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Technology Paper

Seagate Briefing: Optimizing Surveillance DVR Reliability

The purpose of this technology paper is to convey important information on how to design and build surveillance digital video recorders (SDVR) that deliver maximum availability in the most demanding environments.

As the world's largest supplier of hard disc drives (HDDs), Seagate Technology® knows well that all customers and storage applications are not alike. Sometimes the unique requirements of disc drive applications are intuitively obvious. For example, the storage needs of an enterprise database application are clearly different from those of a portable MP3 player stowed in a pocket while jogging.

Yet both systems use HDDs for storage and, though vastly different in size, share a significant amount of technology in common. Other storage applications are much more subtle in their differences, while still having important unique characteristics that must be acknowledged to ensure storage products deliver optimal value, performance and reliability.

Such subtle differences can be found in the growing HDD market in the video surveillance industry. Here disc drive use is expanding at a tremendous rate, reflecting the flexibility and advanced performance of disc drive storage over legacy tape-based systems. According to J.P. Freeman Co., the estimated worldwide market for video surveillance equipment is \$4.5 billion at the factory level, with a compound annual growth rate of 18 percent. For digital systems only, the market is growing at more than double this rate, or approximately 42 percent.¹

While the adoption of HDDs in video surveillance systems is rapidly accelerating, there is significant room for improvement in system interoperability, with reliability proving an industry-wide challenge. Many customers moving to digital surveillance systems and HDD-based storage revel in the performance and flexibility, but are not satisfied with the reliability when general desktop or consumer hard drives are used in these systems.

In evaluating the video surveillance market and working with customers who seek higher levels of reliability, Seagate has identified three key approaches to achieving that goal: education, improved practices in system design for reliability, and deployment of purpose-built surveillance HDDs and related controls. The following Q & A discussion highlights the importance of these approaches.

Why isn't my digital surveillance system as reliable as my old tape-based system?

Digital surveillance systems introduced new technologies into a market where knowledge and appreciation of the equipment are still evolving. Digital-based surveillance systems primarily employ IT-based equipment and cutting-edge electronics. These systems are inherently sensitive to environmental conditions, such as extreme heat, cold, humidity and vibration/shock.

¹ Source: J.P. Freeman Co. 2006 Worldwide Video Surveillance Market Report, March 1, 2006

While it's possible to deploy digital surveillance systems specifically engineered for harsh environments, these systems are prohibitively expensive and only represent a small minority of new systems. It is much more economical to take basic precautionary measures by ensuring that digital surveillance equipment isn't subjected to the extreme conditions noted above.

How much effect do environmental conditions have on a digital video surveillance system's reliability?

For a specific example, the graph in Figure 1 displays the predicted Annual Failure Rate (AFR) of the Seagate SV35 Series hard disc drive as a function of case temperature and power-on hours (POH).

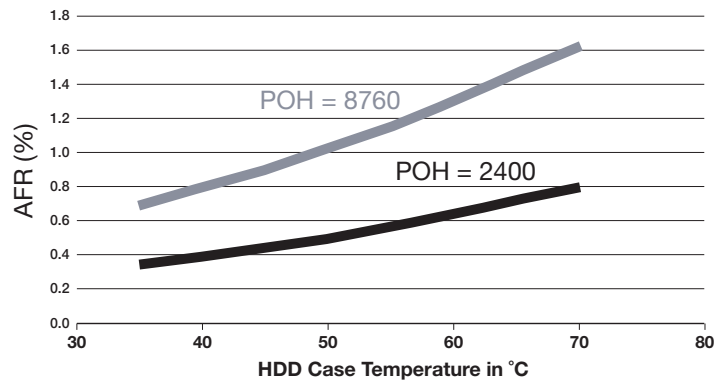


Figure 1. AFR vs. HDD Case Temperature

As can be seen, failure rates increase as HDD case temperatures escalate. Dealers and system integrators, installers and even customers must be educated about proper operational conditions for video surveillance equipment if they are to mitigate damage to electronics and other equipment brought on by exposure to harsh conditions.

Where can I learn more about proper operational conditions for my digital surveillance equipment?

Seagate provides partners and customers with a range of educational tools that can be used to help inform people on HDD opportunities, risk areas and best practices. Seagate maintains a library of technology papers that can aid in this educational effort:

<http://www.seagate.com/newsinfo/newsroom/papers/>

Are there other factors beyond the operational environment that impact digital surveillance system reliability?

Proper enclosure or chassis design is a key factor in achieving optimal reliability. Electronic systems must be housed in well-designed enclosures specifically engineered for proper temperature management and vibration control or compensation. Because disc drives are critical components in digital surveillance systems, Seagate has developed its Design Service Centers, which provide dedicated engineering expertise to help customers evaluate system enclosures for best practices in temperature and vibration/shock management.

To learn more about the importance of temperature management, download this informative Seagate white paper, *Beat the Heat: Designing SDVR Systems for Optimal Thermal Performance*.

http://www.seagate.com/docs/pdf/whitepaper/TP552_SV35Heat_May06.pdf

What is Seagate doing to help optimize disc drive reliability in digital surveillance systems?

The Seagate philosophy on improving products for a given storage segment is one of engagement. Intimate knowledge about the specific needs of a given storage segment is only achieved by actively engaging with customers and partners on a focused, low-level basis.

