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Contents

Compaq Hot Plug Drive Carrier Enhancements

Abstract: High-speed, high-performance disk drives require robust mechanical mountings that allow the drives to operate within specifications for heat and rotational vibration. To satisfy these demanding requirements, as well as requirements for future drive interfaces, Compaq engineers have redesigned the Compaq Hot Plug Drive Carrier.

The new carrier allows single-handed addition or removal of hard drives without having to shut down the system or risk data loss. New features include increased cooling capacity and better damping of rotational vibration.

The new, innovative carrier design was recently named a winner of the 1999 Gold IDEA (Industrial Design Excellence Award) by the Industrial Designers Society of America (IDSA) and *Business Week* magazine.

The purpose of this document is to introduce the new Hot Plug Drive Carrier, detailing its benefits and features, as well as the innovation behind the design.

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Compaq Hot Plug Drive Carrier Enhancements
Technology Brief prepared by Storage Products Division

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Introduction

In today's mission-critical network environments, it is more important than ever that systems provide maximum availability and minimum downtime. Storage solution components should be able to support and even enhance that availability.

For this reason, Compaq redesigned the Hot Plug Hard Drive Carrier, which allows users to add or remove hard drives without shutting down the system or risking data loss. The new carrier provides increased cooling capacity for the high-speed, heat-generating drives of today and tomorrow, and features an enhanced ergonomic design for easier, more comfortable handling.

The following sections describe in detail the benefits and features of the new Compaq Hot Plug Hard Drive Carrier, and the reasons for its recent recognition by the Industrial Designers Society of America (IDSA).

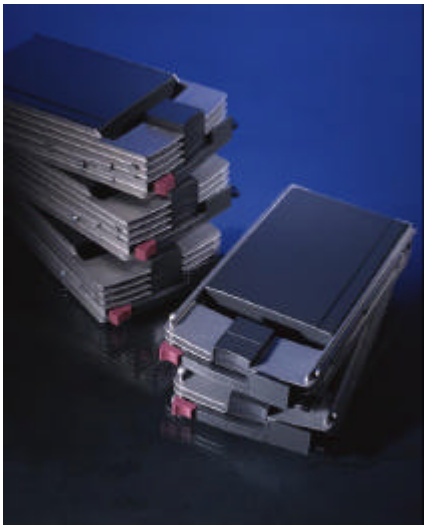


Figure 1. Compaq Hot Plug Hard Drive Carrier

Features and Benefits of the Compaq Hot Plug Hard Drive Carrier

Ultra2 SCSI Support

The new Hot Plug Hard Drive Carrier was designed exclusively for use in Compaq Ultra2-capable systems and future interface technologies. This ensures that single-ended hard drives (such as the Wide-Ultra SCSI) are not inadvertently inserted into Ultra2 systems. Only Ultra2-capable systems supporting a bus that is composed entirely of Ultra2-capable devices will be able to provide the increased data transfer rates available with Ultra2 SCSI.

Compact Design

The Hot Plug Drive Carrier minimizes the space required for each drive, which means up to 33 percent more drives can be inserted into a standard enclosure. For example, up to fourteen 1-inch

Ultra2 drives can be installed in the StorageWorks 4200 enclosure, providing 255 GB of disk capacity in each enclosure.

Note: The ability to accommodate 14 drives in a standard size shelf is a first for the storage products industry.

Direct-Connect Design

The Hot Plug Drive Carrier design features the direct-connect Single Connector Attach (SCA) interface, which connects the drive directly to the backplane. This open design produces a robust, reliable connectionthat delivers the signal integrity necessary for Ultra2 and future high-performance drive interfaces.

Improved Drive Cooling

Historically, hard drives have relied primarily on convection (the movement of air over the drive) for cooling. While the Hot Plug Drive Carrier incorporates this method of cooling, it also includes a thermal conduction feature. Much like heat sinks on microprocessors, dense metal fins attached to the drive conduct heat out of the drive to be cooled convectively. This advanced cooling design provides the thermal cooling characteristics that are required both for today's high-speed drives and tomorrow's ultra high-performance designs, such as 15,000 rpm drives and Fibre Channel interface drives.

Better Damping of Rotational Vibration

The Hot Plug Drive Carrier provides more secure drive mounting within the system chassis to minimize the effects of vibration and improve drive performance. While the faster 7,200 rpm and 10,000 rpm hard disk drives can significantly improve data transfer rates, these high-speed disks also tend to produce greater rotational vibration within the drive. Future high-capacity drives, with greatly increased number of tracks-per-inch (TPI), will require even more rigid mounting designs.

