IBM ®

USER'S GUIDE

ServeRAID-MR10iI SAS/SATA Controller

April 2008

First Edition (April 2008)

Preface

This book is the primary reference and user's guide for the ServeRAID-MR10il SAS/SATA Controller. It contains installation instructions and specifications for the adapter.

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-MR10il SAS/SATA Controller.

* Anyone installing a ServeRAID-MR10il SAS/SATA Controller in a RAID system.

Organization

This document has the following chapters and appendix:

* Chapter 1, **Overview**, provides a general overview of the ServeRAID-MR10il controller.

* Chapter 2, **ServeRAID-MR10il SAS/SATA Controller Hardware Installation**, describes the procedures for installing the ServeRAID-MR10il controller.

- Chapter 3, **ServeRAID-MR10il SAS/SATA Controller Characteristics**, provides the characteristics and technical specifications for the ServeRAID-MR10il controller.

- 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: 43W7844

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-MR10il controller.

ServeRAID-MR Software User's Guide

*IBM Document Numb*er: 43W7843

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
43W7870	First Edition April 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-MR10il 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)

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-MR10il SAS/SATA Controller with RAID control capabilities. It consists of the following sections:

1.1   Overview

The ServeRAID-MR10il 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-MR10il controller has one LSISAS1078 ROC (RAID-on-chip) processor that controls eight internal SAS/SATA ports through two SAS x8 internal connectors. The controller is available with eight PHYs.

The ServeRAID-MR10il 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 ServeRAID-MR10il controller offers a cost-effective way to implement RAID in a server.

The ServeRAID-MR10il controller is based on the MegaRAID first-to-market SAS IC technology and proven technology. As the second-generation PCI Express controller, the ServeRAID-MR10il 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 drive(s)*.

The ServeRAID-MR10il 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-MR10il controller is a versatile controller that provides the backbone of both server and high-end workstation environments.

Each port on the ServeRAID-MR10il 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

1.2 ServeRAID-MR10il SAS/SATA Controller Description

The ServeRAID-MR10il controller is available with eight PHYs. The controller has one LSISAS1078 ROC (RAID-on-chip) processor that controls eight internal SAS/SATA ports through two SAS x8 internal connectors.

1.2.1 Controller Limitations

The ServeRAID-MR10il 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

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-MR10il controller brings 3.0 GB SAS and 3.0 GB SATA 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-MR10il controller can connect to drives directly. Simplified cabling between devices is an additional benefit.

This controller is based on the LSISAS1078 RAID On-a-Chip (ROC) 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 LSISAS1078 RAID-on-chip (ROC) device provides a 2.5 GB PCI Express host interface, eight 3.0 Gbit/s SAS ports or SATA ports, and a full-featured, hardware-based RAID implementation. The LSISAS1078 ROC device integrates a high-speed DDR/DDR2 SDRAM interface with a hardware RAID assist engine for parity calculations. The LSISAS1078 ROC device provides the maximum benefits of a RAID system and enables you to configure the system to satisfy your system requirements.

The LSISAS1078 ROC device increases system performance and provides fault-tolerant data storage. The LSISAS1078 ROC supports data striping across multiple disks, which reduces disk access time because multiple disks simultaneously read or write data. The LSISAS1078 ROC 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-MR10il 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-MR10il 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-MR10il 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^{2}C 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^{2}C) 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
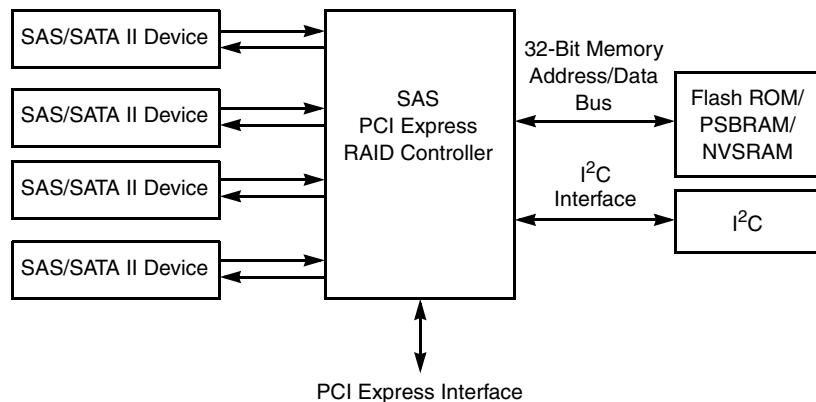
Figure 1.2 shows an example of the ServeRAID-MR10il controller configured with an LSISASx12 expander that is connected to SAS disks, SATA II disks, or both.

