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Introduction to Adaptec SAS RAID

University Training Module

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Introduction

Adaptec SAS RAID adapters set the standard in storage solutions that protect data, maximize system performance, improve energy-efficiency, and reduce capital and operating expenses in today's most demanding storage environments.

Read on to learn more about Adaptec SAS RAID. At the completion of this module, you should be able to:

- Identify which types of devices and cables can be connected to an Adaptec SAS RAID adapter.
- Describe briefly such key Adaptec SAS RAID features as maxCache, Zero-maintenance Cache Protection, Hybrid RAID, Intelligent Power Management, and others.
- Explain how Adaptec RAID adapter model numbers offer easy clues to each adapter's main features.
- Understand the comparisons between different series of Adaptec RAID adapters.
- Name the three storage management utilities included with Adaptec SAS RAID adapters.

About Adaptec SAS RAID

A RAID adapter is a hardware device that can combine multiple disk drives into a single virtual disk drive to increase the capacity, performance, and/or reliability of a data storage system.

Adaptec SAS RAID adapters are installed inside server and workstation computers and are used to build direct-attached storage (DAS) systems. Disk drives are connected to the adapter individually by cable, or are installed in a storage enclosure that is connected to the adapter by cable.

Adaptec SAS RAID adapters support both Serial ATA (SATA) and Serial Attached SCSI (SAS) devices. You can connect these types of drives to an Adaptec SAS RAID adapter:

- SAS hard disk drives (HDDs)
- SATA HDDs
- SATA and SAS Solid State drives (SSDs)

Adaptec SAS Features

maxCache SSD Caching. Starting with the Series 5Q family of RAID adapters, Adaptec introduced maxCache SSD Read Caching to improve read performance and address the problems caused by the traditional processor-hard drive bottleneck.

maxCache 3.0 SSD Read and Write Caching, available for the first time on Series 7Q family of RAID adapters, further improves read performance and also provides safe write caching that boosts overall performance even more.

Note: maxCache SSD caching is available on Adaptec Q-model adapters only, such as the Adaptec RAID 7805Q. Learn more by completing the Adaptec University Training Module, [Introduction to maxCache SSD Caching](#).

Zero-maintenance Cache Protection (ZMCP). Starting with Adaptec Series 5Z RAID adapters, and incorporated as the standard method of protecting cache data starting with Series 6, Zero-Maintenance Cache Protection, or ZMCP (pronounced "zem-cap") represents an improvement over standard backup batteries.

ZMCP uses flash memory to save cache data in the event of a power failure. Flash memory is a type of solid state memory that's non-volatile, which means it can retain stored information even when not being powered—like a USB thumb drive or a memory card on a digital camera.

With ZMCP 3.0, the flash memory and control circuitry is embedded on the RAID adapter, instead of on a daughterboard, for more integrated cache protection.

Note: ZMCP comes pre-installed on or as an optional add-on for most, but not all, Adaptec RAID adapters. Learn more by completing the Adaptec University Training Module, [Introduction to Zero-Maintenance Cache Protection](#).

Hybrid RAID. Hybrid RAID 1 and 10 lets a user combine Solid State Drives (SSDs) and Hard Disk Drives (HDDs) in one mirroring array (either RAID 1 or RAID 10). Hybrid RAID speeds up performance by reading only from SSDs, and writing to both SSDs and HDDs.

Hybrid RAID is available on all Adaptec RAID adapters.

Note: Learn more by completing the Adaptec University Training Module, [Introduction to Hybrid RAID](#).

Intelligent Power Management. A configurable feature that lets the user set their RAID adapter to one of two power- and cost-saving modes:

- **Standby mode**—The RAID adapter automatically spins drives that are not in use at lower RPMs.
- **Power-off mode**—The RAID adapter automatically spins down drives that are not in use.

Intelligent Power Management reduces disk drive energy use by up to 70% without compromising application performance.

Intelligent Power Management is available on all Adaptec RAID adapters.

Note: Learn more by completing the Adaptec University Training Module, [Introduction to Intelligent Power Management](#).

Flexible Configuration. Adaptec RAID adapters (starting with Series 7) include Adaptec Flexible Configuration, which includes two key features:

- **Support for drives in varying functional states**—In addition to supporting arrays and simple volumes, adapters with Flexible Configuration simultaneously support physical drives in three states: raw (same as factory-fresh), ready (initialized), and member (part of a RAID array or logical drive).
- **Four operational modes instead of one**—You can use the adapter in any of these four modes:
 - RAID Show Raw Mode—The adapter functions as a traditional RAID adapter and shows any raw drive to the operating system.
 - RAID Hide Raw Mode—The adapter functions as a traditional RAID adapter and hides any raw drive from the operating system.
 - Auto-Volume (AV) Mode—The adapter functions as a traditional RAID adapter; however, any brand-new or uninitialized drive that is connected to it is automatically converted into a simple volume. No user intervention is required.
 - Host Bus Adapter (HBA) Mode—The adapter operates as a standard host bus adapter (HBA).

