USER'S GUIDE

ServeRAID-MR10is VAULT SAS/SATA Controller

February 2009

IBM P/N: 46M1378

Second Edition (February 2009)

Preface

This book is the primary reference and user's guide for the ServeRAID-MR10is SAS/SATA Controller. It contains installation instructions and specifications for the adapter. In addition, it explains how to install and use the intelligent Battery Backup Unit (iBBU) that is used with the ServeRAID-MR10is controller.

For details on how to configure the controller, refer to the *ServeRAID-MR Software User's Guide*. For information about the operating system drivers, refer to the *ServeRAID-MR Device Driver Installation User's Guide*.

Audience

This document assumes that you have some familiarity with RAID controllers and related support devices. The people who benefit from this book are:

- Engineers who are designing a system that will include a ServeRAID-MR10is SAS/SATA Controller.
- Anyone installing a ServeRAID-MR10is SAS/SATA Controller in a RAID system.
- End users who need to install the iBBU products on the ServeRAID-MR10is SAS/SATA Controller.
- Engineers and managers who are evaluating iBBU products for possible use with ServeRAID controllers.

Organization

This document has the following chapters and appendices:

- Chapter 1, **Overview**, provides a general overview of the ServeRAID-MR10is controller.
- Chapter 2, **ServeRAID-MR10is SAS/SATA Controller Hardware Installation**, describes the procedures for installing the ServeRAID-MR10is controller.
- Chapter 3, **ServeRAID-MR10is SAS/SATA Controller Characteristics**, provides the characteristics and technical specifications for the ServeRAID-MR10is controller.
- Chapter 4, **Introduction to the Intelligent Backup Battery Unit**, describes the iBBU model and explains how it operates.
- Chapter 5, **Installing the Intelligent Battery Backup Unit Remotely**, explains how to install the iBBU model.
- Chapter 6, **Using the Intelligent Battery Backup Unit**, explains how to use and monitor the iBBU model and how to replace it.
- Chapter 7, **Intelligent Battery Backup Unit Specifications**, has complete technical information and specifications for the iBBU model.
- Appendix A, **Notices**, contains information about the warranty, patents, license inquiries, and trademarks.
- Appendix B, **Glossary of Terms and Abbreviations**, lists and explains the terms and abbreviations used in this manual.

Related Publications

ServeRAID-MR Device Driver Installation User's Guide

*IBM Document Numb*er: 46M1382

This document explains how to install the ServeRAID device driver for your operating system. The information in this document is independent of the back-end bus and applies to the ServeRAID-MR10is controller.

ServeRAID-MR Software User's Guide

*IBM Document Numb*er: 46M1381

This document explains how to use the MegaRAID Storage Manager, WebBIOS Configuration Utility, and Command Line Interface (CLI)

utilities to configure, monitor, and maintain ServeRAID controllers and the storage-related devices connected to them.

IBM Systems Safety Notices

*IBM Document Numb*er: G229-9054-01

This book contains safety notices from IBM Systems documentation. The safety notices include danger and caution notices.

Notices and Statements in This Document

The caution and danger statements in this document are also in the multilingual *IBM Systems Safety Notices* document, which is on the *ServeRAID-MR Support* CD. Each statement is followed by a reference number that you can use to locate the corresponding statement in your language in the IBM Systems Safety Notices document. The following notices and statements are used in this document:

Note: These notices provide important tips, guidance, or advice.

Important: These notices provide information or advice that might help you avoid inconvenient or problem situations.

Attention: These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage might occur.

CAUTION: These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.

DANGER: These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Revision History

IBM Document Number	Edition/Date	Remarks
46M1378	Second Edition February 2009	Updated the procedures for monitoring and maintaining the intelligent Battery Backup Unit.
43W7849	First Edition July 2008	Initial release of document.

IBM Customer Support

Web site:

http://www.ibm.com/systems/support/

Safety Instructions

Use the following safety guidelines to help protect your computer system from potential damage and to ensure your own personal safety.

Note: Use the ServeRAID-MR10is SAS/SATA Controller with UL-listed Information Technology Equipment (ITE) products only.

DANGER

When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- **Connect power to this unit only with the provided power cord. Do not use the provided power cord for any other product.**
- **Do not open or service any power supply assembly.**
- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.**
- **Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.**
- **Connect any equipment that will be attached to this product to properly wired outlets.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.**

To disconnect:

1. **Turn off everything (unless instructed otherwise).**
2. **Remove the power cords from the outlets.**
3. **Remove the signal cables from the connectors.**
4. **Remove all cables from the devices.**

To connect:

1. **Turn off everything (unless instructed otherwise).**
2. **Attach all cables to the devices.**
3. **Attach the signal cables to the connectors.**
4. **Attach the power cords to the outlets.**
5. **Turn on the devices.**

(D005)

CAUTION:
The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C007)

Protecting against Electrostatic Discharge – Static electricity can harm delicate components inside your computer. To prevent static damage, discharge static electricity from your body before you touch any of your computer's electronic components, such as the microprocessor. You can do so by touching an unpainted metal surface, such as the metal around the card-slot openings at the back of the computer.

As you continue to work inside the computer, periodically touch an unpainted metal surface to remove any static charge your body may have accumulated. In addition to the preceding precautions, you can also take the following steps to prevent damage from electrostatic discharge:

- When unpacking a static-sensitive component from its shipping carton, do not remove the component from the antistatic packing material until you are ready to install the component in your computer. Just before unwrapping the antistatic packaging, be sure to discharge static electricity from your body.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components in a static-safe area. If possible, use antistatic floor pads and workbench pads.

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Chapter 1
Overview

This section provides a general overview of the ServeRAID-MR10is SAS/SATA Controller with RAID control capabilities. It consists of the following sections:

1.1 Overview

The ServeRAID-MR10is SAS/SATA Controller is a high-performance intelligent Serial Attached SCSI (SAS)/Serial ATA II (SATA II) PCI Express adapter with RAID control capabilities. The ServeRAID-MR10is controller has one LSISAS1078DE processor that controls eight internal SAS/SATA ports through two SAS x8 internal connectors. The controller is available with eight PHYs.

The ServeRAID-MR10is controller provides reliability, high performance, and fault-tolerant disk subsystem management. It is an ideal RAID solution for the internal storage of workgroup, departmental, and enterprise systems. The controller offers a cost-effective way to implement RAID in a server.

The ServeRAID-MR10is controller is based on the MegaRAID® first-to-market SAS IC technology and proven technology. As the second-generation PCI Express storage adapter, the controller addresses the growing demand for increased data throughput and scalability requirements across midrange and enterprise-class server platforms. IBM® offers a family of SAS controllers to address the needs for both internal and external solutions.

SAS technology brings a wealth of options and flexibility with the use of SAS devices and SATA II devices within the same storage infrastructure. However, SAS devices and SATA devices bring individual characteristics that make each one a more suitable choice depending on your storage needs. MegaRAID gives you the flexibility to combine these two similar technologies on the same controller and within the same enclosure.

Note: You cannot mix SAS drives and SATA drives within the same *virtual disk(s)*.

The innovative intelligent Battery Backup Unit (iBBU) is pre-installed on the ServeRAID-MR10is controller. The iBBU provides cached data protection, which allows system builders to protect cached data even during the most catastrophic system failures.

Note: You must charge the battery before use. For more information about charging the battery, see Chapter 5, "Installing the Intelligent Battery Backup Unit Remotely".

The ServeRAID-MR10is controller supports the SAS protocol as described in the *Serial Attached SCSI Standard*, *version 1.1*. The controller also supports the Serial ATA II (SATA II) protocol defined by the *Serial ATA Specification, Version 1.0a*, and the *Serial ATAII; Extension to the Serial ATA Specification, Version 1.1*. SATA II is an extension to SATA 1.0a. The ServeRAID-MR10is controller is a versatile controller that provides the backbone of both server and high-end workstation environments.

Each port on the ServeRAID-MR10is controller supports SAS devices and/or SATA II devices using the following:

- SAS Serial SCSI Protocol (SSP), which enables communication with other SAS devices
- SATA II, which enables communication with other SATA II devices

- Serial Management Protocol (SMP), which communicates topology management information directly with an attached SAS expander device
- Serial Tunneling Protocol (STP), which enables communication with a SATA II device through an attached expander

The ServeRAID-MR10is controller offers data protection using the Data Encryption (DE) feature. This feature protects data from theft and helps meet regulatory compliance. The physical drives and the controller have keys that you can enable or disable to turn the data encryption feature on or off.

As it applies to data encryption, the DE feature satisfies the Federal Information Processing Standard (FIPS197) requirements set forth by the National Institute of Standards and Technology (IEEEP1619). These standards are used by non-military government agencies and contractors. See Section 3.4, “Data Encryption,” for more information about DE.

1.2 ServeRAID-MR10is SAS/SATA Controller Description

The ServeRAID-MR10is controller is available with eight PHYs. The controller has one LSISAS1078DE processor that controls eight internal SAS/SATA ports through two SAS x8 internal connectors.

1.2.1 Controller Limitations

The ServeRAID-MR10is controller has the following limitations:

- You can connect only one device per SAS PHY unless you use an expander
- You can use a maximum cable length of six feet (using shorter cables is preferred)
- Cables have to meet the SAS specification
- You cannot use SAS drives and SATA drives in the same virtual disk
- You cannot mix SAS or SATA Solid State Drives (SSDs) and legacy mechanical drives (SAS or SATA) in the same virtual disk

- You cannot mix Solid State Drives and Solid State SATA Drives in the same virtual disk
- See Section 3.3.4, “Electrical Characteristics,” for information about the power requirements, and Section 3.3.5, “Operating and Non-operating Conditions” for information about the minimum and maximum temperature ranges

1.3 General Description

The ServeRAID-MR10is controller brings 3.0 Gbit/s Serial Attached SCSI and 3.0 Gbit/s Serial ATA II performance to host adapter, workstation, and server designs. The controller supports internal storage devices, which allows you to use a system that supports enterprise-class SAS drives and desktop-class SATA II drives. Each ServeRAID-MR10is controller can connect to drives directly. Simplified cabling between devices is an additional benefit.

This controller is based on the LSISAS1078DE device. This device is compliant with the Fusion-MPT architecture and provides a PCI Express x8 interface.

The controller integrates eight high-performance SAS/SATA II PHYs and a PCI Express bus master DMA core. Each of the eight PHYs is capable of 3.0 Gbit/s SAS link rates and 3.0 Gbit/s SATA II link rates.

The LSISAS1078DE device provides an eight-lane, 2.5-Gbit/s PCI Express host interface, eight 3.0 Gbit/s SAS ports or SATA ports, and a full-featured, hardware-based RAID implementation. The LSISAS1078DE device integrates a high-speed DDR/DDR2 SDRAM interface with a hardware RAID assist engine for parity calculations. The LSISAS1078DE device provides the maximum benefits of a RAID system and enables you to configure the system to satisfy your system requirements.

The LSISAS1078DE device increases system performance and provides fault-tolerant data storage. The LSISAS1078DE supports data striping across multiple disks, which reduces disk access time because multiple disks simultaneously read or write data. The LSISAS1078DE device backs up data with either data mirroring or a parity block. Either backup method enables you to recover lost data in the event of a disk failure.

You can select the data backup method that best suits your needs. A hardware RAID assist exclusive-OR (XOR) engine speeds parity generation and checking and reduces system-access times.

The ServeRAID-MR10is controller supports the SAS protocol as described in the *Serial Attached SCSI Standard*, *version 1.1*. The controller also supports the Serial ATA II (SATA II) protocol defined by the *Serial ATA Specification, Version 1.0a*, and the *Serial ATAII; Extension to the Serial ATA Specification, Version 1.1*. SATA II is an extension to SATA 1.0a. In addition, the controller supports the following SATA II features:

- 3 Gbit/s SATA II
- Staggered spin-up
- Hot plug
- Native command queuing
- Activity and fault indicators for each PHY
- Port Selector (for dual-port drives)

Each port on the ServeRAID-MR10is controller supports SAS devices, SATA II devices, or both using SSP, SMP, STP, and SATA II. SSP enables communication with other SAS devices. SATA II enables the controller to communicate with other SATA II devices.

1.4 Configuration Scenarios

There are two main scenarios in which you can use the ServeRAID-MR10is controller:

- **Low-end, internal SATA II configuration:** In this configuration, use the RAID controller as a high-end SATA II compatible controller that connects up to eight disks either directly or through a port expander. This configuration is mostly for low-end or entry servers. Enclosure management is provided through out-of-band I^2C bus. Side bands of both types of internal SAS connectors support the SFF-8485 (SGPIO) interface.

- **Midrange internal SAS configuration:** This is like the internal SATA II configuration, but with high-end disks. This is more suitable for low-range to midrange servers.

Figure 1.1 shows a direct-connect configuration. The Inter-IC (I^2C) interface communicates with peripherals. The external memory bus provides a 32-bit memory bus, parity checking, and chip select signals for pipelined synchronous burst static random access memory (PSBRAM), nonvolatile static random access memory (NVSRAM), and Flash ROM.