Figure 1.2   Example of a ServeRAID-MR10il Controller Configured with an LSISASx12 Expander
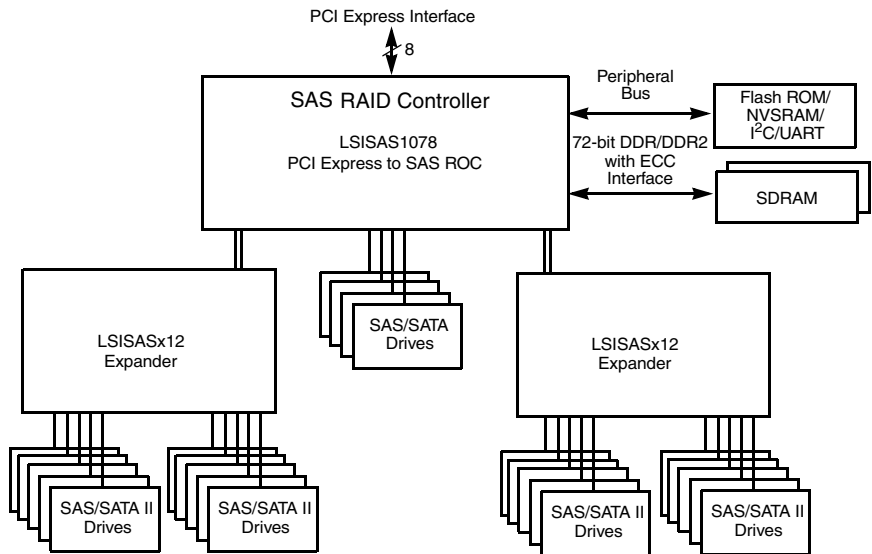
1.4.1   Number of Physical Disks Supported

Your configuration planning for the ServeRAID-MR10il controller depends in part on the number of physical disks 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

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

RAID Level	Minimum # of Physical Drives	Maximum # of Physical Drives
6	3	16
10	4	16
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-MR10il 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-MR10il controllers supports the following operating systems:

- Microsoft® Windows® 2000, Windows Server 2003, Windows XP, and Windows Vista
- Red Hat® Linux™
- SUSE Linux
- Novell® NetWare®
- SCO™ OpenServer®
- SCO UnixWare™
- Solaris

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

The ServeRAID-MR10il controller uses Fusion-MPT™ architecture for all major operating systems, thinner drivers, and better performance.

1.6 Summary of the ServeRAID-MR10il SAS/SATA Controller Characteristics

This section provides a summary of the features and benefits of the ServeRAID-MR10il SAS/SATA controller. It contains information on SAS

features, SATA II features, PCI performance, integration, usability, and flexibility.

The ServeRAID-MR10il controller includes the following features:

- PCI Express x8 lane width, with 8 total channels in two 4-port connectors
- PCI Express performance up to 2.5 GB/s
- Support for 128-Mbyte DDR2 667 MHz on-board SDRAM
- Two 4-port internal connectors supporting 8 total channels
- 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 to check for defects on the physical drives
- No reboot necessary after expansion
- User-specified rebuild rate

1.6.1   SAS Features

The following list describes the SAS features of the ServeRAID-MR10il 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-MR10il controller. These include limitations such as the number of physical disks 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-MR10il Controller Array Limitations

Specification	ServeRAID-MR10il Controller
Maximum virtual disks per controller	64
Maximum arrays per controller	16
Maximum virtual disks per array	16
Maximum drives per array	16
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-MR10il 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.

Though you can have up to 16 virtual disks per array, and up to 16 arrays per ServeRAID-MR10il controller, there is a limit of 64 virtual disks per

controller. Because of this constraint, the 16 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-MR10il 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-MR10il 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 GB/s
  - 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-MR10il 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-MR10il 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

1.7 Hardware Specifications

You can install the ServeRAID-MR10il controller in a computer with a mainboard that has a PCI Express slot. Table 1.3 describes the hardware configuration features for the ServeRAID-MR10il controller.

Table 1.3   ServeRAID-MR10il Controller Specifications

Specification	ServeRAID-MR10il Controller
RAID Levels	0, 1, 5, 6, 10, 50, and 60
Devices Supported per Drive Group	Up to 15 SAS devices or SATA II devices per drive group (such as physical disks and expanders)
Devices Supported per Port	Up to 120 SAS devices or SATA II devices per port (such as physical disks 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 40 virtual disks per controller or per logical array (this value is dependent on the firmware)
Online Capacity Expansion	Yes
Dedicated and Global Hot Spares	Yes
Hot Swap Devices Supported	Yes
Non-Disk Devices Supported	Yes
Mixed Capacity Physical Disks Supported	Yes
Number of Internal Connectors	Two (x4 SAS Port) SFF-8087 Mini SAS 4i connectors
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-MR10iI
SAS/SATA Controller
Hardware Installation

