



USER'S GUIDE

ServeRAID M1015 SAS/SATA Controller

September 2010

Second Edition (September 2010)

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Preface

This book is the primary reference and user's guide for the ServeRAID M1015 SAS/SATA controller, and it contains installation instructions and specifications for the adapter.

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

Audience

This document assumes that the reader is familiar 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 M1015 SAS/SATA controller
- Anyone installing a ServeRAID M1015 SAS/SATA controller in a RAID system
- Anyone installing a ServeRAID M1000 Series Advanced Feature Key in a RAID system

Organization

This document has the following chapters and appendices:

- [Chapter 1, Overview](#), provides a general overview of the ServeRAID M1015 SAS/SATA controller.

- [Chapter 2, **ServeRAID Controller Hardware Installation**](#), describes the procedures for installing the ServeRAID M1015 SAS/SATA controller.
- [Chapter 3, **ServeRAID M1015 SAS/SATA Controller Characteristics**](#), provides the characteristics and technical specifications for the ServeRAID M1015 SAS/SATA controller.
- [Appendix A, **Getting Help and Technical Assistance**](#), contains information about help and technical assistance available for IBM hardware and software products. This includes documentation, web sites, and phone support.
- [Appendix B, **Notices**](#), contains information about warranties, trademarks, particulate contamination, and electronic emission notices.
- [Appendix C, **Glossary of Terms and Abbreviations**](#), lists and explains the terms and abbreviations used in this manual.

Related Publications

ServeRAID-M Device Driver Installation User's Guide

IBM Document Number: 46M1382

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

ServeRAID-M Software User's Guide

IBM Document Number: 46M1381

This document explains how to use the MegaRAID Storage Manager, WebBIOS, and Command Line Interface (CLI) utilities to configure, monitor, and maintain the ServeRAID-M controller and the storage-related devices connected to them.

IBM Systems Safety Notices

IBM Document Number: 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 M 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

Edition/Date	Remarks
Second Edition September 2010	Updated the information about the cache policy and the SAS array limitations.
First Edition September 2009	Initial release of document.

IBM Customer Support

Web site: <http://www.ibm.com/systems/support/>

Note: Record your controller serial number in a safe location in case you need to contact IBM.

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 your ServeRAID M1015 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 M1015 SAS/SATA controller, which have RAID control capabilities. It consists of the following sections:

- [Section 1.1, “Overview”](#)
 - [Section 1.2, “ServeRAID M1015 Controller Descriptions and Limitations”](#)
 - [Section 1.3, “General Description”](#)
 - [Section 1.4, “Configuration Scenarios”](#)
 - [Section 1.5, “Benefits of the SAS Interface”](#)
 - [Section 1.6, “Benefits of the ServeRAID M1015 Controller”](#)
 - [Section 1.7, “Hardware Specifications”](#)
 - [Section 1.8, “Technical Support”](#)
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1.1 Overview

The ServeRAID M1015 Serial Attached SCSI (SAS)/Serial ATA II (SATA II) controller is a high-performance intelligent PCI Express-to-SAS/SATA II adapters with RAID control capabilities. This controller provides reliability, high performance, and fault-tolerant disk subsystem management. It is an ideal RAID solution for the storage of workgroup, departmental, and enterprise systems. This controller offers a cost-effective way to implement RAID in a server.

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 ServeRAID M1015 controller is based on the MegaRAID first-to-market SAS IC technology and proven technology. As a second-generation PCI Express controller, it addresses the growing demand for increased data throughput and scalability requirements across midrange and enterprise-class server platforms. IBM offers a family of SAS controller to address the needs for both internal solutions and external solutions.

The controller supports the SAS protocol as described in the *Serial Attached SCSI Standard, version 2.0*. It also supports the Serial ATA II (SATA II) protocol defined by the *Serial ATA Specification, Version 1.0a*, and the *Serial ATA II; Extension to the Serial ATA Specification, Version 1.1*. SATA II is an extension to SATA 1.0a. The ServeRAID M1015 controller is a versatile controller that provides the backbone of both server and high-end workstation environments.

Each port on the 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 M1015 Controller Descriptions and Limitations

The ServeRAID M1015 SAS/SATA controller is a PCI-Express 2.0, half-size, half-height RAID controller based on the LSI SAS2008 PCI Express-

SAS/SATA I/O Processor chip. The ServeRAID M1015 SAS/SATA controller controls eight internal 6-Gb/s SAS/SATA ports through two SFF-8087 x4 internal mini SAS connectors. The controller is available with eight PHYs.

