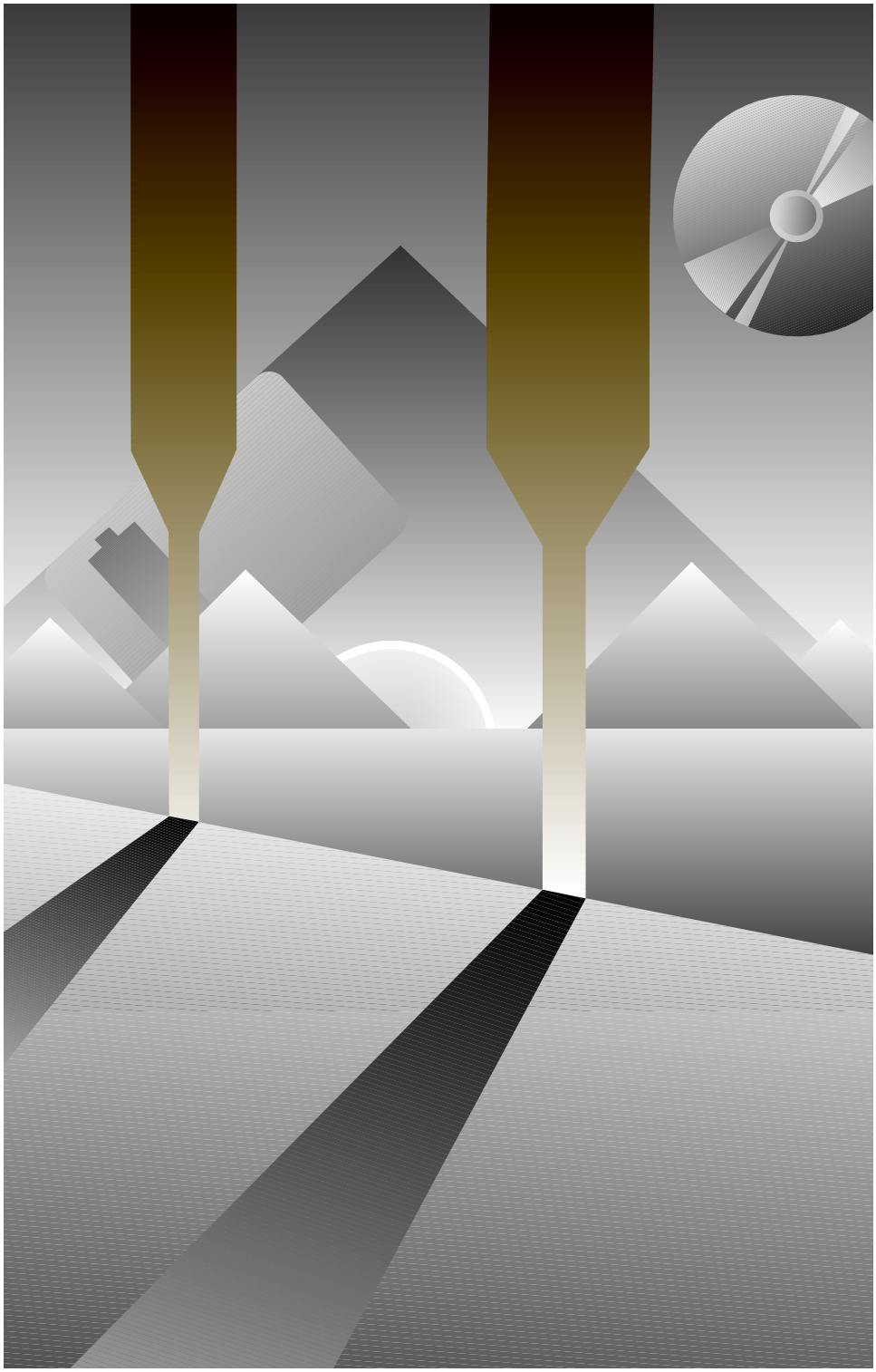
COMPAQ

Troubleshooting DAT Drives

Includes information on:

- DAT Drive Identification
- Sense Codes
- Error Codes
- Media Issues
- Data Compression
- Cleaning
- Jumper Settings
- Frequently asked questions (FAQ's)



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Troubleshooting DAT Drives

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Contents

Preface

This document outlines the recommended procedures to troubleshoot and resolve DAT Drive issues and provides additional information that is not included in the user manual as well as and answers many frequently asked questions regarding Compaq DAT drives.

Considerable effort has been taken by Compaq to more fully understand and resolve DAT Drive issues. Over 100 DAT drives were tested in a wide variety of applications and diagnostic programs to isolate intermittent failures. As a result of this effort, significant enhancements were made in the drive firmware to better accommodate marginal or bad quality media. Marginal or bad quality media was the biggest contributor to Compaq DAT issues.

Compaq used its partnerships with the respective hardware manufacturers and media vendors to correct all known firmware and media issues. In addition, the media audit test at Compaq has been greatly enhanced to better identify specific media issues so poor or marginal media is identified and returned to the vendor.

Another significant finding is that many DAT drives are installed and used to backup more than what is recommended. The 4/16 TurboDAT AutoLoader and 4/16 TurboDAT drive is suited to backup an optimum of 8Gb and a maximum of 12GB of data per job. This limit is primarily due to the time it takes to backup and verify large amounts of data and the increased cleaning requirements of the drive when used for backing up large amounts of data.

Based upon extensive testing, DAT drives require cleaning every 8 to 25 hours or they will fail intermittently when using marginal or bad media.

Most reported Compaq DAT issues have been remedied by upgrading the firmware and using the procedures in this manual to identify and remove bad or marginal media from the back-up application. Removal of this media will significantly improve the success and reliability of the DAT solution. The following items should be performed by the service provider or customer:

1. Update to the current firmware revision
2. Adopt recommended cleaning procedures
3. Identify and discontinue the use of "bad" media using sense codes

4. Ensure backup requirements do not exceed the maximum recommended duty cycle for DAT drives.
5. Use the sense codes to dictate what the next action should be

If the problem persists after addressing the above five items then contact Compaq Technical Support as the issue cannot be resolved at the customer level. A tape drive is very different from a hard drive and failures should be handled differently. Do not assume that the hardware is defective whenever a failure occurs. Review the log files and let the drive detail what is wrong.

If you have any comments or corrections about this troubleshooting guide send them to 'dat_help@bangate.compaq.com'.

Chapter 1
Introduction`

This guide is divided into the following sections:

- Troubleshooting Summary
- Troubleshooting DAT Issues
  - DAT drive and Autoloader Identification
  - Corrective Actions Summary
  - Software troubleshooting
  - Troubleshooting DAT Issues Using Sense Codes
  - Media troubleshooting
- DAT Media
- Data Compression
- Cleaning DAT Drives and the Compaq Autoloader
- Jumper Settings
- Frequently Asked Questions (FAQs)

Troubleshooting Summary

1. Firmware Upgrade: Based upon Compaq testing and validation at customer sites upgrading the firmware and using the procedures in this manual to identify and remove bad or marginal media corrects most issues with DAT drives.
2. Cleaning: Cleaning is also very important. Ensure the drives are being cleaned as often as required. Media may deposit particles on the head much more quickly than the recommended 25 hour cleaning schedule. This is why the cleaning requirements are increased to once every 8 hours when using new media.

3. Identify and remove bad or marginal media: Media is an integral part of the backup solution. If media is marginal or defective it will cause the drive to report an error. The process of identifying and removing bad media only needs to be done once and involves using sense codes which is the best tool available to diagnose DAT issues. If media is the cause of a failure, a drive replacement WILL NOT correct a media problem.
4. DAT usage: Some customer sites are utilizing the DAT drives more than what is recommended. This is especially true with the 4/16 TurboDAT Autoloader. Any backups over 8-12Gb requires more extensive cleaning which is not feasible in most customer environments resulting in failures. This is discussed briefly below in the troubleshooting summary and in more detail later in this document.
5. Sense Codes: Finally use sense codes returned from the drive to determine the appropriate corrective action. Sense codes are the only way to isolate and resolve DAT issues.

Update to Latest Firmware Revision

It is imperative that the latest firmware revision be in use.

Compaq has completed important new firmware releases for DAT drives. These releases include enhancements in the following areas:

- Identification of media problems causing backup failures
- Consistent error reporting for improved troubleshooting
- Improved error recovery
- New drive-cleaning algorithms

For optimum performance, Compaq highly recommends that users upgrade these drives to the latest version of firmware even if no problems are being experienced.

The table below indicates the firmware revision status of each model of DAT drive.

Table 1-1
Firmware Revision Status

Drive Vendor (Product)	Model	SCSI ID String	Current Firmware	New Firmware Source
2/8 Gb DAT Conner (Python)	4322NP	Archive Python 27871-XXX	4BGG	Being qualified
2/8 Gb DAT Hewlett Packard	C1536-00480	Archive Python 27871-XXX	1214	ROMPaq 2.32
4/16 Gb TurboDAT Conner (Piranha)	4326NP	Archive 4326XX 27871-XXX	4c08	ROMPaq 2.32
4/16 Gb TurboDAT Conner (Peregrine)	CTD8000	Archive 4326XX 27871-XXX	0322	ROMPaq 2.32
4/16 Gb AutoLoader Conner (Piranha)	4586NP	Archive 4586XX 28887-XXX	4c04	ROMPaq 2.31 SoftPaq SP1995
4/16 Gb AutoLoader Seagate(Peregrine)	CTL96G-S	Archive 4586XX 28887-XXX	0420	ROMPaq 2.31 SoftPaq SP1995

Adopt Recommended Cleaning Procedures

Most field issues have been identified as resulting from using defective or sub-standard media that requires more cleaning than the recommended 25 hours schedule. Listed below are the Compaq recommended cleaning procedures.

- **Recommend cleaning every eight hours.** This is much more frequent than the manufacturer's recommendation of "once every 25 hours" but this practice will reduce the number of failures.
- Stress that new media requires more frequent cleaning than media that has been used for five or more backups.

- Recommend cleaning four times after a failure occurs.
- When a manual eject is required to remove a cleaning cartridge from the drive, or a 'RPL CLN' message is displayed on the AutoLoaders with the latest firmware, the cleaning tape must be replaced with a new one.
- If the latest firmware is used, cleaning is performed every eight hours, and a head clog error is reported, record that a failure occurred on the label of the cartridge that was inside the drive when the error was reported. Then replace any cartridges that fail more than three out of five times.

Additional Information

The Compaq White Paper titled "Tape Drives, Media, and the Importance of Cleaning" is currently available on the ASE Notebook and on the Internet; http://www.compaq.com/support/techpubs/whitepapers/298a0995.html

The following is an extract from Service Advisory: A1020, May 1996, "Selecting the Correct Cleaning Cartridge for Compaq Digital Audio Tape Drives"

The Sony cleaning cartridge works fine with the DDS1 or 2/8 GB DAT drive since it uses the same base film thickness as the DDS1 media. The Maxell cleaning cartridge is better suited for cleaning the DDS2 or 4/16 GB TurboDAT drive since it uses the same base film thickness as the DDS2 media.

NOTE: The Sony cleaning cartridge will not damage a DDS2 drive, but it does not clean DDS2 drives as effectively as the Maxell cleaning cartridge.

To order cleaning cartridges, use the following spare part numbers:

Table 1-2
Cleaning Cartridges Spare Part Numbers

Tape	Spare Part Number
Maxell DDS2 Cleaning Cartridge	242618-001

Sony DAT Cleaning Cartridge	131194-001

Identify and Discontinue the Use of "Bad" Media Using Sense Codes.

IMPORTANT: A drive replacement WILL NOT correct a media problem

Media is an integral part of any tape backup solution. It is just as important as hardware or firmware. If the media is marginal or defective it will cause the drive to report an error. There are several characteristics of a DAT tape cartridge that can cause DAT drives to fail. These are head clogs, high torque cassettes, BOT/EOT prism failures, physical tape damage, and tape hub alignment. These problems may occur with any tape cartridge from any tape manufacturer, including Compaq-approved media vendors.

It is imperative that the Compaq firmware be upgraded to version 4c04, 0420, 0322, 4c08, 1214, or later as outlined in Table 1. The 2/8Gb DAT drive with firmware revision 4.BGG needs to be upgraded as well but the exact revision is not known at the time of this writing. . Since it is impossible to identify bad or marginal media through a visual inspection of a cartridge, the new firmware together with the sense code list should be used to identify defective cartridges that need to be replaced.

Sense codes reported in application log files are the best tool available to diagnose DAT issues. Compaq User Diagnostics will report that a failure occurred but will not report the sense code needed to correct the problem. Sense codes, however, are not useful unless they can be identified in a log file. Information on capturing and interpreting sense codes and corrective actions for each one of them is listed in this document.

The process of identifying marginal or bad media only needs to be done once. After all the media has been verified it is no longer necessary to go through this process unless new media is added to the tape rotation.

While the marginal and bad media is being identified it is important to increase the cleaning frequency to once every 8 hours. If any tape causes a head clog in under 8 hours then it should be discarded especially if it fails two or more times in under 8 hours.