Note: Learn more by completing the Adaptec University Training Module, [Introduction to Flexible Configuration](#).

Mini-SAS-HD Connectors. mini-SAS-HD connectors give you greater flexibility and more configuration options by supporting a high number of SAS/SATA ports on one RAID adapter. Depending on which model you choose, you can directly connect up to 16 devices to a low-profile Series 8 RAID adapter without using an expander

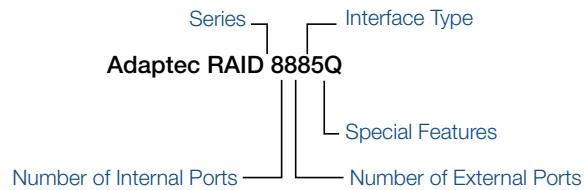
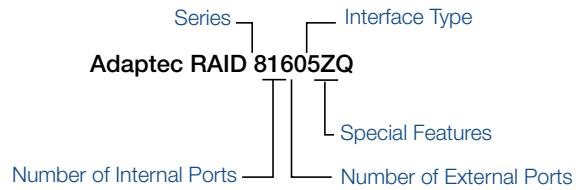
Adaptec RAID Features

These RAID features are common across all Adaptec SAS RAID adapters:

- Performance modes that optimize performance based on how a RAID adapter is being used:
 - Dynamic mode—(Default) The performance mode adjusts automatically based on usage, RAID level, and drive type.
 - OLTP mode—RAID adapter performance is optimized for transaction-oriented applications, such as data entry and retrieval.
 - Big Block Bypass mode—RAID adapter performance is optimized for Web page and file serving, and for data retrieval. In Big Block Bypass mode, the write cache is bypassed based on I/O write size.
- Key software features:
 - Array migration support, so that you can migrate an array from one RAID level to another (some limitations apply)
 - Audible alarm
 - Automatic failover support, so arrays are automatically rebuilt when a failed drive is replaced (applies to redundant arrays in SES2- or SAF-TE-enabled disk drive enclosures only)
 - Background initialization, which lets you use an array while it's being initialized
 - Battery backup (not available on all RAID adapter models; additionally, some RAID adapter models feature ZMCP instead of a backup battery unit)
 - Bootable array support
 - Configurable stripe size
 - Copyback Hot Spare support
 - Disk drive hot-swapping
 - Dynamic sector repair, which allows the RAID adapter to recover from disk drive errors that would normally cause a degraded array
 - Enclosure support for disk drive enclosures with SES2 enclosure management hardware
 - Event logging and broadcasting including email and SNMP messages
 - Flash ROM for updates to adapter firmware, BIOS, and the Adaptec RAID Configuration utility
 - Hot spare (global and dedicated) support
 - I/O statistics logging
 - Native command queuing (NCQ), which lets disk drives arrange commands into the most efficient order for optimum performance
 - Online capacity expansion, so you can increase the capacity of a logical drive without recreating it (some limitations apply)
 - Optimized disk utilization, which ensures that the full capacity of all disk drives can be used, even if the disk drives vary in size
 - Quick initialization
 - S.M.A.R.T. support
 - Staggered drive spin-up

About RAID Adapter Model Numbers

Model numbers offer easy clues to each adapter's main features:



The interface type number denotes PCIe. All Series 7 and later RAID adapters are 8-lane PCIe Gen 3. All Series 6 RAID adapters are PCIe Gen 2.

The special features available on the Series 8 RAID adapters have these letter codes:

- **No letter**—A mainstream RAID adapter.
For example, Adaptec RAID 8805.
- **Z**—A Series 8 RAID adapter with embedded flash backup
For example, Adaptec 81605ZQ
- **Q**—A RAID adapter with maxCache capability.
For example, Adaptec RAID 8885Q.
- **T**—A RAID adapter with top-mounted connectors.
For example, Adaptec RAID 6805T.
- **E**—An entry-level RAID adapter with limited RAID features.
For example, Adaptec RAID 71605E.

Note: Some model numbers use more than one letter to indicate the RAID adapter's features. For example, the Adaptec RAID 81605ZQ has embedded flash backup and maxCache.