1.2.1 Controller Limitations

The ServeRAID M1015 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 mix 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 SAS drives and Solid State SATA drives in the same virtual disk
- See [Section 3.3.4, “Power Supply Requirements for the ServeRAID M1015 Controller,”](#) for information about the power requirements, and [Section 3.3.5, “Operating and Non-operating Conditions”](#) for information about the minimum and the maximum temperature ranges

1.3 General Description

The ServeRAID M1015 controller brings 6.0 Gb/s Serial Attached SCSI and 3.0 Gb/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. The controller can connect to drives directly. Simplified cabling between devices is an additional benefit.

The controller is based on the LSISAS2008 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 6.0 Gb/s SAS link rates and 3.0 Gb/s SATA II link rates.

The LSISAS2008 ROC device provides an eight-lane, 5-Gb/s PCI Express host interface, eight 6.0 Gb/s SAS or 3.0 Gb/s SATA ports, and a full-featured, hardware-based RAID implementation. The LSISAS2008 ROC device provides the maximum benefits of a RAID system and enables you to configure the system to satisfy your system requirements.

The LSISAS2008 ROC device increases system performance and provides fault-tolerant data storage. The LSISAS2008 supports data striping across multiple disks, which reduces disk access time because multiple disks simultaneously read or write data. The LSISAS2008 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 controller supports the SAS protocol as described in the *Serial Attached SCSI Standard, version 2.0*. In addition, it supports the Serial ATA II (SATA II) protocol defined by the *Serial ATA Specification, Version 1.0a*, and the *Serial ATA II; Extension to the Serial ATA Specification, Version 1.1*. SATA II is an extension to SATA 1.0a. The controller supports the following SATA II features:

- 3 Gb/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 M1015 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 this ServeRAID controller:

- **Low-end, internal SATA II configuration:** In this configuration, use the ServeRAID controller as a high-end SATA II compatible controller that connects to several SATA disks. This configuration is mostly for low-end or entry servers. Enclosure management is provided through out-of-band I²C 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 (I²C) 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

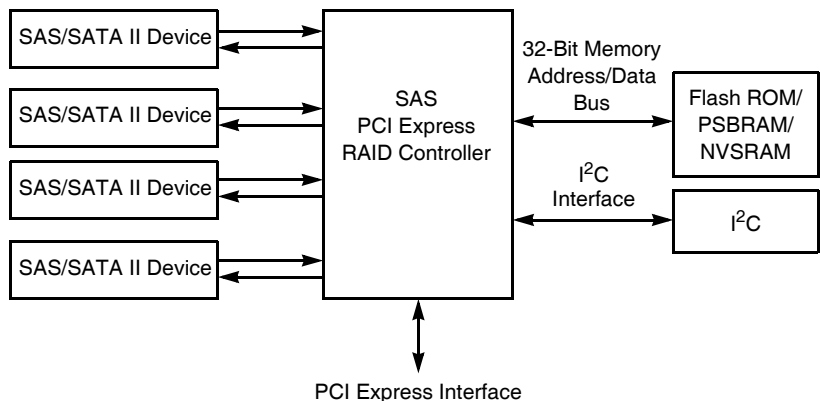
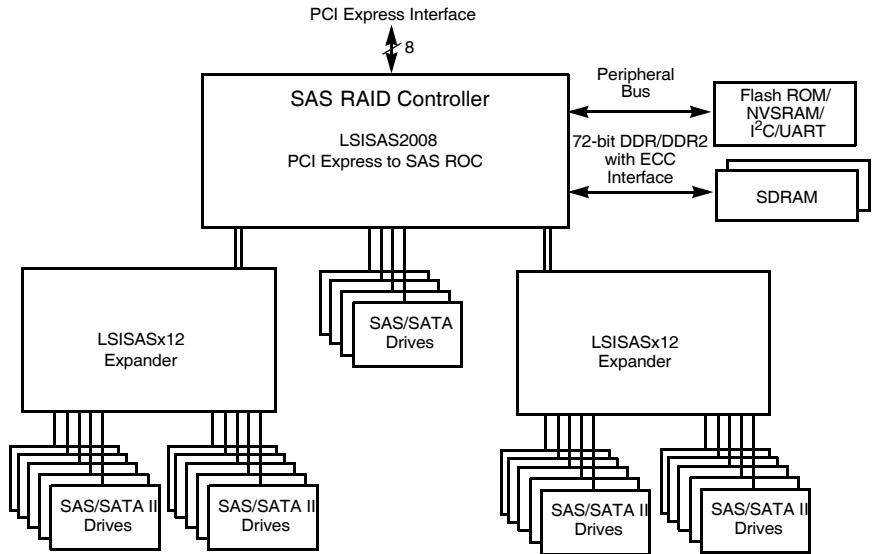


Figure 1.2 shows an example of a ServeRAID controller configured with an LSI SASx12 expander that is connected to SAS disks, SATA II disks, or both.

