LSI MegaRAID SAS 8704ELP RAID Controller Card LSIiBBU05 Battery Backup Unit

User Guide

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Text Conventions

This guide uses the following text conventions.

Warnings, cautions, and notes have the following meanings:

Warning

Warnings alert you to situations that could result in serious personal injury or loss of life.

Caution

Cautions indicate situations that can damage the system hardware or software.

***Notes**: give important information about the material being described.*

- Names of keyboard keys are printed as they appear on the keyboard. For example, **Ctrl**, **Alt**, or **Enter**.
- Text or keystrokes that you enter appear as boldface type. For example, type **abc123** and press **ENTER**.
- File names are printed in upper case letters. For example, AUTOEXEC.BAT.

Safety Notices

⚠ Caution

To reduce the risk of electric shock which could cause personal injury, follow all the safety notices.

Symbols are shown in your documentation and on your equipment to indicate safety hazards.

Regulatory Information

European Notice

Products with the CE marking comply with both the Electromagnetic Compatibility Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) - modified by the Directive 93/68/EEC - issued by the Commission of the European Community.

Compliance with these directives implies conformity to the following European Standards:

- EN55022: Radio Frequency Interference
- EN55024 (1998+A1:2001): Immunity characteristics
- EN6100-3-2: Limits for harmonic current emissions
- EN6100-3-3: Limitation of voltage fluctuation and flicker in low-voltage supply system
- EN60950-1 (2001): Product Safety

⚠ Warning

This is a Class A product. In domestic environment this product may cause radio interference in which case the user may be required to take adequate measures (EN55022).

If your system includes a telecommunication network board, the input/output socket is classified as Telecommunication Network Voltage (TNV-3).

USA and Canada Notice

Products with UL marking comply with the following UL standards:

- UL 1950 (3rd edition 1998)

Products with FCC marking comply with the following FCC standards

- FCC part 15

The model type/ref. used for UL and FCC certification can be found on the regulatory labels stuck on your system.

The equipment has been tested and found to comply with the limits for a Class A or B 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.

Modifications to the Product

CE and FCC Marking

We cannot be held responsible for modifications made by the User and the consequences thereof, which may alter the conformity of the product with the CE or FCC Marking.

Connections and Remote Earths

PELV (Protected Extra Low Voltage)

To ensure the extra-low voltage integrity of the equipment, only connect equipment with mains-protected electrically-compatible circuits to the external ports.

SELV (Safety Extra Low Voltage)

Every input and output of this product is classified as Safety Extra Low Voltage.

Remote Earths

To prevent electrical shock, connect all local (individual office) systems and system support equipment to the same electrical circuit of the building wiring. If you are unsure, check the building wiring to avoid remote earth conditions.

Building Supply

Only connect the equipment to a building supply that is in accordance with current wiring regulations in your country. In the U.K., those are the IEE regulations.

Power Supply and Cables

Power Supply

- The DC push-button on/off switch on the front panel does not turn off the system AC power. +5vdc is present on the system board whenever the AC power cords are connected between the system and an AC outlet. Before doing the procedures in this manual, make sure that your system is powered off and unplug the AC power cords from the back of the chassis. Failure to disconnect power before opening your system can result in personal injury and equipment damage.
- Under no circumstances should the user attempt to disassemble the power supply. The power supply has no user-replaceable parts. Inside the power supply are hazardous voltages that can cause serious personal injury. A defective power supply must be returned to your dealer.

Cables

- In the U.S.A. and Canada, the power cord must be a UL-listed detachable power cord (in Canada, CSA-certified), type ST or SJT, 16 AWG, 3-conductor, provided with a moulded-on NEMA type 5-15 P plug cap at one end and a moulded-on cord connector body at the other end. The cord length must not exceed 9 feet (2.7 meters).
- Outside the U.S.A. and Canada, the plug must be rated for 250 VAC, 10 amp minimum, and must display an international agency approval marking. The cord must be suitable for use in the end-user country. Consult your dealer or the local electrical authorities if you are unsure of the type of power cord to use in your country. The voltage change occurs via a switch in the power supply.
- The detachable power supply cords are intended to serve as the disconnect devices.
- For PLUGGABLE EQUIPMENT, the socket-outlet shall be installed near the equipment and shall be easily accessible.
- This equipment has a 3-wire, grounded power cords. To prevent electrical hazards, do not remove or defeat the ground prong on the power cords. Replace a power cord if it gets damaged. Contact your dealer for an exact replacement.

Batteries

Lithium batteries can be dangerous. Improper handling of lithium batteries may result in an explosion. Dispose of lithium batteries as required by local ordinance. Also *see “Product Disposal” on page 10*

Chassis Cover Removal and Replacement

When servicing your system, make sure to replace the chassis cover and secure it with the screws before plugging in the power cable and turning it on. The chassis cover ensures proper airflow and cooling.

Laser Compliance Statement

The optical devices are tested and certified to be compliant with International Electro-technical Commission IEC60825-1 and European EN60825-1 standards for Class 1 laser products.

Class 1 laser products are not considered hazardous. The optical devices are designed such that there is never human access to laser radiation above a Class 1 level during normal operation or prescribed maintenance conditions.

The optical devices installed in your system are designed for use solely as a component of such electronic product and therefore do not comply with the appropriate requirements of Code of Federal Regulation Sec. 1040.10 and Sec. 1040.11 for **COMPLETE** laser products

Warning - Hazardous Voltage!

Hazardous voltage is present inside your system when it is connected to an AC supply even when the system's power switch is off. Exposure to Hazardous Voltage could cause personal injury. To reduce the risk of electric shock which could cause personal injury, follow all safety notices. The symbols shown are used in your documentation and on your equipment to indicate safety hazards.

Warning -Avoid Electrostatic Discharge!

Circuit cards and integrated circuits can be easily damaged by static electricity. To reduce risk of damage, store them in protective packaging whenever they are not installed in your system.

Before you install or remove memory modules, video memory, disk drives, circuit cards or other devices, protect them from static electricity. To do so, make sure your system's power switch is **OFF**. Then, unplug the system's AC power cord(s). Wear an anti-static wrist strap (available at electronic supplies stores) to handle the device you want to install. Be sure to connect the wrist strap to an unpainted metal portion of the system chassis.

As an alternative, you can dissipate electrostatic buildup by touching an unpainted metal portion of the system chassis with one hand. Handle the device you are installing with the other hand, and maintain continuous contact with the unpainted portion of the chassis until it is installed in the system.

Product Disposal

The Waste Electrical and Electronic Equipment (WEEE) Directive requires that used electrical and electronic products must be disposed of separately from normal household waste in order to promote reuse, recycling and other forms of recovery and to reduce the quantity of waste to be eliminated with a view to reducing landfill. WEEE includes accessories such as keyboard, mouse, remote control, speakers, etc. When you dispose of such products, please follow the agreement made between you and us and/or your distributor.

Overview

This chapter provides a general overview of the MegaRAID SAS 8704ELP controller with RAID control capabilities.

The MegaRAID SAS RAID controllers are high-performance intelligent PCI Express-to-SCSI/Serial ATA II adapters with RAID control capabilities. MegaRAID SAS RAID controllers provide reliability, high performance, and fault-tolerant disk subsystem management. They are an ideal RAID solution for the internal storage of workgroup, departmental, and enterprise systems. MegaRAID SAS RAID controllers offer a cost-effective way to implement RAID in a server.

SAS technology brings a wealth of options and flexibility with the use of SAS and Serial ATA (SATA) II devices within the same storage infrastructure. However, SAS 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, within the same enclosure, and in the same virtual disk.

> ***Note**: We recommend that you carefully assess any decision to mix SAS and SATA drives within the same virtual disk(s). Though it can be done, we strongly discourage the practice.*

The MegaRAID SAS RAID controllers are based on the LSI Logic first-to-market SAS IC technology and proven MegaRAID technology. As second-generation PCI Express RAID controllers, the MegaRAID SAS RAID controllers address the growing demand for increased data throughput and scalability requirements across midrange and enterprise-class server platforms. LSI Logic offers a family of MegaRAID SAS RAID controllers addressing the needs for both internal and external solutions.

