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Installation and User's Guide

Serial Attached SCSI RAID Controllers

Released

June 2017



Revision History

Issue	Issue Date	Details of Change
1	April 2016	Update supported OSes; add backup unit status, SGPIO/IPBI LED blink pattern, DKMS drivers, misc corrections.
2	September 2016	Update supported OSes, Installing driver on Solaris, and Technical Specification.
3	October 2016	Add support for 8405E and 8805E SAS RAID controllers.
4	June 2017	Updated supported OSes; add DKMS installation instructions.

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Limited 3-Year Hardware Warranty

1. Microsemi Corporation (“Microsemi”) warrants to the purchaser of this product that it will be free from defects in material and workmanship for a period of three (3) years from the date of purchase. If the product should become defective within the warranty period, Microsemi, at its option, will repair or replace the product, or refund the purchaser's purchase price for the product, provided it is delivered at the purchaser's expense to an authorized Microsemi service facility or to Microsemi.
2. Repair or replacement parts or products will be furnished on an exchange basis and will either be new or reconditioned and will be subject to original warranty term. All replaced parts or products shall become the property of Microsemi. This warranty shall not apply if the product has been damaged by accident, misuse, abuse or as a result of unauthorized service or parts.
3. Warranty service is available to the purchaser by delivering the product during the warranty period to an authorized Microsemi service facility or to Microsemi and providing proof of purchase price and date. The purchaser shall bear all shipping, packing, and insurance costs and all other costs, excluding labor and parts, necessary to effectuate repair, replacement or refund under this warranty.
4. For more information on how to obtain warranty service, click on the Services & Support link at microsemi.com.
5. THIS LIMITED WARRANTY DOES NOT EXTEND TO ANY PRODUCT WHICH HAS BEEN DAMAGED AS A RESULT OF ACCIDENT, MISUSE, ABUSE, OR AS A RESULT OF UNAUTHORIZED SERVICE OR PARTS.
6. THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESS WARRANTIES WHICH NOW OR HEREAFTER MIGHT OTHERWISE ARISE RESPECT TO THIS PRODUCT. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT SHALL (A) HAVE NO GREATER DURATION THAN 3 YEARS FROM THE DATE OF PURCHASE, (B) TERMINATE AUTOMATICALLY AT THE EXPIRATION OF SUCH PERIOD AND (C) TO THE EXTENT PERMITTED BY LAW BE EXCLUDED. IN THE EVENT THIS PRODUCT BECOMES DEFECTIVE DURING THE WARRANTY PERIOD, THE PURCHASER'S EXCLUSIVE REMEDY SHALL BE REPAIR, REPLACEMENT OR REFUND AS PROVIDED ABOVE. INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION LOSS OF DATA, ARISING FROM BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ARE NOT THE RESPONSIBILITY OF MICROSEMI AND, TO THE EXTENT PERMITTED BY LAW, ARE HEREBY EXCLUDED BOTH FOR PROPERTY DAMAGE, AND TO THE EXTENT NOT UNCONSCIONABLE, FOR PERSONAL INJURY DAMAGE.
7. WITHIN THE US, SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, AND SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION OR EXCLUSIONS MAY NOT APPLY TO YOU.
8. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY DEPENDING ON WHERE YOU RESIDE.
9. FOR AUSTRALIA RESIDENTS, IF THE PRODUCT SHOULD BECOME DEFECTIVE WITHIN THE WARRANTY PERIOD, MICROSEMI, AT ITS OPTION, WILL REPAIR OR REPLACE THE PRODUCT, OR REFUND THE PURCHASER'S PURCHASE FOR THE PRODUCT, PROVIDED IT IS DELIVERED AT THE PURCHASER'S EXPENSE BACK TO THE PLACE OF PURCHASE AFTER MICROSEMI TECHNICAL SUPPORT HAS ISSUED AN INCIDENT NUMBER. IN ADDITION TO THE WARRANTIES SET FORTH HEREIN, OUR GOODS COME WITH GUARANTEES THAT CANNOT BE EXCLUDED UNDER THE AUSTRALIAN CONSUMER LAW. YOU ARE ENTITLED TO A REPLACEMENT OR REFUND FOR A MAJOR FAILURE AND FOR COMPENSATION FOR ANY OTHER REASONABLY FORESEEABLE LOSS OR DAMAGE. YOU ARE ALSO ENTITLED TO HAVE THE GOODS REPAIRED OR REPLACED IF THE GOODS FAIL TO BE OF ACCEPTABLE QUALITY AND THE FAILURE DOES NOT AMOUNT TO A MAJOR FAILURE.

Regulatory Compliance Statements

Federal Communications Commission Radio Frequency Interference Statement

Attention: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. However, if this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.
- Use a shielded and properly grounded I/O cable and power cable to ensure compliance of this unit to the specified limits of the rules.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

UL Compliance Statement

Microsemi Adaptec products are tested and listed by Underwriters Laboratories, Inc. to UL 60950-1 Second Edition and IEC-60950-1 Second Edition standards, file numbers E175975. Microsemi Adaptec products are for use only with UL listed ITE.

Microsemi Corporation	**Use only with the listed ITE:**
	ASR-6405/ASR-6445/ASR-6805/ ASR-6405E/ASR-6805E/ASR-6805E R5/ASR-6805Q/ ASR-6405T/ASR-6805T/ASR-6805TQ/ ASR-7805/ASR-7805Q/ASR-71605/ ASR-71605E/ASR-71605Q/ASR-71685/ ASR-72405/AFM 700 ASR-6405/ASR-6445/ASR-6805/ ASR-6405E/ASR-6805E/ASR-6805E R5/ASR-6805Q/ ASR-6405T/ASR-6805T/ASR-6805TQ/ ASR-7805/ASR-7805Q/ASR-71605/ ASR-71605E/ASR-71605Q/ASR-71685/ ASR-72405/ASR-78165/ ASR-8405/ASR-8405E/ASR-8805/ASR-8805E/ASR-8885/ ASR-8885Q/ASR-81605Z/ASR-81605ZQ/ AFM-700

Tested to Comply With FCC Standards

FOR HOME OR OFFICE USE

European Union Compliance Statement

This Information Technology Equipment has been tested and found to comply with EMC Directive 2014/30/EU, in accordance with:

- EN55032 (2014) Emissions:
  - Class B ITE radiated and conducted emissions
- EN55024 (2010) Immunity:
  - EN61000-4-2 (2009) Electrostatic discharge: ±4 kV contact, ±8 kV air
  - EN61000-4-3 (2010) Radiated immunity: 3V/m
  - EN61000-4-4 (2012) Electrical fast transients/burst: ±1 kV AC, ±0.5 kV I/O
  - EN61000-4-5 (2014) Surges: ±1 kV differential mode, ±2 kV common mode
  - EN61000-4-6 (2014) Conducted immunity: 3 V
  - EN61000-4-11 (2004) Supply dips and variations: 30% and 100%
- EN50581 (2012) Technical Documentation:
  - For the assessment of electrical and electronic products with respect to the restriction of hazardous substances

In addition, all equipment requiring U.L. listing has been found to comply with EMC Directive 2014/35/EU, in accordance with EN60950 with amendments A1, A2, A3, A4, A11, A12.

Australian/New Zealand Compliance Statement

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to the Australian/New Zealand standard AS/NZS 3548 set out by the Spectrum Management Agency.

Canadian Compliance Statement

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Japanese Compliance (Voluntary Control Council Initiative)

This equipment complies to class B Information Technology equipment based on VCCI (Voluntary Control Council for Interface). This equipment is designed for home use but it may causes radio frequency interference problem if used too near to a television or radio. Please handle it correctly per this documentation.

Korean Compliance (KCC) Statement

Microsemi Adaptec products are tested and certified by KCC:

KCC-REM-KHK-ASR-6xx5
KCC-REM-KHK-ASR-7xxx5

KCC-REM-KHK-ASR-6xx5
KCC-REM-KHK-ASR-7xxx5
MSIP-REM-KHK-ASR-8xxx5

The above certification covers the following series:

ASR-6805, ASR-6445, ASR-6405
ASR-6805E, ASR-6405E, ASR-6805Q

ASR-6805T, ASR-6405T, ASR-6805TQ
ASR-7805, ASR-7805Q, ASR-71605
ASR-71605E, ASR-71605Q
ASR-71685, ASR-72405

ASR-6805, ASR-6445, ASR-6405
ASR-6805E, ASR-6405E, ASR-6805Q
ASR-6805T, ASR-6405T, ASR-6805TQ
ASR-7805, ASR-7805Q, ASR-71605
ASR-71605E, ASR-71605Q
ASR-71685, ASR-72405, ASR-78165
ASR-8405, ASR-8405E, ASR-8805, ASR-8805E, ASR-8885
ASR-8885Q, ASR-81605Z, ASR-81605ZQ
AFM-700

B급 기기
(가정용 방송통신기자재)
Class B Equipment
(For Home Use Broadcasting & Communication Equipment)
이 기기는 가정용(B급) 전자파적합기기로서 주
로 가정에서 사용하는 것을 목적으로 하며, 모
든 지역에서 사용할 수 있습니다.

This equipment is home use (Class B) electromagnetic wave suitability equipment and to be used mainly at home and it can be used in all areas.

1 About This Guide

This Installation and User's Guide explains how to install your Microsemi® Adaptec® RAID controller. It also describes the utilities included in your controller kit, and provides a basic overview of Serial Attached SCSI (SAS) and Redundant Array of Independent Disk (RAID) technology.

These Microsemi Adaptec Serial Attached SCSI RAID (ASR) controller models are described in this guide:

- ASR-6405, ASR-6405E, ASR-6405T
- ASR-6445
- ASR-6805, ASR-6805Q, ASR-6805E, ASR-6805E R5, ASR-6805T, ASR-6805TQ
- ASR-7805, ASR-7805Q
- ASR-71605, ASR-71605E, ASR-71605Q
- ASR-71685
- ASR-72405
- ASR-78165
- ASR-8405, ASR-8405E
- ASR-8805, ASR-8805E
- ASR-8885, ASR-8885Q
- ASR-81605Z, ASR-81605ZQ

1.1 What You Need to Know Before You Begin

You should be familiar with computer hardware, data storage, RAID technology, and SAS and Serial ATA (SATA) technology. (For more information about SAS technology, see Introduction to SAS on page 76.)

You should also be familiar with direct-attached storage (DAS) concepts and technology.

> **Note:** Because this guide covers multiple Microsemi Adaptec RAID products, some of the features and functions described may not be available for your controller. For more information, see About Your RAID Controller on page 16.

1.2 Terminology Used in this Guide

Because you can use your Microsemi Adaptec RAID controller to manage data storage in a variety of configurations, the generic term “storage space” is used to refer to controller(s) and disk drives being managed with Microsemi Adaptec maxView Storage Manager™ (called simply maxView Storage Manager in the remainder of this guide) or the other utilities described in this guide.

Many of the terms and concepts referred to in this guide are known to computer users by multiple names. This guide uses these terms:

- Controller (also known as adapter, board, or card)
- Disk drive (also known as hard disk, hard drive, or hard disk drive)
- Solid State Drive (also known as SSD or non-rotating storage media)
- Enclosure (also known as a RAID enclosure, storage enclosure, or disk drive enclosure)
- Array (also known as a container, logical device, or logical drive)

  > **Note:** maxView Storage Manager refers to arrays as logical drives. Your RAID controller creates *arrays*, which your operating system (and maxView Storage Manager) recognizes as *logical drives*. For more information, refer to the *maxView Storage Manager User’s Guide*.

1.3 How to Find More Information

You can find more information about your Microsemi Adaptec RAID controller and utilities software by referring to these documents, available for download at start.microsemi.com.

- *Readme.txt*—Includes updated product information and known issues.

- *maxView Storage Manager User's Guide for Microsemi ARC-Family Controllers*—Describes how to install and use the maxView Storage Manager software (see About maxView Storage Manager on page 71) to manage direct attached storage on Microsemi Adaptec Series 6/7/8 controllers.

  Note: In the remainder of this guide, this manual is referred to simply as the *maxView Storage Manager User's Guide*.
- *maxView Storage Manager Online Help*—Describes how to use the maxView Storage Manager software; accessible from the main window of maxView Storage Manager.
- *Microsemi Adaptec RAID Controller Command Line Utility User's Guide*—Describes how to use the included Microsemi Adaptec RAID Controller Configuration (ARCCONF) command line utility (see About the Microsemi Adaptec RAID Controller Configuration Utility on page 71) to perform basic array and configuration management functions.
- *Microsemi Adaptec Event Monitor User's Guide*—Describes how to use the Event Monitor utility to monitor the Microsemi Adaptec storage controllers installed on your system

2 Kit Contents and System Requirements

This chapter describes the contents of your Microsemi Adaptec RAID controller kit and the system requirements that must be met for you to successfully install and use your controller.

2.1 Kit Contents

- Microsemi Adaptec RAID controller
- Cables (Not included in Microsemi Adaptec 'Single' product. If your kit includes cables, the type and quantity vary—for more information, see Cables on page 37.)
- (*Select models only*) Low-profile bracket

  Note: The latest firmware, controller drivers, utilities (maxView Storage Manager, ARCCONF CLI) and documentation can be downloaded at start.microsemi.com. See Creating a Driver Disk on page 54 for information about downloading drivers.

2.2 System Requirements

- PC-compatible computer with Intel Pentium, or equivalent, processor
- Motherboard with these features:
  - Support for multi-function devices where one of the devices is a PCI bridge
  - Large memory-mapped address ranges

  Refer to the Readme for additional motherboard compatibility information.
- One of these operating systems:
  - Microsoft® Windows® Server 2016 964-bit), Windows Server 2012 R2 (64-bit), Windows Server 2012 (64-bit), Windows Server 2008 R2, R2 SP1 (64-bit), Windows SBS 2011 Standard and Essential (64-bit), Windows 7, Windows 8.1, Windows 10, Windows PE 5.x (64-bit)
  - Red Hat® Enterprise Linux 7.2, 7.1, 6.8, 6.7, 5.11, 5.10 (64-bit)
  - SuSE Linux Enterprise Server 12, 12 SP1, 11 SP3 and SP4 (64-bit)
  - FreeBSD 10.3, 10.2 (64-bit)
  - Debian Linux 8.1 (64-bit)
  - Ubuntu Linux 16.04, 14.04.4 (64-bit)
  - Fedora Linux 22 (64-bit)
  - CentOS 7.3, 7.2, 7.1, 6.8, 6.7, 5.11, 5.10 (64-bit)
  - vSphere 6.0, 6.0 U2
  - Solaris 11, 10 U9 (64-bit)
  - VMware ESXi 6.0, VMware ESXi 5.5 U2, 5.5 U3 (64-bit)
  - Citrix XenServer 6.5.1 (64-bit)

    Note: Refer to the Readme for up-to-date operating system version support, or check the Knowledgebase at www.adaptec.com. From the main menu, select **Support>Knowledgebase> Answers>Advanced Search**. Select your controller, limit the category by OS Support, then click **Search**.
- 4 GB of RAM minimum
- Available compatible PCIe slot (depending on your controller model—see the descriptions in About Your RAID Controller on page 16)
- 350 MB of free disk drive space
- USB flash drive or CD burner, for creating driver disks and bootable media

3 About Your RAID Controller

This chapter provides an overview of the features of your Microsemi Adaptec RAID controller.

3.1 Standard RAID Controller Features

- Support for SAS and SATA Hard Disk Drives (HDD) and Solid State Drives (SSD)
- Flash ROM for updates to controller firmware, BIOS, and the Microsemi Adaptec RAID Configuration utility
- Disk drive hot-swapping
- Event logging and broadcasting, including email notification messages
- Multiple options for creating and managing RAID arrays—A browser-based software application (maxView Storage Manager), a BIOS-based utility (ARC), a command line utility (ARCCONF) (see Managing Your Storage Space on page 71)
- Native command queuing (NCQ), which lets disk drives arrange commands into the most efficient order for optimum performance
- Support for disk drive enclosures with SES2 enclosure management hardware
- Support for a flash backup module (see Adding a Flash Backup Module on page 17)
- Support for Microsemi Adaptec maxCache™ SSD read and write caching (see Modifying Cache Settings on page 91)

  Note: maxCache is supported on Microsemi Adaptec Series Q controllers only.

- Power-management of disk drives in your storage space to reduce cooling and electricity costs (see Modifying Power Management Settings on page 91)
- Audible alarm
- I/O statistics logging

3.1.1 Array-level Features

Note: Not all features are supported by all controllers. For more information, see the *maxView Storage Manager User's Guide*.

- Support for RAID 0, RAID 1, RAID 5, RAID 10, RAID 50, and simple volumes
- Support for hybrid RAID 1 and RAID 10 arrays comprised of hard drives and Solid State Drives (SSDs)
- (*Microsemi Adaptec Series 6 Controllers Only)* Support for JBOD disks (appear as a physical disk drives to the operating system; not redundant)
- Support for hot spares (global and dedicated)
- Support for automatic failover, 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*)
- Optimized disk utilization, which ensures that the full capacity of all disk drives can be used, even if the disk drives vary in size
- Online capacity expansion, so you can increase the capacity of an array without recreating it
- Support for array migration from one RAID level to another

3.1.2 Advanced Data Protection Suite

- Copyback Hot Spare—You can use this feature to move data from a hot spare back to its original location after a failed disk drive is replaced.
- Striped Mirror (RAID 1E)—A RAID 1 Enhanced array is similar to a RAID 1 array except that data is both mirrored *and* striped, and more disk drives can be included.
- (*Microsemi Adaptec Series 6 Controllers Only)* Hot Space (RAID 5EE)—A RAID 5EE array is similar to a RAID 5 array except that it includes a distributed spare and must be built from a minimum of four disk drives.
- Dual Drive Failure Protection (RAID 6)—A RAID 6 array is similar to a RAID 5 array except that it includes *two* independent sets of parity data instead of one.
- Dual Drive Failure Protection (RAID 60)—A RAID 60 array is similar to a RAID 50 array except that it includes *four* independent sets of parity data instead of two.

3.2 Adding a Flash Backup Module

This table shows the flash backup module (or “zero maintenance cache protection”) supported by your Microsemi Adaptec RAID controller. To purchase a flash backup module, visit www.adaptec.com.

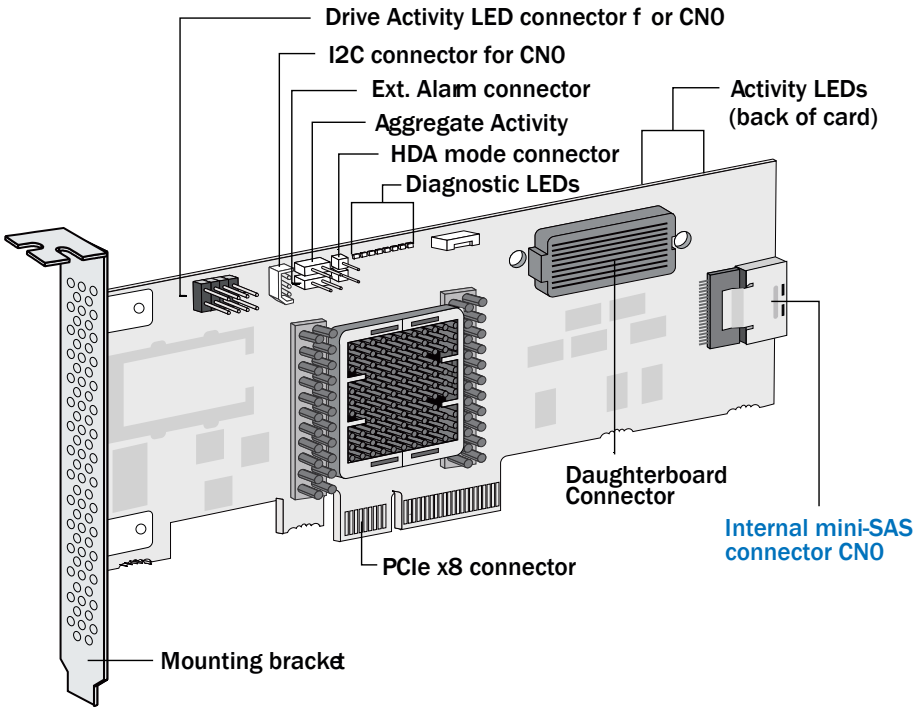
RAID Controller	Flash Module
Microsemi Adaptec RAID 6805/6445/6405/6805T/6405T	Flash Backup Module AFM-600 with Supercapacitor module (optional)
Microsemi Adaptec RAID 6805Q/6805TQ	Flash Backup Module AFM-600 with Supercapacitor module (pre-installed)
Microsemi Adaptec RAID 7805/71605/71685/72405/78165/8405/8805/8885	Flash Backup Module AFM-700 with Supercapacitor module (optional)
Microsemi Adaptec RAID 7805Q/71605Q/8885Q	Flash Backup Module AFM-700 with Supercapacitor module (pre-installed)
Microsemi Adaptec RAID 81605Z/81605ZQ	Flash Backup Module AFM-700 with Supercapacitor module (integrated)

3.3 Upgrading the Controller Firmware

You can upgrade the firmware on your Microsemi Adaptec RAID controller using the Adaptec Flash Utility or from the computer's uEFI BIOS. Follow the instructions in Using_the_Adaptec_Flash_Utility on page 103 or Updating the Controller Firmware on page 100. You can also upgrade the controller firmware with maxView Storage Manager and the ARCCONF command-line utility. Refer to the *maxView Storage Manager User's Guide* and the *Microsemi Adaptec Command Line Interface User's Guide* for more information. If the firmware upgrade is unsuccessful, follow the instructions in Resetting the Controller on page 75.

3.4 About the Microsemi Adaptec RAID 6405

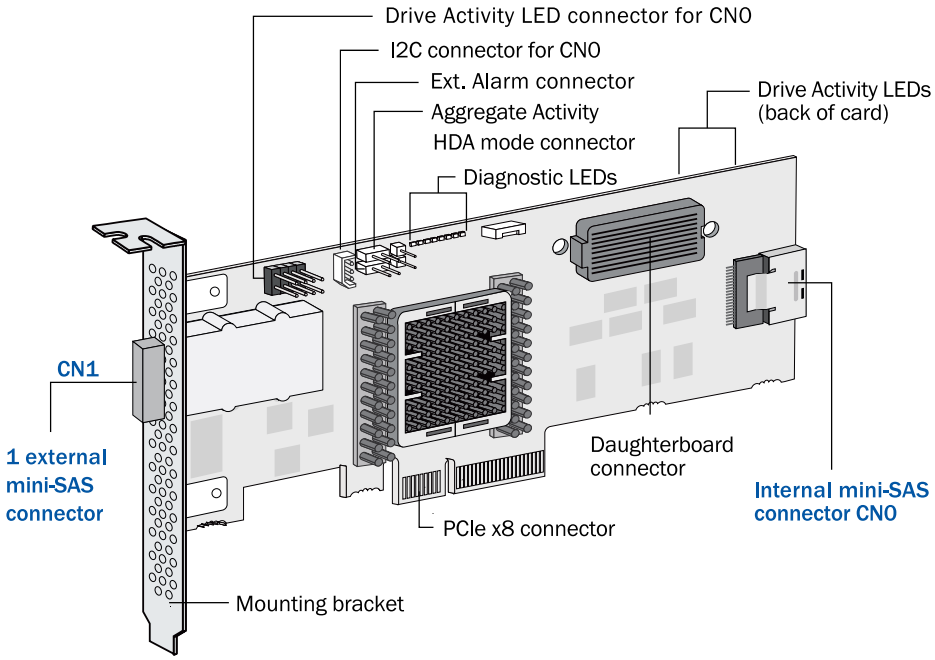
The Microsemi Adaptec RAID 6405 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 2.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	4
Standard cache	512 MB DDR2
Connectors, internal	1 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	4 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-600 (optional; sold separately)

3.5 About the Microsemi Adaptec RAID 6445

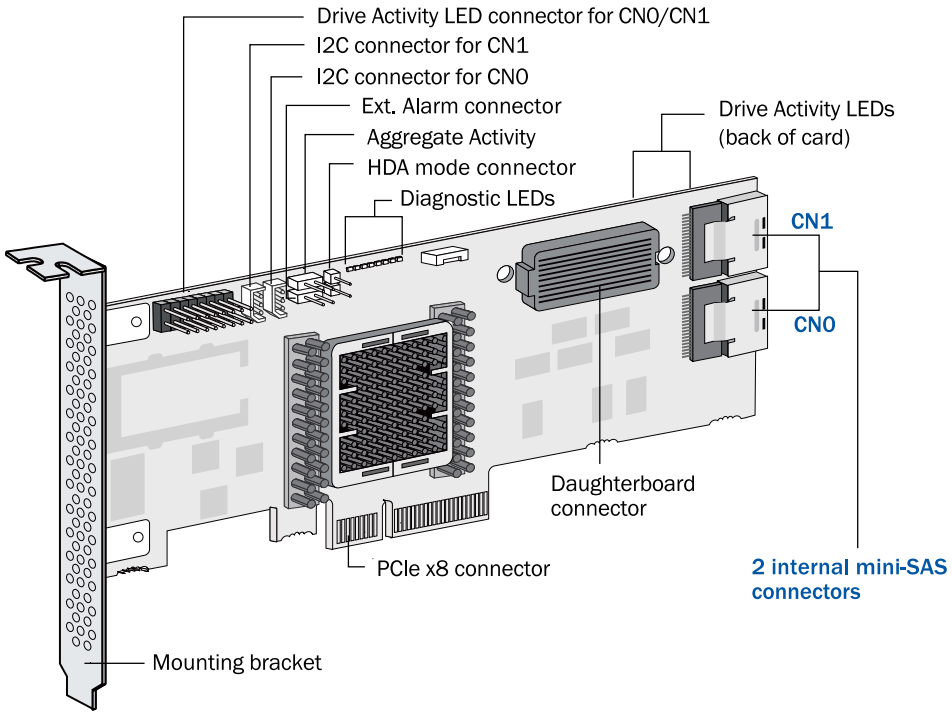
The Microsemi Adaptec RAID 6445 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 2.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	8
Standard cache	512 MB DDR2
Connectors	1 mini-SAS x4 (SFF-8087) internal 1 mini-SAS x4 (SFF-8088) external
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
Enclosure Support	SES, I2C, and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-600 (optional; sold separately)

3.6 About the Microsemi Adaptec RAID 6805/6805Q

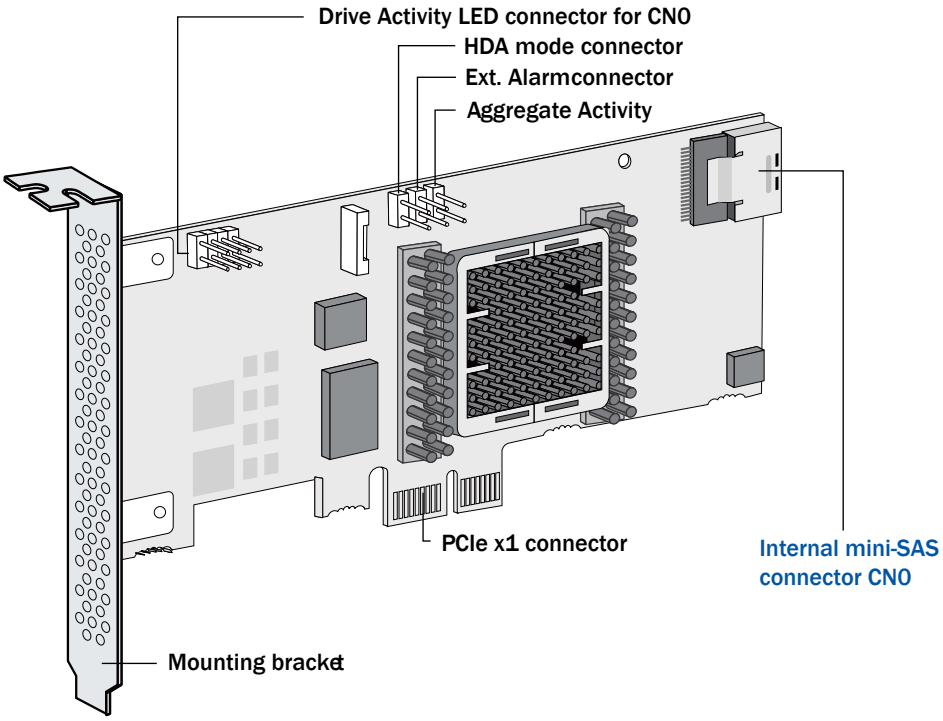
The Microsemi Adaptec RAID 6805/6805Q is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 2.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	8
Standard cache	512 MB DDR2
Connectors, internal	2 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
maxCache SSD support	**6805Q**: Up to 8 solid state drives, 1TB capacity, max. See the maxCache compatibility list at www.adaptec.com/compatibility.
Enclosure Support	I2C and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-600 (6805: optional, sold separately; 6805Q: standard, pre-installed)