Figure 1.2 Example of a ServeRAID Controller Configured with an LSI SASx12 Expander



1.4.1 Number of Physical Disks Supported

Your configuration planning for your ServeRAID 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 by this controller. Only one RAID level can be assigned to each virtual disk. [Table 1.1](#) shows the minimum number and the maximum number of drives required for each RAID level.

Table 1.1 Physical Devices Required for Each RAID Level

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

Note: To enable RAID level 5, use the ServeRAID M1000 Series Advanced Feature Key. For more information about the Advanced Feature Key, see the *ServeRAID M1000 Series Advanced Feature Key Quick Install Guide* on the *ServeRAID M Support CD*.

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 ServeRAID M1015 controller leverages a common electrical and physical connection interface that is compatible with Serial ATA technology. 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. 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 your ServeRAID M1015 PCI Express SAS/SATA controller in PCI Express computer systems with a standard bracket type. With this

controller in your system, you can connect SCSI 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

To check for the latest list of supported operating systems and to download the drivers for those operating systems, see <http://www.ibm.com/systems/support/>.

The ServeRAID M1015 controller uses Fusion-MPT™ architecture for all major operating systems, thinner drivers, and better performance.

1.6 Benefits of the ServeRAID M1015 Controller

This section provides a summary of the features and benefits of the ServeRAID M1015 controller. It contains information on SAS features, SATA II features, PCI performance, integration, usability, and flexibility.

The ServeRAID M1015 controller offers the following features:

- PCI Express x8 lane width
- PCI Express performance up to 5 Gb/s per lane
- Two internal connectors
- Support for RAID levels 0, 1, 5, and 10
- 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
- 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 M1015 controller:

- Provides eight fully independent PHYs
- Supports 6.0 Gb/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
- 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 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 ServeRAID M1015 controller.

Table 1.2 ServeRAID M1015 SAS/SATA Controller Array Limitations

Specification	ServeRAID M1015 SAS/SATA Controller
Maximum virtual disks per controller	16
Maximum arrays per controller	16
Maximum virtual disks per array	16
Maximum physical devices per array	16

Table 1.2 ServeRAID M1015 SAS/SATA Controller Array Limitations

Specification	ServeRAID M1015 SAS/SATA Controller
Maximum physical devices per controller	16 Note: Can support up to 64 devices, but only 16 can be used in a RAID configuration.
Maximum hot spares per controller	8
Maximum spans per virtual disk	8
Maximum ports	2

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

The controller supports 64-bit logical block addressing (LBA), which makes it possible to connect a large number of drives to the RAID 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 the 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 disks supported by the controller up to the limit of 16 arrays per controller. In addition, though you can have up to 16 virtual disks per array, and up to 16 arrays per controller, there is a limit of 16 virtual disks per controller.

1.6.3 SATA II Features

The following list describes the SATA II features of the ServeRAID ServeRAID M1015 controller:

- Supports SATA II data transfers of 3.0 Gbs/s
- Supports STP data transfers of 3.0 Gbs/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 M1015 controller:

- Provides a PCI Express interface that:
 - Supports a dedicated PCI Express bus
 - Supports x8 lane configuration
 - Supports transfer rates of up to 5 Gb/s per lane
 - Complies with the *PCI Express Specification, Revision 2.0*
- Provides unequalled 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 M1015 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 I²C interface for enclosure management
- Supports the external SAS Sideband signal SFF-8485 (SGPIO) interface

1.6.6 Flexibility Features

These features increase the flexibility of the ServeRAID M1015 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 connections 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 disks 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 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 the power to the server and all physical disks, 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 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. The controller to which you migrate the drives cannot have an existing 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 drives and the NVRAM.

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

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

Step 3. Open the host system, 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 disks from the first system, and insert them into drive bays on the second system.
- Step 6. Connect the SAS cables to the physical disks 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 RAID 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 your ServeRAID M1015 controller in a computer with a mainboard that has a PCI Express slot. [Table 1.3](#) describes the hardware configuration features of the controller.

Table 1.3 ServeRAID M1015 SAS/SATA Controller Specifications

Specification	ServeRAID M1015 SAS/SATA Controller
RAID Levels	0, 1, 5, and 10
Devices Supported per Port	Up to 8 SAS or SATA II devices (such as drives and expanders)
Ports	Eight internal
Data Transfer Rate	Up to 6 Gb/s per phy

Table 1.3 ServerRAID M1015 SAS/SATA Controller Specifications (Cont.)