The LSI Logic intelligent Battery Backup Unit 05 provides cached data protection and allow system builders to protect cached data even during the most catastrophic system failures. Refer to the MegaRAID Battery Backup Unit User's Guide on the ExpressBuilder disc for more information about these batteries.

The SAS controllers support the ANSI Serial Attached SCSI standard, version 1.1. In addition, the controller supports the SATA II protocol defined by the Serial ATA specification, version 1.0a. Supporting both the SAS and SATA II interfaces, the SAS controller is a versatile controller that provides the backbone of both server and high-end workstation environments.

Each port on the SAS RAID controller supports SAS 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.

SAS Controller Description

The MegaRAID SAS 8704ELP PCI Express 1078-based Low-Profile Serial-Attached SCSI/SATA II Disk Array Controller controls four internal SAS/SATA ports through one Mini SAS 4i internal connector

General Description

The MegaRAID 1078-based SAS RAID controllers bring 3.0 Gbit/s Serial Attached SCSI and 3.0 Gbit/s SATA II performance to host adapter, workstation, and server designs. The controllers support internal and external storage devices, which allows you to use a system that supports enterprise-class SAS and desktop-class SATA II drives. Each MegaRAID 1078-based SAS RAID controller can connect to drives directly and can use expanders to connect to additional drives. Simplified cabling between devices is an additional benefit.

These SAS controllers are based on the LSISAS1078 RAID On-a-Chip (ROC) device that is compliant with the Fusion-MPT™ architecture, and provides a PCI Express x4 or x8 interface.

> ***Note**: The MegaRAID SAS 8704ELP RAID controller provides a x4 PCI Express interface.*

LSISAS1078 Features:

- Provides an eight lane, 2.5 Gbit/s PCI Express host-interface, eight 3.0 Gbit/s SAS/SATA ports, and a full-featured, hardware-based RAID implementation.
- Integrates a high speed DDR/DDR2 SDRAM interface with a hardware RAID assist engine for parity calculations.
- Provides the maximum benefits of a RAID system, and enables you to configure the system to satisfy your system requirements.
- Increases system performance and provides fault tolerant data storage.
- Supports data striping across multiple disks, which reduces disk access time since multiple disks simultaneously read or write data.
- Backs up data with either data mirroring or a parity block. Either back up method enables the user 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.
- Supports the PCI Express Specification, Revision 1.0a. The PCI Express software is backward compatible with previous revisions of the PCI bus and PCI-X bus.
- The SAS RAID controllers integrate 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.

- Supports the SAS protocol as described in the Serial Attached SCSI Standard, version 1.1.
- 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 SAS RAID controllers support 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 SAS controllers supports SAS and/or SATA II devices using the SSP (Serial SCSI Protocol), SMP (Serial Management Protocol), STP (Serial Tunneling Protocol), and SATA II. The SSP enables communication with other SAS devices. SATA II enables the SAS controllers to communicate with other SATA II devices.

Supported RAID Levels

The controller supports disk arrays using the following RAID levels:

- RAID 0 (data striping): Data is striped across all disks in the array, enabling very fast data throughput. There is no data redundancy. All data is lost if any disk fails.
- RAID 1 (disk mirroring): Data is written simultaneously to two disks, providing complete data redundancy if one disk fails. The maximum array capacity is equal to the available size of the smaller of the two hard drives.
- RAID 5 (disk striping with distributed parity): Data is striped across all disks in the array. Part of the capacity of each disk stores parity information that reconstructs data if a disk fails. RAID 5 provides good data throughput for applications with high read request rates.
- RAID 6 (disk striping with distributed parity across two disks): Data is striped across all disks in the array and two parity disks are used to provide protection against the failure of up to two physical disks. In each row of data blocks, two sets of parity data are stored.
- RAID 10 (RAID 1 and RAID 0 in spanned arrays): RAID 10 uses mirrored pairs of disks to provide complete data redundancy. RAID 10 provides high data throughput rates.
- RAID 50 (RAID 5 and RAID 0 in spanned arrays): RAID 50 uses both parity and disk striping across multiple disks to provide complete data redundancy. RAID 50 provides high data throughput rates.

- RAID 60 (RAID 6 and RAID 0 in spanned arrays): RAID 60 uses both distributed parity across two parity disks and disk striping across multiple disks to provide complete data redundancy. RAID 60 provides high fault tolerance.

Configuration Scenarios

There are three main scenarios in which you can use the SAS RAID controllers:

- Low-end, internal SATA II configurations: as a high-end SATA II compatible controller that connects up to four disks either directly or through a port expander. Enclosure management through out-of-band I^2C bus. Mostly for low-end/entry servers. Side bands of both types of internal SAS connectors support the SFF-8485 (SGPIO) interface.
- Midrange internal SAS configurations: like internal SATA II configurations, but with high-end disks. More suitable for low- to mid-range servers.
- High-end external SAS/SATA II configurations: both internal and external connectivity. Disks can be either SATA II, SAS or a combination of both. External enclosure management through in-band, SCSI-enclosed storage. STP and SMP need to be supported.

Figure 1 shows a direct-connect configuration. The Inter-IC (I^2C) interface communicates with peripherals. The external memory bus provides a 32-bit memory bus, parity checking, and chip select signals for pipelined synchronous burst static random access memory (PSBRAM), nonvolatile static random access memory (NVSRAM), and Flash ROM.

***Note**: The external memory bus is 32-bit for the SAS 8704ELP.*

Figure 1: Example of LSI Logic SAS Direct-Connect Application

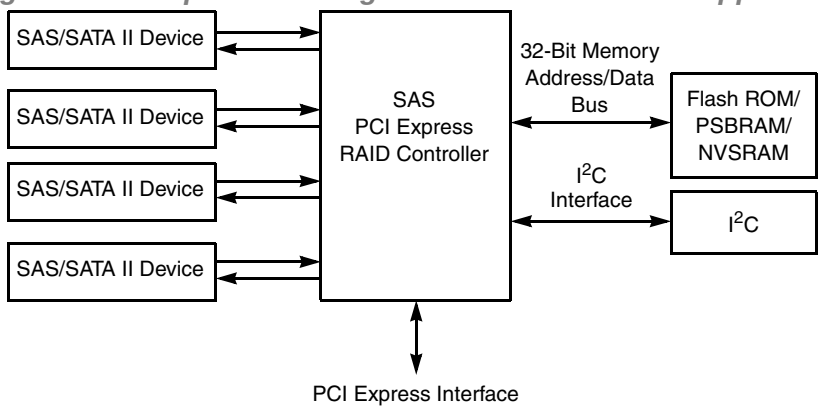
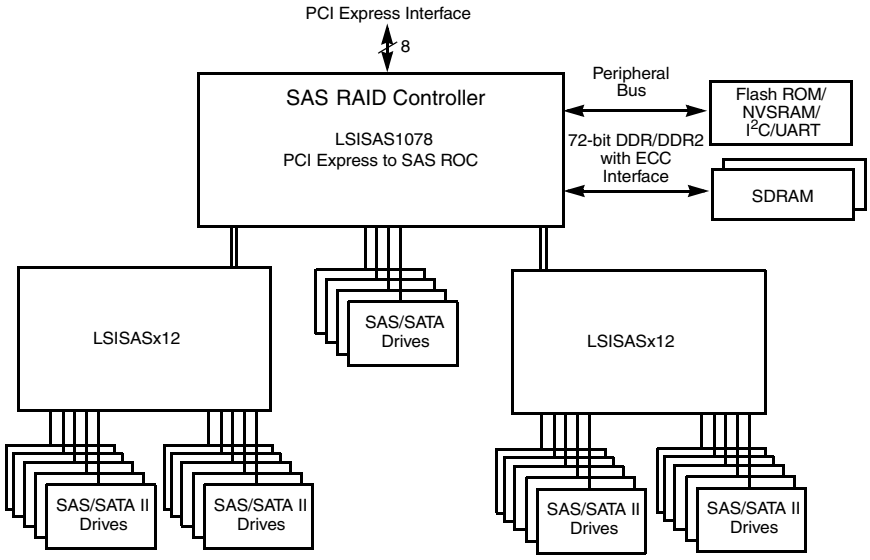


Figure 2 shows an example of a SAS RAID Controller configured with an LSISASx12 expander that is connected to SAS and/or SATA II disks.

