tell you whether you need to install the driver before or after installing the tape drive.

If you do not have internet access, you can also download drivers from the HP StorageWorks Tape CD-ROM, but these may not be the latest versions available.

### UNIX users

The recommended backup applications use the operating system's standard, built-in device drivers. To upgrade drivers we recommend that you patch to the latest version of the operating system or configure device files, as described in the *UNIX Configuration Guide* on the CD-ROM.

### IA64 users

If you are installing on an IA64 system, such as an HP Integrity server, check [www.hp.com/go/connect](http://www.hp.com/go/connect) for the latest information on the availability of backup application upgrades and drivers.

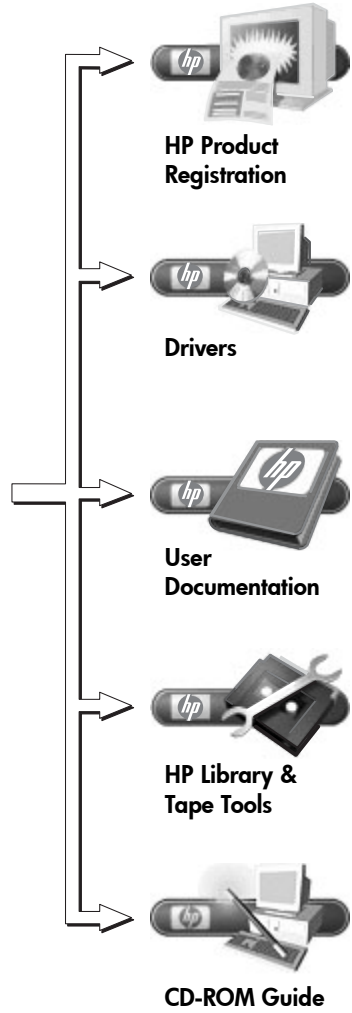


Figure 1: the HP StorageWorks Tape CD-ROM



# Using the CD-ROM

The HP StorageWorks Tape CD-ROM contains drivers, useful utilities and information to help you install and use your tape drive. For most operating systems, HP Library & Tape Tools will help you check SCSI ID information on the SCSI bus before installation. The UNIX Configuration guide on the CD-ROM also contains information about checking SCSI IDs on UNIX systems.

## HP product registration

To register your new tape drive electronically via the web, use the “Product Registration” link on the HP StorageWorks Tape CD-ROM.

## Drivers

For detailed information about drivers, refer to the appropriate README file in the `DRIVERS` directories on the HP StorageWorks Tape CD-ROM. There is a separate sub-directory for each operating system.

## User documentation

Refer to the “User Documentation” topic on the HP StorageWorks Tape CD-ROM for a UNIX Configuration guide and an online User’s Guide that provides more detailed information about using your HP StorageWorks DAT tape drive.

Refer to your backup application’s documentation for instructions on how to back up and restore data.

## HP Library & Tape Tools

HP Library & Tape Tools software provides diagnostic and troubleshooting utilities. It allows you to identify your product correctly, check SCSI ID information on the SCSI bus, run tests, carry out firmware upgrades and, if necessary, generate comprehensive troubleshooting information for support calls. Use the link on the HP StorageWorks Tape CD-ROM to access our Support web site, [www.hp.com/support/tapetools](http://www.hp.com/support/tapetools), and download the latest version of this software. For further details see page 29.

## CD-ROM guide

The CD-ROM guide provides an overview of the CD directory structure and information about the languages in which the contents of the CD-ROM are available. It also contains a set of URLs and links for further information.

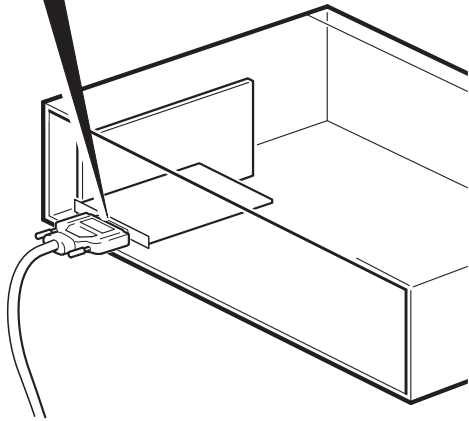
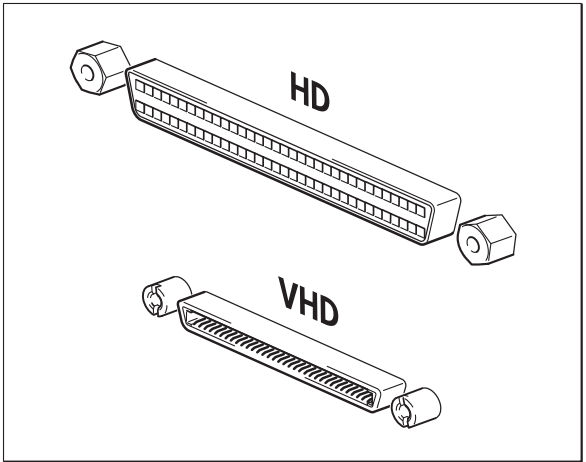
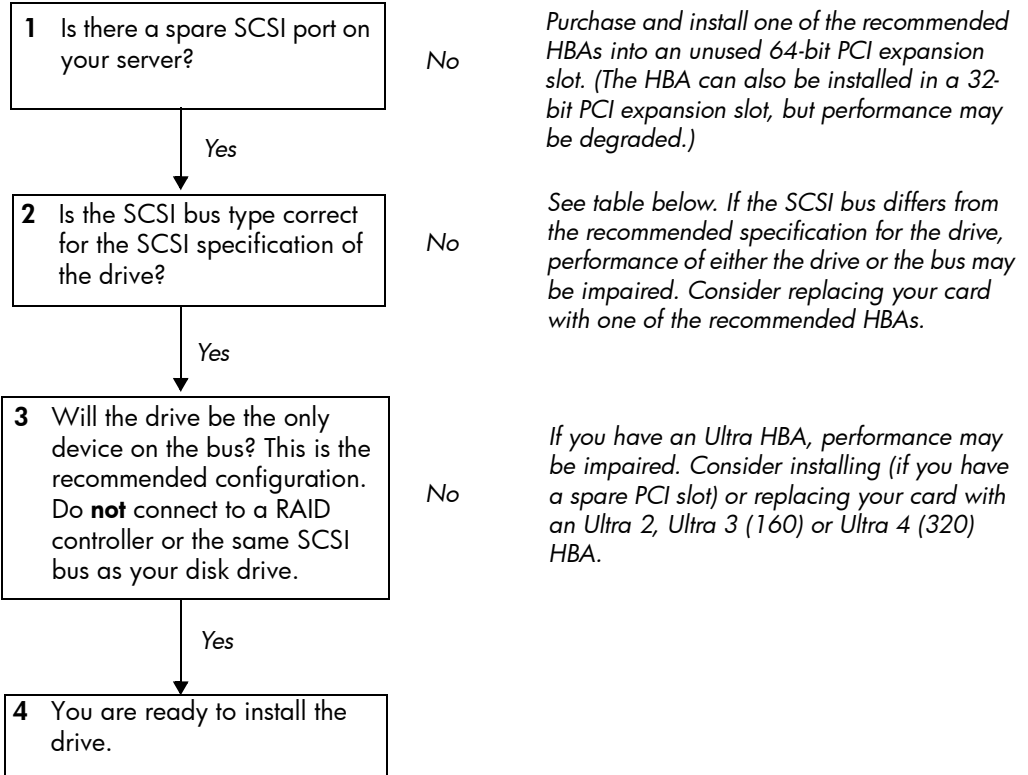


Figure 2: checking the SCSI connection

# Checking the SCSI connection

Use the following questions to help you check your SCSI connection. Many users can use HP Library & Tape Tools to check the SCSI bus type, see page 29. If you answer 'Yes' to all these questions, you are ready to install your tape drive. If you answer 'No', you will probably need to purchase and install additional items. For compatibility and product details, go to [www.hp.com/go/connect](http://www.hp.com/go/connect).



