Sun StorEdge™ UniPack System with DDS-4 Tape Drive

Just the Facts

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Positioning

Introduction

The Sun StorEdge™ UniPack system with the DDS-4 tape drive is Sun's latest 4-mm DAT offering which provides improved performance, capacity, and reliability while maintaining compatibility with older DDS formats. The 4-mm DDS-4 tape drive is ideal for such critical applications as workstation backup and archive, and data distribution and interchange and is compatible with the majority of Sun™ servers and workstations, including the Sun Enterprise™ family of servers.

The new 4-mm DDS-4 tape drive offers a native capacity of 20 GB per tape and a compressed capacity of 40 GB (assuming 2:1 compressible data pattern). The capacity is almost twice that of the 12-GB DDS-3 system. The 3 MB per second transfer rate is up to three times that of its predecessor.

The Sun StorEdge™ UniPack system with DDS-4 offers superior capability as a workstation backup solution while maintaining backward read/write compatibility with DDS-3 and DDS-2 formats.

Key Messages

- 20-GB native capacity on DDS-4 tape drive using DDS-4 media
- 3 MB/sec. native data transfer rate
- Backward read/write compatible with DDS-3 and DDS-2 formats, with media recognition system (MRS) capability to automatically adjust to the correct tape format; read compatible with 90-meter DDS-1 tapes
- Robust, highly reliable, low-cost mechanism
- Meets multiple domestic and international regulations for safety and emissions
- Standard SCSI-2 interface with active termination

Target Users

There are multiple types of users who would be interested in the key features and benefits of this 4-mm DDS-4 tape offering. These include the following:

- Customers with mid-sized workgroup servers or small departmental servers looking for an excellent price/performance backup and archive solution
- Customers needing large capacity add-on storage and high performance on the desktop or configured into workgroup or departmental servers
- Users interested in local backup and archive of their workstation(s)
- Companies needing a reliable, compact method of data distribution and interchange
- Sun installed base customers requiring additional storage and interested in staying with their current investment in 4-mm technology

Key Features and Benefits

Features	Benefits
• 3 MB/sec. native data transfer rate	• Customers can backup larger amounts of data during a small backup window, 10.8 GB/hour
• Backward compatibility	• Provides the capability of restoring old archived data and is ideal for data interchange
• Media recognition system	• Automatically adjusts to correct tape format
• Built-in data compression	• Doubles capacity and transfer rate; requires less tape swapping compared to native data transfer rate
• Every drive rigorously tested on Sun systems	• Helps ensure optimal performance and quality

Target Markets

The Sun StorEdge™ UniPack system with DDS-4 is an excellent solution for backup, archive, data distribution, and interchange for companies in any industry. Based on a particular market, you can highlight different features.

Industry	Key Features to Highlight
• Financial – Stock and commodity traders – Banks	• Small desktop footprint for data backup and archive • Internal drive to backup data for mid-sized workgroup, small departmental, and network servers
• Government – Civilian agencies – Military	• Satisfies multiple environmental, safety, and regulatory specifications • Internal drive to backup data for mid-sized workgroup, small departmental, and network servers
• Health – Hospitals – Doctor's office – Drug companies	• Small desktop footprint for data backup and archive • Internal drive to backup data for mid-sized workgroup, small departmental, and network servers
• Publishing – Newspapers – Magazines – Television newsrooms – Advertising agencies	• High-capacity autoloader to backup data for mid-sized workgroup, small departmental, and network servers
• Engineering/scientific companies – Maintenance operations – Design center – Operations center	• Small desktop footprint for data backup and archive • Reliable, compact method for data distribution and interchange • Internal drive to backup data for mid-sized workgroup, small departmental, and network servers

Key Applications

The Sun StorEdge™ UniPack system with DDS-4 does not require any specific application software. Solaris™ Operating Environment commands (for example, `tar` and `dump`), will work the same as for existing DDS-2 and DDS-3 drives.

