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NEARLINE

NL35 Series Evaluation Kit

Experience the new NL35 Series 500GB SATA drives.

RAID-READY.

SET.

GO.

Seagate



Welcome

November 2005

Dear Storage Manager,

Why settle for less when you can have it all? With the Seagate® NL35™ Series of SATA hard drives, you can meet the demands of capacity-intensive RAID applications without sacrificing performance. Now you can be one of the first to try a 500GB version of the NL35 Series—a massive half-terabyte capacity, designed specifically for nearline storage.

Built with the industry's most advanced integration features, the NL35 Series 500GB SATA drive brings new meaning to RAID readiness. It's the stronger, smarter solution for the high-capacity, reliability and workload needs of today's multi-disc nearline applications.

As a Seagate preferred customer, you're part of a select group to receive this NL35 Series Evaluation Kit. Contents include: two NL35 Series 500GB SATA drives (a Terabyte of storage) and this reference booklet containing a product overview, technical highlights, a detailed firmware reference and more.

Ready to get a closer look at the NL35 Series 500GB SATA drive? Use this kit to see how the drives work in your own storage environment. You'll discover firsthand the clear advantages of higher performance, reliability and ease of integration.

Ready. Set. Go.

The NL35 Series Team
Seagate Technology

OVERVIEW

NL35 Series: Nearline Serial ATA Hard Drives

Highest-capacity, nearline-ready hard drives for cost-effective tiered storage

Today's enterprises are turning to lower-cost nearline storage solutions to fill the gap between online and offline storage. The foundation of this nearline storage is high-capacity, low-cost-per-gigabyte, reliable hard drives with Serial ATA (SATA) interfaces. The Seagate NL35 Series of SATA hard drives was designed specifically to meet the workload and integration needs of a broad range of nearline applications, including:

- D2D (disc to disc) backup/recovery storage
- Virtual tape backup/recovery storage
- Fixed content storage for image and document management
- Lower-tiered storage of regulatory compliance or other reference data

Featuring up to a half-terabyte (500GB) of capacity, the Seagate NL35 Series answers the growing need for high-capacity storage arrays that seamlessly integrate into existing storage environments. And with the NL35 Series, there's no need to sacrifice data integrity or reliability for extra storage capacity. Companies simply gain lower-cost, high-capacity storage.

Key features and benefits

- Leverages SAS compatibility with a SATA interface, enabling tiered storage in a single enterprise-class SAS infrastructure
- Reduces storage infrastructure costs by providing high-capacity, low-cost storage for data applications that don't require the performance of mainstream enterprise hard drives
- Delivers best-in-class rotational vibration tolerance with the 500GB drive, enabling steady performance for multi-disc applications
- Lowers capacity costs while still meeting the demands of the data center, ensuring application performance and availability are not compromised
- Integrates easily with existing storage infrastructures, enabling efficient use of multiple tiers of storage to meet varied application needs

Learn more about the NL35 Series 500GB SATA hard drives, visit:

<http://NL35.seagate.com>

TECHNICAL HIGHLIGHTS

NL35 Series 500GB SATA Drives

The NL35 Series SATA drives go beyond desktop capabilities to enable enterprise-friendly drive integration and greater reliability in nearline applications. Their primary features are based on SCT (SMART Command Transport). For more information on optimizing the drives for your environment, please see the Appendix.

Superior reliability

Built for the rigors of capacity-intensive nearline RAID applications, you can count on the NL35 Series day in and day out to get the job done.

- **Workload management** – Seagate proprietary technology protects the drives from peak workloads to increase reliability
- **Best-in-class RV tolerance** – Resilience to vibration from neighboring drives enables steady performance
- **Rigorous reliability testing** – Based on enterprise-class processes, the drives are rated to meet 24x7, low duty-cycle requirements
- **5-year warranty** – The NL35 Series drives come with Seagate warranty protection

Intelligent integration boosts performance

Seagate intelligent integration features increase RAID system uptime, optimize performance and simplify management.