The most common media related sense codes are covered here;

- Head clogs are the most common issue media problem and are caused by loose particles that are deposited on the read/write heads. These deposits prevent the drive from reading or writing to the tape. Head clogs are reported in many ways when using the latest firmware. When a head clog occurs clean the drive at least four times to ensure the heads are clean. Track when tapes fail and when they are successful for the first three uses. If a tape fails 2 out of 3 times, the tape must be replaced. The sense codes reporting head clogs are 03/03/02 and any sense code starting with 03 and ending with either BE or BF. For example 03/3B/BE is a head clog.
- High-torque cartridges may be wound incorrectly during manufacturing in such a way that the tape rubs against the top and/or bottom of the inside of the tape cartridge shell. This creates enough resistance to prevent the DAT drive from moving the tape consistently. High-torque cartridges are always reported as 04/44/AF. Autoloaders will display the message "BAD TPE #," where # is the slot number of the tape. High-torque tapes must be replaced.
- BOT/EOT prism problems are caused by bad cartridges and are not frequent, but when they happen they will intermittently prevent the drive from sensing the end or beginning of tape. This causes the motors that move the tape to stop suddenly, resulting in an error message. BOT/EOT Prism failures are either reported as 04/44/AF or 04/44/B9 and in either case the cartridge must be replaced.
- Physical tape damage may be caused by the drive or may occur during manufacturing. This problem always occurs on the exact same location on tape. Physical damage is reported as a 03/31/00 or 03/3b/00 in the exact same location on tape. This issue can only be verified by testing with a special debug tool that can eject the tape without rewinding so the damage is visible and requires that the tape be captured. It is recommended that tapes reporting these sense codes be replaced.

- Tape hub alignment problems cause noise during high speed tape motion such as a rewind. When this occurs it is recommended to replace the tape..

In Summary;

Table 1-3
Table Name

Media related problem	Sense Codes, or other indicator
Head clogs	03/03/02 and any sense code starting with 03 and ending with either BE or BF, i.e. 03/XX/BE or 03/XX/BF
High-torque cartridges	04/44/AF
BOT/EOT prism problems	04/44/AF or 04/44/B9
Physical tape damage	03/31/00 or 03/3B/00 in the exact same location on tape
Tape hub alignment problems	noise during high speed tape motion

Compaq recommended media.

Table 1-4
Table Name

Compaq Part No.	Manufacturer/Size	Suited for use in;
131107-001	Sony 60M	2/8 GB DAT, 4/16 GB TurboDAT, 4/16 GB AutoLoader
131107-002	Sony, Fuji, Maxell 90M	2/8 GB DAT, 4/16 GB TurboDAT, 4/16 GB AutoLoader
137611-001	Sony, Fuji, Maxell 120M	4/16 GB TurboDAT, 4/16 GB AutoLoader

Ensure backup requirements do not exceed the maximum recommended duty cycle for DAT drives

The 4/16 TurboDAT AutoLoader and 4/16 TurboDAT drive are suited to backup an optimum of 8Gb and a maximum of 12GB of data per job. This is primarily because of the time it takes to backup and verify large amounts of data in conjunction with the cleaning requirements of the drives for larger 8-12Gb backups. The 2/8Gb DAT drive is best suited for 4-6Gb backups.

Assuming an average 1.5:1 compression ratio and that the drive is performing a backup and verify, a backup job will take approximately one hour per Gigabyte to complete. Therefore a 12Gb backup job will take approximately 12 hours to complete. Using the DAT drives for jobs larger than this is not recommended, not because the drive or heads will wear out, but because the cleaning requirements will not be met, namely that the heads be cleaned every eight hours of use to insure optimal drive performance.

One way to address the cleaning requirement is to break up the backup job into smaller 8 hour jobs with automatic cleaning jobs in between the backup jobs. This is discussed later in this manual.

Customers with backup requirements greater than 12Gb of total hard drive space should consider using DLT technology which is better suited for larger backup requirements.

Use the Sense Codes to Dictate What the Next Action Should Be

Collect information detailing sense codes generated by the drive, and let the sense codes determine what the next action should be. All sense codes listed in this document have been verified and accurately report an issue so appropriate corrective action may be taken. For example, if sense codes are not used to identify a failure and a drive is replaced for a media issue, the problem will reoccur on the new drive the next time that particular media is used since the cause of the failure was the media.

Chapter 2
Troubleshooting DAT Issues

This section provides much more detail and additional information regarding DAT drives and troubleshooting issues. It provides much more information than the summary and is recommended reading for anyone that troubleshoots DAT issues frequently or wants to know more about DAT drives.

Compaq is developing other methods of troubleshooting issues to make the process of identifying bad or marginal media as simple as possible. At this time sense codes are the only accurate method of troubleshooting DAT issues. If sense codes are not recorded in a log file then after upgrading the firmware assume and handle every failure like a head clog error was reported. This is not as accurate as using sense codes but it is an effective way to identify bad or marginal media.

The troubleshooting section is divided into the following topics:

- DAT drive and AutoLoader identification
- Corrective Actions Summary
- Software Troubleshooting
- Troubleshooting DAT Issues Using Sense Codes
- Media troubleshooting

Identifying DAT drives and Autoloaders is discussed in the first section since the corrective actions may differ between drives and models and the drives look very similar and are difficult to identify.

The Corrective Actions Summary lists all possible methods for a customer to resolve the problem. If all actions are taken and the problem is not resolved then contact Compaq Customer Service for assistance with hardware issues and contact the Software vendor for software issues. Use sense codes to determine whether the failure is a software or hardware issue.

Software Troubleshooting details how to use several of the more prevalent applications to identify the sense codes. This section addresses what sense codes are, how to use them, and provides a list of sense codes and their respective corrective actions. Media troubleshooting discusses the specific media issues that were identified.

DAT drive and Autoloader identification

Since there are two different physical devices for each type of Compaq DAT drive the only way to identify the type of drive that is installed is to run *Inspect* to view the ID or inquiry string and firmware revision. The firmware revision in combination with the inquiry string will distinguish one version of the DAT drive from another.

The firmware revisions listed below are exactly what would be displayed in the *Inspect* report. The *Inspect* report shows only four characters. The firmware tapes for the Conner drives have a dash number after the firmware revision. The dash number is either a "-10" indicating it is for the 2/8 Gb DAT or 4/16 Gb TurboDAT, or a "-410"' indicating it is for the 4/16 TurboDAT Autoloader.

Table 2-1
DAT Drive Identification

DAT Drive	ID String	Model	Firmware
2/8-GB DAT	ARCHIVE Python 27871-XXX	Conner 4322 HP C1536-00480	4BGG 1214
4/16-GB TurboDAT	ARCHIVE 4326XX 27871-XXX	Conner Archive 4326NP Conner Peregrine CTD8000	4c08 0322
4/16-GB Autoloader	ARCHIVE 4586XX 28887-XXX	Conner Archive 4586NP Seagate Peregrine CTL 96G-S	4C04 (May 96) 0417 (April 96) 0420 (May 96)

Corrective Actions Summary

- DAT drive failures can manifest themselves in many formats, however all of these failures can be corrected by a very few actions:**Upgrade Firmware:** Firmware may be upgraded using firmware tapes or Options ROMPaq. A SoftPAQed version of Options ROMPaq may be downloaded from the Compaq bulletin board system.
- **Upgrade drivers/software/firmware:** One of the first steps that should be taken when a problem exists is to upgrade to the latest revisions. If the problem reoccurs after upgrading all drivers, software, and firmware it is a new issue and not one that is already resolved.
- **Replace Media:** If the latest firmware indicates a bad tape, or if head clogs occur regularly, then the media should be replaced.
- **Disregard Error:** Some errors such as the E6911 SCSI Reentrancy error under Cheyenne ArcServe do not cause a failure. If an error occurs but does not disrupt the backup, the error should either be ignored or contact the software vendor for more information regarding the message.
- **Investigate:** If a sense code that begins with a 03 or 04 occurs in the field and is not listed in this document, contact customer service for clarification and possible investigation of the error. Sense codes that are not on the list can not be corrected by changing a software parameter so they must be addressed by Compaq.
- **Clean drive:** DAT drives are susceptible to particle contamination on the heads. When a problem occurs, the drive should be cleaned at least four times to ensure the heads are clean and to eliminate diryt heads as the cause of the failure.
- **Use the Training Guide:** Expert users in the field can use this guide to resolve DAT drive issues.
- **Replace Drive**: If firmware upgrades, cleaning, media replacements, and using the training guide do not correct the problem, the drive may need to be replaced.

If the problem persists after all the following actions have been taken:

- Upgrading to the latest firmware
- Replacing bad or marginal media
- Upgrading all drivers to the latest version
- Upgrading the software application to the latest version
- Following the corrective action for the sense code when one is returned
- Replacing the drive

then contact Compaq Customer Service for assistance with hardware issues and contact the application vendor for software issues. Use sense codes to determine whether the failure is a software or hardware issue.

Software Troubleshooting

This section details how to locate sense codes that are used to resolve DAT issues by looking up the corrective action in the sense code list. Sense codes are reported by the following applications:

- Arcada Backup Exec for NT, SQLServer for NT, and NT Backup
- ArcServe 5.x for Netware and ArcServe for NT
- Banyan

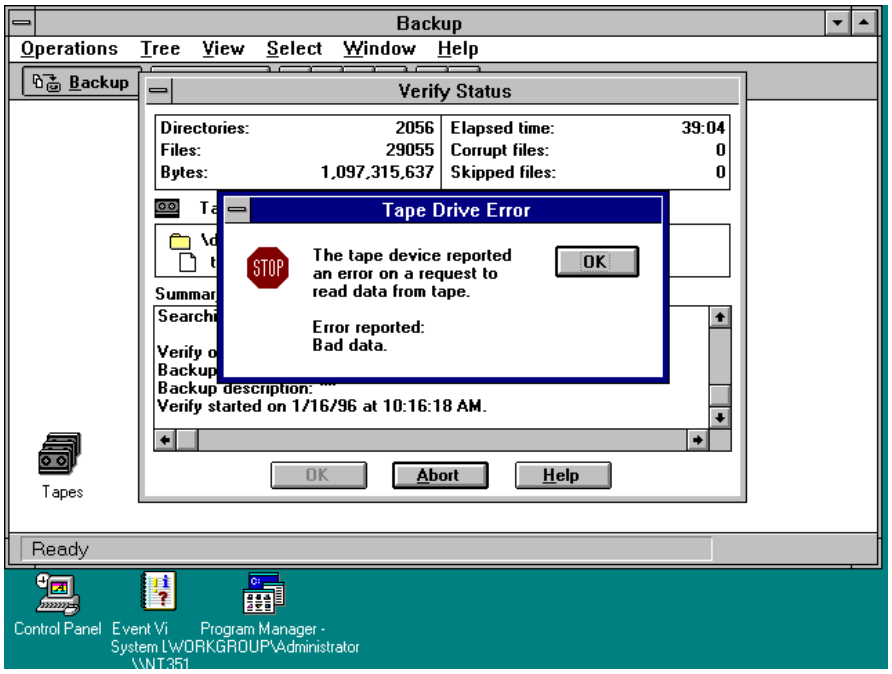
Arcada Backup Exec for NT, SQLServer for NT, and NT Backup

The standard 4mmdat.sys DAT driver under Microsoft NT 3.5x will return information in the System Event Log that can be very useful in diagnosing tape drive hardware problems.

Two common backup solutions for NT that use this driver are the Microsoft Windows NT Backup application and the Arcada Backup Exec.

Action

When the 4mmdat.sys encounters a tape hardware error, it displays as “STOP: The tape device reported an error on a request to read data from tape. Error reported: Bad data.” This indicates that the tape drive has returned error code information.



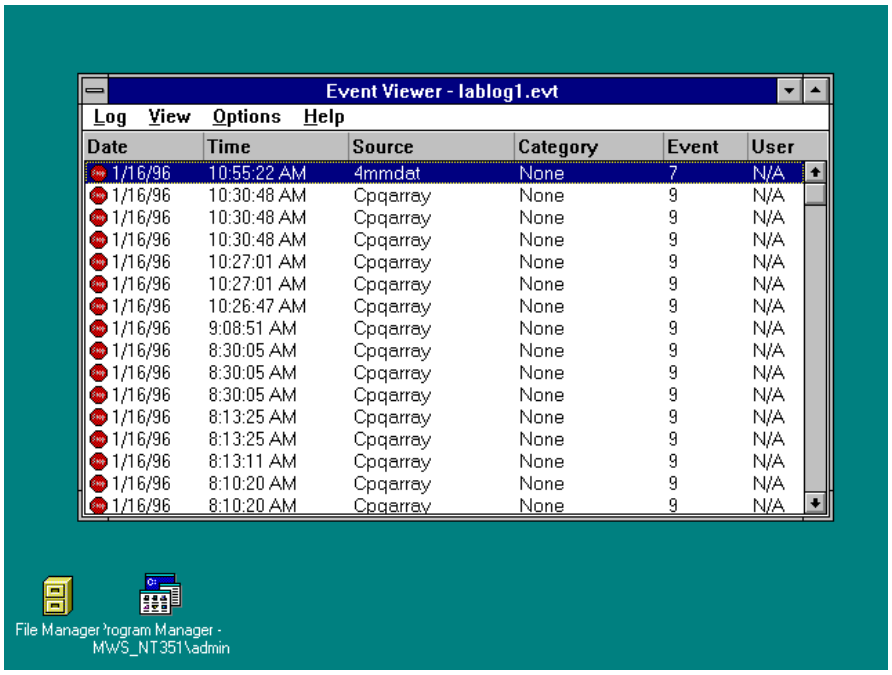
Other errors such as the following may not indicate actual hardware errors:

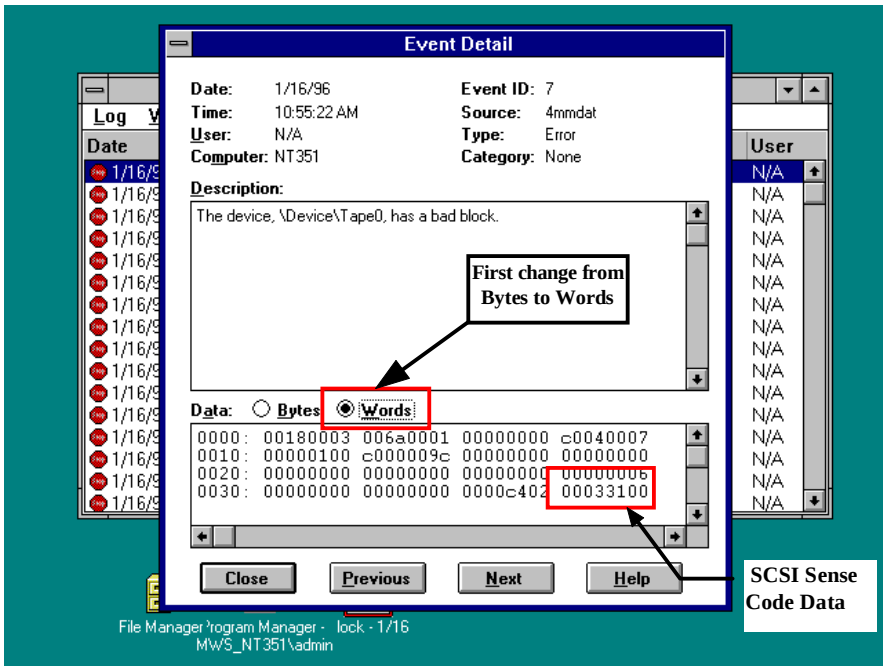
- “The device,\Device\Tape0, is not ready for access yet.”
- “Tape device “Archive 1” reported an error on a request to write data to tape. Error Reported: Hardware Error.”