Product Family Placement

The Sun StorEdge™ UniPack system with DDS-4 augments Sun's 4-mm tape drive product line. The 4-mm DDS-4 tape drive is well positioned for:

- Workstation backup and archive
- Network/server backup and archive
- Data interchange/distribution/acquisition

In regards to Sun's tape product line, this is a small-to-mid range solution for tape backup, whereas 8-mm and DLT products offer a higher end solution. The price/performance ratio for the DDS-3 and DDS-4 tape drives enables a lower total cost-of-ownership. DLT and 8-mm products offer an even lower price/performance cost, but the initial unit cost of these products demonstrates that they are a higher end solution.

Market Value Proposition

Sun customers who purchase Sun StorEdge products expect performance and cost-effective storage solutions that protect their investment. Sun is introducing the Sun StorEdge™ UniPack system with DDS-4 to further meet the growing information storage needs of our customer base and future customers. With the rapid increase in the capacity of disk drives, higher capacity backup is required to protect information.

Tape Technology Overview

Using tape technology, data is stored by moving a tape across a recording head and converting the data stream into small magnetic domains on the tape. These domains are stored along a track. To read the information, the recording head follows the track and recovers the stored information. Tape capacity is determined by the width and length of the tape, the linear density of the magnetic domains, and the number of tracks on the tape.

There are two basic implementations of tape recording technology, linear and helical scan. We'll discuss both technologies in this document, although the helical scan is used in 4-mm tape technology.

Linear Tape Technology

Linear tape drive technology records data in long, parallel tracks that run the length of the media. It does this with fixed read/write head and very fast moving tape. The number of recording elements on the head determines how many tracks can be written on the tape. For example, the recording head on a 3490E tape drive has 18 recording heads. A total of 36 tracks are written by making two passes of the tape over the fixed head. In the tape industry, the process of moving the tape across the heads multiple times is known as *serpentine* recording.

The drive mechanism for linear tape technology is very simple with few moving parts. The original implementation of linear tape technology was a reel-to-reel drive format where tapes were threaded onto open reels. Later, a cartridge format was developed where the tape reels and drive mechanism were self contained in a sturdy cartridge. Since the heads are fixed in linear recording technology, they are inherently very reliable with quoted MTBFs of over 100,000 passes.

The complexity of this technology resides in the constructions of the coated tape media. Different media formulations allow different linear recording densities. Recent development of Metal Particle (MP++) media doubles the recording density over Chromium Oxide (CrO_2) coated materials which are the most common in the industry. Another new method of coating tapes called Metal Evaporate (ME) also provides very high recording densities.

Helical Scan Technology

Instead of creating tracks parallel to the tape edge, helical scan technology records data on relatively slow moving tape in narrow tracks that run diagonally across the tape. A single track is written by a rotating read/write head in contact with the media with an axis of rotation at five to six degrees from the perpendicular. Contact is made by wrapping the tape partially around the rotating recording head.

This technique was developed for use in video recording, but engineers discovered that it allowed much higher image density to be written on 4-mm and 8-mm tape at faster rate of speed than linear recording technology.

The complexity of helical scan recording technology lies in the construction of the drive. By wrapping the tape around a rotating head, both the tape and the head are gradually worn after repeated passes. The tape cartridge is very simple and much less rugged than linear tape cartridges.

4-mm Tape Technology

The 4-mm tape technology was originally developed by Philips Consumer Electronics as a digital audio format for the consumer market. Also known as DAT (Digital Audio Tape), 4-mm tape drives have two heads for reading and two for writing. The tape wraps 90 degrees around the drum's circumference and the heads move in a spiral motion from the bottom to the top of the tape. This method permits much higher recording density than streaming tape methods because magnetic interference between tracks is reduced and tracks can be positioned more precisely.

The standards for recording using DAT devices are called Digital Data Storage (DDS). They include

- **DDS (or DDS-1)**

  DDS is a modification of the DAT technology that constructs a sequence of fixed-capacity groups on the tape. The basic DDS format allows data to be written sequentially, appending data to the existing information, and to be read randomly beginning at any point. DDS tapes can store up to 2 GB of data on a 90-meter tape.

- **DDS-DC**

  DDS-DC is similar to DDS-2 but includes a data compression standard that enables up to 8 GB per tape (assuming 2:1 compression). It allows uncompressed data to be stored in a way that maintains full DDS functionality and helps ensure backward compatibility with existing DDS drives. However, older drives that do not include the data compression algorithm cannot read this format.