- **Error Recovery Control** – The industry's most flexible time-limited error recovery feature reduces drive failures and increases system performance
- **One-Step Microcode Download** – You can update the code across all drives in a single system in one step
- **Write Same** – You can use a single command to make multiple writes, streamlining system integration
- **SAS compatibility** – The drives are designed for seamless integration and scaling within SAS/SATA arrays

Exceptional capacity and speed

Leveraging industry-leading Seagate SATA technology, the NL35 Series enables new levels of RAID capacity and performance.

- **Nearline-ready** – The NL35 Series SATA drives include Native Command Queuing (NCQ) and the SoftSonic™ motor
- **High capacity** – You can choose from 250GB, 400GB or 500GB SATA drives
- **High performance** – The drives include an 8MB or 16MB cache, and support data transfer rates of 3.0Gb/sec

Specifications	500GB SATA	400GB SATA	250GB SATA
Model Number	ST3500841NS ST3500641NS	ST3400832NS ST3400632NS	ST3250823NS ST3250623NS
Internal/External Transfer Rate (Mbytes/sec)	300	150 300 (Jan 2006)	150 300 (Jan 2006)
Performance			
Spindle Speed (RPM)	7200	7200	7200
Average Latency (ms)	4.17	4.16	4.16
Seek Time			
Average Read/Write (msec)	8.5/9.5	8.0/9.0	8.0/9.0
Track-to-Track Read/Write (msec)	0.8/1.0	0.8/1.0	0.8/1.0
Transfer Rate			
Internal (Mbytes/sec)	669	754	754
Internal Formatted (Mbytes/sec)	66	95	95
Sustained (Mbytes/sec)	56	65	65
Cache, Multisegmented (Mbytes)	8	8/16	8/16
Configuration/Organization			
Bytes Per Sector	512	512	512
Power Management			
Typical (watts)	14.18	12.8	12.8
Idle Average (watts)	10.75	7.2	7.2
Standby Average (watts)	1.4	1.4	1.4
Environmental			
Temperature, Operating (°C)	0 to 60	0 to 60	0 to 60
Temperature, Nonoperating (°C)	-40 to 70	-40 to 70	-40 to 70
Shock, Operating: 2 msec (Gs)	25	63	63
Shock, Nonoperating: 2 msec (Gs)	225	300	≥300
Acoustics Idle (Bels-sound power)	3.1	2.8	≤2.8
Rotational Vibration (Rad/sec)	12.5	8.5	8.5
Physical			
Height (in/mm)	1/26.10	1/26.11	1/26.11
Width (in/mm)	4/101.6	4/101.85	4/101.85
Depth (in/mm)	5.78/146.99	5.78/146.99	5.78/146.99
Weight (lb/kg)	1.6/0.726	1.4/0.635	1.4/0.635
Warranty			
Limited Warranty (years)	5	5	5

APPENDIX

NL35 Series 500GB SATA – Firmware Reference

Write Same

Command Description: Implemented according to T13 Working Draft 1701DT-N Rev 5 using the SMART Command Transport (SCT) mechanism. The host sends a 4-byte or 512-byte/single block pattern to be written as a repeating pattern. The pattern is written beginning at the specified Start LBA for the specified Count of sectors. A count of zero means write to the last user LBA. If the Start LBA or Start LBA plus Count are beyond the last user LBA, an error is reported and the command is not executed.

SCT Status Request

- The SCT Status Request returns information on the current SCT command
- This information includes command active / complete, current LBA and errors
- SCT Status Error Code is set to FFFFh while the command is in progress
- SCT Status Error Code becomes 0000h when the command is complete
- SCT Status Error code other than 0000h / FFFFh indicates the command terminated prematurely

Segment Initialized Flag

- The Segment Initialized Flag is reported in Status Flags bit 0 in the SCT Status Response
- The flag is set if the command successfully writes all user-addressable sectors
- The flag is cleared by a write to any user-addressable sector (except another successful Write Same to all user sectors)
- The flag is not cleared by Auto-Reallocations during reading
- The flag is persistent through power cycles
- The flag is not cleared by reset

