Dell™ Digital Data Storage/Digital Audio Tape Media Handbook (DDS/DAT)

Version 1.0
Last Modified 08/17/05

List of Tables

List of Figures

This page is left blank intentionally

1 Introduction

This document describes media compatibility, handling for all Dell™ PowerVault™ DDS/DAT Drives.

For information regarding use and operation of the PowerVault Tape Drive, please consult the User's Guide located on **http://support.dell.com**.

2 Dell PowerVault DDS/DAT Drives and Media

2.1   Drive Types and Basic Characteristics – DDS/DAT Drives

	 Figure 1- Dell PowerVault 100T DAT72 External	 *Figure 2- Dell PowerVault 100T DDS4 External*	 *Figure 3 - Dell PowerVault 120T DDS4 Autoloader*
Capacity (native/compressed)	36 GB/72 GB	20 GB/40 GB	20 GB/40GB
Native Speed	3.5 MB/s	2.75 MB/s	2.36 MB/s
Primary Media	Digital Audio Tape 4mm	Digital Audio Tape 4mm	Digital Audio Tape 4mm
Physical Differences	• Label: DAT72	No specific label.	• Supports up to 8 media cartridges • LCD front panel
Used in:	• PV100 Internal/External • Dell PV112T • Dell PV114T	• PV100 Internal/External • Dell PV112T Drive Enclosure	• PV120T DDS4 Autoloader

Table 1 DDS/DAT Drive Types and Basic Characteristics

2.2   Media types used in Dell PowerVault DDS/DAT drives

Cartridge Type	Part #	Dell DAT72	Dell DDS4	Dell DDS4 Autoloader	DDS3 Drive	DDS2 Drive	DDS1 Drive
Figure 4 - DAT72 Media	340-7240	YES	NO	NO	NO	NO	NO
Figure 5 - DDS4 Media	340-8701	YES	YES	YES	NO	NO	NO
Figure 6 - DDS3 Media	n/a	YES	YES	YES	YES	NO	NO
Figure 7 - DDS2 Media	n/a	NO	YES	YES	YES	YES	NO
(DDS1 Media Picture Not available)	n/a	NO	YES	YES	YES	YES	YES

Table 2 - Media Types and Interoperability

2.3   Media Color Schemes and description

- Dell DDS/DAT media and most other manufacturer's media are black and marked with the DDS/DAT label. (See Table 2 for figures.)
- Dell recommends the use of Dell branded media in all Dell PowerVault DDS/DAT drives.

    Note: DDS/DAT tapes are normally black, but Non-Dell branded media may come in other colors. Please pay attention to the DDS/DAT label on the tape to determine correct media for your drive.

2.4   Invalid Media Symptoms

Standalone drive reaction to inserting invalid media into drive. (i.e. DAT72 media into DDS4 Drive)

1. All LED's will flash
2. Drive will eject and reload tape and the LED's will flash again trying to load cartridge.
3. Drive will eject tape

Drive autoloader reaction to inserting invalid media into drive. (i.e. DAT72 media into DDS4 Drive)

1. Magazine will load normally.
2. The drive will unload the invalid media back into the magazine.
3. The magazine will then eject from the autoloader and the message "Remove Invalid Cartridge" will be displayed on the LCD panel. This message will not go away until a valid media cartridge is inserted into the drive.

2.5   Migrating DDS/DAT media

DDS/DAT drives are backwards capable with media that was written by previous DDS/DAT generations. See table 2 for details and limitations.

Regardless of what vendor or OEM product is being used to create media, always use the latest available firmware for the drive. This will ensure optimal performance for using tape from different drive vendors.

3 Cleaning & LED/LCD Definitions

3.1   Standalone Drive LED

Figure 8 - LED Diagram

LED codes on Dell DAT/DDS tape drives

CLEAN LED (Green)	MEDIA LED (Green)	DRIVE LED (Amber)	Description
Solid On	Off	Off	Cleaning recommended
Slow Flashing	Off	Off	Cleaning required
Rapid Flashing	Off	Off	Expired cleaning tape (Use new cleaning tape)
Off	Solid On	Off	No problems
Off	Rapid Flashing	Off	Possible write error. Cleaning recommended.
Off	Solid On	Solid On	Drive reading or writing normally.
Off	Solid On	Rapid Flashing	Hardware Fault has occurred.

Table 3 - LED drive codes

Table 3 Legend
Solid On = Constant light on.
Slow flashing = blink rate of 2 seconds on, 1 second off.
Rapid flashing = blink rate of 1/8th of a second on, 1/8th of a second off.