3.7 About the Microsemi Adaptec RAID 6405E

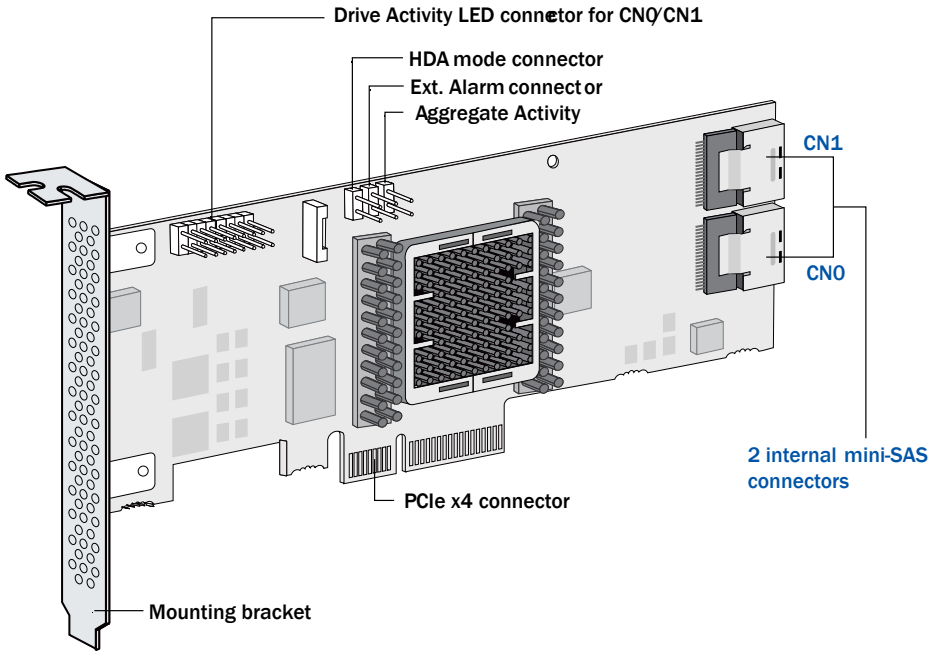
The Microsemi Adaptec RAID 6405E is a SAS RAID controller with these features:



Form Factor	Low-profile MD2 (reduced length: 5.12 inches)
Bus compatibility	PCIe 2.0
PCIe bus width	x1
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	4
Standard cache	128 MB DDR2
Connectors, internal	1 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	4 direct-attached
Enclosure Support	SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	No

3.8 About the Microsemi Adaptec RAID 6805E/6805E R5

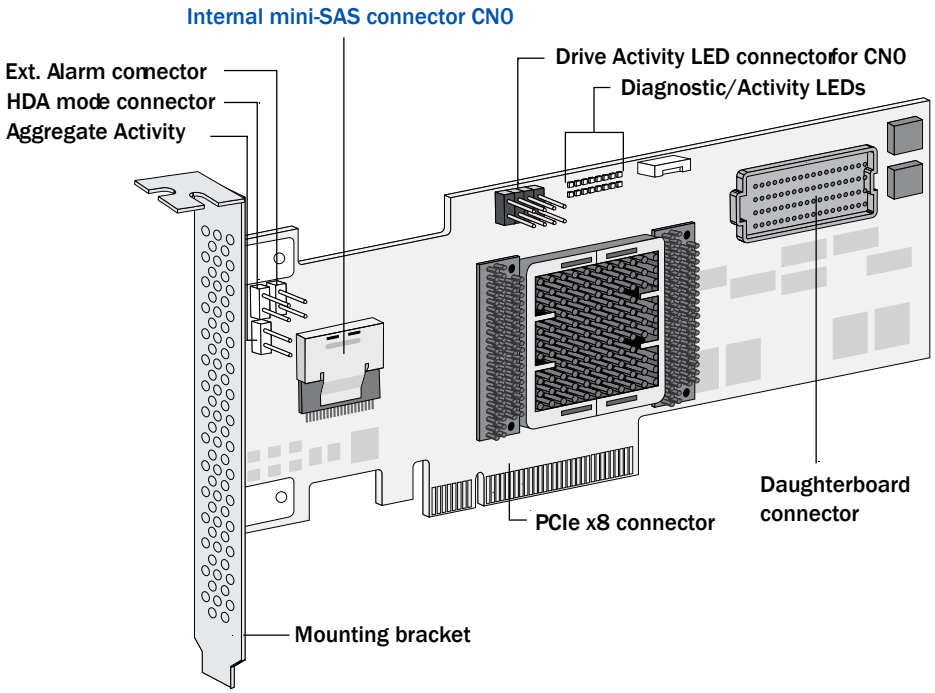
The Microsemi Adaptec RAID 6805E/6805E R5 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2 (reduced length: 6.1 inches)
Bus compatibility	PCIe 2.0
PCIe bus width	x4
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	8
Standard cache	128 MB DDR2
Connectors, internal	2 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	8 direct-attached
Enclosure Support	SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	No

3.9 About the Microsemi Adaptec RAID 6405T

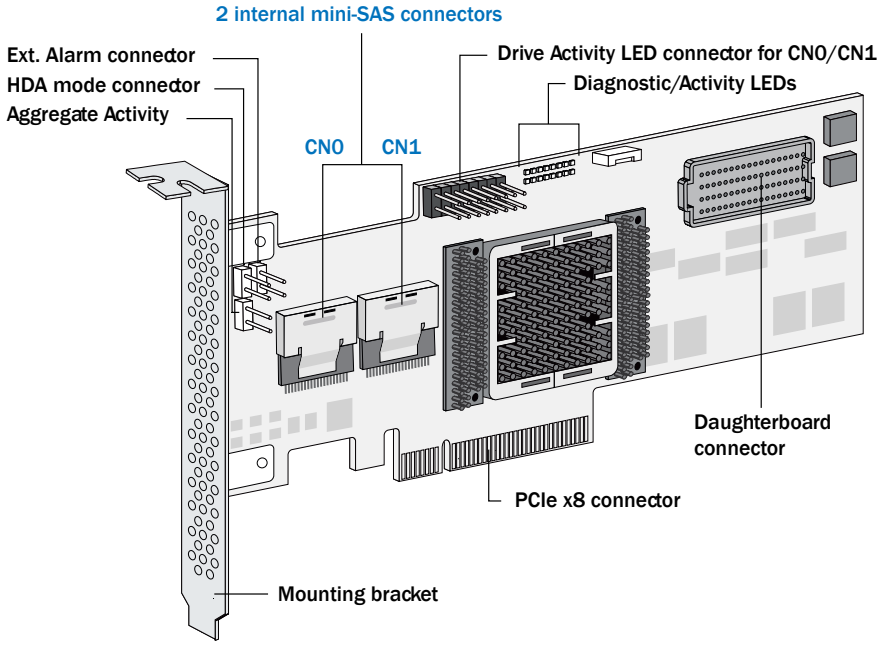
The Microsemi Adaptec RAID 6405T is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 2.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	4
Standard cache	512 MB DDR2
Connectors, internal	1 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	4 direct-attached (or up to 256 with expanders)
Enclosure Support	SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-600 (optional; sold separately)

3.10 About the Microsemi Adaptec RAID 6805T/6805TQ

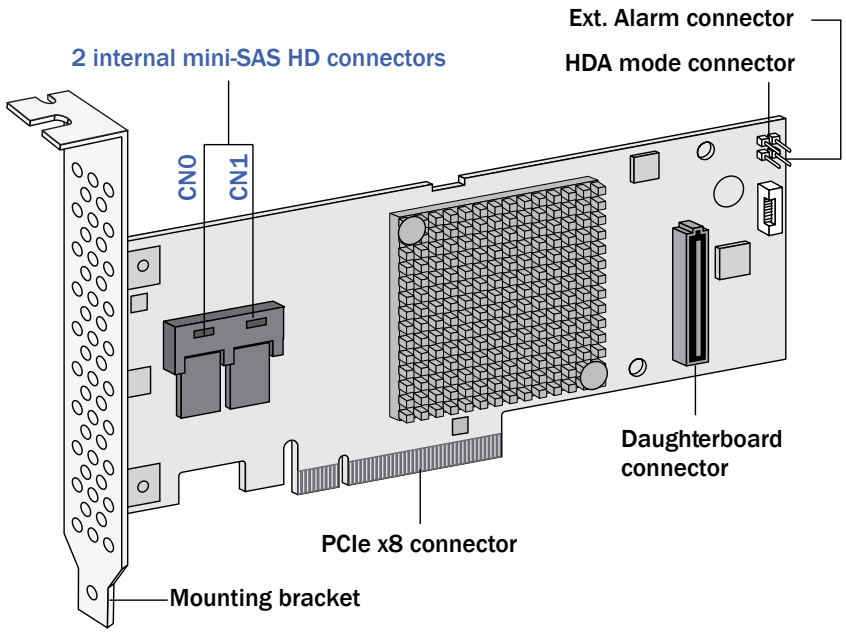
The Microsemi Adaptec RAID 6805T/6805TQ is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 2.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	8
Standard cache	512 MB DDR2
Connectors, internal	2 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
maxCache SSD support	**6805TQ**: Up to 8 solid state drives, 1TB capacity, max. See the maxCache compatibility list at www.adaptec.com/compatibility.
Enclosure Support	SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-600 (6805T: optional, sold separately; 6805TQ: standard, pre-installed)

3.11 About the Microsemi Adaptec RAID 7805/7805Q

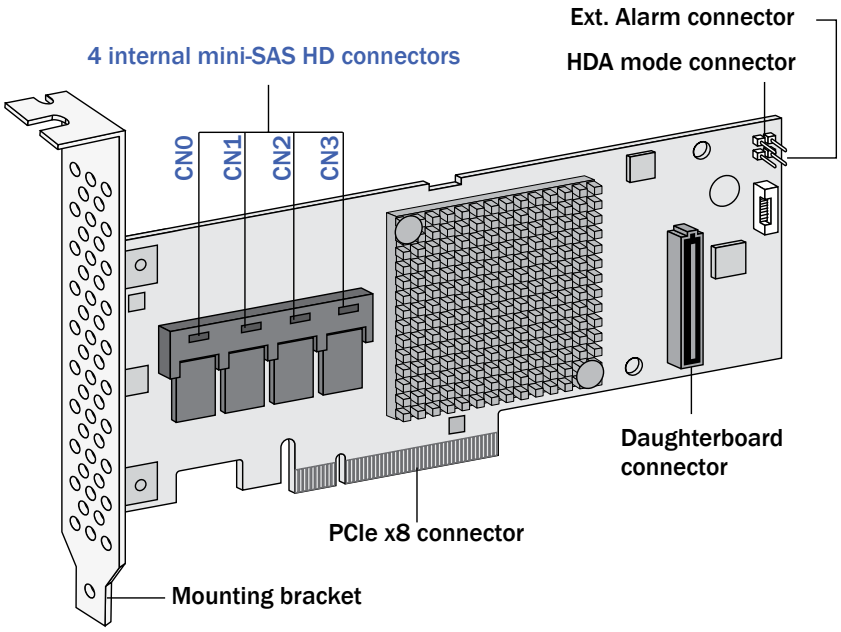
The Microsemi Adaptec RAID 7805/7805Q is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	8
Standard cache	1024 MB DDR3
Connectors, internal	2 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
maxCache SSD support	**7805Q**: Up to 8 solid state drives, 2TB capacity, max. See the maxCache compatibility list at www.adaptec.com/compatibility.
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (7805: optional, sold separately; 7805Q: standard, pre-installed)

3.12 About the Microsemi Adaptec RAID 71605/71605Q

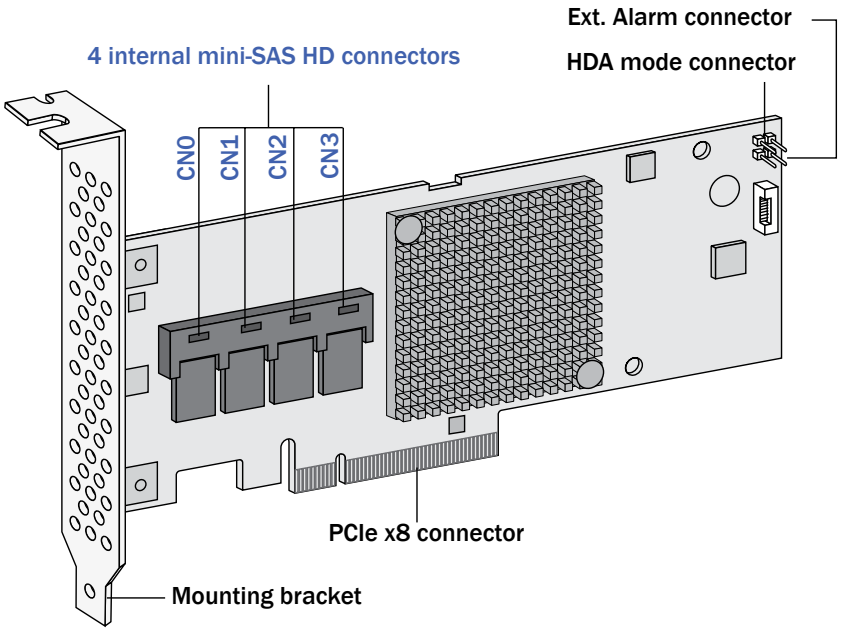
The Microsemi Adaptec RAID 71605/71605Q is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	16
Standard cache	1024 MB DDR3
Connectors, internal	4 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	16 direct-attached (or up to 256 with expanders)
maxCache SSD support	**71605Q**: Up to 8 solid state drives, 2TB capacity, max. See the maxCache compatibility list at www.adaptec.com/compatibility.
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (71605: optional, sold separately; 71605Q: standard, pre-installed)

3.13 About the Microsemi Adaptec RAID 71605E

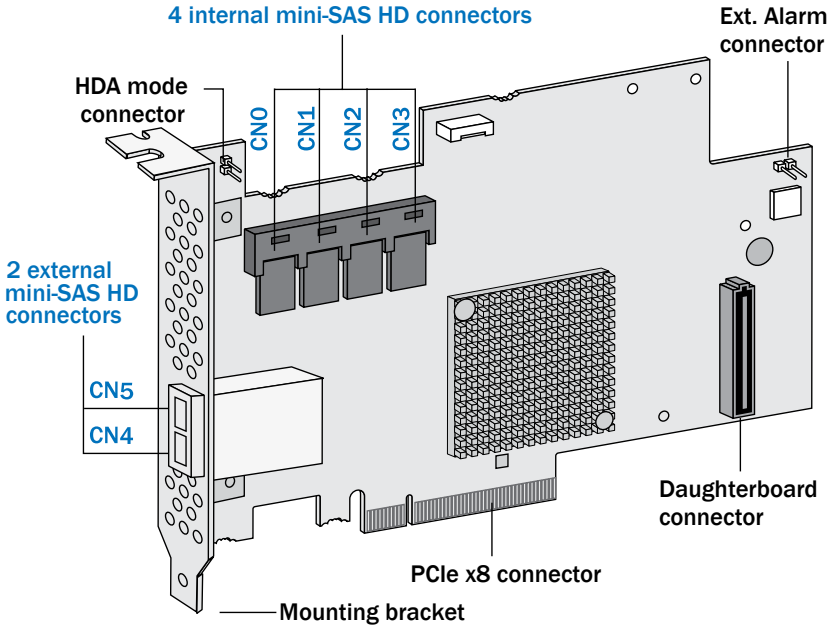
The Microsemi Adaptec RAID 71605E is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	16
Standard cache	256 MB DDR3
Connectors, internal	4 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	16 direct-attached (or up to 256 with expanders)
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	No

3.14 About the Microsemi Adaptec RAID 71685

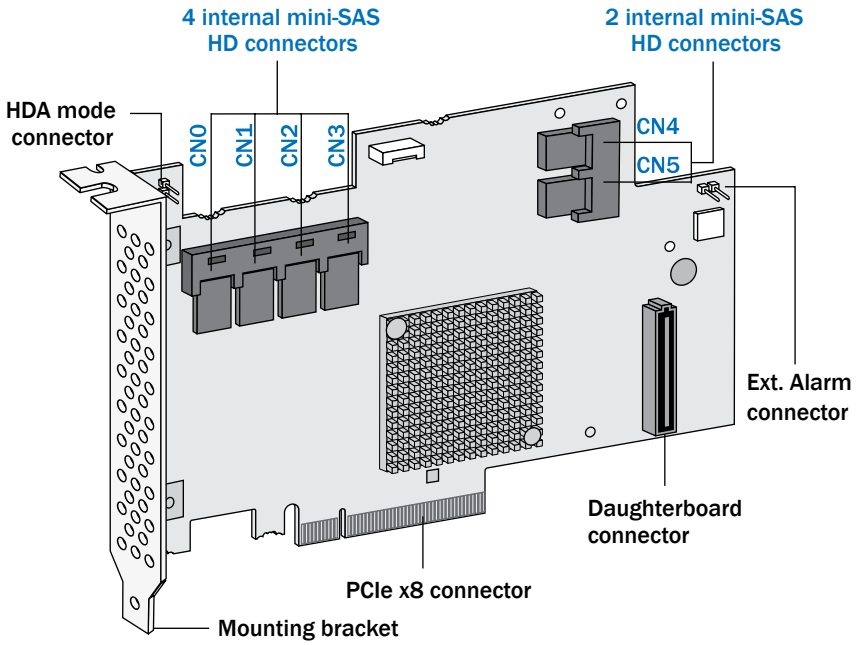
The Microsemi Adaptec RAID 71685 is a SAS RAID controller with these features:



Form Factor	Full Height, Half Length
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	24
Standard cache	1024 MB DDR3
Connectors, internal	4 mini-SAS HD x4 (SFF-8643)
Connectors, external	2 mini-SAS HD x4 (SFF-8644)
Maximum number of disk drives	24 direct-attached (or up to 256 with expanders)
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (optional, sold separately)

3.15 About the Microsemi Adaptec RAID 72405

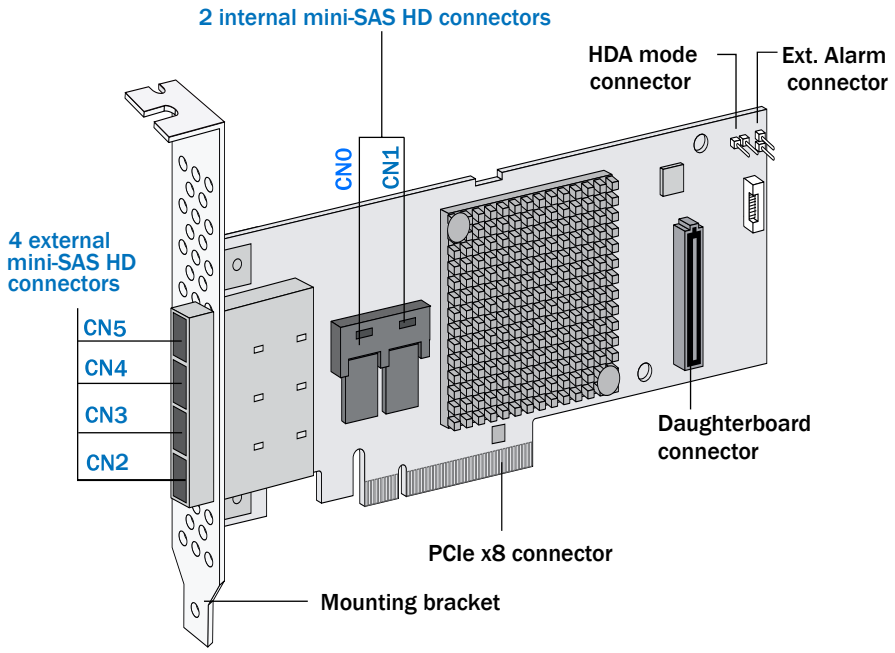
The Microsemi Adaptec RAID 72405 is a SAS RAID controller with these features:



Form Factor	Full Height, Half Length
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	24
Standard cache	1024 MB DDR3
Connectors, internal	6 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	24 direct-attached (or up to 256 with expanders)
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (optional, sold separately)

3.16 About the Microsemi Adaptec RAID 78165

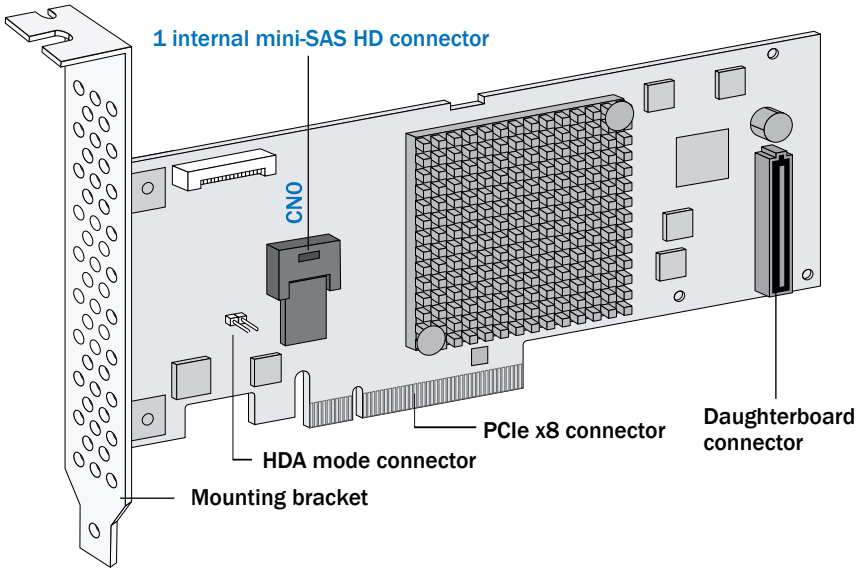
The Microsemi Adaptec RAID 78165 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	6 Gb/s per port
Phys (Unified Serial Ports)	24
Standard cache	1024 MB DDR3
Connectors, internal	2 mini-SAS HD x4 (SFF-8643)
Connectors, external	4 mini-SAS HD x4 (SFF-8644)
Maximum number of disk drives	24 direct-attached (or up to 256 with expanders)
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (optional, sold separately)

3.17 About the Microsemi Adaptec RAID 8405

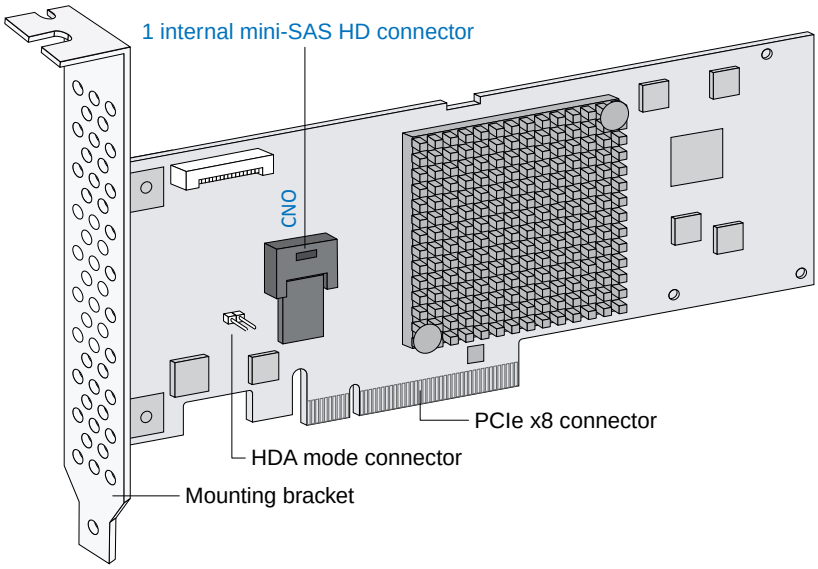
The Microsemi Adaptec RAID 8405 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	12 Gb/s per port
Phys (Unified Serial Ports)	4
Standard cache	1024 MB DDR3
Connectors, internal	1 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	4 direct-attached (or up to 256 with expanders)
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (optional, sold separately)

3.18 About the Microsemi Adaptec RAID 8405E

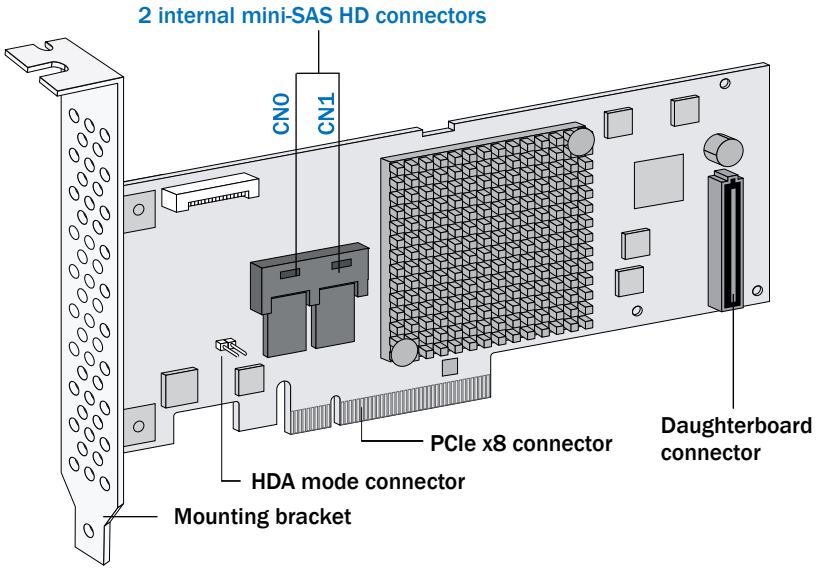
The Microsemi Adaptec RAID 8405E is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	12 Gb/s per port
Phys (Unified Serial Ports)	4
Standard cache	1024 MB DDR3
Connectors, internal	1 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	4 direct-attached
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	No

3.19 About the Microsemi Adaptec RAID 8805

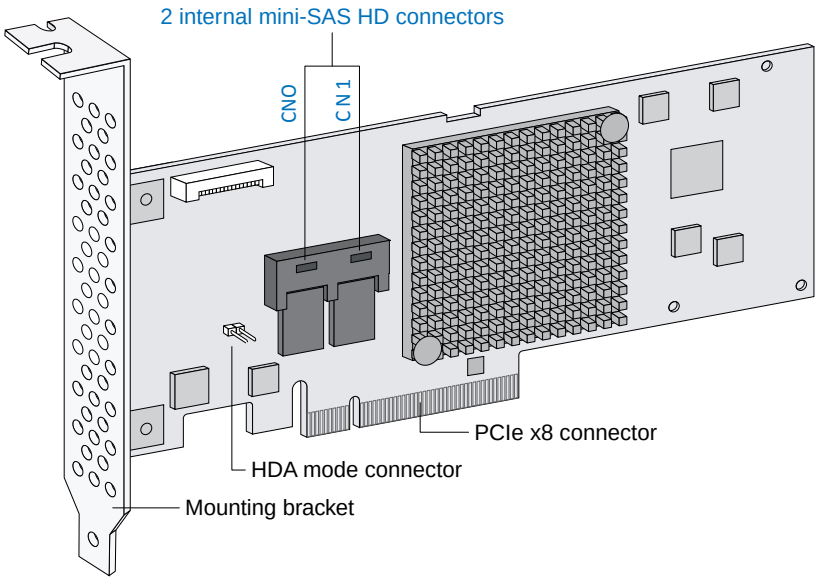
The Microsemi Adaptec RAID 8805 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	12 Gb/s per port
Phys (Unified Serial Ports)	8
Standard cache	1024 MB DDR3
Connectors, internal	2 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (optional, sold separately)

3.20 About the Microsemi Adaptec RAID 8805E

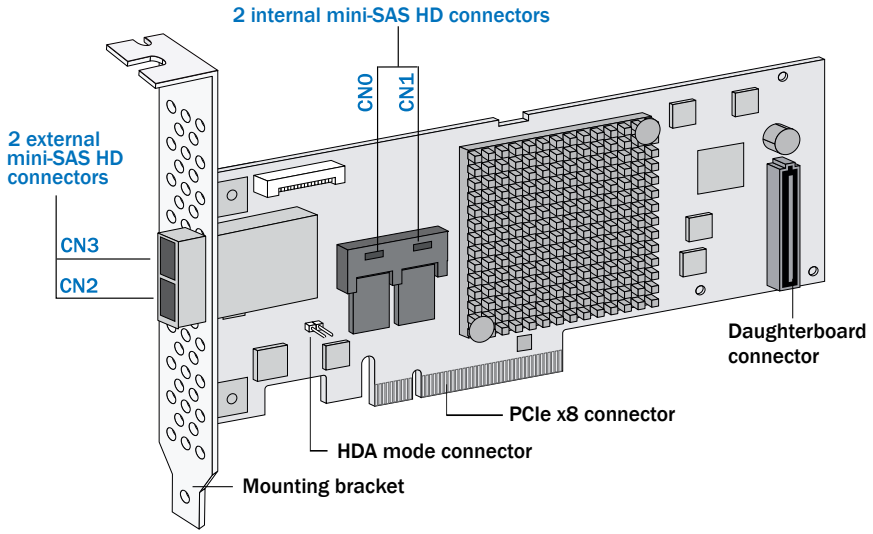
The Microsemi Adaptec RAID 8805E is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	12 Gb/s per port
Phys (Unified Serial Ports)	8
Standard cache	1024 MB DDR3
Connectors, internal	2 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	8 direct-attached
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	No

3.21 About the Microsemi Adaptec RAID 8885/8885Q

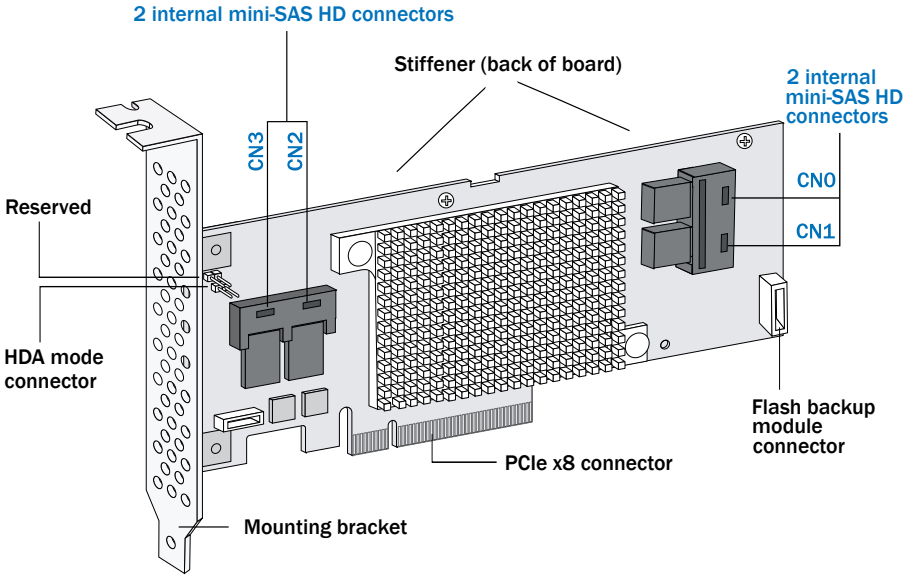
The Microsemi Adaptec RAID 8885/8885Q is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	12 Gb/s per port
Phys (Unified Serial Ports)	16
Standard cache	1024 MB DDR3
Connectors, internal	2 mini-SAS HD x4 (SFF-8643)
Connectors, external	2 mini-SAS HD x4 (SFF-8644)
Maximum number of disk drives	16 direct-attached (or up to 256 with expanders)
maxCache SSD support	**8885Q**: Up to 8 solid state drives, 2TB capacity, max. See the maxCache compatibility list at www.adaptec.com/compatibility.
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Microsemi Adaptec Flash Backup Module AFM-700 (8885: optional, sold separately; 8885Q: standard, pre-installed)

3.22 About the Microsemi Adaptec RAID 81605Z/81605ZQ

The Microsemi Adaptec RAID 81605Z/81605ZQ is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe 3.0
PCIe bus width	x8
Data transfer rate	12 Gb/s per port
Phys (Unified Serial Ports)	16
Standard cache	1024 MB DDR3
Connectors, internal	4 mini-SAS HD x4 (SFF-8643)
Maximum number of disk drives	16 direct-attached (or up to 256 with expanders)
maxCache SSD support	**81605ZQ:** Up to 8 solid state drives, 2TB capacity, max. See the maxCache compatibility list at www.adaptec.com/compatibility.
Enclosure Support	IBPI and SGPIO (Serial General Purpose Input/Output)
Onboard speaker	Yes
Zero Maintenance Cache Protection Module	Integrated Microsemi Adaptec Flash Backup Module AFM-700

4 Getting Started

This chapter provides the basic information you need to set up your disk drives and arrays the way you want them. It describes the options you have for installing your Microsemi Adaptec RAID controller and disk drives and creating arrays for storage. It also describes how to prepare your controller for installation into a low-profile computer cabinet.