When the 4mmdat.sys driver encounters an error as in the above screen, detailed failure information is recorded in the System Log, which is viewable within the NT Event Viewer, shown below.

To access the Event Viewer Log, from the drop down menu bar select;

Log | System





IMPORTANT: If the sense code is blank the DAT drive is not the source of the error.

Highlight the entry in the System Log that has 4mmdat as the source and double-click to view the details. While viewing the data associated with the event, clicking the *Words* radio button will make the data easier to read. Regardless of how many lines of data there are, the last 3 bytes of information will be the SCSI sense code data. In the example below, the sense code would be 03/31/00, which equates to Tape Format Corrupted (see the Sense Code lists).

The System Event log can be saved as a *.EVT file that can be kept for review and possible problem escalation as follows:

- From Event Viewer select *Log* from menu bar.
- Highlight *System* and a check mark will appear next to it.
- Select *Save As* from the Log menu and enter a filename.
- Ensure that the Save File As type is (*.EVT) and click *OK*.

ArcServe for NT Under Microsoft NT

In ArcServe for NT, information in the Tape Engine Log (Tape.log) and Activity Log (Arcserve.log) files are useful in diagnosing tape drive hardware problems if sense code information is captured. By default, ArcServe NT **does not** log any sense code information into the Tape Engine log file which is needed to diagnose tape drive issues.

IMPORTANT: The Activity Log file alone is not very helpful in resolving tape issues since it only indicates that the backup was not successful. ArcServe reports sense codes that are required to troubleshoot failures in the Tape Engine Log file.

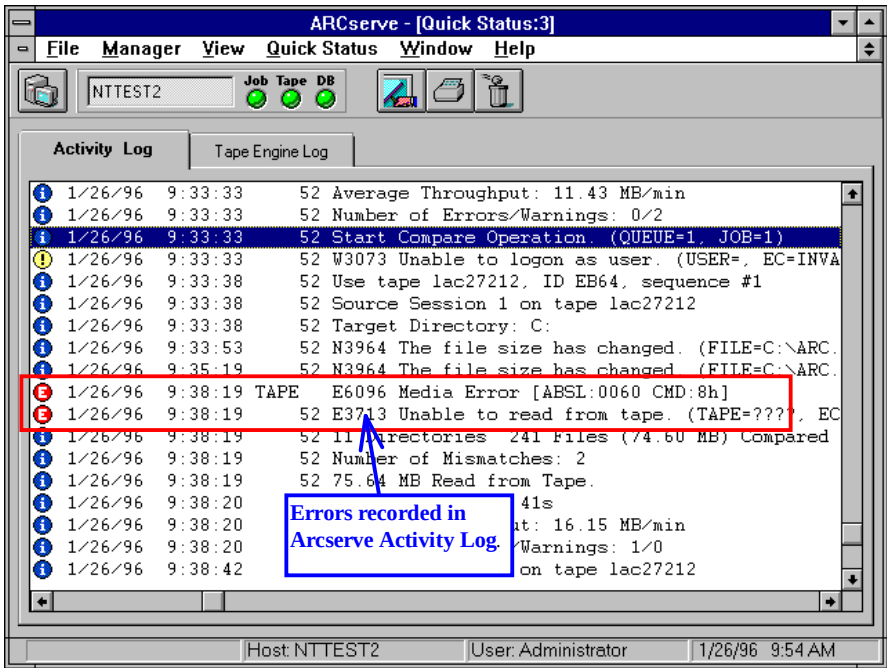
Capturing Sense Code Information

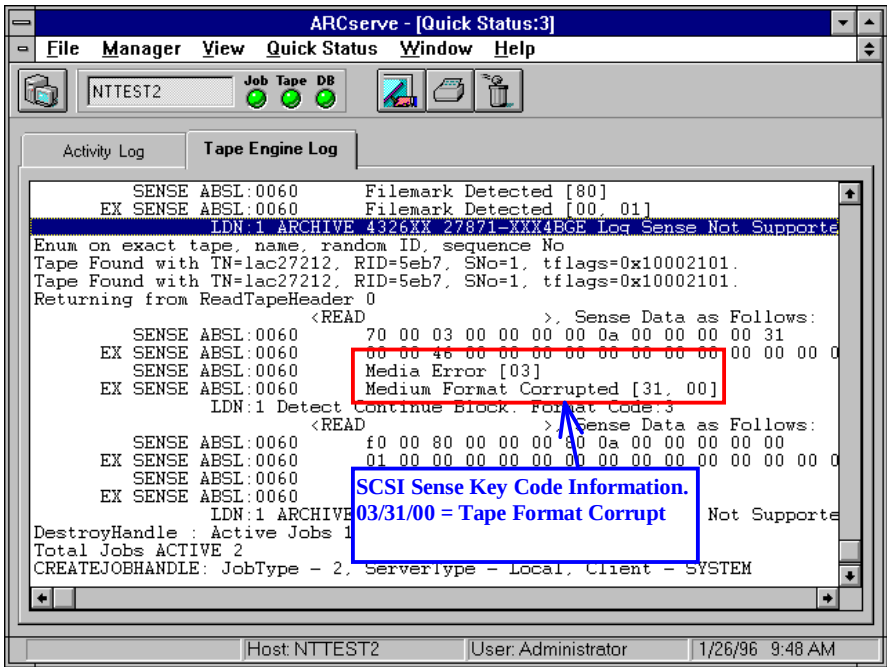
To ensure that the proper level of detail is captured, follow these steps:

1. Launch the ArcServe Server Admin utility.
2. From the menu bar choose *Admin*, then *Configuration*…\\
3. From the Configuration screen, choose the *Tape Engine* tab.
4. Change the *Message Level* from *None* to *Brief*
5. Change the *Message Output* to either *File Only* or *Both Screen and File*.
6. Ensure that either *All Devices* or that the correct tape device is selected in the *Device to Monitor* section.

NOTE: If the *Message Level* is set to *Detail* the Tape.log file can grow at a very rapid rate. The *Brief* setting is sufficient to capture the proper detail needed.

Information in the Activity Log and Tape Engine Log can be viewed from the menu by selecting *Manager* → *Quick Status*. Following are examples of the Activity Log and Tape Engine Log with errors highlighted.





In the example above, the sense code would be 03/31/00, which equates to Tape Format Corrupted.

NOTE: Note that the errors listed in both the Activity Log and Tape Engine Log file occurred at exactly the same time. Are you pointing out that two errors occurred at the same time? Or does this confirm that both refer to the same error?

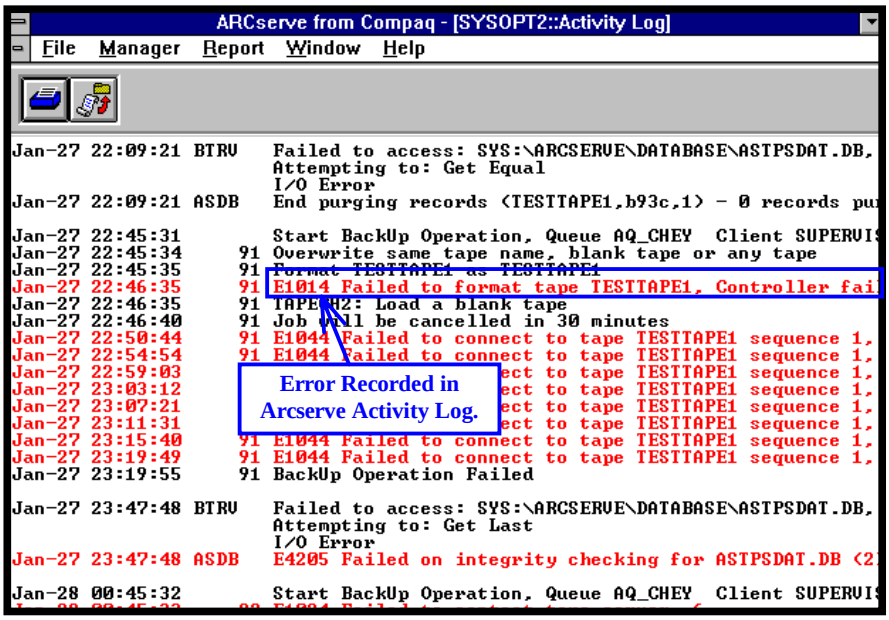
ArcServe for Netware 5.01g

In ArcServe for Netware, information in the Tape Server Log (TAPE$SVR.LOG) and Activity Log (ARCH$SVR.LOG) files can be very useful in diagnosing tape drive hardware problems if the proper level of detail is captured. By default, ArcServe for Netware captures enough of the Tape Server information needed to help diagnose tape drive hardware errors.

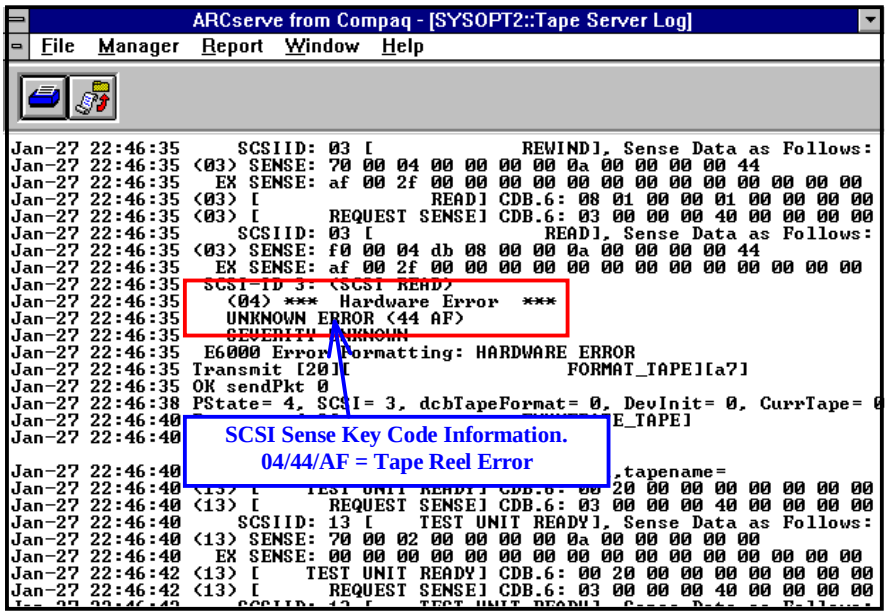
IMPORTANT: The ARCH$SVR.LOG file alone is not very helpful in resolving tape issues since it only indicates that the backup failed. Sense codes that are required to identify failures are reported by ARcServe in the TAPE$SVR.LOG file.

When attempting to diagnose a problem, review the log files daily and either archive or delete files to keep them manageable during this diagnosis period. If errors are encountered and escalation becomes necessary, include the TAPE$SVR.LOG and ARCH$SVR.LOG files or printouts of the section of the files where the error occurred.

Information in the Activity Log and Tape Server Log can be viewed by selecting *Manager* from the menu bar then *Reports*. The easiest way to find an error is to first look through the Activity Log to pinpoint the error, which will usually be in red. Take note of the date and time the error occurred. With this information review the Tape Server Log to narrow the search. Below are pictures of the Activity Log and Tape Server Log with errors highlighted.



Errors messages in the ARCH$SVR.LOG file consist of two parts. For example “E1014 Failed to format tape TESTTAPE1” is the first part and “Controller Failure” is the second part. Both parts are needed to understand the failure. However, the TAPE$SVR.LOG file reports an 04/44/AF, which indicates a media failure, not a Controller Failure. Time-outs or drive lockups are also reported as Controller Failures.



In the example above, the sense code would be 04/44/AF, which equates to Tape Reel Error.

IMPORTANT: Errors listed in both the ARCH$SVR.LOG and TAPE$SVR.LOG file occurred at exactly the same time on Jan-27th at 22:46:35.

Banyan

By default, log files from backup jobs in Banyan do not have enough detail necessary to identify problems with DAT drives. This makes it difficult to troubleshoot issues.