This chapter describes the procedures used to install the ServeRAID-MR10il SAS/SATA Controller. It consists of the following sections:

- Section 2.1, "Requirements"

- Section 2.2, "Quick Installation"

- Section 2.3, "Detailed Installation"

- Section 2.4, "After Installing the ServeRAID-MR10il Controller"

2.1   Requirements

The following items are required for installation:

- A ServeRAID-MR10il 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 disks or SATA II physical disks

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

2.2   Quick Installation

The following steps are for quick ServeRAID-MR10il 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. Install the ServeRAID-MR10il 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 4. Perform a safety check.

   a. Make sure that all cables are properly attached

   b. Make sure that the ServeRAID-MR10il controller is installed correctly

   c. Close the cabinet of the host system

Step 5. Reconnect the power cords to the system and to all of the attached devices.

Step 6. 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-MR10il controller.

Step 1. Unpack the ServeRAID-MR10il Controller

   Unpack and remove the ServeRAID-MR10il controller. Inspect it for damage. If it appears damaged, or if any of the following items are missing, contact your place of purchase. The ServeRAID-MR10il 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-MR10il Controller Connectors

Refer to Chapter 3, "ServeRAID-MR10il SAS/SATA Controller Characteristics" for a diagram of the ServeRAID-MR10il 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.   Install the ServeRAID-MR10il 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-MR10il controller in a PCI Express slot.

Figure 2.1   Installing the ServeRAID-MR10il Controller in a PCI Express Slot
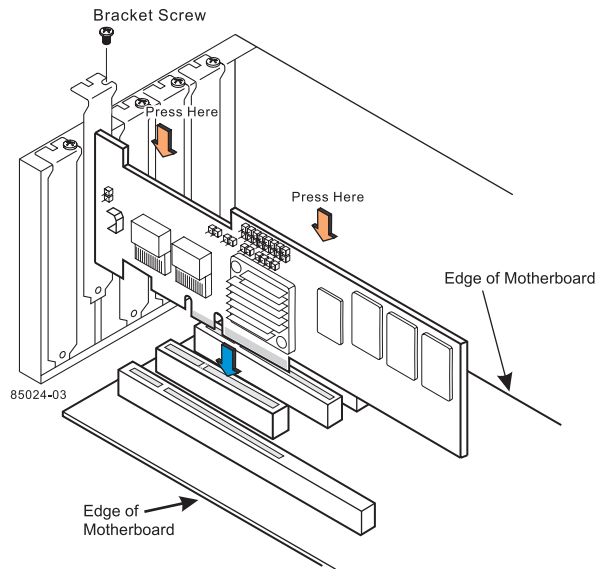
Step 6.   Configure and Install the SAS Devices, the SATA II Devices, or Both, in the Host Computer Case

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

Step 7.   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-MR10il controller.

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 8.   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-MR10il 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 9. 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 10. 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   After Installing the ServeRAID-MR10il Controller

After the ServeRAID-MR10il controller installation, you must configure the ServeRAID-MR10il 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-MR10il controller. The *ServeRAID-MR Device Driver Installation User's Guide* provides detailed installation instructions for operating system drivers.

Chapter 3
ServeRAID-MR10iI
SAS/SATA Controller
Characteristics

This chapter describes the characteristics of the ServeRAID-MR10iI SAS/SATA Controller. It consists of the following sections:

- Section 3.1, "ServeRAID-MR10iI SAS/SATA Controller"
- Section 3.2, "ServeRAID-MR10iI Controller Characteristics"
- Section 3.3, "Technical Specifications"

3.1 ServeRAID-MR10iI SAS/SATA Controller

The ServeRAID-MR10iI 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 controller.

The ServeRAID-MR10iI controller has one LSISAS1078 ROC (RAID-on-chip) 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 controller, which has eight internal SAS/SATA connectors. Figure 3.1 displays the connectors on the controller, while Table 3.1 describes them.

Figure 3.1   Card Layout for the ServeRAID-MR10iI Controller

85020-00
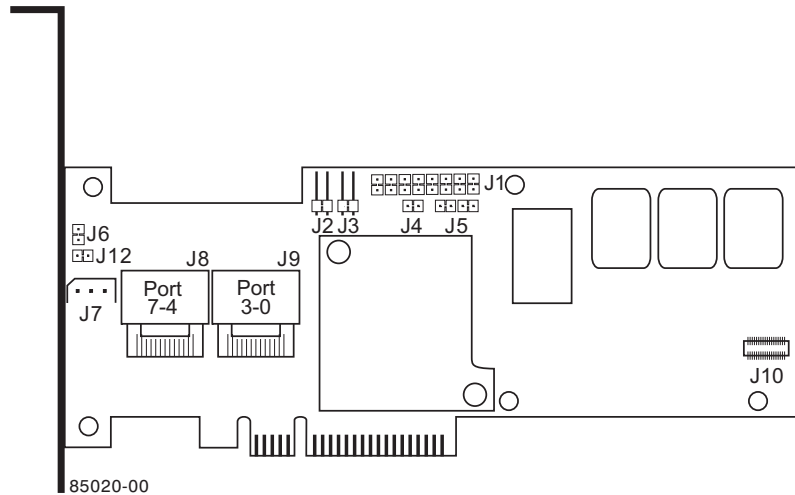
Table 3.1   ServeRAID-MR10iI Controller – Connectors