Figure 1.1 Example of a SAS Direct-Connect Application

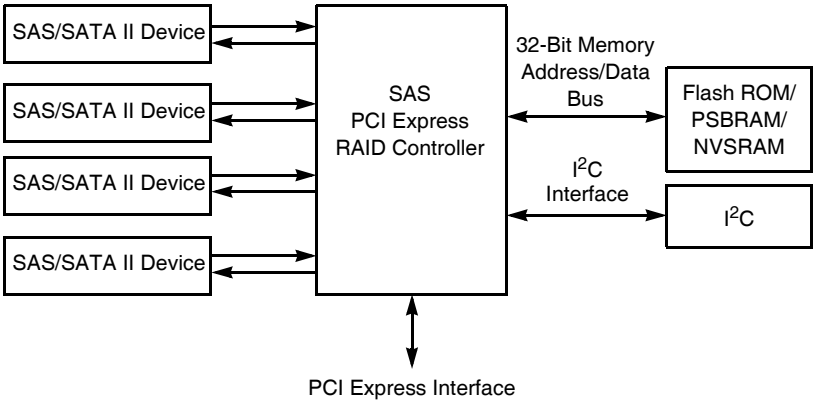
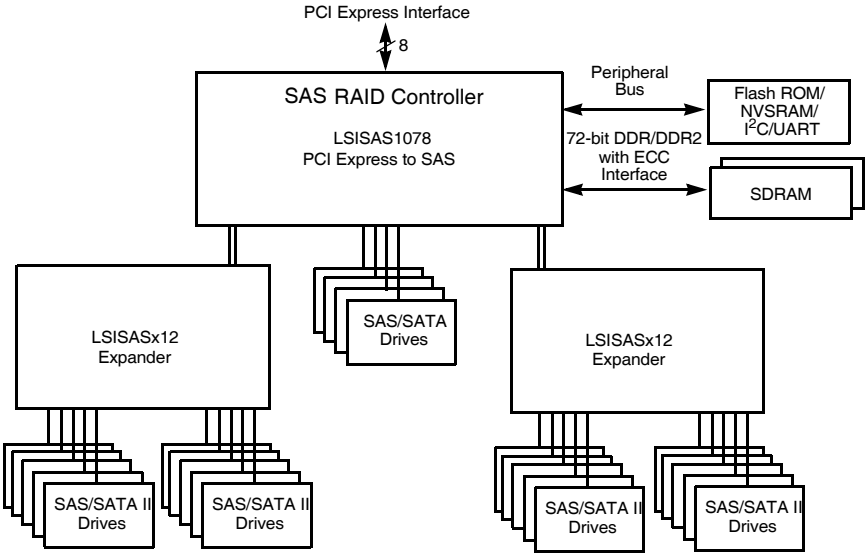


Figure 1.2 shows an example of the ServeRAID-MR10is controller configured with an LSISASx12 expander that is connected to SAS disks, SATA II disks, or both.

Figure 1.2 Example of a ServeRAID-MR10is Controller Configured with an LSISASx12 Expander



1.4.1 Number of Physical Drives Supported

Your configuration planning for the ServeRAID-MR10is controller depends in part on the number of physical drives that you want to use in a RAID array. The number of drives in an array determines the RAID levels that can be supported. Only one RAID level can be assigned to each virtual disk. Table 1.1 shows the minimum and maximum number of drives required for each RAID level.

Table 1.1 Physical Drives Required for Each RAID Level

RAID Level	Minimum # of Physical Drives	Maximum # of Physical Drives
0	1	16
1	2	2
5	3	16
6	3	16
10	4	16

Table 1.1 Physical Drives Required for Each RAID Level (Cont.)

RAID Level	Minimum # of Physical Drives	Maximum # of Physical Drives
50	6	32
60	6	32

1.5 Benefits of the SAS Interface

SAS is a serial, point-to-point, enterprise-level device interface that leverages the proven SCSI protocol set. SAS combines the advantages of SATA II, SCSI, and Fibre Channel, and is the future mainstay of the enterprise and high-end workstation storage markets. SAS offers a higher bandwidth per pin than parallel SCSI, and it improves signal and data integrity.

The SAS interface uses the proven SCSI command set to ensure reliable data transfers, while providing the connectivity and flexibility of point-to-point serial data transfers. The serial transmission of SCSI commands eliminates clock-skew challenges. The SAS interface provides improved performance, simplified cabling, smaller connectors, lower pin count, and lower power requirements when compared to parallel SCSI.

The controller leverages a common electrical and physical connection interface that is compatible with Serial ATA technology. The SAS protocols and the SATA II protocols use a thin, 7-wire connector instead of the 68-wire SCSI cable or 26-wire ATA cable. The SAS/SATA II connector and cable are easier to manipulate, allow connections to smaller devices, and do not inhibit airflow. The point-to-point SATA II architecture eliminates inherent difficulties created by the legacy ATA master-slave architecture, while maintaining compatibility with existing ATA firmware.

1.5.1 PCI Express Architecture

PCI Express is a local bus system designed to increase data transfers without slowing down the central processing unit (CPU). You can install the ServeRAID-MR10is PCI Express SAS/SATA controller in PCI

Express computer systems with a standard bracket type. With these adapters in your system, you can connect SAS devices and SATA II devices over the bus.

PCI Express goes beyond the PCI specification in that it is intended as a unifying I/O architecture for various systems: desktops, workstations, mobile, server, communications, and embedded devices.

1.5.2 Operating System Support

The ServeRAID-MR10is controller supports the following operating systems:

- Microsoft® Windows® 2000, Windows Server 2003, Windows Server 2008
- Red Hat® Enterprise Linux™ version 4 and version 5
- SUSE™ Linux Enterprise Server version 9 and version 10
- Novell® NetWare® 6.5
- SCO™ OpenServer® 6.0.0
- SCO UnixWare™ 7.1.4
- VMWare® ESX 3.0 and ESX 3.5

To download the latest operating system drivers, you can access http://www.ibm.com/systems/support/.

The ServeRAID-MR10is controller uses Fusion-MPT™ architecture for all major operating systems, thinner drivers, and better performance.

1.6 Summary of the ServeRAID-MR10is SAS/SATA Controller Characteristics

This section provides a summary of the features and benefits of the ServeRAID-MR10is SAS/SATA Controller. It contains information on SAS features, SATA II features, PCI performance, integration, usability, and flexibility.

The ServeRAID-MR10is controller includes the following features:

- PCI Express x8 lane width

- PCI Express performance up to 2.5 Gbits/s per lane
- Support for 128-, 256-, or 512-Mbyte DDR2 667 MHz on-board SDRAM intelligent battery backed module
- Two internal connectors
- Support for RAID levels 0, 1, 5, 6, 10, 50, and 60
- Advanced array configuration and management utilities
- Online RAID level migration
- Drive migration
- Drive roaming
- Media scan
- No reboot necessary after expansion
- More than 200 Qtags per array
- Hardware clustering support on the board
- User-specified rebuild rate
- 32-Kbyte nonvolatile random access memory (NVRAM) for storing RAID system configuration information; the MegaRAID SAS firmware is stored in flash ROM for easy upgrade.

1.6.1 SAS Features

The following list describes the SAS features of the ServeRAID-MR10is controller:

- Provides eight fully independent PHYs
- Supports 3.0 Gbit/s SAS data transfers per PHY
- Supports SSP to enable communication with other SAS devices
- Supports SMP to communicate topology management information
- Provides a serial, point-to-point, enterprise-level storage interface
- Simplifies cabling between devices
- Provides a scalable interface that supports up to 122 devices through the use of expanders
- Supports wide ports consisting of 2, 3, or 4 PHYs within a single quad port

- Supports narrow ports consisting of a single PHY
- Transfers data using SCSI information units

1.6.2 SAS Array Limitations

This section describes the array limitations of the ServeRAID-MR10is controller. These include limitations such as the number of physical drives supported, the maximum number of disks per controller, and the maximum number of virtual disks allowed per controller.

Table 1.2 lists the array limitations for the controller.

Table 1.2 ServeRAID-MR10is Controller Array Limitations

Specification	ServeRAID-MR10is Controller
Maximum virtual disks per controller	64
Maximum arrays per controller	128
Maximum virtual disks per array	16
Maximum drives per array	32
Maximum drives per controller	16
Maximum hot spares	16
Maximum spans per virtual disk	8
Maximum enclosures per port*	3
Maximum ports	2

* - Assumes one Storage Enclosure Processor (SEP) per enclosure.

Note: The maximum number of hot spares per array is equal to the maximum number of drives per array.

The ServeRAID-MR10is controller supports 64-bit logical block addressing (LBA), which makes it possible to connect a large number of drives to the controller, directly and through expanders. However, the actual number of drives that you can attach depends on the limits listed in Table 1.2 rather than by actual RAID volume capacity.

The maximum numbers in Table 1.2 depend on how many physical devices you have connected to the controller. For example, the maximum number of arrays per controller is equal to the number of

physical drives supported by the controller up to the limit of 128 arrays per controller. The ServeRAID-MR10is controller supports up to 240 physical drives, but the maximum number of arrays is limited to 128.

Though you can have up to 16 virtual disks per array, and up to 64 arrays per ServeRAID-MR10is controller, there is a limit of 64 virtual disks per controller. Because of this constraint, the 32 arrays cannot all contain 16 virtual disks at the same time.

Note: The maximum number of hot spares per array is equal to the maximum number of drives per array.

1.6.3 SATA II Features

The following list describes the SATA II features of the ServeRAID-MR10is controller:

- Supports SATA II data transfers of 3.0 Gbits/s
- Supports STP data transfers of 3.0 Gbits/s
- Provides a serial, point-to-point storage interface
- Simplifies cabling between devices
- Eliminates the master-slave construction used in parallel ATA
- Allows addressing of multiple SATA II targets through an expander
- Allows multiple initiators to address a single target (in a fail-over configuration) through an expander

1.6.4 PCI Express Performance

The following list describes the PCI Express performance features of the ServeRAID-MR10is controller:

- Provides a PCI Express interface that:
  - Supports a dedicated PCI Express bus
  - Supports x8 lane configuration
  - Supports transfer rates of up to 2.5 Gbits/s per lane
  - Complies with the *PCI Express Specification*, *Revision 1.0a*
- Provides unequaled performance through the Fusion-MPT architecture

- Provides high throughput and low CPU utilization to offload the host processor

1.6.5 Usability Features

The following list describes the usability features of the ServeRAID-MR10is controller:

- Simplifies cabling with point-to-point, serial architecture
- Supports smaller, thinner cables that do not restrict airflow
- Provides drive spin-up sequencing control
- Provides up to two LED signals for each PHY to indicate link activity and faults
- Provides an I^2C interface for enclosure management
- Supports the internal SAS Sideband signal SFF-8485 (SGPIO) interface

1.6.6 Flexibility Features

These features increase the flexibility of the ServeRAID-MR10is controller:

- Supports a Flash ROM interface, a nonvolatile static RAM (NVSRAM) interface, and a pipelined synchronous burst SRAM (PSBRAM) interface
- Offers a flexible programming interface to tune I/O performance
- Allows mixed connections to SAS targets or SATA II targets
- Leverages compatible connectors for SAS connectors and SATA II connections
- Allows grouping of up to four PHYs in a single quad port to form a wide port
- Allows programming of the World Wide Name

1.6.7 Drive Roaming

Drive roaming occurs when the physical drives are changed to different ports on the same controller. When the drives are placed on different

channels, the controller detects the RAID configuration from the configuration data on the drives.

Note: In a clustering environment, drive roaming is supported within the same channel only.

Configuration data is saved in both the NVRAM on the RAID controller and on the physical drives attached to the controller. This action maintains the integrity of the data on each drive, even if the drives have changed their target ID.

Note: If you move a drive that is being rebuilt, the rebuild operation will restart, not resume.

Follow these steps to use drive roaming:

Step 1. Turn off all power to the server and all physical drives, enclosures, and system components. Disconnect the power cords from the system.

Step 2. Open the host system by following the instructions in the host system technical documentation.

Step 3. Move the drives to different positions on the backplane to change the targets.

Step 4. Determine the SAS target requirements.

Step 5. Perform a safety check.

a. Make sure that the drives are inserted correctly.

b. Close the cabinet of the host system.

Step 6. Reconnect the power cords to the system.

Step 7. Turn on the power to the system.

The controller then detects the RAID configuration from the configuration data on the drives.

1.6.8 Drive Migration

Drive migration is the transfer of a set of physical drives in an existing configuration from one controller to another. The drives must remain on the same channel and must be reinstalled in the same order as in the original configuration.

Note: Only complete configurations can be migrated; individual virtual disks cannot be migrated.

Note: Drive roaming and drive migration cannot be supported at the same time.

Follow these steps to migrate drives:

Step 1. Make sure that you clear the configuration on the system to which you migrate the drives, to prevent a configuration data mismatch between the physical drives and the NVRAM.

Note: When you migrate drives, move only the disks that make up the virtual disk (not all of the physical drives in an array), so you do not see an NVRAM mismatch error (providing a configuration is on the destination controller). The NVRAM mismatch error appears only if you move all of the physical drives to the other controller.

Step 2. Turn off all power to the server and all physical drives, enclosures, and system components. Disconnect the power cords from the systems.

Step 3. Open the host system by following the instructions in the host system technical documentation.

Step 4. Remove the SAS cable connectors from the internal drives that you want to migrate.

a. Make sure that pin 1 on the cable matches pin 1 on the connector.

b. Make sure that the SAS cables conform to all SAS specifications.

Step 5. Remove the physical drives from the first system, and then insert them into drive bays on the second system.