The backup jobs can be configured to log sense code information that is needed to diagnose hardware and firmware errors to log files.

Below are the two methods for generating System Log files in a Banyan environment.

- From the Server Console beginning from the Operator menu:

1. Select 10, System Maintenance
2. From the System Maintenance menu select 4, Save/Display Server Log Reports
3. Select 1, Server Operating System
4. Select N for No to consistency check
5. Press **Enter** for prompt. Enter another number or press <RETURN>
6. At this point you can either display on screen or save to file as LOGFILES\SVRLOG.

- From the Operate utility on a workstation:

7. Select Manage Server Logs.
8. Select 1, Generate a log report.
9. Highlight System Log and press **Enter** to select the System Log????.
10. Press **F10** after the System Log is selected.
11. Enter beginning and ending dates for report.
12. Press **Enter** to select default of NO for consistency check.
13. After the report is generated you can display on screen or save to file name of your choice.

Troubleshooting DAT Issues Using Sense Codes

The general method of software troubleshooting and use of sense codes to troubleshoot DAT issues also applies to DLT drives and any SCSI tape drive. The specific list of sense codes, descriptions, and corrective actions however are vendor specific. The list of sense codes in this document does not apply any of the DLT drives or even the Compaq 2/8Gb DAT drive model C1536-00480.

To effectively troubleshoot DAT drive issues you must be at the latest firmware revisions and know the following:

- DAT drive name or inquiry string
- Model number
- Firmware version

To determine the above information run the Compaq *Inspect* utility. The Inspect utility provides a report (that can be printed) detailing your DAT drive's system information. The Inspect utility can be run from either the main menu of the *System Configuration* utility or the Compaq *Diagnostics* program.

Note: This information is also available through some software applications.

Sense Codes

SCSI sense codes are returned from SCSI devices, CDs, hard drives, and tape drives, that indicate status or error information. SCSI Sense Codes are composed of three 8-bit hex numbers. The first numbers indicates the type of sense code. The last two numbers provide more specific error information.

Sense Codes are essential in troubleshooting DAT drives because:

- In most cases with updated firmware, sense codes provide the information needed to determine corrective action.

- Sense codes can be used to resolve DAT issues in all operating systems and backup applications that log these codes to log files.
- Sense codes isolate the problem since they originate from the device. It does not mean that the drive is the cause of the problem, just that the drive was the origin of the sense code. A sense code indicates either a firmware, hardware, or media issue.
- If sense codes are not returned, the problem can be diagnosed as:
  - Software or driver issue
  - Drive is not responding
  - Time-out values are set too low
- SCSI devices return sense codes whenever a recoverable or non-recoverable error occurs.
  - Codes 01, recoverable error, indicate an error occurred however the drive was able to recover from the error.
  - Codes 03 (media errors) and 04 (hardware errors) indicate an unrecoverable error.
  - Codes 05, Illegal command, usually indicate an application issue.

Sense Code Categories

Sense codes are classified into eight major categories.

Table 2-2
Sense Codes

Category	Description
01 Recovered Error	Indicates that the last command completed successfully with some recovery action performed by the tape drive.
02 Not Ready	Drive is busy. Operator Intervention may be required to correct this condition.
03 Medium Error	An unrecoverable error occurred that may have been caused by the media.
04 Hardware Error	The drive detected an unrecoverable hardware failure that may have been caused by the hardware. Drive will continue to return this sense code until the cartridge is ejected or the drive is reset.
05 Illegal Request	Indicates that an illegal parameter was sent to the drive such as to eject a tape after it is already ejected. This code is usually returned by the application, or is easier to correct in the application than in firmware.
06 Unit Attention	This code is returned after the drive is reset, firmware is upgraded, the media was changed, or the drive is turned off then on again.
07 Data Protect	Cartridge is write-protected.
08 Blank Check	This code is returned if tape is blank, or when the tape cannot be read because it has an unknown format.

NOTE: This table describes tape drive sense codes. Sense codes returned from other devices may indicate a very different cause and corrective action.

03 and 04 Sense Codes

The sense code list below is specifically for the following DAT drives:

- Compaq 2/8GB DAT Drive Model 4322NP
- Compaq 4/16GB TurboDAT Drive Model 4326NP
- Compaq 4/16GB TurboDAT Drive Model CTD8000
- Compaq 4/16GB TurboDAT Autoloader Model 4586NP
- Compaq 4/16GB TurboDAT Autoloader Model CTL 96G-S

Compaq 2/8Gb DAT drive Model C1536-00480 sense code descriptions and corrective actions are not the same.

The following table provides a description and corrective actions for category 03 and 04 sense codes. These two categories are considered critical errors and require corrective actions.

IMPORTANT: Banyan reports errors in decimal, while the error codes below are hexadecimal A table providing the equivalent Banyan codes follows the 03 and 04 sense codes table

Table 2-3
03 and 04 Sense Codes

Sense Code: 03/00/02

Name: Reached EOT

Description: EOD marker was not written to tape, drive unexpectedly reached end-of-tape (EOT).

Corrective Action: Reformat tape unless previous error is known.

Sense Code: 03/03/02

Name: Excessive write errors

Firmware: 0420 or later, 0322 or later, 4c04 or later.

Description: Indicates a head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 03/03/BE

Name: Excessive write errors

Firmware: 0420 or later, 0322 or later, 4c04 or later

Description: Indicates a head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 03/31/00 -

Name: Media format is corrupt

Description: This may be caused by a head clog, physical damage, or vertical creases in the media, or an alignment problem.

Corrective Action:

1. If firmware is 4.BG, 4.BGD, 4BGE, or 4BGG upgrade the firmware. Since the head clog is the most common cause of this error it is absolutely critical that the firmware is upgraded to separate that possibility out from the others.

2. If 0420 or later, 0322 or later, 4c04 or later firmware, replace the tape cartridge.

Sense Code: 03/31/BE

Name: Media format is corrupt while writing

Description: The error always indicates a head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 03/31/BF

Name: Media format is corrupt while reading

Firmware: 0420 or later, 0322 or later, 4c04 or later

Description: The error always indicates a head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 03/3B/00

Name: Sequential positioning error

Firmware: 4.BG, 4.BGD, 4BGE, or 4BGG

Description: 1. Head clog (most probable cause), or
2. Using 120m DDS2 tape in a 2/8Gb DAT drive.

Corrective Actions:
1. Upgrade the firmware to the latest revision. Since the head clog is the most common cause of this error it is absolutely critical that the firmware is upgraded to distinguish between these two possible causes.

2. Upgrade the firmware to the latest revision. This firmware prevents the use of 120m tapes by immediately ejecting 120m tapes.

Firmware: 0322, 4c04, 4c08, 0420

Description: Physical damage

Corrective Actions:
With the above versions of firmware, this may be caused by physical damage to the tape. When this occurs the tape will fail consistantly in the exact same location on tape. Replace the media.

Sense Code: 03/3B/BE

Name: Sequential positioning error while writing

Firmware: 0420 or later, 0322 or later, 4c04 or later

Description: Head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 03/3B/BF

Name: Sequential positioning error while reading

Firmware: 0420 or later, 0322 or later, 4c04 or later

Description: Indicates a head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 03/XX/BE

Name: Error while writing (XX indicates any number)

Firmware:: 0420 or later, 0322 or later, 4c04 or later

Description: Indicates a head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 03/XX/BF

Name: Error while reading (XX indicates any number)

Firmware: 0420 or later, 0322 or later, 4c04 or later

Description: Indicates a head clog

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 04/44/80

Name: Hardware compression fault

Firmware: 4.BG, 4.BGD, 4BGE, or 4BGG

Description: Indicates a head clog.

Corrective Action: Upgrade the firmware and clean the drive four times and record the failure occurred on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Firmware: 0316

Description: Firmware error.

Corrective Action: Upgrade firmware to 0322 or later

Firmware: 0420 or later, 0322 or later, 4c04 or later

Description: Head clog (most common) or Firmware issue..

Corrective Action: First reread the tape and check to see if the 04/44/80 sense code is returned in the same spot on tape. If this occurs, it indicates that the compressed data was written to the tape incorrectly and the error should be verified by Compaq Technical Support. Usually this is caused by a head clog.

To verify that it is caused by a head clog, run a backup job without cleaning the drive first. If the backup always fails within ten minutes it is caused by a head clog. Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. If error occurs more than once per month Contact Compaq customer support..

Sense Code: 04/44/A0

Name: Unknown

Firmware: 4.BG, 4.BGD, 4BGE, or 4BGG

Description: The error always indicates a head clog.

Corrective Action: Clean the drive four times and record the failure on the label of the cartridge that was inside the drive when the error was reported. Replace any cartridges that fail two out of three times or three out of five times.

Sense Code: 04/44/A1

Name: Unknown

Firmware: 4.BG, 4.BGD, 4BGE, or 4BGG

Description: Typically reported after an 04/44/A0 error and indicates a head clog.

Corrective Action: Upgrade to firmware 0420 or later, 0322 or later, 4c04 or later. These later versions of firmware report head clogs consistently as media errors.

Sense Code: 04/44/AF

Name: Tape reel error

Firmware: 4.BG, 4.BGD, 4BGE, 4BGG, 0420 or later, 0322 or later, 4c04 or later

Description: Media or drive tape reel error.

Corrective Action:

1. If this sense code is reported intermittently, replace the defective tape cartridge

2. If this sense code is reported on every tape, even after a power reset to the drive, the motors that turn the reels on the tape cartridge are not working and the drive must be replaced.

Sense Code: 04/44/B4

Name: Tape process internal error

Firmware: 4.BG, 4.BGD, 4BGE, or 4BGG

Description: General Tape error. The latest versions of firmware expand this error into multiple codes.

Corrective Action: Upgrade firmware to 0420 or later, 0322 or later, 4c04 or later.

Sense Code: 04/44/B9

Name: Erase Failure

Firmware: 0420 or later, 0322 or later

Description: Potential marginal prism

Corrective Action: Replace the tape cartridge.

Firmware: 4c04 or earlier for the Autoloader, 4c08 or earlier for the 4/16 TurboDAT drive.

Description: May be a falsely reporteddew sensor error. See sense code 04/82/80.

Corrective Action: Replace drive.

Sense Code: 04/46/00

Name: Unsuccessful soft reset (usually seen with 4mmdat driver for NT)

Firmware: 4.BG, 4.BGD, 4BGE, or 4BGG

Description: Firmware error

Corrective Action: Upgrade to latest firmware version.

Sense Code: 04/82/80

Name: Dew Indicator

Firmware: 4.BG, 4.BGD, 4.BGE, 4.BGG, 4c04 or later

Description: Indicates moisture has condensed in the drive.

Corrective Action: Replace the drive.

Sense Code: 05/3B/0D

Name: Destination Element Full

Firmware: all revisions

Description: This means that the software issued a command to the drive to move a cartridge into either the drive or a slot in the magazine that is full or already has a cartridge in that particular location.

Corrective Action: Usually this occurs if the application lost track of where the cartridges are located. Reinventory magazine.

Sense Code: 05/3B/0E

Name: Source Element Empty

Firmware: all revisions

Description: This means that the software issued a command to the drive to eject the tape cartridge however no cartridge is currently inside the drive. On the Autoloader the software may be requesting to move a cartridge from the magazine to the drive and the magazine slot is empty.

Corrective Action: This is usually reported after automating cleaning. The drive automatically ejects the cartridge after it is finished cleaning however the application still issues the eject command. Recommend disregarding this error message.

NOTE: Banyan reports errors in decimal, while the error codes above are hexadecimal. Refer to the table below to convert the decimal code to equivalent hex values. Then refer to

Table 2-4
Banyan Sense Code Translation Table

Decimal (Banyan)	Hex (Sense Codes)	Decimal (Banyan)	Hex (Sense Codes)
03/00/02	03/00/02	04/68/00	04/44/00
03/03/02	03/03/02	04/68/128	04/44/80
03/03/190	03/03/BE	04/68/160	04/44/A0
03/03/191	03/03/BF	04/68/161	04/44/A1
03/49/00	03/31/00	04/68/175	04/44/AF
03/49/190	03/31/BE	04/68/180	04/44/B4
03/49/191	03/31/BF	04/68/189	04/44/B9
03/59/00	03/3B/00	04/70/00	04/46/00
03/59/190	03/3B/BE	04/130/128	04/82/80
03/59/191	03/3B/BF		

AutoLoader Error Codes

The 4/16 TurboDAT AutoLoader has an eight character front panel display that indicates drive status or an error message when a problem occurs.