Comparing Key Features of Adaptec RAID Adapters

This table compares the key features of current and previous series of Adaptec SAS RAID adapters:

		Adaptec SAS RAID Adapter Features					Cache Features		Mgmt Tools
Adapter Series	Speed	maxCache Support	ZMCP	Hybrid RAID	Intelligent Power Mgmt	Flexible Configuration	Cache Memory ^a	Cache Protection	MSM/ACU/ARCCONF/uEFI
Series 8Q	12 Gb/s	★ maxCache 3.0	★	★	★	★	1024 MB DDR3 (Included ^b)	★	★
Series 8Z	12 Gb/s		★	★	★	★	1024 MB DDR3 (Included ^b)	★	★
Series 8	12 Gb/s		★	★	★	★	1024 MB DDR3 (Optional ^b)	★	★
Series 7Q	6 Gb/s	★ maxCache 3.0	★	★	★	★	1024 MB DDR3 (Included ^b)	★	★
Series 7	6 Gb/s		★	★	★	★	1024 MB DDR3 (Optional ^b)	★	★
Series 7E	6 Gb/s			★	★	★	256 MB DDR3		★
Series 6Q	6 Gb/s	★ maxCache	★	★	★		512 MB DDR2 (Included ^c)		★
Series 6	6 Gb/s		★	★	★		512 MB DDR2 (Optional ^c)	★	★
Series 6T	6 Gb/s		★	★	★		512 MB DDR2 (Optional ^c)	★	★
Series 6E	6 Gb/s			★	★		128 MB DDR2		★

a. On-board memory is not expandable.

Adaptec RAID adapters use a portion of installed memory for the on-board microprocessor. This means that the available I/O cache capacity is less than the actual amount of memory installed. Additional memory (approximately 12%) is allocated for RAID 6 operations (if RAID 6 is being used).

b. Adaptec Flash Module AFM-700. The Adaptec RAID 81605ZQ has flash backup embedded on the card; the Adaptec RAID 8885Q includes flash backup on a pre-installed daughterboard.

c. Adaptec Flash Module AFM-600.

Read more about each RAID adapter series and learn more technical details about individual RAID adapter models in the series-specific Adaptec University Training Modules, such as *Adaptec Series 8 RAID Adapters*.

Adaptec SAS Cables

This table shows all available Adaptec SAS cables. You can use any of these cables to connect disk drives or storage enclosures to an Adaptec SAS RAID adapter, depending on system requirements:

The Adaptec 12Gb SAS HD Cable Family

Internal mini-SAS-HD x4 (SFF-8643) to mini-SAS-HD x4 (SFF-8643) cable

Connect a Series 8 SAS/SATA RAID adapter to a SAS/SATA backplane with mini-SAS HD connectors

- **Model Number:** ACK-I-HDmSAS-HDmSAS-.5M
Part Number: 2282200-R
Dimension: 0.5 Meter
 - **Model Number:** ACK-I-HDmSAS-HDmSAS-1M
Part Number: 2282100-R
Dimension: 1.0 Meter
-



Internal right-angle mini-SAS-HD x4 (SFF-8643) to mini-SAS-HD x4 (SFF-8643) cable

Connect a Series 8 SAS/SATA RAID adapter to a SAS/SATA backplane with mini-SAS HD connectors

- **Model Number:** ACK-I-rA-HDmSAS-HDmSAS-.5M
Part Number: 2282500-R
Dimension: 0.5 Meter
 - **Model Number:** ACK-I-rA-HDmSAS-HDmSAS-1M
Part Number: 2282800-R
Dimension: 1.0 Meter
-



External mini-SAS-HD x4 (SFF-8644) to mini-SAS-HD x4 (SFF-8644) cable

Connect a Series 8 RAID adapter to an external storage enclosure or tape drive

- **Model Number:** ACK-E-HDmSAS-HDmSAS-2M
Part Number: 2282600-R
Dimension: 2.0 Meters
-



The Adaptec 6Gb SAS HD Cable Family

Internal mini-SAS-HD x4 (SFF-8643) to mini-SAS (SFF-8087) x 4 cable

Connect a Series 7/7Q RAID adapter or Series 7H host bus adapter to a SAS/SATA backplane

- **Model Number:** ACK-I-HDmSAS-mSAS-1M
- Part Number:** 2279700-R
- Dimension:** 1.0 Meter



Internal right-angle mini-SAS-HD x4 (SFF-8643) to mini-SAS (SFF-8087) x4 cable

Connect a Series 7/7Q RAID adapter or Series 7H host bus adapter to a SAS/SATA backplane