Step 6. Connect the SAS cables to the physical drives in the second system.

Step 7. Determine the SAS target requirements.

Step 8. Perform a safety check.

a. Make sure that all of the cables are attached correctly.

b. Make sure that the controller is installed correctly.

c. Close the cabinet of the host system.

Step 9. Reconnect the power cords to the system.

Step 10. Turn on the power to the system.

The controller detects the RAID configuration from the configuration data on the drives.

1.7 Hardware Specifications

You can install the ServeRAID-MR10is controller in a computer with a mainboard that has a PCI Express slot. Table 1.3 describes the hardware configuration features for the ServeRAID-MR10is controller.

Table 1.3 ServeRAID-MR10is Controller Specifications

Specification	ServeRAID-MR10is Controller
RAID Levels	0, 1, 5, 6, 10, 50, and 60
Devices Supported per Port	Up to 15 SAS devices or SATA II devices (such as physical drives and expanders)
Ports	Eight internal
Data Transfer Rate	Up to 3 Gbits/s per phy
Bus	PCI Express 1.0a
Cache Function	Write-back, write-through, adaptive read ahead, non-read ahead, read ahead, cache I/O, direct I/O
Multiple Virtual Disks/ Arrays per Controller	Up to 64 virtual disks per controller or per logical array
Online Capacity Expansion	Yes
Dedicated and Global Hot Spares	Yes
Hot Swap Devices Supported	Yes
Non-Disk Devices Supported	Yes
Mixed Capacity Physical Drives Supported	Yes
Number of Internal Connectors	Two x8 Mini SAS 4i ports

Table 1.3 ServeRAID-MR10is Controller Specifications (Cont.)

Specification	ServeRAID-MR10is Controller
Hardware Exclusive OR (XOR) Assistance	Yes
Direct I/O	Yes
Architecture	Fusion-MPT

1.8 Technical Support

See the *Warranty and Support Information* document for information about the technical support available for this product.

Chapter 2
ServeRAID-MR10is SAS/SATA Controller Hardware Installation

This chapter describes the procedures used to install the ServeRAID-MR10is SAS/SATA Controller. It consists of the following sections:

2.1 Requirements

The following items are required for installation:

- A ServeRAID-MR10is SAS/SATA Controller
- A host system with an available PCI Express expansion slot
- The *ServeRAID-MR Support* CD, containing the drivers and documentation
- The necessary internal cables
- SAS physical drives or SATA II physical drives (Mechanical or Solid State Devices, SSDs)

  Note: For optimal performance, use an uninterruptible power supply.

2.2 Quick Installation

The following steps are for quick ServeRAID-MR10is controller installation. These steps are for experienced computer users/installers. Section 2.3, "Detailed Installation," contains the steps for all others to follow.

Step 1. Review all safety information provided with the server. Turn off the server and all attached devices, and unplug the server and the device power cords.

Step 2. Open the cabinet of the host system by following the instructions in the host system technical documentation.

Step 3. Check the intelligent Battery Backup Unit (iBBU) on the controller.

Step 4. Install the ServeRAID-MR10is controller in the computer and connect the SAS devices or SATA II devices to it. Make sure that the cables you use conform to all specifications.

Step 5. Perform a safety check.

a. Make sure that all cables are properly attached

b. Make sure that the ServeRAID-MR10is controller is installed correctly

c. Close the cabinet of the host system

Step 6. Reconnect the power cords to the system and to all of the attached devices.

Step 7. Turn on the power to the system after you complete the safety check.

2.3 Detailed Installation

This section provides detailed instructions for installing a ServeRAID-MR10is controller.

Step 1. Unpack the ServeRAID-MR10is Controller

Unpack and remove the controller. Inspect it for damage. If it appears damaged, or if any of the following items are missing,

contact your place of purchase. The controller is shipped with the following items:

- The *ServeRAID-MR Support* CD containing MegaRAID® drivers for supported operating systems, an electronic version of this *User's Guide*, and other related documentation
- Warranty information

Step 2. Turn off the Power to the System

Review all safety information provided with the computer. Turn off the computer, unplug the power cords from the power supplies, disconnect the computer from the network, and remove the computer cover. See the documentation provided with the computer for instructions. Before you install the controller, make sure that the computer is disconnected from the power and from any networks.

Step 3. Review the ServeRAID-MR Controller Connectors

Refer to Chapter 3, "ServeRAID-MR10is SAS/SATA Controller Characteristics" for a diagram of the ServeRAID-MR10is controller with its connectors.

Step 4. Review the Controller Limitations

Review Section 1.2.1, "Controller Limitations" before you install the controller in the system.

Step 5. Check the Intelligent Battery Backup Unit

Make sure that the iBBU is present.

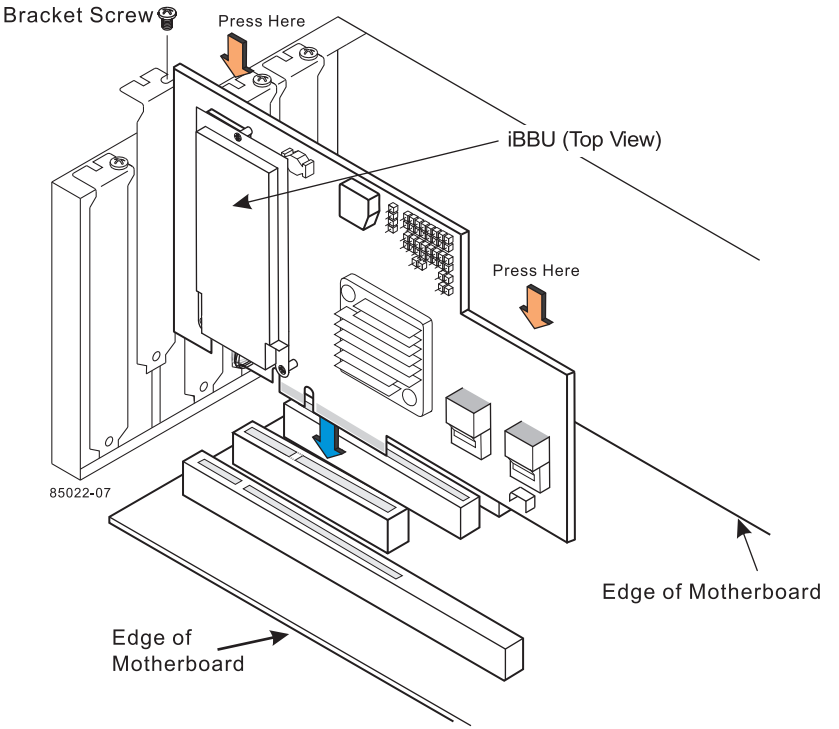
Step 6. Install the ServeRAID-MR10is Controller

Select a PCI Express slot and align the controller's PCI Express bus connector to the slot. Press down gently but firmly to make sure that the card is properly seated in the slot. Secure the bracket to the computer chassis.

Figure 2.1 shows the installation of the ServeRAID-MR10is controller in a PCI Express slot.

Note: Some PCI-E slots support PCI-E graphics cards only. If a RAID controller is installed one of those slots, the controller will not function.

Figure 2.1 Installing the ServeRAID-MR10is Controller in a PCI Express Slot



Step 7. Configure and Install the SAS Devices, the SATA II Devices, or Both, in the Host Computer Case

Refer to the documentation for the devices for any preinstallation configuration requirements.

Step 8. Connect the SAS Devices, the SATA II Devices, or Both, to the Controller

Use SAS cables to connect SAS devices, SATA II devices, or both to the ServeRAID-MR10is controller. Refer to Section 2.4, "SAS Device Cables" for SAS cable information. Refer to Section 2.4.1, "Connecting the ServeRAID-MR10is SAS/SATA Controller to Physical Drives," for details on connecting the controller to physical drives and expanders.

The maximum cable length is six meters. You can connect one device per SAS PHY unless you use an expander.

System throughput problems can occur if the SAS cables are not the correct type. To minimize the potential for problems:

a. Use cables no longer than six meters (using shorter cables is preferred)

b. Use cables that meet the SAS specification

c. Route the SAS cables carefully

Step 9. Turn on the Power to the System

Reinstall the computer cover, and reconnect the AC power cords. Turn on the power to the computer. Make sure that the power is turned on to the SAS devices and the SATA II devices before or at the same time as the host computer. If the power is turned on to the computer before it is turned on to the devices, the computer might not recognize the devices.

During boot, a BIOS message appears. The firmware takes several seconds to initialize. The configuration utility prompt times out after several seconds. The second portion of the BIOS message displays the ServeRAID-MR10is controller number, firmware version, and cache SDRAM size. The numbering of the controller follows the PCI slot scanning order used by the host mainboard.

Step 10. Run the WebBIOS Configuration Utility

Run the WebBIOS Configuration Utility to configure the physical arrays and the logical drives. When the message `Press <Ctrl><H> for WebBIOS` appears on the screen, press CTRL+H immediately to run the utility.

Step 11. Install the Operating System Driver

The controller can operate under various operating systems. To operate under these operating systems, you must install the software drivers.The *ServeRAID-MR Support* CD includes software drivers for the supported operating systems, and documentation. You can download the latest drivers at http://www.ibm.com/systems/support/. For updates, click **Downloads and drivers**.

For details on installing the driver, refer to the *ServeRAID-MR Device Driver Installation User's Guide* on the *ServeRAID-MR Support* CD. Be sure to use the latest Service Packs provided

by the operating system manufacturer and to review the `readme` file that accompanies the driver.

2.4 SAS Device Cables

This section describes the cables used on the controller and provides step-by-step instructions for connecting SAS physical drives and/or SATA II physical drives to the controller. The SAS protocols and SATA II protocols use a thin, 7-wire connector instead of the 68-wire SCSI cable or 26-wire ATA cable.

Note: Use only straight SAS cables, not cross-over SAS cables.

Figure 2.2 displays the SAS cable that connects the internal connectors on the controller to SAS drives.

Figure 2.2 Internal SAS Cable for Connection to SAS Physical Drives or SATA II Physical Drives

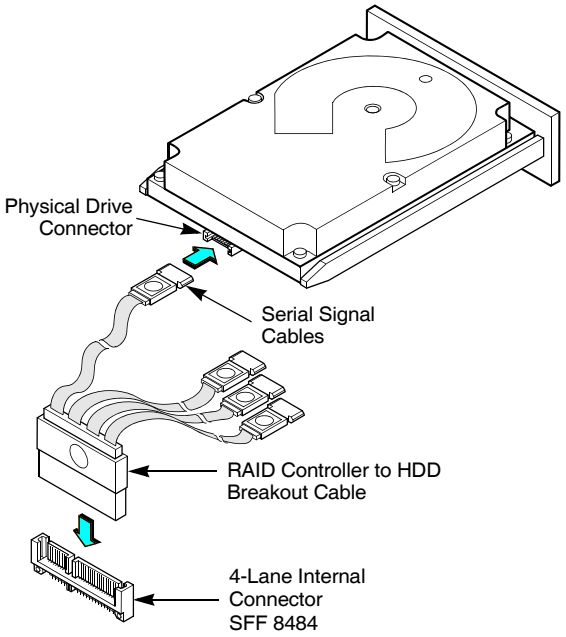


Figure 2.3 displays the SATA II device plug connector used to connect a controller with internal connectors to the host receptable connector on

a backplane. A SATA II connector consists of a signal connector and a power connector.

Figure 2.3 SATA II Connectors

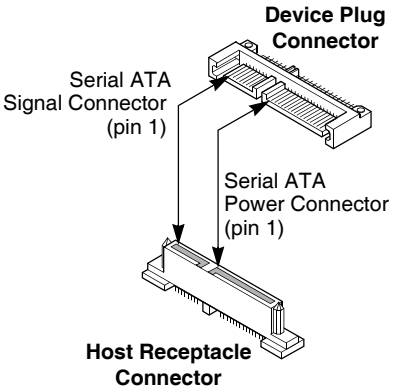
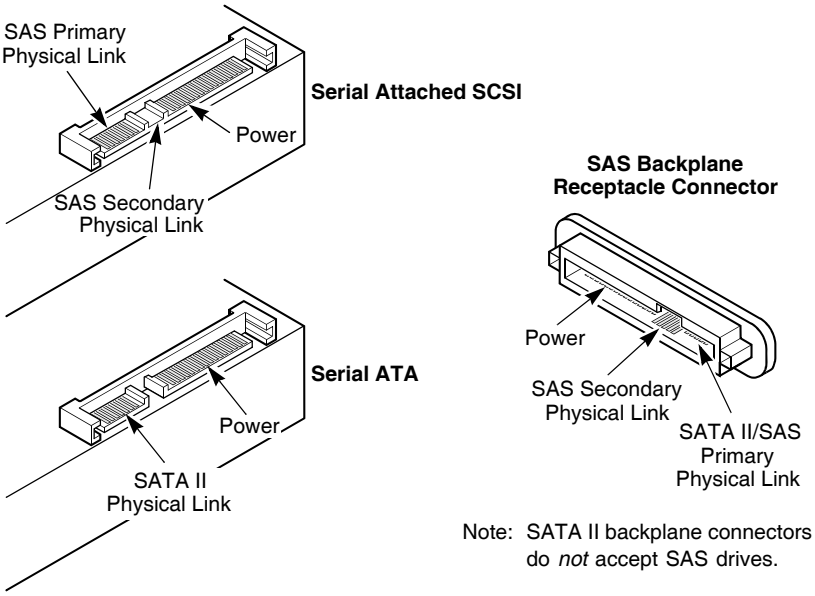


Figure 2.4 shows SAS connectors and SATA II connectors on SAS physical drives and SATA II physical drives, respectively. Cables are used for connection between internal connectors on the controller and connectors on SAS drives and/or SATA II drives, respectively. Both SAS physical drives and SATA II physical drives can connect to SAS backplane receptable connectors. The difference between the SAS connector and SATA II connector is the bridge between the SAS primary physical link and the power connector on the SAS controller, which the SATA II connector does not have.