SCSI Bus Type	Supported
Ultra wide LVD	<b>Yes.</b> This is a <b>recommended</b> configuration as long as the drive is the only device on the SCSI bus.
Ultra 2 LVD, Ultra 3 (160) LVD, Ultra 4 (320) LVD	<b>Yes.</b> These are <b>recommended</b> configurations, particularly if there are several devices on the SCSI bus.
Ultra wide, single-ended	Yes. But this is <b>not</b> a recommended configuration as it will restrict performance.
Ultra narrow, single-ended	Yes. But this is <b>not</b> recommended as it will severely restrict performance and you will need a suitable cable or adapter.
High Voltage Differential	<b>No.</b> The drive will not work and you may damage the drive or controller

**table 1: supported SCSI bus types**

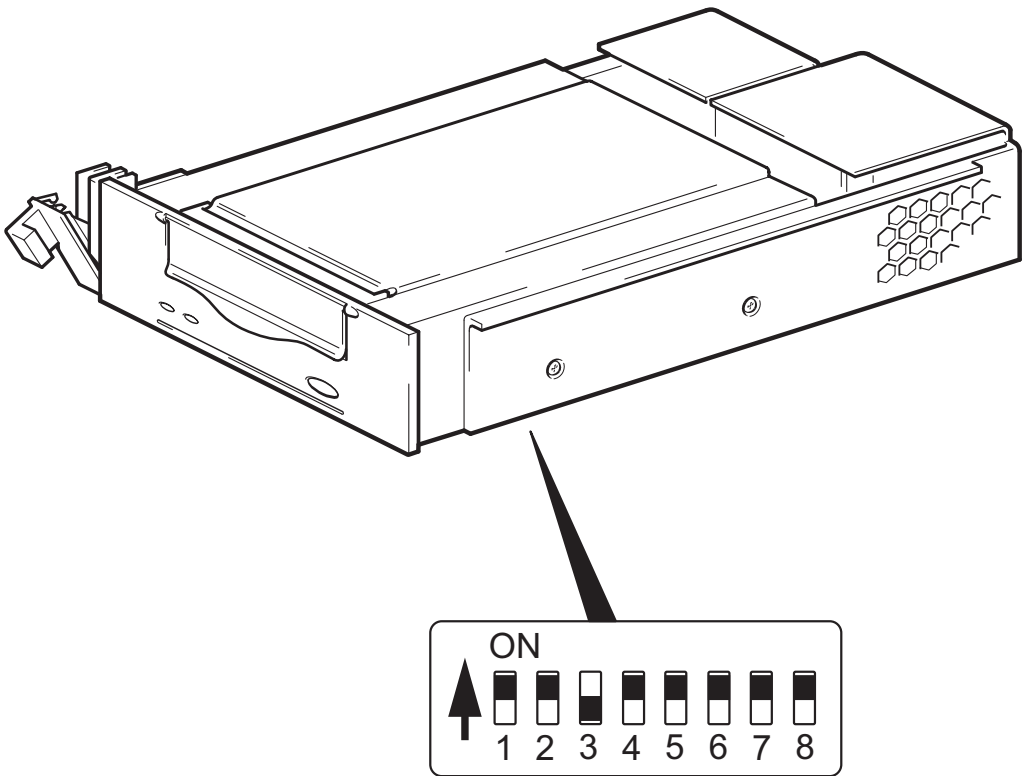


Figure 3: checking UNIX configuration switches

# Checking the configuration switches (UNIX systems)

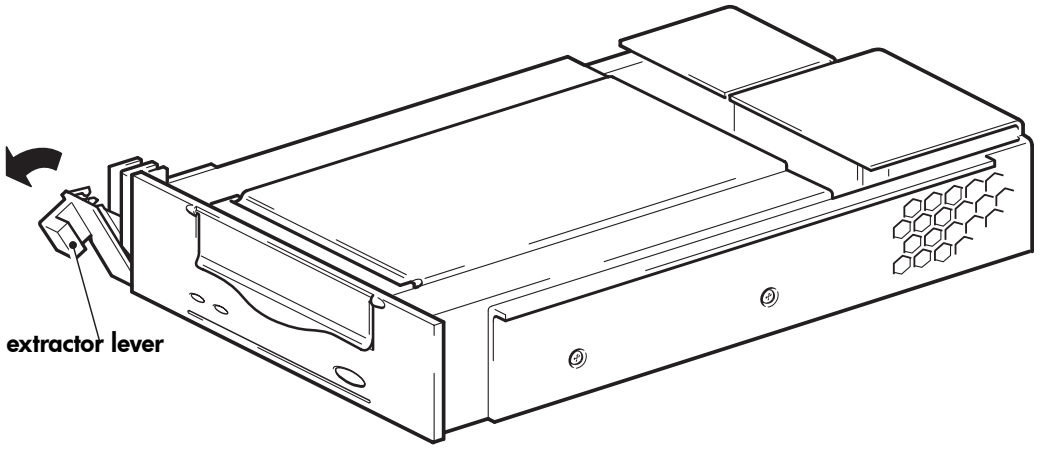
Only read this section if you are installing your tape drive into a UNIX system. Go to “Step 1: Install the drive” on page 13 if you are installing your drive into a Windows PC system.

- 1 Check the *UNIX Configuration Guide* on the HP StorageWorks Tape CD-ROM for specific advice for your operating system.

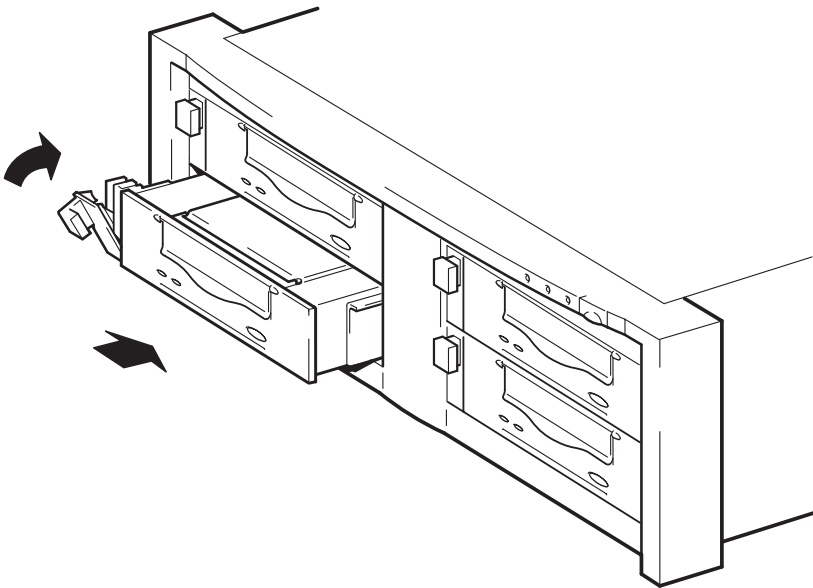
The following table summarizes the *typical* switch settings for different types of server.

System Type	Switch Number							
	1	2	3	4	5	6	7	8
Default and most PC systems	On	On	Off	On	On	On	On	On
HP Tru64 v.5.0 systems	On	On	Off	On	On	On	On	On
HP Tru64 v.4.0 systems	On	On	Off	On	On	On	On	Off
HP OpenVMS systems	On	On	Off	On	On	On	On	On
HP-UX systems	On	On	Off	On	On	On	On	On
IBM AIX systems	On	On	Off	On	On	On	On	On
Linux systems	On	On	Off	On	On	On	On	On
Sun Solaris, version 2.7 and higher	On	On	Off	On	On	On	On	On
Sun Solaris, version 2.6 and lower	On	On	Off	Off	On	On	Off	Off

- 2 If your UNIX configuration requires it, change the configuration switches located on the underside of the tape drive from the default settings shown in figure 3.



**Figure 4a: extractor lever in the out position**



**Figure 4b: installing the drive**

# Step 1: Install the drive

HP StorageWorks DAT removable tape drives are designed to be installed in a rack-mounted HP Tape Array 5300. Refer to the documentation supplied with your tape array for tape array installation instructions.

- 1 Before installing a tape drive, make sure that the extractor lever is in the fully open position (pulled out) as shown on figure 4a.

**Caution** When handling a tape drive, hold the drive by the side carrier framework. To avoid possible damage, do not hold the body of the drive and do not push or pull on the tape drive's front panel.