3.2   Autoloader LCD and Magazine Layout
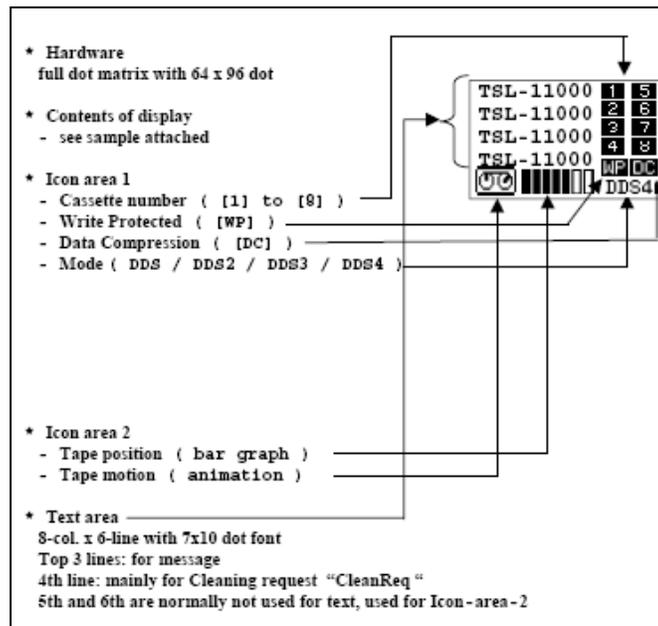
Figure 9 - DDS4 Autoloader LCD

The autoloader will accept a cleaning cartridge only in Slot 8 of the magazine. See the figure below for the magazine slot layout. You can use the cleaning tape in slot 8 with the magazine fully loaded in slots 1-7, or empty, or partially loaded. Please consult the Autoloader's User's Guide for magazine configurations.
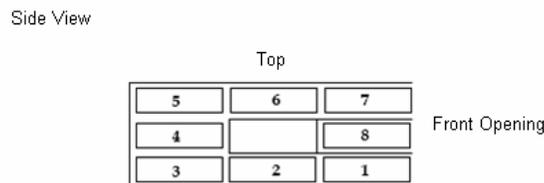
Figure 10 - DDS4 Autoloader Magazine
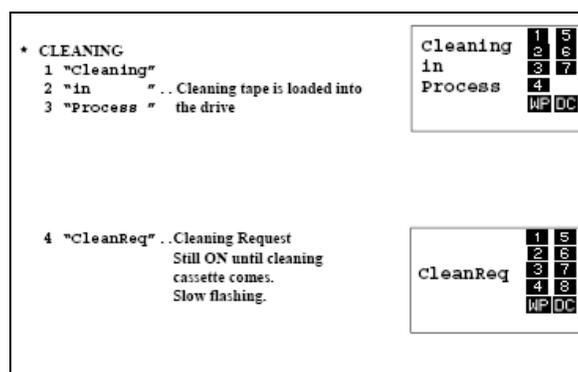
Figure 11 - DDS4 Autoloader LCD with Cleaning

3.3   Cleaning Cycles

Regularly cleaning DDS/DAT drives helps in long-term reliability and should be conducted on a scheduled cycle as well as when requested by the drive.   The recommended cleaning interval for the drive is 50 tape motion hours which is indicated when the cleaning LED comes on solid. Dell does not recommend cleaning outside of the normal cleaning requests from the tape drive unless you are performing Read/Write troubleshooting steps.

Note: If the Cleaning LED remains on after using a valid cleaning tape, this would indicate the use of an expired cleaning tape. See table 3 and table 5 for additional characteristics.

3.4   Cleaning media usage and drive cleaning lights

	Figure 12 - Universal Cleaning Tapes
Physical Description	Black tape labeled with "DG-12CL or DG-15CL are the current recommended clean cartridge to use."
Part Number	**310-5053**
Characteristics	Appearance almost identical to DDS/DAT Data cartridge. Only difference is the labeling and cleaning cartridge has no write protect tab. **NOTE**: Do not use any cleaning cartridge that has cloth like material. Material for valid drive should resemble magnetic tape.
Life Expectancy	40 cleanings

Table 4 -Cleaning Characteristics per Drive

* If excessive dust or debris from the tape media collects at one or more of the tape heads, your drive may not be able to read from or write to tape. To avoid this situation, it is recommended that you maintain the above clean schedule on your DDS/DAT tape drive.