Figure 2: Example of LSI Logic SAS RAID Controller Configured with LSISASx12 Expander



Benefits of the SAS Interface

SAS is a serial, point-to-point, enterprise-level device interface that leverages the proven SCSI protocol set. SAS is a convergence of 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 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.

SAS controllers leverage a common electrical and physical connection interface that is compatible with Serial ATA technology. The SAS 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.

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 MegaRAID PCI Express RAID controllers in PCI Express computer systems with a standard bracket type. With these adapters in your system, you can connect SCSI 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.

Summary of SAS RAID Controller Characteristics

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

The MegaRAID SAS RAID controllers include the following features:

- PCI Express x4 lane width (with support for x8 connections).
- PCI Express performance up to 2.5 Gbits/s per lane.
- Support for 128, 256, or 512 Mbyte DDR2 667 MHz on-board SDRAM intelligent battery backed module.
- One internal connector for the MegaRAID SAS 8704ELP RAID controller.
- 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.
- Patrol read.
- No reboot necessary after expansion.
- More than 200 Qtags per array.
- Hardware clustering support on the board.
- User-specified rebuild rate.
- 32 Kbyte nonvolatile random access memory (NVRAM) for storing RAID system configuration information; the MegaRAID SAS firmware is stored in flash ROM for easy upgrade.

SAS Features

The following list describes the SAS features of the RAID controllers:

- 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 (depending on your configuration).
- 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.

SAS Array Limitations

Table 1: SAS RAID Controller Array Limitations

	Maximum Virtual Disks per Controller	Maximum Arrays per Controller	Maximum Virtual Disks per Array	Maximum Drives per Array	Maximum Drives per Controller	Maximum Hot Spares	Maximum Spans per Virtual Disk	Maximum Enclosures per Port*	Maximum Ports
SAS 8704ELP	64	128	16	8	8	16	8	3	1

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

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

These RAID controllers support 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 rather than by actual RAID volume capacity.

SATA II Features

The following list describes the SATA II features of the RAID controllers:

- 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.

PCI Express Performance

The following list describes the PCI Express performance features of the RAID controllers:

- Provides a PCI Express interface that:

- Supports a dedicated PCI Express bus.
- Supports x4, x8, or x16 lane configuration.
- Supports transfer rates of up to 2.5 Gbits/s per lane.
- Complies with the PCI Express Specification, Revision 1.0a.

- Provides unequaled performance through the Fusion-MPT architecture.
- Provides high throughput and low CPU utilization to offload the host processor.

Usability Features

The following list describes the usability features of the RAID controllers:

- 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.

Flexibility Features

These features increase the flexibility of the RAID controllers:

- Supports a Flash ROM interface, a nonvolatile 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 or SATA II targets.
- Leverages compatible connectors for SAS 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.

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 hard drives attached to the controller. This 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:

1. Turn off all power to the server and all hard drives, enclosures, and system components, then disconnect power cords from the system.
2. Open the system according to the instructions provided in the system User Guide.
3. Move the drives to different positions on the backplane to change the targets.
4. Determine the SAS target requirements.
5. Perform a safety check.
   a. Make sure the drives are inserted properly.
   b. Close the cabinet of the host system.
6. Power-on the system.
   The controller detects the RAID configuration from the configuration data on the drives.

Drive Migration

Drive migration is the transfer of a set of hard 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.

> ***Notes**:*
>
> - *Only complete configurations can be migrated; individual virtual disks cannot be migrated.*
> - *Drive roaming and drive migration cannot be supported at the same time.*

Follow these steps to migrate drives:

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 hard drives and the NVRAM.

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

2. Turn off all power to the server and all hard drives, enclosures, and system components, then disconnect power cords from the systems.
3. Open the system according to the instructions provided in the system User Guide.
4. Remove the SAS cable connectors from the internal drives or the shielded cables from the external drives you want to migrate.
   a. Make sure pin 1 on the cable matches pin 1 on the connector.
   b. Make sure that the SAS cables conform to all SAS specifications.
5. Remove the hard drives from the first system and insert them into drive bays on the second system.
6. Connect the SAS cables to the hard drives in the second system.
7. Determine the SAS target requirements.
8. Perform a safety check.
   a. Make sure all cables are properly attached.
   b. Make sure the RAID controller is properly installed.
   c. Close the cabinet of the host system.
9. Power-on the system.

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

Hardware Specifications

Table 2: MegaRAID SAS RAID controller specifications

Specifications	MegaRAID SAS 8704ELP
RAID Levels	0, 1, 5, 6, 10, 50, and 60
Devices Supported per Port	Up to 15 SAS or SATA II devices (such as hard drives and expanders)
Ports	Four 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 (firmware-dependent)
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

Table 2: MegaRAID SAS RAID controller specifications (Continued)

Specifications	MegaRAID SAS 8704ELP
Number of Internal Connectors	MegaRAID SAS 8704ELP – One (x4 SAS Port) Mini SAS 4i connector
Hardware Exclusive OR (XOR) Assistance	Yes
Direct I/O	Yes
Architecture	Fusion-MPT

MegaRAID SAS Hardware Installation

This chapter describes the procedures used to install the MegaRAID SAS 8704ELP controller.

Requirements

The following items are required:

- A MegaRAID SAS RAID Controller.
- A host system with an available PCI Express slot.
- The ExpressBuilder disc, containing the drivers and documentation.
- The necessary internal and/or external cables.
- SAS or SATA II physical disks.

> ***Note**: We strongly recommend using an uninterruptible power supply (UPS).*

Quick Installation

The following steps are for quick MegaRAID SAS RAID controller installation. These steps are for experienced computer users/installers. Refer to *"Detailed Installation" on page 25* if this is not your case.

1. Turn power off to the system, all physical disks, enclosures, and system components, and remove the PC power cord.
2. Open the cabinet of the host system by following the instructions in the host system technical documentation.
3. Check the jumper settings and memory module.
4. Install the MegaRAID SAS RAID controller in the server and connect SAS or SATA II devices to it. Ensure that the cables you use conform to all specifications.
5. Perform a safety check.
   a. Ensure that all cables are properly attached.
   b. Ensure that the MegaRAID SAS RAID controller is properly installed.
   c. Close the cabinet of the host system.
6. Turn power on after you complete the safety check.

Detailed Installation

This section provides detailed instructions for installing a MegaRAID SAS RAID controller.

1. Unpack the RAID Controller.

   Unpack and remove the MegaRAID SAS RAID controller. Inspect it for damage. If it appears damaged, or if any of the following items are missing, contact your LSI Logic support representative. The MegaRAID SAS RAID controller is shipped with the following:

   - A CD containing MegaRAID drivers for supported operating systems, an electronic version of this User's Guide, and other related documentation.
   - A license agreement.
   - Warranty information.

2. Turn off the Power to the System.

   Turn off the computer and remove the AC power cord. Remove the system cover. Refer to the system documentation for instructions. Before installing the controller, make sure that the computer is disconnected from the power and from any networks.

3. Review the MegaRAID Controller Jumpers and Controllers.

   The jumpers are set at the factory, and you usually do not need to change them. Refer to *"MegaRAID SAS RAID Controller Characteristics" on page 32* for diagrams of the MegaRAID SAS RAID controllers with their jumpers and connectors.