- 2 Slide the tape drive into one of the open bays, as shown on figure 4b, ensuring that the guide rails on both sides of the drive locate into the slots on the partition wall. Carefully but firmly ensure the tape drive is pushed fully in so that the rear connectors are securely seated. The extractor level will close slightly.

**Note** Correct alignment of SCSI tape drives in the tape array is essential to ensure a secured connection is made between the interface of the drive and the interface of the array.

- 3 Push on the extractor lever to complete the insertion and to lock the tape drive in place.
- 4 If there are less than four half-height drives installed, insert a blanking plate into the empty bays. This is essential to ensure adequate airflow is maintained. Failure to do so may affect tape drive performance.

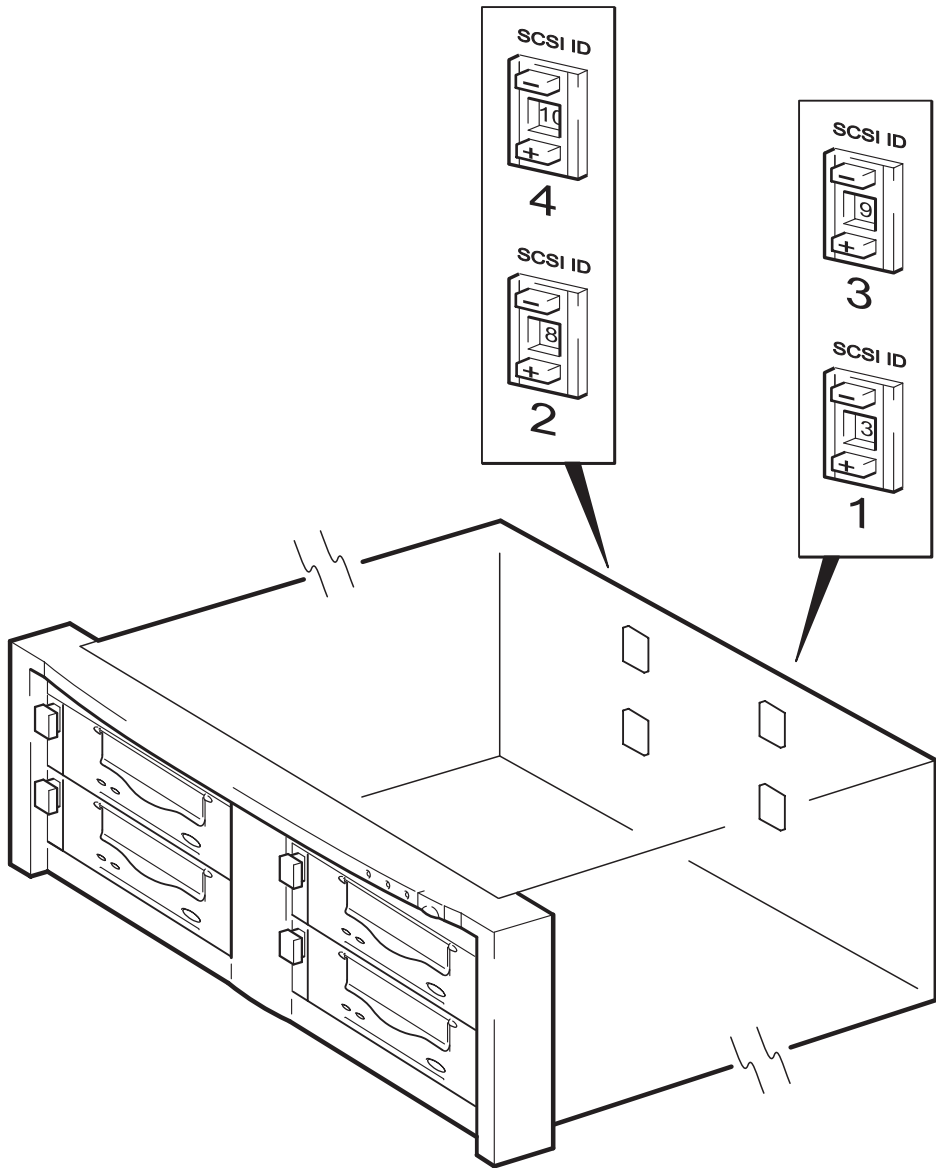


Figure 5: setting the SCSI ID



## Step 2: Set the drive's SCSI ID

To set the tape drive's SCSI ID you need to set the appropriate switch on the rear of the tape array. The number of address switches corresponds to the number of tape drives that can be inserted into the tape array.

Each device on the SCSI bus must have a unique SCSI ID.

- For HP ProLiant servers where the tape drive is connected to the built-in SCSI bus, we recommend that the tape drive is assigned a SCSI ID between 1 and 6.
- For all other servers and when used with separate HBAs, it can be assigned any *unused* ID between 0 and 15. Do not use SCSI ID 7, which is reserved for the SCSI controller. SCSI ID 0 is typically assigned to the boot disk and should also not be used unless the tape drive is on a dedicated SCSI bus.

Typically, the HP Tape Array may hold up to four tape drives where each drive is attached to a separate server. Under this configuration, the SCSI IDs of each tape drive will not conflict with each other as they are each installed onto a separate SCSI bus.

However, if you daisy-chain devices make sure that the devices are of the same SCSI type and that each device on the same SCSI bus has a unique SCSI ID. Do not daisy-chain more than two devices on the same SCSI bus and make sure that the end device is terminated.

### 1 Decide which SCSI ID to use.

For many operating systems you can install HP Library & Tape Tools from the HP StorageWorks Tape CD-ROM and run the "Install Check" to check your computer's current SCSI configuration (see page 29). This will provide information about the SCSI bus and the SCSI IDs in use. The *UNIX Configuration Guide* on the HP StorageWorks Tape CD-ROM, also provides instructions on how to determine the SCSI IDs of existing devices.

### 2 Set the appropriate switch. Figure 5 shows the address switch on the back panel of the HP Tape Array 5300.

The HP Tape Array 5300 has four SCSI ID switches to enable the installation of up to four half-height drives.

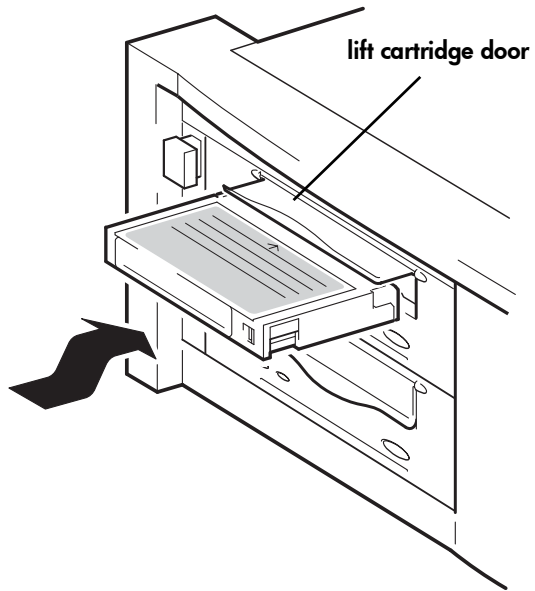
### 3 Make sure that a SCSI terminator is attached to the appropriate SCSI-OUT connector on the back of the tape array.

## Why does the tape drive need a terminator?

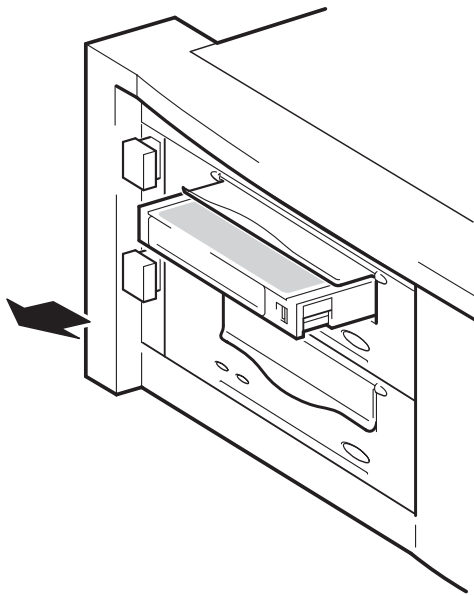
Terminators are essential, as they provide the correct voltages on the SCSI bus and prevent unwanted signal reflections from interfering with data transfers. The rule is:

**There must be termination at both physical ends of the bus and only at the ends.**

Normally the HBA forms one end of the SCSI bus and provides termination. You, therefore, need to ensure that the other end of the bus is terminated. Attach the terminator to the appropriate SCSI-OUT connector on the tape array.