3.5   Identifying Exhausted/Expired Cleaning Tape Characteristics

The cleaning tape for a DDS/DAT drive only moves in one direction. Looking at the figure below if all of the tape resides on the left roller, then you have a new cleaning tape. If all the tape resides on the Right roller then the tape is expired.
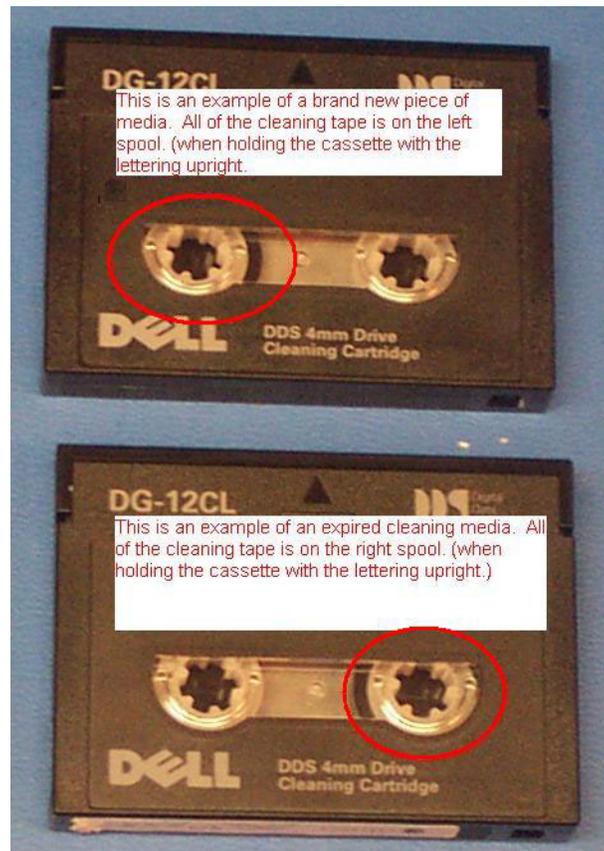
Figure 13- New and Expired Cleaning Media

Drive Type	Cleaning with a Good Tape	Cleaning with an Expired Tape
Dell PowerVault DAT72, DDS4, and other manufacturer DDS drives	**Tape** and **Drive** LED will turn on while drive is cleaned and media will eject when completed.	**Clean** light will flash rapidly and Media Light will remain on. Nothing will happen and tape will stay in drive.

Table 5 Characteristics of DDS/DAT cleaning tape in various drives

The cleaning light on a DDS/DAT drive can come on for two reasons.

1. A periodic maintenance threshold has been exceeded.

2.   A high error rate has occurred. This can happen for 3 reasons.

- A head clog

- A hardware failure on the drive

- Bad or marginal media. (see Troubleshooting Cleaning/Read/Write errors)

Note: Run Dell PowerEdge^{TM} Diagnostics to determine media or hardware related failures.

4 Stuck Tapes

Dell standalone tape drives have the capability to reset the drive in the event of a stuck tape or other non-responsive drive issues. Attempting this drive reset may or may not help in removing a stuck tape.

Note: Dell PowerEdge Diagnostics also includes a **Media Eject** test that can be run to eject the media in the drive.

	How to perform a device reset on Dell PowerVault DDS/DAT drives
Dell PowerVault DAT72, DDS4, and all other DDS drives	Press the **eject** button for about 5 seconds, the tape will rewind and may eject after about 30 seconds to 1 minute.

5   Diagnostics

5.1   Troubleshooting Cleaning/Read/Write errors

If Clean, Read, or Write errors are reported by backup software try alternate pieces of media before replacing tape drives.   If there are invalid media errors reported by the drive via the LED/LCD then also try using an alternate piece of media before replacing the drive.

To troubleshoot errors with tape drives, you need to determine the root of the problem. Tape related problems can come from two primary sources; Media and Hardware.   Dell Online PowerEdge Diagnostics can be used under either Microsoft® Windows® or Linux to narrow down the likely cause. This tool can be downloaded for free from **support.dell.com**.

Within the Diagnostic tools there is a **Media test** which can be run in a long test or quick test mode to help with the diagnosis. The quick test will fill 20 percent of the tape and the long test will write to 80 percent. Reading, writing, spacing, and verifying will all happen during this test so do not use it as a performance tool.

Note: The **Media test** will overwrite data on the tape. Dell suggests using a blank (new) or scratch piece of media. If the intent is to test a specific piece of media then make sure the data contained on that media is backed-up elsewhere.   If a failure is seen it is important to run the test on more than one piece of media to narrow the issue down to the drive or the tape media.