Specification	ServerRAID M1015 SAS/SATA Controller
Bus	PCI Express 2.0
Cache Function	No ¹ . See Note following this table.
Multiple Virtual Disks per Controller	Yes. Up to 16 virtual disks per controller.
Multiple Arrays per Controller	Yes. Up to 8 arrays per controller
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 SFF-8087 x4 internal mini SAS connectors
Hardware Exclusive OR (XOR) Assistance	Yes
Direct I/O	Yes
Architecture	Fusion-MPT
<p>¹ The ServerRAID M1015 SAS/SATA controller does not support cache policy, which includes write-back, write-through, adaptive read ahead, non-read ahead, read ahead, cache I/O, and direct I/O.</p>	

Note: The ServerRAID M1015 SAS/SATA controller does not support cache policy, which includes write-back, write-through, adaptive read ahead, non-read ahead, read ahead, cache I/O, and direct I/O.

1.8 Technical Support

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

Chapter 2

ServeRAID Controller Hardware Installation

This chapter describes the procedures used to install the ServeRAID M1015 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, “SAS Device Cables”](#)
 - [Section 2.5, “After Installing the Controller”](#)
-

2.1 Requirements

The following items are required for installation:

- A ServeRAID M1015 SAS/SATA controller
- A host system with an available PCI Express expansion slot
- The *ServeRAID M Support* CD containing the documentation
- The necessary internal cables
- SAS physical disks or SATA II physical disks (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 installation of your controller. 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; then, turn off the power to the server and all of the 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 controller in the server and connect the SAS devices or the 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 controller is installed correctly
 - c. Close the cabinet of the host system
- Step 5. Reconnect the power cords to the system and to all 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 M1015 controller.

- Step 1. Unpack the 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:

- A CD containing 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; then, turn off the power to 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 Controller Connectors

Refer to [Chapter 3, “ServeRAID M1015 SAS/SATA Controller Characteristics”](#) for a diagram of the ServeRAID M1015 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 Controller

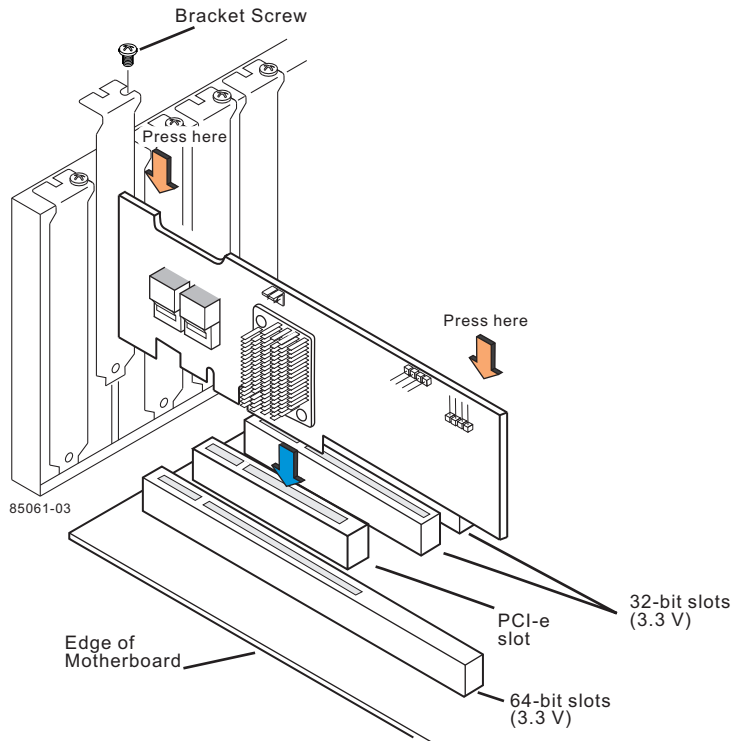
Select a PCI Express slot and align the controller’s PCI Express bus connector to the slot. Press down gently but firmly to ensure that the card is properly seated in the slot. Secure the bracket to the computer chassis.

[Figure 2.1](#) shows the installation of the ServeRAID M1015 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.

Attention: To avoid damage to the computer, always remove the controller from the PCI Express slot before you relocate or ship the computer.

Figure 2.1 ServerRAID M1015 Controller Installation in a PCI Express Slot



Step 6. Configure and Install the SAS Devices, the SATA II Devices, or Both in the Host Computer Case

Configure and install SAS devices, SATA II devices, or both, in the system.

Note: See the documentation for the devices for pre-installation 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 controller. Refer to [Section 2.4, “SAS Device Cables”](#) for SAS cable information. Refer to [Section 2.4.1, “Connecting the ServeRAID M1015 SAS/SATA Controller to Physical Drives,”](#) for details on connecting the controller to the physical disks and the 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 8. Turn on the Power to the System

Reinstall the computer cover and reconnect the AC power cords; then, 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.

For the United Extensible Firmware Interface (UEFI), no BIOS message displays. Press F1 to enter System Setup. Refer to your system user's guide for specific configuration information.

