USER'S GUIDE

MegaRAID® 320-0X Zero-Channel PCI-X RAID Storage Adapter

April 2005

LSI LOGIC®

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Preface

This book is the primary reference and user's guide for the LSI Logic MegaRAID® 320-0X Zero-channel PCI-X RAID Storage Adapter. It contains complete installation instructions for this adapter and specifications.

The LSI Logic MegaRAID 320 Storage Adapter family consists of the following:

- MegaRAID 320-0 ZCR PCI SCSI Disk Array Controller
- MegaRAID 320-0X ZCR PCI-X SCSI Disk Array Controller
- MegaRAID 320-1 PCI SCSI Disk Array Controller
- MegaRAID 320-2 PCI SCSI Disk Array Controller
- MegaRAID 320-2X PCI-X SCSI Disk Array Controller
- MegaRAID 320-4X PCI-X SCSI Disk Array Controller

To obtain an overview of RAID, see the *LSI Logic RAID Primer* (available for download from the LSI Logic web site).

For information about how to configure the storage adapters, and for an overview of the software drivers, see the *MegaRAID Configuration Software User's Guide*.

Audience

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

- Engineers who are designing a MegaRAID 320-0X storage adapter into a system
- Anyone installing a MegaRAID 320-0X storage adapter in their RAID system

Organization

This document has the following chapters and appendixes:

- Chapter 1, **Overview**, provides a general overview of the LSI Logic MegaRAID 320-0X PCI-X to SCSI storage adapter with RAID control capabilities.
- Chapter 2, **MegaRAID 320-0X Hardware Installation**, describes the procedures for installing the MegaRAID 320-0X storage adapter.
- Chapter 3, **MegaRAID 320-0X Storage Adapter Characteristics**, provides the characteristics and technical specifications for the MegaRAID 320-0X storage adapter.
- Appendix A, **Audible Warnings**, explains the meanings of the warning tones generated by the MegaRAID SCSI 320-0X RAID controller.
- Appendix B, **Glossary of Terms and Abbreviations**, lists and explains the terms and abbreviations used in this manual.

Related Publications

MegaRAID Configuration Software User's Guide, LSI Logic Document No. DB15-000269-00 (on the *U320 Driver Suite* CD included with the MegaRAID 320-0X storage adapter and available for download from the LSI Logic web site)

MegaRAID Device Driver Installation User's Guide, LSI Logic Document No. DB11-000018-02 (on the *U320 Driver Suite* CD included with the MegaRAID 320-0X storage adapter and available for download from the LSI Logic web site)

MegaRAID 320 Storage Adapters User's Guide, LSI Logic Document No. DB15-000260-05 (on the *U320 Driver Suite* CD included with the MegaRAID 320-0X storage adapter and available for download from the LSI Logic web site)

Safety Instructions

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

When Using Your Computer System

As you use your computer system, observe the following safety guidelines:

CAUTION: Do not operate your computer system with any cover(s) (such as computer covers, bezels, filler brackets, and front-panel inserts) removed.

- To help avoid damaging your computer, be sure the voltage selection switch on the power supply is set to match the alternating current (AC) power available at your location:
  - 115 volts (V)/60 hertz (Hz) in most of North and South America and some Far Eastern countries such as Japan, South Korea, and Taiwan
  - 230 V/50 Hz in most of Europe, the Middle East, and the Far East. Also, be sure your monitor and attached peripherals are electrically rated to operate with the AC power available in your location.
- To help avoid possible damage to the system board, wait five seconds after turning off the system before removing a component from the system board or disconnecting a peripheral device from the computer.
- To help prevent electric shock, plug the computer and peripheral power cables into properly grounded power sources. These cables are equipped with 3-prong plugs to ensure proper grounding. Do not use adapter plugs or remove the grounding prong from a cable. If you must use an extension cable, use a 3-wire cable with properly grounded plugs.
- To help protect your computer system from sudden, transient increases and decreases in electrical power, use a surge suppressor, line conditioner, or uninterruptible power supply.
- Be sure nothing rests on your computer system's cables and that the cables are not located where they can be stepped on or tripped over.