In the event of a failure complete the following procedure.
1. Run the test on one tape. (We suggest running the full test if you think the errors occur later in the backup – run the short test if errors tend to occur early in the backup)
2. If a failure occurs, mark the tape and set it aside.
3. Insert another tape and rerun the same test.
4. If failure occurs, clean the drive and try a 3rd tape.
5. If failures persist, contact Dell Support.

5.2   Dell PowerEdge Diagnostics
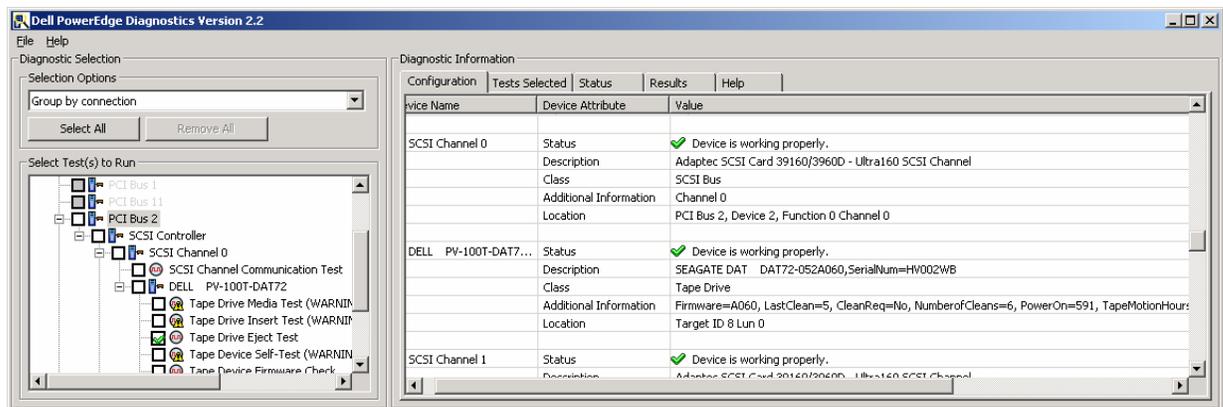
Figure 14 – Dell Online PowerEdge Diagnostic

Dell Online PowerEdge Diagnostics can be used to troubleshoot tape drives in Linux and Windows.

Note: As of the publication date of this document, a tape device driver must be loaded in Windows device manager in order to run Dell PowerEdge Diagnostics Version 2.3. Future version may eliminate this requirement.

Tests included in Dell PowerEdge Diagnostics are the following:

1. The media can be used to determine if errors are related to tape hardware or certain pieces of media.
   - The media test can be run in full mode which will fill 80 percent of the tape.
   - The media test can also be run in quick mode that will fill 20 percent of the tape.

     Note: These tests could take between 2 to 6 hours. Read, Write, Space, Rewind, and Verify tests will be run to exercise the drive and media.

2. The **Drive Insert test** will test the capabilities of the drive to mount, thread, and do a short write operation to the tape. A tape must be present in the drive to run this test, note that the tape will be overwritten.

3. The **Tape Drive Eject test** can be used to try to eject a stuck tape.   This test will not work under true hardware failures. If the stuck tape is due to software this test could work when trying to eject a stuck tape.

4. The **Tape Device Self test** can be used to do a quick verify of drive operations without spending hours writing to tape in search of bad media as seen in the Media test. This test will usually finish within 4 minutes.

6. Use the **Tape Device Firmware Check** test to verify that the drive firmware is up-to-date. New firmware can fix many types of known issues.
   Note: If a tape is stuck in a DDS/DAT drive, the firmware can still be updated.

6   Erasing a prewritten DDS/DAT Tape

Write-protection will not prevent a cartridge from being erased by bulk-erasure or degaussing. You may bulk erase DDS/DAT format cartridges. The cartridge will be usable; however the previous data will be lost.

NOTE: The erase feature in backup software is the preferred method for erasing a DDS/DAT tape. DAT 72 drives do not support long erase. They only support quick erase. To prevent erasing a tape set the write protect switch.
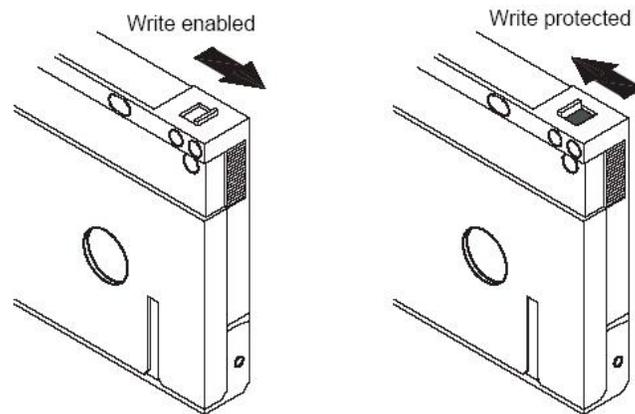
Figure 15 - Media Write Protect Tab

7   Media Handling

7.1   Perform a Thorough Inspection

- Inspect the cartridge's packaging to determine potential rough handling.