4.1 Choosing a RAID Level

This section provides a brief overview of the RAID levels supported by your Microsemi Adaptec RAID controller, including the minimum and maximum number of disk drives required by each.

Note: Before you begin, familiarize yourself with your controller's physical features and the RAID levels that it supports (see Standard RAID Controller Features on page 16).

- RAID 0 (Non-redundant Array)—Stripes data across multiple disk drives. Improved performance but no redundancy (see RAID 0 on page 81).
- RAID 1 Array—Created from two disk drives where one disk drive is a *mirror* of the other (the same data is stored on each disk drive). Redundancy, but reduced capacity (see RAID 1 on page 82).
- RAID 1E Array—Similar to a RAID 1 array except that data is mirrored *and* striped, and more disk drives can be included (see RAID 1E on page 82).
- RAID 5 Array—Stripes data for improved performance and uses *parity* data to provide redundancy (see RAID 5 on page 84).
- (*Microsemi Adaptec Series 6 Controllers Only)* RAID 5EE Array—Similar to a RAID 5 array, but includes a distributed spare and must include a minimum of four disk drives (see RAID 5EE on page 85).
- RAID 10 Array—Built from two or more equal-sized RAID 1 arrays, stripes and mirrors data across multiple disk drives. Redundancy and improved performance (see RAID 10 on page 83).
- RAID 50 Array—Built from multiple disk drives configured as two or more RAID 5 arrays, stripes stored data and parity data across all disk drives (see RAID 50 on page 86).
- RAID 6 Array—Similar to a RAID 5 array except that it includes *two* independent sets of parity data instead of one (see RAID 6 on page 87).
- RAID 60 Array—Similar to a RAID 50 array except that it includes *four* independent sets of parity data instead of two (see RAID 60 on page 87).

See Selecting the Best RAID Level on page 88 to see how many disk drives you must connect to your RAID controller to support the RAID level you want.

4.2 Selecting Disk Drives and Cables

4.2.1 Disk Drives

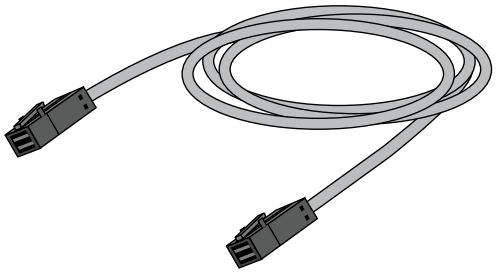
Your RAID controller supports SAS disk drives, SATA disk drives, and SATA and SAS Solid State Drives (SSDs). When selecting disk drives for your RAID array, ensure that all the disk drives have the same performance level. You can use different-sized disk drives in the array, but the array will be limited to the capacity of the smallest and slowest disk drive. For more information about arrays, refer to the *maxView Storage Manager User's Guide* or online Help. For more information about compatible disk drives, refer to www.adaptec.com/compatibility.

4.2.2 Cables

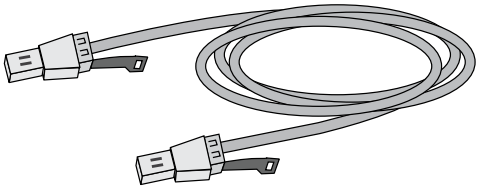
Depending on your requirements, you can use any of the cables listed below. Cable connectors are keyed so that you can't insert them incorrectly. For more information about cabling options for your RAID controller, visit www.adaptec.com.

Note: We recommend using only Microsemi Adaptec SAS cables.

SAS HD Cables (Series 7 and Series 8 controllers)

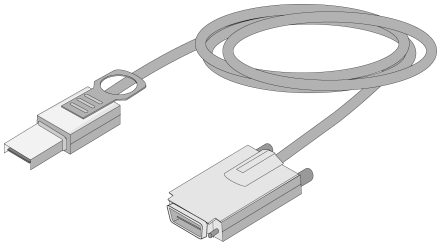


Internal SAS HD to SAS HD (SFF-8643 to SFF- 8643)—Connects to a backplane or enclosure.

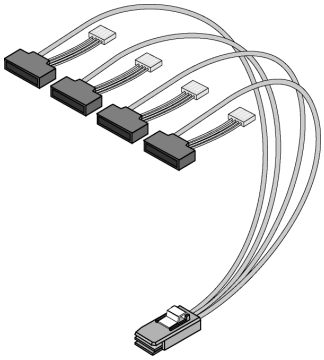


External SAS HD to SAS HD (SFF-8644 to SFF- 8644)—Connects to a backplane or enclosure.

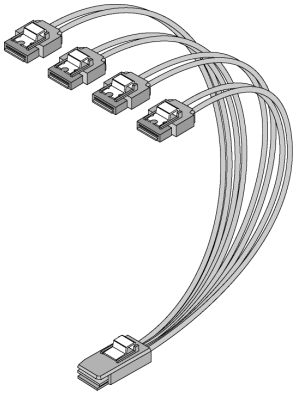
mini-SAS Cables (Series 6 controllers)



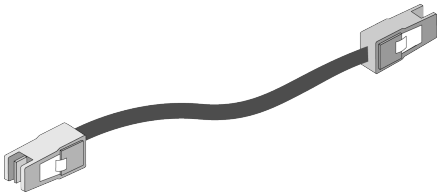
External mini-SAS (SFF-8088 to SFF-8470)—Connects to an external SAS enclosure.



Internal mini-SAS with power (SFF-8087 to SFF-8482)—Connects to four SAS or SATA disk drives.



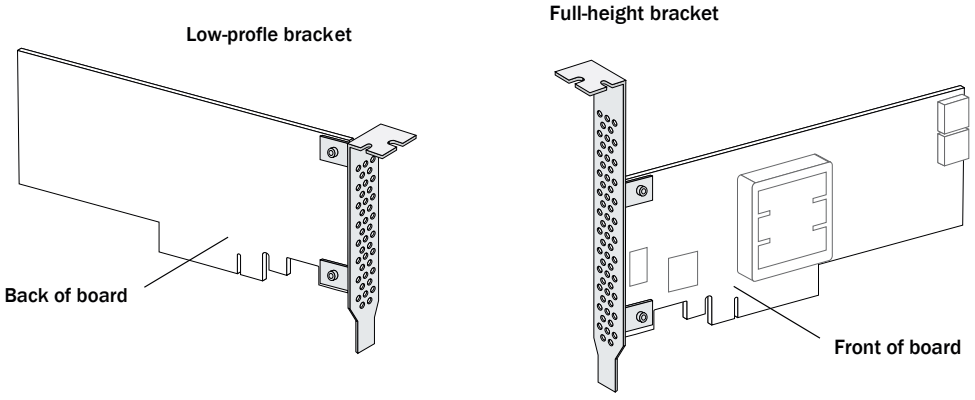
Internal mini-SAS to SATA fan-out (SFF-8087 to 4x SATA)—Connects to four SATA disk drives.



Internal mini-SAS to mini-SAS (SFF-8087 to SFF-8087)—Connects to a backplane or enclosure.

4.3 Replacing the Full-Height Bracket with a Low-Profile Bracket

If you are installing your Microsemi Adaptec RAID controller into a low-profile computer cabinet, replace the original full-height bracket with the low-profile bracket included in your distribution kit. The full-height bracket is mounted on the front of the controller, the low-profile bracket is mounted on the back of the controller, as shown in the figure below.



To replace the full-height bracket with the low-profile bracket:

1. Remove the full-height bracket from the controller board. The full-height bracket is installed on the front side of the controller, with the mounting screws inserted from the back of the controller, as shown in the Figure 1.

   Using a Phillips head screw driver, remove the mounting screws, as shown in Figure 2, then set the screws aside for use in the next step.

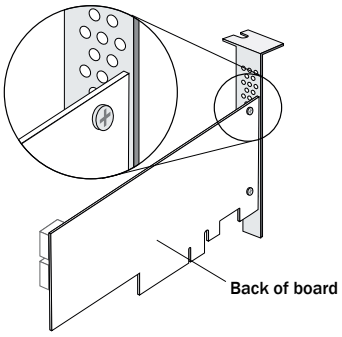


Figure 1

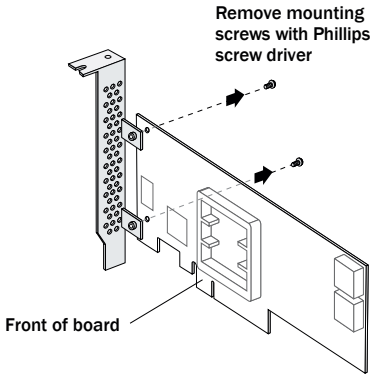


Figure 2

2. Attach the low-profile bracket to the controller board. The low-profile bracket is installed on the *back* side of the controller, with the mounting screws inserted from the front of the controller, as shown the Figure 3.

   Insert the screws through the holes on the front of the controller, then fasten the screws to the bracket with a Phillips screw driver.

   Caution: The mount points on the low-profile bracket have a smooth or flat side and a raised side that looks like a spacer (see Figure 3). Be sure to install the bracket with the flat side against the controller PCB and the raised side facing away from the PCB.

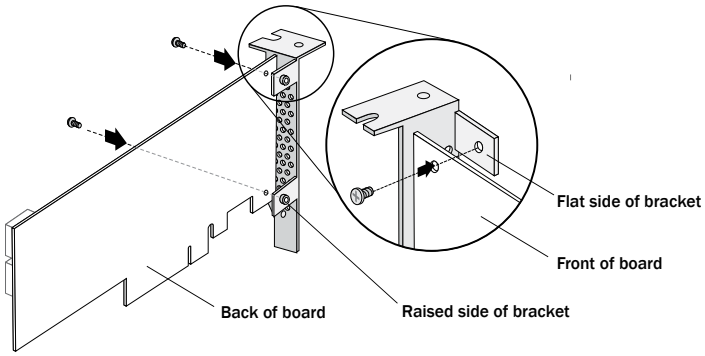


Figure 3

   Caution: The torque on the mounting screws should be a maximum of 3.0-4.0 lbf-in to avoid deformation. Be sure that the controller is not bent after attaching the low-profile bracket to the controller board.

4.4 Installation Options

When you install your Microsemi Adaptec RAID controller, you can choose to create a bootable array and then install your operating system and the controller driver on that array.

Alternatively, you can complete a standard installation, where the controller driver is installed on an existing operating system.

4.5 Basic Installation Steps

This section describes the installation process. Follow the steps for the installation option you've chosen.

4.5.1 Installing with an Operating System

1. Install and connect your controller and internal disk drives (see Installing the Controller and Disk Drives on page 42).

   If your controller has an external connector, you can connect external disk drives as well (or instead).
2. Set the boot controller (see Setting the Boot Controller on page 50).
3. Create a bootable array (see Creating an Array on page 50).
4. Install your operating system and the controller driver (see Installing the Driver and an Operating System on page 54.)
5. Install maxView Storage Manager and begin to manage your data storage (see Managing Your Storage Space on page 71).

4.5.2 Installing on an Existing Operating System

1. Install and connect your controller and internal disk drives (see Installing the Controller and Disk Drives on page 42).

   If your controller has an external connector, you can connect external disk drives as well (or instead).
2. Install the controller driver (see Installing the Driver on an Existing Operating System on page 63).
3. Install maxView Storage Manager and begin to manage your data storage (see Managing Your Storage Space on page 71).

5 Installing the Controller and Disk Drives

This chapter explains how to install your Microsemi Adaptec RAID controller, and how to install and connect internal and external disk drives.

5.1 Before You Begin

- Read Safety Information on page 117.
- Familiarize yourself with your RAID controller's physical features and the RAID levels that it supports (see Standard RAID Controller Features on page 16).
- Ensure you have the right number of disk drives for the RAID level you want to use for your arrays (see Selecting Disk Drives and Cables on page 37).
- If you are installing the RAID controller into a low-profile computer cabinet, replace the original full-height bracket with the low-profile bracket included in the kit (see Replacing the Full-Height Bracket on page 39).

5.2 Installing the Controller

This section describes how to install the RAID controller into your computer cabinet. Microsemi Adaptec RAID controllers come in two basic configurations: standard and zero maintenance cache protection with batteryless backup (ZMCP). ZMCP uses flash memory and a supercapacitor module to protect the cache without a battery.

Follow one of these sets of instructions:

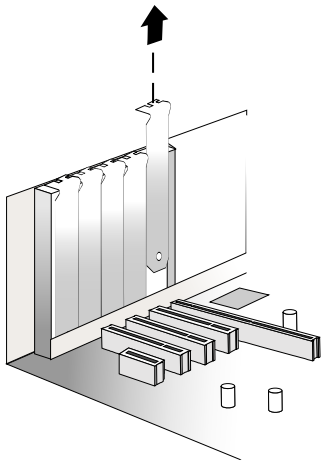
- To install a Microsemi Adaptec RAID controller *without* zero maintenance cache protection, see the next section.
- To install a Microsemi Adaptec RAID controller *with* zero maintenance cache protection, see To install a RAID Controller with Zero Maintenance Cache Protection on page 43.

Caution: Be sure to handle the controller by its bracket or edges only.

5.2.1 Installing a RAID Controller without Zero Maintenance Cache Protection

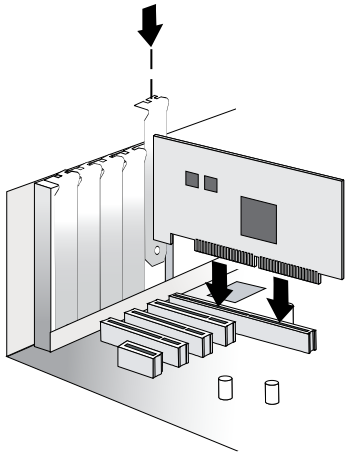
To install a Microsemi Adaptec RAID controller without zero maintenance cache protection:

1. Turn off your computer and disconnect the power cord. Open the cabinet, following the manufacturer's instructions.
2. Select an available PCIe expansion slot that's compatible with your RAID controller and remove the slot cover, as shown below. (PCIe bus compatibility is marked to the controller figures in About Your RAID Controller on page 16.)



3. Insert the RAID controller into the expansion slot and press down gently but firmly until it clicks into place. When installed properly, the RAID controller should appear level with the expansion slot.

   Caution: Touch a grounded metal object before handling the RAID controller.



4. Secure the bracket in the expansion slot, using the retention device (for instance, a screw or lever) supplied with your computer.
5. (*Series 6 controllers only*) Connect your computer's disk activity LED cable to the LED connector on the controller (marked on the figures in About Your RAID Controller on page 16).

   Ensure that the positive lead of the LED cable (usually a red wire or a wire marked with a red stripe) is attached to pin 1.
6. (*Series 6 controllers only*) Optionally, connect your RAID controller's I2C connector (not available on all models) to an I2C connector on an internal backplane or enclosure, using an I2C cable. For more connection details, see About Your RAID Controller on page 16.
7. Prepare and install your internal disk drives, following the instructions in Connecting Disk Drives to Your Controllers on page 46.

   If you are not installing internal disk drives, close your computer cabinet, reattach the power cord, then continue with Connecting External Devices on page 48.

5.2.2 Installing a RAID Controller with Zero Maintenance Cache Protection

Microsemi Adaptec RAID controllers with zero maintenance cache protection include a flash module daughterboard and a supercapacitor module. On Microsemi Adaptec Series Q controllers, the daughterboard is pre-installed. On Microsemi Adaptec RAID controllers with *optional* zero maintenance cache protection (see Adding A Flash Backup Module on page 17), the daughterboard is user installed. The supercapacitor module is always user installed.

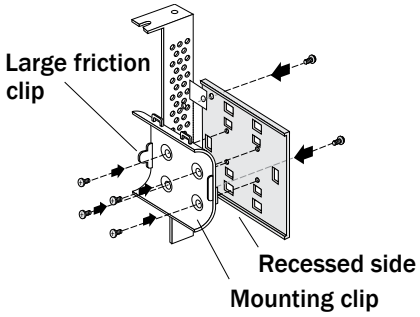
The following instructions describe how to install the RAID controller and supercapacitor module on a Microsemi Adaptec Series 7/8/8ZQ controller using the *mounting plate* method. It assumes that the daughterboard is already installed.

Note: Microsemi Adaptec Series 6Q controllers do not include a mounting plate for the supercapacitor module. You must affix the supercapacitor to the computer chassis with cable ties. For controllers with *optional* zero maintenance cache protection (non-Q controllers), refer to the *AFM-700 Installation Guide* for details about installing the daughterboard on the controller.

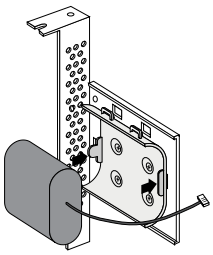
Warning: Do NOT remove or insert a fully charged supercapacitor module. Always discharge the unit first to avoid damage to the controller or flash backup module. The factory ships with discharged units, so they are safe to install when you receive them. To ensure that an installed unit is discharged, switch your system OFF, then wait 5 minutes. After a dirty shutdown, wait 3 minutes after backup is complete, then remove the unit.

To install a Microsemi Adaptec RAID controller with zero maintenance cache protection:

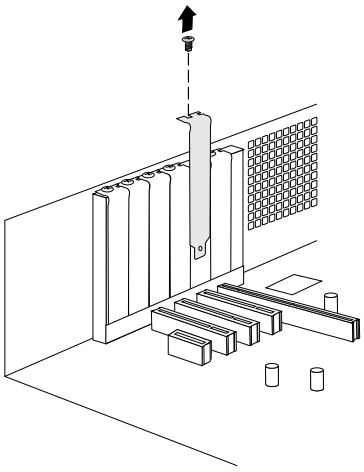
1. Assemble the mounting plate and attach the supercapacitor module:
   a) Attach the full-height bracket and mounting clip to the mounting plate. The full-height bracket is installed on the front side of the mounting plate (the side with the bents), with the mounting screws inserted from the back, as shown in the figure below. (Be sure to attach the mounting plate to the bracket with recessed side at the bottom!) Attach the mounting clip to the front of the mounting plate with four (4) Phillips screws. The large friction clip should face the front of the mounting plate.



   b) Insert the supercapacitor module into the mounting clip. The supercapacitor module snaps securely into place between the large and small friction clips, as shown in the figure below. Be sure to orient the supercapacitor module such that the connecting cable faces the rear of the mounting plate.



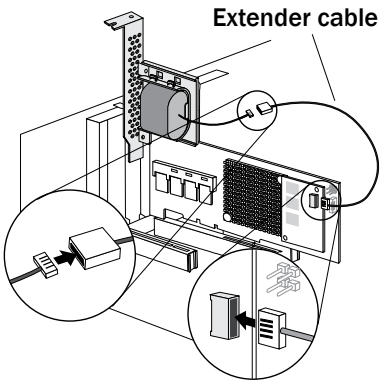
   c) Set the mounting plate aside; continue with the steps below.
2. Turn off your computer and disconnect the power cord. Open the cabinet, following the manufacturer's instructions.
3. Select an available PCIe expansion slot that's compatible with your RAID controller and remove the slot cover, as shown in the figure below. (PCIe bus compatibility is marked on the controller figures in About Your RAID Controller on page 16.) Be sure to choose a slot in the backplane with an *empty* slot next to it; you will use the empty slot to install the supercapacitor mounting plate, after you install the controller. Remove the slot cover for the mounting plate, then continue with the next step.



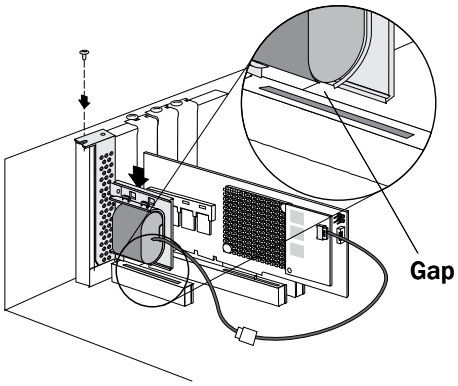
4. Insert the RAID controller into the expansion slot and press down gently but firmly until it clicks into place. When installed properly, the RAID controller should appear level with the expansion slot. Secure the bracket in the expansion slot, using the retention device (for instance, a screw or lever) supplied with your computer.

   Caution: Touch a grounded metal object before handling the RAID controller.

5. Attach the supercapacitor module to the RAID controller by inserting the connector into the socket on the flash module daughterboard, as shown in the figure below. (The connector attaches to the socket in only one direction.) Use the included extender cable if you need extra length to reach the connector on the daughterboard.



6. Install the mounting plate in the empty slot next to the controller, as shown in the next figure. After securing the mounting plate to the card cage, verify that the supercapacitor module and mounting plate sit above (and do not touch) the PCIe slot.



7. Prepare and install your internal disk drives, following the instructions in Connecting Disk Drives to Your Controllers on page 46.

   If you are not installing internal disk drives, close your computer cabinet, reattach the power cord, then continue with Connecting External Devices on page 48.

8. Restart your computer.

   The supercapacitor starts charging automatically. It should reach full charge in 5-6 minutes.

5.3 Connecting Disk Drives to Your Controllers

You can connect SAS disk drives, SATA disk drives, and SATA and SAS Solid State Drives (SSDs) to your Microsemi Adaptec RAID controller. (See www.adaptec.com/compatibility for a list of compatible drives.) There are no jumpers or switches to set before installation.

If you plan to build a bootable array, ensure that you install at least the minimum number disk drives required to support the RAID level you want. See Choosing a RAID Level on page 37 for more information.

> **Note:** Although you can connect both SAS and SATA disk drives to your SAS controller, we recommend that you do *not* combine SAS and SATA disk drives within the same array. See What is SAS? on page 76 for more information.

You have two connection options:

- To connect directly to the controller, see the following section.
- To connect to a backplane, see Connecting Drives to a System Backplane on page 47.

To connect Solid State Drives to your controller, see Connecting SSDs on page 47.

5.3.1 Connecting Drives Directly to the Controller

In a direct-attach connection, SAS or SATA disk drives are connected directly to a SAS card with SAS cables. The number of direct-attached disk drives is limited to four per internal SAS connector. (For more information about direct-attach connections, see How Disk Drives are Identified in SAS on page 78.)

1. Install your internal SAS or SATA disk drives, following the instructions in your system's documentation.
2. Use internal SAS, mini-SAS, or mini-SAS HD cables to attach the disk drives to the controller, as required.
3. When all internal disk drives have been installed and attached to the controller, close your computer cabinet, reattach the power cord, then continue with Connecting External Devices on page 48.

5.3.2 Connecting Drives to a System Backplane

In a backplane connection, disk drives and SAS cards are attached to and communicate with each other through a system backplane.

The number of disk drives is limited to the number of slots available on the backplane. Some backplanes have embedded SAS expanders and can support up to 128 end devices. (For more information about backplane and expander connections, see How Disk Drives are Identified in SAS on page 78.)

1. Connect one or more internal SAS or SATA disk drives to the backplane. (Refer to your system's documentation for more information.)
2. Use an internal mini-SAS or mini-SAS HD cable to connect the controller to the backplane, as required.
3. When all internal disk drives have been installed and connected, close your computer cabinet, reattach the power cord, then continue with Connecting External Devices on page 48.

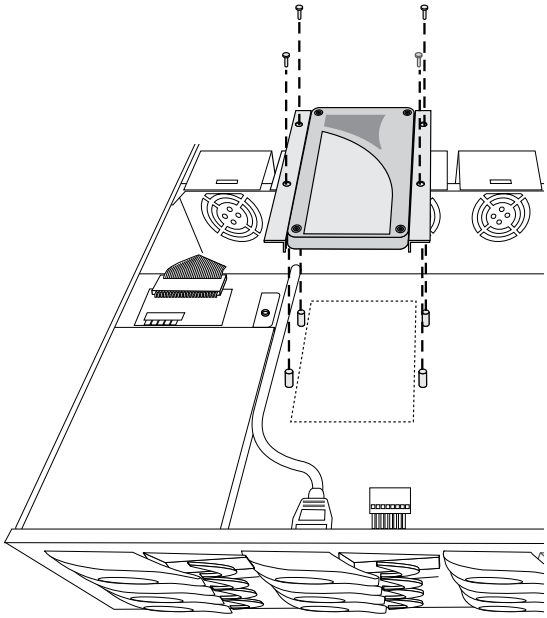
5.3.3 Connecting Solid State Drives (SSDs)

To connect a Solid State Drive to your controller, you can use a direct-attached connection or a backplane connection, as required. If your server does not have a standard 2.5-inch drive tray, you must use a bracket/SLED which enables the SSD to fit properly.

> **Note:** For Microsemi Adaptec maxCache applications or hybrid RAID arrays (comprised of hard drives and SSDs) you can use any Solid State Drive on the compatibility list. See www.adaptec.com/compatibility for a list of compatible SSDs. maxCache is supported on Microsemi Adaptec Series Q controllers only.