Under other interfaces or operating systems, a BIOS message appears during boot. 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 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. You can find and download the latest drivers

at <http://www.ibm.com/support/>. For updates, click **Downloads and drivers**.

Device driver updates are made available periodically. To ensure that you have the current version of the driver, download the latest driver at <http://www.ibm.com/support/>. See the readme file that accompanies the driver for any updated information.

For details on installing the driver, refer to the *ServeRAID-M Device Driver Installation User's Guide* on the *ServeRAID M 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 the 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

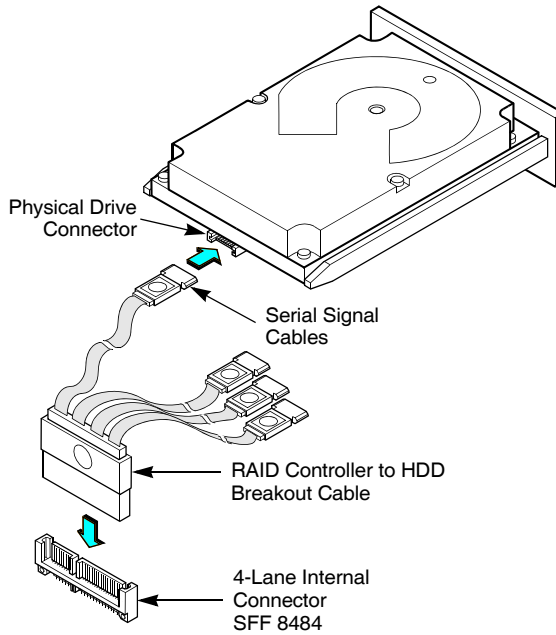


Figure 2.3 displays the SATA II device plug connector used to connect a controller with internal connectors to the host receptacle connector on a backplane. A SATA II connector consists of a signal connector and a power connector.

Figure 2.3 SATA II Connectors

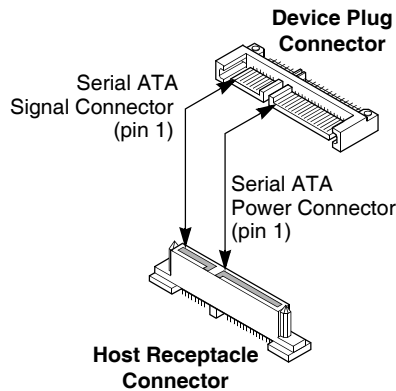
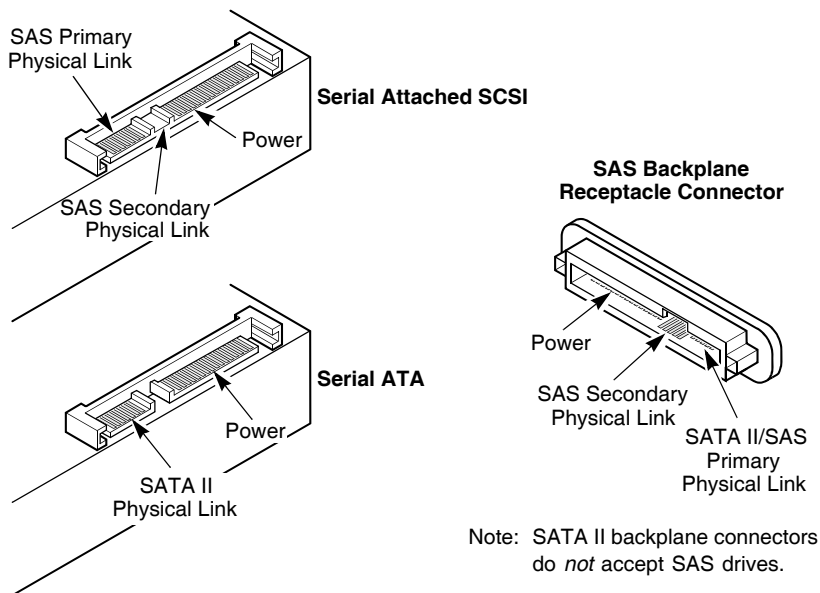


Figure 2.4 shows SAS connectors and SATA II connectors on SAS physical drives and SATA II physical drives, respectively. Cables are used for connection between internal connectors on the controller and connectors on SAS drives and/or SATA II drives, respectively. Both SAS physical drives and SATA II physical drives can connect to SAS backplane receptacle 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



2.4.1 Connecting the ServeRAID M1015 SAS/SATA Controller to Physical Drives

This subsection provides step-by-step instructions for connecting your ServeRAID M1015 controller to the SAS physical drives and the SATA II