**Figure 6a: loading a cartridge**



**Figure 6b: unloading a cartridge**

# Step 3: Verify installation

Once you have installed the drive hardware, verify that the tape drive is functioning properly before you store your valuable data.

## Check operation

Ensure that you have downloaded any drivers and upgrades necessary for your backup application (see page 5).

- 1 Switch on the drive and the server. The tape drive will run its hardware self-test, which takes about 5 seconds. At the end of the hardware self-test, both front panel lights should be off. See “Your HP StorageWorks DAT tape drive” on page 19 for more information about front panel lights.
- 2 Verify that the tape drive installation was successful.  
For many operating systems, you can use HP Library & Tape Tools as described on page 29. The UNIX Configuration Guide on the HP StorageWorks Tape CD-ROM also includes a verification procedure.

**Note** If you encounter a problem during this verification procedure, turn to “Troubleshooting” on page 31 for help in diagnosing and fixing the problem.

- 3 You are now ready to carry out a backup and restore test to check that the drive can write data to tape. Use the blank cartridge supplied with the tape drive.

## To load a cartridge

- 1 Lift the cartridge door on the front of the tape drive and insert the cartridge into the slot in front of the drive with the white arrow uppermost and facing the drive door. Apply gentle pressure until the drive takes the cartridge and loads it. (See figure 6a.)
- 2 The Ready light flashes green while the drive performs its load sequence. When the cartridge is loaded, the Ready light shows steady green.

## To perform a backup and restore test

Refer to your backup application documentation for specific instructions.

- 1 Perform a trial backup of data to tape.
- 2 Perform a trial restore of data from tape.

## To unload a cartridge

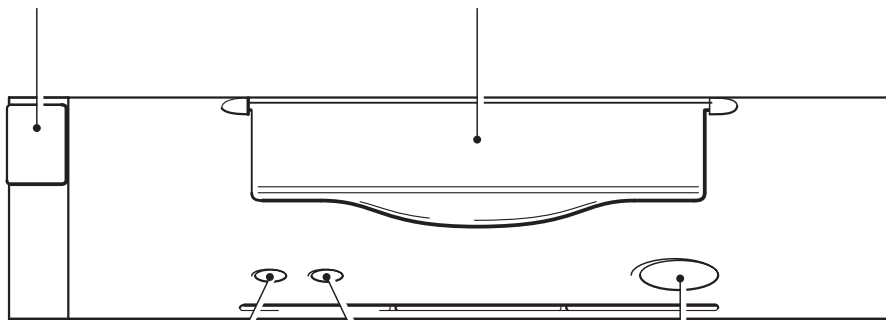
**Caution** Never try to remove a cartridge before it is fully ejected.

- 1 Press the Eject button on the front panel. (See figure 6b.)

The drive completes any task it is currently performing, winds the tape to the beginning, and ejects the cartridge. The sequence will take about 25 seconds for a write-enabled cartridge and 10 seconds for a write-protected cartridge.

extraction lever

cartridge door



Tape LED

Clean LED

Eject button





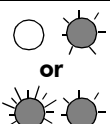

Figure 7: tape drive controls and indicators

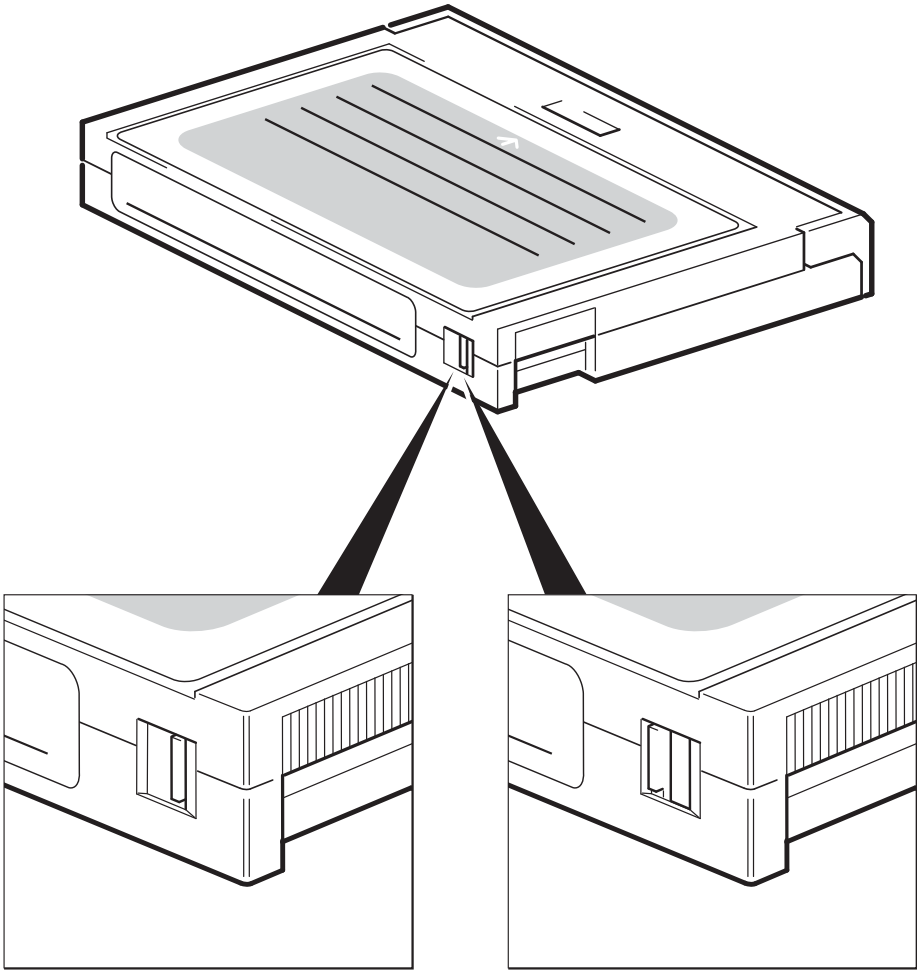
# Your HP StorageWorks DAT tape drive

There are two LEDs and an eject cartridge button on the front panel of your tape drive. See page 17 for more information about loading and unloading cartridges and page 36 for information about forcing ejection.

## Front panel LEDs

There are two LEDs, labeled Tape and Clean. (See figure 7.)

	Tape LED	Clean LED	Meaning
	on	off	The cartridge is loaded and the drive is ready.
	flashing slowly	off	The cartridge is loading or unloading, or self-test is in progress.
	flashing rapidly	off	The cartridge is loaded, activity is occurring.
	off	on	This is the Error Condition Signal. HP StorageWorks DAT drives perform a comprehensive self-test during power-up. If a hard error causes the self-test to fail, the clean light changes to steady amber. Run HP Library & Tape Tools to help diagnose the problem. (See page 29.)
	off or flashing rapidly	flashing slowly	This is the Media Caution Signal. <ol style="list-style-type: none"> <li><b>1</b> Wait for the current operation to finish, then insert a different tape and repeat the operation that was being performed.</li> <li><b>2</b> If the media caution signal does not show this time, it indicates that the original cartridge was nearing the end of its useful life. Copy any data you want to keep from the original tape onto a new tape if possible, then discard the old tape.</li> <li><b>3</b> If the media caution signal appears again with the second tape, the tape heads need cleaning.</li> <li><b>4</b> If the media caution signal appears after using a cleaning cartridge, the cleaning cartridge has probably expired and should be discarded.</li> </ol>
	flashing slowly	flashing slowly	When the two LEDs flash alternately, the tape drive is in disaster recovery mode, restoring the operating system (see "Running HP OBDR" on page 28).



**tab closed, cartridge  
write-enabled**

**tab open, cartridge  
write-protected**

**Figure 8: write-protecting cartridges**

# Use the correct media

For best performance we recommend HP branded media. Order online at: [www.hp.com/go/storagemedia](http://www.hp.com/go/storagemedia). If you do not have internet access, refer to the User's Guide on the HP StorageWorks Tape CD-ROM for ordering information for tape cartridges and cleaning cartridges.