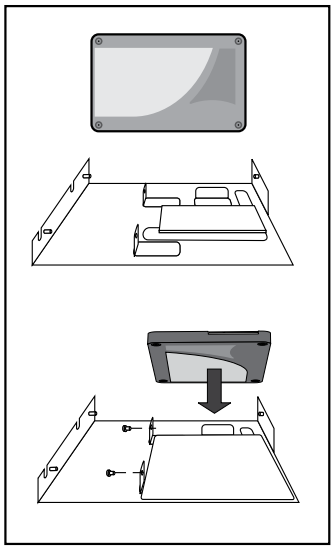
In a direct-attach connection (described in the steps below), you connect SSDs directly to the controller with SAS cables (mini-SAS to SATA). In a backplane connection, use the appropriate cable for your backplane type (see Connecting Drives to a System Backplane on page 47 for more about backplane connections). For maxCache caching applications, you can connect a maximum of 8 maxCache-compatible SSDs to a controller. For RAID arrays, Microsemi Adaptec controllers support a maximum of 256 drives, including SSDs (for details, see About Your RAID Controller on page 16).

1. Install the SSDs in your server. For servers with a standard 2.5-inch drive tray, install the SSD directly into the tray. If your server does not have a standard 2.5-inch drive tray, use a bracket or adapter which enables it to fit properly.

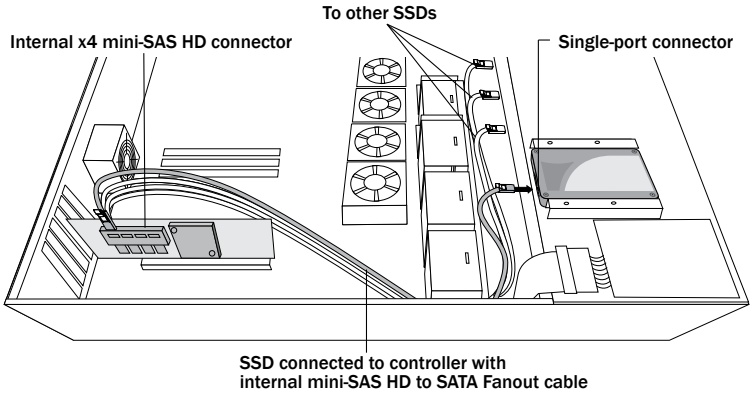


Typical SSD installation

Use a 2.5” to 3.5” adapter to install your SSD if server does not have 2.5” tray.



2. Use an internal mini-SAS or mini-SAS HD to SATA cable, as required, to attach the SSD(s) to the controller, as shown in the example below.



3. When all SSDs have been installed and connected, close your computer cabinet, reattach the power cord, then continue with Connecting External Devices on page 48.

5.4 Connecting External Devices

Note: If you are not connecting any external devices, see the following section, Next Steps on page 49.

Use high-quality cables to connect your controller to your external device(s), such as disk drives or disk drive enclosures.

We recommend using only Microsemi Adaptec cables. For more information about cabling options for your controller, see Cables on page 37.

5.5 Next Steps

If you are installing the controller driver and an operating system onto a bootable array, continue with Creating a Bootable Array.
If you are completing a standard installation onto an existing operating system, continue with Installing the Driver on an Existing Operating System on page 63.

6 Creating a Bootable Array

This chapter explains how to set your Microsemi Adaptec controller to be the boot controller, and how to create a bootable array.

> **Note:** If you are completing a standard installation onto an existing operating system, you don't have to complete this task. Skip to Installing the Driver on an Existing Operating System on page 63.

6.1 Setting the Boot Controller

> **Note:** If your system won't contain more than one bootable controller, skip to the next section, Creating an Array on page 50.

Your Microsemi Adaptec RAID controller supports bootable disk drives and bootable arrays. To enable your system to boot from either a disk drive or an array connected to your controller:

1. Enter the system setup.
2. Navigate to the drive boot sequence.
3. Move the boot controller to the top of the list.

For more information, refer to your computer documentation.

6.2 Creating an Array

This section explains how to create an array.

A RAID 5 array is created in the examples shown in this section because RAID 5 provides the most security and best performance with a minimum of three disk drives. However, you can choose to create an array with a different RAID level; you can also change array level later, after the operating system is installed.

You can create an array using any of these tools:

- Microsemi Adaptec RAID Configuration Utility (ARC)—BIOS-based menus and keyboard navigation (see the following section).
- maxView Storage Manager—Graphical software application (running from a bootable USB image) that you can navigate with your mouse (see About maxView Storage Manager on page 71).
- ARCCONF—Command line utility. For instructions, refer to the *Microsemi Adaptec RAID Controller Command Line Utility User's Guide.*

You can use any of these tools, but the ARC utility is the quickest and easiest tool for this task.

> **Note:** We recommend that you do *not* combine SAS and SATA disk drives within the same array. maxView Storage Manager displays a warning if you try to create a logical drive using a combination of SAS and SATA disk drives. See What is SAS? on page 76 for more information.

6.2.1 Creating an Array with the ARC Utility

The ARC utility is menu-based. Instructions for completing tasks appear on-screen. Menus can be navigated using the arrows, Enter, Esc, and other keys on your keyboard.

To create a RAID 5 array:

1. Power on your computer. When prompted, press `Ctrl+A` to enter the ARC utility.

   > **Note:** On computers that support the Unified Extensible Firmware Interface, or uEFI, ARC utility options are presented with a uEFI/HII interface rather than the Microsemi Adaptec Ctrl-A interface described below. To begin using the ARC utility with the uEFI/HII interface, see Ctrl-A or uEFI/HII? on page 89.

2. If you have more than one controller of the same model or family in your computer, select your controller, then press Enter .
3. Select **Logical Device Configuration**, then press Enter .
4. Select **Initialize Drives**, then press Enter .
5. Select at least three disk drives for the array, press Insert for each selected disk drive, then press Enter.

   Caution: During initialization, all data is deleted from the disk. Before continuing, back up any data you want to keep.

6. Press Y , then press Enter .
   The selected disk drives are initialized, then the Logical Device Configuration screen appears.
7. Select **Create Array**, then press Enter .
8. Select the disk drives that were just initialized, press Insert for each selected disk drive, then press Enter .
9. When the Array Properties screen opens, follow the instructions in the following table.

Property Line	Entry or Selection
Array Type	Select **RAID 5**, then press Enter .
Array Label	Type a name, then press Enter .
Array Size	Press Enter , then press Enter again to use the default granularity of GB.
Stripe Size	Press Enter to use the default (256 KB). **Note:** This property applies only to striped arrays (RAID 0, 1E, 10, 5, 50, 5EE, 6, and 60).
Read Caching	Press Enter to use the default (Enable).
Write Caching	Press Enter to use the default (Enable always), then press Y to confirm.
Create RAID via	Press Enter to use the default (Build/Verify).
MaxCache Read	Press Enter to use the default (Enable)
MaxCache Write	Press Enter to use the default (Disable)
[Done]	Press Enter .

10. When a cache warning message displays, type Y .
11. Once the array is created, a message displays telling you that the array can now be used. Press any key to return to the Logical Device Configuration menu.
    You can start using the array immediately. However, performance is reduced until the build process is complete.
12. Press Esc until the Exit utility window appears.
13. Select Yes, then press Enter.
    The computer restarts.
14. Continue with Making Your Array Bootable on page 53.

6.2.2 Creating an Array with maxView Storage Manager

This section describes how to use the maxView Storage Manager configuration wizard to build an array.

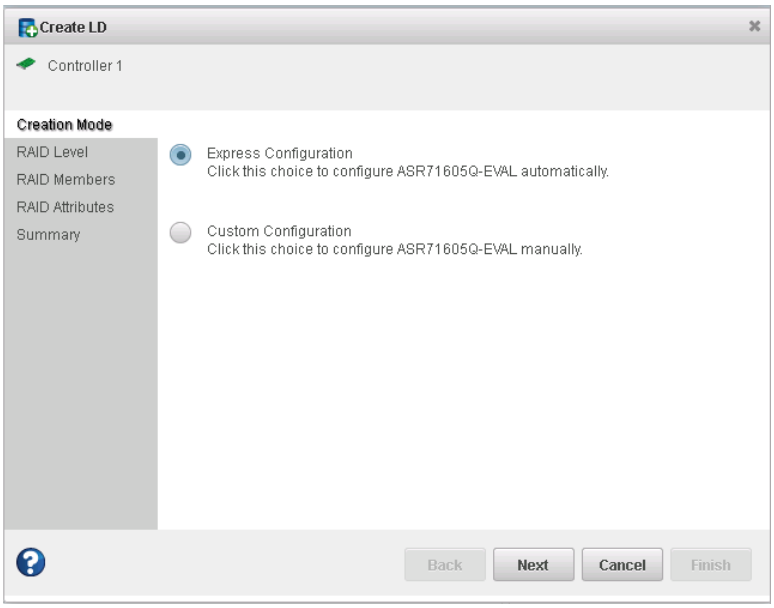
Note: Before you begin, download the maxView Storage Manager bootable USB image at start.microsemi.com, then copy the bootable image to a USB flash drive. For details, refer to the *maxView Storage Manager User's Guide*.

To create a RAID 5 array:

1. Insert the bootable USB drive on the machine you want to configure.
   The Boot menu opens in a shell window.
2. Select **Launch maxView** from the menu.
   After a minute or so, the maxView Storage Manager login screen opens in a browser window.
3. Enter `root/root` for the login credentials.
4. On the ribbon, in the Logical Disk group, click **Create Logical Drive**.



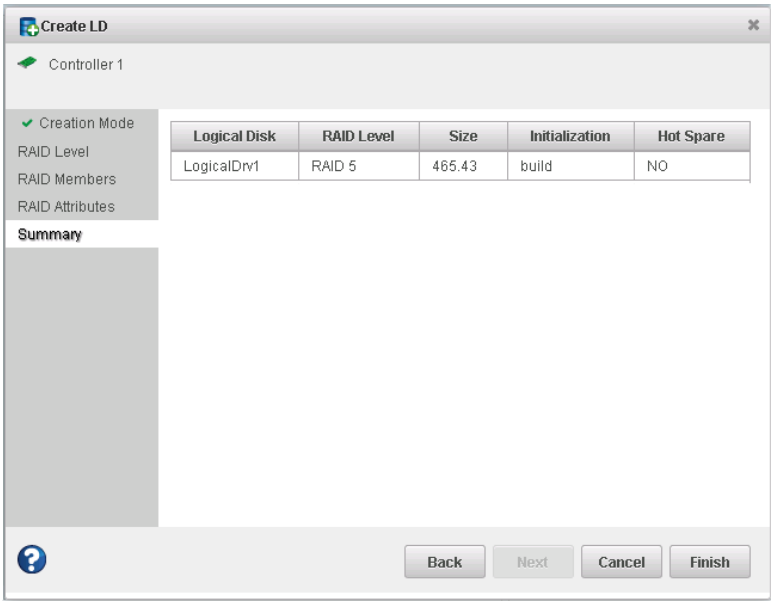
5. When the wizard opens, ensure that **Express Configuration** is selected, then click **Next**.



6. Review the logical drive configuration summary.

   Note: maxView Storage Manager uses the term *logical drive* when referring to an *array* (see Terminology Used in this Guide on page 13).

   The following example shows a RAID 5 array, ready to be created.



7. Click **Finish**.
   maxView Storage Manager builds the logical drives.
8. Partition and format the logical drive(s).
   The logical drives you created appear as a physical disk drives on your operating system. You *must* partition and format these logical drives before you can use them to store data.
9. Close all windows, remove the bootable USB drive, then restart your system.

   For information about installing and using maxView Storage Manager as a full software application, see the *maxView Storage Manager User's Guide*.
10. Continue with the following section.

6.3 Making Your Array Bootable

Use the ARC Utility to make the array bootable (see Creating Bootable Arrays on page 90).

Then continue with Installing the Driver and an Operating System on page 54.

7 Installing the Driver and an Operating System

This chapter explains how to install your Microsemi Adaptec RAID controller driver and an operating system on a bootable array (see Creating a Bootable Array on page 50).

Note:

1. To install the driver on an existing operating system, see Installing the Driver on an Existing Operating System on page 63.
2. To install the Linux drivers from source with Dynamic Kernel Module Support (for persistence across across kernel updates), download the Linux Driver Source Code package from the support page for your product at start.microsemi.com, then follow the instructions in the embedded Readme.

7.1 Before You Begin

- Install and connect your RAID controller and internal disk drives (see Installing the Controller and Disk Drives on page 42).
- Create a bootable array (see Creating a Bootable Array on page 50).
- Download drivers from the web
- Create a driver disk (see the following section)

7.2 Creating a Driver Disk

Download the latest drivers from the Web, then create a driver disk by completing the steps below. You will need a USB flash drive to complete this task. If the driver binary is an iso image, use a writable CD instead of a flash drive.

To download drivers and create a driver disk:

1. Open a browser window, then type `start.microsemi.com` in the address bar.
2. Select your RAID controller family (Series 7, Series 8, and so on) and controller model.
3. Select your operating system version, for instance, Microsoft Windows Server 2012 x64 or Red Hat Enterprise Linux 6; then select the appropriate driver from the list.

   Note: For Linux OSs, the list of drivers typically includes a rpm file and an Images file. Select the Images file only if you are installing the driver on an existing operating system (for more information, see Installing the Driver on an Existing Operating System on page 63).

4. Click **Download Now** and accept the license agreement.
5. When the download completes, extract the contents of the driver archive file to a temporary location. If the archive includes drivers for multiple operating system versions (Windows, for instance), each driver is stored in a separate folder.
6. Change to the folder for your operating system version, as needed.
7. Copy the driver binary file or the entire driver folder contents to a USB flash drive. For Debian, Ubuntu, and Fedora Linux, be sure to extract the contents of the .tgz files first.

   If the driver binary is an iso image, see Step [8].

8. If the driver binary is an iso image–for instance, for Citrix XenServer–burn the iso to a writeable CD.

   Use whatever tool you prefer to burn the CD, such as an interactive, GUI-based, tool or the Linux command line.

   Note: For VMware ESXi 5.5 and VMware ESXi 6.0, see Installing with VMware ESXi .

9. Remove and label the driver disk.
10. Continue the installation with the instructions for your operating system.

7.3 Installing with Windows

Note: The following instructions apply to all supported Windows operating systems. You need the Windows installation DVD (or equivalent virtual media/iso image) to complete this task.

To install the Microsemi Adaptec RAID controller driver while installing Windows:

1. Insert your Windows DVD, then restart the computer.
2. Follow the on-screen instructions to begin the Windows installation.
3. When prompted to specify a location for Windows, select **Load Driver**.
4. Insert the USB driver disk, browse to the driver location, then click **OK**.
5. When the driver is found, press **Next**.

   Note: You may see the message 'No drives were found'. Repeat Step 3, Step 4 (browse to driver location), and Step 5. On the second attempt, the driver will load successfully.

6. Click **Next** again to accept the default partition configuration, or refer to your Windows documentation to configure partitions manually.
7. Follow the on-screen instructions to complete the installation.
8. Continue with Managing Your Storage Space on page 71.

7.4 Installing with Red Hat Linux or CentOS

Note: You will need the Installation DVD (or equivalent virtual media/iso image) for your operating system to complete this task. You must have root privilege to install the driver image.

To install the Microsemi Adaptec RAID controller driver while installing Red Hat Linux or CentOS:

1. Insert your installation DVD.
2. Restart your computer.
3. When the first installation screen appears, insert the USB driver disk.
4. Type this command at the Boot: prompt, then press `Enter`:

   ```
   linux dd
   ```

5. Select **Yes** to indicate that you have a driver disk, browse the USB drive (typically, `/dev/sda1`), then select the driver image.
6. Verify that the driver is loaded, then complete the installation following the on-screen instructions.
7. Continue with Managing Your Storage Space on page 71.

7.5 Installing with SuSE Linux Enterprise Server

Note: You need the SuSE installation DVD (or equivalent virtual media/iso image) to complete this task.

To install the Microsemi Adaptec RAID controller driver while installing SuSE Linux:

1. Insert the SuSE Installation DVD.
2. Restart your system.
3. When the installation selection screen appears, choose the type of installation you want, press F5 (SuSE 10) or F6 (SuSE 11), then select **Yes** to indicate that you have a driver disk.
4. Insert the USB driver disk.
5. (*SuSE 11 SP3 only*) Add 'brokenmodules=aacraid dud=1' to the Boot menu. This step ensures that the installer loads from the driver disk, not the in-box driver.
6. When prompted to "Please choose the Driver Update medium", highlight the USB partition, then select **OK**.

Note: If the "choose Driver Update medium" screen is displayed again, assume that the driver was accepted; select **Back**, then press Enter.

7. (*SuSE 11 SP3 only*) On the "Welcome screen", switch to the console by typing CTRL+ALT+F2, then type this command:

   ```
   insmod ./update/000/modules/aacraid.ko
   ```

   Press CTRL+ALT+F7 to return to the Welcome screen.

8. Complete the installation, following the on-screen instructions.
9. Continue with Managing Your Storage Space on page 71.

7.6 Installing with Fedora Linux

Note: You need the Fedora installation DVD (or equivalent virtual media/iso image) to complete this task.. You must have root privilege to install the driver image.

To install the Microsemi Adaptec RAID controller driver while installing Fedora Linux:

1. Insert the Fedora Installation DVD, then restart your computer.
2. When the Welcome screen appears, press Enter. When the installation switches to Graphical Installation, press CTRL+ALT+F2 to switch to the console. (Do not pass the "linux dd" boot option!)
3. Insert the USB driver disk, then type the following command to scan for the device:

   ```
   fdisk -l
   ```

4. Assuming the USB drive is assigned to /dev/sda1, type the following commands:

   ```
   mkdir /mnt2 /AACRAID
   mount /dev/sda1 /mnt2
   cp -r /mnt2/* /AACRAID
   umount /mnt2
   cd /AACRAID
   ```

5. Extract the .tgz file (if not done already) and ensure that the .ko file(s) are located directly under /AACRAID. For example:

   ```
   tar -zxvf aacraid-1.2.1-XXXXX-Fedora_20-Boot-x86_64.tgz
   cp aacraid-1.2.1-XXXXX-Fedora_20-Boot-x86_64/* .
   rm -rf aacraid-1.2.1-XXXXX-Fedora_20-Boot-x86_64*
   ```

6. Run the pre-installation script:

   ```
   sh ./fc-pre-install.sh
   ```

7. Press ALT+F6 to switch back to the installation screen, select Next, then follow the on-screen prompts to continue the installation.

   Note: Do not reboot at the end of the installation until you complete Step [8]!

8. When prompted to reboot the system, press CTRL+ALT+F2 to switch to the console, then type the following commands to complete the driver installation:

   ```
   mkdir /mnt/sysimage/tmp/AACRAID
   cp -r /AACRAID/* /mnt/sysimage/tmp/AACRAID
   chroot /mnt/sysimage/
   cd /tmp/AACRAID
   sh ./fc-post-install.sh
   exit
   ```

9. Press ALT+F6 to switch back to the installation screen, finish the installation, then reboot.

10. Continue with Managing Your Storage Space on page 71.

7.7 Installing with Debian Linux

Note: You need the Debian installation DVD (or equivalent virtual media/iso image) to complete this task. You must have root privilege to install the driver image.

To install the Microsemi Adaptec RAID controller driver while installing Debian Linux:

1. Insert the Debian Installation DVD, then restart your computer.
2. When the Welcome screen appears, select **Graphical Install**. Continue the installation until you see the "Configure Network" screen, then type CTRL+ALT+F2 to switch to the console.
3. Insert the USB driver disk, then type the following command to scan for the device:

   ```
   fdisk -l
   ```

4. Assuming the USB drive is assigned to `/dev/sda1`, type the following commands to begin loading the driver:

   ```
   mkdir /AACRAID
   mount /dev/sda1 /mnt
   cp -R /mnt/* /AACRAID
   umount /mnt
   ```

   Note: The following steps assume you are installing Debian 7 64-bit using kernel 3.2.0-4.

5. Copy the driver file to the /lib/modules directory:

   ```
   cp -f /AACRAID/aacraid.ko
   /lib/modules/3.2.0-4-amd64/kernel/drivers/scsi/aacraid/aacraid.ko
   ```

6. Remove the USB drive.
7. Install the loadable module:

   ```
   insmod /lib/modules/3.2.0-4-amd64/kernel/drivers/scsi/aacraid/aacraid.ko
   ```

8. Press CTRL+ALT+F5 to switch back to the installation screen, then follow the on-screen prompts to continue the installation.

   Note: Do not press Continue at the end of the installation until you complete Step [9]!

9. When prompted to reboot the system, press CTRL+ALT+F2 to switch to the console.
10. Type the following commands to complete the driver installation:

    ```
    cp -f /AACRAID/aacraid.ko
    /target/lib/modules/3.2.0-4-amd64/kernel/drivers/scsi/aacraid/aacraid.ko
    chroot /target
    /sbin/depmod -a 3.2.0-4-amd64
    update-initramfs -u -v
    exit
    ```

11. Press CTRL+ALT+F5 to switch back to the installation screen, then reboot.
12. Continue with Managing Your Storage Space on page 71.

7.8 Installing with Ubuntu Linux

Note: You need the Ubuntu installation DVD (or equivalent virtual media/iso image) to complete this task. You must have root privilege to install the driver image.

To install the Microsemi Adaptec RAID controller driver while installing Ubuntu Linux:

1. Insert the Ubuntu Installation DVD, then restart your computer.
2. When the installation menu appears, select **Install Ubuntu Server**. Continue the installation until the "Configure Network" screen appears, then type CTRL+ALT+F2 to switch to the console.
3. Insert the USB driver disk, then type the following command to scan for the device:

   ```
   fdisk -l
   ```

4. Assuming the USB drive is assigned to `/dev/sda1`, type the following commands to begin loading the driver:

   ```
   mkdir mnt2 /AACRAID
   mount /dev/sda1 /mnt2
   cp -R /mnt2/* /AACRAID
   umount /mnt2
   ```

   Note: The following steps assume you are installing Ubuntu 12 or higher.

5. Copy the driver file to the /lib/modules directory:

   ```
   rmmod aacraid
   cp -f /AACRAID/aacraid.ko
   /lib/modules/3.16.0-23-generic/kernel/drivers/scsi/aacraid/aacraid.ko
   ```

6. Remove the USB drive.
7. Install the loadable module:

   ```
   insmod /lib/modules/3.16.0-23-generic/kernel/drivers/scsi/aacraid/aacraid.ko
   ```

8. Press CTRL+ALT+F1 to switch back to the installation screen, then follow the on-screen prompts to continue the installation.

   Note: Do not press Continue at the end of the installation until you complete Step [9]!

9. When prompted to reboot the system, press CTRL+ALT+F2 to switch to the console.
10. Type the following commands to complete the driver installation:

    ```
    cp -f /AACRAID/aacraid.ko
    /target/lib/modules/3.16.0-23-generic/kernel/drivers/scsi/aacraid/aacraid.ko
    chroot /target
    /sbin/depmod -a 2.6.32-28-server
    update-initramfs -u -v
    exit
    ```

11. Press CTRL+ALT+F1 to switch back to the installation screen, then reboot.
12. Continue with Managing Your Storage Space on page 71.

7.9 Installing with Solaris

Note: This task is not necessary if you are installing Solaris 10 Update 2 or later. Instead, you can choose to install Solaris using the in-box driver and update it either during or after the installation is complete, if required.

Note: If necessary, you can create a driver disk by burning a CD with the `aac_solaris-x86.iso` file; for more information, see Creating a Driver Disk on page 54.

The following tasks describe how to install the Microsemi Adaptec RAID controller driver during Solaris OS installation:

- Installing with Solaris 10 U9 on page 59
- Installing with Solaris 11 on page 59

7.9.1 Installing with Solaris 10 U9

Note:
- During Solaris 10 U9 installation, the iso image of the driver is required. When the OS installation process prompts you to insert the iso image of the driver, insert the CD ROM or DVD ROM containing the driver image.
- You can create a driver disk by burning a CD with the `aac_solaris-x86.iso` file; for more information, see Creating a Driver Disk on page 54.
- Login as a superuser to preform this task.

To install the Microsemi Adaptec RAID controller driver while installing Solaris 10 U9:

1. Start your computer.
2. Interrupt the autoboot, press the ESC key. The Device Configuration Assistant (DCA) Utility will open.
3. Select `Apply driver updates`.
4. Insert the driver disk or other update media, then press `Return`.
5. Complete the Solaris installation, following the instructions included with your operating system.

7.9.2 Installing with Solaris 11

Note: Login as a superuser to perform this task.

To install the Microsemi Adaptec RAID controller driver during Solaris 11 installation:

1. Remove the in-box driver package by executing these steps:
   a. Check to see which AAC RAID driver package is installed on your system by using the following command:

      ```
      # modinfo | grep aac
      ```

   b. Run the following commands to find the inbox aac package name:

      ```
      #pkg list | grep aac
      #driver/storage/aac ----> inbox aac IPS packagename
      ```

   c. Remove the package (if the IPS package is installed) by using the following command:

      ```
      #pkg uninstall driver/storage/aac
      ```

   d. Press y to remove the aac package.
   e. Run the following commands to reconfigure while rebooting the machine:

      ```
      #touch /reconfigure
      #reboot
      ```

   f. At the next boot, a new OS boot option like Solaris1 is shown, select this option.
2. Install the driver by executing these steps:
   a. Insert the USB drive and copy the aac package from it on your computer.
   b. Change the directory (command cd) to the directory where the Driver Package is, and type the following command:

      ```
      # pkgadd -d
      ```

   c. At the following prompt, enter y.

      ```
      Do you want to continue with the installation of <aac> [y,n,?]
      ```

      The following message appears after a successful installation:

      ```
      Installation of <aac> was successful.
      ```

If the installation is not successful, the following message appears:

```
Installation of <aac> was suspended (administration).
```

d. If the installation was successful, skip this step, and go to step 5.

e. If the installation was not successful, remove the previously installed driver package, and then repeat step 3 to apply the drive package.

f. Run the following commands to reconfigure while rebooting the machine:

```
# touch /reconfigure
# reboot
```

g. At the next bootup, enter `b -r` as a boot option.

7.10 Installing with FreeBSD

Note: You need the FreeBSD installation DVD (or equivalent virtual media/iso image) to complete this task.

To install the Microsemi Adaptec RAID controller driver while installing FreeBSD:

1. Insert the FreeBSD Installation DVD.
2. Insert the USB driver disk.
3. Restart your computer. (Be sure to boot from the installation CD!)
4. When the FreeBSD start screen opens, select **2** for 'Escape to Loader Prompt'.
5. Type: `load kernel`
6. Type this command to locate the USB drive: `lsdev`
7. Assuming the USB drive is `disk2s1`, type this command:

   `load disk2s1:aacu.ko`

8. Type this command: `boot`
9. Complete the FreeBSD installation, as usual. When finished, remove the installation CD, but *not* the USB driver disk, then reboot.

   Note: Be sure the system is configured to boot from the controller's bootable array, not the USB drive!

10. To ensure that the driver is loaded automatically as a module at boot time, repeat Steps [4]-[7], then complete the steps below.
11. Type this command to boot to the kernel: `boot`
12. Login as root, then type:

    `dmesg`

13. Assuming the USB drive is `da1s1`, type this command to mount the drive:

    `mount -t msdosfs /dev/da1s1 /mnt`

14. Install the driver package (FreeBSD 9, in this example):

    `pkg_add /mnt/aac9x-amd64.tgz`

15. Reboot the computer.

7.11 Installing with VMware

Note: You will need a writable CD or USB flash drive to complete this task. You must have administrator privileges to create the driver disk and install the driver image.

To install the RAID controller driver with VMware ESXi 6.0 or VMware ESXi 6.5, you must create a custom boot image using the ESXi-Customizer tool. This tool automates the process of customizing the ESXi install-ISO and runs as a script under Microsoft PowerShell.

You can download the ESXi-Customizer tool, `ESXi-Customizer-PS-v2.5.ps1`, from https://www.v-front.de/p/esxi-customizer-ps.html and other locations on the Web.

Note: Be sure to install the prerequisite software first, including Powershell and VMware POWERCLI, before you install ESXi-Customizer.

Note: VMware 6.0 driver supports VMware 6.5.

To install the RAID controller driver while installing VMware:

1. Download and install Microsoft PowerShell and VMware POWERCLI, as needed. You can download PowerShell from the Microsoft Download Center at www.microsoft.com/download, and POWERCLI from my.vmware.com.

   Note: PowerShell is pre-installed on many Windows systems, including Windows Server 2012 and Windows Server 2016.

