



Technical Note

Understanding Kaleidescape Hot Spare Disk Cartridges
TN-005 Rev. 2



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1.0 Introduction

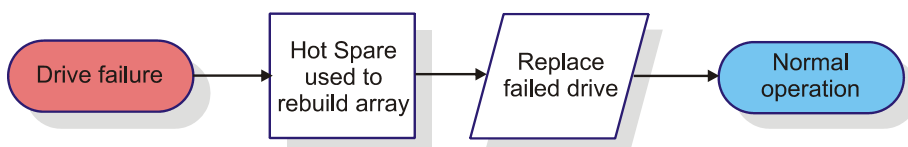
The Kaleidescape Hot Spare Disk Cartridge is an additional Disk Cartridge installed in the 3U Server that is immediately available as a replacement if a hard drive fails. If a drive fails, content that was stored on the failed drive is restored to the Hot Spare without user intervention. This eliminates the need for an urgent service call to prevent data loss should a second drive fail. The Hot Spare provides additional flexibility and convenience when supporting marine and other remote installations.

2.0 How the Hot Spare Works

Every 3U Server requires an unused Disk Cartridge to serve as a Hot Spare. The Hot Spare does not contain any content or file system information. The Server periodically checks the Hot Spare to make sure that it is still operating normally but does not write content to it until there is a drive failure. You can identify the Hot Spare Disk Cartridge by the slow blink of its blue LED indicating a standby or ready status.

When the Server detects a failed drive, it enters degraded mode and begins an immediate rebuild using RAID-K data and algorithms to restore the failed drive's data to the Hot Spare. The Hot Spare's LED changes to a steady blue to indicate that it is now involved in the rebuild and is not available as a Hot Spare. When the Server enters degraded mode, current imports will be completed but new imports will not be allowed until the rebuild is complete. The Server functions normally in all other ways while it is in degraded mode. When the rebuild is complete, the Hot Spare is incorporated into the RAID-K disk array and its LED remains steady blue. At this point the Server no longer has a Hot Spare but it is not in degraded mode because it is protected by RAID-K.

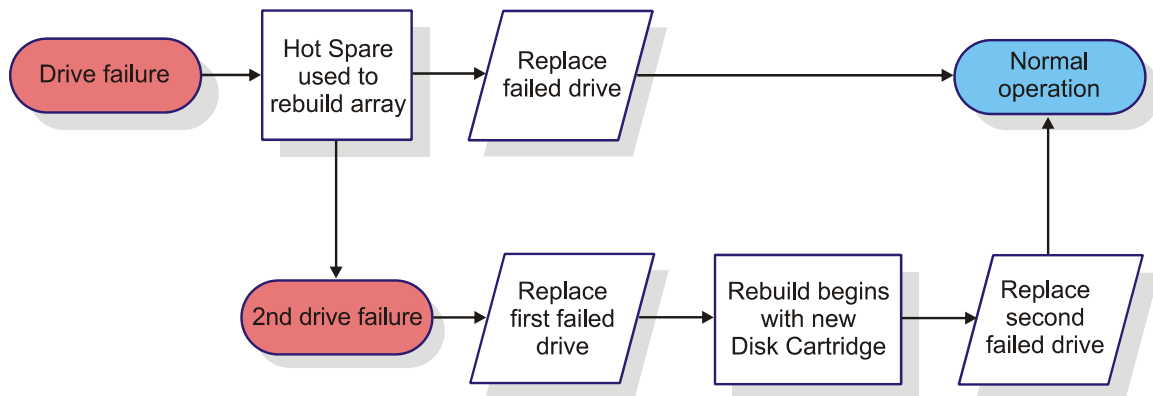
To restore the Server to the original level of fault protection, install a new Disk Cartridge as soon as practical. This Disk Cartridge becomes the Server's new Hot Spare. The replacement Hot Spare Disk Cartridge should have at least as much capacity as the largest capacity Disk Cartridge in the Server.



3.0 Remote Installations

In many installations it is not possible, or not practical, to replace a Disk Cartridge promptly when a drive fails. For example, a Kaleidescape System installed on a yacht may not be available for maintenance for weeks at a time. Or the System may be installed in a vacation home where a timely service call is not possible. In such installations, the Hot Spare greatly reduces the risk of losing content due to a second drive failing before a service call can be made. The 3U Kaleidescape Server will lose content only in rare cases: (1) when a second drive fails during a rebuild, or (2) when a third drive fails before any maintenance has been performed.

If there is a second drive failure before the Hot Spare Disk Cartridge is replaced, the Server enters degraded mode. Content that was stored on the second failed drive is still accessible via RAID-K, but content will be lost if a third drive fails. To prevent content loss, it is extremely important that you replace at least one of the failed drives as quickly as possible so that RAID-K rebuild can commence.



4.0 Examples

The following sections give examples of Server and Disk Cartridge behavior during normal operation and after one or two hard drives fail.

4.1 Normal Operation

When a 3U Server is functioning normally, the status lights on the Server's front bezel have a steady blue glow. All the Disk Cartridge LEDs are a steady blue except for the Hot Spare, which slowly blinks blue. The Hot Spare may be located in any slot.

4.2 Single Drive Failure

When a 3U Server experiences a single drive failure, the Server's front bezel will continue to glow blue while the Server enters degraded mode and begins an immediate rebuild with the Hot Spare. A steady blue LED on the Hot Spare indicates that it is now involved in the rebuild and is not available as a Hot Spare. Any imports already in progress will finish but new imports will not be permitted until the rebuild is complete. When the rebuild is complete, the Server exits degraded mode and resumes normal operation.

When the rebuild is complete, all the Disk Cartridge LEDs are a steady blue except for one. One Disk Cartridge displays an amber LED indicating it contains the failed drive. The former Hot Spare Disk Cartridge is now integrated into the RAID-K disk array. Without a Hot Spare, the Server continues to function normally and without any change in the user experience. To restore the Hot Spare feature, replace the failed drive with a new Disk Cartridge as soon as practical.

4.3 Second Drive Failure

If a 3U Server experiences a second drive failure before the first failed drive is replaced, the Server's front bezel will glow amber. The Server is now in degraded mode. Any imports already in progress will finish but new imports will not be permitted. The Server is now at risk of losing content if a third drive fails. All the Disk Cartridge LEDs are a steady blue except for two. These two Disk Cartridges display amber LEDs indicating that they contain the failed drives. The

Server requires one new Disk Cartridge immediately and a second new Disk Cartridge to restore the Hot Spare feature.

5.0 LED Indicators

The following table summarizes the Disk Cartridge LED and Server front bezel behavior.

Server	Disk Cartridge LEDs	Condition	Action Required
Blue	All blue, one with slow blink	Normal operation; Hot Spare is available.	No action required.
Blue	All blue except one amber	Normal operation; no Hot Spare is available.	Replace failed drive as soon as practical to restore Hot Spare feature.
Amber	All blue except two amber	Degraded mode; Hot Spare is not available and content is at risk if another drive fails.	Immediately replace at least one failed drive. Replace second failed drive as soon as practical.

6.0 Conclusion

The Hot Spare Disk Cartridge feature provides additional data protection for the 3U Server. The Hot Spare allows the rebuild process to begin sooner and significantly reduces the risk of content loss from a double-drive failure. It is still important to replace failed drives as quickly as practical. If you have further questions, please contact Kaleidescape Support at 650-625-6160 between 6 a.m. and 6 p.m. Pacific Time.