## Data cartridges

For optimum performance and storage capacity, use tape cartridges that match your drive's format, and normally use only one cartridge per day. **Ideally, use HP's DDS-4 cartridges with DAT 40 tape drives and HP's DAT 72 cartridges with DAT 72 tape drives.**

Although HP StorageWorks DAT tape drives are fully backward compatible, old tape formats are more abrasive than later generations and using older tape formats can reduce the life expectancy of the tape drive. The compatibility between drive models and cartridges is summarized in the following table. Shaded boxes show the recommended media for each tape drive.

	<b>DDS-1 90 meter</b>	<b>DDS-2 120 meter</b>	<b>DDS-3 125 meter</b>	<b>DDS-4 150 meter</b>	<b>DAT 72 170 meter</b>
HP StorageWorks DAT 40	<b>read only</b>	<b>read/write</b>	<b>read/write</b>	<b>40 GB* (C5718A)</b>	<b>not supported</b>
HP StorageWorks DAT 72	<b>not supported</b>	<b>not supported</b>	<b>read/write</b>	<b>read/write</b>	<b>72 GB* C8010A</b>

\* Capacity assumes 2:1 compression.

**table 2: data cartridge compatibility**

## Write-protecting cartridges

If you want to protect the data on a cartridge from being altered or overwritten, you can write-protect the cartridge. (See figure 8.)

Always remove the cartridge from the tape drive before you change the write protection.

- To write-protect a cartridge, slide the tab on the rear of the cartridge so that the recognition hole is open.
- To write-enable a cartridge, slide the tab back so that the hole is closed.

Write-protection will not protect your cartridges against magnets (or bulk erasers).

## Cleaning cartridges

HP recommends weekly cleaning of the tape drive using an HP cleaning cartridge (part number C5709A). Do not use swabs or other means of cleaning the heads. The cleaning cartridge uses a special tape to clean the tape heads. A cleaning cartridge can only be used 50 times or as instructed on the cartridge packaging. Always place a check mark in a box each time you use the cartridge to clean the drive. Replace the cleaning cartridge when all the boxes are checked. New cleaning cartridges are available from HP.

- 1 Insert a cleaning cartridge into the drive. The tape drive automatically loads the cartridge and cleans the heads.

At the end of the cleaning cycle, the drive ejects the cartridge. The cleaning cycle takes approximately 30-60 seconds.

**HP StorageWorks DAT 40 drives:** If the cleaning cartridge ejects in less than 20 seconds, it has probably expired. In this case, discard the cleaning cartridge and repeat the operation with a new one.

**HP StorageWorks DAT 72 drives:** If the cleaning cartridge is not ejected, it has probably expired. In this case, press the Eject button, discard the cleaning cartridge and repeat the operation with a new one.

## 2 Remove the cleaning cartridge from the drive.

The drive's TapeAlert feature will send a message to your backup application when the tape heads need cleaning or a cleaning cartridge has expired.

## Handling cartridges

- Do not touch the tape media.
- Do not attempt to clean the tape path or tape guides inside the cartridge.
- Do not leave cartridges in excessively dry or humid conditions. Do not leave cartridges in direct sunlight or in places where magnetic fields are present (for example, under telephones, next to monitors or near transformers).
- Do not drop cartridges or handle them roughly.
- Do not stick more than one label onto the cartridge label area; extra labels can cause the cartridges to jam in the drive. Stick labels onto the label area only.
- See the insert included with the tape cartridge for storage conditions.

## Getting the most out of cartridges and drives

- Use mostly the matching media type (DAT 72 media for HP StorageWorks DAT 72, DDS-4 media for HP StorageWorks DAT 40).
- Use media for the recommended number of times (DAT 72 and DDS-4=100 full backups). Overuse of the tape will cause it to degrade and possibly shed tape debris in the drive. Too many new tapes can also cause wear of the drive as they are rougher than used ones.
- Do not verify (DDS does read-after-write checking automatically).
- Do not overload the server during backups. Maximize the transfer rate (run overnight with no other processes) and use incremental backups if convenient.
- Do not overuse your tape drive—it is designed for approximately three hours of tape pulling per day, not constant usage—and clean the drive regularly. See page 21.
- If you want to bulk erase cartridges, this should be done in a controlled environment. You need to make sure there are no other cartridges with sensitive information on them anywhere near the bulk eraser when in use. All data will be lost on cartridges that are bulk erased.

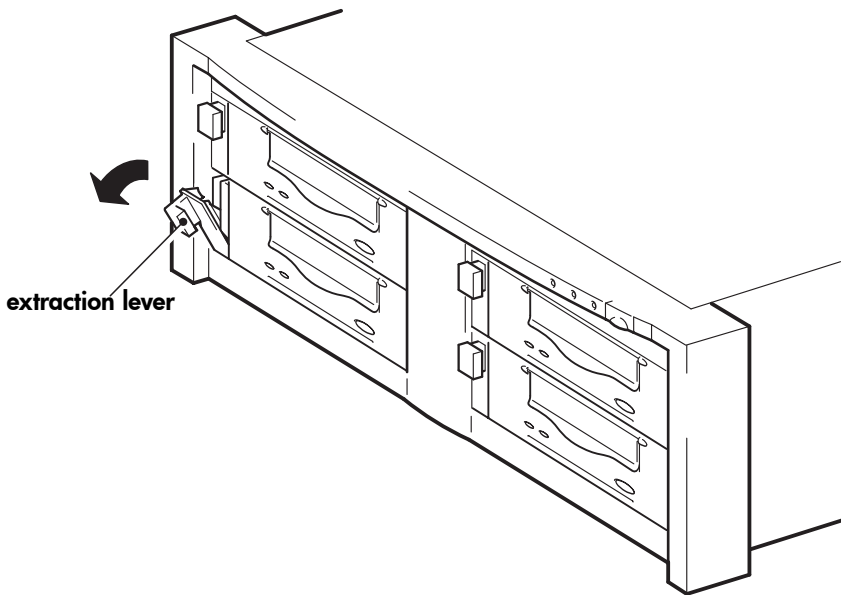


# Register your tape drive

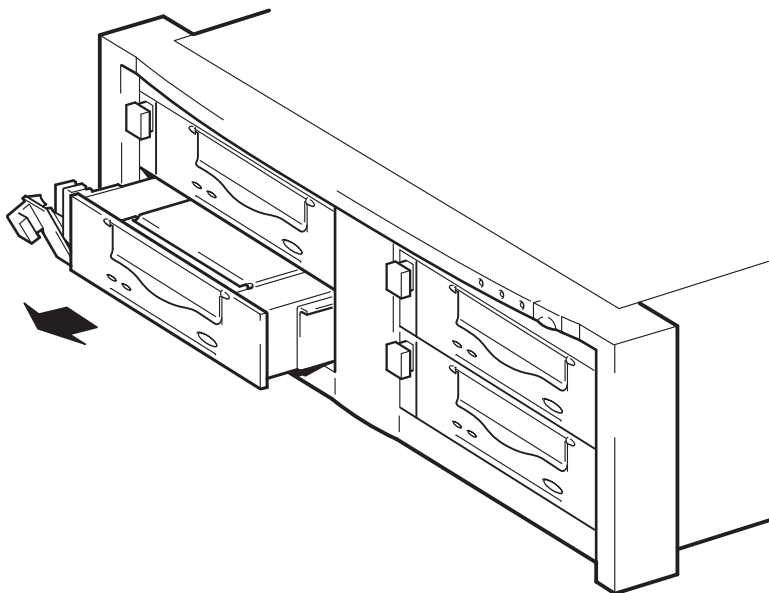
Once you have installed and tested your HP StorageWorks DAT tape drive, please take a few minutes to register your product. You can register via the web ([www.register.hp.com](http://www.register.hp.com)).

To ensure your registration is complete, there are a number of questions on the electronic form that are mandatory. Other questions are optional. However, the more you feel able to complete, the better we can meet your needs.

**Note** HP and its subsidiaries are committed to respecting and protecting your privacy. For further information, please visit our World Wide Web site ([www.hp.com](http://www.hp.com)) and click on Privacy Statement.