Table 2-5
AutoLoader Error Codes

Error	Definition	Action
CHK MAG	Cartridge is inserted upside-down in the magazine, or slider (_____) on the data cartridge is open.	Check magazine; invert or close slider.
RPL CLN	Cleaning cartridge has reached the end and must be replaced	Replace cleaning Cartridge
BAD TPE #	A high torque cartridge or a cartridge with a marginal prism. Displayed after a reel error (04/44/AF) occurs.	Replace cartridge
Error 10	Magazine Initialization Failure (first part of scanning). May be caused by a damaged magazine.	Clean AutoLoader
Error 11	Magazine Initialization Failure (second part of scanning). May be caused by a damaged magazine.	Clean AutoLoader
Error 20	Magazine Ejection Failure	Clean AutoLoader
Error 30	Magazine Positioning Failure (moving up)	Clean AutoLoader
Error 31	Magazine Positioning Failure (moving down)	Clean AutoLoader
Error 40	Cassette Insertion Failure. May be caused by a cassette if it is inserted incorrectly	Clean AutoLoader
Error 41	Cassette Insertion Failure (cannot clamp on)	Clean AutoLoader
Error 42	Cassette Insertion Failure (cannot clamp off)	Clean AutoLoader

Error 50	Cassette Ejection Failure	Clean AutoLoader
Error 51	Cassette Ejection Failure (cannot clamp on)	Clean AutoLoader
Error 52	Cassette Ejection Failure (cannot clamp off)	Clean AutoLoader
Error 60	Drawer Closing Failure	Replace Drive with Spare Part 199466-001
Error 61	Drawer Opening Failure	Replace Drive with Spare Part 199466-001
Error 70	Magazine Position Lost	Replace Drive with Spare Part 199466-001
Error B2	Magazine Initialization Failure (drawer closed)	Replace Drive with Spare Part 199466-001
Error B3	Magazine Initialization Failure (drawer closed)	Replace Drive with Spare Part 199466-001
Error F0	Power-up Failure	Replace Drive

These following AutoLoader errors are returned after a previous error occurs and indicate the last command that was sent to the drive was rejected. Take appropriate action for the previous error and these errors will not occur.

Table 2-6
AutoLoader Error Codes Returned after a Previous Error Table Name

Error #	Definition
Error 03	Command was rejected because magazine is not present.
Error 04	Command was rejected because magazine is not initialized.
Error 05	Command was rejected because invalid slot specified.
Error 06	Command was rejected because cassette is still in drive.
Error 07	Command was rejected because there is no cassette in magazine.
Error 08	Command was rejected because there is no cassette in drive.
Error 09	Command was rejected because specified slot is full.

Media Troubleshooting

IMPORTANT: A drive replacement WILL NOT correct a media problem.

Media is in integral part of any tape backup solution. It is just as important as hardware or firmware. If the media is marginal or defective it will cause the drive to report an error. There are several characteristics of a DAT tape cartridge that can cause DAT drives to fail. These are head clogs, high torque cassettes, BOT/EOT prism failures, physical tape damage, and tape hub alignment. These problems may occur with any tape cartridge from any tape manufacturer, including Compaq-approved media vendors.

It is imperative that the firmware be upgraded to version 4c04, 0420, 0322, 4c08, 1214, or later as outlined in Table 1. The 2/8Gb DAT drive with firmware revision 4.BGG needs to be upgraded as well but the exact revision is not known at the time of this writing. Since it is impossible to identify bad or marginal media through a visual inspection of a cartridge, the new firmware together with the sense code list should be used to identify cartridges that need to be replaced.

Sense codes reported in application log files are the best tool available to diagnose DAT issues. Compaq User Diagnostics will report that a failure occurred but will not report the sense code needed to correct the problem. Sense codes, however, are not useful unless they can be identified in a log file. Information on sense codes and corrective actions for each code is listed in this document.

The process of identifying marginal or bad media only needs to be done once. After all the media has been verified then it is no longer necessary to go through this process unless new media is added to the tape rotation.

While the marginal and bad media is being identified it is important to increase the cleaning frequency to once every 8 hours. If any tape causes a head clog in under 8 hours the tape should be discarded especially if it fails two or more times in under 8 hours.

The most common media related sense codes are covered here;

- Head clogs are the most common issue and are caused by loose particles that are deposited on the read/write heads. These deposits prevent the drive from reading or writing to the tape. Head clogs are reported in many ways when using the latest firmware. When a head clog occurs clean the drive at least four times to ensure the heads are clean. Track when tapes fail and when they are successful for the first three uses. If a tape fails 2 out of 3 times, the tape must be replaced. The sense codes reporting head clogs are 03/03/02 and any sense code starting with 03 and ending with either BE or BF. For example 03/3B/BE is a head clog.

- High-torque cartridges may be wound incorrectly during manufacturing in such a way that the tape rubs against the top and/or bottom of the inside of the tape cartridge shell. This creates enough resistance to prevent the DAT drive from moving the tape consistently. High-torque cartridges are always reported as 04/44/AF. Autoloaders will display the message "BAD TPE #," where # is the slot number of the tape. High-torque tapes must be replaced.
- BOT/EOT prism problems are caused by bad cartridges and are not frequent, but when they happen they will intermittently prevent the drive from sensing the end or beginning of tape. This causes the motors that move the tape to stop suddenly, resulting in an error message. BOT/EOT Prism failures are either reported as 04/44/AF or 04/44/B9 and in either case the cartridge must be replaced.
- Physical tape damage may be caused by the drive or may occur at time of manufacture. This problem always occurs on the exact same location on tape. Physical damage is reported as a 03/31/00 or 03/3B/00 in the exact same location on tape. This issue can only be verified by testing with a special debug tool that can eject the tape without rewinding so the damage is visible and requires that the tape be captured. It is recommended that tapes reporting these sense codes be replaced.
- Tape hub alignment problems cause noise during high speed tape motion such as a rewind. When this occurs it is recommended to replace the tape.

In Summary;

Table 2-7
Table Name

Media related problem	Sense Codes, or other indicator
Head clogs	03/03/02 and any sense code starting with 03 and ending with either BE or BF, ie. 03/XX/BE or 03/XX/BF
High-torque cartridges	04/44/AF
BOT/EOT prism problems	04/44/AF or 04/44/B9
Physical tape damage	03/31/00 or 03/3B/00 in the exact same location on tape
Tape hub alignment problems	noise during high speed tape motion

Compaq recommended media.

Table 2-8
Table Name

Compaq Part No.	Manufacturer/Size	Suited for use in;
131107-001	Sony 60M	2/8 GB DAT, 4/16 GB TurboDAT, 4/16 GB AutoLoader
131107-002	Sony, Fuji, Maxell 90M	2/8 GB DAT, 4/16 GB TurboDAT, 4/16 GB AutoLoader
137611-001	Sony, Fuji, Maxell 120M	4/16 GB TurboDAT, 4/16 GB AutoLoader

Chapter 3
DAT Media

This chapter answers what are the recommended media cartridges, how to identify each type of DAT cartridge, which cartridge should be used with each drive, how long does the media last, why is media quality so important, and why rotating tapes between drives is not recommended.

Recommended Tape Cartridges

Compaq recommends tape cartridges that have been tested with the appropriate tape drive. Before Compaq makes a recommendation, the tape cartridge is evaluated to determine the quality and reliability of the magnetic media and the cartridge. The use of non-approved tape cartridges is not supported because of potential compatibility issues with Compaq tape drives.

Table 3-1
Recommended Tape Cartridges

Drive	Media	Option Kit	Spare Kit
2/8-GB DAT	Maxell 90M DDS1	131107-002	131148-001
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001
4/16-GB TurboDAT	Maxell 120M DDS2	137611-001	199496-001
	Sony 120M DDS2		
	Maxell 90M DDS1	131107-002	131148-001

continued

Drive	Media	Option Kit	Spare Kit
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001
4/16 TurboDAT Autoloader	Maxell 120M DDS2, Sony 120M DDS2	137611-001	199496-001
	Maxell 90M DDS1	131107-002	131148-001
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001

DAT Cartridge identification and use in the proper drive

DAT cartridges look alike, and it is very easy to mistake one type for another. The easiest way to distinguish tape cartridges is by the length. 60-meter and 90-meter tape are always DDS1 media, and 120-meter tape is always DDS2 media.

The amount of data that can be stored on the media is also proportionate to the length of the tape. Since a 90-meter tape is 50% longer than a 60-meter tape, it stores 50% more data. Although a 120-meter tape is not twice as long as a 90-meter tape, it stores twice as much data. The format of the DDS2 tape allows it to store more data in the same amount of space or area compared to the DDS1 format.

Finally, another way to distinguish tape cartridges is by the label: DDS1 media is generally labeled “DDS” (not DDS1 media), and 120-meter media is labeled “DDS2.”

IMPORTANT: It is **VERY** important to use the correct length, type, and brand of media for each type of drive.

Only Compaq-approved data-grade DAT cassettes with the official Digital Data Storage (DDS) logo are recommended for use in Compaq DAT Drives.

- The 2/8-GB DAT drive support these tapes:
  - 60-m (197-ft) 1.3-GB DDS1
  - 90-m (295-ft) 2.0-GB DDS1
- The 4/16-GB DAT TurboDAT drive or 4/16 TurboDAT Autoloader support these tapes:
  - 60-m (197-ft) 1.3-GB DDS1
  - 90-m (295-ft) 2.0-GB DDS1
  - 120-m (394-ft) 4.0-GB DDS2

IMPORTANT: Listed above are the non-compressed capacities

IMPORTANT: The 2/8 DAT drive **DOES NOT** support 120m DDS2 tapes

Media Life

DAT cartridges are not used enough in typical application to actually wear out the. Media wear is usually not a problem if a grandfather-father-son backup methodology is used. Using multiple cartridges in this way increases the longevity of the cartridge.

The actual life of a tape cartridge is determined by such factors as the design of the tape path and head, the number of passes (or tracks) a drive requires for one complete backup, humidity, temperature, and whether the header at the beginning of the tape is read and updated frequently, causing additional passes.

The media life in Compaq tape drives is:

- 2,000 passes, or
- 300 backups based on ideal environmental conditions

One backup makes several passes on a tape.

Another important factor that affects media and head life is tape streaming. Tape drives and backup software are designed to stream the tape drive. Streaming is defined as a uninterrupted forward motion of the tape media across the read/write head during a backup. Non-streaming is defined as a discontinuous back-and-forth motion of the tape across the read/write head. Non-streaming significantly reduces media life, increases head wear, and lowers backup performance.

A tape drive will stream the tape cartridge when the following conditions occur:

- The disk drive or disk drive array can supply data as fast or faster than the tape drive can accept data.
- The software configuration of the operating system and backup software is optimized correctly to support streaming.
- The CPU has sufficient processing power to handle tracking the backup progress and streaming the tape drive, while accessing the disk drive or disk drive array.

Media Quality

Media quality is very important for a successful backup. If media has quality issues it will generally cause intermittant failures such as once every two weeks. Generally this is because the media that is defective causes a failure every backup however this is not obvious because it is used periodically. This is why it is important to track failures on the label of the tape cartridge. There are many different media manufacturers however there are only three different media vendors that are approved.

Compaq screens all DAT media with specific tests to isolate each type of media issue that can cause a failure with a drive. This insures that only high quality media is available from Compaq. This is in addition to the error rate, signal strength, and durability tests that are performed on the media by the media vendor.

Rotating tapes between drives

It is strongly recommended to use the same set of tapes on the same DAT drive. Although rotating tape cartridges will work, it will make diagnosing problems much more difficult when failures occur. A small percentage of tapes may be contaminated, or become contaminated, and will spread this contamination to other drives unless each tape is isolated to one drive.

Some contamination agents are easily removed by normal recommended processes; however, there are two types of contamination that are difficult to remove. These contamination problems are either grease picked up from inside the drive due to a high torque cassette, or a process-related problem with the media itself introduced during the manufacturing process Hardware Switch Settings

Chapter 4
Data Compression

Compaq DAT Drives support industry standard Digital Data Storage (DDS) and Digital Data Storage-Data Compression (DDS-DC) tape formats. These formats were introduced by the DDS Manufacturers Group and are approved by the American National Standards Institute (ANSI) and the European Computer Manufacturers Association (ECMA). The DDS-DC format is a superset of the DDS format, ensuring backward compatibility with uncompressed tapes.

Compaq DAT Drives read and write both DDS uncompressed and DDS-DC compressed data. The drive is equipped with onboard DDS-DC hardware, using the Data Compression Lempel Ziv (DCLZ) data-compression algorithm, the industry-standard for DAT drives. A tape can be written on one DAT drive manufacturer and read on another.

DCLZ data compression uses a fast, fixed algorithm where speed has a higher priority than maximum compression. As a result, customers will typically experience a compression ratio between 1.25:1 and 1.75:1. Higher and lower compression ratios may occur depending on the data. Please, be aware that data on a server may already be compressed, or may not be very compressible.

The configuration switch settings are used when power is applied. Once power is on, hardware data compression may be enabled or disabled by the software application.

IMPORTANT: See Information Brief #052 - Compaq Digital Audio Tape (DAT) Drives, as it relates to capacity and data compression. Also see the section “Effectiveness of Compression” below for compression data.

The following lists the storage capacity of each drive that Compaq offers:

Table 4-1
Storage Capacity

Type	Format	Uncompressed
2/8-Gb DAT Drive	DDS1 90m cartridge DDS1 60m cartridge	2 GB 1.3 GB
4/16-Gb TurboDAT Drive	DDS2 120m cartridge DDS1 90m cartridge DDS1 60m cartridge	4 GB 2.0 GB 1.3 GB
4/16-Gb TurboDAT Drive with Autoloader	DDS2 120m cartridge DDS1 90m cartridge DDS1 60m cartridge	4 GB 2.0 GB 1.3 GB

NOTE: 4/16 drives are backward compatible with 2/8 drives.

Compaq and other companies have named these products based on the theoretical maximum capacity (4 to 1 ratio) that can be achieved using hardware compression technology included in each DAT drive.

Some environments may even experience "data expansion" rather than data compression, where the size of the resulting file actually increases. This can occur if both software and hardware compression is used at the same time, or if the data is already compressed and hardware compression is enabled.

Effectiveness of Compression

This table shows the results of an experiment to determine the effectiveness of the DCLZ compression algorithm (reference: HP DDS Technical Manual Part number C1534-90912).

- The “Compressed man pages” entry shows how the drive will actually lose 10% capacity if the data is compressed.
- Oracle database files will compress very well using the DCLZ algorithm.
- The maximum compression ratio of 6.8 to 1 was achieved with MPE Turbo images.