Note: SAS backplane connectors can accept SAS physical drives or SATA II physical drives, but SATA II backplane connectors *cannot* accept SAS drives.

Figure 2.4 SAS Plugs, SATA II Plugs, and SAS Backplane Receptacle Connector



Note: SATA II backplane connectors do *not* accept SAS drives.

2.4.1 Connecting the ServeRAID-MR10is SAS/SATA Controller to Physical Drives

This subsection provides step-by-step instructions for connecting the ServeRAID-MR10is controller to the SAS physical drives and SATA II physical drives. Figure 2.5 shows how to connect the internal SAS cable from the controller to the physical drives.

Follow these steps to connect the ServeRAID-MR10is controller with internal connectors to a physical drive.

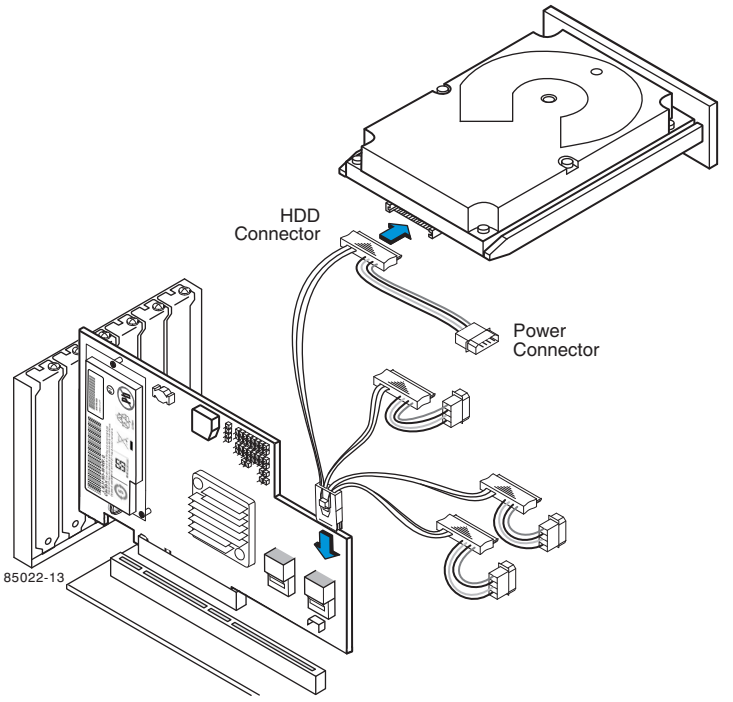
Step 1. Plug the connector on the internal cable into the internal connector on the controller.

Step 2. Plug the connector on the other end of the internal cable into the connector on the SAS physical drive or the SATA II physical drive.

Step 3. If you have another physical drive, connect it to another plug on the internal cable.

You can connect other devices if the cable has more connectors.

Figure 2.5 Connecting the ServeRAID-MR10is SAS/SATA Controller with Internal Connectors to a Physical Drive



2.5 Replacing a Failed Controller Containing Data in the IBBU

The ServeRAID-MR10is intelligent Battery Backup Unit is a cache memory module with an integrated battery pack. The module provides an uninterrupted power source to the module if power is unexpectedly interrupted while cached data is still present. If the power failure is the result of the ServeRAID-MR10is controller itself failing, then the iBBU can be moved to a new controller and the data can be recovered. The replacement controller must have a cleared configuration.

Note: See the *Warranty and Support Information* document for the replacement battery part number and battery-disposal instructions.

Follow these steps to replace a failed controller with data in the transportable battery backup unit.

Step 1. Review all safety information provided with the server; then, power down the server and the drives.

Step 2. Remove the failed controller from the system.

Step 3. Remove the iBBU from the failed controller.

Step 4. Insert the iBBU into the replacement controller.

Step 5. Insert the replacement controller into the system.

Step 6. Turn on the power to the system.

The controller then reads the disk configuration into NVRAM and flushes cache data to the virtual disks.

2.6 After Installing the ServeRAID-MR10is Controller

After the ServeRAID-MR10is controller installation, you must configure the ServeRAID-MR10is controller and install the operating system driver. The *ServeRAID-MR Software User's Guide* instructs you on the configuration options and how to set them on your ServeRAID-MR10is controller. The *ServeRAID-MR Device Driver Installation User's Guide* provides detailed installation instructions for operating system drivers.

Chapter 3
ServeRAID-MR10is SAS/SATA Controller Characteristics

This chapter describes the characteristics of the ServeRAID-MR10is SAS/SATA Controller. It consists of the following sections:

3.1 ServeRAID-MR10is SAS/SATA Controller

The ServeRAID-MR10is SAS/SATA Controller is a dual PHY, SAS PCI Express adapter and is used in a system with a PCI Express slot. PCI Express goes beyond the PCI specification in that it is intended as a unifying I/O architecture for various systems: desktops, workstations, mobile, server, communications, and embedded devices.

The following subsections provide graphics and connector information for the ServeRAID-MR10is controller.

The ServeRAID-MR10is PCI Express Disk Array Storage Adapter has one LSISAS1078DE processor that controls eight internal SAS/SATA ports through two SAS 4x internal connectors.

This subsection provides the board layout and connector information for the ServeRAID-MR10is controller, which has eight internal SAS/SATA connectors. Figure 3.1 displays the connectors on the controller, and Table 3.1 describes them.

Figure 3.1 Card Layout for the ServeRAID-MR10is Controller

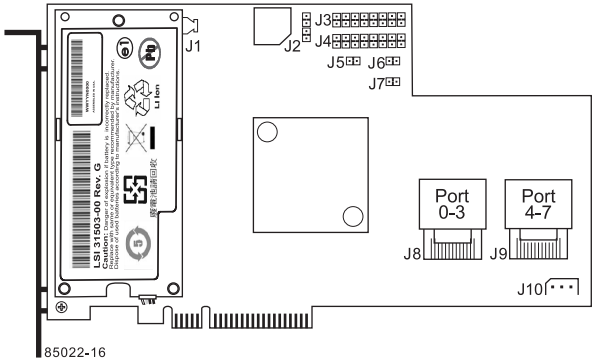


Table 3.1 ServeRAID-MR10is Controller – Connectors

Connector	Description	Type	Comments
J1	Board-to-board connector for battery backup unit daughter card	20-pin connector	Provides an interface to the daughter card that contains the battery backup unit.
J2	Universal Asynchronous Receiver/ Transmitter debugging	4-pin connector	Reserved for IBM® use.
J3	Individual Activity LED header for eight SAS ports	16-pin connector	Provides an LED interface individually to eight SAS ports. The LED indicates activity on individual drives.
J4	Individual Fault LED header for eight SAS ports	16-pin connector	Provides an LED interface individually to eight SAS ports. The LED indicates errors on individual drives.
J5	Debug connector	2-pin connector	Reserved for IBM use.
J6	Board Default Debug	2-pin connector	Reserved for IBM use.

Table 3.1 ServeRAID-MR10is Controller – Connectors (Cont.)

Connector	Description	Type	Comments
J7	Cache Write Pending LED	2-pin connector	The connector for the enclosure LED. It provides a signal that indicates when the on-board cache contains data and a write from the cache to the physical drives is pending. Optional.
J8	Ports 0–3	x8 SAS Ports	The x8 Mini SAS 4i ports connect the cables from the RAID controller to SAS physical drives, SATA II physical drives, or a SAS expander.
J9	Ports 4–7	x8 SAS Ports	The x8 Mini SAS 4i ports connect the cables from the RAID controller to SAS physical drives, SATA II physical drives, or a SAS expander.
J10	IPMI-style SMBus (System Management)/I^2C header	3-pin shielded header	Provides enclosure management support.

3.2 ServeRAID-MR10is Controller Characteristics

Table 3.2 shows the general characteristics for the ServeRAID-MR10is controller.

Table 3.2 ServeRAID-MR10is Characteristics

Flash ROM[1]	Serial EEPROM[2]	SAS Data Transfers	SCSI Features	SCSI Termination
Yes	Yes	Up to 3 Gbits/s per port	Plug and Play Scatter/Gather Activity LED	Active

1. For boot code and firmware.
2. For BIOS configuration storage.

The ServeRAID-MR10is controller ensures data integrity by intelligently validating the compatibility of the SAS domain. The controller uses Fusion-MPT architecture, which allows for thinner drivers and better performance.

3.3 Technical Specifications

The design and implementation of the ServeRAID-MR10is controller minimizes electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge. The controller carries the following marks and certifications:

- CE mark
- C-Tick mark
- FCC Self-Certification logo
- Canadian Compliance Statement
- Korean MIC
- Taiwan BSMI
- Japan VCCI

In addition, the adapter meets the requirements of CISPR Class B.

The ServeRAID-MR10is controller and the intelligent Battery Backup Unit (iBBU) are CSA C22.2 No. 60950-1, UL 60950-1 First Edition listed Accessory, UL file number E257743.

3.3.1 Storage Adapter Specifications

Table 3.3 lists the specifications for the ServeRAID-MR10is controller.

Table 3.3 ServeRAID-MR10is Controller Specifications

Specification	ServeRAID-MR10is Controller
Processor (PCI Express Host Controller to PCI Secondary I/O Controller)	LSISAS1078DE device with Integrated PowerPC processor
Operating Voltage	+3.3 V, +12 V
Card Size	Standard height, half-length PCI Express adapter card size (4.376" x 6.6")
Array Interface to Host	PCI Express Rev 1.0a

Table 3.3 ServeRAID-MR10is Controller Specifications (Cont.)

Specification	ServeRAID-MR10is Controller
Type of Drives Supported	Serial Attached SCSI (SAS) and Serial ATA II (SATA II)
PCI Express Bus Data Transfer Rate	• Up to 2.5 Gbits/s per lane • x8 lane width (with support for downshifting for motherboards with x1 and x4 connections) • Up to 2 Gbytes/s per direction for SAS x8 cards (4 Gbytes/s total)
Serial Port	3-pin RS232-compatible connector (for manufacturing use only)
SAS Controller(s)	One LSISAS1078 Single SAS controller
SAS Bus Speed	3 Gbits/s
SAS Ports	Two SAS connectors with four SAS ports each
Cache Configuration	Integrated 128 Mbyte - 256 Mbyte Double Data Rate II 667 MHz SDRAM intelligent battery backup unit
Size of Flash ROM for Firmware	4 Mbytes
Nonvolatile Random Access Memory (NVRAM)	32 Kbytes for storing RAID configuration

3.3.2 Array Performance Features

Table 3.4 shows the array performance features of the ServeRAID-MR10is controller.

Table 3.4 Array Performance Features

Specification	ServeRAID-MR10is Controller
PCI Express Host Data Transfer Rate	2.5 Gbits/s per lane
Drive Data Transfer Rate	3.0 Gbits/s per lane
Maximum Scatter/Gathers	26 elements
Maximum Size of I/O Requests	6.4 Mbytes in 64 Kbyte stripes
Maximum Queue Tags per Drive	As many as the drive can accept

Table 3.4 Array Performance Features (Cont.)

Specification	ServeRAID-MR10is Controller
Stripe Sizes	8, 16, 32, 64, 128, 256, 512, and 1024 Kbytes
Maximum Number of Concurrent Commands	255
Support for Multiple Initiators	Yes

3.3.3 Fault Tolerance

Table 3.5 shows the fault tolerance features of the ServeRAID-MR10is controller.

Table 3.5 Fault Tolerance Features

Specification	ServeRAID-MR10is Controller
Support for SMART[1]	Yes
Optional Battery Backup for Cache Memory	iBBU battery backup. 4.8V/880mAH battery pack; up to 72 hours of data retention for 512 Mbytes
Drive Failure Detection	Automatic
Drive Rebuild Using Hot Spares	Automatic
Parity Generation and Checking	Yes

1. The Self Monitoring Analysis and Reporting Technology (SMART) detects up to 70 percent of all predictable disk drive failures. In addition, SMART monitors the internal performance of all motors, heads, and drive electronics.

3.3.4 Electrical Characteristics

All power is supplied to the ServeRAID-MR10is controller through the PCI Express 3.3V rails and the 12V rail. Onboard switching regulator circuitry operating from the 3.3V rails and the 12V rail provide the necessary voltages. The following states determine the typical current consumption of the controller:

- State 1: During a hard reset
- State 2: During a disk stress test

- State 3: While sitting idle at the DOS prompt

The supply voltages are 12V ± 8 percent (from PCI edge connector only) and 3.3V ± - 9 percent (from PCI edge connector only). Table 3.6 lists the power supply for the controller for each of the three states at the different voltages.