2. Download the ESXi-Customizer tool from https://www.v-front.de/p/esxi-customizer-ps.html or other Web location. Then, unpack the archive to a local directory on your Windows system; `C:\ESXi-Customizer`, for instance.
3. Copy the VMware driver vib for your OS version to a temp directory, such as `C:\temp\pkg`. The driver vib files (listed below, where xxxxxxx is the driver version number) should be in the driver download directory on your Windows system (see Creating a Driver Disk).

Options	Description
ESXi 6.5/6.0	VMware-VMvisor-Installer-6.0.0-2494585.x86_64.iso vmware-esxi-drivers-scsi-aacraid-600.6.2.1.XXXXX.-1.0.6.2159203.x86_64.vib

4. Run ESXi-Customizer from the installation directory:

   ```
   C:\ESXi-Customizer>ESXi-Customizer.cmd
   ```

5. In PowerShell, enter the following command:

   ```
   .\ESXi-Customizer-PS-v2.5.ps1 –Vxx -pkgDir C:\temp\pkg
   ```

   where Vxx is the VMware OS version: `V60` for VMmare 6.0, `V65` for VMware 6.5.

   PowerShell begins creating the custom ESXi install-ISO with embedded RAID controller driver. It displays "All done" when the ISO is ready.

6. Burn the custom ISO image to a writable CD or USB drive.

   Note: Use whatever tool you prefer to burn the CD or USB drive.

   Remove the CD or USB drive after you finish burning the image.

7. On the VMware ESXi machine, insert the custom boot CD/USB, then restart your computer.
8. Follow the on-screen instructions to begin the VMware installation.
9. Complete the VMware installation, following the on-screen instructions.
10. Remove the custom boot CD or USB drive, then reboot your computer.

7.12 Installing with Citrix XenServer

Note: To install the RAID controller driver with Citrix XenServer, you must burn the XenServer driver iso image to a writeable CD; USB driver disks are not supported for XenServer (see Creating a Driver Disk on page 54). You will be prompted to insert the XenServer driver CD *twice*. You need the XenServer installation DVD (or equivalent virtual media/iso image) to complete this task. You must have administrator privilege to install the driver image.

To install the RAID controller driver while installing Citrix XenServer:

1. On the machine where you want to install the OS and RAID controller driver, insert the XenServer installation DVD, then restart your computer.
2. When prompted to add a driver, press F9.
3. Remove the XenServer installation DVD and insert the driver CD.
4. When the driver update is complete, remove the driver CD and insert the XenServer installation DVD.
5. Continue the XenServer installation, following the on-screen instructions.
6. When prompted to add a driver (at the end of the OS installation),remove the XenServer installation DVD and insert the driver CD.
7. Complete the XenServer installation, following the on-screen instructions.
8. Remove the driver CD, then reboot your computer.

8 Installing the Driver on an Existing Operating System

This chapter explains how to install your Microsemi Adaptec RAID controller driver on an existing operating system.

Note:

1. To install the driver while you're installing an operating system, see Installing the Driver and an Operating System on page 54
2. To install the Linux drivers from source with Dynamic Kernel Module Support (for persistence across across kernel updates), download the Linux Driver Source Code package from the support page for your product at start.microsemi.com, then follow the instructions in the embedded Readme.

8.1 Before You Begin

- Install and connect your Microsemi Adaptec RAID controller and internal disk drives (see Installing the Controller and Disk Drives on page 42).
- Download drivers from the web site
- Create a driver disk (see the following section)

8.2 Creating a Driver Disk

Download the latest drivers from the Web, then create a driver disk by completing the steps below. You will need a USB flash drive to complete this task.

To download drivers and create a driver disk:

1. Open a browser window, then type `start.microsemi.com` in the address bar.
2. Select your RAID controller family (Series 7, Series 8, and so on) and controller model.
3. Select your operating system version, for instance, Red Hat Enterprise Linux 6 or Microsoft Windows Server 2012 x64; then select the appropriate driver from the list.

   Note: For Linux OSs, the list of drivers typically includes a rpm file and an Images file. You can use either one to install the driver on an existing operating system. The instructions in this chapter use the rpm.

4. Click **Download Now** and accept the license agreement.
5. When the download completes, extract the contents of the driver archive file to a temporary location. If the archive includes drivers for multiple operating system versions (Windows, for instance), each driver is stored in a separate folder, including one each for 32-bit and 64-bit operating systems.
6. Change to the folder for your operating system version, as needed.
7. Copy the driver binary file or the entire driver folder contents to a USB flash drive.

   Note: For VMware and Citrix XenServer, use a remote copy utility to copy the driver to the local machine; see Installing on VMware on page 67 and Installing on XenServer. on page 67.

8. Remove and label the driver disk.
9. Continue the installation with the instructions for your operating system.

8.3 Installing on Windows

Note: The following instructions apply to all supported Windows operating systems.

To install the driver on Windows:

1. Start or restart Windows.

2. In the Control Panel, launch the Device Manager, right-click your RAID controller, then select **Update Driver Software**.
3. Insert the driver disk, then select **Browse my computer for driver software**.
4. Browse to the driver disk location, then click **Next**.
5. Select the driver from the list, then click **Next**.
6. When the installation is complete, remove the driver disk and restart your computer.
7. Continue with Managing Your Storage Space on page 71.

8.4 Installing on Red Hat, CentOS, SuSE, or Fedora Linux

Note: If your Red Hat 7, SLES 11 SP3, or SLES 12 system is booted with uEFI Secure Boot, you will need to add a public key to the MOK list (Machine Owner Key) before completing the steps below. See the Readme for more information.

To install the driver on Red Hat Linux, CentOS, SuSE Linux, or Fedora Linux:

1. Insert and mount the driver disk (assuming the USB drive is `/dev/sda1`):

   ```
   mount /dev/sda1 /mnt/usb
   ```

2. Install the module RPM:

   ```
   rpm -ivh mount-point/xxx/yyy.rpm
   ```

   where *mount-point* is the mount point on the Linux system, *xxx* is the driver path, and *yyy.rpm* is the rpm file name.

3. Reboot your computer to ensure the driver loaded correctly.
4. Continue with Managing Your Storage Space on page 71.

8.5 Installing on Ubuntu Linux

Note: For driver installation on Ubuntu Linux, you may need to create the root account and password. Enter these commands: `sudo bash; sudo passwd root`. You must have root privilege to install the driver image.

Note: Microsemi's pre-built driver supports the kernel that is delivered as part of the ISO. For other kernels, use DKMS process.

To install the driver on Ubuntu Linux:

1. Update the Ubuntu package index:

   ```
   sudo apt-get update
   ```

2. Load the Ubuntu unpacking tools:

   ```
   sudo apt-get install build-essential
   ```

3. Insert and mount the driver disk (assuming the USB drive is `/dev/sda1`):

   ```
   mount /dev/sda1 /mnt/usb
   ```

4. Install the DEB driver package (where xxxxx is the build number):

   Ubuntu 11:

   ```
   sudo dpkg -i
   /mnt/usb/aacraid-1.2.1-xxxxx-Ubuntu11.10+12.04+12.04.1+12.04.2-all.deb
   ```

   Ubuntu 14:

```
sudo dpkg -i /mnt/usb/aacraid-1.2.1-xxxxx-Ubuntu14.10-x86_64.deb
```

Ubuntu 16:

```
sudo dpkg -i /mnt/usb/aacraid-1.2.1-xxxxx-Ubuntu16.10-x86_64.deb
```

5. Reboot your computer to ensure the driver loaded correctly.
6. Continue with Managing Your Storage Space on page 71.

8.6 Installing on Solaris

Note: On the Microsemi website, drivers for Solaris 10 and 11 are provided in two formats— iso (in the diskette folder) and aac installable (in the solaris-x86 folder). When installing the driver on an existing Solaris 10 U9 and 11 OS, use the aac installable. You can copy the solaris-x86 folder to your USB drive from your local machine.

The following tasks describe how to install the Microsemi Adaptec RAID controller driver on an existing Solaris OS:

- Installing on Existing Solaris 10 U9 on page 65
- Installing on Existing Solaris 11 on page 65

8.6.1 Installing on Existing Solaris 10 U9

Note: Login as a superuser to perform this task.

To install or upgrade the Microsemi Adaptec RAID controller driver on an existing Solaris 10 U9 OS:

1. Remove the pre-existing driver package by executing the following command:

```
# pkgrm SUNWaac
```

2. Insert the USB drive and copy the aac package from it on your computer.
3. Change the directory (command cd) to the directory where the Driver Package is, and type the following command:

```
# pkgadd -d AAC.PKG
```

4. Run the following command to reboot the machine:

```
# reboot
```

5. Continue with Managing Your Storage Space. on page 71

8.6.2 Installing on Existing Solaris 11

Note: Login as a superuser to perform this task.

To install or upgrade the Microsemi Adaptec RAID controller driver on an existing Solaris 11 OS:

1. Remove the in-box driver package by executing these steps:
   a. Check to see which AAC RAID driver package is installed on your system by using the following command:

```
# modinfo | grep aac
```

   b. Run the following commands to find the inbox aac package name:

```
#pkg list | grep aac
#driver/storage/aac ----> inbox aac IPS packagename
```

   c. Remove the package (if the IPS package is installed) by using the following command:

```
#pkg uninstall driver/storage/aac
```

d. Press y to remove the aac package.

e. Run the following commands to reconfigure while rebooting the machine:

```
#touch /reconfigure
#reboot
```

f. At the next boot, a new OS boot option like Solaris1 is shown, select this option.

2. Install or upgrade the driver by executing these steps:

a. Insert the USB drive and copy the aac package from it on your computer.

b. Change the directory (command cd) to the directory where the Driver Package is, and type the following command:

```
# pkgadd -d
```

c. At the following prompt, enter y.

```
Do you want to continue with the installation of <aac> [y,n,?]
```

The following message appears after a successful installation:

```
Installation of <aac> was successful.
```

If the installation is not successful, the following message appears:

```
Installation of <aac> was suspended (administration).
```

d. If the installation was successful, skip this step, and go to step 5.

e. If the installation was not successful, remove the previously installed driver package, and then repeat step 3 to apply the drive package.

f. Run the following commands to reconfigure while rebooting the machine:

```
# touch /reconfigure
# reboot
```

g. At the next bootup, enter b `-r` as a boot option.

3. Continue with Managing Your Storage Space. on page 71

8.7 Installing on FreeBSD

To install the driver on FreeBSD:

1. Start your computer.
2. Insert and mount the driver disk:

```
mount -t msdos /dev/fd1 /mnt
```

3. Copy the driver package to the /tmp directory:

```
cp /mnt/aac9x-i386.tgz /tmp
```

4. Install the driver package:

```
pkg_add /tmp/aac9x-i386.tgz
```

5. Remove the driver disk, then reboot your computer.
6. Continue with Managing Your Storage Space on page 71.

8.8 Installing on VMware

Note: You must remove the old driver before you can install the new one. You must have root privilege to install the new driver.

Note: To copy the driver VIB file to the VMware ESXi server (in Step 2 below), you must have access to a remote copy utility, such as WinSCP, putty, or Linux scp.

To install the driver on VMware:

1. At the VMware console screen, type these commands to remove the old driver from a VMware 5.x or VMware 6.0 system:

```
esxcli software vib list | grep -i aacraid (list driver packages)
esxcli software vib remove --vibname=scsi-aacraid --maintenance-mode (remove
 package)
```

2. Using a remote copy utility, copy the driver VIB file for your operating system version to a local directory on the ESXi server. This example uses Linux scp to copy the driver to /tmp/aacraid (where xxxxx is the build number):

   VMware ESXi 5.5:

```
scp
/mnt/sda1/linux/driver/vmware-esxi-drivers-scsi-aacraid-550.5.2.1.xxxxx.-1.5.5.1331820.x86_64.vib
 root@<esx-server-ip>:/tmp/aacraid
```

   VMware ESXi 6.0:

```
scp
/mnt/sda1/linux/driver/vmware-esxi-drivers-scsi-aacraid-600.6.2.1.xxxxx.-1.0.6.2159203.x86_64.vib
 root@<esx-server-ip>:/tmp/aacraid
```

3. Install the VIB module (where xxxxx is the build number):

   VMware ESXi 5.5:

```
esxcli software vib install -f -v
file:/tmp/aacraid/vmware-esxi-drivers-scsi-aacraid-550.5.2.1.xxxxx.-1.5.5.1331820.x86_64.vib
```

   VMware ESXi 6.0:

```
esxcli software vib install -f -v
file:/tmp/aacraid/vmware-esxi-drivers-scsi-aacraid-600.6.2.1.xxxxx.-1.0.6.2159203.x86_64.vib
```

4. Reboot your computer.

8.9 Installing on Citrix XenServer

Note: To copy the driver RPM file to XenServer (in Step 1 below), you must have access to a remote copy utility, such as WinSCP, putty, or Linux scp. You must have root privilege to install the driver.

To install the driver on XenServer (where xxxxx is the build # and .x is the OS version):

1. Using a remote copy utility, copy the driver RPM file to a local directory on XenServer. This example uses Linux scp to copy the driver to /tmp/aacraid:

```
scp /mnt/sda1/linux/driver/citrix-aacraid-1.2.1-xxxxx.xen-6.x.rpm
root@<xen-server-ip>:/tmp/aacraid
```

2. Install the driver module rpm:

```
rpm -ivh /tmp/aacraid/citrix-aacraid-1.2.1-xxxxx.xen-6.x.rpm
```

3. Reboot your computer.

9 Installing Dynamic Kernel Module Support

This chapter explains how to install the DKMS driver.

9.1 Installing the DKMS Deb Package on Ubuntu Systems

The following steps are for installing the DKMS deb package on an Ubuntu System.

1. Since DKMS involves changing system-level kernel files, it requires superuser permissions.

   ```
   $sudo su
   ```

2. DKMS requires build-essential (which installs all packages that are required to build an executable on Ubuntu), the current kernel headers, and DKMS.

   ```
   # apt-get install dkms build-essential linux-headers-`uname -r`
   ```

3. Once the dependency packages have been installed, the DKMS deb package can be installed. Now DPKG calls DKMS internally, which builds the driver and installs it to the current kernel. XXXXX is the driver release version.

   ```
   # dpkg -i aacraid-dkms_1.2.1.XXXXX_all.deb
   ```

4. After the DKMS install is done, the system needs to be rebooted for the new driver to take effect.

   ```
   # apt-get install linux-headers-`uname -r`
   ```

   Note: When the Ubuntu Linux kernel is updated, then DKMS will attempt to build the driver for the newly updated kernel and fail, since the headers for the new kernel have not been installed yet. Reboot the system and select the newly updated kernel. Once it boots up, previous command will install headers for the updated kernel and install AACRAID driver on it as well.

9.2 Installing the DKMS RPM Package

The DKMS executable package is available in the EPEL repository.

1. Retrieve the EPEL repository file (the "X" denotes the major version).

   ```
   $ wget https://dl.fedoraproject.org/pub/epel/epel-release-latest-X.noarch.rpm
   ```

2. Install the EPEL repository.

   ```
   $ sudo rpm -Uvh epel-release-latest-X.noarch.rpm
   ```

3. Install DKMS.

   ```
   $ sudo yum install dkms
   ```

9.3 DKMS Reference

This section contains information on the other functions of DKMS.

1. Build and install a driver.

   ```
   # dkms add -m aacraid -v 1.2.1.XXXXX
   # dkms build -m aacraid -v 1.2.1.XXXXX
   # dkms install -m aacraid -v 1.2.1.XXXXX
   ```

2. Build a driver for a different system other than native.

```
# dkms build -k 2.4.21-4.ELsmp -m aacraid -v 1.2.1.XXXXX
# dkms install -k 2.4.21-4.ELsmp -m aacraid -v 1.2.1.XXXXX
```

3. Make a driver disk from a set of built drivers.

```
# dkms mkdriverdisk -k 2.4.21-4.ELBOOT,2.4.21-4.ELsmp,2.4.21-4.EL \
      -d redhat -m aacraid -v 1.2.1.52009
# dkms mkdriverdisk -k 2.6.11.4-20a-default,2.6.11.4-20a-smp \
      -d suse -m aacraid -v 1.2.1.52009
```

4. Check current status of DKMS.

```
# dkms status
```

10 Managing Your Storage Space

Once you have installed your Microsemi Adaptec RAID controller, disk drives (or other devices), and device driver, you can begin to build and manage your storage space.

This chapter introduces maxView Storage Manager, and describes the other utilities included with your Microsemi Adaptec RAID controller.

10.1 About maxView Storage Manager

maxView Storage Manager is a browser-based software application that helps you build a storage space for your online data, using Microsemi Adaptec RAID controllers and disk drives.

With maxView Storage Manager, you can group disk drives into logical drives and build in redundancy to protect your data and improve system performance.

From a single workstation, you can use maxView Storage Manager to monitor and manage all the controllers and disk drives in your storage space.

When maxView Storage Manager is installed on a computer, the *maxView Storage Manager Agent* (and other related services) is also installed automatically. The Agent is designed to run in the background, without user intervention. Its job is to monitor system health, manage event notifications, task schedules, and other on-going processes on a system. It sends notices when tasks are completed successfully, and notifies you when errors or failures occur on that system.

If your storage space includes systems that won't be connected to monitors (and therefore won't require the graphical user interface), you can choose to run the *Agent only* on those systems instead of the full application. For more information, refer to the *maxView Storage Manager User's Guide*.

10.1.1 Installing maxView Storage Manager

For details about installing maxView Storage Manager on different operating systems, refer to the *maxView Storage Manager User's Guide*.

10.2 About the Microsemi Adaptec RAID Controller Configuration Utility

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

With ARCCONF, you can:

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

For information about installing and using ARCCONF, refer to the *Microsemi Adaptec RAID Controller Command Line Utility User's Guide*.

10.3 About the Microsemi Adaptec RAID Configuration Utility

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

- Logical Device Configuration—For creating and managing arrays, and initializing and rescanning disk drives.
- Controller Settings—For modifying your controller and disk drive settings.
- Disk Utilities—For formatting or verifying disk drives.

The ARC utility is included in your controller's BIOS. For more information, see Using the Microsemi Adaptec RAID Configuration Utility on page 89.

Note: The ARC utility is primarily intended for pre-operating system installation configuration.

10.4 About the Adaptec Flash Utility

The Adaptec Flash Utility (AFU) is a text-based DOS utility that you can use to update, save, or verify your RAID controller's firmware.

Caution: Although the AFU contains safeguards to prevent you from accidentally damaging your RAID controller's flash contents, it is still important to use the AFU carefully and correctly to avoid rendering your RAID controller inoperable. We recommend that only advanced users familiar with working in DOS use the AFU. You can also use maxView Storage Manager to update the controller firmware. See the *maxView Storage Manager User's Guide* for more information.

10.5 Which Utility Should I Use?

To create a bootable array, we recommend that you use the BIOS-based ARC utility (See Using the Microsemi Adaptec RAID Configuration Utility on page 89).

For subsequent storage management tasks on most supported operating systems, including VMware Guest OSs, we recommend that you install and use maxView Storage Manager (see About maxView Storage Manager on page 71). As a full-featured software application with a graphical user interface, it is the easiest to use and offers the widest range of management functions. For operating systems that do not support the maxView Storage Manager GUI, such as FreeBSD, use the ARCCONF command line utility to configure and manage arrays.

11 Solving Problems

This chapter provides basic troubleshooting information and solutions for solving controller problems.

11.1 Troubleshooting Checklist

If you encounter difficulties installing or using your Microsemi Adaptec RAID controller, check these items first:

- With your computer powered off, check the connections to each disk drive, power supply, LED connector, and so on.
- Try disconnecting and reconnecting disk drives from the Microsemi Adaptec RAID controller.
- Check that your RAID controller is installed in a compatible PCIe expansion slot. To double-check the bus compatibility of your controller, see About Your Adaptec RAID Controller on page 16.
- Ensure that your RAID controller is firmly seated and secured in the PCIe expansion slot.
- If your RAID controller is not detected during system boot, try installing it in a different compatible expansion slot. (See Installing the Controller on page 42 for instructions.)
- Did the driver install correctly?
- If you have external disk drives (or other devices), are they powered on?
- Check the Readme for compatibility issues and known problems.

If you are still unable to resolve a problem, you can find additional troubleshooting information and direction at www.adaptec.com or the Support Knowledgebase at ask.adaptec.com.

11.2 Monitoring Disk Drives Status

You can use the 'blink' feature in the ARC utility and maxView Storage Manager to monitor the status of your SAS and SATA disk drives. When you blink a specific disk drive or set of disk drives, the LED(s) on the selected disk drives flash.

This table describes the LED flash states.

Controller Device State	Slot State	LED Flash State
Failed	Device is faulty	On
Rebuilding	Device is rebuilding	Slow flash
Blink	Identify the device	Fast flash
Other	No error	Off

For more information about using maxView Storage Manager to monitor your disk drives, refer to the *maxView Storage Manager User's Guide* or the online Help.

11.3 Silencing the Alarm

If your Microsemi Adaptec RAID controller includes an alarm, the alarm will sound when an error occurs. To silence the alarm, use maxView Storage Manager (see Managing Your Storage Space on page 71.) OR the ARC utility (see Modifying Your Controller Configuration on page 94.)

11.4 Recovering from a Disk Drive Failure

This section explains how to recover when a disk drive or SSD fails:

- If the array was protected by a hot spare, see Failed Disk Drive Protected by a Hot Spare on page 74.
- If the array was *not* protected by a hot spare, see Failed Disk Drive Not Protected by a Hot Spare on page 74.

- If there is a disk drive failure in more than one array simultaneously, see Failure in Multiple Arrays Simultaneously on page 74.
- If it is a RAID 0 array, see Disk Drive Failure in a RAID 0 Array on page 74.
- If multiple disk drives fail within the same array, see Multiple Failures in the Same Array on page 74.
- If the drive is part of the maxCache Device, see Failed Drive in maxCache Device on page 75.

Note: maxView Storage Manager uses the term *logical drives* or *logical devices* when referring to *arrays* (see Terminology Used in this Guide on page 13).

11.4.1 Failed Disk Drive Protected by a Hot Spare

When an array is protected by a hot spare, if a disk drive in that array fails the hot spare is automatically incorporated into the array and takes over for the failed drive.

To recover from the failure:

1. Remove and replace the failed disk drive.
2. *If copyback is not enabled*—In maxView Storage Manager, remove the 'hot spare' designation from the original hot spare (the disk drive that was built into the array). Then, designate a new hot spare to protect the arrays on that controller.

   If copyback is enabled—Data is automatically moved back to its original location once the controller detects that the failed drive has been replaced. No action is required.

11.4.2 Failed Disk Drive *Not* Protected by a Hot Spare

When an array is not protected by a hot spare, if a disk drive in that array fails, remove and replace the failed disk drive. The controller detects the new disk drive and begins to rebuild the array.

If the controller fails to rebuild the array, check that the cables, disk drives, and controllers are properly installed and connected. Make sure that the new disk drive is equal or greater in size than the failed disk drive. Then, if necessary, use maxView Storage Manager to rebuild the array. For instructions, refer to the *maxView Storage Manager User's Guide* or the online Help.

11.4.3 Failure in Multiple Arrays Simultaneously

If there's a disk drive failure in more than one array at the same time (one failure per array), and the arrays have hot spares protecting them, the controller rebuilds the arrays with these limitations:

- A hot spare must be of equal or greater size than the failed disk drive it's replacing.
- Failed disk drives are replaced with hot spares in the order in which they failed. (The array that includes the disk drive that failed first is rebuilt first, assuming an appropriate hot spare is available—see bullet above.)

If there are more disk drive failures than hot spares, see Failed Disk Drive Not Protected by a Hot Spare on page 74.

If copyback is enabled, data is moved back to its original location once the controller detects that the failed drive has been replaced.

11.4.4 Disk Drive Failure in a RAID 0 Array

Because RAID 0 volumes do not include redundancy, if a disk drive fails in a RAID 0 array, the data can't be recovered.

Correct the cause of the failure or replace the failed disk drives. Then, restore your data (if available).

11.4.5 Multiple Failures in the Same Array

Except in RAID 6 and RAID 60 arrays (see Understanding RAID on page 81), if more than one disk drive fails at the same time in the same array, the data normally can't be recovered.

You *may* be able to recover the data by forcing the logical drive online or by recreating the logical drive without the initialization step. You can use the BIOS utility, ARC (see About the Microsemi Adaptec RAID Configuration Utility on page 71), the command-line utility, ARCCONF, or maxView Storage Manager. For more information, refer to the *Microsemi Adaptec RAID Controller Command Line Interface User's Guide* and *maxView Storage Manager User's Guide*.

> **Note:** In some instances, RAID 10 and RAID 50 arrays *may* survive multiple disk drive failures, depending on which disk drives fail.

11.4.6 Failed SSD in maxCache Device

Because the maxCache Device is a redundant logical device, comprised of SSDs only, it is rebuilt automatically when a failed SSD is replaced, just like an ordinary array. Once you identify the failed SSD, for example, by using *maxView Storage Manager's* rapid fault isolation feature, replace it with a new one (see Connecting SSDs on page 47). The controller detects the new SSD and begins rebuilding the maxCache Device.

11.5 Resetting the Controller

You may need to reset, or *flash*, your Microsemi Adaptec RAID controller if it becomes inoperable or if a firmware upgrade is unsuccessful. Microsemi Adaptec RAID controllers support a reset protocol called HDA mode flash. For information about HDA mode, see the Readme or contact your support representative. To locate the flash jumper on your RAID controller board, see the illustrations in About Your RAID Controller on page 16.

A Introduction to SAS

This section provides a basic overview of the main features of SAS, introduces some common SAS terms, and explains how SAS differs from parallel SCSI.

> **Note:** For technical articles and tutorials about SAS, refer to the SCSI Trade Association (STA™) Web site at www.scsita.org.

A.1 Terminology Used in This Appendix

For convenience, SAS HBAs and SAS RAID controllers are referred to generically in this chapter as *SAS cards*. HBAs, RAID controllers, disk drives, and external disk drive enclosures are referred to as *end devices* and expanders are referred to as *expander devices*.

For convenience, this chapter refers to end devices and expander devices collectively as *SAS devices*.

A.2 What is SAS?

Legacy parallel SCSI is an interface that lets devices such as computers and disk drives communicate with each other. Parallel SCSI moves multiple bits of data *in parallel* (at the same time), using the SCSI command set.

SAS is an evolution of parallel SCSI to a point-to-point serial interface. SAS also uses the SCSI command set, but moves multiple bits of data one at a time. SAS links end devices through direct-attach connections, or through expander devices.

SAS cards can typically support up to 128 end devices and can communicate with both SAS and SATA devices. (You can add 128 end devices—or even more—with the use of SAS expanders. See SAS Expander Connections on page 79.)

> **Note:** Although you can use both SAS and SATA disk drives in the same *SAS domain* (see SAS Expander Connections on page 79), we recommend that you do not combine SAS and SATA disk drives within the same array or logical drive. The difference in performance between the two types of disk drives may adversely affect the performance of the array.

Data can move in both directions simultaneously across a SAS connection (called a *link*—see How SAS Devices Communicate on page 76). Link speed is 300 MB/sec in half-duplex mode. Therefore, a SAS card with eight links has a bandwidth of 2400 MB/sec.

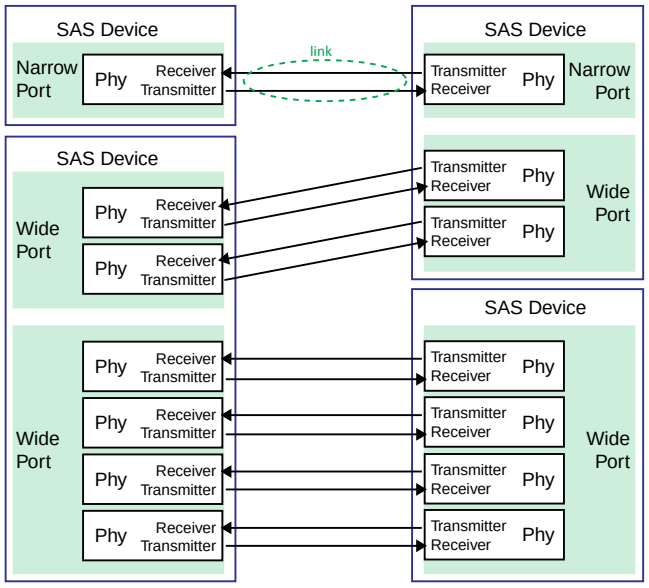
Although they share the SCSI command set, SAS is conceptually different from parallel SCSI physically, and has its own types of connectors, cables, connection options, and terminology, as described in the rest of this chapter.

To compare SAS to parallel SCSI, see How is SAS Different from Paralle SCSI? on page 80.

A.3 How Do SAS Devices Communicate?

SAS devices communicate with each other through links. A *link* is a physical connection between two phys.