- **DDS-2**

  DDS-2 was developed to allow for higher density recording. DDS-2 doubles the density of DDS but maintains full DDS functionality and is backwards compatible. It has a native capacity of 4 GB on a 120-meter tape.

- **DDS-3**

  DDS-3, an implementation of helical scan technology, offers three times the capacity and double the data transfer rate of current DDS-2 drives. It offers a native capacity of 12 GB with a transfer rate of 1 MB/sec. on a 125-meter tape.

- **DDS-4**

  Sun's newest 4-mm product is the 4-mm helical scan DDS-4 tape device, operating on the industry-standard SCSI-2 interface and fitting within the 5.25-inch, half-height form factor. Digital Data Storage 4 (DDS-4) is a follow-on of DDS-2 and DDS-3 DAT drive. This device provides a sustained transfer rate of 3 MB/sec. (uncompressed data). The device is capable of reading and writing 120-, 125-, and 150-meter DDS data tapes. The capacity of DDS-4 is typically 20-GB native on a 150-meter cartridge.

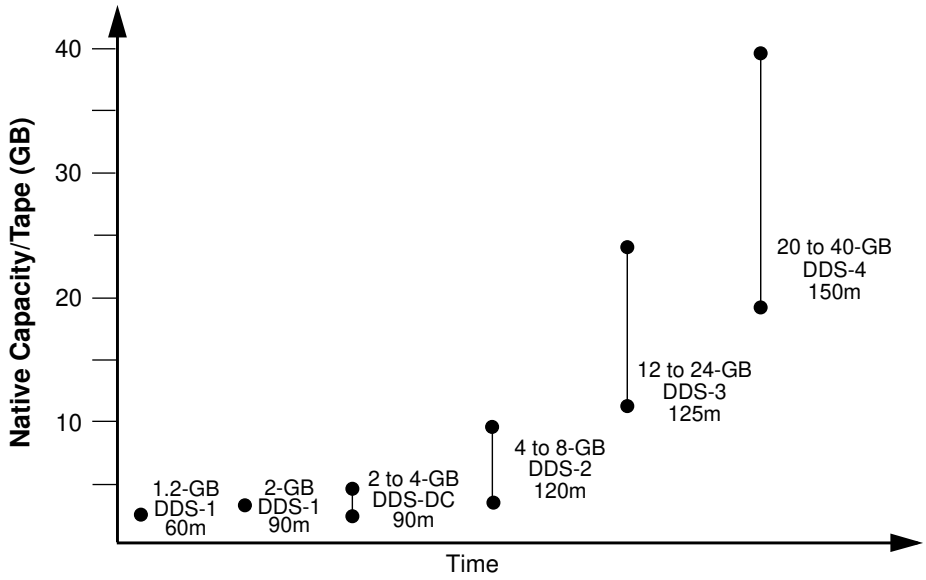

Figure 1. The evolution of 4-mm tape capacities

4-mm tape has well-defined manufacturing standards. A DDS manufacturing group has been established that defines industry standards for format and production. As a result there are multiple sources of supply for 4-mm tape drives and 4-mm media.

Tech Facts for the DDS-4 Tape Drive

Compression (2:1 ratio) is an average. Different types of data compress at different rates. Some data hardly compresses at all, while some compresses at greater than the 2:1 ratio. A duty cycle is the amount of time the drive mechanism is active as a percentage of clock time.