Table 3.6 Maximum Power Requirements

PCI Edge Connector	State 1	State 2	State 3
3.3V supply	330mA	330mA	330mA
+12V supply	1.00A	1.81A	1.53A
3.3V auxiliary supply	30mA	30mA	30mA

+12V is used in the charging circuitry for the battery pack on the optional iBBU battery-backed daughter card. If the iBBU daughter card is mounted, the following power consumption figures apply:

- During trickle charging of the battery pack: N/A (no trickle charge for Li-ION)
- During fast charging of the battery pack: 230mA in +12V current

3.3.5 Operating and Non-operating Conditions

For the ServeRAID-MR10is controller, the operating (thermal and atmospheric) conditions are:

- Relative humidity range is 5% to 90% noncondensing
- Airflow must be at least 200 linear feet per minute (LFPM) to avoid operating the Intel IOP333 processor above the maximum ambient temperature

The parameters for the non-operating (such as storage and transit) environment for the ServeRAID-MR10is controller are:

- Temperature range: –30° C to +80° C without the battery backup unit
- Temperature range: 0° C to +45° C with the iBBU battery backup

3.3.6 Safety Characteristics

The ServeRAID-MR10is controller meets or exceeds the requirements of UL flammability rating 94 V0. Each bare board is also marked with the supplier name or trademark, type, and UL flammability rating. The board is installed in a PCI Express bus slot, so all voltages are lower than the SELV 42.4 V limit.

3.4 Data Encryption

The ServeRAID-MR10is controller offers data protection using the Data Encryption (DE) feature. This feature protects data from theft and helps meet regulatory compliance. The DE feature allows you to enable or disable security through management of the keys on the controller and physical drives.

Note: For the procedures used to implement the DE feature, refer to the *ServeRAID-MR Software User's Guide*.

3.4.1 Support of Governmental Standards

As it applies to data encryption, the DE feature implements the XTS-AES encryption algorithm, as defined by FIPS 197 and IEEE P1619, to satisfy the Federal Information Processing Standard requirements set forth by the National Institute of Standards and Technology. These standards are used by non-military government agencies and contractors.

3.4.2 Characteristics of Volume Encryption Keys and Security Keys

There are two keys used in Data Encryption, the Security Key and the Volume Encryption Key.

The controller uses the Security Key to lock and unlock access to the secure user data. The Security Key is a key based on a user-provided string. This key is encrypted into the security key blob and stored on the controller.

Attention: If the Security Key is unavailable, your data will be irretrievably lost. You must take all precautions so that you never lose the security key.

The controller uses the Volume Encryption Keys (VEK) to encrypt data when a controller-encrypted virtual disk is created. These keys are not available to the user. The firmware uses a unique 512-bit key for each virtual disk. The VEK for the virtuals disks are stored on the physical drives in a VEK blob.

Note: For more information about Data Encryption terminology, refer to the *ServeRAID-MR Software User's Guide*.

The Volume Encryption Key is used by physical drives in encrypted volumes and has the following characteristics:

- The keys are used to encrypt written data and decrypt read data
- When the Volume Encryption Key is enabled, the controller encrypts written data and decrypts read data
- When the virtual disk is created without a Volume Encryption Key, it behaves like a regular virtual disk
- When the virtual disk is created with a Volume Encryption Key, it is known as a secure drive group

The controller uses the Security Key to lock and unlock access to the secure user data. The Security Key has the following characteristics:

- The Security Key is generated by the user and stored in non-volatile synchronous random access memory (NVSRAM) in the controller
- To use the encryption feature, you have to use the security key; you can have a Security Key and still create or import unsecured virtual disks
- The Volume Encryption Keys of all secure disks connected to a ServeRAID-MR10is controller are protected by the same Security Key
- When the Security Key is enabled, secure disk groups can be created or imported

Other important points to note about Data Encryption are as follows:

- It is not possible to convert an encrypted volume group to a non-encrypted volume group or vice versa
- If you delete a secure virtual disk, the Volume Encryption Key is destroyed, and the data will be undecipherable and irretrievable

3.4.3 Archiving Keys

You can securely archive the Security Keys from the controller(s) to a file in a repository location (typically not in the array) of your choice for storage, backup, and so on. IBM recommends that you archive your Security Keys for any array that is operating with a single controller.

3.4.4 Virtual Disk Migration

Drive migration is the transfer of a set of physical drives in an existing configuration from one controller to another. The drives must remain on the same channel and must be reinstalled in the same order as in the original configuration.

An encrypted volume group can be migrated from one array to another. If a secured configuration is moved to a controller that does not support encryption, the configuration is locked and foreign, and it cannot be imported.

Note: Drive roaming and drive migration cannot be supported at the same time.

To migrate encrypted volume groups, perform the following steps:

Step 1. Generate a Security Key on the destination controller. If a Security Key already exists, this step is not necessary.

Step 2. Move the drives to the destination array.

Step 3. Enter the Security Key string of the migrated drives.

Step 4. Import the configuration.

Note: For the procedures used to import a foreign configuration, refer to the *ServeRAID-MR Software User's Guide*.

3.4.5 Modifying the Keys

You can regenerate the Security Key for an array without making the data inaccessible. Through the Host SW Client, you can perform a password-protected operation to regenerate the Security Key. These operations are an option when you think the security of the array is under threat because the Security Key might have been compromised.

3.4.6 Fault Handling and Recovery

An array that has the DE feature enabled can handle array component failures without experiencing any additional degradation in data availability or data recoverability, compared to an array that does not used the DE feature. This includes but is not limited to failed and offline controllers, failed drives, failed drive trays, pulled cables, and failed firmware downloads.

Chapter 4
Introduction to the Intelligent Backup Battery Unit

IBM® provides the ServeRAID-MR10is intelligent Battery Backup Unit (iBBU) on its high-performance ServeRAID-MR10is SAS/SATA Controller. The iBBU protects the integrity of the cached data on RAID controller by providing backup power if there is a complete AC power failure or a brief power outage. The iBBU provides an inexpensive alternative to using an uninterruptible power supply (UPS).

Writing a block of data to cache memory is much faster than writing it to a storage device. The ServeRAID-MR10is controller then writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it has been written to the storage device.

4.1 Functionality

An *intelligent* BBU has built-in functionality to charge the battery pack automatically and to communicate battery status information such as voltage, temperature, and current, to the host computer system.

The iBBU is compatible with systems that offer auxiliary power. Battery charging and recharging take place automatically. The battery in the iBBU must recharge for at least six hours under normal operating conditions. To protect your data, the firmware changes the Write Policy to *write-through* until the battery unit is sufficiently charged. When the battery unit is charged, the controller firmware changes the Write Policy to *write-back* to take advantage of the performance benefits of data caching.

The iBBU monitors the voltage level of the DRAM modules installed on the ServeRAID-MR10is controller. If the voltage drops below a predefined level, the battery backup module switches the memory power

source from the controller to the iBBU. As long as the voltage level stays below the predefined value, the iBBU provides power for memory. If the voltage level returns to an acceptable level, the iBBU switches the power source back to the controller, and all incomplete writes to storage devices are completed with no data loss.

The maximum ambient temperature for battery packs is 0° C to 45° C.

Note: The temperature of the battery pack is typically 15–20 degrees higher than the ambient temperature during fast charge. For the fast charge circuit to complete a fast charge cycle, ambient temperature should be less than 40° C. If the ambient temperature is greater than 40° C, the fast charge cycle could terminate prematurely.

CAUTION:

The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C007)

Chapter 5
Installing the Intelligent Battery Backup Unit Remotely

This chapter explains how to connect the the intelligent Battery Backup Unit (iBBU) remotely to the ServeRAID-MR10is SAS/SATA Controller.

The ServeRAID-MR10is SAS/SATA Controller comes with the ServeRAID-MR10is iBBU already connected directly to the board. You can remove the iBBU and use a daughtercard and a cable to connect the iBBU remotely to the controller. The daughtercard connects to the controller and then connects to the iBBU using the 12-inch cable. The battery backup unit must be mounted inside the chassis within 10 inches of the controller.

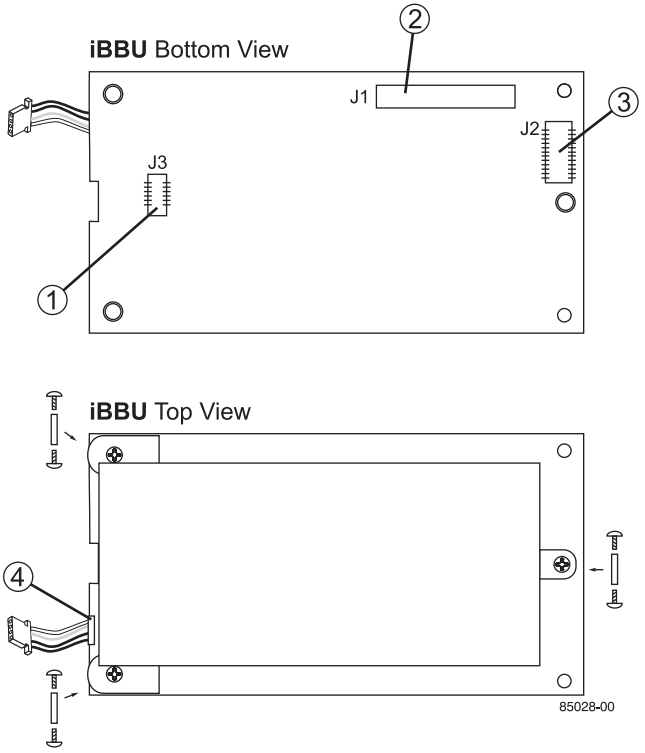
Attention: Electrostatic discharge can damage the iBBU and the controller on which it is installed. Always ground yourself and/or use a ground strap before you touch the controller or the iBBU. Perform all installation work at an ESD safe workstation that meets the requirements of EIA-625—"Requirements for Handling Electrostatic Discharge Sensitive Devices." Follow the ESD recommended practices in the latest revision of IPC-A-610.

5.1 Installing the iBBU on the ServeRAID-MR10is Controller

You can connect the ServeRAID-MR10is iBBU remotely to the ServeRAID-MR10is SAS/SATA Controller using a daughtercard and a cable to connect it to the controller.

Figure 5.1 displays the top view and the bottom view of the card. Note that this unit combines a battery pack with a daughtercard.

Figure 5.1 Intelligent Battery Backup Unit



1 - J3 battery pack harness connector

2 - J1 connector

3 - J2 board-to-board connector

4 - Battery pack harness

CAUTION:

The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C007)

5.2 Connecting the ServeRAID-MR10is iBBU Remotely

This section contains the procedures used to install the ServeRAID-MR10is iBBU for remote connection to the ServeRAID-MR10si controller. You have to perform the following tasks to connect the iBBU remotely to the controller:

- Remove the controller from the computer
- Remove the iBBU from the controller (the iBBU comes installed on the controller)
- Mount the iBBU on the chassis
- Mount the daughtercard on the controller
- Re-install the controller
- Connect the controller to the remote iBBU using the daughtercard and 12-inch cable (the battery backup unit must be mounted inside the chassis within 10 inches of the controller

Note: Because server and workstation chassis vary from vendor to vendor, there is no standard mounting option that is compatible with the various system configurations. Therefore, the ServeRAID-MR10is iBBU battery kit contains only the battery, daughtercard, and cable, allowing VAR's and chassis manufacturers to customize the location of the remote battery to provide the most flexibility within various environments.

Follow these steps to remove the controller from the computer.

Step 1. Shut down the computer, turn off the power, and unplug the power cords.

Step 2. Remove the cover from the computer according to the instructions in the system user's manual to allow access to the controller.

Step 3. Unplug all cables from the controller, remove the screw attaching the bracket to the computer case, and carefully remove the controller from the slot.

Step 4. Place the controller on a flat, clean, static-free surface, and continue with the next procedure.

Follow these steps to remove the iBBU from the controller and mount the iBBU on the chassis.

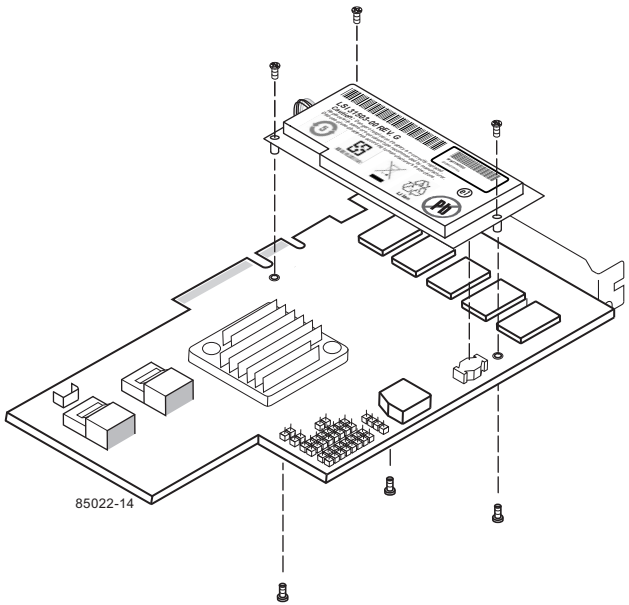
Step 1. With the controller on a flat, clean, static-free surface, unscrew the M2.50-0.45 x 5mm screws and the 6mm standoffs in the three screwholes, as shown in Figure 5.2.