As shown in the following figure, SAS devices contain ports (see What is a SAS Port on page 77), ports contain *phys*, and each phy contains one transmitter and one receiver—one transceiver. A phy can belong to one port only.



A.4 What's a Phy?

Phys are part of the physical communication connection between SAS devices. Each phy contains a transceiver that sends data back and forth between SAS devices.

When a connection is formed between two end devices, a link is established from a phy in one port to a phy in the other port. As shown in the figure above, a wide port can support multiple independent links simultaneously.

Phys are internal, within SAS connectors (see What's a SAS Connector? on page 78).

SAS cables physically connect one or more phys on one SAS device to one or more phys on another SAS device.

A.5 What's a SAS Port?

> **Note:** Because the physical link between SAS devices is from phy to phy, rather than port to port, a "port" is more of a virtual concept, different from what is normally considered a port on other types of RAID controllers and storage devices.

A *port* is one or more phys. A *narrow port* contains one phy. A *wide port* typically contains four phys.

Each port has its own unique SAS address (see How are Disk Drives Identified? on page 78), and all the phys in a port share that same SAS address.

SAS card port options vary. A SAS card with four phys could be configured with one wide port, with two wide ports that comprise two phys, or with four narrow ports each containing one phy. (A wide port with four phys is referred to as a *4-wide* or *4x* port.)

A.6 What's a SAS Address?

Each SAS port is identified with a unique SAS address, which is shared by all phys on that port.

For example, a SAS disk drive might have two narrow ports. Each port has one unique SAS address. The single phy in each port uses its port's SAS address.

In another example, a SAS device might have one 4-wide port. That port has one SAS address, which is shared by all four phys in the port.

Unlike SCSI devices and SCSI IDs, SAS devices self-configure their SAS addresses. User intervention is not required to set SAS addresses, and SAS addresses cannot be modified.

A.7 What's a SAS Connector?

A SAS or mini-SAS connector is the physical plug or receptacle that you see on a SAS device. It's what you plug a SAS cable into, or the end of the SAS cable that's being plugged in. (See See Cables on page 37.)

A connector is what forms physical links between phys. Some SAS connectors can support multiple links. The number of links a SAS connector can support is referred to as its *width*. *Narrow* connectors support a single link; *wide* connectors supports more than 1 link.

A single SAS device may have one or more connectors. A single SAS connector may help form links between more than two SAS devices. (For instance, as shown in the figure in Connecting Drives Directly to the Controller on page 46, the 4-wide internal SAS connector forms links with four independent disk drives.)

A.8 What do SAS Cables Look Like?

Internal standard SAS cables are narrower than internal parallel SCSI cables. The connectors vary in size depending on the number of links they support, from single link connectors to 4-wide (or larger) connectors. Internal fan-out cables let you attach four disk drives to a single 4-wide connector.

Mini-SAS connectors support both internal and external SAS connections. The mini-SAS connectors are smaller than the standard SAS internal and external connectors. Mini-SAS connectors support single and multilinks with the ability to scale to future speed needs.

For examples of some internal SAS/mini-SAS cables and an external SAS/mini-SAS cables, see Cables on page 37.

A.9 How are Disk Drives Identified in SAS?

In the BIOS and in the management utilities (see Identifying Disk Drives on page 99), disk drives are identified in the following formats:

- CNX:DevY = Device Y is attached to Connector X (see Direct-Attach Connections on page 78 for more information)
- BoxX:SlotX = Enclosure X is attached to a disk drive in Slot X (see Backplane Connections on page 79 for more information)
- ExpX:PhyX = Expander X is attached to Phy X (see SAS Expander Connections on page 79 for more information)

where X is the count number.

> **Note:** Devices other than disk drives (CDROM, tape drives, etc...) are listed in order after your system disk drives.

In parallel SCSI, XX is the disk drive's channel number, YY is the target number, and ZZ is the logical unit number (LUN).

A.10 What are the SAS Connection Options?

You can connect end devices to each other through direct cable connections and through backplane connections. When you use one or more expander devices (see SAS Expander Connections on page 79), you can create large configurations.

A.10.1 Direct-attach Connections

In a direct-attach connection, SAS or SATA disk drives are connected directly to a SAS card with SAS or mini-SAS cables. One disk drive is attached to one SAS/mini-SAS connector with one SAS/mini-SAS cable (or multiple disk drives are attached to one SAS/mini-SAS connector with one fan-out cable). The figure in Connecting Drives Directly to the Controller on page 46 shows an example of direct-attach connections.

The number of direct-attached disk drives is limited to the number of *phys* supported by the SAS card. (Note that there may be multiple phys within a single connector. See SAS Expander Connections on page 79.)

A.10.2 Backplane Connections

In a backplane connection, disk drives and SAS cards are attached to and communicate with each other through a system backplane.

There are two types of backplane connections, *passive* and *active*. When connecting to either backplane, it's important to properly connect your disk drive LEDs in order to identify disk drive conditions. See About Your RAID Controller on page 16 for your RAID controller Activity LED connections and locations.

Once you have connected to a backplane, use maxView Storage Manager to manage your disk drives. For more information, refer to the *maxView Storage Manager User's Guide*.

The number of end devices is limited to the number of slots available on the backplane.

Some backplanes support daisy-chain expansion to other backplanes, allowing you to connect multiple enclosures to a single SAS card in a host system.

A.10.3 SAS Expander Connections

A SAS expander device literally expands the number of end devices that you can connect together. Expander devices, typically embedded into a system backplane (see Backplane Connections on page 79), support large configurations of SAS end devices, including SAS cards and SAS and SATA disk drives. With expander devices, you can build large and complex storage topologies.

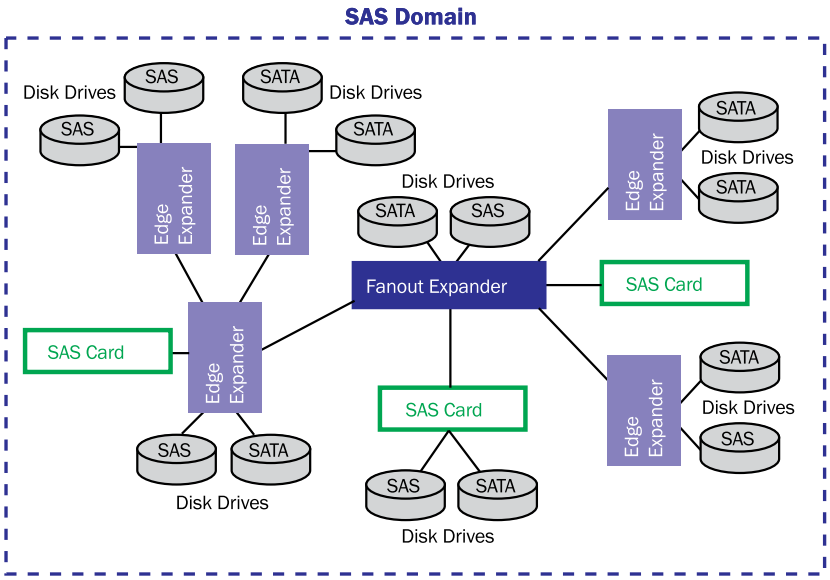
There are two types of SAS expanders: *fanout expanders* and *edge expanders*. Each performs a different role in a storage system. (For more information about how SAS expanders work, refer to the STA Web site at www.scsita.org.)

You can connect up to 128 SAS ports to an edge expander. (A single edge expander can therefore support up to 128 SAS addresses.)

You can connect up to 128 edge expanders to a fanout expander.

You can use only one fanout expander in any single SAS *domain* (a topology of SAS—and possibly SATA—end devices and expander devices). A single SAS domain can therefore comprise up to 16,384 SAS ports (and therefore up to 16,384 SAS addresses including the fanout expander).

The next figure illustrates (in very basic terms) a SAS domain and shows how SAS cards, SAS and SATA disk drives, and expander devices can fit together in a large data storage topology.



A.11 How is SAS Different from Parallel SCSI?

In summary, although SAS and parallel SCSI both use the SCSI command set, how they move data from one place to another is very different. To support point-to-point *serial* data transport, SAS introduces new types of connectors, cables, connection options, and terminology.

Generally speaking, SAS is faster and more flexible than parallel SCSI, and provides more options for building your storage space. SAS lets you mix SAS and SATA disk drives together, and lets you connect many, *many* more devices.

This table describes many of the main differences between the two interfaces.

Parallel SCSI	Serial Attached SCSI
Parallel interface	Serial interface
Maximum speed 320 MB/sec shared by all devices on the bus	Maximum speed 300 MB/sec per phy when in half-duplex mode
Supports SCSI devices only	Supports SATA and SAS disk drives simultaneously
Up to 16 devices per SCSI channel	More than 100 disk drives per SAS card, using an expander (see SAS Expander Connections on page 79) or 50 SATAII disk drives.
Supports single-port devices only	Supports single- and dual-port devices
Uses SCSI IDs to differentiate between devices connected to the same adapter	Uses unique SAS addresses to differentiate between devices
User intervention required to set SCSI IDs	SAS addresses self-configured by SAS devices
Requires bus termination	Requires no bus termination
Standard SCSI connectors	SAS connectors (see Cables on page 37)

B Understanding RAID

When you create arrays (or logical drives), you can assign a RAID level to protect your data.

Each RAID level offers a unique combination of performance and redundancy. RAID levels also vary by the number of disk drives they support.

This appendix describes the RAID levels supported by your Microsemi Adaptec RAID controller, and provides a basic overview of each to help you select the best level of protection for your data storage.

B.1 Understanding Drive Segments

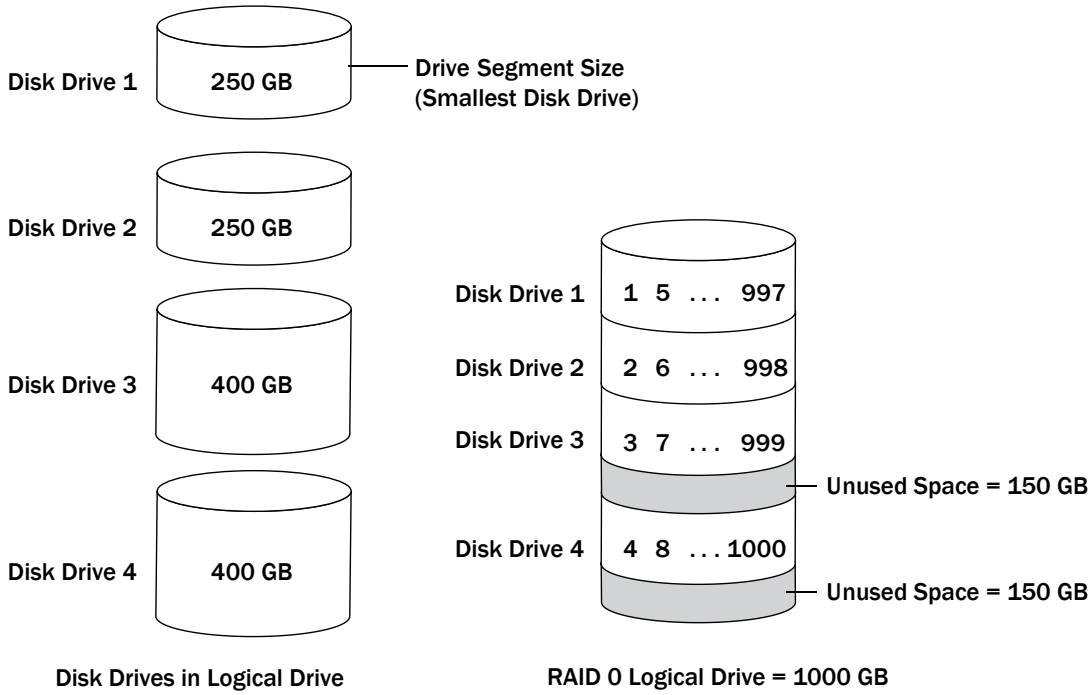
A *drive segment* is a disk drive or portion of a disk drive that is used to create an array. A disk drive can include both *RAID segments* (segments that are part of an array) and available segments. Each segment can be part of only one logical device at a time. If a disk drive is not part of any logical device, the entire disk is an available segment.

B.2 Non-redundant Arrays (RAID 0)

An array with RAID 0 includes two or more disk drives and provides data *striping*, where data is distributed evenly across the disk drives in equal-sized sections. However, RAID 0 arrays do not maintain redundant data, so they offer *no data protection*.

Compared to an equal-sized group of independent disks, a RAID 0 array provides improved I/O performance.

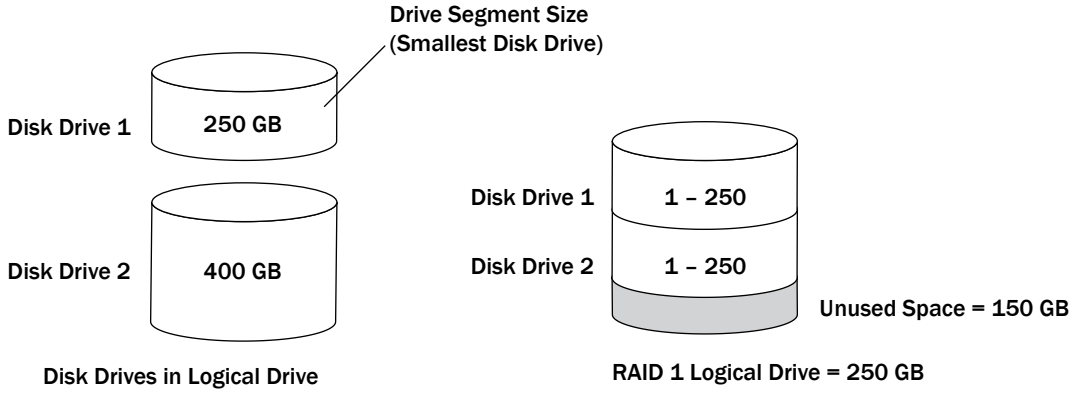
Drive segment size is limited to the size of the smallest disk drive in the array. For instance, an array with two 250 GB disk drives and two 400 GB disk drives can create a RAID 0 drive segment of 250 GB, for a total of 1000 GB for the volume, as shown in this figure.



B.3 RAID 1 Arrays

A RAID 1 array is built from two disk drives, where one disk drive is a *mirror* of the other (the same data is stored on each disk drive). Compared to independent disk drives, RAID 1 arrays provide improved performance, with up to twice the read rate and an equal write rate of single disks. However, capacity is only 50 percent of independent disk drives.

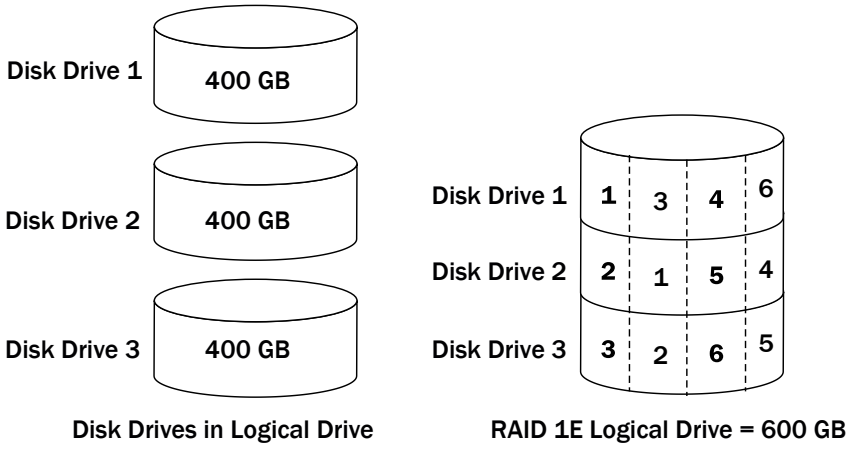
If the RAID 1 array is built from different- sized disk drives, the free space, drive segment size is the size of the smaller disk drive, as shown in this figure.



B.4 RAID 1 Enhanced Arrays

A RAID 1 Enhanced (RAID 1E) array—also known as a *striped mirror*—is similar to a RAID 1 array except that data is both mirrored *and* striped, and more disk drives can be included. A RAID 1E array can be built from three or more disk drives.

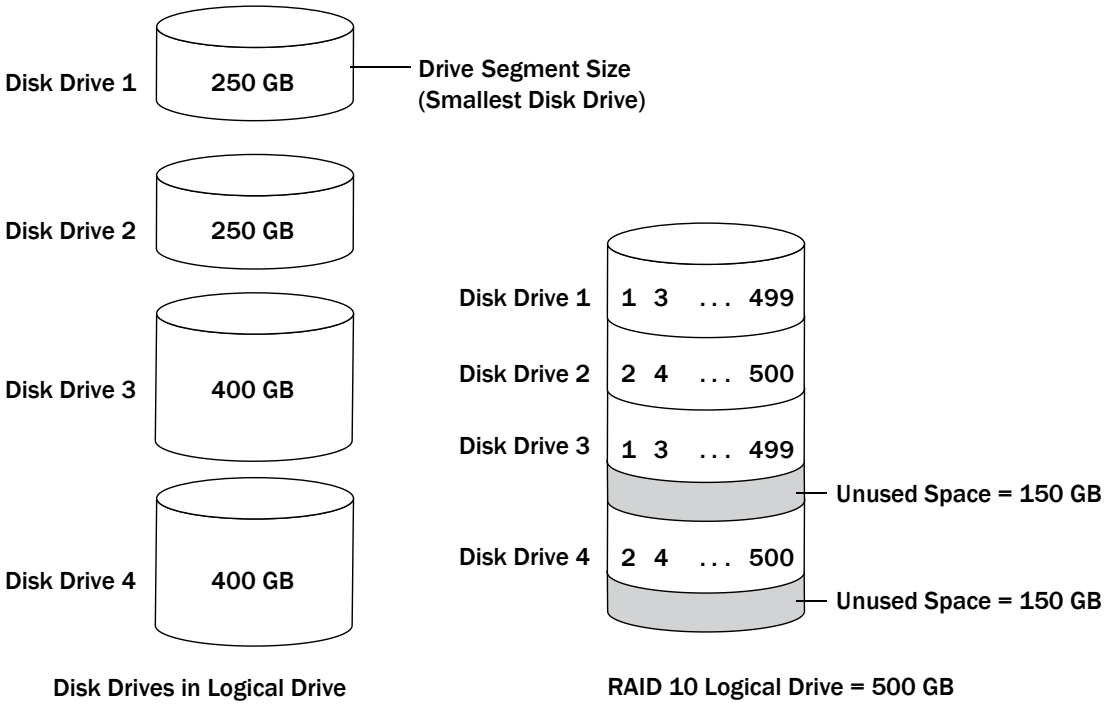
In this example, the large bold numbers represent the striped data, and the smaller, non-bold numbers represent the mirrored data stripes.



B.5 RAID 10 Arrays

A RAID 10 array is built from two or more equal-sized RAID 1 arrays. Data in a RAID 10 array is both striped and mirrored. Mirroring provides data protection, and striping improves performance.

Drive segment size is limited to the size of the smallest disk drive in the array. For instance, an array with two 250 GB disk drives and two 400 GB disk drives can create two mirrored drive segments of 250 GB, for a total of 500 GB for the array, as shown in this figure.

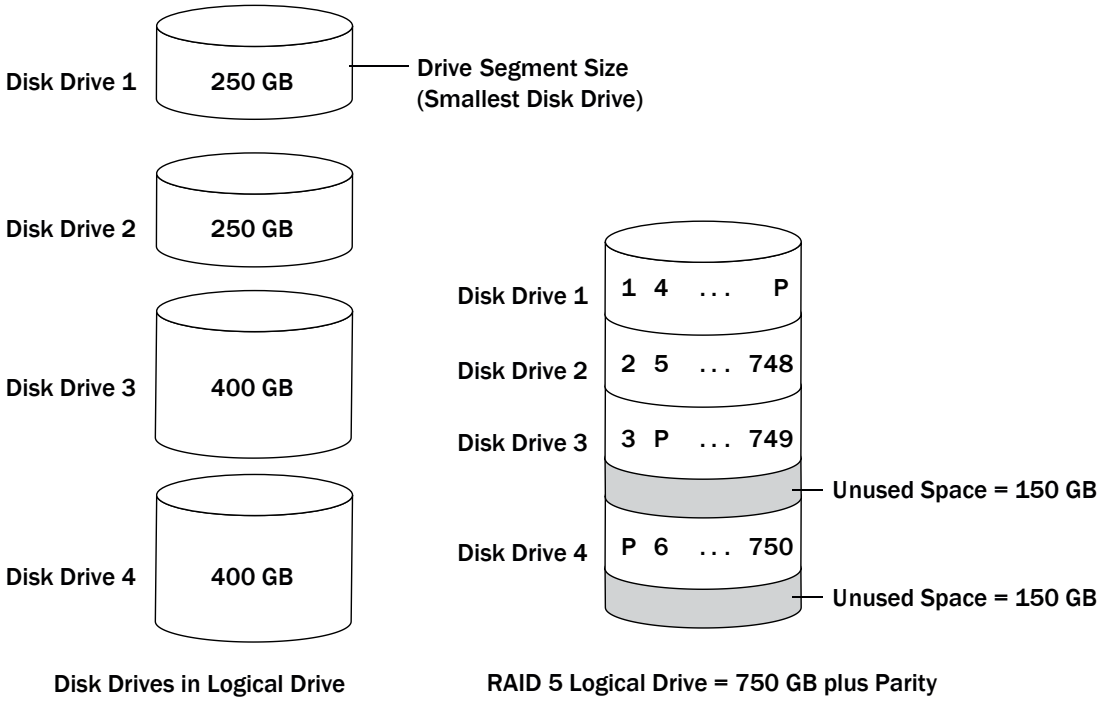


B.6 RAID 5 Arrays

A RAID 5 array is built from a minimum of three disk drives, and uses data striping and *parity* data to provide redundancy. Parity data provides data protection, and striping improves performance.

Parity data is an error-correcting redundancy that's used to re-create data if a disk drive fails. In RAID 5 arrays, parity data (represented by Ps in the next figure) is striped evenly across the disk drives with the stored data.

Drive segment size is limited to the size of the smallest disk drive in the array. For instance, an array with two 250 GB disk drives and two 400 GB disk drives can contain 750 GB of stored data and 250 GB of parity data, as shown in this figure.



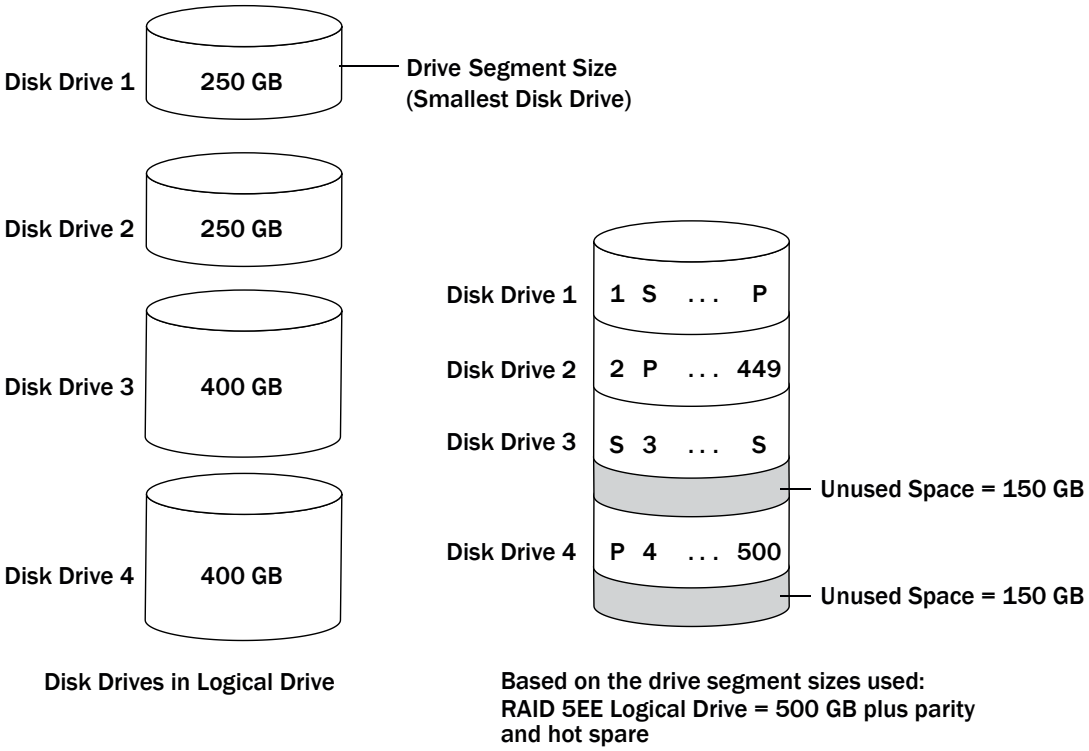
B.7 RAID 5EE Arrays

A RAID 5EE array—also known as a *hot space*—is similar to a RAID 5 array except that it includes a *distributed spare* drive and must be built from a minimum of four disk drives.

Unlike a hot spare, a distributed spare is striped evenly across the disk drives with the stored data and parity data, and can't be shared with other logical disk drives. A distributed spare improves the speed at which the array is rebuilt following a disk drive failure.

A RAID 5EE array protects your data and increases read and write speeds. However, capacity is reduced by two disk drives' worth of space, which is for parity data and spare data.

In this figure, S represents the distributed spare, P represents the distributed parity data.



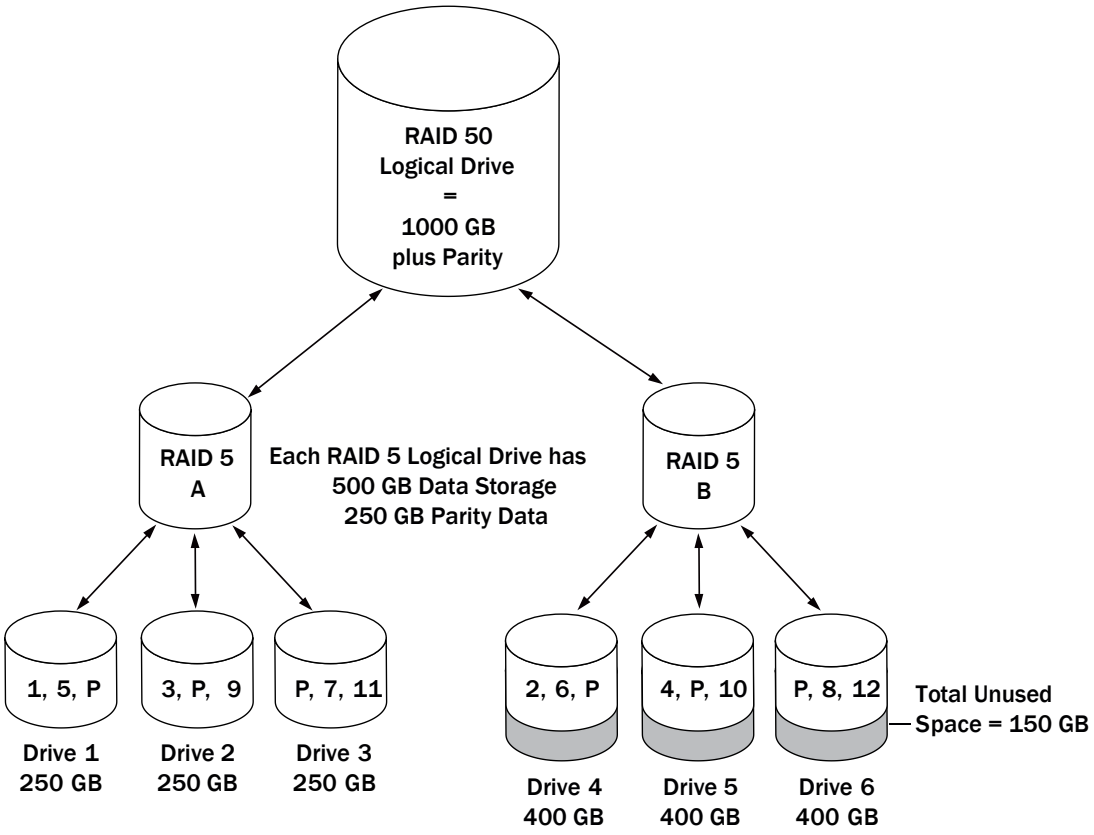
B.8 RAID 50 Arrays

A RAID 50 array is built from six to forty-eight disk drives configured as two or more RAID 5 arrays, and stripes stored data and parity data across all disk drives in both RAID 5 arrays. (For more information, see RAID 5 Arrays on page 84.)

The parity data provides data protection, and striping improves performance. RAID 50 arrays also provide high data transfer speeds.

Drive segment size is limited to the size of the smallest disk drive in the array. For example, three 250 GB disk drives and three 400 GB disk drives comprise two equal-sized RAID 5 arrays with 500 GB of stored data and 250 GB of parity data. The RAID 50 array can therefore contain 1000 GB (2 x 500 GB) of stored data and 500 GB of parity data.