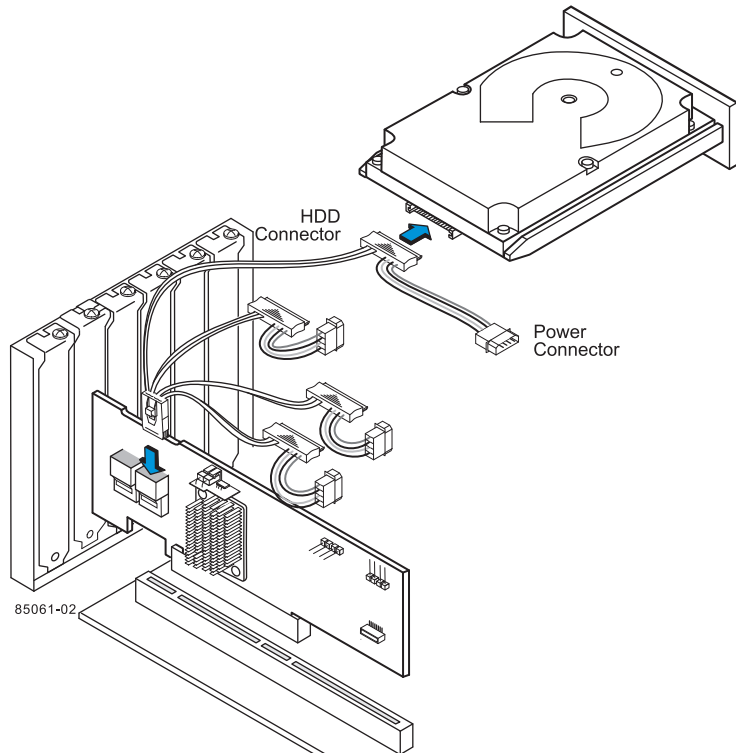
physical drives. [Figure 2.5](#) shows how to connect the internal SAS cable from the controller to the drives.

Follow these steps to connect the 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 ServerRAID M1015 Controller Internal Connectors to a Physical Drive



2.5 After Installing the Controller

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

Chapter 3

ServeRAID M1015

SAS/SATA Controller

Characteristics

This chapter describes the characteristics of the ServeRAID M1015 SAS/SATA controller. It consists of the following sections:

- [Section 3.1, “ServeRAID M1015 SAS/SATA Controller Descriptions”](#)
- [Section 3.2, “Characteristics of the ServeRAID M1015 Controller”](#)
- [Section 3.3, “Technical Specifications”](#)

3.1 ServeRAID M1015 SAS/SATA Controller Descriptions

The ServeRAID M1015 SAS/SATA controller is dual PHY, SAS PCI Express adapters and is used in systems 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 ServeRAID M1015 controller has one LSISAS2008 ROC (RAID-on-chip) processor that controls eight internal SAS/SATA ports through two SFF-8087 x4 internal mini SAS connectors.

3.1.1 Board Layout and Connector Information

This subsection provides the board layout and connector information for the controller. The following subsections provide graphics and connector information for the controller.

The controller has eight internal SAS/SATA connectors. [Figure 3.1](#) displays the connectors on the controller, which are described on [Table 3.1](#).

Figure 3.1 Card Layout for the ServeRAID M1015 RAID Controller

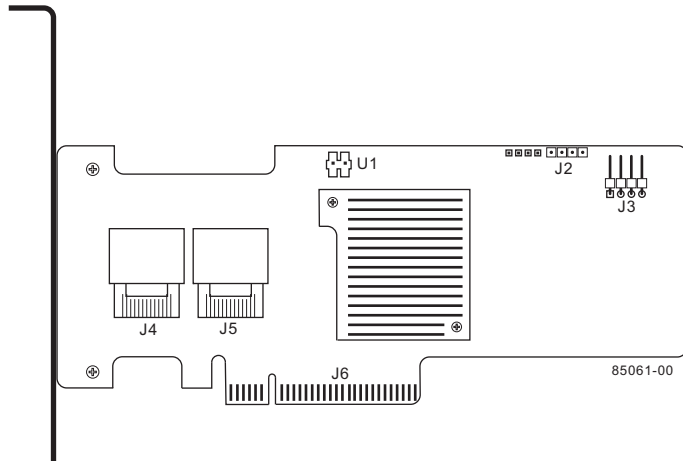


Table 3.1 ServeRAID M1015 Controller Connectors

Connector	Description	Type	Comments
J2	CPLD header	10-pin header	Reserved for IBM use.
J3	External LED drive activity/fault header	4-pin connector	Connects to external, bi-color LEDs that indicates drive activity or faults.
J4	Ports 0–3 internal connector	SFF-8087 x4 internal mini SAS connector	Connects the cables from the controller to SAS drives or SATA II drives, or a SAS expander.
J5	Ports 4–7 internal connector	SFF-8087 x4 internal mini SAS connector	Connects the cables from the controller to SAS drives or SATA II drives, or a SAS expander.
J6	PCI Express x8 board edge connector	Board edge connector	x8 interface that provides connections on both the top and the bottom of the board.
U1	ServeRAID M1000 Series Advanced Feature Key header	2-pin shielded header	Enables support for RAID 5 configurations and self-encrypting disks (SED) when you connect the ServeRAID M1000 Series Advanced Feature Key.