4. Check the Memory Module.

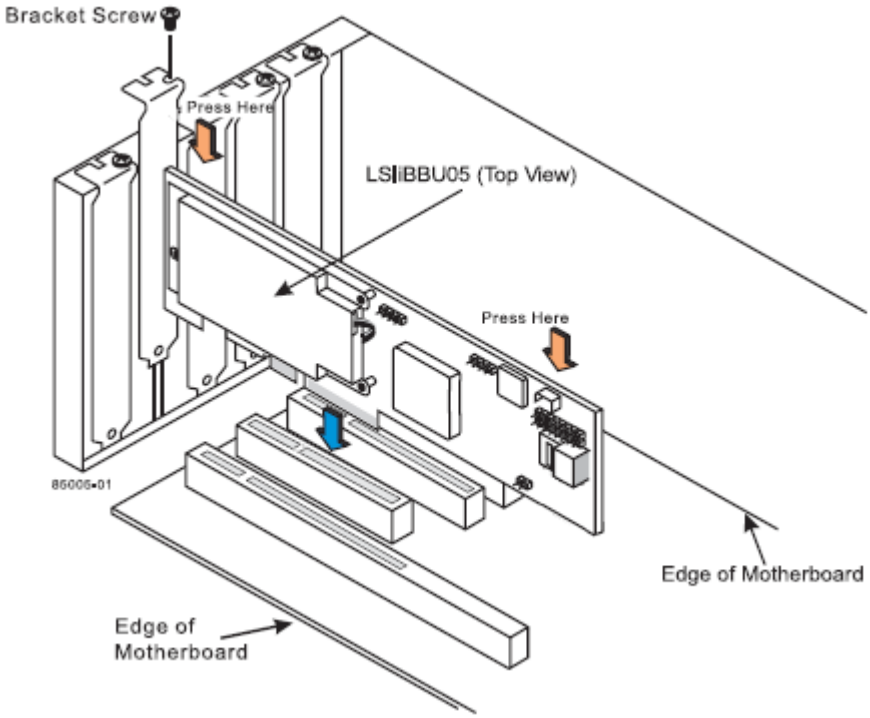
   Ensure that the memory module is present and seated firmly in the dual-inline memory module (DIMM) socket.

> ***Note**: The SAS 8704ELP has on-board DDR2 memory.*

5. Install the MegaRAID SAS RAID 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 3: Example of a MegaRAID Board Installation in a PCI Express Slot



6. Configure and Install the SAS and/or the SATA II Devices in the Host Computer Case.

   Refer to the devices documentation for any preinstallation configuration requirements.

7. Connect SAS and/or SATA II Devices to the RAID Controller.

   Use SAS cables to connect SAS and/or SATA II devices to the MegaRAID SAS RAID controller. Refer to *"SAS Device Cables" on page 28* for SAS cable information.

8. Turn on the Power to the System.

   Replace the computer cover and reconnect the AC power cords. Turn power on to the host computer. Ensure that the SAS and/or SATA II devices are powered up before or at the same time as the host computer. If the computer is powered up before a SAS or SATA II device, the device might not be recognized.

   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 MegaRAID SAS RAID controller number, firmware version, and cache SDRAM size. The numbering of the controllers follows the PCI slot scanning order used by the host mainboard.

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.

10. Install the Operating System Driver.

The SAS RAID controllers can operate under various operating systems. To operate under these operating systems, you must install the software drivers. The ExpressBuilder disc includes software drivers for the supported operating systems, along with documentation.

For details on installing the driver, refer to the MegaRAID SAS Device Driver Installation User's Guide on the ExpressBuilder disc. Be sure to use the latest Service Packs provided by the operating system manufacturer and to review the readme file that accompanies the driver.

SAS Device Cables

This section describes the cables used on the SAS controllers and provides step-by-step instructions for connecting SAS and/or SATA II physical disks to the SAS RAID controller. The SAS and SATA II protocols use a thin, 7-wire connector instead of the 68-wire SCSI cable or 40-wire ATA cable.

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

Figure 4 displays the SAS cable that connects the internal connectors on a SAS RAID controller to SAS drives.

Figure 4: Internal SAS Cable for Connection to SAS and/or SATA II Physical Disks

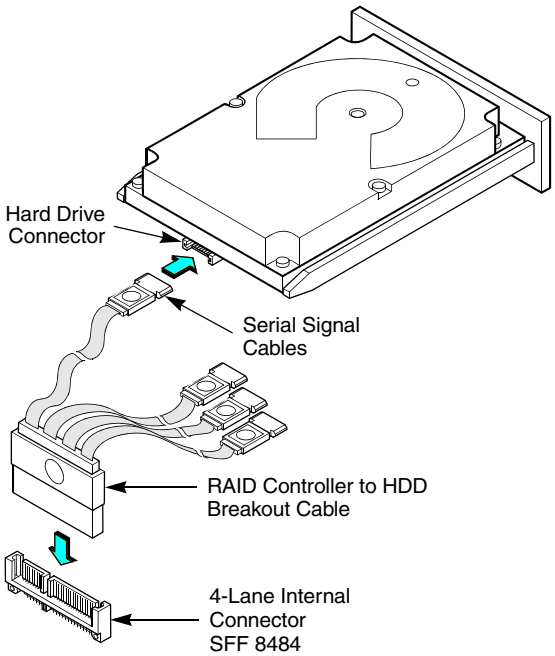


Figure 5 displays the SATA II device plug connector used to connect a SAS RAID controller with internal connectors to the host receptable connector on a backplane. A SATA II connector consists of a signal connector and a power connector.

Figure 5: SATA II Connectors

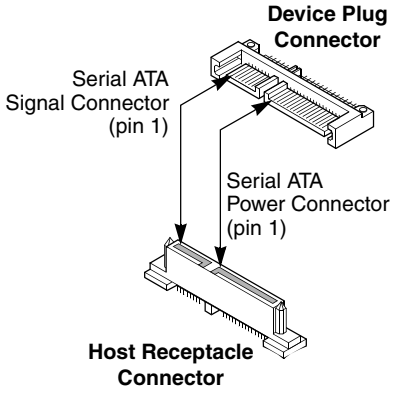
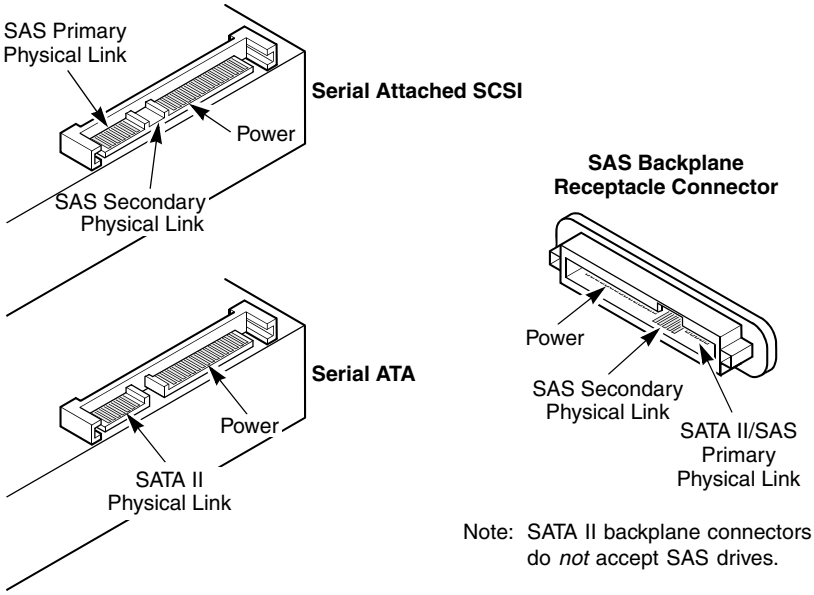


Figure 6 shows SAS and SATA II connectors on SAS and SATA II physical disks, respectively. Cables are used for connection between internal connectors on the RAID controllers and connectors on SAS and/or SATA II drives, respectively. Both SAS and/or SATA II physical disks can connect to SAS backplane receptable connectors. The difference between the SAS connector and SATA II connector is the bridge between the SAS primary physical link and power connector on the SAS controller, which the SATA II connector does not have.

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

Figure 6: SAS and SATA II Plugs and SAS Backplane Receptacle Connector



The following subsections provide step-by-step instructions for connecting the SAS RAID controllers to SAS and SATA II physical disks, either directly or through an expander.