Miscellaneous

- Any command, other than SCT Status Request, will terminate the LBA Segment Access command and the new command will execute
- If Write Auto-Reallocation is enabled it is active during LBA Segment Access

Inputs

Word	Name	Value	Description
0	Action Code	0002h	This action writes a pattern or sector of data repeatedly to the media. This capability could also be referred to as "Write Same."
1	Function Code	0001h 0002h	Repeat write pattern Repeat write sector
5:2	Start	QWord	First LBA
9:6	Count	QWord	Number of sectors to fill
11:10	Pattern	DWord	If the Function Code is 0001h, this field contains a 32-bit pattern that is written on the media starting at the location specified in words two through five.

Outputs

Field Name	Value
Error	See ATA/ATAPI-7
Sector Count	Reserved
LBA Low	Reserved
LBA Mid	Low 8 bits of number of sectors requested (Normally this will be one.)
LBA High	High 8 bits of number of sectors requested (Normally this will be zero.)
Device	Reserved
Status	See ATA/ATAPI-7

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NL35 Series 500GB SATA – Firmware Reference

Error Recovery Control

Command Description: SCT Error Recovery Control (ERC) is a subset of the SCT command set, currently a T13 draft. It allows the host to put a soft time limit on certain commands (reads and writes). The time limit is timed at the interface, not at the disc. If the timer expires and the drive has not completed the command, then the drive stops the command and returns an error. The time limit is “soft” in that if a sector is being spared when the time limit expires, the spare is finished.

It differs from the “streaming” time limit command set in ATA7 in that ERC has longer time limits and assumes data reliability is still important under time limits. By contrast, streaming CE customers will trade data errors for timely command completion.

Specifications

Here are some key things to note in the spec:

- Timing is at the interface
- Time limits have a large granularity and range; 100msec and many seconds, respectively
- The time limit is soft, not hard—you can finish a spare once started
- The behavior of write caching or command queuing, in combination with ERC, is not defined

Why a customer would use ERC

The first reason is to protect hosts that behave badly if a disc goes busy for too long. One example of such a host would be a RAID array that considers any disc busy for more than 30 seconds to be dead and in need of maintenance. This scenario might occur outside the disc array realm as well, since many operating systems have a maximum amount of time they will wait for a disc that is less than our worst-case command completion time in the face of grievous errors.

The second reason is to improve performance in a disc array in the face of errors. If a command is taking seconds to complete on one disc, it is almost certainly faster to reconstruct that data from the other discs in the array. The easiest way to trigger this is if the first disc times out. The extremely slow disc can then be re-written to clean up the error or receive maintenance.

When a customer shouldn't use ERC

Customers should not use this interface for CE streaming applications or any other situation where short or hard time limits are required.

ERC Caveats

Most importantly, customers must be aware that an ERC timeout indicates there are defect management tasks the disc would like to have done that were not completed. This could include not sparing sectors known to be bad or not marking them as “pending reallocation” and thus losing track of their “badness” down the road.

In order to ensure disc reliability, this rule must be followed

If you issue a command (read or write) under an ERC time limit that times out, you must successfully re-write the same LBAs (thus allowing the disc to clean up whatever issue caused the timeout) before you can consider that region reliable again.

A failsafe way to successfully write an LBA is to write it without time limits.

An additional caveat is that the commands are timed at the interface rather than the disc. That means that the behavior of ERC is essentially undefined when combined with other drive features such as SATA native command queuing and write caching, since both of these allow the interface to finish processing the command without the actual disc operation completing.

Therefore it is recommended Write Cache be disabled

Note, for example, that ERC provides no mechanism to time limit Flush Cache commands. An NCQ SATA customer can avoid this issue by forcing unit access (FUA) on timed commands.

Inputs

Word	Name	Value	Description
0	Action Code	0003h	Set the read and write error recovery time
1	Function Code	0001h 0002h	Set New Value Return Current Value
2	Selection Code	0001h 0002h	Read Timer Write Timer
3	Value	Word	If the function code is 0001h then this field contains the recovery time limit in 100ms units. A value of 1=100ms, 2=200ms, etc.