The standoffs are threaded at both ends and a 6mm screw is in each end.

Important:: Center the screwdriver carefully to avoid stripping the screwhead.

Step 2. Carefully remove the J2 connector on the iBBU from the J1 BBU connector on the controller.

Figure 5.2 Removing the iBBU from the ServeRAID-MR10is SAS/SATA Controller



Step 3. Mount the iBBU to the chassis of your computer based on the location and type of mounting option.

Follow these steps to install the daughtercard on the controller, as shown in Figure 5.3.

Step 1. With the controller on a flat, clean, static-free surface, ground yourself, and remove the daughtercard, standoff, and screws from the package.

Step 2. Place the standoff on the controller so that the bottom side is over the screwhole next to the J1 connector on the controller.

Step 3. Use one of the screws to secure the standoff to the controller.

Important: Center the screwdriver carefully to avoid stripping the screwhead. Do not over-tighten the screws.

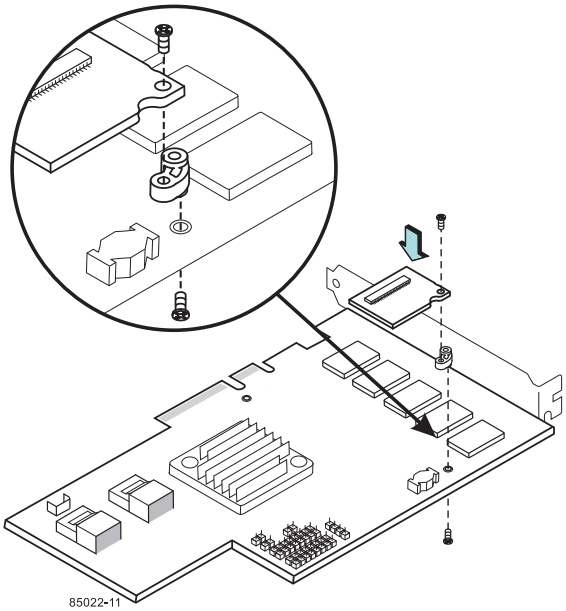
Step 4. Hold the daughtercard so that the J2 board-to-board connector on the daughtercard lines up with the J1 board-to-board connector on the controller.

Step 5. Carefully press the J2 connector on the daughtercard into the J1 connector on the controller so that the two connectors are firmly joined.

The connectors fit only when they are in the correct alignment.

Step 6. Use the other screw to secure the daughtercard to the controller and continue with the next procedure.

Figure 5.3 Connecting the Daughtercard to the ServeRAID-MR10is SAS/SATA Controller



Follow these steps to install the controller in the computer, as shown in Figure 5.4.

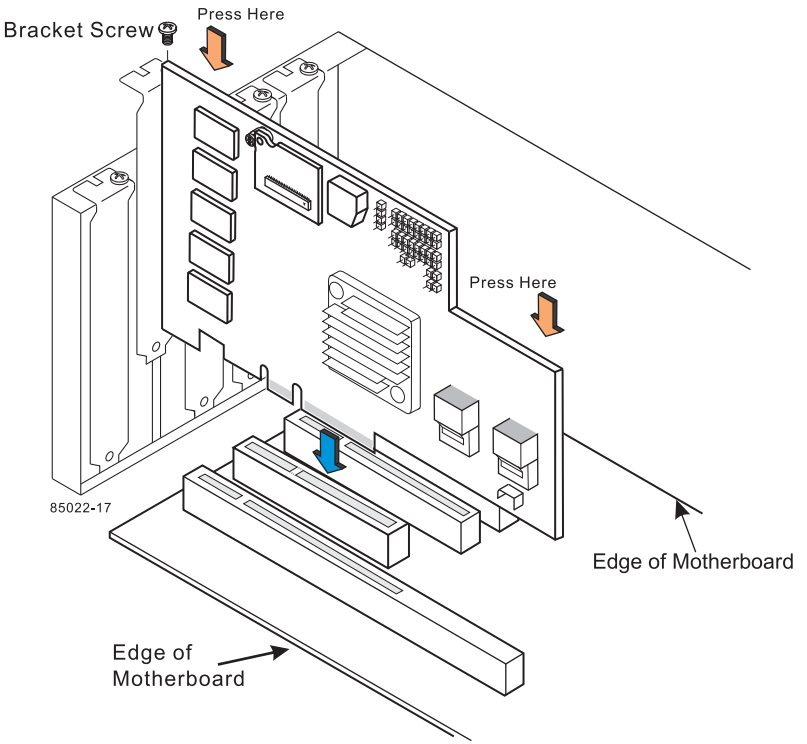
Step 1. Insert the controller in a PCI Express slot on the motherboard.

Step 2. Press down gently but firmly to seat the card correctly in the slot.

Step 3. Secure the controller to the computer chassis with the bracket screw.

Note: Refer to your computer documentation for information about the PCI Express slot.

Figure 5.4 Installing the ServeRAID-MR10is SAS/SATA Controller



Follow these steps to connect the cable between the daughtercard on the controller and the iBBU, as shown in Figure 5.5.

Step 1. Make sure you are grounded and then remove the 12-inch cable from the package.

Step 2. Attach the controller to the computer chassis with the bracket screw.

Step 3. Insert one end of the cable into the 20-pin J1 connector on the iBBU and the other end into the 20-pin J1 connector on the daughtercard.

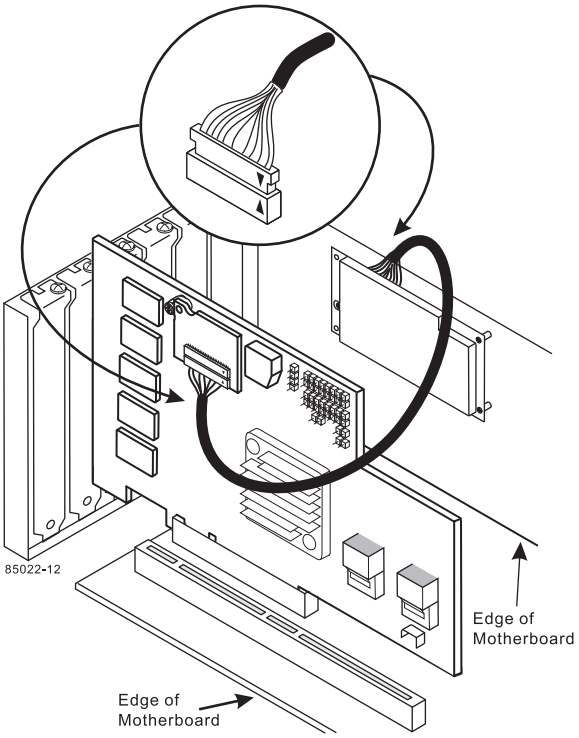
Align the black triangles on the connectors to make sure they are connected properly.

Note: The cable connectors are polarized and can be inserted into the connectors on the daughtercard and the iBBU only if the rails on the cable connectors align with the slots on the other connectors. **Do not** force the cable into the 20-pin connectors. The cable end inserts into the connector with minimal resistance.

Step 4. Attach the cables, as needed, to the connectors on the controller.

Step 5. Replace the computer cover and reattach the power cords. Turn on the power to the computer.

Figure 5.5 Connecting the ServeRAID-MR10is SAS/SATA Controller Remotely to the iBBU



Important: See the *ServeRAID-MR Software User's Guide* for information about running the RAID configuration utility and installing software drivers.

Chapter 6
Using the Intelligent Battery Backup Unit

This chapter explains how to monitor and maintain the intelligent Battery Backup Unit (iBBU) for your ServeRAID-MR10is SAS/SATA Controller. Most of the iBBU functions, such as battery recharging, occur automatically. Click on the following links to view instructions on how to use the iBBU:

You can monitor the battery status (temperature, voltage, and so on) in these MegaRAID® utility programs:

- WebBIOS Configuration Utility
- MegaCLI (Command Line Interface)
- MegaRAID Storage Manager (MSM)

The MegaRAID utilities display a counter showing the number of times the battery pack on the iBBU has been recharged. When you install a new iBBU, the battery recharge cycle counter for the iBBU is automatically set to zero.

Note: For optimal performance, replace the iBBU once a year.

This chapter describes only the iBBU-related features of the MegaRAID utility programs. For complete information on these utilities, see the *ServeRAID-MR Software User’s Guide*, IBM Document Number 46M1381.

6.1 Monitoring the iBBU with the MegaRAID Configuration Utilities

This section describes the MegaRAID utilities that you can use to monitor the condition of the installed iBBU and to change the automatic learn mode options. They include the WebBIOS Configuration Utility, MegaCLI, and MegaRAID Storage Manager.

6.1.1 Monitoring the iBBU with the WebBIOS Configuration Utility

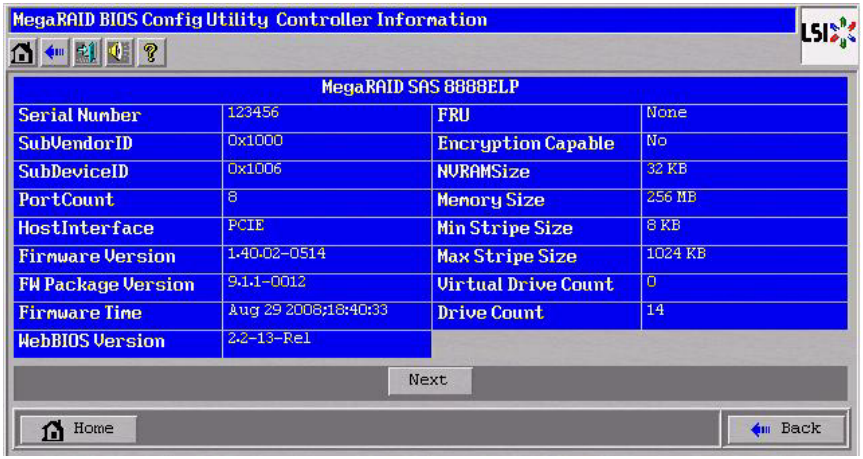
The WebBIOS CU is a web-based utility for configuring and managing RAID volumes. Its operation is independent of the operating system because the utility resides in the MegaRAID BIOS. Follow these steps to monitor the status of an installed iBBU with the WebBIOS utility:

1. Boot the system.
2. Start the WebBIOS CU by pressing CTRL+H when the prompt appears on the screen during boot-up.

   The WebBIOS CU main menu screen appears.
3. Click **Controller Properties** on the WebBIOS CU main menu screen.

   The first **Controller Properties** screen appears, as shown in Figure 6.1.

Figure 6.1 First Controller Properties Screen



4. Click **Next** to view the second Controller Properties screen.

   The second Controller Properties screen appears, as shown in Figure 6.2. The **Battery Backup** field at the top left of the screen indicates whether the iBBU is present.

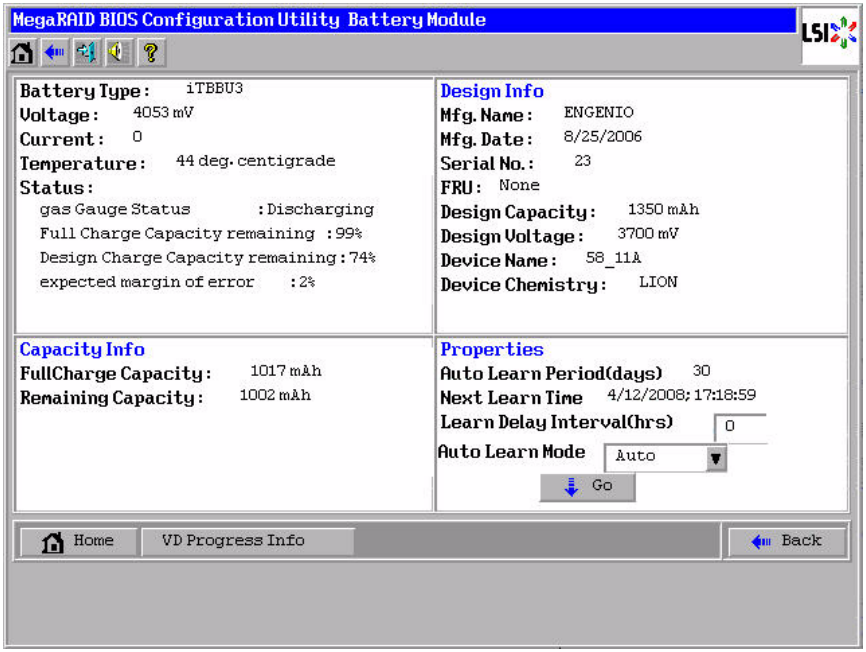
Figure 6.2 Second Controller Properties Screen

5. Click the word **Present** in the **Battery Backup** field.

   The Battery Module screen appears, as shown in Figure 6.3. This screen contains the following information:

   – Battery information
   – Design information
   – Capacity information
   – Auto Learn properties

Figure 6.3 Battery Module Screen



Most of the Battery Module properties are view-only and are self-explanatory.

In the lower right corner of the screen are the Auto Learn options. A *learning cycle* is a battery calibration operation performed by the controller periodically to determine the condition of the battery. You can change the learn delay interval and the auto learn mode.

Note: LSI recommends leaving the the learn delay interval and the auto learn mode at their default settings.