Greater Component Commonality throughout the Enterprise

The new Hot Plug Drive Carrier represents a major step toward Compaq's goal of achieving greater component commonality across the enterprise. The redesigned carrier is the foundation of Compaq Ultra2 Universal Disk Drives, which can be deployed on all Compaq Ultra2 servers and external storage solutions.

Enhanced Ergonomic Design

Based on years of feedback from customers and field representatives, Compaq has learned how to improve on the previous drive trays available in the field. The enhanced ergonomic design of the Hot Plug Hard Drive Carrier is intuitive and easy-to-use. The new carrier's ejection mechanism and handle allow users to use only one hand to eject devices from server and storage bays and carry them.

Unique Drive Height Converter

Compaq has designed a drive height converter (see Figure 2) that allows a 1-inch Ultra2 Universal Drive to be installed into a 1.6-inch drive bay, common in High Performance AlphaServers. The drive height converter simply snaps onto a 1-inch Universal Drive, providing seamless installation into the 1.6-inch drive bays of server or storage enclosures.

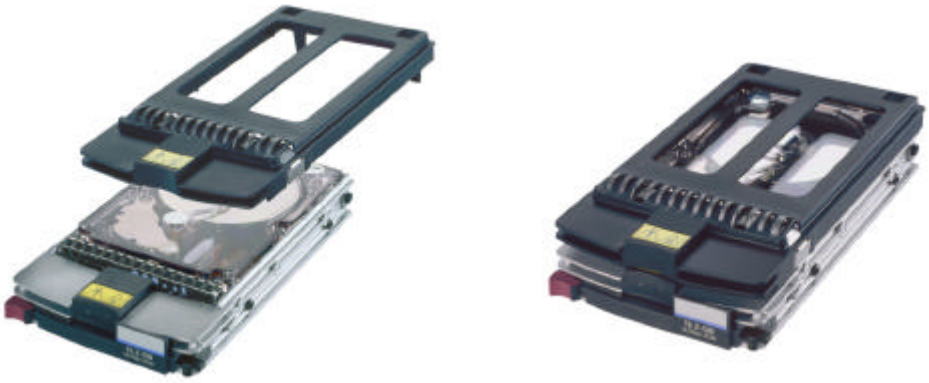
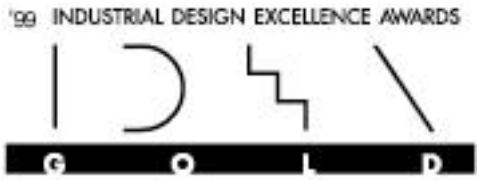


Figure 2. Compaq Hot Plug Drive Carrier Drive Height Converter

1999 Gold IDEA Design Award



Presented by the IDSA and sponsored by *Business Week* magazine, the Industrial Design Excellence Award (IDEA) has become the world's most prestigious annual recognition of excellence in the industrial design profession for the form, use, features, and interactive qualities of products, exhibits, and software.

The Compaq Hot Plug Hard Drive Carrier was named a 1999 Gold IDEA winner in the Business and Industrial Products category. The carrier was cited because it allows users to add or remove hard drives without losing data or shutting down the system.The carrier’s increased cooling capacity and ergonomic design also were praised.

"The lucid and appropriate use of materials in the design of this hard drive brings an uncommon beauty to an obscure computer peripheral. The exposed die cast aluminum fins clearly show the heat dissipation function. With this clever package, good design comes at half the manufacturing cost of prior models." (Sam Lucente, IDSA, Lucente Design Inc.)

Entries for the awards were submitted in 47 categories, ranging from cars and computers to museum exhibits and furniture. The jurors scored how well each entry fulfilled five criteria: design innovation, benefit to the user, benefit to the client/business, ecological responsibility,and appropriate aesthetics and appeal.

The award ceremony took place in Chicago on the evening of July 17, as the closing event of the 1999 IDSA National Conference. A gallery of the winners was featured at the conference, and is still available on the IDSA website:

www.idsa.org/idea99/

The goal of the IDEA is to foster business and public understanding about the impact of industrial design excellence on quality of life and the economy. The awards are presented annually by the IDSA, a nonprofit association that represents the industrial design profession to education, business, government, and the public, and serves the profession's needs for information and networking.

Conclusion

Development of the new Compaq Hot Plug Drive Carrier represents a major milestone in Compaq's realization of its Enterprise Network Storage Architecture vision. The Hot Plug Drive Carrier is a critical component for keeping disk drives operating within design specifications for heat and rotational vibration. Extensive engineering and research has been devoted to designing a carrier that satisfies the demanding requirements of today's high-performance disk drives, as well as those in the future. Compaq's receipt of the Gold IDEA has been an important acknowledgement of these efforts.