Performance Specifications	**DDS-4 Tape Drive**
Compression	DCLZ
Capacity (native)	20 GB per 150-meter DDS-4 tape
Number of tapes	1
Sustained transfer rate	3 MB/sec. native
Burst rate (synchronous/asynchronous)	40 MB/sec. (synch.); 6 MB/sec. (asynch.)
Error rate	<1 in 10e15
Buffer	8 MB
Interface	Single-ended SCSI-2
MTBF	400,000 hours (12 percent duty cycle)
Cartridge swaps	N/A
Tape speed	0.41 in/sec.
Average file access time	50 sec. on 150-meter cartridge

Physical Specifications

Characteristic	DDS-4 Tape Drive
Form factor	5.25 inch
Height	41.3 mm (1.6 in.)
Width	146 mm (5.75 in.)
Depth	162 mm (6.4 in.)
Weight	0.98 kg (2.16 lbs)

Input Power Requirements

The drive functions off the shelf, switching the +5.5-volt power supply. Currents on the +5-volt supply do not include an additional 0.68A for SCSI terminators. The figures below include ripple noise, transient response, load vibration, and environmental conditions. Maximum average is measured with an average reading DC ammeter.

Condition	DC Voltage	
	+5VDC +/-5%	+12VDC +/-10%
Initial power up maximum peak (>1ms)	0.85A	1.20A
Idle	0.20A	0.20A
Typical operation	0.50A	0.40A
Ripple noise, maximum	150mV Peak-Peak	150mV Peak-Peak
Power requirements		
• Idle	1.00 Watts	2.40 Watts
• Typical operation	2.50 Watts	4.80 Watts
• Maximum	4.25 Watts	14.40 Watts

Environment Specifications

	Operating	Non-Operating
Temperature range Gradient (maximum)	5 to 40°C 10°C/hour	-40 to +70°C 20°C/hour
Humidity range Wet bulb, maximum Gradient, maximum	20% to 80% RH, non-condensing 26°C 30% RH/hour	5% to 95% RH, non-condensing 26°C 30% RH/hour
Altitude range	0 to 4,600 meters (0–15,000 ft.)	0 to 15,200 meters (0–50,000 ft.)
Vibration	Swept Sine: 0.3g peak, 5–500 Hz @ 1 octave/min. Random: 5–350 Hz = 0.0011 G^2/Hz 350–500 Hz = -6 Db/octave Approximate level 0.5 grams	Swept Sine: 0.75g peak, 5–500 Hz @ 1 octave/min. Random: 5–100 Hz = 0.01961 G^2/Hz 100–137 Hz = -6 Db/octave 137–350 Hz = 0.01 G^2/Hz 350–500 Hz = -6 Db/octave

	Operating	Non-Operating
ESD immunity (front panel only)	0–10 kV air discharge (no performance change) 0–25 kV air discharge (hardware survival)	N/A
Shock	8 G's peak, 11 ms half sine	90 G's peak, 3 ms half sine 30 G's 26 ms trapezoidal
Acoustical noise	45 dBA (IEC 179 A-weighted) MAX at 1m	N/A

Applicable Documents

Environmental	
910-3930-XX	Qualification Test Requirements for a Data Storage Tape Drive

Compliance	
990-1151-XX	Electrical and Immunity Test Specification

Cosmetic	
950-1310-XX	Sun Microsystems General Cosmetic Specifications
950-2671-XX	Sun Microsystems Specifications for a Sun Server Medium Grey Bezel
IEC 73	Workstation Color Requirements (Bezel Requirements)

Interface	
ANSI X3T9.2/375R	Small Computer Systems Interface-2, SCSI-2 Rev. 10k

Reliability and Quality	
MIL-STD-217E	Military Handbook: Reliability Prediction of Electronic Equipment
MIL-STD-781	Military Handbook: Reliability Test Procedures

Safety	
UL 1950 (Edition 3)	Standard for Safety: Information Technology Equipment, Including Electrical Business Equipment (includes USA and Canada Safety Standards)
CAN/CSA-C22.2, No. 950-M89	Safety of Information Technology Equipment, Including Electrical Business Equipment
EN 60825	Safety of Laser Products
EN 60950	European Community Regulations for Safety of Information Technology Equipment Including Electrical Business Equipment
IEC 950	Safety of Information Technology Equipment, Including Electrical Business Equipment
VDE 0805	Safety for Business Machines
TUV	Component Mark