Table 4-2
Recommended Tape Cartridges

Type of Data	Compression Ratio
Compressed man pages	.9 to 1
Gallery drawings	1.3 to 1
DOS binaries	1.5 to 1
C object code	1.6 to 1
S700 HPUX binaries	1.7 to 1
General PC apps	2.0 to 1
Lotus spreadsheets	2.1 to 1
Microsoft Word documents	2.2 to 1
Email	2.3 to 1
ME3- drawings	2.4 to 1
C source code	2.4 to 1

continued

Recommended Tape Cartridge *continued*

Type of Data	Compression Ratio
HPUX man pages	2.4 to 1
Empress database	2.5 to 1
Oracle Database	4.0 to 1
Uncomp .tiff images	4.2 to 1
Island DTP documents	6.0 to 1
MPE Turbo image	6.8 to 1

Before attempting any hardware switch and/or jumper changes you must run the Compaq Inspect utility to verify the version of DAT drive model you are working on. Switch and jumper settings may differ between versions of the same model.

Chapter 5
Cleaning DAT Drives and Autoloaders

Compaq tape drives are designed to operate reliably under worst case conditions; however, they require simple routine maintenance to operate efficiently. Regular cleaning is the most essential step in properly maintaining a tape drive and preventing errors. This chapter discusses the importance of cleaning, what happens when cleaning is not performed, how often to clean, how to clean, and how to schedule automated cleaning jobs.

Reliable backup of your system is the product of the following components:

- A reliable tape drive
- Quality tape cartridges
- Regular backup schedule
- Routine tape drive maintenance
- Automated cleaning for Autoloaders

Importance of Routine Cleaning

Routine cleaning of a tape drive minimizes buildup on the read/write heads so that fewer cleaning cycles are required to keep the tape drive in good working order. See the Recommended Cleaning Frequency table.

When a tape drive is cleaned according to a regular schedule, one cleaning cycle typically removes accumulated dirt and particle deposits. If the drive is not cleaned regularly, however, up to 4 cleaning cycles may be necessary to fully clean the drive.

IMPORTANT: Regular cleaning is vital to trouble-free operation of any tape device. Failure to follow recommended cleaning procedures can result in serious damage to your tape drive.

Errors Resulting from Cleaning Neglect

Among the tape drives available today, DAT drives are some of the most susceptible to particle buildup. If a DAT drive is not kept clean, increased dropouts where the drive cannot read or write to the tape will occur. You may lose 20 percent of backup capacity and performance if the recommended head cleaning schedule is not followed. DAT drives monitor the total number of dropouts; when the number reaches a predetermined threshold, the green LED will slowly flash, indicating the tape drive needs cleaning.

These are some of the errors that can result from failure to observe routine maintenance and cleaning of tape drives:

- Dropouts. Caused by weak signal strength from dirty read/write heads, a dropout can result in reduced tape capacity and backup performance.
- Media errors. The backup tapes can be jammed, torn, or otherwise damaged by a dirty read/write head.
- Read or write errors. Because of a dirty read/write head, data may not be recorded on the tape during backup. Even if the data is on the backup tape, retrieval may not be possible if the dirty head cannot read the data.
- Format failures. During backup, data is laid on the tape in a certain format for easy retrieval. A dirty write head can cause format failures, which means that data can be lost or impossible to retrieve.
- Bad blocks. Because of media damage (see Media errors above), the tape may not accept backup data. Also, the read/write head may be unable to retrieve data from bad blocks.

Recommended Cleaning Frequency

To optimize DAT performance, follow these recommendations for cleaning:

- When using new tape media for backups, DAT drives need to be cleaned after each 8 hours of read/write operation until the entire data cartridge has been used 5 times.

- When using data cartridges that have already been used 5 times or more, clean DAT drives after each 25 hours of read/write operation.
- Clean DAT drives before performing a complete server backup.
- Clean only once for routine cleaning, to minimize head wear. Occasionally a single cleaning cycle will not fully clean read/write heads on a DAT drive. If the backup software reports errors, clean the drive to eliminate the possibility that dirty heads are causing the error.
- Clean 4 times after a failure to ensure the heads are cleaned. A single clean may not remove a head clog.
- When using a TurboDAT AutoLoader, keep a cleaning cartridge in the last slot. Refer to your software user manual for instructions on how to schedule and perform cleaning operations using the software application. Also, refer to the section below on automating a cleaning cycle.
- DAT cleaning cartridges typically last 30 cleaning cycles (passes).
- Use only the cleaning cartridge to clean the heads.

IMPORTANT: All of the recent DAT drives have head cleaning rollers that are used to remove head clogs if they occur during backup or restore operations. The auto-cleaning features of the newer DAT drives do not change the cleaning requirements of the drive.

CAUTION: Do not use alcohol or cleaning solution to clean DAT drive read/write heads. To avoid damaging a DAT drive, **do not** clean read/write heads with a cotton swab. Fibers from a cotton swab can cause permanent damage to the head. Only the cleaning cartridge must be used to clean the heads.

Listed below are the cleaning cartridge part numbers and the recommended cleaning frequencies for both new and used data cartridges.

Table -1
Cleaning Frequency

Tape Drive Model	Option Kit	Cleaning Cartridge	New Data Cartridges	Used Data Cartridges
2/8 GB DAT	142019-001	131194-001	after 8 hrs. read/write	after 25 hrs. read/write
4/16 GB TurboDAT	142181-001	242618-001	after 8 hrs. read/write	after 25 hrs. read/write
TurboDAT AutoLoader (internal)	142183-001	242618-001	after 8 hrs. read/write	after 25 hrs. read/write
TurboDAT AutoLoader (external)	142187-001	242618-001	after 8 hrs. read/write	after 25 hrs read/write

NOTE: In the chart above the term *new data cartridge* refers to a new, unused tape cartridge and to a tape cartridge that has not been used in its entirety five times. The term *used data cartridge* refers to a tape cartridge that has been used in its entirety more than five times.

Cleaning Procedures

Using a Cleaning Cartridge

Following are instructions for using a cleaning cartridge:

1. Insert the cleaning cartridge into the drive. The drive automatically takes the cartridge, loads it, and cleans the heads.
2. After about 30 seconds, the drive ejects the cartridge.
3. If the drive does not eject the cartridge and the drive light flashes rapidly, press the eject button, discard the cartridge, and insert a new cleaning cartridge.
   Autoloaders will display the message "RPL CLN" on the front panel.

4. After a successful clean cycle, the drive ejects the cartridge.
5. Remove the cartridge from the drive and write the cleaning date on the cartridge label. This provides a record of how many times the cleaning cartridge has been used. The cleaning cartridge has a typical life of about 30 cleaning cycles.

AutoLoader

The AutoLoader is an integrated unit that consists of a DAT drive and a loader mechanism. The loader mechanism retrieves cartridges from a magazine, inserts them in the DAT drive internal to the AutoLoader, and returns them to the magazine when the cartridges are unloaded and ejected by the internal drive.

Follow these guidelines for cleaning and maintenance of the AutoLoader:

- The magazine guide path of a TurboDAT AutoLoader also becomes dirty. The cartridge rollers and magazine rollers should be cleaned every month or when the AutoLoader front panel error is displayed.
- If you begin to experience read or write errors, format failures, or a number of bad blocks, clean the head and capstan 3 times before concluding that either the tape or the tape drive is defective.
- In a dusty environment, one cleaning cycle may not fully clean the DAT drive read/write heads. If backup software reports errors, clean the drive again. No more than four cleanings will be required to ensure that heads are fully clean.

CAUTION: DO NOT use alcohol or cleaning solution to clean DAT drives. DO NOT clean read/write heads with a cotton swab. Fibers from a cotton swab can cause permanent damage to the head.

- When using AutoLoader firmware versions 4BG, 4BGD, or 4BGG, the AutoLoader does not identify a completely used cleaning cassette. Since the cleaning cassette does not rewind, a used cassette is recognized only by visual inspection when all the tape is in the take-up spool.

- AutoLoader firmware revisions 0420 (model CTL 96GS), 4c04 (model 4586NP) or later will eject the cleaning cassette when it has been used up and will display “RPL CLN” on the front panel.

Cleaning the Loading Mechanism on the 4/16 TurboDAT AutoLoader

These AutoLoader cleaning procedures should be performed once a month or after a front panel error message is displayed.

CAUTION: Do not use cosmetic swabs when cleaning rollers. Fibers from a cosmetic cotton swab can cause permanent damage to the head.

Cleaning the Cartridge Rollers

Follow these steps to clean the left and right cartridge rollers as outlined in the user’s guide. These rollers should be cleaned once every month.

1. Dip a lint-free cotton swab in ethyl alcohol.
2. Press the *slot* button 3 times within a 3-second period. "Clean 1" should be displayed.
3. As the cartridge rollers begin to rotate, extend the swab into the throat of the drive and wipe the rollers with the **wet** end of the swab as the rollers rotate. (Cartridge rollers rotate for 10 seconds.)
4. Wipe the rollers with the **dry** end of the swab as the rollers rotate.

Cleaning the Left Magazine Rollers

Follow these steps to clean the left magazine rollers. These rollers should be cleaned once every month.

1. Dip a lint-free cotton swab in ethyl alcohol.
2. Press the *slot* button 3 times within a 3-second period.
   "Clean 2" should be displayed.
3. As the left magazine rollers begin to rotate, extend the swab into the throat of the drive and wipe the rollers with the **wet** end of the swab as the rollers rotate. (Magazine rollers rotate for 10 seconds.)
4. Wipe the rollers with the **dry** end of the swab as the rollers rotate.

Cleaning the Right Magazine Rollers

Follow these steps to clean the right magazine rollers. These rollers should be cleaned once every month.

1. Dip a lint-free cotton swab in ethyl alcohol.
2. Press the *slot* button 3 times within a 3-second period.
   "Clean 3" should be displayed.
3. As the right magazine rollers begin to rotate, extend the swab into the throat of the drive and wipe the rollers with the **wet** end of the swab as the rollers rotate. (Magazine rollers rotate for 10 seconds.)
4. Wipe the rollers with the **dry** end of the swab as the rollers rotate.

Cleaning the Magazine Well

Follow these steps to clean the magazine well using a compressed air canister that is typically used to blow dust off electronic assemblies.

1. Direct a blast of air against the left side of the magazine well adjacent to the front of the well. Pay attention that the area surrounding the five sensor holes on the left side is well dusted by the air stream.
2. Direct a blast of air against the right side of the magazine well adjacent to the front of the well. Pay attention that the area surrounding the five sensor holes on the left side is well dusted by the air stream.
3. Dip a lint-free cotton swab in ethyl alcohol and wipe the left side of the magazine well adjacent to the front of the well. Pay attention that the area surrounding the five sensor holes on the left side is wiped.
4. Dip a lint-free cotton swab in ethyl alcohol and wipe the right side of the magazine well adjacent to the front of the well. Pay attention that the area surrounding the five sensor holes on the right side is wiped.

Scheduling Automated Cleaning Jobs for the AutoLoader

Scheduling an automated cleaning job under control of the backup application is the most effective and reliable way to clean AutoLoaders. Below are the procedures to schedule cleaning jobs under Cheyenne ARCserve and under Arcada backup exec. Essentially they are regular backup jobs that do not backup any files. This causes the tape to load at a scheduled time which is all that is needed to automate cleaning.

Cheyenne ArcServe version 5.01x

To enable automated cleanings within Cheyenne ArcServe for Netware, the module CLEAN.NLM must be used. CLEAN.NLM can be found on the SmartStart product builder under “Cheyenne Products,” under the heading “Tape Drive Cleaning Utility.”

To set up the CLEAN.NLM utility, perform the following steps:

1. TAPESVR.NLM and CHANGER5.NLM must be loaded.

2. The cleaning tape must be present in the last slot of the changer.
3. Copy CLEAN.NLM into Netware's :system\ directory.
4. Deactivate ArcServe.
5. Re-configure the changer module and select tape cleaning cartridge installed, then ASTOP and ASTART the server.
6. In the ArcServe manager, select Options from the Backup menu.
7. Click the Pre/Post Job Execution button.
8. In the After Job Execution box, enter the command line:

   ```
   load CLEAN.NLM /c[id] /d[id]
   ```

   where /c[id] is the changer SCSI id and /d[id] is the tape drive SCSI ID.

   NOTE: In the case of the Compaq TurboDAT AutoLoader, the changer and tape drive id's are the same.

9. Schedule the job to run as you would a normal backup job.

Arcada Backup Exec

1. Under Settings, loader, set up a normal magazine configuration.
2. Depending on magazine size, define the last slot as a Clean slot.
3. Click OK when finished.
4. Backup Exec will then inventory the slots.
5. Next, configure a normal backup with Clean slot as its destination and name the job Clean.
6. Choose Edit Selections.
7. Edit the clean job to exclude *.* or essentially all files.

Schedule the Clean job like any other normal backup.

Chapter 6
Jumper Settings

SCSI IDs

Each SCSI device on the same SCSI bus must have a unique SCSI ID. The default SCSI ID is 6. The following figure shows the other SCSI ID assignment options. Set the SCSI ID for the DAT Drive based on the drive's position.

Your drive may have more than one set of jumper pins or dip switches. When changing the SCSI ID, use the jumper pins or dip switches only on the back of your drive.