**Figure 9a: pulling out the extraction lever**



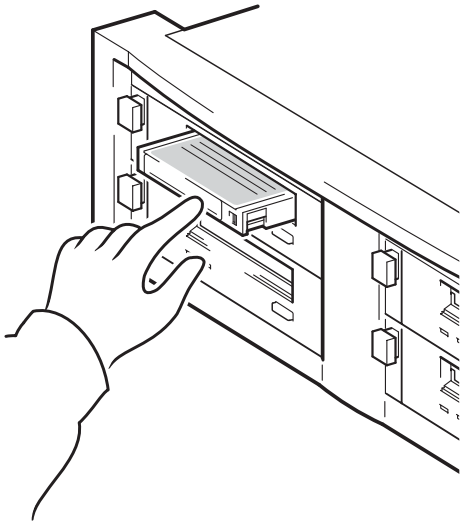
**Figure 9b: removing the drive**

# Replacing the drive

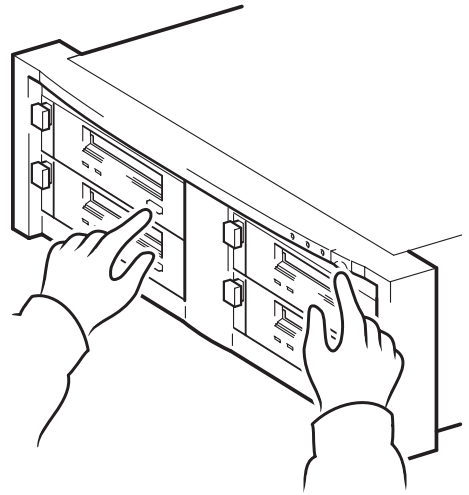
HP StorageWorks DAT removable drives can be removed and replaced without powering down the tape array. However you should be aware of the following:

- If all drives in the tape array are powered up when the system is turned on, the host will be aware of those drives. You can remove any of those drives and replace it with another drive as long as there is no activity on the bus.
- Do not remove or add drives to a bus that already has drives connected and running, for example backing up or restoring data. Wait until there is no activity on the bus before removing or adding drives.
- If a drive is not powered up or you place a drive in an empty slot *after* the system has been powered up, the system will have to be reset before the host will recognize the drive.
- The SCSI IDs are controlled by the tape array, not by the drives themselves, so if you remove a drive and replace it with another the ID will not change.

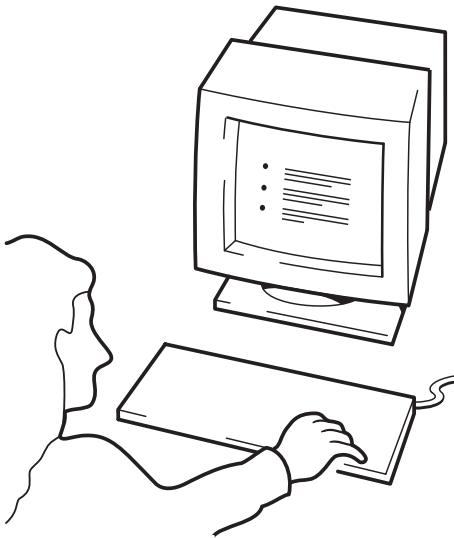
- 1 Pull the extraction lever of the drive that you want to replace so that it is in the out position. (See figure 9a.)
- 2 Using the extraction lever, pull the drive gently and firmly out of the tape array. (See figure 9b.)
- 3 To insert another drive, follow the instructions in “Step 1: Install the drive” on page 13.



**Figure 10a: hp obdr, step 1**



**Figure 10b: hp obdr, step 2**



**Figure 10c: hp obdr, step 3**

# Using HP OBDR

## Compatibility

HP One-Button Disaster Recovery is a standard feature on all HP StorageWorks DAT tape drives. However, it can only be used with specific configurations and will only recover the server to which the tape drive is directly connected.

To check whether your system (hardware, operating system and backup software) is OBDR-compatible, please refer to our World Wide Web site [www.hp.com/go/connect](http://www.hp.com/go/connect).

For more specific information concerning the benefits of OBDR and the latest new features please refer to our World Wide Web site [www.hp.com/go/obdr](http://www.hp.com/go/obdr).

**Note** HP OBDR is not applicable to HP-UX and other non-Intel UNIX operating systems, and it is not compatible with Intel-based Solaris systems. HP OBDR is supported on a server with a RAID controller if the tape drive is connected directly to a host bus adapter (HBA).

If your system does not support HP One-Button Disaster Recovery, you can still use your tape drive normally to back up and restore data. However, you must remember to create a separate set of emergency recovery disks for your operating system whenever you change your system configuration.

## What does HP OBDR do?

Using just the tape drive and the most recent backup cartridge HP OBDR allows you to recover from the following types of system disaster:

- Hard disk failures, as long as the replacement hard disk is the same size or larger than the original and uses the same interface (for example, replace a SCSI hard disk with another SCSI disk)
- Hardware failures where the server is replaced by an **identical** component
- File corruption because of an operating system error
- File corruption because of an application software error
- Viruses that prevent you from booting your system correctly
- User errors that stop you from booting your system correctly

When you run HP One-Button Disaster Recovery, your tape drive goes through the following sequence:

- 1 It goes into a special disaster recovery mode that enables it to restore your operating system and reboot. It acts like a bootable CD-ROM. (Your system's ability to boot from CD-ROM is normally enabled by default. If you have changed this setting, you will need to enable it again. Refer to your system BIOS manual for further details.)
- 2 It returns to normal tape drive mode and restores the data.

## Remote disaster recovery (ProLiant servers only)

The HP Remote Insight Lights-Out Edition (RILOE) on ProLiant servers gives the IT Administrator the ability to completely recover a failed server at a remote location without physically traveling to where the server resides. The on-site non-technical person need only insert the bootable cartridge into the tape drive when asked to do so by the administrator.

Refer to the HP OBDR web site at [www.hp.com/go/obdr](http://www.hp.com/go/obdr) for more information about using this feature and compatibility.

## Testing for compatibility

We recommend that you perform a full disaster recovery immediately after installation—if possible, onto a blank hard disk. If you do not have a blank hard disk and do not want to overwrite your system, you can safely cancel the disaster recovery process at step 3 in the following procedure.

Refer to our connectivity web site ([www.hp.com/go/connect](http://www.hp.com/go/connect)) for more information about suitable backup applications.

## Running HP OBDR

HP OBDR can only be used with backup applications that support one-button disaster recovery and methods of operating OBDR will vary between different software companies. Check our World Wide Web site ([www.hp.com/go/obdr](http://www.hp.com/go/obdr)) for the latest information about software compatibility, firmware upgrades and troubleshooting before you use HP OBDR.

- 1 Insert the latest bootable cartridge in the tape drive that you have assigned to HP OBDR (see figure 10a). The cartridge must be written by a backup application that writes data to tape in CD-ROM format.
- 2 Hold down the eject button of the tape drive that you have assigned to HP OBDR. Keeping the eject button pressed down, power on your tape rack and server (see figure 10b.) This activates the HP One-Button Disaster Recovery process. Release the button as soon as the Tape Light and Clean light on the front panel flash alternately, which is the OBDR sequence.

### Keyboard shortcut for HP ProLiant servers

There is no need to press the Eject button. Just power on your server and press the [F8] function key during the Power On Self Test (POST). This invokes OBDR to restore your system. For more information and specific instructions please refer to our World Wide Web site at [www.hp.com/go/obdr](http://www.hp.com/go/obdr).

- 3 Follow the on-screen instructions to set up the operating system. (See figure 10c.) Normally, you can accept the default response to all the prompts, for example just press <Enter>. The LEDs will flash in OBDR mode (as described in step 2) while the tape drive restores your operating system to a state where it can run a normal data restore.
- 4 Once the operating system has been set up and rebooted, the Ready LED display on the tape drive changes to constant green and you can remove the backup cartridge, if you wish. You are now ready to run a normal data restore. Follow the normal process for your restore application.

### If restore fails

If the restore fails for any reason, refer to our World Wide Web site ([www.hp.com/go/obdr](http://www.hp.com/go/obdr)) and do a search on OBDR for detailed troubleshooting information.

# Diagnostic tools

## HP Library & Tape Tools

HP Library & Tape Tools does not work on all operating systems. Compatibility information, updates, and the latest version of this software can be found at [www.hp.com/support](http://www.hp.com/support).