Regulatory	
VCCI (= CISPR 22)	Japanese Voluntary Council for the Control of Interference Regulations
EN 55022 (=CISPR 22)	Specification for Limits and Methods of Measurement of Radio Interference, Characteristics of Information Technology Equipment
EN 60 555-2 (IEC 55-2)	Disturbances in Supply Systems Caused by Household Appliances and Similar Equipment—Specification for Harmonics
CSA C108.8	Electromagnetic Emissions from Data Processing Equipment and Electronic Office Machines
FCC CFR 47, Part 15, Subpart B	FCC Rules for Computing Devices
FCC MP-4	Procedure for Measuring RF Emissions from Computing Devices.
FCC OST 55	Characteristics of Open Field Test Sites
VFG243/1991	Regulation for Radio Frequency Interference

Acoustical	
ISO Standard 3744	Engineering Methods for Free Field Conditions Over a Reflecting Plane
910-3930-XX (IEC)	Qualification Test Requirements for a Data Storage Tape Device

Miscellaneous	
910-3930-XX (IEC)	Qualification Test Requirements for a Data Storage Tape Device
MS3.2	Sun OEM Supplier/Product Quality Agreement

System Configuration

Systems Supported

The Sun StorEdge™ UniPack system with DDS-4 is supported on the following systems:

- Sun Enterprise™ 3500 server
- Sun Enterprise 4500 server
- Sun Enterprise 5500 server
- Sun Enterprise 6500 server
- Ultra™ 60 workstation
- Ultra 80 workstation
- Sun Enterprise 220R server
- Sun Enterprise 250 server
- Sun Enterprise 420R server
- Sun Enterprise 450 server
- Ultra 2 workstations

Operating Environment

The Sun StorEdge UniPack system with DDS-4 supports the following operating environments:

- Solaris™ 2.5.1 Operating Environment with patch 103857
- Solaris 2.6 Operating Environment with patch 105847
- Solaris 7 Operating Environment with patch 10740
- Solaris 8 Operating Environment with patch to be released later

Software

The Sun StorEdge UniPack system with DDS-4 supports Solstice Backup™ software, VERITAS NetBackup software, as well as most other backup applications.

Ordering Information

Sun StorEdge™ UniPack System with DDS-4 Marketing Part Numbers

Part Number	Option Description
SG-XTAP4MM-012A	20-GB, 4-mm DDS-4 in a Sun StorEdge™ UniPack desktop enclosure
SG-XMED4MMDDS410	4-mm, 190-meter DDS-4 tapes, package of 10

Configuration Guidelines

- The 4-mm DDS-4 tape drive can also support previous generation 4-mm tape media such as the DDS-3 and DDS-2.
- The 50-pin to 68-pin cables are required when chaining the DDS-4 tape drive to a narrow on-board host adapter or another external 50-pin connector device (i.e., Desktop Storage Module tape drive).

Host Adapters

Sun StorEdge UniPack system with DDS-4 supports the following host adapters:

Option Number	Description
X1032A	10/100BASE-T UltraSCSI adapter with SunPCI™
X6540A	Dual-channel, single-ended UltraSCSI controller
X1063A	SBus, single-ended, Fast/Wide, intelligent SCSI-2 host adapter (SWIS/S)

Upgrades

In order to upgrade to the DDS-4 system, the customer can return any Sun 4-mm DDS-3 UniPack system.

Part Number	Option Description
UG-DDS-XTAPDDS4	Upgrade to 20-GB, 4-mm DDS-4 in a Sun StorEdge UniPack desktop enclosure

Service and Support

The SunSpectrum℠ program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs, ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ Operating Environment software, and telephone support for Sun™ software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value that it represents. Customers should check with their local Sun Enterprise Services representatives for program and feature availability in their areas.

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Systems Features				
Systems approach coverage	Yes	Yes	Yes	Yes
System availability guarantee	Customized	No	No	No
Account Support Features				
Service account management team	Yes	No	No	No
Local customer support management	No	Yes	No	No
Personal technical account support	Yes	Yes	Option	No
SunStart℠ installation service	Yes	No	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semiannual	No	No
Skills assessment	Yes	No	No	No
Site activity log	Yes	Yes	No	No
Coverage / Response Time				
Standard telephone coverage hours	7 day/24 hour	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday
Standard on-site coverage hours	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday	N/A
7-day/24-hour telephone coverage	Yes	Yes	Option	Option
7-day/24-hour on-site coverage	Yes	Option	Option	N/A
7-day/12-hour on-site coverage	No	Option	No	No
5-day/24-hour on-site coverage	No	Option	No	No