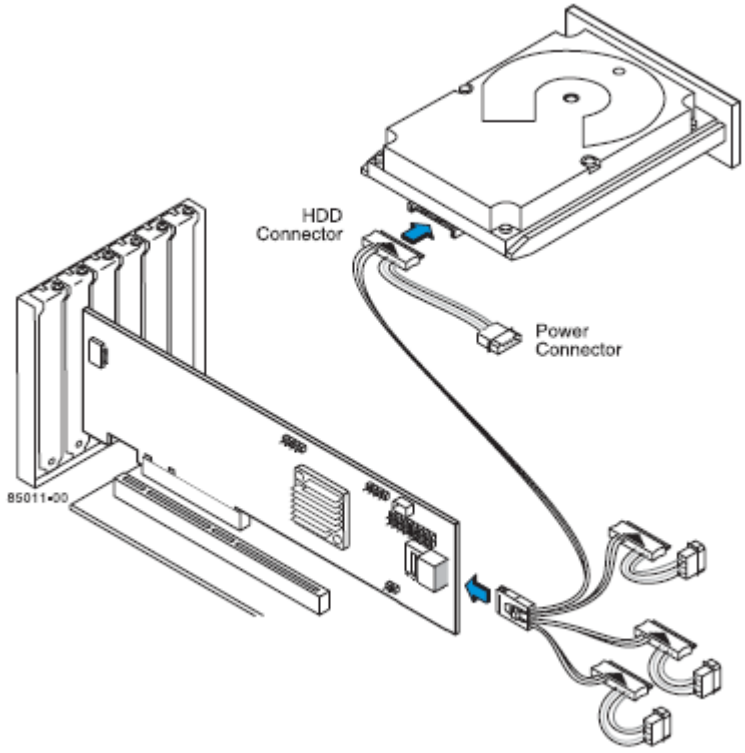
Connecting the SAS RAID Controller with Internal Connectors to Physical Disks

Follow these steps to connect a SAS RAID controller with internal connectors directly to SAS and/or SATA II physical disks.

1. Plug the connector on the internal cable into the internal connector on the SAS RAID controller.
2. Plug the connector on the other end of the internal cable into the connector on the SAS or SATA II physical disk.
3. If you have another physical disk, connect it to another plug on the internal cable.

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

Figure 7: Connecting a SAS RAID Controller with Internal Connectors to Physical Disks



After Installing the RAID Controller

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

MegaRAID SAS RAID Controller Characteristics

The MegaRAID 1078-based SAS RAID controllers are dual PHY, SAS PCI Express RAID controllers and are 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.

MegaRAID SAS 8704ELP RAID Controller

The MegaRAID SAS 8704ELP PCI Express Low-Profile Disk Array RAID Controller controls four internal SAS/SATA ports through one (x4 SAS Port) SFF-8087 Mini SAS 4i internal connector.

Figure 8: Card Layout

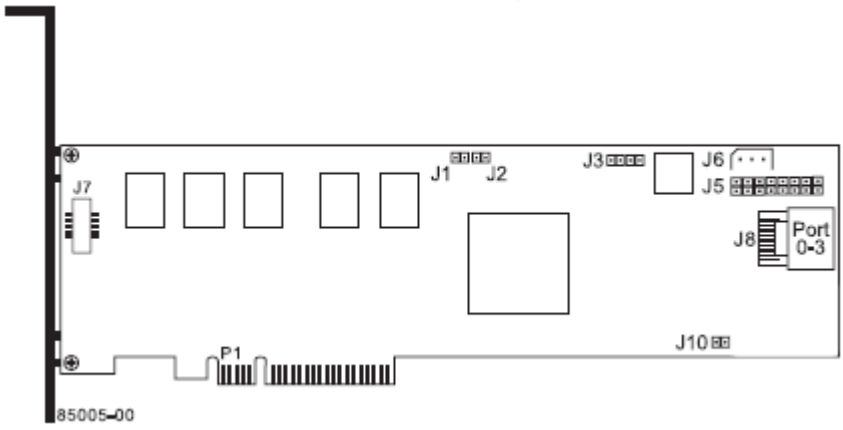


Table 3: Jumpers and connectors

Jumper	Type	Description
J1	Cache Write Pending LEDx	2-pin connector. Connector for enclosure LED. Provides a signal that indicates when the on-board cache contains data and a write from the cache to the hard drives is pending. Optional.
J2	On-board BIOS Enable	2-pin shielded header. The optional BIOS function is enabled or disabled in software depending on the status of this jumper. No jumper: BIOS is enabled (default). Jumper: BIOS is disabled.
J3	Universal Asynchronous Receiver/Transmitter debugging (UART)	4-pin connector. Reserved for LSI Logic use.

Table 3: Jumpers and connectors

Jumper	Type	Description
J5	Individual Fault LED header for 8 ports	16-pin connector. Provides LED interface individually to 8 SAS ports. The LED indicates errors on particular ports.
J6	IPMI-style SMBus (System Manage-ment)/ I2C header	3-pin shielded header. Provides enclosure management support.
J7	Board-to-board connector for battery backup unit daughtercard	20-pin connector. Provides interface to the daughtercard that contains the battery backup unit.
J8	x4 SAS Ports 0-3	The x4 SAS connectors connect the cables from the adapter to SAS or SATA II physical drives, or to a SAS expander
J10	Default Boot Strap Controller	2-pin connector. Loads the defaults in case the boot strap controller (the serial ROM that controls the memory and processor speeds) becomes corrupt.

RAID Controller Characteristics

Table 4 shows the general characteristics for all MegaRAID 1078-based SAS RAID controllers.

Table 4: MegaRAID SAS RAID controller Characteristics

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

a. For boot code and firmware.
b. For BIOS configuration storage.

Each MegaRAID 1078-based SAS RAID controller ensures data integrity by intelligently validating the compatibility of the SAS domain. The MegaRAID 1078-based SAS RAID controllers use Fusion-MPT architecture, which allows for thinner drivers and better performance.

Technical Specifications

The design and implementation of the MegaRAID 1078-based SAS RAID controllers minimize electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge. The MegaRAID SAS RAID controllers carry the CE mark, C-Tick mark, FCC Self-Certification logo, Canadian Compliance Statement, Korean MIC, Taiwan BSMI, and Japan VCCI, and they meet the requirements of CISPR Class B.

The MegaRAID SAS 8704ELP (Model 01116), and LSIiBBU05 (Model 01117) are CSA C22.2 No. 60950-1, UL 60950-1 First Edition listed Accessory, UL file number E257743.

RAID Controller Specifications

Table 5 lists the specifications for the MegaRAID 1078-based SAS RAID controllers.

Table 5: RAID Controller Specifications

Specification	MegaRAID SAS 8704ELP
Processor (PCI Express Host Controller to PCI Secondary I/O Controller)	SAS 8704ELP RAID Controller: LSISAS1078 with Integrated PowerPC processor
Part Number	SAS 8704ELP RAID Controller: 01116 LSIiBBU05 intelligent Battery Backup Unit 05: 01117
Operating Voltage	+3.3 V, +12 V
Card Size	Low-profile PCI Express adapter card size (6.600" x 2.713")
Array Interface to Host	PCI Express Rev 1.0a
PCI Express Bus Data Transfer Rate	Up to 2.5 Gbits/s per lane x4, x8, and x16 lane width
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	SAS connectors with four SAS ports each
Cache Configuration	• 128 MB - 40b arrangement (3) 32Mx16, Double Data Rate II @ 667 MHz battery-backed module • 256 MB - 40b arrangement (3) 64Mx16, Double Data Rate II @ 667 MHz battery-backed module • 256 MB - 72b arrangement (3) 32Mx16, Double Data Rate II @ 667 MHz battery-backed module • 512 MB - 72b arrangement (3) 64Mx16, Double Data Rate II @ 667 MHz battery-backed module
Size of Flash ROM for Firmware	4 Mbytes
Nonvolatile Random Access Memory (NVRAM)	32 Kbytes for storing RAID configurations

Array Performance Features

Table 6: Array Performance Features

Specification	MegaRAID SAS 8704ELP
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 Kbyte
Maximum Number of Concurrent Commands	255
Support for Multiple Initiators	Yes

Fault Tolerance

Table 7: Fault Tolerance Features

Specification	MegaRAID SAS 8704ELP
Support for SMART[a]	Yes
Optional Battery Backup for Cache Memory	LSIiBBU05 battery backup. <3.6V/880mAH battery pack; up to 72 hours of data retention for 128 Mbytes
Drive Failure Detection	Automatic
Drive Rebuild Using Hot Spares	Automatic
Parity Generation and Checking	Yes

a. 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.