In this figure, P represents the distributed parity data.

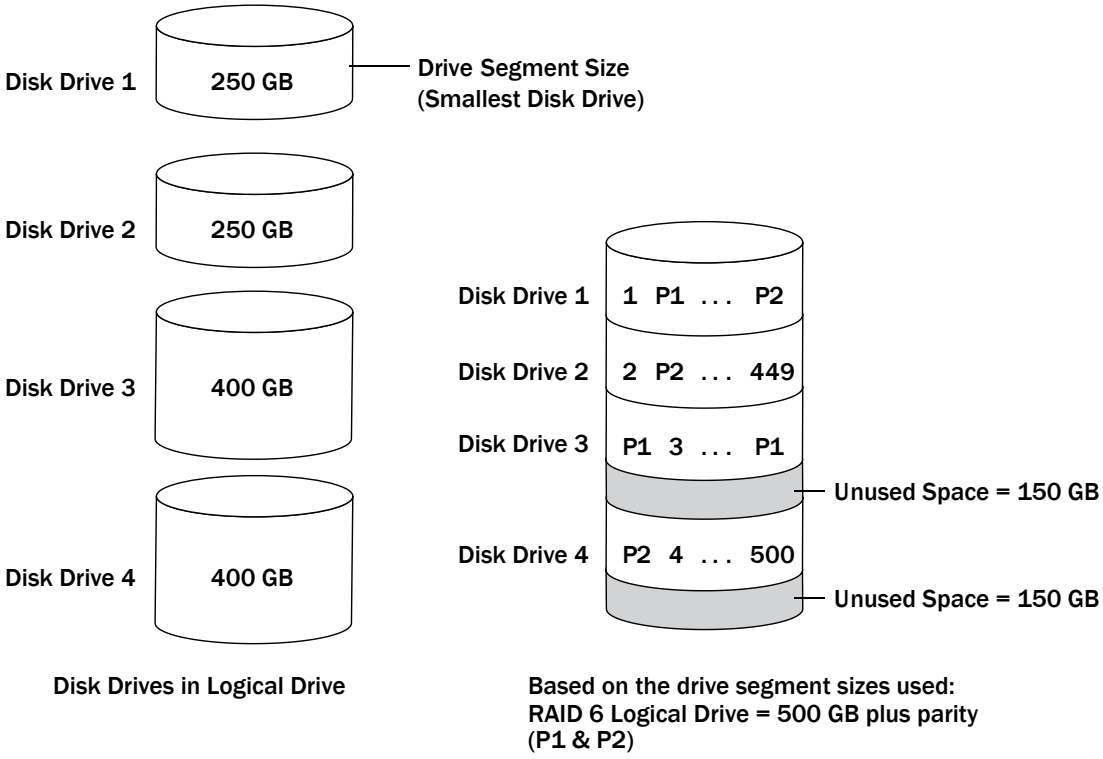


B.9 RAID 6 Arrays

A RAID 6 array—also known as dual drive failure protection—is similar to a RAID 5 array because it uses data striping and parity data to provide redundancy. However, RAID 6 arrays include *two* independent sets of parity data instead of one. Both sets of parity data are striped separately across all disk drives in the array.

RAID 6 arrays provide extra protection for your data because they can recover from two simultaneous disk drive failures. However, the extra parity calculation slows performance (compared to RAID 5 arrays).

RAID 6 arrays must be built from at least four disk drives. Maximum stripe size depends on the number of disk drives in the array.



B.10 RAID 60 Arrays

Similar to a RAID 50 array (see RAID 50 Arrays on page 86), a RAID 60 array—also known as dual drive failure protection—is built from eight disk drives configured as two or more RAID 6 arrays, and stripes stored data and two sets of parity data across all disk drives in both RAID 6 arrays.

Two sets of parity data provide enhanced data protection, and striping improves performance. RAID 60 arrays also provide high data transfer speeds.

B.11 Comparing RAID Levels

Use this table to select the RAID levels that are most appropriate for the logical drives on your storage space, based on the number of available disk drives and your requirements for performance and reliability.

RAID Level	Redundancy	Disk Drive Usage	Read Performance	Write Performance	Built-in Hot Spare	Minimum Disk Drives
RAID 0	No	100%	***	***	No	2
RAID 1	Yes	50%	**	**	No	2
RAID 1E	Yes	50%	**	**	No	3
RAID 10	Yes	50%	**	**	No	4
RAID 5	Yes	67 – 94%	***	*	No	3
RAID 5EE	Yes	50 – 88%	***	*	Yes	4
RAID 50	Yes	67 – 94%	***	*	No	6
RAID 6	Yes	50 – 88%	**	*	No	4
RAID 60	Yes	50 – 88%	**	*	No	8

Disk drive usage, read performance, and write performance depend on the number of drives in the logical drive. In general, the more drives, the better the performance.

C Using the Microsemi Adaptec RAID Configuration Utility

The Microsemi Adaptec RAID Configuration (ARC) utility is a BIOS-based utility that you can use to create arrays and manage controllers, disk drives and other devices.

C.1 Introduction to the ARC Utility

The ARC utility comprises these tools:

- Logical Device Configuration—For creating and managing arrays, and initializing and rescanning disk drives (see Using the ARC Utility to Create and Manage Arrays on page 90).

  Note: On Microsemi Adaptec Series 6 controllers, the tool for creating and managing arrays is called "Array Configuration Utility".

- Controller Settings—For modifying your controller settings (see Using the ARC Utility to Modify Controller Settings on page 94).
- Disk Utilities—For formatting or verifying disk drives (see Drives on page 99), locating disk drives, or setting the drive-specific write cache policy.
- Administration (*uEFI only*)—For flashing the controller, updating the CPLD, and creating a support archive (see Updating the Controller Firmware on page 100).

C.1.1 Ctrl-A or uEFI/HII?

Your Microsemi Adaptec RAID controller supports two interfaces to the BIOS-level RAID configuration options of the ARC utility: Ctrl-A and uEFI/HII. On computers that support the Unified Extensible Firmware Interface, or uEFI (version 2.10 or higher), the BIOS-level RAID configuration options are presented with a HII interface, or Human Interaction Infrastructure, rather than the Microsemi Adaptec Ctrl-A interface described in this chapter. uEFI/HII provides an architecture-independent mechanism for initializing add-in cards, like the Microsemi Adaptec RAID controller, and rendering contents to the screen in a uniform way.

In the uEFI/HII interface, access to the RAID controller configuration options is provided through the computer's standard BIOS. How you access the BIOS varies, depending on the computer manufacturer, but typically it's started by simply pressing DEL. Once you enter setup, navigate to the "**PMC maxView Storage Manager**" option, typically on the BIOS' "Advanced" menu, then scan for and select a controller.

From that point on, the uEFI/HII menus and the Ctrl-A menus for configuring your RAID controller are almost identical. For example, the top-most menu contains the same three options: Logical Device Configuration, Controller Settings, Disk Utilities (described above). But it also contains the Administration option, which is available only in the uEFI/HII menu. Options in the lower-level menus are also similar.

In both interfaces, all the tools are menu-based and instructions for completing tasks appear on-screen. Menus can be navigated using the arrows, Enter, Esc, and other keys on your keyboard.

This chapter provides instructions for navigating and completing tasks with the Ctrl-A interface. To complete tasks with the uEFI/HII interface:

- Refer to the on-screen instructions for keyboard navigation and selection options.
- Refer to the option descriptions in this chapter for details about individual RAID configuration settings and tasks.

  Note: Some RAID configuration options are available only in the uEFI/HII interface. uEFi options are noted in the task descriptions below.

C.1.2 Running the ARC Utility

If your Microsemi Adaptec controller is connected to a RAID enclosure, power on your enclosure (or enclosures) before you power on your computer.

Start or restart your computer. When prompted, press **Ctrl+A**.

During boot up, if your system has insufficient memory this message displays:

"Adaptec RAID Configuration Utility will load after, system initialization. Please wait... Or press <Enter> Key to attempt loading the utility forcibly [Generally, not recommended]"
"RAID Configuration Utility will load after, system initialization. Please wait... Or press <Enter> Key to attempt loading the utility forcibly [Generally, not recommended]"

Note: The first time you power on your computer after you install a new controller, the BIOS may display a configuration that doesn't match your system's configuration. This is normal.

C.2 Using the ARC Utility to Create and Manage Arrays

To use the ARC utility to create and manage arrays, start the ARC utility (see Running the ARC Utility on page 89), select your controller (if you have more than one), then press `Enter`. Select **Logical Device Configuration** (or Array Configuration Utility on Series 6 controllers) from the ARC main menu, then press `Enter`.

Follow the on-screen instructions to create and manage arrays, and initialize, rescan, and erase disk drives.

C.2.1 Creating a New Array

To begin creating an array, select **Create Arrays** from the Logical Device Configuration menu.

Only disk drives that can be used in a new array are available for selection. (Disk drives must be initialized before they can be used in an array. See Initializing Disk Drives on page 92 for more information.)

Note:

- To create a hybrid array that leverages the performance benefits of the SSDs in your system, you must select an equal number SSDs and HDDs. You can create a hybrid RAID1 or hybrid RAID10 only.
- When you create an all SSD array, we recommend *disabling* all caching, including maxCache caching. If any caching is enabled when you create the array, you will be prompted to turn caching off.

Use the Array Properties menu to modify the array's RAID level, size, name, stripe size, cache settings, and maxCache settings.

Note: For more information about RAID levels and using disk drives to create arrays, see Choosing a RAID Level on page 37. For more information about maxCache, see Modifying Cache Settings on page 91.

C.2.2 Managing Existing Arrays

To view or modify existing arrays, select **Manage Arrays** from the Logical Device Configuration menu.

From the Manage Arrays menu, you can:

- View the properties of an array.
  Note: Failed drives are displayed in a different text color.
- Make an array bootable (see Creating Bootable Arrays on page 90).
- Assign or remove hot spares.
- Modify power management settings.
- Change the cache settings for an array.
- Delete an array.
  Caution: Before deleting an array, back up the data to avoid permanently losing it.

C.2.2.1 Creating Bootable Arrays

Note: You may need to change the system BIOS to modify the boot order. For more information, refer to your computer documentation.

The controller always uses the lowest numbered array as its bootable array.

To make an array bootable:

1. Select **Manage Arrays** from the Logical Device Configuration menu.
2. Select the array that you want to make bootable, then press `Ctrl+B`.

   Note: You cannot make an array bootable while it's building, verifying, or rebuilding.

   The array's number changes to Array 00, which makes this array the controller's boot array.
3. Restart your computer.

C.2.2.2 Modifying Power Management Settings

Power management settings switch the array to low power state when it is inactive for a specific time. To modify power management settings:

1. Select **Manage Arrays** from the Logical Device Configuration menu.
2. Select the array, then press `Ctrl+W`.

   In the power management console, enter these details:

Option	Description
Power Management	When enabled, switches the array to low power state, when the array/drive is inactive.
Slow Down Drive After	The duration of inactive state of the array/drive after which it is slowed down to low power mode. This is an optional setting. **Note:** The disk drive should support low power mode.
Power Off Drive After	The duration of inactive state of the array/drive after which it is powered off. This is an optional setting. **Note:** Power Off Drive After duration should be greater than Slow Down Drive After Duration.
Verify Drive After	The regular time interval at which the system performs a health check of the array/drive.

C.2.2.3 Modifying Cache Settings

You can modify the read and write cache settings for an array. You can also modify the maxCache settings. maxCache uses the compatible Solid State Drives (SSDs) in your system as fast cache memory to improve performance for both read and write operations in I/O-intensive applications with mixed workloads.

Note: maxCache SSD Caching is supported on Microsemi Adaptec Series Q controllers only.

To modify the cache settings for an array:

1. Select **Manage Arrays** from the Logical Device Configuration menu.
2. Select the array, then press `Ctrl+C`.
   The Modify Cache Settings window opens.
3. Enable or disable read caching.
4. Press `Tab`.
5. Enable or disable write caching:
   - Select Enable always for “write-back” caching
   - Select Enable with Backup Unit if your controller has a zero-maintenance cache protection module
   - Select Disable for “write-through” caching
6. Press `Tab`.

7. Select the maxCache Read Cache setting (Enable/Disable).
8. Select the maxCache Write Cache setting (Enable/Disable).
9. Press `Enter` to accept the values.

C.2.3 Initializing Disk Drives

If a disk drive appears grayed-out (unavailable for use in a new array), it may need to be initialized.

To begin initializing a disk drive, select **Initialize Drives** from the Logical Device Configuration menu. You can initialize one drive or multiple drives. If an error occurs during initialization, the message "Initializing drives...FAILED x of n" is displayed. Press `Enter` to see a list of drives that failed to initialize. Press `Esc` to continue.

> **Caution:** Do not initialize a disk drive that is part of an array. Initializing a disk drive that's part of an array may make the array unusable. Back up all data from your disk drive before you initialize it.

C.2.4 Rescanning Disk Drives

To begin rescanning a disk drive, select **Rescan Drives** from the Logical Device Configuration menu.

C.2.5 Secure Erasing Disk Drives

When you perform a secure erase on a disk drive, all data on that disk drive is completely and irretrievably eradicated. Secure erase performs three distinct writing passes to the disk drive being erased—it does not just write zeros.

Performing a secure erase takes up to six times longer than clearing (or zeroing) a disk drive; on a 2TB or 3TB drive, often it takes hours, possibly as long as a day! You may want to perform a secure erase only on disk drives that contain confidential or classified information.

> **Note:** To erase (or zero) a disk drive with non-classified information, you may choose to *format* it (see Formatting and Verifying Disk Drives on page 99) instead, or *initialize* it using maxView Storage Manager—both options take much less time than the secure erase option.

To begin a secure erase, select **Secure Erase** from the Logical Device Configuration menu, then select `Y` (yes). To return to the main Logical Device Configuration menu once the secure erase has begun, press `Esc`.

> **Note:** For newer SATA drives, you can choose to perform a Secure ATA Erase, which implements the secure erase feature at the drive firmware level. To start a Secure ATA Erase, select a SATA drive, then type `Ctrl-S` to open the Secure ATA Erase dialog. You will see this dialog only if the drive supports Secure ATA Erase.

The selected disk drive(s) cannot be used until the erase is complete.

C.2.5.1 Stopping a Secure Erase

To stop a secure erase in progress:

1. In the Logical Device Configuration menu, select **Secure Erase**.
2. Select the disk drive being secure erased, then press `Ctrl+Q`.
   The secure erase stops and you return to the main Logical Device Configuration menu.

C.2.6 Uninitializing Disk Drives

> **Note:** This option is available on Microsemi Adaptec Series 7 and Series 8 controllers only.

Uninitializes one or more physical drives. This option clears Microsemi Adaptec metadata and reserved space and any OS partitions from a drive; any existing data on the drive is destroyed. Drives can uninitialized only if they are not part of any array.

> **Note:** Uninitialized drives are surfaced to the OS as RAW Pass Through Devices. Typically, they are used with the controller in HBA mode. Uninitialized drives are also compatible with any HBA

and can be exchanged with drives on the motherboard's SATA interface. For more information about uninitialized devices and controller modes, see General Controller Settings on page 94.

To begin uninitializing a disk drive, select **Uninitialize Drives** from the Logical Device Configuration menu, then type Y to continue.

C.2.7 Managing Global Hot Spares

Note: For Microsemi Adaptec Series 7 and Series 8 controllers, this option is available in the uEFI interface only.

A hot spare is a disk drive that automatically replaces any failed drive in a logical drive. A *global* hot spare is not assigned to a specific logical drive. It protects any logical drive on the controller (except RAID 0 logical drives). You can create and delete global hot spares even if no arrays exist.

To create and delete global hot spares:

1. Select **Global Hotspares** from the Logical Device Configuration menu.
   The Global Hotspare Management window opens.
2. Using the arrow keys, select a drive from the list. Existing hot spares are highlighted.
3. Press `Ins` to create a new global hot spare. Press `Del` to delete a hot spare.
4. Press `Enter` to save your changes and return to the main menu.

C.2.8 Creating and Managing JBODs

Note: This option is available on Microsemi Adaptec Series 6 controllers only.

Follow the on-screen instructions to create and manage JBODs.

C.2.8.1 Creating a New JBOD

A JBOD disk appears as a physical disk drive to the operating system. A JBOD disk is not redundant and not bootable.

To begin creating a JBOD, select **Create JBOD** from the Logical Device Configuration menu. All the supported disk drives are displayed. Select a disk drive and `Enter`.

C.2.8.2 Managing Existing JBODs

To delete a JBOD or morph a JBOD into a simple volume, select **Manage JBODs** from the Logical Device Configuration menu.
From the Manage JBODs menu, you can:

- Morph a JBOD into a simple volume.
- Delete a JBOD

Note: When you delete a JBOD, you lose all data on that disk.

C.2.8.3 Converting a JBOD Into a Simple Volume

You can convert any JBOD into a simple volume.

1. Select **Manage JBODs** from the main Logical Device Configuration menu.
2. Select the JBOD that you want to morph into a simple volume and press `Ctrl`+V.

C.2.9 Managing the maxCache Pool

Note: This option is available on Microsemi Adaptec Series 6Q controllers only.

Microsemi Adaptec maxCache uses the compatible Solid State Drives (SSDs) in your system as fast cache memory for read-intensive operations. Before you can enable maxCache read caching on a logical device (see Modifying Cache Settings on page 91), you must assign at least one SSD to the maxCache pool.

Note: You can configure the maxCache pool only if you have one or more compatible Solid State Drives installed on the RAID controllers in your system. For a list of maxCache-compatible SSDs, refer to the Adaptec Web site at www.adaptec.com/compatibility.

To add a SSD to the maxCache pool or to remove a SSD from the pool:

1. Select **Manage MaxCache Pool** from the Logical Device Configuration menu.
   All supported SSDs are displayed.
   Note: Uninitialized SSDs may not appear in the list; see Initializing Disk Drives on page 92 for more information.
2. Using the arrow keys, select a SSD from the list.
3. Press `Ins` to add the SSD to the maxCache pool.
4. To remove a SSD from the pool, press the right arrow to switch windows, use the arrow keys to select a SSD, then press `Del`.
5. Press `Enter` to save your changes and return to the main menu.

C.3 Using the ARC Utility to Modify Controller Settings

The ARC Controller Settings tool allows you to modify the settings of your controller and the disk drives connected to it.

C.3.1 Opening the Controller Settings Tool

To open the ARC Controller Settings tool, start the ARC utility (see Running the ARC Utility on page 89), select **Controller Settings** from the ARC main menu, then press `Enter`.

Follow the on-screen instructions to modify the settings of your controller and connected disk drives, as needed.

C.3.2 Applying Changes and Exiting

1. To exit the Controller Settings tool, press `Esc` until you are prompted to exit.
   If you modified any settings, you are prompted to save the changes before you exit.
2. Select `Yes` to exit, then press any key to restart your computer.
   Any changes you made take effect after the computer restarts.

C.3.3 Modifying Your Controller's Configuration

Note: Default controller settings are suitable for most computers. We recommend that you *do not* change the default setting.

To modify your controller's basic settings, select **Controller Configuration** from the main Controller Settings menu.

To modify your controller's power management settings, select **Advanced Configuration**.

Some options may not be available for your controller.

C.3.3.1 General Controller Settings

Note: Default settings are shown in **bold** type.

Option	Description
Drive's Write Cache	When set to Enable All, write cache is enabled on all disk drives on the controller. (Enabling the write cache overrides any individual drive settings in maxView Storage Manager or the BIOS.) When set to Disable All, write cache is not used on the disk drives. When set to Drive Specific, write cache is enabled/disabled on a per-drive basis. Default is **Drive Specific**. **Caution:** When write cache is enabled, there is a slight possibility of data loss or corruption during a power failure.
Runtime BIOS	When **enabled**, the controller BIOS allows the controller to act as a bootable device. Disabling the BIOS allows another controller to act as a bootable device.

Option	Description
Automatic Failover	When **enabled**, the controller automatically rebuilds an array when a failed disk drive is replaced. When disabled, the array must be rebuilt manually.
Array Background Consistency Check	When enabled, the controller constantly verifies a redundant array. Note that there may be a significant performance reduction. Default is **disabled**.
Device-based BBS Support	When enabled in systems that support BBS, the controller presents attached bootable devices up to the BIOS for boot device selection. This is relevant for logical arrays. Default is **disabled**.
SATA Native Command Queuing (NCQ)	When enabled, NCQ is enabled. Only available with SATA II disk drives.
Physical Drives Display During POST	When enabled, connected disk drives are displayed during system Power On Self Test (POST). Displaying the disk drives adds a few seconds to the overall POST time. Default is **disabled**.
DVD/CD-ROM Boot Support	When **enabled**, the system can be booted from a bootable DVD/CD. (This setting is not available on all RAID controller models.)
Removable Media Devices Boot Support	When **enabled**, removable media devices, such as CD drives, are supported. (This setting is not available on all RAID controller models.)
Alarm Control	When enabled, the alarm sounds. Default is **enabled**. **Note:** When the alarm is turned off (disabled), it will remain off after a reboot.
Default Background Task Priority	Sets the default priority for background tasks on the controller (such as logical drive creation) to High, Medium, or Low. Default is **High**. **Note:** This setting applies to new tasks. It does not affect currently running tasks.
LED Indication Mode	When set to Activity and Fault, the drive activity LEDs blink to indicate I/O activity (randomly depending on I/O load) and fault (steady 1 Hz). When set to Fault Only, the drive activity LEDs blink to indicate fault state only. For Series 6/6E controllers only. Default is **Fault Only**.
Backplane Mode	Microsemi Adaptec Series 6 Controllers (*except Series 6E/6T*): When set to Auto, controller automatically detects backplane signal type: I2C or SGPIO. To set the backplane mode explicitly select SGPIO, I2C, or Disabled. Default is **Auto**. Microsemi Adaptec Series 7, Series 8, and Series 6E/6T Controllers: When set to Default, controller automatically sets the backplane mode to IBPI. To set the backplane mode explicitly, select IBPI, SGPIO, or Disabled. Default is **IBPI**. **Note:** With the default IBPI setting, the firmware sends a SGPIO "Backplane_TYPE" signal if it recognizes that a SGPIO Backplane is connected. If any connected SGPIO backplane does not support the "Backplane_TYPE" signal, or it does not support the IBPI protocol, you can manually set the Backplane Mode to "SGPIO". **Table 1 • IBPI LED Blink Pattern** **Interpretation** | **2 LEDs per Slot** (**Activity LED** | **Status LED**) | **3 LEDs per Slot** (**Activity LED** | **Locate LED** | **Fail LED**)

Option	Description
	Drive not present: Off / X / Off / X / X Drive present, no activity: On / X / On / X / X Drive present, activity: 4 Hz (Blink) / X / 4 Hz (Blink) / X / X Locate (Identify): 4 Hz (Blink) / 4 Hz (Blink) / X / 4 Hz (Blink) / Off Fail: X / On / X / Off / On Rebuild: X / 1 Hz (Blink) / X / Off / 1 Hz (Blink) **Table 2 • SGPIO LED Blink Pattern** Activity: On / X / X No activity: Off / X / X Locate (Identify): X / On / Off Fail: X / Off / On Rebuild: X / On / On
Selectable Performance Mode	When set to Dynamic, performance criteria adjusts automatically based on controller usage, RAID level, and disk drive type. When set to OLTP/Db, performance criteria is optimized for transaction-oriented applications, such as data entry and retrieval. When set to Big Block Bypass, DRAM write cache is bypassed based on IO write size; performance criteria is optimized for serving Web pages, file serving, and data retrieval. When set to User Defined, you are prompted to use the OS tools to set individual parameters (contact Microsemi Adaptec support for more information). Default is **Dynamic**.
Controller Mode	Microsemi Adaptec Series 7 and Series 8 Controllers Only: • When set to RAID: Expose RAW mode, all RAID functions of the controller are enabled. Attached drives without Microsemi Adaptec metadata are surfaced to the host operating system as RAW Pass Through devices (similar to JBODs on legacy Adaptec controllers). • When set to RAID: Hide RAW mode, all RAID functions of the controller are enabled, but RAW devices are not exposed to the operating system. • When set to HBA Mode, attached drives are surfaced as RAW devices. The intent of this mode is to allow the RAID controller to act and be used as an HBA. Changing into HBA mode is allowed only if there are no drives with Microsemi Adaptec metadata attached to the controller, including hot spare drives (see Uninitializing Disk Drives on page 92 for more information). Uninitialized drives are compatible with *any* HBA and can be exchanged with drives on the motherboard's SATA interface. • When set to Auto Volume Mode, attached drives without Microsemi Adaptec metadata, but with an OS partition, are surfaced to the host operating system as RAW devices, where the RAID layer of the controller firmware is bypassed

Option	Description
	when the host issues commands to the device. Attached drives without Microsemi Adaptec meta-data and without OS partitions, are automatically configured as Simple Volumes (single drives with Microsemi Adaptec meta-data). In Auto Volume Mode, you can create up to a maximum of 128 Simple Volumes; no other RAID types are supported. Auto Volume Mode enables DRAM caching on rotating media to help reduce latency and accelerate performance. • When set to Simple Volume mode, you can create Simple Volumes only (up to a maximum of 128 volumes); no other RAID types are supported. **Note:** Before you can change into Auto Volume mode or Simple Volume mode, you must delete existing RAID arrays, maxCache Devices, and hot spares drives (if any). Default is **RAID: Expose RAW** mode.
Max Link Speed (uEFI only)	Sets the maximum connection speed for SAS devices to 6 Gb/s or 12 Gb/s. Default is taken from firmware.

C.3.3.2 Power Management Settings

Note: Default settings are shown in **bold** type.

Option	Description
Power Management Settings	When enabled, switches the system to low power state, based on the specified settings.
Time Zone	The time zone of the place in which the system is located. Time specific power management settings are implemented based on the set time zone. By default, it is set to **00:00**. The valid range for the time zone settings is -12:00 to +12:00.
Stay Awake Start	The time from which the system should operate in the full power mode, irrespective of other power management settings, daily. By default it is set to **00:00**. The valid range is 00:00 to 23:59.
Stay Awake End	The time until which the system should operate in the full power mode, irrespective of other power management settings, daily. By default it is set to **00:00**. The valid range is 00:00 to 23:59.
Spin Up Limit (Internal)	The number of internal drives to be spun up at wakeup. By default it is set to **0**. In the default setting, all the internal drives will spin up.
Spin Up Limit (External)	The number of external drives to be spun up at wakeup. By default it is set to **0**. In the default setting, all the external drives will spin up.

C.3.3.3 Preserving the Controller Cache

Note: This option is available in the uEFI interface only.

Follow the on-screen instructions to toggle the controller's cache preservation policy; clear the preserved cache for one or more logical drives; and check the controller cache preservation state.

C.3.3.3.1 Enabling and Disabling Controller Cache Preservation

This option toggles the controller cache preservation state. With cache preservation enabled, the system preserves the controller's DDR cache to prevent data loss in the event of (1) a power failure or unsafe shutdown of external enclosures while the host system, with the controller, still has power; and (2) connectivity problems with drives.

"Dirty pages" (data that have not been committed to disk) are restored to the cache when power is restored and the logical drives on the controller are back online. Once the preserved cache is restored, the controller flushes the data to disk using its normal scheduling mechanism.

> **Note:** You cannot enable maxCache read and/or write caching on a controller with cache preservation enabled. In addition, the following operations are not permitted on a controller in the cache preserved state:
> - Creating a logical drive
> - Changing the Performance mode
> - Running a consistency check
> - Changing the RAID Level of a logical drive
> - Forcing a logical drive online or offline
> - Changing the cache page size

To enable controller cache preservation:

1. Start the ARC utility in uEFI mode (see Running the ARC Utility on page 89).
2. Scan for controllers, then select the controller you want.
3. Select **Controller Settings**.
4. Select **Controller Configuration**, then select **Cache Preservation**.
5. Select **Enabled**.

C.3.3.3.2 Clearing the Controller Cache

You can clear the preserved dirty cache (data not committed to disk) for a specific logical drive or for all logical drives on the controller if you expect a failed enclosure or logical drive to remain offline.

To clear the cache for all logical drives on the controller:

1. Start the ARC utility in uEFI mode (see Running the ARC Utility on page 89).
2. Scan for controllers, then select the controller you want.
3. Select **Controller Settings**.
4. Select **Clear Cache Preserved on Controller**.

To clear the cache for a specific logical drive:

1. Start the ARC utility in uEFI mode (see Running the ARC Utility on page 89).
2. Scan for controllers, then select the controller you want.
3. Select **Logical Device Configuration**, then select a logical drive.
4. Select **Clear Cache Preserved**.