HP Library & Tape Tools software provides free diagnostic and troubleshooting utilities. It allows you to:

- Quickly identify, diagnose and troubleshoot drive and media problems.
- Verify that the drive is installed correctly and check drive health.
- Upgrade to the latest drive firmware (you will need internet connection to do this)

You can also install HP Library & Tape Tools from the link on the HP StorageWorks Tape CD-ROM.

**Note** You may notice the internal identifier for the tape drive when you use HP Library & Tape Tools. This is also the name that appears on the bootup screen for Windows users and is used to identify the tape drive when configuring UNIX device files.

Drive model	Internal Identifier
HP StorageWorks DAT 40	HP C5683A
HP StorageWorks DAT 72	HP C7438A

## Performance Assessment Tool

Use our free Performance Assessment Toolkit, PAT, to check tape performance and test the speed at which your disk sub-system can supply data.

PAT does not work on all operating systems. Compatibility information, updates and the latest version of this software can be found at [www.hp.com/support/pat](http://www.hp.com/support/pat).

# Optimizing performance

Various factors can affect tape drive performance, particularly in a network environment or if the drive is not on a dedicated SCSI bus.

If your tape drive is not performing as well as expected, consider the following points before contacting HP Support at [www.hp.com/support](http://www.hp.com/support).

- Is the tape drive connected to a suitably-rated built-in SCSI bus or HBA, see “Why is the SCSI bus type important?” on page 4. Suitably-rated means an Ultra Wide or higher SCSI specification.
- Is the tape drive on a dedicated SCSI bus? For optimum performance, we recommend that the tape drive is the only device on the SCSI bus. If it is not, ensure other devices are the same SCSI specification as your tape drive model. If they are single-ended, the bus will switch to single-ended mode with a lower transfer speed. There will also be restrictions on cable length. Do not put tape drives and hard disks on the same SCSI bus.
- Is the SCSI bus terminated correctly. The last device on the SCSI bus must be terminated. Use a multimode terminator.
- Is the cabling correct? Use properly-rated cables and adhere to maximum cabling length. See the SCSI topic in the online User’s Guide on the HP StorageWorks Tape CD-ROM for more information about cable length.
- Have you installed the correct device drivers for your operating system and backup application? See “Backup software and drivers” on page 5.
- Are you backing up across a network? The network load may be affecting the speed of transfer or your backup application may only be appropriate for a single-server environment.
- Is the backup application writing buffers at the correct speed? You may need to tune the transfer, buffer and block size settings to optimize the speed that the application writes data to the tape drive. HP StorageWorks DAT tape drives have an internal buffer of 8 MB.



# Troubleshooting

The first step in problem-solving is establishing whether the problem lies with the cartridge, the drive, the host server and its connections, or with the way the system is being operated.

Most modern SCSI host bus adapters locate and display attached devices when the system is booting up. On Windows systems, if you swap or connect a product when your system is running, you will need to reboot the system. IA32 systems also usually need to be rebooted. UNIX systems may have pluggable drivers, which allow drives to be attached to a running system and detected without rebooting.

If the device is not detected on boot up, there is probably a problem with the physical hardware: cables, termination, connections, power or the host bus adapter itself. If the device is displayed during boot up but cannot be found in the operating system, this is more likely to be a software problem.

- If you encounter a problem during installation and need further clarification, refer to “Problems encountered during installation” below.
- If a problem arises during testing after you have installed the drive, refer to the symptom-based section “Testing after installation” on page 33.
- For information about cartridges, refer to “Problems with cartridges” on page 36.

Many users can use HP Library & Tape Tools to help them diagnose problems.

## Problems encountered during installation

### Unpacking

Description	Further information
Some parts appear to be missing or damaged.	Contact your vendor if any parts need replacing. Note that SCSI cables and terminators are not shipped with your tape drive, or with the tape array. You need to order the correct size cables and terminators to suit your particular configuration. Cable and terminator options are listed at the HP tape array support web site: <a href="http://www.hp.com/support/tapearray">//www.hp.com/support/tapearray</a> .

### It is unclear which SCSI ID to use

Description	Further information
It is uncertain which ID numbers are available.	Use HP Library & Tape Tools (see page 29) to provide information on your current SCSI settings. The HP StorageWorks DAT drive has its SCSI ID set to 3 by default. This should be left unchanged unless this number is already in use. Full instructions on how to change the SCSI ID are given on page 13.

### How should the SCSI bus be configured?

Description	Further information
Correct configuration of the SCSI bus with multiple drives can be a complex area and more help may be required.	Refer to the SCSI Configuration section in the online HP StorageWorks User’s Guide on the HP StorageWorks Tape CD-ROM.

## How should the SCSI bus be terminated?

Description	Further information
It is unclear if the bus is already terminated or where an additional terminator should be placed.	<p>Refer to the SCSI Configuration section in the online HP StorageWorks User's Guide on the HP StorageWorks Tape CD-ROM.</p> <p>Both ends of a SCSI bus must be terminated. Assuming that the host bus adapter is already correctly terminated, there are typically two possibilities:</p> <ul style="list-style-type: none"> <li>• The tape drive is being connected in a direct one-to-one configuration to the host server - termination must be used.</li> <li>• The tape drive is being daisy-chained with other tape devices onto the host server - only the last device must be terminated.</li> </ul> <p>The terminator plugs directly onto either SCSI connection on the rear of the tape array. Terminators must be ordered separately.</p> <p>Refer also to the "SCSI Configuration" section in the online User's Guide on the HP StorageWorks Tape CD-ROM.</p>

## Is the correct SCSI host bus adapter installed?

Description	Further information
The server already has a SCSI host bus adapter but it is difficult to determine what type it is.	If your server is in its original configuration (no SCSI adapters have been added or removed) then use <a href="http://www.hp.com/go/connect">www.hp.com/go/connect</a> to check the compatibility of your system.
The server may not have a SCSI host bus adapter installed.	Use HP Library & Tape Tools (see page 29) to check whether you have a SCSI host adapter on your system. If not, you will need to purchase one. Refer to the <a href="http://www.hp.com/go/connect">www.hp.com/go/connect</a> web site.

## Do drivers need to be installed and, if so, which ones

Description	Further information
It is unclear whether there is a need to install drivers onto the system, and more help is required.	Detailed information specific to your system can be found on the <a href="http://www.hp.com/go/connect">www.hp.com/go/connect</a> web site. Typically, if you are using backup software that states support for HP StorageWorks DAT tape drives, then all the required drivers will be provided. Windows drivers can be obtained from the HP StorageWorks Tape CD-ROM or from <a href="http://www.hp.com/support">www.hp.com/support</a> . For support on UNIX systems, see the UNIX Configuration Guide on the HP StorageWorks Tape CD-ROM.
The required drivers do not appear to be available.	Future drivers will be provided via the support web site when they become available.

## Testing after installation

Remember that the system recognizes devices during boot-up. If you swap or connect a product when your system is running, you will need to reboot the system. Rebooting the system will reset devices and will often resolve problems. It is good practice to reboot every time you add a driver or install firmware.

**Caution** Never power off the drive during a firmware upgrade.

### The server does not recognize the tape drive when it boots up

Possible reason	Recommended action
The power or SCSI cable is not connected properly.	Check that the cables to the tape array are firmly connected. Ensure that the SCSI cable is LVDS-compliant and does not have any bent pins. Replace, if necessary.
The SCSI bus is not terminated correctly.	Check that the SCSI bus is actively terminated. (Refer also to the documentation for your SCSI controller and any other SCSI devices you may have.)
The tape drive's SCSI ID address is not unique.	Make sure that each device on the SCSI bus has a unique ID. Remember that 7 is normally reserved for the host bus adapter. (Users of most operating systems can run HP Library & Tape Tools to check the SCSI IDs of each device attached to the SCSI bus, see page 29.)

### The drive does not work

Possible reason	Recommended action
The drive is not receiving power from the tape array.	Check that the tape array is connected to a power source and switched on. Check that the drive is properly inserted into the tape array so that it mates with the connections at the rear of the enclosure. The extraction lever should be pushed in, locking the drive in position. If the drive READY light is still off, call for assistance.
There is a fault with the drive.	If possible, and if no other drives in the tape array are in use, try resetting the drive, or turning the power switch on the tape array off and then on again. (If there is a tape cartridge loaded in the drive, try to unload it by pressing the Eject button. If this succeeds, switch the tape array off and then on again. If the problem persists, call for assistance.
There is a hard error on the drive.	The Media Caution (Clean) LED shows steady amber. Try powering the system off and then on again. If the error condition signal still shows, call for service.