Electrical Characteristics

Power Supply Requirements

All power is supplied to the controller through the PCI Express 3.3V and 12V rails. Onboard switching regulator circuitry operating from the 12V and the 3.3V rails 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% (from PCI edge connector only) and 3.3V +/- 9% (from PCI edge connector only).

Table 8: Power Supply

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 AUX. supply	30mA	30mA	30mA

***Notes**: The voltage level used in the charging circuitry for the battery pack on the optional battery backed daughter board. If the iBBU DIMM is mounted the following expected power consumption figures apply:*

- *During trickle charging of the battery pack: Trickle charge not available for IBBU*
- *During fast charging of the battery pack: 200ma [need verification]*

Operating and Non-operating Conditions

The operating (thermal and atmospheric) conditions are:

- Relative humidity range is 5% to 90% noncondensing (20% to 80% noncondensing for the RAID controllers).
- Airflow must be at least 200 linear feet per minute (LFPM) to avoid operating the processor above the maximum ambient temperature.

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

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

Safety Characteristics

All MegaRAID 1078-based SAS RAID controllers meet or exceed 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. For the boards installed in a PCI Express bus slot, all voltages are lower than the SELV 42.4 V limit.

Battery Backup Unit

Introduction

The battery backup unit protects the integrity of the cached data on a MegaRAID RAID controller by providing backup power if there is a complete AC power failure or a brief power outage. The LSI Logic MegaRAID iBBU provides an inexpensive alternative to using an uninterruptible power supply (UPS), and a second level of fault tolerance when used in conjunction with a UPS.

The cache memory available on MegaRAID controllers can improve overall system performance. Writing data to the controllers cache memory is much faster than writing it to a storage device. Write operations appear to complete very quickly at the software application level. The RAID controller then writes the cached data to the storage device when system activity is low or when the cache is getting full. The risk of using write-back cache is that the cached data can be lost if the AC power fails before it has been written to the storage device. This risk factor is eliminated when using an onboard iBBU.

The MegaRAID iBBUs monitor the voltage level of the DRAM modules installed on the RAID controller. (Some types of iBBUs are installed directly on the daughtercard with the DRAM modules.) If the voltage drops below a predefined level, the battery backup module switches the memory power source from the RAID controller to the battery pack attached to the iBBU. As long as the voltage level stays below the predefined value, the iBBU provides power for memory. If the voltage level returns to an acceptable level, the iBBU switches the power source back to the RAID controller, and all pending writes to storage devices are completed with no data loss.

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

Installing the Battery Backup Unit

This chapter explains how to install the iBBUs for MegaRAID 1078-based SAS RAID controllers.

⚠ Caution

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

Use an ESD-safe Phillips screwdriver to attach the iBBU to the RAID controller. Set the screwdriver to a maximum torque of 2.25 inch pounds, and be sure the screwdriver is centered in the screw to avoid damaging the screw head. If you exceed the maximum torque specification, you may damage the board, connectors, or screws, and you will void the warranty of the board.

The batteries in the iBBUs must recharge for at least six hours during fast charge under normal operating conditions. To protect your data, LSI Logic recommends that you set the RAID controller Write Policy to *write-through* until the battery unit is fully charged. When the battery unit is charged, you can change the Write Policy to *write-back* to take advantage of the performance improvements of data caching.

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

Note: *The temperature of the battery packs are generally 15–20 degrees higher than the ambient temperature during fast charge. Therefore, to complete fast charge cycle, ambient temperature should be less than 45 °C. If the ambient temperature exceeds 45 °C, the fast charge cycle will terminate prematurely, thus preventing the battery pack from reaching a fully charged state.*

Installing the LSIiBBU05

The LSIiBBU05 Intelligent BBU is compatible with systems that offer auxiliary power. Battery charging and recharging take place automatically. The LSIiBBU05 features NiMH battery cell technology.

The LSIiBBU05 mounts directly to the SAS RAID controller using a small board-to-board connector (daughtercard).

Figure 9 displays the top view and the bottom view of the card, the 2-56 screws, and the 7/32” standoffs. (The “top” side is the side you can see after you install the LSIiBBU05 on the RAID controller.) Note that this unit combines a battery pack with a daughtercard.

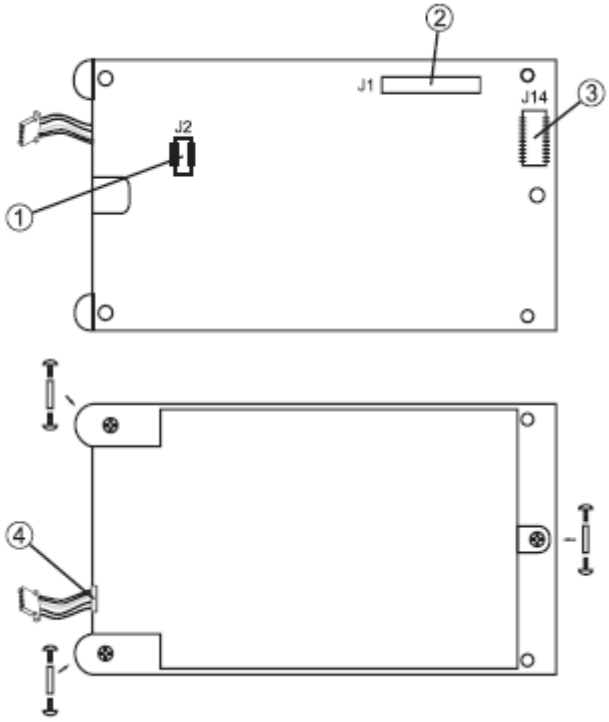


Figure 9: LSIiBBU05 and Components

1: 5-pin J2 connector
2: J1 connector
3: J14 connector
4: Battery pack harness connector

Connecting to the RAID Controller Using a Board-to-Board Connector (Daughtercard)

Follow the steps in this section to install the LSIiBBU05 on the SAS controller.

If the RAID controller is already installed in a computer, follow these steps to remove it before you install the LSIiBBU05:

1. Shut down the computer, turn off the power, and unplug the power cord(s).

2. Remove the cover from the computer according to the instructions in the system user's manual so you can access the RAID controller.
3. Ground yourself before touching the RAID controller.
4. Unplug all cables from the RAID controller, remove the screw attaching the bracket to the computer case, and carefully remove the RAID controller from the slot.
5. Place the RAID controller on a flat, clean, static-free surface, and continue with the next section.

Follow these steps to install the LSIiBBU05. All components are installed on the bottom of the card. The battery is installed on the top. The maximum height of components installed on LSIiBBU05 is 0.125".

1. Ground yourself, and remove the LSIiBBU05 daughtercard from the package.
2. Insert the battery pack harness connector (4) at the end of the colored wires into the 5-pin J2 connector (1) on the backside of the LSIiBBU05.
3. With the front side up, place the RAID controller on a flat, clean, static-free surface.
4. Hold the LSIiBBU05 daughtercard so that the battery side is up and the J14 connector (3) lines up with the J7 BBU connector on the RAID controller, as shown in *Figure 10*.