- When inspecting a cartridge, make sure there is no blockage over the open holes.   These are cartridge sensors to identify the type of tape, the magnetic thickness and whether the tape is pre-recorded, unrecorded, or is a cleaning cartridge. Other cartridge features allow the drive to determine the cartridge in the BOT (beginning of tape), or EOT (end of tape) points.

- Inspect the cartridge for damage before using or storing it.

- If you suspect that the cartridge has been mishandled but it appears useable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.
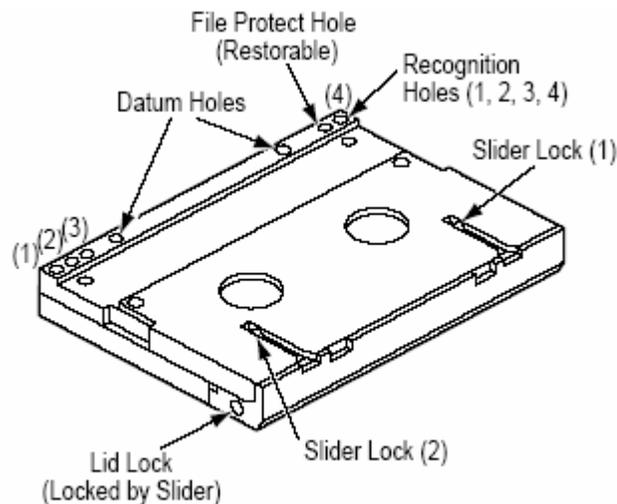
Figure 16 -Media Recognition Holes

7.2   Handle the Cartridge Carefully

- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.

- Degaussing will lose all data on a pre-recorded cartridge. It is usable for a new data backup.

7.3   Ensure Proper Packaging if shipping tapes

- When you ship a cartridge, ship it in its original or better packaging.

- Always ship or store a cartridge in a jewel case.

- Use only a recommended shipping container that securely holds the cartridge in its jewel case during transportation.

- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.

- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure the following:

  o Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.

  o Pack the cartridge snugly. Do not allow it to move around.

  o Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes

7.4 Cartridge Storage Conditions

Provide Proper Acclimation and Environmental Conditions

- Before you use a cartridge, let it acclimate to the normal operating environment for 24 hours.

- Ensure that all surfaces of a cartridge are dry before inserting it.

- Do not expose the cartridge to moisture or direct sunlight.

- Do not expose recorded cartridges to stray magnetic fields (for example, terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies). Such exposure can cause the loss of recorded data.

- Maintain the following environmental conditions outlined in the table below.

Environmental Factor	Operating	Non Operational Storage
Temperature	5 to 45 degrees Celsius (41 to 113 degrees Fahrenheit)	-40 to 65 degrees Celsius (-40 to 149 degrees Fahrenheit)
Relative humidity (non-condensing)	20 to 80%	0 to 90%
Wet bulb temperature	28 degrees Celsius (82.4 degrees Fahrenheit)	No condensation

Table 6 Tape Environmental Specifications

7.5 Cartridge life

- Durability - 2,000 passes on any area of full tape backups.
  o Each time media gets loaded, unloaded, written to, read from, the media must pass through contact patches on the cylinder head, which can eventually wear down the media.

- A single media under optimum conditions can run around 250 backup, restore or verify operations.
- Media Coating - Patented Ceramic Coated Metal Particle
- Archival life – 30 years.

7.6   Media Do's and Don'ts

DO	DON'T
Store cartridges in their protective cases	Touch media with bare fingers
Store Cartridges vertically	Stack cartridges horizontally
Inspect Cartridge for damage before each use	Use pens or pencils during cartridge inspection
Unload cartridge prior to powering down the drive.	Drop cartridge
Allow 24-hour conditioning period before using media when moving between environment change i.e. temperature and humidity changes	Disassemble cartridge
	Ship cartridges loaded into a tape drive.
	Store near magnetic devices i.e. speakers, monitors, electrical motors, power supplies.

Table 7 - Media Do's and Don't