## The server no longer recognizes the tape drive

Possible reason	Recommended action
You powered up the drive or added it to the tape array after the host system was turned on.	The host computer system only identifies which IDs are present on SCSI buses after power-on or a reset. To make the host look for devices on the bus, you need to reset the host. You should be able to do this using the SCSI management software on your computer. As a last resort, you could turn the host system off and on again
You changed the drive's SCSI ID after the host system was turned on.	<ul style="list-style-type: none"> <li>• If you have replaced a drive that was recognized by the host, the host should recognize the new drive at the same SCSI ID as its predecessor.</li> <li>• If you make any changes to SCSI IDs (on the back on the tape array), you need to reset the bus for the host to recognize the changes.</li> </ul>
The drive is not inserted correctly.	Check that the drive is properly inserted into the tape array so that it mates with the connections at the rear of the enclosure. The extraction lever should be pushed in, locking the drive in position.
The SCSI bus is not terminated correctly.	<ul style="list-style-type: none"> <li>• Check that the SCSI cable from the tape array is firmly connected to the SCSI connector in the computer.</li> <li>• If there are other devices in the SCSI bus, make sure that each device has a unique ID. Use HP Library &amp; Tape Tools to find details of the devices on the bus.</li> <li>• If there is more than one SCSI bus attached to your system, check that the system is looking for the drive on the correct SCSI bus.</li> <li>• Make sure that the bus is terminated correctly. If the array is the only device or the last device on the bus, it must have a terminator fitted. If some other device is last on the bus, it should have a terminator fitted and the tape array should not.</li> </ul>
There is a fault with the host system.	<ul style="list-style-type: none"> <li>• Make sure that the system is configured to recognize the correct device at each SCSI ID.</li> <li>• Ensure that the correct driver for the tape drive is installed. Look at the SCSI host adapter documentation and backup software documentation for further advice.</li> </ul>

## The application does not recognize the tape drive

<b>Possible reason</b>	<b>Recommended action</b>
The application does not support the tape drive.	Use HP Library & Tape Tools to check that the drive is installed properly. Refer to our World Wide Web site ( <a href="http://www.hp.com/go/connect">www.hp.com/go/connect</a> ) for details of backup applications that support the HP StorageWorks DAT tape drive. Load any service packs as necessary.
Some applications require drivers to be loaded.	Check that the correct SCSI and tape drive drivers are installed. Consult the backup application's installation notes for details.

# Problems with cartridges

If you experience any problems using HP branded cartridges, check:

- The cartridge case is intact and that it contains no splits, cracks or damage.
- The cartridge has been stored at the correct temperature and humidity. This prevents condensation. See the insert included with the tape cartridge for storage conditions.
- The write-protect switch is fully operational. It should move from side to side with a positive click.
- The World Wide Web site for more detailed troubleshooting information: [www.hp.com/support](http://www.hp.com/support).

## The cartridge is jammed

If the cartridge is jammed or the backup application is unable to eject it, you can force eject the cartridge. Once the cartridge is successfully ejected, it is good practise to upgrade the firmware. If the failure occurs regularly, contact customer service at [www.hp.com/support](http://www.hp.com/support).

- 1 Either press and hold the Eject button on the front of the tape drive for at least 15 seconds. Or press the Eject button three times within 5 minutes.
- 2 Wait for the cartridge to be ejected. The drive waits until 35 seconds have passed from the time of the first press, to give the normal eject procedure a chance to proceed. After this period, it immediately releases the tape and ejects the cartridge, regardless of what operation it was performing. It is important that you allow sufficient time for the drive to complete this process. If you interrupt it, you may damage the media or the tape drive.

The drive is then reset as though you had turned the power off and then on again.

- 3 You may lose data if you force eject a cartridge. The tape may also become unreadable because an EOD (End of Data) mark may not be properly written.

If the cartridge is still jammed, the tape drive has failed. Contact customer service at [www.hp.com/support](http://www.hp.com/support).

## The drive will not accept the cartridge (or ejects it immediately)

The cartridge may have been damaged, for example dropped, or the drive may have a fault. If it is a cleaning cartridge, it has probably expired and should be discarded immediately. For data cartridges:

- 1 Check that the drive has power (the power cable is properly connected and the ready LED is on).
- 2 Check that you are using the correct media for the tape drive, see page 21.
- 3 Make sure that you have loaded the cartridge with the correct orientation (see "To load a cartridge" on page 17).

- 4 Check for damage to your media and discard it if it is damaged.
- 5 Use a new or known, good piece of media and see if it loads. If it does, the original cartridge is faulty and should be discarded.
- 6 Check if another DAT drive of the same model will accept the cartridge. If it does, the original drive may be faulty. Before calling customer service, please check that the tape drive is responding and that it can be seen on the SCSI bus. Use HP Library & Tape Tools, see page 29.

# Other sources of information

You will also find troubleshooting information and contact details on the HP StorageWorks Tape CD-ROM and the HP web site. In particular:

- The online *User's Guide* on the HP StorageWorks Tape CD-ROM contains an extensive troubleshooting topic.
- The HP support web site contains a link to [www.hp.com/support/dat](http://www.hp.com/support/dat) that takes you to HP's Customer Care web site for a wide range of up-to-date information about your product.
- The HP web site at [www.hp.com/go/connect](http://www.hp.com/go/connect) provides details of recommended products and configurations.
- The HP web site at [www.hp.com/go/obdr](http://www.hp.com/go/obdr) provides detailed information about HP One-Button Disaster Recovery.

## How to contact HP

You can also use the HP Customer Call Centers for specialist technical help. Contact details can be found at [www.hp.com](http://www.hp.com). Click on the link to "contact HP".

To make the best use of this service, we ask that you work with our Support Specialists to resolve any issues with your drive. This may include downloading diagnostic software, that will assist in the rapid resolution of your problems.



the  $\mathbb{R}^n$  is a linear space over  $\mathbb{R}$  with the usual addition and scalar multiplication. The inner product is defined by

$$\langle x, y \rangle = x_1 y_1 + x_2 y_2 + \dots + x_n y_n \quad (1)$$

where  $x = (x_1, x_2, \dots, x_n)$  and  $y = (y_1, y_2, \dots, y_n)$  are vectors in  $\mathbb{R}^n$ .

The norm of a vector  $x$  is defined by

$$\|x\| = \sqrt{\langle x, x \rangle} = \sqrt{x_1^2 + x_2^2 + \dots + x_n^2} \quad (2)$$

The distance between two vectors  $x$  and  $y$  is defined by

$$d(x, y) = \|x - y\| = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} \quad (3)$$

The distance between two points  $x$  and  $y$  in  $\mathbb{R}^n$  is defined by

$$d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} \quad (4)$$

The distance between two points  $x$  and  $y$  in  $\mathbb{R}^n$  is defined by

$$d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} \quad (5)$$

The distance between two points  $x$  and  $y$  in  $\mathbb{R}^n$  is defined by

$$d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} \quad (6)$$

The distance between two points  $x$  and  $y$  in  $\mathbb{R}^n$  is defined by

$$d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} \quad (7)$$

The distance between two points  $x$  and  $y$  in  $\mathbb{R}^n$  is defined by

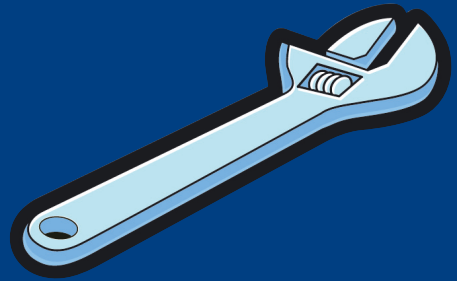
$$d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} \quad (8)$$

The distance between two points  $x$  and  $y$  in  $\mathbb{R}^n$  is defined by

$$d(x, y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2} \quad (9)$$



<http://www.hp.com/go/storagemedia>



<http://www.hp.com/support/dat>



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