3.2 Characteristics of the ServeRAID M1015 Controller

Table 3.2 shows the general characteristics of the ServeRAID M1015 SAS/SATA controller.

Table 3.2 ServeRAID M1015 SAS/SATA Controller Characteristics

Flash ROM ¹	Serial EEPROM ²	SAS Data Transfers	SCSI Features	SCSI Termination
Yes	Yes	Up to 6 Gb/s per port	Plug and Play Scatter/Gather Activity LED	Active

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

The 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 M1015 SAS/SATA controller minimize 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 controller meets the requirements of CISPR Class B.

The ServeRAID M1015 SAS/SATA 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 M1015 SAS/SATA controller.

Table 3.3 ServeRAID M1015 SAS/SATA Controller Specifications

Specification	ServeRAID M1015 SAS/SATA Controller
Processor (PCI Express Host Controller to PCI Secondary I/O Controller)	LSISAS2008 ROC device with Integrated PowerPC processor
Operating Voltage	+3.3 V, +12 V
Card Size	Low profile PCI Express adapter card size (2.713" x 6.6")
Array Interface to Host	PCI Express Rev 2.0
Type of Drives Supported	Serial Attached SCSI (SAS) and Serial ATA II (SATA II)
PCI Express Bus Data Transfer Rate	<ul style="list-style-type: none">• Up to 5 Gb/s per lane• x8 lane width• Up to 2 Gbytes/s per direction for SAS x4 cards (4 Gbytes/s total)
Serial Port	3-pin RS232-compatible connector (for manufacturing use only)
SAS Controller(s)	One LSISAS 2008 Single SAS controller
SAS Bus Speed	6 Gb/s
SAS Ports	Two SAS connectors with four SAS ports each
Size of Flash ROM for Firmware	8 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 for the ServeRAID M1015 SAS/SATA controller.

Table 3.4 Array Performance Features

Specification	ServeRAID M1015 Controller
PCI Express Host Data Transfer Rate	5 Gb/s per lane
Drive Data Transfer Rate	6.0 Gb/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, or 64 Kbyte
Maximum Number of Concurrent Commands	255

3.3.3 Fault Tolerance

Table 3.5 shows the fault tolerance features of the ServeRAID M1015 SAS/SATA controller.

Table 3.5 Fault Tolerance Features

Specification	ServeRAID M1015 SAS/SATA 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 drive failures. In addition, SMART monitors the internal performance of all motors, heads, and drive electronics.

3.3.4 Power Supply Requirements for the ServeRAID M1015 Controller

All power is supplied to the 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 Power Supply for the ServeRAID M1015 Controller

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

3.3.5 Operating and Non-operating Conditions

The operating (thermal and atmospheric) conditions for the ServeRAID M1015 SAS/SATA controller are:

- Relative humidity range is 20 percent to 80 percent noncondensing
- Airflow must be at least 200 linear feet per minute (LFPM) to avoid operating the Intel IOP333 processor above the maximum ambient temperature
- Temperature range: +10 °C to +60 °C

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

- Relative humidity range is 5 percent to 90 percent noncondensing
- Temperature range: -30 °C to +80 °C

3.3.6 Safety Characteristics

The ServeRAID M1015 SAS/SATA 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.

Appendix A Getting Help and Technical Assistance

If you need help, service, or technical assistance or just want more information about IBM® products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your system, and whom to call for service, if it is necessary.

A.4 Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system. Information about diagnostic tools is in the *Problem Determination and Service Guide* on the IBM Documentation CD that comes with your system.
- Go to the IBM support Web site at <http://www.ibm.com/systems/support/> to check for technical information, hints, tips, and new device drivers or to submit a request for information.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documentation that is provided with your IBM product. The documentation that comes with IBM systems also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with documentation that contains troubleshooting

procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

A.5 Using the documentation

Information about your IBM system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/systems/support/> and follow the instructions. Also, some documents are available through the IBM Publications Center at <http://www.ibm.com/shop/publications/order/>.