Connector	Description	Type	Comments
J1	Individual Fault LED header for eight ports	16-pin connector	Indicates physical disk faults. There is one LED per port. When lit, each LED indicates the corresponding physical disk has failed or is in the Unconfigured-Bad state. Refer to the *ServeRAID-MR Software User's Guide* for more information about drive states. Note: The LEDs function in a direct-attach configuration (there are no SAS expanders). Direct attach is defined as a maximum of one physical disk connected directly to each port.
J2	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 disks is pending. Optional.
J3	Combined Activity header	2-pin connector	Provides an LED interface that indicates activity on individual drives attached to the card.

Table 3.1   ServeRAID-MR10il Controller – Connectors (Cont.)

Connector	Description	Type	Comments
J4	Mode Select header	2-pin connector	Reserved for IBM® use.
J5	Universal Asynchronous Receiver/Transmitter (UART) debugging	4-pin connector	Reserved for IBM use.
J6	BRK Debug connector	2-pin header	Reserved for IBM use.
J7	IPMI-style SMBus (System Management)/I²C header	3-pin shielded header	Provides enclosure management support.
J8	x8 SAS Ports 4–7	(x4 SAS Port) SFF-8087 Mini SAS 4i connector	Connect the cables from the RAID controller to SAS physical disks, SATA II physical disks, or a SAS expander.
J9	x4 SAS Ports 0–3	(x4 SAS Port) SFF-8087 Mini SAS 4i connector	Connect the cables from the RAID controller to SAS physical disks, SATA II physical disks, or a SAS expander.
J10	Battery Backup connector	20-pin connector	N/A
J12	Reserved for IBM use.	2-pin connector	Reserved for IBM use.

3.2 ServeRAID-MR10il Controller Characteristics

Table 3.2 shows the general characteristics for the ServeRAID-MR10il controller.

Table 3.2 ServeRAID-MR10il 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-MR10il 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-MR10il 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-MR10il controller is CSA C22.2 No. 60950-1, UL 60950-1 First Edition listed Accessory, UL file number E257743.

3.3.1 Controller Specifications

Table 3.3 lists the specifications for the ServeRAID-MR10il controller.

Table 3.3   ServeRAID-MR10il Controller Specifications

Specification	ServeRAID-MR10il Controller
Processor (PCI Express Host Controller to PCI Secondary I/O Controller)	LSISAS1078 ROC device with Integrated PowerPC processor
Operating Voltage	+3.3 V, +12 V
Card Size	Standard height, half-length PCI Express adapter card size (167.64 mm x 68.91 mm)
Array Interface to Host	PCI Express Rev 1.0a
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 • x4 lane width • 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 LSISAS1068 Single SAS controller
SAS Bus Speed	3 Gbits/s
SAS Ports	Two SAS connectors with four SAS ports each
Cache Configuration	Integrated 128 Mbyte Double Data Rate II 667 MHz SDRAM
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-MR10il controller.

Table 3.4   Array Performance Features

Specification	ServeRAID-MR10il 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
Stripe Sizes	8, 16, 32, 64, or 128 Kbytes
Maximum Number of Concurrent Commands	255
Support for Multiple Initiators	Yes

3.3.3 Fault Tolerance

Table 3.1 shows the fault tolerance features of the ServeRAID-MR10il controller.

Table 3.5   Fault Tolerance Features

Specification	ServeRAID-MR10il Controller
Support for SMART[1]	Yes
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-MR10il 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
3.3V auxiliary supply	30mA	30mA	30mA

3.3.5 Operating and Non-operating Conditions

For the ServeRAID-MR10il controller, the operating (thermal and atmospheric) conditions are:

- Relative humidity range is 20% to 80% 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-MR10il controller are:

- Temperature range: $-30°$ C to $+80°$ C

3.3.6 Safety Characteristics

The ServeRAID-MR10il 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.

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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 controller is installed. It uses the controller 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-MR10il 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 disks managed together to yield higher reliability and/or performance exceeding that of a single physical disk. 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-MR10il 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-MR10il 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 controllers (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.

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 disks 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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