– **Setting the Learn Delay Interval –** The learn delay interval is the length of the interval between automatic learning cycles. Perform the following steps to change the interval:

1. Open the drop-down menu in the **Auto Learn Mode** field.
2. Set the learn mode as `Auto` (the default).
3. Change the number of hours in the **Learn Delay Interval** field.

   You can delay the start of the learn cycles for up to 168 hours (7 days).
4. Click **Go**

– **Setting the Learn Mode –** You can start battery learn cycles manually or automatically. Perform the following steps to choose the learn mode:

1. Open the drop-down menu in the **Auto Learn Mode** field.
2. Set the learn mode as `Auto` (the default) or `Manual`.
3. Click **Go**.

Note: LSI recommends 30 days for the interval between cycles.

Note: When you replace the iBBU, the charge cycle counter is reset automatically.

6.1.2 Monitoring the iBBU with the MegaCLI Utility

You can use the MegaCLI commands in this section to monitor the iBBU and to select the settings for BBU-related options.

6.1.2.1 Display BBU Information

Use the command in Table 6.1 to display complete information about the BBU for the selected controller(s).

Table 6.1 Display BBU Information

Convention	`MegaCli -AdpBbuCmd -aN|-a0,1,2|-aALL`
Description	Displays complete information about the BBU, such as status, capacity information, design information, and properties.

6.1.2.2 Display BBU Status Information

Use the command in Table 6.2 to display complete information about the status of the BBU, such as temperature and voltage, for the selected controller(s).

Table 6.2 Display BBU Status Information

Convention	`MegaCli -AdpBbuCmd -GetBbuStatus -aN|-a0,1,2|-aALL`
Description	Displays complete information about the BBU status, such as the temperature and voltage. The information displays in the following formats: **BBU Status for Adapter: xx** Battery Type: XXXXXX(string) Voltage: xx mV Current: xx mA Temperature: xx C° Firmware Status: xx Battery state: xx **Gas Gauge Status:** Fully Discharged: Yes/No Fully Charged: Yes/No Discharging: Yes/No Initialized: Yes/No Remaining Time Alarm: Yes/No Remaining Capacity Alarm: Yes/No Discharge Terminated: Yes/No Over Temperature: Yes/No Charging Terminated: Yes/No Over Charged: Yes/No Additional status information displays differently for iBBU™ and BBU. **For iBBU:** Relative State of Charge: xx Charger System State: xx Charger System Ctrl: xx Charging Current: xx mA Absolute State of Charge: xx% Max Error: xx% **For BBU:** Relative State of Charge: xx Charger Status: xx Remaining Capacity: xx mAh Full Charge Capacity: mAh isSOHGood: Yes/No

6.1.2.3 Display BBU Capacity

Use the command in Table 6.3 to display the BBU capacity for the selected controller(s).

Table 6.3 Display BBU Capacity Information

Convention	`MegaCli -AdpBbuCmd -GetBbuCapacityInfo -aN|-a0,1,2|-aALL`
Description	Displays BBU capacity information. The information displays in the following format: BBU Capacity Info for Adapter: x Relative State of Charge: xx% Absolute State of Charge: xx% Remaining Capacity: xx mAh Full Charge Capacity: xx mAh Run Time to Empty: xxx Min Average Time to Empty: xxx Min Average Time to Full: xxx Min Cycle Count: xx Max Error: xx%

6.1.2.4 Display BBU Design Parameters

Use the command in Table 6.4 to display BBU design parameters for the selected controller(s).

Table 6.4 Display BBU Design Parameters

Convention	`MegaCli -AdpBbuCmd -GetBbuDesignInfo -aN|-a0,1,2|-aALL`
Description	Displays information about the BBU design parameters. The information displays in the following formats: BBU Design Info for Adapter: x Date of Manufacture: mm/dd, yyyy Design Capacity: xxx mAh Design Voltage: mV Serial Number: 0xhhhh Pack Stat Configuration: 0xhhhh Manufacture Name: XXXXXX(String) Device Name: XXXXXX(String) Device Chemistry: XXXXXX(String)

6.1.2.5 Display Current BBU Properties

Use the command in Table 6.5 to display the current BBU properties for the selected controller(s).

Table 6.5 Display Current BBU Properties

Convention	`MegaCli -AdpBbuCmd -GetBbuProperties -aN|-a0,1,2|-aALL`

Table 6.5 Display Current BBU Properties (Cont.)

Description	Displays current properties of the BBU. The information displays in the following formats: BBU Properties for Adapter: x Auto Learn Period: xxx Sec Next Learn Time: xxxx Sec Learn Delay Interval: xx Hours Auto-Learn Mode: Warn via Event/Disabled/Enabled

6.1.2.6 Start BBU Learning Cycle

Use the command in Table 6.6 to start the BBU learning cycle on the selected controller(s). A learning cycle is a battery calibration operation performed by the controller periodically (approximately every three months) to determine the condition of the battery.

Table 6.6 Start BBU Learning Cycle

Convention	`MegaCli -AdpBbuCmd -BbuLearn -aN|-a0,1,2|-aALL`
Description	Starts the learning cycle on the BBU. No parameter is needed for this option.

6.1.2.7 Place Battery in Low-Power Storage Mode

Use the command in Table 6.7 to place the battery into Low-Power Storage mode on the selected controller(s). This saves battery power consumption.

Table 6.7 Place Battery in Low-Power Storage Mode

Convention	`MegaCli -AdpBbuCmd -BbuMfgSleep -aN|-a0,1,2|-aALL`
Description	Places the battery in Low-Power Storage mode. The battery automatically exits this state after 5 seconds.

6.1.2.8 Set BBU Properties

Use the command in Table 6.8 to set the BBU properties on the selected controller(s) after reading from the file.

Table 6.8 Set BBU Properties

Convention	`MegaCli -AdpBbuCmd -SetBbuProperties -f<fileName> -aN|-a0,1,2|-aALL`

Table 6.8 Set BBU Properties (Cont.)

Description	Sets the BBU properties on the selected controller(s) after reading from the file. The information displays in the following formats: autoLearnPeriod = 1800Sec nextLearnTime = 12345678Sec Seconds past 1/1/2000 learnDelayInterval = 24hours Not greater than 7 days autoLearnMode = 0 0 – Enabled, 1 - Disabled, 2 – WarnViaEvent. 1. NOTE: You can change only two of these parameters, learnDelayInterval and autoLearnMode.

6.1.3 Monitoring the iBBU with the MegaRAID Storage Manager

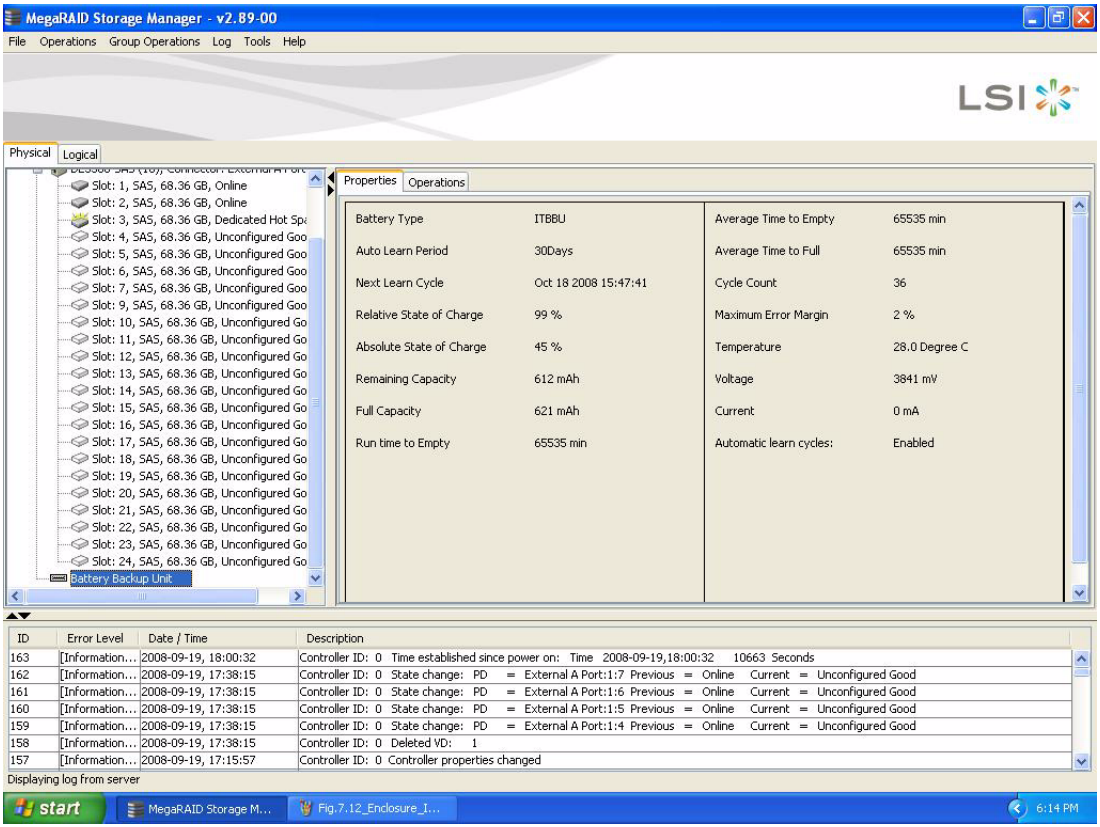
When MegaRAID Storage Manager software is running, you can monitor the status of all of the BBUs connected to controllers in the server. If a BBU is operating normally, the icon looks like this: If it has failed, a red dot appears next to the icon.

To show the properties for a BBU, perform the following steps:

1. Click the **Physical** tab to open the physical view.
2. Select the BBU icon in the left panel.
3. Click the **Properties** tab.

The BBU properties, such as the battery type, temperature, and voltage, appear, as shown in Figure 6.4.

Figure 6.4 Battery Backup Unit Information



The BBU properties include the following:

- The number of times the BBU has been recharged (**Cycle Count**)
- The full capacity of the BBU, plus the percentage of its current state of charge, and the estimated time until it will be depleted
- The current BBU temperature, voltage, current, and remaining capacity
- If the battery is charging, the estimated time until it is fully charged

6.1.3.1 Battery Learn Cycle

Learn Cycle is a battery calibration operation performed by the controller periodically to determine the condition of the battery. You can start battery learn cycles manually or automatically. To choose automatic

battery learn cycles, enable automatic learn cycles. To choose manual battery learn cycles, disable automatic learn cycles.

If you enable automatic learn cyles, you can delay the start of the learn cycles for up to 168 hours (7 days). If you disable automatic learn cycles, you can start the learn cycles manually, and you can choose to receive a reminder to start a manual learn cycle.

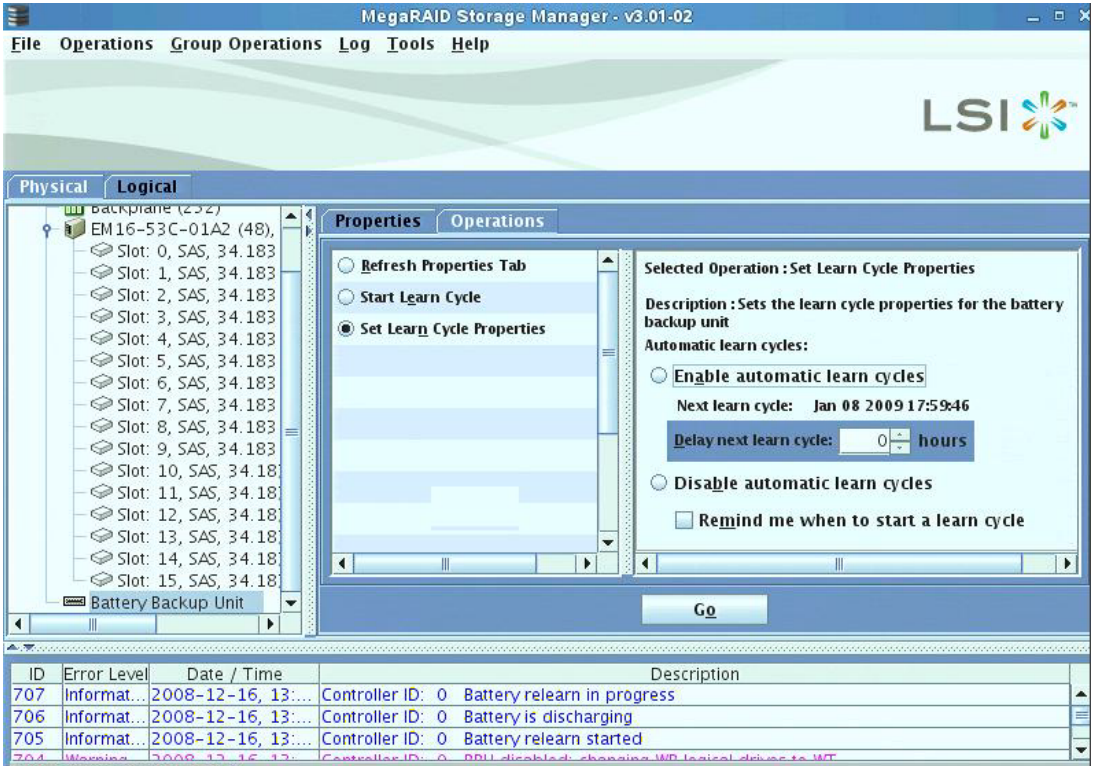
6.1.3.2 Setting Learn Cycle Properties

To set the learn cycle properties, perform the following steps:

1. Click the **Physical** tab to open the physical view.
2. Select the BBU icon in the left panel.
3. Click the **Operations** tab.