A.6 Getting help and information from the World Wide Web

On the World Wide Web, the IBM Web site has up-to-date information about IBM systems, optional devices, services, and support. The address for IBM System x™ and xSeries® information is <http://www.ibm.com/systems/x/>. The address for IBM BladeCenter® information is <http://www.ibm.com/systems/bladecenter/>. The address for IBM IntelliStation® information is <http://www.ibm.com/intellistation/>.

You can find service information for IBM systems and optional devices at <http://www.ibm.com/systems/support/>.

A.7 Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with System x and xSeries servers, BladeCenter products, IntelliStation workstations, and

appliances. For information about which products are supported by Support Line in your country or region, see <http://www.ibm.com/services/sl/products/>.

For more information about Support Line and other IBM services, see <http://www.ibm.com/services/>, or see <http://www.ibm.com/planetwide/> for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

A.8 Hardware service and support

You can receive hardware service through your IBM reseller or IBM Services. To locate a reseller authorized by IBM to provide warranty service, go to <http://www.ibm.com/partnerworld/> and click **Find a Business Partner** on the right side of the page. For IBM support telephone numbers, see <http://www.ibm.com/planetwide/>. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

A.9 IBM Taiwan product service

台灣 IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路 7 號 3 樓
電話：0800-016-888

IBM Taiwan product service contact information:

IBM Taiwan Corporation
3F, No 7, Song Ren Rd.
Taipei, Taiwan

Telephone: 0800-016-888

Appendix B Notices

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B.2 Important Notes

Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

Maximum memory might require replacement of the standard memory with an optional memory module.

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Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

B.3 Particulate Contamination

Attention: Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the device that is described in this document. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the device to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If IBM determines that the levels of particulates or gases in your environment have caused damage to the device, IBM may condition provision of repair or replacement of devices or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table B.1 Limits for Particulates and Gases

Contaminant	Limits
Particulate	<ul style="list-style-type: none"> •The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2¹. •Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. •The deliquescent relative humidity of the particulate contamination must be more than 60%². •The room must be free of conductive contamination such as zinc whiskers.
Gaseous	<ul style="list-style-type: none"> •Copper: Class G1 as per ANSI/ISA 71.04-1985³ •Silver: Corrosion rate of less than 300 Å in 30 days
<p>1 ASHRAE 52.2-2008 - <i>Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size</i>. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.</p> <p>2 The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.</p> <p>3 ANSI/ISA-71.04-1985. <i>Environmental conditions for process measurement and control systems: Airborne contaminants</i>. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.</p>	

B.4 Electronic emission notices

B.4.1 Federal Communications Commission (FCC) statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended

cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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

B.4.2 Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

B.4.3 Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

B.4.4 Australia and New Zealand Class A statement

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

B.4.5 United Kingdom Telecommunications safety requirement

Notice to Customers –

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

B.4.6 European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

European Community contact:

IBM Technical Regulations

Pascalstr. 100, Stuttgart, Germany 70569

Telephone: 0049 (0)711 785 1176

Fax: 0049 (0)711 785 1283

E-mail: tjahn@de.ibm.com

B.4.7 Taiwanese Class A warning statement

警告使用者：
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

B.4.8 Germany Electromagnetic Compatibility Directive

Deutschsprachiger EU Hinweis: –

Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit –

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung der IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung der IBM gesteckt/eingebaut werden.

EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden: "Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen."

Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten –

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2004/108/EG in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC EG Richtlinie 2004/108/EG) für Geräte der Klasse A –

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen. Verantwortlich für die Konformitätserklärung des EMVG ist die IBM Deutschland GmbH, 70548 Stuttgart.

Generelle Informationen: –

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

B.4.9 People's Republic of China Class A warning statement

声 明
此为 A 级产品。在生活环境中，
该产品可能会造成无线电干扰。
在这种情况下，可能需要用户对其
干扰采取切实可行的措施。

B.4.10 Japanese Voluntary Control Council for Interference (VCCI) statement

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

B.4.11 Korean Class A warning statement

이 기기는 업무용으로 전자파 적합등록을 받은 기기 이오니, 판매자 또는 사용자는 이점을 주의하시기 바라며, 만약 잘못 구입하셨을 때에는 구입한 곳에서 비업무용으로 교환하시기 바랍니다.

Appendix C

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 drives combines the storage space on the 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 Electrically 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	<p>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.</p> <p>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, and 10; not RAID level 0), and the hot spare must have sufficient capacity.</p>
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 (Electrically 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, drive, printer, or CD-ROM) used with a computer and under the control of the computer. SCSI peripherals are controlled through a ServeRAID SAS/SATA 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, and 10) 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 SAS/SATA controller supports the SAS protocol as described in the *Serial Attached SCSI Standard, version 2.0*. 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 M1015 SAS/SATA 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 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 disks in the stripe). You can specify stripe sizes of 8 Kbytes, 16 Kbytes, 32 Kbytes, or 64 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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