FEATURE	SUNSPECTRUM PLATINUM[SM] Mission-critical Support	SUNSPECTRUM GOLD[SM] Business-critical Support	SUNSPECTRUM SILVER[SM] Systems Support	SUNSPECTRUM BRONZE[SM] Self Support
Coverage / Response Time (cont.)				
Customer-defined priority setting	Yes	Yes	Yes	Option
• Urgent (phone/on-site)	Live transfer/ 2 hour	Live transfer/ 4 hour	Live transfer/ 4 hour	4 hour / N/A
• Serious (phone/on-site)	Live transfer/ 4 hour	2 hour/next day	2 hour/next day	4 hour / N/A
• Not critical (phone/on-site)	Live transfer/ customer convenience	4 hour/ customer convenience	4 hour/ customer convenience	4 hour / N/A
2-hour on-site response	Yes	Option	Option	N/A
Additional contacts	Option	Option	Option	Option
Premier Support Features				
Mission-critical support team	Yes	For urgent problems	No	No
Sun Vendor Integration Program (SunVIP[SM])	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Hardware Support Delivery				
Replacement hardware parts	On-site technician	On-site technician	On-site technician	Courier
Two day parts delivery	N/A	N/A	N/A	Yes
Overnight parts delivery	N/A	N/A	N/A	Option
Same-day parts delivery	Yes	Yes	Yes	Option
Remote Systems Diagnostics				
Remote dial-in analysis	Yes	Yes	Yes	Yes
Remote systems monitoring	Yes	Yes	No	No
Remote predictive failure reporting	Yes	Yes	No	No
Software Enhancements and Maintenance Releases				
Solaris Operating Environment enhancement releases	Yes	Yes	Yes	Yes
Patches and maintenance releases	Yes	Yes	Yes	Yes
Sun unbundled software enhancements	Option	Option	Option	Option
Internet and CD-ROM Support Tools				
SunSolve[SM] license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier[SM] Service	Yes	Yes	Yes	Yes

Glossary

ANSI	American National Standards Institute, which sets standards for SCSI and the safety of electrical devices, among other things.
Asynchronous	*See* Data transfer phase.
Autoload	When a tape cartridge is inserted, a tape drive with autoload will automatically load it without the host having to send a load command. If a drive does not have autoload, the drive will take no action until it receives a load command from the host computer.
Autoloader	A device embodying a tape drive and a cartridge changer mechanism, housed in a single case.
Block	A logical unit of information. Called “record” in the DDS-format specification.
C3 ECC	A third level of error correction code covered by the DDS format. C3 allows any two tracks in a group to be corrected, and is used only when a raw data error is too big to be corrected by C1 and C2. C3 code is stored in an extra frame at the end of the 22 frames of data in each group.
Changer	A mechanism within an autoloader for moving tape cartridges from the magazine into the tape drive, and back again. *See also* Random mode, Stacker mode
Compression	A procedure in which data is transformed by the removal of redundant information in order to reduce the number of bits required to represent the data. This is done by representing strings of bytes with codewords.
DAT	Digital audio tape.
Data randomizer	*See* Randomizing.
Data transfer phase	On a SCSI bus, devices put in requests to be able to transfer information. Once a device is granted its request, it and the target to which it wants to send information can transfer the data using one of two protocols (assuming both devices support them): asynchronous or synchronous. In *asynchronous* transfers, the target controls the flow of data. The initiator can only send data when the target has acknowledged receipt of the previous packet. All SCSI devices must support asynchronous transfer. In *synchronous* data transfer, the initiator and target work in synchronization, allowing transmission of a packet of data to start before acknowledgment of the previous transmission. Sun DDS drives support asynchronous and synchronous transfers.
DCLZ	Data Compression Lempel-Ziv. A compression algorithm based on the Lempel-Ziv LZ2/LZW algorithms, but with improved performance.