- **Model Number:** ACK-I-rA-HDmSAS-mSAS-.8M
- Part Number:** 2280200-R
- Dimension:** 0.8 Meter



Internal mini-SAS-HD x4 (SFF-8643) to (4) x1 SATA (adapter based) fan-out cable with sideband signals

Connect a Series 7/7Q RAID adapter or Series 7H host bus adapter to SATA drives or a SAS/SATA backplane

- **Model Number:** ACK-I-HDmSAS-4SATA-SB-.8M
- Part Number:** 2279800-R
- Dimension:** 0.8 Meter



Internal right-angle mini-SAS-HD x4 (SFF-8643) to (4) x1 SATA (adapter based) fan-out cable with sideband signals

Connect a Series 7/7Q RAID adapter or Series 7H host bus adapter to SATA drives or a SAS/SATA backplane

- **Model Number:** ACK-I-rA-HDmSAS-4SATA-SB-.8M
- Part Number:** 2280000-R
- Dimension:** 0.8 Meter



Internal right-angle mini-SAS-HD x4 (SFF-8643) to right-angle (4) x1 SATA fan-out cable with sideband signals

Connect a Series 7/7Q RAID adapter or Series 7H host bus adapter to SATA drives or a SAS/SATA backplane

- **Model Number:** ACK-I-rA-HDmSAS-4rASATA-SB-.8M
- Part Number:** 2279900-R
- Dimension:** 0.8 Meter



Internal mini-SAS-HD x4 (SFF-8643) to (4) x1 SAS (SFF-8482 adapter based) fan-out cable with sideband signals

Connect a Series 7/7Q or 8/8Q RAID adapter or Series 7H host bus adapter to SAS drives

- **Model Number:** ACK-I-HDmSAS-4SAS-SB-.8M
- Part Number:** 2280100-R
- Dimension:** 0.8 Meter



Internal right-angle mini-SAS-HD x4 (SFF-8643) to (4) x1 SAS (SFF-8482, adapter based) fan-out cable with sideband signals

Connect a Series 7/7Q or 8/8Q RAID adapter or Series 7H host bus adapter to SAS drives

- **Model Number:** ACK-I-rA-HDmSAS-4SAS-SB-.8M
- Part Number:** 2279600-R
- Dimension:** 0.8 Meter



External mini-SAS-HD x4 (SFF-8644) to external mini-SAS (SFF-8088) cable

Connect a Series 7/7Q RAID adapter or Series 7H host bus adapter to an external storage enclosure or tape drive

- **Model Number:** ACK-E-HDmSAS-E-mSAS-2M
- Part Number:** 2280300-R
- Dimension:** 2.0 Meters



Managing SAS RAID Adapters

Adaptec SAS RAID adapters come with three storage management tools: a software application, a command-line utility, and a BIOS-based utility.

Adaptec maxView Storage Manager. (Available starting with Adaptec Series 7 RAID adapters) Adaptec maxView Storage Manager (MSM) is a full-featured software application that helps you build a storage space for your online data. Using MSM, you can:

- Create, modify, and delete logical drives (also known as arrays)
- Protect your data by creating and managing hot spares and creating snapshots
- Manage all your RAID adapters, disk drives, and enclosures
- Monitor your entire storage space
- Recover from disk drive failures and troubleshoot your system

Complete MSM instructions are available in the *Adaptec maxView Storage Manager User's Guide*, available on the Microsemi Web site at www.microsemi.com.

Note: Learn more by completing the Adaptec University Training Module, *Introduction to Adaptec maxView Storage Manager*.

Adaptec RAID Controller Configuration (ARCCONF). ARCCONF is a command line utility that you can use to perform basic array and configuration management functions. Using ARCCONF, you can:

- Create and delete logical drives
- Modify and copy configuration settings
- Recover from disk drive failures and troubleshoot your system

A complete description of ARCCONF is available in the Adaptec RAID Controller Command Line Utility User's Guide, available on the Microsemi Web site at www.microsemi.com.

Adaptec RAID Configuration Utility (ARC). The Adaptec RAID Configuration (ARC) utility is a BIOS-based utility that you can use to create and manage adapters, disk drives and other devices, and arrays. The ARC utility comprises these tools:

- **Array Configuration Utility (ACU)**—For creating and managing arrays, and initializing and rescanning disk drives
- **SerialSelect**—For modifying your adapter and disk drive settings
- **Disk Utilities**—For formatting or verifying disk drives

The ARC utility is included in each RAID adapter's BIOS. A complete description of ARCCONF is available in the Adaptec RAID Controller Installation and User Guide, available at www.microsemi.com.



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