The BBU operations appear, as shown in Figure 6.5.

Figure 6.5 Battery Backup Unit Operations



4. Select **Set Learn Cycle Properties**.

   The options appear in the right frame.

5. To enable automatic learn cycles, click **Enable automatic learn cycles** and click **Go**.

   You can delay the start of the next learn cycle by up to 7 days (168 hours) using the **Delay next learn cycle** field.

6. To disable automatic learn cycles, click **Disable automatic learn cycles** and click **Go**.

   You can start the learn cycles manually. In addition, you can check the box next to the field **Remind me when to start a learn cycle** to receive a reminder to start a manual learn cycle.

6.1.3.3 Starting a Learn Cycle Manually

To start the learn cycle properties manually, perform the following steps:

1. Click the **Physical** tab to open the physical view.
2. Select the BBU icon in the left panel.
3. Click the **Operations** tab.

   The BBU operations appear, as shown in Figure 6.5.

4. Click **Start Learn Cycle** and click **Go**.

Another method to use the BBU operations is to right-click the BBU icon to open the operations menu and select **Start Learn Cycle**.

6.2 Replacing the Battery Backup Unit

For optimal performance, replace the iBBU once a year. See the *Warranty and Support Information* document for the replacement battery part number.

When you install a new iBBU, the battery recharge cycle counter for the iBBU is automatically set to zero. For instructions on installing the iBBU, see Section 5.1, “Installing the iBBU on the ServeRAID-MR10is Controller.”

CAUTION:

The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C007)

6.3 Transferring Cached Data from a Failed Controller

If you are using the ServeRAID-MR10is controller with an iBBU, and if the controller fails when there is data in the cache that has not been written to disk, you can save the cached data. To do so, remove the iBBU from the failed controller and install it on a new controller. To save the data, the following conditions must be met:

- The new controller on which you install the iBBU must be the same model as the failed controller
- The replacement controller must have a *cleared configuration*
- The new controller must be connected to the same drives that the failed controller was connected to

Follow these steps to use the iBBU to transfer cached data from a failed controller to a new controller:

Attention: Be sure to ground yourself before you touch the controller and the iBBU.

1. Shut down the computer, turn off the power, and unplug the power cords.
2. Remove the cover from the computer according to the instructions in the system user's manual so you can access the controller.
3. Ground yourself before you touch the controller.
4. Unplug all cables from the controller, remove the screw attaching the bracket to the computer case, and carefully remove the failed storage adapter from the slot.
5. Remove the iBBU from the failed controller.

6. Install the iBBU on the replacement controller.

   Note: See Section 5.1, “Installing the iBBU on the ServeRAID-MR10is Controller” for instructions on how to install an iBBU on your controller and install the controller in a system.

7. Install the replacement controller in the computer and connect it to the drives.
8. Replace the computer cover and reconnect the power cords.
9. Turn on the power to the computer.

The replacement controller will then read the disk configuration into NVRAM and flush the cache data to the logical drives.

6.4 Resolving a Configuration Mismatch

If the replacement controller has a previous configuration, this message displays during the power-on self-test (POST):

```
Unresolved configuration mismatch between disk(s) and NVRAM
on the adapter
```

A configuration mismatch occurs when the configuration data in the NVRAM and the configuration data on the drives are different. To resolve this, you need to update the configuration data in the NVRAM with the data from the hard drive. To do so, follow these steps:

1. Press CTRL+M when prompted during boot-up to access the BIOS CU.
2. Select Configure-> View/Add Configuration.

   This gives you the option to view both the configuration on the NVRAM and the physical drive.
3. Select the configuration on the drive.
4. Press ESC, and select YES to update the NVRAM.
5. Press ESC to exit, and then reboot the computer.

Chapter 7
Intelligent Battery Backup Unit Specifications

This chapter includes technical information and specifications for the intelligent Battery Backup Unit (iBBU). The second section lists information about battery life and data retention time. Click on the following links to access detailed iBBU specifications:

7.1 iBBU Specifications

The following specifications apply to the iBBU:

- **Battery type:** LiON
- **Battery operating ambient temperature:** 10–45° C
- **Humidity (storage and operating):** 20% to 80% non-condensing
- **Battery storage temperature:** Depends on storage time, as follows:

  < 30 days: 0–50° C

  30–90 days: 0–40° C

  > 90 days: 0–30° C

Table 7.1 Specifications

	iBBU
Fast Charge Rate	500 mAH
Battery Pack	4 cells
Mechanical	3.7” x 2.2”
Battery Capacity	880 mAH
Charge Circuitry Card	Yes

Table 7.1 Specifications

	iBBU
Memory Technology	DDR2 SDRAM (1.8V)
Battery Charge Time	~3 hours
Socket Type	N/A
Module Support	DDR2
Cache Memory Size Supported	128 MB - 256 MB
Memory Bus Speed	667 MHz
Memory Bus Width	Maximum 72-bit
Error Correcting Capability (ECC)	N/A

7.2 Battery Life and Data Retention Time

The MegaRAID® utilities display a counter showing the number of times the iBBU has been recharged. When you install a new iBBU, the battery recharge cycle counter for the iBBU is automatically set to zero. For instructions on installing the iBBU, see Section 5.1, “Installing the iBBU on the ServeRAID-MR10is Controller.”

For optimal performance, replace the battery pack on the iBBU once a year. The data retention time shown in Table 7.2 is approximate. They can vary based on a number of factors, including the following:

- Capacity of the battery pack and the battery load
- Ambient temperature
- Age of the battery and number of discharge cycles it has been through
- Number of DIMMs installed and number of chips on the installed DIMMs
- DRAM size

Table 7.2 Reference Data Retention Times

iBBU Name	Data Retention Times
iBBU	- 72 hours for 256 Mbytes, using five 32 Mx16 parts DDR2 (low power) - 72 hours for 256 Mbytes, using three 64 Mx16 parts DDR2 (low power) - 72 hours for 128 Mbytes, using three 32 Mx16 DDR2 (low power)

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Appendix B
Glossary of Terms and Abbreviations

active termination	The electrical connection required at each end of the SCSI bus, composed of active voltage regulation and a set of termination resistors.
array	An array of disk drives combines the storage space on the disk drives into a single segment of storage space. A hot spare drive does not actively participate in an array.
BIOS	Acronym for Basic Input/Output System. Software that provides basic read/write capability. Usually kept as firmware (ROM-based). The system BIOS on the mainboard of a computer boots and controls the system. The BIOS on your host adapter acts as an extension of the system BIOS.
configuration	Refers to the way a computer is set up, the combined hardware components (computer, monitor, keyboard, and peripheral devices) that make up a computer system, or the software settings that allow the hardware components to communicate with each other.
device driver	A program that allows a microprocessor (through the operating system) to direct the operation of a peripheral device.
domain validation	Domain Validation is a software procedure in which a host queries a device to determine its ability to communicate at the negotiated data rate.
EEPROM	Acronym for Electronically Erasable Programmable Read-Only Memory. It is a memory chip that typically stores configuration information, as it provides stable storage for long periods without electricity and can be reprogrammed. Refer to NVRAM.
external SAS device	A SAS device installed outside the computer cabinet. These devices are connected using specific types of shielded cables.
Fusion-MPT architecture	Fusion-MPT (Message Passing Technology) architecture consists of several main elements: Fusion-MPT firmware, the Fibre Channel and SCSI hardware, and the operating system level drivers that support

these architectures. Fusion-MPT architecture offers a single binary, operating system driver that supports both Fibre Channel and SCSI devices.

host The computer system in which a storage adapter is installed. It uses the storage adapter to transfer information to and from devices attached to the SCSI bus.

host adapter board A circuit board or integrated circuit that provides a device connection to the computer system.

hot spare An idle, powered on, standby drive ready for immediate use in case of disk failure. It does not contain any user data. A hot spare can be dedicated to a single redundant array or it can be part of the global hot-spare pool for all arrays managed by the controller.

When a disk fails, the controller firmware automatically replaces and rebuilds the data from the failed drive to the hot spare. Data can be rebuilt only from virtual disks with redundancy (RAID levels 1, 5, 6, 10, 50, and 60; not RAID level 0), and the hot spare must have sufficient capacity.

internal SAS device A SAS device installed inside the computer cabinet. These devices are connected by using a shielded cable.

main memory The part of a computer's memory which is directly accessible by the CPU (usually synonymous with RAM).

NVRAM Acronym for Nonvolatile Random Access Memory. An EEPROM (Electronically Erasable Read-Only Memory chip) that stores configuration information. Refer to EEPROM.

PCI Acronym for Peripheral Component Interconnect. A high-performance, local bus specification that allows the connection of devices directly to computer memory. The PCI Local Bus allows transparent upgrades from 32-bit data path at 33 MHz to 64-bit data path at 33 MHz, and from 32-bit data path at 66 MHz to 64-bit data path at 66 MHz.

PCI Express Acronym for Peripheral Component Interconnect Express. A high-performance, local bus specification that allows the connection of devices directly to computer memory. PCI Express is a two-way, serial connection that transfers data on two pairs of point-to-point data lines. PCI Express goes beyond the PCI specification in that it is intended as

a unifying I/O architecture for various systems: desktops, workstations, mobile, server, communications, and embedded devices.

peripheral devices A piece of hardware (such as a video monitor, disk drive, printer, or CD-ROM) used with a computer and under the control of the computer. SCSI peripherals are controlled through a ServeRAID-MR10is controller (host adapter).

PHY The interface required to transmit and receive data packets transferred across the serial bus. Each PHY can form one side of the physical link in a connection with a PHY on a different SATA device. The physical link contains four wires that form two differential signal pairs. One differential pair transmits signals, while the other differential pair receives signals. Both differential pairs operate simultaneously and allow concurrent data transmission in both the receive and the transmit directions.

RAID Acronym for Redundant Array of Independent Disks (originally Redundant Array of Inexpensive Disks). An array of multiple independent physical drives managed together to yield higher reliability and/or performance exceeding that of a single physical drive. The RAID array appears to the controller as a single storage unit. I/O is expedited because several disks can be accessed simultaneously. Redundant RAID levels (RAID levels 1, 5, 6, 10, 50, and 60) provide data protection.

RAID levels A set of techniques applied to disk groups to deliver higher data availability, and/or performance characteristics to host environments. Each virtual disk must have a RAID level assigned to it.

SAS Acronym for Serial Attached SCSI. A serial, point-to-point, enterprise-level device interface that leverages the proven SCSI protocol set. The SAS interface provides improved performance, simplified cabling, smaller connections, lower pin count, and lower power requirements when compared to parallel SCSI. The SAS controller leverages a common electrical and physical connection interface that is compatible with Serial ATA.

The ServeRAID-MR10is controller supports the SAS protocol as described in the *Serial Attached SCSI Standard*, *version 1.1*. The controller also supports the Serial ATA II (SATA II) protocol defined by the *Serial ATA Specification, Version 1.0a*, and the *Serial ATAII*; *Extension to the Serial ATA Specification, Version 1.1*. SATA II is an extension to SATA 1.0a. The ServeRAID-MR10is controller is a versatile

controller that provides the backbone of both server and high-end workstation environments. Each port on the RAID controller supports SAS devices and/or SATA II devices.

SAS device Any device that conforms to the SAS standard and is attached to the SAS bus by a SAS cable. This includes SAS storage adapters (host adapters) and SAS peripherals.

SATA Acronym for Serial Advanced Technology Attachment. A physical storage interface standard, SATA is a serial link that provides point-to-point connections between devices. The thinner serial cables allow for better airflow within the system and permit smaller chassis designs.

SMP Acronym for Serial Management Protocol. SMP enables communicates topology management information directly with an attached SAS expander device. Each PHY on the controller can function as an SMP initiator.

SSD Acronym for Solid State Devices. A Solid State Device uses solid-state memory to store data. They have no moving parts, and they are faster and more reliable than hard disk drives (HDDs).

SSP Acronym for Serial SCSI Protocol. SSP enables communication with other SAS devices. Each PHY on the SAS controller can function as an SSP initiator or SSP target.

STP Acronym for Serial Tunneling Protocol. STP enables communication with a SATA II device through an attached expander. Each PHY on the SAS controller can function as an STP initiator.

stripe size The total disk space consumed by a stripe not including a parity disk. For example, consider a stripe that contains 64 Kbytes of disk space and has 16 Kbytes of data residing on each disk in the stripe. In this case, the stripe size is 64 Kbytes and the stripe element size is 16 Kbytes. The stripe depth is four (four physical drives in the stripe). You can specify stripe sizes of 8 Kbytes, 16 Kbytes, 32 Kbytes, 64 Kbytes, or 128 Kbytes for each virtual disk. A larger stripe size produces improved read performance, especially if most of the reads are sequential. For mostly random reads, select a smaller stripe size.

striping Disk striping writes data across two or more disks. Each stripe spans two or more disks but consumes only a portion of each disk. Each disk, therefore, may have several stripes. The amount of space consumed by

a stripe is the same on each disk included in the stripe. The portion of a stripe that resides on a single disk is a stripe element. Striping by itself does not provide data redundancy; striping in combination with parity provides data redundancy.


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