DDS	Digital Data Storage is a recording format that builds on the DAT format to support the storage of computer data. It was developed originally by Hewlett-Packard and Sony as an industry standard. The first-generation standard was DDS-1 (or simply DDS), to which was added data compression to produce the DDS-DC standard.
Differential	*See* Single-ended.
Duty cycle	Amount of time the drive mechanism is active as a percentage of clock time.
ECC	Error Correction Code. *See* C3 ECC.
Fast-SCSI	Data transfer rate of 10 MB/sec.
Fast/wide-SCSI	Data transfer rate of 20 MB/sec. Wide devices can be connected to a narrow SCSI interface but the extra data lines need to be terminated.
Forced ejection	In an emergency, you can force the drive to eject a cartridge. In doing so, data will probably be lost, and the tape may become unusable, so *be very cautious about using this emergency procedure*. To force the ejection of a cartridge, press the Unload button (the Eject button) three times within a 5-minute period, or hold it down for at least 5 seconds.
FRU	Field replaceable unit, an assembly or group of components that is replaced in its entirety by Service Engineers when it contains a fault.
Host	The host computer system acting as controller for the drive.
Host adapter	A device that connects a peripheral device I/O protocol and medium to the computer system's I/O bus.
IOPS	Input/output operations per second. A measure of I/O performance, this is usually used to quote random I/O performance. See throughput.
Load	The process in which the drive takes in an inserted cartridge and goes online.
Magazine	A holder for up to six tape cartridges used in autoloaders.
Media recognition system (MRS)	A method by which a drive can recognize data-grade tape. The tape has a series of stripes on its transparent leader tape that the drive can detect. By default, the drive treats a non-media recognition system tape as read-only and will not write data to it. However, it is possible to switch the recognition system off using the configuration switches on the underside of the drive. If this is done, the drive will treat all DDS tapes the same.
MTBF	Mean time between failures. A measure of reliability, this is the average expected time between failures of equipment, usually measured in operating hours.

Offline	The drive is offline if the tape is currently unloaded or not in the drive. The host has limited access, and cannot perform any commands that would cause tape motion. The host can, however, load a tape if one is inserted, and can execute any diagnostic tests that do not require tape motion.
Online	The drive is online when a tape is loaded. The host has access to all command operations, including those that access the tape, set configurations and run diagnostic tests.
Partition	A part of a tape that can be treated as a complete and independent whole. A tape can have one or two partitions.
PRML	Partial response maximum likelihood—a method of recovering data from a signal that can cope with the higher density of data used by the DDS-4 format. The technique not only identifies data bits more accurately, but by scanning the bits surrounding a bit being read, it can deduce the correct value for dubious bits.
Random mode	*Autoloaders only:* In random mode, cartridges are used in order dictated by the host or the user, rather than sequentially, as in Stacker mode. For each cartridge to be used, the host must issue a SCSI `MOVE MEDIUM` command to instruct the autoloader to move the cartridge from the magazine to the drive. When the cartridge is full, or when no further use is to be made of it, the host must again use the `MOVE MEDIUM` command to load another. Random mode is sometimes referred to as Changer mode.
Randomizing	A recoding of data symbols before they are written to tape in order to provide a consistently high RF envelope level. An inconsistent RF envelope is one of the criteria for rewriting a frame on read-after-write.
Read-after-write (RAW)	Read-after-write improves data integrity by reading data immediately after it is written and writing the frame again if an error is found. The Audio DAT two-head drum is replaced by a four-head drum for this, with two read-only heads and two write-only heads. Frames are only re-written as necessary, so speed and capacity are affected minimally. RAW is included in the DDS format.
SCSI	Small computer system interface—a standard command specification and command set that enables computers and peripherals to communicate with each other. Sun's current family of tape drives adhere to the SCSI-2 specification.
SCSI address	The octal representation of the unique address (0–7) assigned to a narrow device; or hex representation of the unique address (0–15) assigned to a wide SCSI device.
Sequential access	Sequential access devices store data sequentially in the order in which it is received. Tape devices are the most common sequential access devices. Devices such as disk drives are direct access devices, where data is stored in blocks, not necessarily sequentially.