C.3.3.3.3 Checking the Cache Preservation Status

To check the controller's cache preservation status, select **Controller State** from the Controller Settings, Advanced Configuration menu. With cache preservation enabled, the controller enters the Cache Preserved state; otherwise, it remains in the Optimal state.

C.3.4 Checking Backup Unit Status

To check the status of the controller's flash backup unit, select **Backup Unit Status** from the Controller Settings menu. Table 3 • Backup Unit Status describes the backup unit states. This option is available only if the controller is configured with a flash backup unit.

Table 3 • Backup Unit Status

Status	Meaning
Not Present, Not Ready	Supercapacitor not present, suffered a fatal error, or backup unit temperature exceeded allowed maximum.
Preparing	Backup unit preparing the NAND flash for backup. The supercapacitor can take up to 10 minutes to charge to 100% from zero charge and report Ready status.
Ready	Backup unit is ready to be enabled if NAND is prepared and supercapacitor is charged.
Invalid, Not Supported	Green backup feature not enabled in firmware.
Failed, Fatal	Firmware could not retrieve backup unit information or configuration due to hardware issues, over-voltage, etc.
Health Normal/Low/Dead	Indicates overall energy holding ability of the supercapacitor. Dead status means that supercapacitor should be replaced.

C.4 Formatting and Verifying Disk Drives

You can use the ARC Disk Utilities tool to low-level format or verify your disk drives. (New disk drives are low-level formatted at the factory and do not need to be low-level formatted again.)

> **Caution:** Before you format a disk drive, back up all data. Formatting destroys all data on a disk drive.

To format or verify a disk drive:

1. Start the ARC utility (see Running the ARC Utility on page 89).
2. Select the controller you want, then press `Enter`.
3. Select **Disk Utilities**.
4. Select the disk drive you want, then press `Enter`.
5. Select **Format Disk** or **Verify Disk Media**.

C.5 Locating Disk Drives

You can use the Identify Drive feature to physically locate a disk drive by blinking the LED.

> **Note:** This feature is only available with disk drives that have an activity LED.

To locate a disk drive:

1. Start the ARC utility (see Running the ARC Utility on page 89).
2. Select the controller you want, then press `Enter`.
3. Select **Disk Utilities**.
4. Select the disk drive you want, then press `Enter`.
5. Select **Identify Drive**, then press `Enter`.
6. When you have finished locating your disk drive, press any key to stop the blinking.

C.6 Identifying Disk Drives

You can identify disk drives by viewing the list of disk drives on your system. Only physical drives that display during POST are shown.

To identify a disk drive:

1. Start the ARC utility (see Running the ARC Utility on page 89).
2. Select the controller you want, then press `Enter`.
3. Select **Disk Utilities**.
   The Disk Utilities view provides you with the following information:

Location	Model	Rev#	Speed	Size
CN1=DEV1 Box0=Slot0 Exp0=phy0	The manufacturer information.	The revision number of the disk drive.	The speed of the disk drive.	The size of the disk drive.

   The location information of a disk drive is determined by three types of connections:
   - Direct attached drives—The connection is determined by the cable connected to a device, for example CN1 (connector 1) is connected to DEV1 (device 1). For more information, see Direct-attach Connections on page 78.
   - Storage Enclosure Processor (SEP) managed devices—The connection is determined by an active backplane. Box0 (enclosure 0) is connected to slot0 (disk drive slot 0 in the enclosure). For more information, see Backplane Connections on page 79.
   - Expanders—The connections is determined by an expander. Exp0 (expander 0) is connected to phy0 (phy 0 within a connector). For more information, see SAS Expander Connections on page 79.

     Note: Devices other than disk drives (CDROM, tape drives, etc...) are listed in order after your system disk drives.

C.7 Setting the Drive Write-Cache Policy

If the global write cache policy is set to "Drive Specific" (see General Controller Settings on page 94), you can set the write-cache policy for individual disk drives on the controller. (If the global write-cache policy is set to Enable All or Disable All, this option is grayed out.)

To set the drive-specific write-cache policy:

1. Start the ARC utility (see Running the ARC Utility on page 89).
2. Select the controller you want, then press `Enter`.
3. Select **Disk Utilities**.
4. Select the disk drive you want, then press `Enter`.
5. Select **Write Cache**, then choose the policy for the drive: **Write-Back (Enable)** or **Write-Through (Disable)**.
6. Select **Submit**.

C.8 Updating the Controller Firmware

Note: This option is available in the uEFI interface only.

Use this option to flash the controller's firmware.

To update the controller firmware:

1. Start the ARC utility in uEFI mode (see Ctrl-A or uEFI/HII? on page 89).
2. Select **Administration**, then select **FW update from Media**.
3. Select the device you want to flash, then press `Enter`.
4. Browse the folder hierarchy, select the firmware update (.UFI) file, then press `Enter`.
5. Select **Update Firmware**.

The firmware is sent to the controller and the system verifies the operation to ensure that it was successful.

6. When the verification is complete, press `Enter` to reboot the server.

C.9 Updating the Controller CPLD

Note: This option is available in the uEFI interface only.

Use this option to update the controller CPLD. (The CPLD includes reset logic, determines board type and feature set, and also provides cable management functions.) You should update the CPLD if the version running on the controller is lower than the version in flash.

Note: CPLD Update is for advanced users only. It is typically used in manufacturing by an OEM/ODM/System Integrator when building a new machine. For more information, contact Microsemi Adaptec Support.

To update the controller CPLD:

1. Start the ARC utility in uEFI mode (see Ctrl-A or uEFI/HII? on page 89).
2. Select **Administration**, then select **CPLD Information**.

   The system displays the current (running) version of the CPLD and the version available in flash.
3. If the version in flash is newer than the running version, select **Update CPLD**.
4. When prompted, restart the computer.

C.10 Creating a Support Archive

Note: This option is available in the uEFI interface only.

Use this option to save configuration and status information to help Customer Support diagnose a problem with your system. Saved information includes (but is not limited to) device logs, drive logs, event logs, error logs, controller logs, and statistics.

To create a support archive:

1. Start the ARC utility in uEFI mode (see Ctrl-A or uEFI/HII? on page 89).
2. Select **Administration**, then select **Save Support Archive**.
3. Select the device where the support archive information will be gathered and stored, then press `Enter`.

   The system gathers the logs and statistics for the device and displays the path where the information is saved.
4. Press any key to complete the operation and exit.

C.11 Viewing the Event Log

The BIOS-based event log records all firmware events, such as configuration changes, array creation, and boot activity.

Some events are not stored indefinitely—the event log is cleared of any non-persistent events each time you restart your computer; additionally, once the log is full, new events overwrite old events.

To view the event log:

1. Start the ARC utility (see Running the ARC Utility on page 89).
2. Select the controller you want, then press `Enter`.
3. When the ARC utility menu appears, press `Ctrl`+`P`.
4. Select **Controller Log Information**, then press `Enter`.

The current event log opens.

D Using the Adaptec Flash Utility

This chapter describes how to use the Adaptec Flash Utility (AFU), a text-based DOS utility that you can use to update, save, or verify the RAID controller's firmware.

> **Caution:** Although the AFU contains safeguards to prevent you from accidentally damaging your RAID controller's flash contents, it is still important to use the AFU carefully and correctly to avoid rendering your RAID controller inoperable. We recommend that only advanced users familiar with working in DOS use the AFU. For more information, see Managing Your Storage Space on page 71.

D.1 System Requirements

- DOS version 5.0 or later.
  Note: You can't run the AFU from a DOS command prompt window under any version of Windows.
- At least 8 MB of extended memory.

D.1.1 Compatibility Notes

- Supports HIMEM.SYS; compatible with other DOS drivers running under HIMEM.SYS (for example, SMARTDRV.SYS and SETVER.SYS).
- *Does not* support DOS extenders installed in memory, such as EMM386.SYS and DOS4GW.

D.2 Before You Begin

1. Obtain the firmware (see the following section).
2. Create firmware disk (see Creating the Firmware Update Disk on page 103).

There are two ways to run the AFU:

1. Using the AFU menus (see Running the Menu-based AFU on page 104)
2. From the command line (see Running the AFU from the Command Line on page 104)

D.2.1 Obtaining the Firmware

To obtain RAID controller firmware, you can:

- Download a new firmware file from the Web to get the most recent version of firmware/BIOS and the AFU executable (AFU.exe). The flash image comprises a single User Flash Image (UFI) file.

Visit www.adaptec.com for more information.

D.2.2 Creating the Firmware Update Disk

To create the firmware update disks:

1. Copy these files to a USB flash drive or writable CD:
   - AFU.exe
   - A*xxx*01.ufi

   where *xxx* is the model number of your controller.

   Note: Most controller model numbers have a suffix (for example, Microsemi Adaptec RAID 6405). Check that the .ufi file is the correct file for your controller before copying.
2. To use a menu-based AFU, see the following section.

   To run the AFU from the command line, see Running the AFU from the Command Line on page 104.

D.3 Running the Menu-based AFU

To run the menu-based AFU:

1. Shut down your operating system and reboot to DOS from from a DOS partition on a bootable drive. (You can use a disk drive connected to the controller you are updating.) If your computer isn't set up to boot from a bootable device other than a disk drive, enter the system setup utility to change the setting.
2. Insert the firmware update disk (created using the steps above) containing AFU.exe
3. At the DOS command prompt, type AFU with no arguments.
   The AFU's main menu is displayed.
4. Select **Select Controllers**, then select the RAID controller(s) to be flashed.

   To update multiple RAID controllers in the same system, update the boot controller's flash first, restart the computer, then update the flash for the remaining controllers.
5. Select **Select an Operation**.
6. Choose the operation you want, then follow the on-screen instructions to complete the task:

   - **Update flash image**—Updates all the flash components on a RAID controller with the flash image data from the UFI file.
   - **Save flash image**—Reads the contents of a RAID controller's flash components and saves the data to a UFI file, which you can use to restore a RAID controller's flash if required.
   - **Verify flash image**—Reads the contents of a RAID controller's flash components and compares it to the contents of the specified UFI file.
   - **Display flash information**—Displays version information about a RAID controller's flash components.

7. Complete the flash operation and restart your computer before trying to use the RAID controller again. (You can not use your RAID controller while you are updating its flash.)
   The AFU processes the selected command and reports either success or an error message code.

D.4 Running the AFU from the Command Line

Note: You can also run a menu-based AFU (see Running the Menu-based AFU on page 104).

To run the AFU from the command line:

1. Shut down your operating system and reboot to DOS from a DOS partition on a bootable drive. (You can use a disk connected to the controller you're updating.) If your computer isn't set up to boot from a bootable device other than a disk drive, enter the system setup utility to change the setting.
2. Insert the firmware update disk containing AFU.exe.
3. At the DOS command, type AFU followed by a command (see AFU Commands on page 104) and any switches you want.

   Note: To find a controller number, type `AFU LIST`, then press `Enter`.

   The AFU processes the command and reports either success or an error message code.

To update a RAID controller's flash using the command line utility ARCCONF, see Updating the Flash using the AFU Command Line on page 106.

D.4.1 AFU Commands

This section lists the available AFU commands.

D.4.1.1 List

Displays the AFU-supported RAID controllers installed on your computer. Also displays the ID numbers assigned to each controller.
You don't have to restart the computer after completing this command.

This example shows a typical system response to a LIST command:

```
A:\> AFU LIST
Adaptec Flash Utility V4.0-0 B5749 (c)Adaptec Inc. 1999–2005.
 All Rights Reserved.
Controllers Detected and Recognized:
Controller #0 (03:05:00) Adaptec RAID 51645
```

D.4.1.2 Save

Saves the contents of a RAID controller's flash in a UFI file. The name of the UFI file is based on the controller type and can't be changed.
You must restart the computer following a SAVE command.

The command syntax for the SAVE command is:

```
AFU SAVE [/C<Controller ID>] [/D <UFI File Path>]
```

These switches are available:

- /C <Controller ID>—One or more RAID controller IDs representing the set of RAID controllers on which to perform the specified command. The default is 0; if the computer has multiple RAID controllers, the AFU defaults to controller 0 unless you specify otherwise.
  For example:
  To specify a single RAID controller ID: `/C 0`
  To specify multiple IDs separated by commas: `/C 0,2`
  To indicate all RAID controllers:`ALL`
  If you are using multiple RAID controllers, you must specify the controller you want by using the /C switch; otherwise, the AFU displays an error message and exits.
- /D <UFI File Path>—Specifies the path where the UFI files are located. If you do not specify the /D switch, the AFU looks for (or creates) its UFI files in the default location.
  You cannot specify the name of a UFI file, only its path. UFI filenames are predefined, based on the RAID controller type.
  In this example, the AFU saves flash contents from RAID controller 0 to a UFI file in the current default drive and directory:

  ```
  A:\> AFU SAVE /C 0
  ```

  In this example, the AFU saves flash contents from Controller 1 to a UFI file in C:\UFI_FILES:

  ```
  A:\> AFU SAVE /C 1 /D C:\UFI_FILES
  ```

D.4.1.3 Update

Updates the flash components of one or more RAID controllers on your computer from the flash image data in a UFI file. You must restart the computer following an UPDATE command.

The command syntax for the UPDATE command is:

```
AFU UPDATE [/C<Controller ID>] [/D <UFI File Path>]
```

This example shows a typical system response after an update.

```
A:\> AFU UPDATE /C 0
Adaptec Flash Utility V4.0-0 B5749
(c)Adaptec Inc. 1999–2005. All Rights Reserved.
Updating Controller 0 (Adaptec RAID 31205)
Reading flash image file (Build 5749)
```

```
AFU is about to update firmware on controllers Adaptec RAID
51645
***PLEASE DO NOT REBOOT THE SYSTEM DURING THE UPDATE***
This might take a few minutes.
Writing Adaptec RAID 51645 (4MB) Flash Image to controller
0...OK.
Verifying...OK
Please restart the computer to allow firmware changes to take
 effect.
```

D.4.1.4 Verify

Compares the contents of each of the flash components on a RAID controller to the corresponding image in a UFI file, and indicates whether they match. After using the VERIFY command, you must restart the computer.

The command syntax for the VERIFY command is as follows:

```
AFU VERIFY [/C<Controller ID>] [/D <UFI File Path>]
```

This example shows a typical system response after a VERIFY command.

```
A:\> AFU VERIFY /C 0
Adaptec Flash Utility V4.0-0 B5749 (c)Adaptec Inc. 1999–2005.
 All Rights Reserved.
Reading flash image file (Build 5748) Controller #0: Adaptec
RAID 51645
ROM: Checksum: 797B [VALID] (Build 5748)
File: Checksum: 797B [VALID] (Build 5748)
              Image Compares Correctly
```

D.4.1.5 Version

Displays version information about the flash components on a RAID controller. After using the VERSION command, restart your computer.

The command syntax for the VERSION command is:

```
AFU VERSION [/C<Controller ID>]
```

This example displays version information about all supported RAID controllers.

```
A:\> AFU VERSION /C 0
Adaptec Flash Utility V4.0-0 B5749 (c)Adaptec Inc. 1999–2005.

All Rights Reserved.
Version Information for Controller #0 (Adaptec RAID 51645)
ROM: Build 5748 [VALID] Fri Sep 27 13:28:40 EDT 2005
A:\> AFU VERSION /C ALL
```

D.4.1.6 Help

Displays a summary of AFU functions and command switches.

For example:

```
A:\> AFU HELP
```

```
A:\> AFU /?
```

D.5 Updating the Flash Using the AFU Command Line

1. Create the firmware update disk (see Creating the Firmware Update Disk on page 103).

2. Shut down your operating system and reboot to DOS from a DOS partition on a bootable drive. (You can use a disk connected to the controller you're updating.) If your computer isn't set up to boot from a bootable device other than a disk drive, enter the system setup utility to change the setting.
3. Insert the firmware update disk containing AFU.exe
4. At the DOS command, if you have multiple controllers and you don't know the number of the controller you want to update, type `AFU LIST`, then press `Enter`. Otherwise, skip to the next step.
5. At the DOS command, type AFU followed by a command (see AFU Commands on page 104) and any switches you want.
6. Update the flash using the instructions suitable for your requirements:
   - To update a single RAID controller:

     `AFU UPDATE /C <cont_number>`

     Where *<cont_number>* is the number of the RAID controller whose firmware you are updating. For example, to upgrade Controller 0, type `AFU UPDATE /C 0`
   - To update multiple RAID controllers:

     `AFU UPDATE /C <cont_number_a>,<cont_number_b>`

     Where *<controller_number_a>* and *<controller_number_b>* are the numbers of the RAID controllers whose firmware you are updating. For example, to upgrade controllers 0, 2, and 3, type `AFU UPDATE /C 0, 2, 3`
   - To update all RAID controllers simultaneously:

     `AFU UPDATE /C all`

     Note: The UFI file identifies the RAID controllers, so you don't have to worry about flashing the wrong controller.
7. When prompted, insert the firmware disk.
   The AFU processes the command and reports either success or an error message code.

E Controller LED, I2C, and Alarm Connector Quick Reference

This appendix provides a reference guide for Microsemi Adaptec RAID controller activity LED connectors, I2C connectors, and external alarm connectors.

E.1 Microsemi Adaptec RAID 6405/6445 LED and I2C Connector Specification

2271100-R	ASR-6405 Kit
2270000-R	ASR-6405 SGL
2270200-R	ASR-6445 SGL

- Microsemi Adaptec RAID 6405/6445 Activity LED Header Connector: Molex 22-43-6030 or equivalent
- Activity LED Header Mating Cable Connector: Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3 V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3 V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3 V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3 V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7

- Microsemi Adaptec RAID 6405/6445 Aggregate Activity LED Board Connector: Molex 22-28-4023 or equivalent
- Aggregate LED Mating Cable Connector: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3 V	LED Anode

- Microsemi Adaptec RAID 6405/6445 External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor

J12 Pin Number	Signal	Description
1	+3.3 V	—

- Microsemi Adaptec RAID 6405/6445 I2C CN0 Board Connector: Molex 22-43-6030 or equivalent
- I2C Mating Cable Connector: Molex 22-43-3030 or equivalent

J4:

J4 Pin Number	Signal
3	I2C Clock, CN0
2	Ground
1	I2C Data, CN0

E.2 Microsemi Adaptec RAID 6805/6805Q LED and I2C Connector Specification

2271200-R	ASR-6805 Kit
2270100-R	ASR-6805 SGL
2270700-R	ASR-6805Q SGL

- Microsemi Adaptec RAID 6805/6805Q Activity LED Header Connector: Molex 22-43-6030 or equivalent
- Activity LED Header Mating Cable Connector: Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3 V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3 V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3 V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3 V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7
9	+3.3 V	LED Anode	10
10	ACTIVITY CN1, LANE 0	LED Cathode	9
11	+3.3 V	LED Anode	12
12	ACTIVITY CN1, LANE 1	LED Cathode	11
13	+3.3 V	LED Anode	14

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
14	ACTIVITY CN1, LANE 2	LED Cathode	13
15	+3.3 V	LED Anode	16
16	ACTIVITY CN1, LANE 3	LED Cathode	15

- Microsemi Adaptec RAID 6805/6805Q Aggregate Activity LED Board Connector: Molex 22-28-4023 or equivalent
- Aggregate LED Mating Cable Connector: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3 V	LED Anode

- Microsemi Adaptec RAID 6805/6805Q External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor
1	+3.3 V	—

- Microsemi Adaptec RAID 6805/6805Q I2C CN0 Board Connector: Molex 22-43-6030 or equivalent
- I2C Mating Cable Connector: Molex 22-43-3030 or equivalent

J4:

J4 Pin Number	Signal
3	I2C Clock, CN0
2	Ground
1	I2C Data, CN0

- Microsemi Adaptec RAID 6805/6805Q I2C CN1 Board Connector: Molex 22-43-6030 or equivalent
- I2C Mating Cable Connector: Molex 22-43-3030 or equivalent

J5:

J4 Pin Number	Signal
3	I2C Clock, CN1
2	Ground
1	I2C Data, CN1

E.3 Microsemi Adaptec RAID 6405E LED Connector Specification

2271700-R	ASR-6405E Kit
2270800-R	ASR-6405E SGL

- Microsemi Adaptec RAID 6405E Activity LED Header Connector: Molex 22-43-6030 or equivalent
- Activity LED Header Mating Cable Connector: Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3 V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3 V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3 V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3 V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7

- Microsemi Adaptec RAID 6405E Aggregate Activity LED Board Connector: Molex 22-28-4023 or equivalent
- Aggregate LED Mating Cable Connector: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3 V	LED Anode

- Microsemi Adaptec RAID 6405E External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor
1	+3.3 V	—

E.4 Microsemi Adaptec RAID 6805E/6805E R5 LED Connector Specification

2271800-R	ASR-6805E Kit

2270900-R	ASR-6805E SGL
2275600-R	ASR-6805E R5 BULK

- Microsemi Adaptec RAID 6805E/6805E R5 Activity LED Header Connector: Molex 22-43-6030 or equivalent
- Activity LED Header Mating Cable Connector: Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3 V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3 V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3 V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3 V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7
9	+3.3 V	LED Anode	10
10	ACTIVITY CN1, LANE 0	LED Cathode	9
11	+3.3 V	LED Anode	12
12	ACTIVITY CN1, LANE 1	LED Cathode	11
13	+3.3 V	LED Anode	14
14	ACTIVITY CN1, LANE 2	LED Cathode	13
15	+3.3 V	LED Anode	16
16	ACTIVITY CN1, LANE 3	LED Cathode	15

- Microsemi Adaptec RAID 6805E/6805E R5 Aggregate Activity LED Board Connector: Molex 22-28-4023 or equivalent
- Aggregate LED Mating Cable Connector: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3 V	LED Anode

- Microsemi Adaptec RAID 6805E/6805E R5 External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor
1	+3.3 V	—

E.5 Microsemi Adaptec RAID 6405T LED Connector Specification

2272700-R	ASR-6405T SGL

- Microsemi Adaptec RAID 6405T Activity LED Header Connector: Molex 22-43-6030 or equivalent
- Activity LED Header Mating Cable Connector: Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3 V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3 V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3 V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3 V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7

- Microsemi Adaptec RAID 6405T Aggregate Activity LED Board Connector: Molex 22-28-4023 or equivalent
- Aggregate LED Mating Cable Connector: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3 V	LED Anode

- Microsemi Adaptec RAID 6405T External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor
1	+3.3 V	—

E.6 Microsemi Adaptec RAID 6805T/6805TQ LED Connector Specification

2272800-R	ASR-6805T SGL
2273700-R	ASR-6805T with AFM-600 Bulk
2273600-R	ASR-6805TQ SGL

- Microsemi Adaptec RAID 6805T/6805TQ Activity LED Header Connector: Molex 22-43-6030 or equivalent
- Activity LED Header Mating Cable Connector: Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3 V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3 V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3 V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3 V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7
9	+3.3 V	LED Anode	10
10	ACTIVITY CN1, LANE 0	LED Cathode	9
11	+3.3 V	LED Anode	12
12	ACTIVITY CN1, LANE 1	LED Cathode	11
13	+3.3 V	LED Anode	14
14	ACTIVITY CN1, LANE 2	LED Cathode	13
15	+3.3 V	LED Anode	16
16	ACTIVITY CN1, LANE 3	LED Cathode	15

- Microsemi Adaptec RAID 6805T/6805TQ Aggregate Activity LED Board Connector: Molex 22-28-4023 or equivalent
- Aggregate LED Mating Cable Connector: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3 V	LED Anode

- Microsemi Adaptec RAID 6805T/6805TQ External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor
1	+3.3 V	—

E.7 Microsemi Adaptec RAID 7805/7805Q/71605/71605Q/71605E Alarm Connector Specification

2274100-R	ASR-7805 SGL
2274200-R	ASR-7805 Kit
2274300-R	ASR-7805Q SGL
2274400-R	ASR-71605 SGL
2274500-R	ASR-71605E SGL
2274600-R	ASR-71605Q SGL

- Microsemi Adaptec RAID 7805/7805Q/71605/71605Q/71605E External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J6:

J6 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor
1	+3.3 V	—

E.8 Microsemi Adaptec RAID 71685/72405/78165 Alarm Connector Specification

2274700-R	ASR-71685 SGL
2274900-R	ASR-72405 SGL
2280900-R	ASR-78165 SGL

- Microsemi Adaptec RAID 71685/72405/78165 External Alarm Connector: Molex 22-28-4023 or equivalent
- Alarm Mating Cable Connector: Molex 50-57-9002 or equivalent

J6:

J6 Pin Number	Signal	Description
2	~2 kHz Square Wave	Open collector transistor
1	+3.3 V	—

F Safety Information

To ensure your personal safety and the safety of your equipment:

- Keep your work area and the computer clean and clear of debris.
- Before opening the system cabinet, unplug the power cord.

F.1 Electrostatic Discharge (ESD)

Caution: ESD can damage electronic components when they are improperly handled, and can result in total or intermittent failures. Always follow ESD-prevention procedures when removing and replacing components.

To prevent ESD damage:

- Use an ESD wrist or ankle strap and ensure that it makes skin contact. Connect the equipment end of the strap to an unpainted metal surface on the chassis.
- Avoid touching the controller against your clothing. The wrist strap protects components from ESD on the body only.
- Handle the controller by its bracket or edges only. Avoid touching the printed circuit board or the connectors.
- Put the controller down only on an antistatic surface such as the bag supplied in your kit.
- If you are returning the controller to Microsemi Adaptec Product Support, put it back in its anti-static bag immediately.

If a wrist strap is not available, ground yourself by touching the metal chassis before handling the controller or any other part of the computer.

G Technical Specifications

G.1 Environmental Specifications

Note: Microsemi Adaptec RAID controllers require adequate airflow to operate reliably. The recommended airflow is 200 LFM (linear feet per minute), minimum. Forced airflow is **required**.

Ambient temperature with forced airflow	0 °C to 55 ° C
Ambient temperature with Flash Backup Unit	0 °C to 55 ° C
Relative humidity	10% to 90%, non-condensing
Altitude	Up to 3,000 meters

Note: Ambient temperature is measured 1” from the RAID controller processor.

G.2 DC Power Requirements

Bus Type	Description	Requirements
PCIe	Ripple and noise	50 mV peak-to-peak (max)
PCIe	DC Voltage	3.3 V ± 9%, 12 V ± 8%

G.3 Current Requirements

Controller Model	Typical Current
Microsemi Adaptec RAID 6405	0.17A @ 3.3 VDC; 1.25A @ 12.0 VDC
Microsemi Adaptec RAID 6445	0.17A @ 3.3 VDC; 1.25A @ 12.0 VDC
Microsemi Adaptec RAID 6805/6805Q	0.17A @ 3.3 VDC; 1.25A @ 12.0 VDC
Microsemi Adaptec RAID 6405E	0.11A @ 3.3 VDC; 0.75A @ 12.0 VDC
Microsemi Adaptec RAID 6805E/6805E R5	0.125A @ 3.3 VDC; 0.80A @ 12.0 VDC
Microsemi Adaptec RAID 6405T	0.125A @ 3.3 VDC; 0.97A @ 12.0 VDC
Microsemi Adaptec RAID 6805T/6805TQ	0.125A @ 3.3 VDC; 0.97A @ 12.0 VDC
Microsemi Adaptec RAID 7805/7805Q	0.1A @ 3.3 VDC; 1.5A @ 12.0 VDC
Microsemi Adaptec RAID 71605/71605Q	0.1A @ 3.3 VDC; 1.6A @ 12.0 VDC
Microsemi Adaptec RAID 71605E	0.1A @ 3.3 VDC; 1.5A @ 12.0 VDC
Microsemi Adaptec RAID 71685	0.1A @ 3.3 VDC; 1.8A @ 12.0 VDC
Microsemi Adaptec RAID 72405	0.1A @ 3.3 VDC; 1.8A @ 12.0 VDC
Microsemi Adaptec RAID 78165	1.1A @ 3.3 VDC; 1.3A @ 12.0 VDC
Microsemi Adaptec RAID 8405/8405E	0.1A @ 3.3 VDC; 1.2A @ 12.0 VDC

Controller Model	Typical Current
Microsemi Adaptec RAID 8805/8805E	0.1A @ 3.3 VDC; 1.2A @ 12.0 VDC
Microsemi Adaptec RAID 8885/8885Q	0.1A @ 3.3 VDC; 1.2A @ 12.0 VDC
Microsemi Adaptec RAID 81605Z/81605ZQ	1.0A @ 3.3 VDC; 1.1A @ 12.0 VDC

G.4 Supercapacitor Ratings

Specification	Microsemi Adaptec Flash Backup Module AFM-700
Maximum voltage	5.4V
Minimum voltage	2.5V
Maximum Rated Charge Current	0.5A
Maximum Rated Discharge Current	0.5A
Charge Rate	1C
Discharge Rate	1C
Operating temperature	0°C to 55°C
Storage temperature	-20°C to 70°C

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