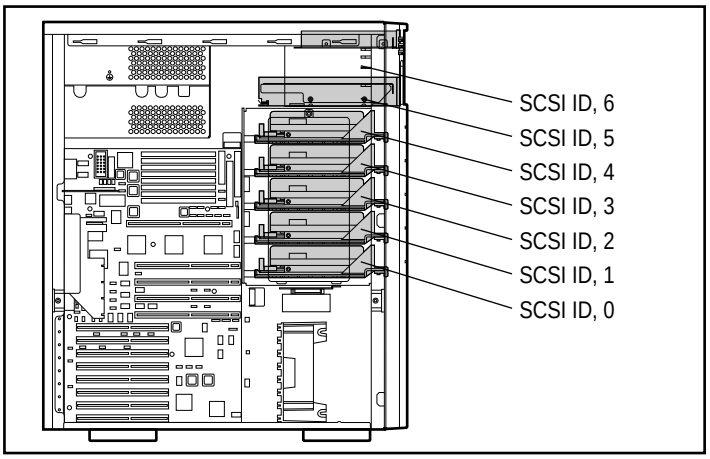


Figure 6-1. Suggested SCSI ID settings

IMPORTANT: Do not set any device to SCSI ID 7, which is reserved for the SCSI controller.

Set the DAT Drive's SCSI ID based on the tables in the following figures. If your model has dip switches, toggle them to ON or OFF to achieve the desired setting.

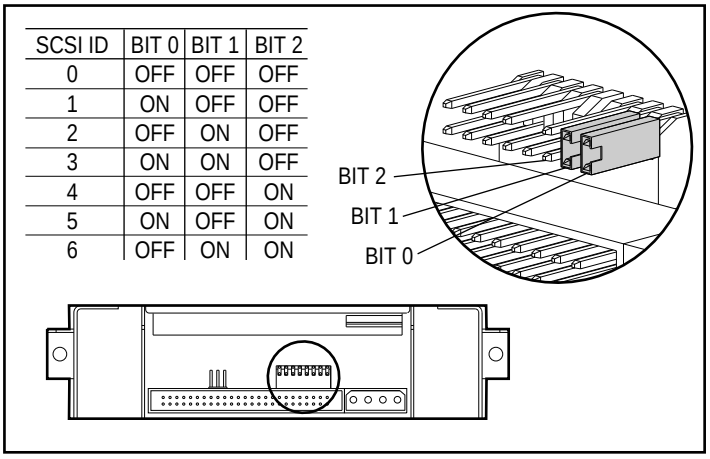


Figure 6-2. Locating and setting the SCSI ID with jumper pins

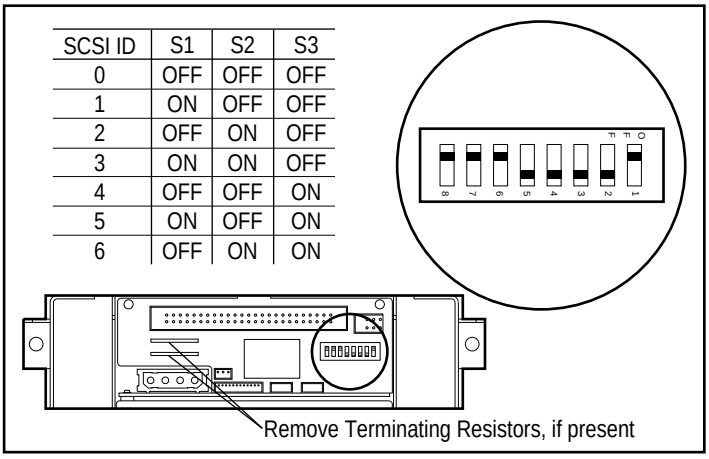


Figure 6-3. Locating and setting the SCSI ID with dip switches

DAT Drive Configuration Switches

2/8-GB DAT Drive Model XX

The C1536-00480 version of the 2/8-GB DAT drive contains a set of configuration switches on the underside of the DAT drive. Switch 1 and 2 are normally used to configure the way in which data compression is set for the drive. The following table shows the available options:

Table 6-1
Switches 1 and 2

Switch 1	Switch 2	Definition
ON*	ON*	Compression enabled at power-on with host control
ON	OFF	Compression enabled at power-on, no host control
OFF	ON	Compression disabled at power-on; host is allowed to control compression
OFF	OFF	Compression disabled at power-on; no host control
*Default setting		

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

Table 6-2
Switch 3

Switch 3	Definition
ON	The Media Recognition System is disabled. All DDS tapes will be treated the same, whether they possess the Media Recognition Stripes at the beginning of tape or not.
OFF	The Media Recognition System is active. This is the default. Non-Media Recognition System. Tapes are treated as if they are write-protected.

*Default setting

Switches 4 to 8 are used to specify connectivity and functionality according to host or customer requirements. The default setting is all switches ON.

4/16-GB DAT Drive Model CTD8000

Some CTD8000 4/16 GB DAT drives have dip switches on the bottom that should **not** be configured. Changing these switches **will override** any jumper settings on the back of the drive and will cause errors when trying to configure the drive.

If these switches have been changed return them to their default settings. The SCSI Mode should always be SCSI-2 and Parity should always be enabled:

Table 6-3
CTD8000 4/16 GB DAT Dip Switch Settings

Switch #	Default Setting	Switch Definition
1	OFF	SCSI ID
2	OFF	SCSI ID
3	OFF	SCSI ID
4	ON	SCSI Mode. On selects SCSI-2. Off selects SCSI-1.
5	ON	Parity. On enables Parity. Off disables parity.
6	OFF	Hardware compression. Off enables compression at power up.
7	OFF	Reserved. Set switch to OFF.
8	OFF	Power-On Self-Test mode. When ON, the drive responds to SCSI commands after successful completion of the test (about 5 seconds).

CTD8000 DAT Drive Configuration Information

In addition to the switch settings on the bottom of the drive(which should never be changed) the following table provides switch settings and there definitions.

Table 6-4
CTD8000 16-Pin Header

Pins	Description	JUMPER
Pins 15-16	Term Power-On	ON
Pins 13-14	Reserved	No Connection
Pins 11-12	Reserved	No Connection
Pins 9-10	Data Compression Disabled	ON
Pins 8-10	Power-On Self Test Enabled	ON
Pins 5-6	SCSI Bit 2	ON*
Pins 3-4	SCSI Bit 1	ON*
Pins 1-2	SCSI Bit 0	OFF*

* Factory Defaults to SCSI ID 6

Chapter 7
Frequently Asked Questions (FAQs)

What are the most commonly reported problems?

- 120m (4/16-GB) DAT cartridges being used in 2/8-GB drives. This causes media failures because the 120m tape does not support the DDS1 (2/8-GB) format. The easiest way to correct this is to upgrade to 4BGE or later firmware, which immediately ejects a 120m cartridge when inserted.

IMPORTANT: To restore data written on 120m tapes in a DDS1 drive, down rev the firmware on an archive 2/8 GB DAT Drive to revision 4BGD. DDS1 drives cannot be used to restore data from 120m tapes.

- Tapes being rotated between drives. This should not normally be a problem; however, some tapes may have contamination issues. If these tapes are switched between drives, it is difficult or even impossible to troubleshoot a hardware problem, and may spread the contamination. Therefore, rotating media is **not** recommended.
- Exhausted cleaning cartridges being inserted into AutoLoaders. The AutoLoader **does not** indicate when a cleaning cartridge is exhausted; visual inspection is required to see whether all the tape is in the take-up spool, indicating that the cleaning cassette needs to be replaced. The newest versions of AutoLoader firmware (0420 for the Conner/Seagate model CTL96G-S, and 4c04 for the Conner/Seagate model 4586NP) clearly warn of an exhausted cleaning cassette by flashing “RPL CLN” on the front panel display.

- AutoLoaders lock up or will not eject the tape.

  IMPORTANT: Multiple lock up problems have been corrected through firmware upgrades. The following firmware versions should be used:
  - ☐ Model 4586NP - firmware version - 4C04
  - ☐ Model 4326 - firmware version - 4C08.
  - ☐ Model 4322 - firmware version - 4.BGG (to be updated Aug96)
  - ☐ Model CTL96G-S - firmware version - 6420
  - ☐ Model CTD8000 - firmware version - 0322

- 4BG firmware reports false media errors and should be upgraded. When the firmware is upgraded on the AutoLoader, a ROM chip replacement is required to update the low-level-mechanism firmware. The chip revision is 2.95D.

- Labels other than those shipped with data cartridges are being used. Non-approved labels may be too thick or may not fit correctly. The top of every data cartridge is slightly recessed to accommodate the label and avoid mechanical problems. If different label stock is used, it is important to apply the label in the recessed areas.

- Do not put labels on the 4-cart or 12-cart magazine except on the top to prevent the labels from interfering with the sensors.

Which DAT drives does Compaq currently support?

Compaq supports three DAT drive options: 2/8-GB DAT, 4/16-GB TurboDAT, and 4/16 TurboDAT AutoLoader.

- 2/8-GB DAT Drive: This drive is typically referred to as a DDS1 drive since it only uses DDS1 media. The non-compressed data transfer rate is 183Kb per second.
  - Model C1536-00480
  - Model 4322NP
- 4/16-GB TurboDAT Drive: This is the DDS2 drive. It can use either DDS1 or DDS2 media. When using DDS2 media the non-compressed data transfer rate is 402Kb per second.
  - Model CTD8000
  - Model 4326
- 4/16-TurboDAT AutoLoader: Combines a 4/16GB TurboDAT drive with a loader and supports either a 4-cartridge or 12-cartridge magazine. It also has a non-compressed transfer rate of 402Kb per second. A 4-cartridge magazine is included with the drive and the 12 cartridge magazine is available as an option.
  - Model CTL 96G-S, Serial # DT999A9 (where 9 indicates any number)
  - Model 4586NP, Serial # CAC99999 (where 9 indicates any number)

IMPORTANT: When identifying between these two models you must reference the serial numbers. Both the CTL 96G-S and the 4586NP models have the letters CTL on there product ID labels.

How do I differentiate between the drives?

Since there are two different physical devices for each type of Compaq DAT drive the only way to tell what type of drive is installed is to run *Inspect* to view the ID or inquiry string and firmware revision. The firmware revision in combination with the inquiry string will distinguish one version of the DAT drive from another.

The firmware revisions listed below are exactly what would be displayed in the *Inspect* report. The *Inspect* report shows only four characters. The firmware tapes for the Conner drives have a dash number after the firmware revision. The dash number is either a "-10" indicating it is for the 2/8 Gb DAT or 4/16 Gb TurboDAT, or a "-410"' indicating it is for the 4/16 TurboDAT Autoloader.

DAT Drive Identification

DAT Drive	ID String	Model	Firmware
2/8-GB DAT	ARCHIVE Python 27871-XXX	Conner 4322 HP C1536-00480	4BGG 1214
4/16-GB TurboDAT	ARCHIVE 4326XX 27871-XXX	Conner Archive 4326NP Conner Peregrine CTD8000	4c08 0322
4/16-GB Autoloader	ARCHIVE 4586XX 28887-XXX	Conner Archive 4586NP Seagate Peregrine CTL 96G-S	4C04 0420

How Do I Set The SCSI ID For Each Drive?

Set the DAT Drives SCSI ID based on the tables in the following figures, If your model has dip switches, toggle them to ON or OFF to achieve the desired setting.

SCSI ID	BIT 0	BIT 1	BIT 2
0	OFF	OFF	OFF
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF
4	OFF	OFF	ON
5	ON	OFF	ON
6	OFF	ON	ON

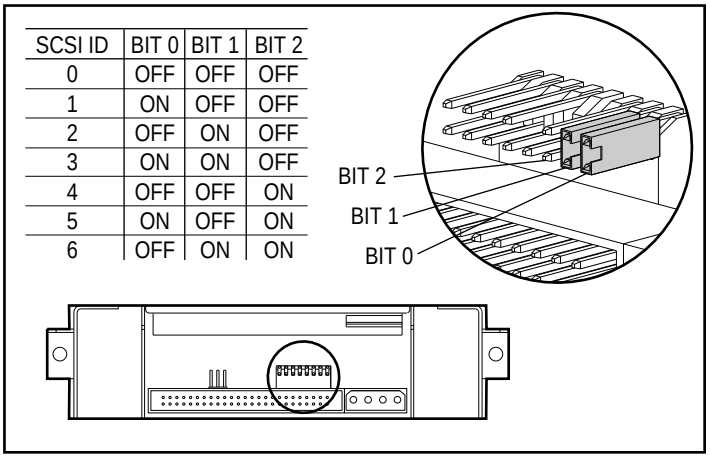


Figure 7-1. Locating and setting the SCSI ID with jumper pins

SCSI ID	S1	S2	S3
0	OFF	OFF	OFF
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF
4	OFF	OFF	ON
5	ON	OFF	ON
6	OFF	ON	ON

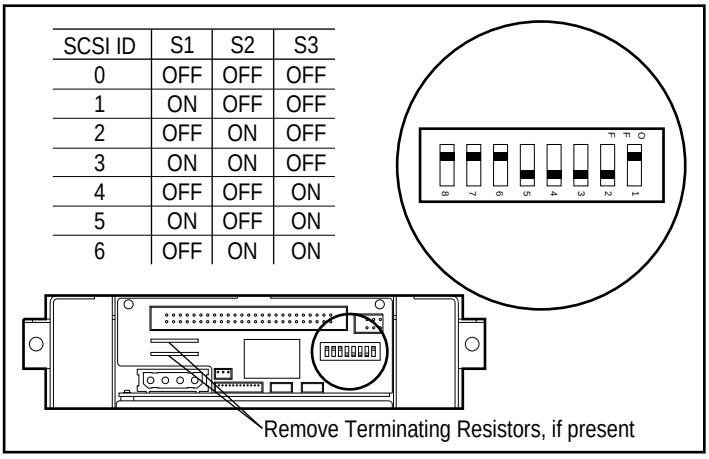


Figure 7-2. Locating and setting the SCSI ID with dip switches

What is the Compaq Inspect Utility?