Single-ended	SCSI devices can be single-ended or differential. *Single-ended* devices transmit signals by setting a line in the cable to a pattern of high and low voltages in relation to a ground line. *Differential* devices send signals by swapping over high and low states between two lines. This is more expensive to implement, but reduces interference and allows longer cable lengths. Sun's 4-mm tape drives only support single-ended SCSI. *Note*: Single-ended and differential devices must not be mixed on one SCSI bus
Stabilizing	Leaving a cartridge for a period of time in the room in which it is to be used in order to avoid condensation problems caused by changes in humidity and temperature. A period of two hours is recommended.
Stacker mode	*Autoloaders only:* In stacker mode, cartridges are used sequentially from the autoloader magazine. The cartridge selected by the user (by pressing the front panel Select button, and then loaded by pressing the Load button) is used first. When it is full, the changer mechanism automatically moves it back to the magazine, and then moves the cartridge in the next highest numbered slot to the drive. This continues until all the cartridges have been used. To load cartridges under host control, the device must be in random mode. Stacker mode is sometimes referred to as sequential mode.
SWIS/S	Single-ended wide intelligent SCSI/SBus host adapter.
Synchronous	*See* data transfer.
System area	A section in the Lead-in Area at the beginning of a partition used to store the tape usage information.
Tape log	The tape log contains details of the history of a tape, the total number of groups written, of RAW retries, of groups read, of C3 ECC retries, and of loads. The log is copied into RAM when the tape is loaded into the drive, updated as the tape is used, and loaded back into the System area on the tape when it is unloaded.
Tape alert	The tape alert log holds a set of flags that indicate faults with the drive or tape. For example, the not data grade flag is set to indicate that the drive has detected that a tape that is not media recognition system is loaded. By reading this log, host software or the operating system can inform users of existing or impending conditions and can give advice. For example, the software might recommend that you use a new tape or clean the heads.
Termination	A SCSI bus (or cable) can have many devices plugged into it, but the end of the cable furthest from the host computer must always be *terminated* to avoid signals being reflected back and interfering with other signals. The terminator both absorbs signals and provides power to the lines in the cable. For this reason, it must itself be provided with power. Terminators can be of two types, active and passive. Active termination is recommended for a bus that has the tape drive on it, because although more expensive, it helps ensure better and more secure performance.
Throughput	A measure of sequential I/O performance, quoted in MB/sec. *See* IOPS.

Time-tracking	A technique of ensuring that the read head stays in the center of the track that it is reading. The drive measures the time it takes to reach a particular point on the track, and if this time is less than or greater than its expected value, the drive adjusts the tape speed to compensate. In the Sun 4-mm DDS-4 drive, time-tracking replaces the automatic track following (ATF) used in DDS-1 and DDS-2 drives, and allows more of each track to be available for data storage. The Sun 4-mm DDS-4 tape drive and autoloader still write ATF signals on DDS-1 and DDS-2 tapes to help ensure full backward compatibility.
Transfer rate	The rate at which data is transferred from one device to another, for example from the host computer to the tape drive during backup.
Vendor-unique	The addition of commands to SCSI that are not included in the standard.

Materials Abstract

All materials will be available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Powerpack				
– *Sun StorEdge™ UniPack System with DDS-4 Tape Drive, Just the Facts*	Reference Guide (this document)	Training Sales Tool	SunWIN, Reseller Web	59386
– *Literature - Sun StorEdge DDS-4 Tape Drive And Autoloader Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web	99538
References				
– *Quick Reference Card—Sun StorEdge Product Family Overview, 2/00*	Quick Reference Card	Sales Tool	SunWIN, Reseller Web	73691
– *DDS-4 Tape Drive Product Brief*	Product Brief	Sales Tool	SunWIN, Reseller Web	62061
External Web Sites				
– *Network Storage Solutions Web Site*	`http://www.sun.com/storage/`			
– *DDS-4 Specifications*	`http://www.sun.com/storage/dds/index.html` *and* `http://wwwwseast.usec.sun.com:80/storage/dds/spec.html`			
– *Tape Backup Solutions Main Page*	`http://www.sun.com/storage/tape.html`			