Outputs

Field Name	Value
Error	See ATA/ATAPI-7
Sector Count	If Function Code was 0002h, then this is the LSB of the requested recovery limit. Otherwise, this field is Reserved.
LBA Low	If Function Code was 0002h, then this is the MSB of the requested recovery limit. Otherwise, this field is Reserved.
LBA Mid	Reserved
LBA High	Reserved
Device	Reserved
Status	See ATA/ATAPI-7

APPENDIX

NL35 Series 500GB SATA – Firmware Reference

One-Step Microcode Download

Description: Microcode download-ready drives enable the user to download compatible code in an array, using the host download utility.

Features

- Safely download new firmware on top of nearline hard drives
- Only one Seagate file (updated code) required
- ATA download 0x92 can be used to pass the code (in conjunction with the host utility)
- Prevents firmware for one product family from being downloaded onto a different family; within a firmware family, prevents firmware for one version from being downloaded onto an incompatible version
- The drive will not reset itself
- If the device has a SATA interface, the device shall not induce any COMRESET, COMINIT or COMWAKE events on the SATA bus
- If the device has a PATA interface, the device shall not initiate any new DASP/PDIAG handshake sequence
- The new firmware version shall not become active until after a physical power cycle
- The current (e.g., old) firmware version shall remain active across Hard, Soft, and COMRESET reset events

PRESS

NL35 Series – The Word is Out

Press and analysts alike understand the benefits of nearline storage, so it's no surprise the introduction of the Seagate NL35 Series caught their attention.

"The NL35 SATA hard drive joins the previously unveiled NL35 FC Fibre Channel model that together effectively fill the price/performance gap between online and archive storage."

Digital Silence – November 2004

"As data manageability continues to become an increasingly larger task, so does corporate data storage needs. With this in mind, Seagate Technology has expanded its range of enterprise products with some new nearline SATA hard disks."

Bios UK – November 2004

"The Fibre-Channel-based NL35 series is billed as the first half-terabyte drive designed for nearline storage to fill the gap between primary and archived storage."

VarBusiness – September 2004

"The SATA NL35 is intended to provide reliable storage of nearline data for the enterprise. It's also compatible with Serial Attached SCSI environments."

Processor – November 2004

"Data centers face a growing set of challenges, including satisfying bulk storage requirements, simplifying data management, meeting service levels of high I/O transaction processing applications, managing within existing space constraints and minimizing data center cost per square foot.

Seagate's broad portfolio of enterprise drives enables solution providers and IT managers to satisfy a myriad of unique and challenging storage requirements within the data center."

Dave Reinsel, program director of storage research at IDC

Seagate NL35 Series Resources

Want to learn more about the NL35 Series of hard drives or nearline storage solutions in general? Check out the following valuable resources by visiting:

<http://NL35.seagate.com>.

White Papers

Nearline Storage Requirements: Choosing the Optimal SATA Hard Drive

Tiered storage is more cost-effective when drives are optimized for their specific application, expected duty cycle and workload environment. Learn more about selecting the right drive for your storage applications.

Choosing the Right Hard Drive for Tiered Storage Applications in the Enterprise

Read how HDD vendors are now offering drives that deliver performance, capacity and a variety of interfaces, without compromising data integrity or reliability.

Simplifying Tiered Storage

Learn why the advent of purpose-built, enterprise-class nearline drives heralds a new era of efficiency and cost-effectiveness in tiered storage.

Product Information

NL35 Series Family Overview

Nearline storage can be a messy undertaking without a drive designed for the job. Seagate provides the ideal solution with the NL35 Series family of nearline-ready enterprise hard drives.

Tiered Storage Knowledge Center

<http://tieredstorage.seagate.com>

Discover the power of tiered storage to improve storage productivity and how to configure a tiered storage system that optimizes performance, capacity and cost.

SAS Knowledge Center

<http://www.sasknowledge.com>

View the "SAS Bridges the Enterprise" module to see how Serial Attached SCSI (SAS) compatibility with SATA delivers unprecedented flexibility to deploy the most appropriate drive for every storage application.