The Inspect utility provides a report detailing system information.

How Do I Run the Compaq Inspect Utility?

The Inspect utility can be run from either the main menu of the *System Configuration* utility or the Compaq *Diagnostics* program.

What SCSI modes do Compaq DAT drives require?

The SCSI Mode should always be SCSI-2. DAT drives negotiate on the SCSI-Bus at a maximum rate of 5MB/sec.

Is Parity Required for Compaq DAT drives?

Yes, parity should always be enabled.

What Is The Expected Life Of A Tape?

Theoretically, most DAT cartridges are not used enough to actually wear out the media. The only way this would occur is if the same tape is used every day for a year.

Typically, customers use a grandfather-father-son backup methodology. Rotating cartridges in this way increases the longevity of the cartridge.

The actual life of a tape cartridge is determined by such factors as the design of the tape path and head, the number of passes (or tracks) a drive requires for one complete backup, humidity, temperature, and whether the header at the beginning of the tape is read and updated frequently, causing additional passes.

The media life in Compaq tape drives is:

- 2,000 passes (cycles), or
- 300 backups based on ideal environmental conditions

IMPORTANT:

What about Tape Streaming?

Tape drives and backup software are designed to stream the tape drive. Streaming is defined as a uninterrupted forward motion of the tape media across the read/write head during a backup. Non-streaming is defined as a discontinuous back-and-forth motion of the tape across the read/write head. Non-streaming significantly reduces media life, increases head wear, and lowers backup performance.

A tape drive will stream the tape cartridge when the following conditions occur:

- The disk drive or disk drive array can supply data as fast or faster than the tape drive can accept data.
- The software configuration of the operating system and backup software is optimized correctly to support streaming.
- The CPU has sufficient processing power to handle tracking the backup progress and streaming the tape drive, while accessing the disk drive or disk drive array.

Why doesn't the 4/16Gb DAT drive back up 16Gb on one tape?

The 4/16Gb TurboDAT drive is equipt with built-in hardware compression that uses a fixed algorithm to compress the data before it is written to tape and also uncompresses the data after it is read from tape. The 16 in the product name 4/16Gb TurboDAT drive indicates a theoritical maximum compression ratio of 4 to 1 not the typical compression ratio that is between 1.25 to 1 and 1.75 to 1. Most DDS2 tapes store between 6 and 7 Gb of data.

How Do I Configure A DAT Drive For Maximum Performance?

DAT drives, like any tape drive, should “stream” or run continuously. To ensure the DAT drive is tuned properly, schedule some test jobs with both hardware and software compression turned off or disabled. When the job is running, watch the amber drive LED???. This light typically indicates when the drive is accessing the tape.

Some applications such as Backup Exec disable the eject button to prevent user intervention during backups, and this will turn the light on solid. With applications that disable the eject button, turn both software and hardware compression off. Run the backup job and monitor the transfer rate of the data to the DAT drive. The following table list the transfer rates of each type of drives. DAT drives run well with a block size of 512 bytes.

Table -1
Transfer Rates for DAT Drives

DAT Drive	Uncompressed Transfer Rate
2/8GB DAT drive (HP)	283 Kb/sec, 16.9 Mb/min., 1.02 Gb/hr
2/8GB DAT drive (Conner/Archive)	283 Kb/sec, 16.9 Mb/min., 1.02 Gb/hr
4/16 TurboDAT (Conner)	402 Kb/sec, 24.0 Mb/min., 1.44 Gb/hr
4/16 TurboDAT (Peregrine)	402 Kb/sec, 24.0 Mb/min., 1.44 Gb/hr
4/16 TurboDAT AutoLoader	402 Kb/sec, 24.0 Mb/min., 1.44 Gb/hr

How Do Improve Reliability?

For maximum reliability it is important to follow the cleaning guidelines established for tape drives. Routine cleaning is particularly important for DAT drives to prevent the buildup of particles.

Reliability of backup devices depends largely upon usage level. Like any other mechanical device, the tape drive is designed to support specific applications or duty cycles. Exceeding those duty cycles can accelerate wear and shorten the life of tape devices.

Problems of exceeding the drive duty cycle occur most often at sites that are doing server consolidation. As server capacity grows, the tape drive is sometimes overlooked or expected to provide the same level of reliability regardless of the added capacity.

When adding capacity to any server, it is important to evaluate whether the tape backup device and backup software currently being used can still do the job adequately. The following table lists Compaq tape drives and the optimum backup capacity of each for maximizing device life.

Table 7-2
Optimum Backup Capacity of Compaq DAT and DLT Tape Drives

Device	Backup Capacity (per backup session)	Usage Pattern
2/8-GB DAT	< 4 GB	low to medium
4/16-GB TurboDAT	< 8 GB	low to medium
4/16 TurboDAT AutoLoader	< 8 GB	low to medium
10/20 GB DLT	< 20 GB	medium to high
15/30-GB DLT	< 30 GB	medium to high
15/30-GB DLT Tape Array	< 48 GB	medium to high

What is the difference between differential and incremental backup?

A differential backup is the difference between the last full backup and today's backup regardless of any other backup. An incremental is the difference between the last backup whether it is full, differential, or incremental and today's backup.

How Can I back up more than 12GB of Data?

DAT drives may be used to perform very large backups; however the data transfer rate may not sufficient enough to finish a full backup in a typical 8 hour backup window, and the DAT drive cleaning requirements must be followed to ensure a successful backup.

If the DAT drive is used for large backups of over 12Gb without a verify or 6Gb with a verify, which will take over 8 hours to perform split the one large backup into multiple backups with automated cleaning every 8 hours.

How Frequently Should I Clean a DAT Drive

Recommended Cleaning Frequency:

Table 7-3
Recommended Cleaning Frequency

Tape Drive Model	Option Kit	Cleaning Cartridge	New Data Cartridges	Used Data Cartridges
2/8 GB DAT	142019-001	131194-001	after 8 hrs. read/write	after 25 hrs. read/write
4/16 GB TurboDAT	142181-001	242618-001	after 8 hrs. read/write	after 25 hrs. read/write
TurboDAT Autoloader (internal)	142183-001	242618-001	after 8 hrs. read/write	after 25 hrs. read/write
TurboDAT Autoloader (external)	142187-001	242618-001	after 8 hrs. read/write	after 25 hrs read/write

New Data Cartridge refers to a new, unused tape cartridge and to a tape cartridge that has not been used in its entirety five times.
Used Data Cartridge refers to a tape cartridge that has been used in its entirety more than five times.

How Do I Use A Cleaning Cartridge?

Following are instructions for using a cleaning cartridge:

- Insert the cleaning cartridge into the drive. The drive automatically takes the cartridge, loads it, and cleans the heads.
- After about 30 seconds, the drive ejects the cartridge.
- If the drive does not eject the cartridge and the drive light flashes fast, press the eject button, discard the cartridge, and clean using a new cleaning cartridge.
- After a successful clean cycle, remove the cartridge from the drive and write the cleaning date on the cartridge label. This provides a record of how many times the cleaning cartridge has been used. The cleaning cartridge has a typical life of about 30 cleaning cycles.

Should I Rotate Tapes.

It is strongly recommended to use the same set of tapes on the same DAT drive. Although rotating tape cartridges will work, it will make diagnosing problems much more difficult. If a tape becomes contaminated it will spread the contamination to other drives unless each tape is isolated to one drive.

What are the Recommended Types of Tapes?

Compaq recommends tape cartridges that have been tested with the appropriate tape drive. Before Compaq makes a recommendation, the tape cartridge is evaluated to determine the quality and reliability of the magnetic media and the cartridge. The use of non-approved tape cartridges is not supported because of potential compatibility issues with Compaq tape drives.

Table 7-4
Approved DAT Drive Media

Drive	Media	Option Kit	Spare Kit
2/8-GB DAT	Maxell 90M DDS1	131107-002	131148-001
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001
4/16-GB TurboDAT	Maxell 120M DDS2	137611-001	199496-001
	Sony 120M DDS2		
	Maxell 90M DDS1	131107-002	131148-001
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001
4/16 TurboDAT Autoloader	Maxell 120M DDS2, Sony 120M DDS2	137611-001	199496-001
	Maxell 90M DDS1	131107-002	131148-001
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001

How do I know it is a software problem:

The best way to know if it is a software problem it to eliminate the possibility that it is caused by a drive hardware/firmware/media problem and it is not a SCSI controller/termination/cabling issue. Also, an “Illegal Request” sense code (see Troubleshooting section) is typically a software problem.

What do I do if a Sense Code starts with 03 or 04 and is not on the list of Sense codes?

Contact Compaq Customer Support. If the Customer Support is unable to provide an answer the problem will be escalated to a member of the Compaq engineering staff to resolve your issue.

How do I know it is a hardware or firmware issue with the DAT drive:

If a sense code is returned from the drive and the code does not indicate a media error, then it is most likely a hardware or firmware issue. Generally 04 Hardware errors indicate either a firmware or hardware issue with that particular drive with the exceptions: 04/44/AF reel error and 04/44/B9 prism error with DAT drive models 4586NP (not CTL96G-S), 4322NP, and 4326NP. 4BGG or earlier firmware would occasionally report a hardware error when a media failure occurred so it is recommended to upgrade to 0420 or later, 0322 or later, 4c04 or later firmware.

How do I know it is a media error:

The first step is to upgrade to the latest firmware which reports media errors consistently: 0420 or later, 0322 or later, 4c04 or later firmware. There are special sense codes that indicate media failures and the sense codes is the only reliable method to determine if the media is marginal or bad.

If the drive returns an 04/44/AF Reel error it means the reels stopped moving unexpectedly. This can be caused by a high torque cassette that requires more torque to move the tape than the maximum torque available from the reel motors. It may also be caused when the drive is searching for data on the tape and does not detect either the beginning or end of tape (BOT/EOT) due to the prism inside the cartridge not reflecting enough light for the drive to detect BOT or EOT. The reels will stop unexpectedly when they physically reach the end of tape. When this occurs, ‘BAD TPE #’ where # indicates the slot number of the bad tape, is displayed on the front panel and the tape must be replaced. If the drive reports 04/44/AF on every tape then the drive has a bad reel motor.

If the drive returns any of the following sense codes it indicates one of two things: either the drive is not cleaned on a regular basis, or the media has loose magnetic or other particles that are collecting on the head or tape path:

- 03/03/02, Excessive write errors
- 03/3B/BE, Sequential Position Error caused by head clog while writing
- 03/3B/BF, Sequential Positioning Error cause by head clog while reading
- Any sense code starting with 03 and ending with BE or BF

If these error occur frequently, it is recommended to clean the drive every eight hours, and then monitor the backups for head clog sense codes. It is also recommended to record on the label of each tape the number of times it was used successfully, and the number of times it was not used successfully. Replace tapes that fail two out of three backups or three out of five. Tapes that fail at this rate will typically continue to cause failures every use.

If a 03/31/00 error is returned typically in the exact same location on the tape it usually indicates a vertical crease or other type of physical damage on the tape. This is the worst-case defect that can occur on a tape and may cause the drive to lose head to tape contact. Sometimes the crease will cause a failure every time and other times it will cause a failure intermittently. The firmware is being modified to skip over larger sections of bad tape to reduce the consequences of this problem; however, if there are multiple creases over several inches on the tape, they would still render the tape unusable. What Cleaning Schedule Should I Use? Pg. 15-16

How Frequently Should I Clean my DAT Drive

The table below provides Compaq's recommended DAT cleaning frequency:

Table 7-5
Cleaning Frequency

Tape Drive Model	Option Kit	Cleaning Cartridge	New Data Cartridges	Used Data Cartridges
2/8 GB DAT	142019-001	131194-001	after 8 hrs. read/write	after 25 hrs. read/write
4/16 GB TurboDAT	142181-001	242618-001	after 8 hrs. read/write	after 25 hrs. read/write
TurboDAT Autoloader (internal)	142183-001	242618-001	after 8 hrs. read/write	after 25 hrs. read/write
TurboDAT Autoloader (external)	142187-001	242618-001	after 8 hrs. read/write	after 25 hrs read/write

New Data Cartridge refers to a new, unused tape cartridge and to a tape cartridge that has not been used in its entirety five times.
Used Data Cartridge refers to a tape cartridge that has been used in its entirety more than five times.

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	Fuji 90M DDS1		
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	Sony 120M DDS2		
	Maxell 90M DDS1	131107-002	131148-001
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001
4/16 TurboDAT Autoloader	Maxell 120M DDS2, Sony 120M DDS2	137611-001	199496-001
	Maxell 90M DDS1	131107-002	131148-001
	Fuji 90M DDS1		
	Sony 90M DDS1		
	Sony 60M DDS1	131107-001	131167-001

How Do I Use A Cleaning Cartridge?

Following are instructions for using a cleaning cartridge:

- Insert the cleaning cartridge into the drive. The drive automatically takes the cartridge, loads it, and cleans the heads.
- After about 30 seconds, the drive ejects the cartridge.
- If the drive does not eject the cartridge and the drive light flashes fast, press the eject button, discard the cartridge, and clean using a new cleaning cartridge.
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How Do I Diagnosing DAT Issues

The most practical way to troubleshoot DAT issues is first to know how to use the application to record the sense codes that are returned from the drive, then to know how to lookup the corrective action from a sense code list.