This philosophy is reflected in the introduction of the Seagate SV35 Series disc drive, the first HDD specifically engineered for the video surveillance market. The initial release of the SV35 Series drive represents an incremental step in differentiating features specifically for surveillance. More importantly, it represents a significant investment by Seagate in a growing market. By

setting aside an entire product family and the engineering and support resources that go along with it, Seagate has made a substantial commitment. Based on the experience of Seagate, such commitments result in valuable learning and advances in technology, functionality, performance and reliability that simply don't occur as quickly without a focused approach.

How does the SV35 Series drive differ from other Seagate HDD products?

While the first-generation SV35 Series drive is not radically different from its Seagate HDD siblings, it does represent a significant step towards providing additional value to existing surveillance customers. Below is a summary comparison of several Seagate HDD products specialized to service different segment niches.

Application-Specific HDD Comparison Table				
	Barracuda 7200.10	DB35 Series	SV35 Series	Barracuda ES
Optimal Application	Personal computing	Personal video recording(set-top box)	Surveillance digital video recording	RAID-based surveillance digital video recording
Maximum Power Use	Spin-up power 2.8 amps; seek power 12.6 watts	Spin-up power 2.0 amps; seek power 8.6 watts	Spin-up power 2.0 amps; seek power 8.6 watts	Spin-up power 2.8 amps; seek power 12.6 watts
Thermal Environment	Chassis and CPU fans typical	Often fanless, convection cooling only	Chassis and CPU fans typical; drive supports spin-down features to improve cooling and drive reliability	Chassis and CPU fans typical
Performance Profile	Priority is data integrity; ECC, error logging, retries	Priority is stream integrity; handles ten simultaneous TV streams	Priorities are both smooth, reliable video streams and data integrity	Priorities are data integrity, RAID-friendly integration features

This table illustrates how subtle differences in storage segments drive the need for specific products with task-optimized features and functionality.

What surveillance-specific features should I look for?

In the SV35 Series drive, Seagate has focused on power management and thermal control, optimized data payload reading/writing and performance.

Digital video surveillance systems commonly include a surveillance digital video recorder (SDVR). This device accepts multiple analog video inputs, typically from coaxial video cable, digitizing the analog streams and recording the digital video onto disc drives installed within the SDVR chassis.

While many SDVR systems are implemented on a PC platform, others have moved to embedded systems that use optimized components. For example, it is common to use smaller, optimized power supplies to save on system cost and control heat more efficiently. The SV35 Series drive supports this design practice by limiting both spin-up current and seek current. This approach doesn't degrade performance, and enables the use of low-cost, cooler-running power supplies.

Are there other ways to cut my surveillance system's heat output?

SDVR designs commonly include enough storage to hold a desired amount of online archival video storage. System archival needs can vary widely, ranging from only a few days of archival video up to many months. Archival storage needs typically dictate using more than one disc drive in the SDVR system.

Of course, the most frequent function of an SDVR system is actively recording video. Once images are recorded on the system, they are rarely reviewed and sometimes never viewed again before being overwritten. To satisfy this use, most SDVR systems incorporate enough storage to meet the customer's archival needs, and then simply record on the disc drives one after another, overwriting old data once the archival period has elapsed.

As a result, at any given time it's likely that one or more disc drives in the system are spinning and running at full performance levels, even though they are not actively being used by the system. The SV35 Series disc drive supports features that enable putting the drive into standby mode when not in active use. This greatly reduces both the drive's power consumption and heat generation, as well as extending its useful service life.

Why is optimizing read/write performance important?

Surveillance systems spend the majority of their time streaming video, and a small percentage of time writing traditional data. Optimizing performance for reading or writing video streams depends on reliable, predictable and timely command execution.

Perhaps surprisingly, complete data integrity for video is not vitally important. That's because a small error introduced into a video stream doesn't compromise the overall integrity of the visual image. While a small, perhaps imperceptible, flaw may occur, the overall video is still intact.

However, in order to manage the vast amounts of video and related metadata in a surveillance system, a keyed relational database or similar traditional data organizational system is often used. It is absolutely critical that reads and writes for such systems employ the utmost levels of error correction and detection to ensure data integrity isn't compromised.

An important feature of the SV35 Series disc drive is its support of the ATA-7 streaming command set. ATA-7 is a recent extension of the industry-standard ATA command set for controlling disc drives. The streaming component of this standard enables the SV35 Series drive's reads and writes to be customized for either video or data payloads. Using the ATA-7 streaming commands, both of these requirements are elegantly met.²

SV35 Series drive summary

The SV35 Series drive is based on the Seagate flagship drive platform for high-performance PCs, the Barracuda 7200. While the changes to operational features described above deliver unique value to surveillance customers, users will also benefit from the basic performance advantages of a 7200-RPM, SATA 3Gb/sec or PATA 100 MB/sec disc drive.

The unique suite of features offered in the Seagate SV35 Series disc drive enables customers to immediately begin making incremental progress toward improved performance and reliability in video surveillance applications. The time-honored strategy of Seagate in focusing product categories on specific storage segments to drive continuous improvement will pay still higher dividends in the future.

² For specific guidance and descriptions of how to implement the features of the SV35 Series disc drive, including the ATA-7 commands, see the SV35 Series product manuals.