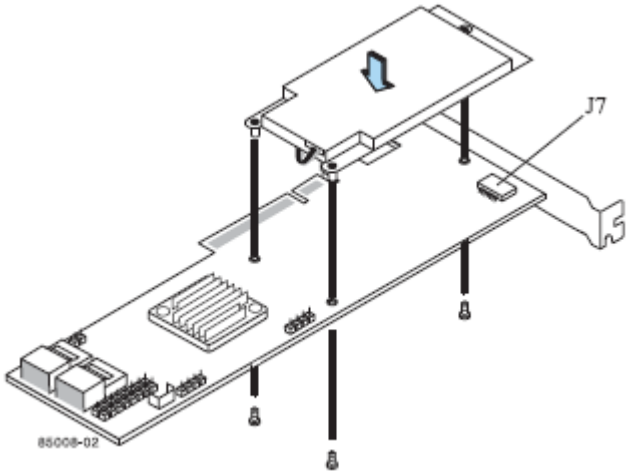


Figure 10: Installing the LSIiBBU05 Daughtercard on the MegaRAID SAS 8708ELP RAID Controller

(The procedure is identical on the MegaRAID SAS 8704ELP controller)

5. Carefully press the LSIiBBU05 onto the RAID controller, so that the two connectors are firmly joined.
6. Secure the LSIiBBU05 to the RAID controller with the 2-56 screws and the standoffs in the three screwholes.
7. The standoffs are threaded at both ends and a 2-56 screw goes into each end.
8. Use the Phillips-head screws that are provided to secure the LSIiBBU05 to the RAID controller, as shown in *Figure 10*.

⚠ Caution

Center the screwdriver carefully to avoid stripping the screw-head. Do not over-tighten the screws. The maximum recommended torque is 2.25 inch pounds.

9. Install the RAID controller in the computer in the PCI Express slot, as shown in *Figure 11*. Press down gently, but firmly, to ensure that the RAID controller is properly seated in the slot. The bottom edge of the RAID controller must be flush with the slot.

⚠ Caution

Never apply pressure to the LSIiBBU05 when you insert the RAID controller. Instead, press down only on the top edge of the RAID controller, as shown in *Figure 11*.

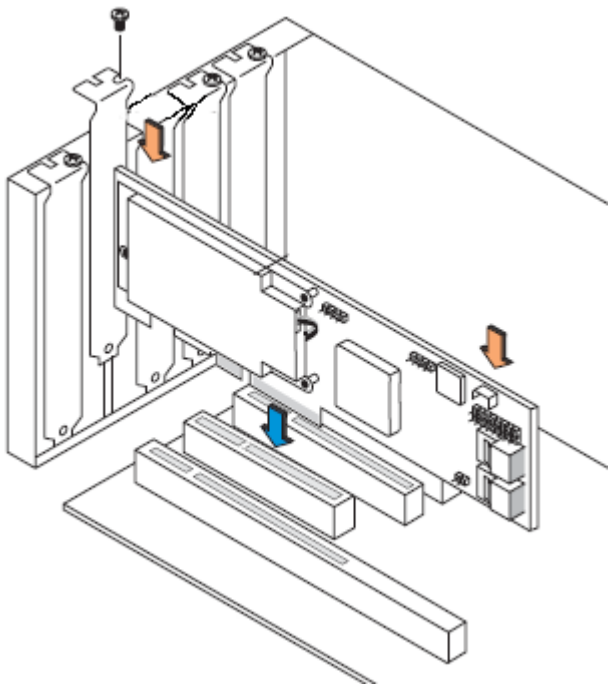


Figure 11: Installing the MegaRAID SAS 8708ELP RAID Controller

(The procedure is identical on the MegaRAID SAS 8704ELP controller)

10. Attach the RAID controller to the computer chassis with the bracket screw.

11. Attach the cables, as needed, to the connectors on the MegaRAID RAID controller.

12. Replace the computer cover and reattach the power cord(s).

Using the Battery Backup Units

This chapter explains how to monitor and maintain the MegaRAID BBUs used with the MegaRAID 1078-based SAS RAID controllers. Most of the MegaRAID BBU functions, such as battery recharging, occur automatically.

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

- MegaRAID WebBIOS Configuration Utility
- MegaCLI (command line utility)
- MegaRAID Storage Manager Configuration Utility

> ***Note:*** *This chapter describes only the BBU-related features of the MegaRAID utility programs. For complete information on these utilities, see the MegaRAID SAS Software User's Guide.*

The MegaRAID utilities display a counter showing the number of times the battery pack on the BBU has been recharged. When you replace a BBU, you should run the utility program and reset this counter to zero for the new BBU.

> ***Note:*** *LSI Logic recommends that you replace the BBU once per year or after 500 recharge cycles, whichever comes first.*

Monitoring BBUs with the MegaRAID Configuration Utilities

This section describes how you can use the MegaRAID utilities to monitor the condition of installed BBUs. You can also use these utilities to reset the recharge cycle counter to zero when you replace a battery pack.

Monitoring BBUs with the WebBIOS Configuration Utility

The MegaRAID WebBIOS Configuration Utility (CU) configures disk arrays and logical drives. Because the WebBIOS CU resides in the BIOS, it is independent of the operating system.

Viewing Battery Backup Unit Information

If your SAS RAID controller has a battery backup unit (BBU), you can view information about it. To do this, follow these steps:

1. Click **Adapter Properties** on the main WebBIOS CU screen.
2. Click **Next** to view the second Adapter Properties screen.
3. Click the word *Present* in the Battery Backup field at the top left of the screen. The Battery Module screen appears, as shown in *Figure 12*.

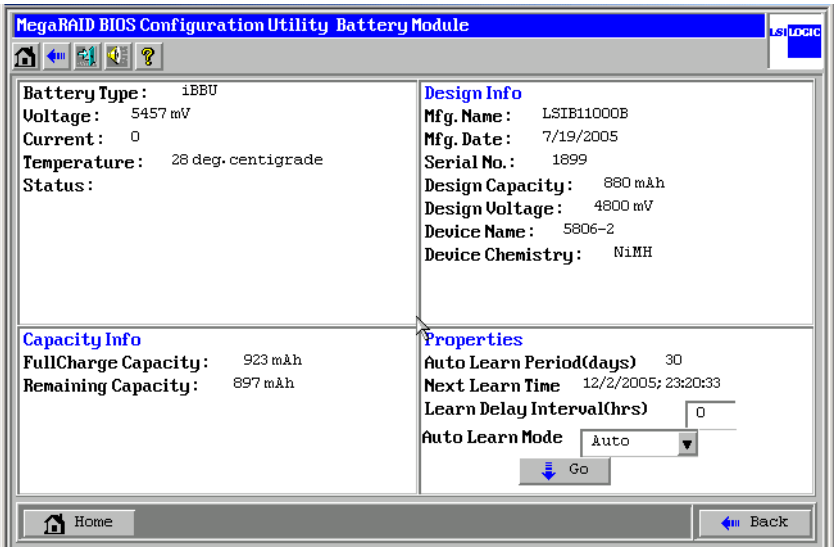


Figure 12: Battery Module Screen

Most of the Battery Module properties are view-only and are self-explanatory. In the lower right panel, there are two properties that can be changed. (LSI Logic recommends that you leave these properties at their default settings.)

A *learning cycle* is a battery calibration operation performed by the controller periodically to determine the condition of the battery. To change the length of the interval between learning cycles, enter a different number of hours for Learn Delay Interval and click **Go**.

Monitoring BBUs with MegaCLI

MegaCLI is a character-based, non-GUI, command line utility that you can use to configure, monitor, and maintain MegaRAID SAS RAID controllers and the devices connected to them. MegaCLI runs under Red Hat Linux and Microsoft Windows.

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

Display BBU Information

Use the command in *Table 9* to display complete information about the BBU for the selected controller(s).

Table 9: Display BBU Information

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

Display BBU Status Information

Use the command in *Table 10* to display complete information about the status of the BBU, such as temperature and voltage, for the selected controller(s).

Table 10: Display BBU Status Information

Convention	`CmdTool -AdpBbuCmd -GetBbuStatus -aN|-a0,1,2|-aALL`

Table 10: Display BBU Status Information (Continued)

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

Display BBU Capacity

Use the command in *Table 11* to display the BBU capacity for the selected controller(s).

Table 11: Display BBU Capacity Information

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

Display BBU Design Parameters

Use the command in *Table 12* to display BBU design parameters for the selected controller(s).

Table 12: Display BBU Design Parameters

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

Display Current BBU Properties

Use the command in *Table 13* to display the current BBU properties for the selected controller(s).

Table 13: Display Current BBU Properties

Convention	`CmdTool -AdpBbuCmd -GetBbuProperties -aN|-a0,1,2|-aALL`
Description	Displays current properties of the BBU. The information displays in the following formats: BBU Properties for Adapter: x Auto Learn Period: xxx Sec Next Learn Time: xxxx Sec Learn Delay Interval: xx Hours Auto-Learn Mode: Warn via Event/Disabled/Enabled

Start BBU Learning Cycle

Use the command in *Table 14* to start the BBU learning cycle on the selected controller(s). A learning cycle is a battery calibration operation performed by the controller periodically (approximately every three months) to determine the condition of the battery.

Table 14: Start BBU Learning Cycle

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

Place Battery in Low-Power Storage Mode

Use the command in *Table 15* to place the battery into Low-Power Storage mode on the selected controller(s). This saves battery power consumption.

Table 15: Place Battery in Low-Power Storage Mode

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

Set BBU Properties

Use the command in *Table 16* to set the BBU properties on the selected controller(s) after reading from the file.

Table 16: Set BBU Properties

Convention	`CmdTool -AdpBbuCmd -SetBbuProperties -f<fileName> -aN|-a0,1,2|-aALL`
Description	Sets the BBU properties on the selected controller(s) after reading from the file. The information displays in the following formats: autoLearnPeriod = 1800Sec nextLearnTime = 12345678Sec Seconds past 1/1/2000 learnDelayInterval = 24hours Not greater than 7 days autoLearnMode = 0 0 – Enabled, 1 - Disabled, 2 – WarnViaEvent.

Monitoring Battery Backup Units with MegaRAID Storage Manager

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

Figure 13 shows the BBU information that appears in the right panel when you select the **Properties** tab.

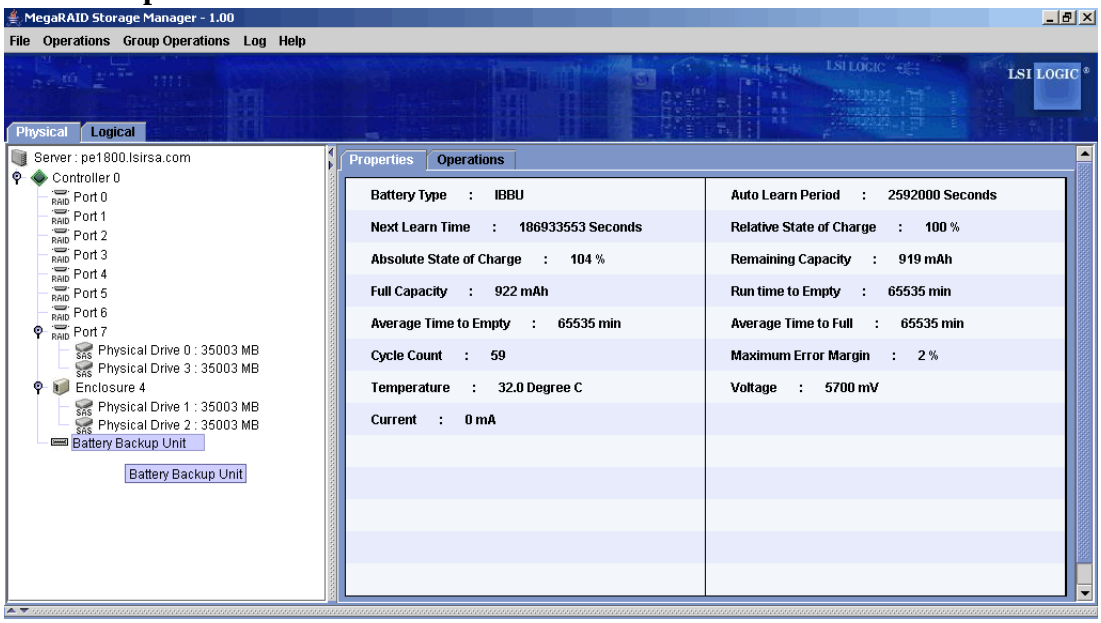


Figure 13: Battery Backup Unit Information

The BBU properties include the following:

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

Replacing Battery Backup Units

We recommend you replace BBUs once a year or after 500 recharging cycles, whichever comes first.

After you install a new BBU, use one of the MegaRAID configuration utilities to reset the battery recharge cycle counter to zero.

Disposing of Battery Backup Units

Warning

Do not damage the battery pack in any way. Toxic chemicals can be released if it is damaged.

The material in the battery pack contains heavy metals that can contaminate the environment. Federal, state, and local regulations prohibit the disposal of rechargeable batteries in public landfills. Be sure to recycle the old battery packs properly. LSI Logic reminds you that you must comply with all applicable battery disposal and hazardous material handling laws and regulations in the country or other jurisdiction where you are using the BBU.

Battery Backup Unit Specifications

This chapter includes technical information and specifications for the LSIiBBU05. A second section lists information about battery life and data retention time.

Specifications

Table 17: Specifications for the LSIiBBU05

	LSIiBBU05
Battery Technology	NiMH
Battery Operating Temperature (Ambient)	10–45 °C
Humidity (Storage and Operating)	20% to 80% non-condensing
Battery Storage Temperature	Depends on storage time, as follows: < 30 days: 0–50 °C 30–90 days: 0–40 °C > 90 days: 0–30 °C
Battery Voltage Conditioning	<3.6 V
Fast Charge Rate	350 mAH
Battery Pack	4 cells
Mechanical	3.7” x 2.2”
Battery Capacity	880 mAH
Charge Circuitry Card	Yes
Memory Technology	DDR2 SDRAM (1.8 V)
Battery Charge Time	~6 hours
Socket Type	Not applicable
Module Support	DDR2
Cache Memory Size Supported	128 - 256 Mbytes
Memory Bus Speed	667 MHz
Memory Bus Width	Maximum 72-bit
Error Correcting Capability (ECC)	Not applicable
Auxiliary Power	Yes[a]

a. These battery products have the ability to detect the presence of an external auxiliary power source. Circuitry on this product automatically chooses auxiliary power to maintain cache contents, deferring battery discharge until auxiliary power is removed or exhausted. Presence of an auxiliary power source thus increases the overall DRT ratings in *Table 18*.

Battery Life and Data Retention Time

The MegaRAID utilities display a counter showing the number of times a BBU has been recharged. When you replace a BBU, you should run the utility program and reset this counter to zero for the new BBU.

We recommend you replace the battery pack on the BBU once a year or after 500 recharging cycles, whichever comes first.

The data retention times shown in *Table 18* are approximate. They can vary based on a number of factors, including the following:

- Capacity of the battery pack and the battery load

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

Table 18: Reference Data Retention Times

BBU Name	Data Retention Times
LSIiBBU05	- 72 hours for 512 Mbytes, using five 64 Mx16 parts DDR2 (low power) - 72 hours for 256 Mbytes, using five 32 Mx16 parts DDR2 (low power) - 72 hours for 256 Mbytes, using three 64 Mx16 parts DDR2 (low power) - 72 hours for 128 Mbytes, using three 32 Mx16 DDR2 (low power)

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 RAID controller is installed. It uses the RAID 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, 10, and 50; 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 SAS MegaRAID SAS RAID 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, 10, and 50) 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. SAS controllers leverage a common electrical and physical connection interface that is compatible with Serial ATA. The SAS controllers support the ANSI *Serial Attached SCSI standard, version 1.0*. In addition, the controller supports the Serial ATA II (SATA II) protocol defined by the *Serial ATA specification, version 1.0a*. Supporting both the SAS and SATA II interfaces, the SAS controller is a versatile controller that provides the backbone of both server and high-end workstation environments. Each port on the SAS RAID controller supports SAS 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 RAID 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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