- Do not spill food or liquids on your computer. If the computer gets wet, consult the documenation that came with it.
- Do not push any objects into the openings of your computer. Doing so can cause fire or electric shock by shorting out interior components.
- Keep your computer away from radiators and heat sources. Also, do not block cooling vents. Avoid placing loose papers underneath your computer; do not place your computer in a closed-in wall unit or on a rug.

When Working Inside Your Computer

Notice: Do not attempt to service the computer system yourself, except as explained in this guide and elsewhere in LSI Logic documentation. Always follow installation and service instructions closely.

1. Turn off your computer and any peripherals.
2. Disconnect your computer and peripherals from their power sources. Also, disconnect any telephone or telecommunications lines from the computer.

   Doing so reduces the potential for personal injury or shock.

Also note these safety guidelines:

- When you disconnect a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs; if you are disconnecting this type of cable, press in on the locking tabs before you disconnect the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before you connect a cable, make sure both connectors are correctly oriented and aligned.
- Handle components and cards with care. Don’t touch the components or contacts on a card. Hold a card by its edges or by its metal mounting bracket. Hold a component such as a microprocessor chip by its edges, not by its pins.

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 (ESD):

- 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 LSI Logic MegaRAID 320-0X controller, which is a zero-channel (ZCR) RAID PCI-X to SCSI storage adapter. It consists of the following sections. RAID is an acronym for Redundant Array of Independent Disks.

1.1 Overview

The LSI Logic MegaRAID 320-0X storage adapter is a low-profile, high-performance zero-channel, intelligent PCI-X to SCSI host adapter with RAID (Redundant Array of Independent Disks) control capabilities. The MegaRAID 320-0X storage adapter provides reliability, high performance, and fault-tolerant disk subsystem management. It is an ideal RAID solution for the internal storage of workgroup, departmental, and enterprise systems. The MegaRAID 320-0X storage adapter offers a cost-effective way to implement RAID in a server.

MegaRAID SCSI 320-0X can be installed in a special PCI-X expansion slot in a computer with a motherboard that has the LSI Logic 53C1020 or 53C1030 SCSI chip. The zero-channel adapter converts a motherboard’s own on-board SCSI controller into a powerful PCI-X SCSI RAID solution and is targeted for 1U, 2U, and stand-alone server environments.

The MegaRAID SCSI 320-0X is part of the LSI Logic Intel 80321-based MegaRAID controller family and is an entry-level to mid-range RAID controller solution.

The MegaRAID 320-0X storage adapter supports a low-voltage differential (LVD) or a single-ended (SE) SCSI bus. The type of bus and speed depend on the SCSI controller on the motherboard. With LVD, you can use cables up to 12 meters long. Throughput on each SCSI channel can be as high as 320 Mbytes/s. With this adapter in your PCI or PCI-X system, you can create RAID volumes from the SCSI devices attached to the on-board SCSI bus.

For Ultra320 SCSI performance, you must connect only LVD devices to the bus. Do not mix SE with LVD devices, or the bus speed will be limited to the slower SE (Ultra SCSI) SCSI data transfer rates. Do not connect a high voltage differential (HVD) device to the SCSI bus because the chip on the storage adapter must be reset to return to LVD or SE mode once the HVD device is removed.

1.1.1 Operating System Support

The MegaRAID 320-0X storage adapter supports major operating systems, including Windows (2000, Server 2003, and XP), Red Hat Linux, SuSe Linux, Novell NetWare, SCO OpenServer, and UnixWare. Refer to the *MegaRAID 320 Device Driver Installation User's Guide* for more information.

The MegaRAID 320-0X storage adapter uses Fusion-MPT™ architecture for all major operating systems for thinner drivers and better performance.

1.1.2 Technical Support

For questions or to obtain a driver for an operating system other than the ones listed above, contact the LSI Logic Technical Support team at:

- support@lsil.com
- 1-678-728-1250 or 1-800-633-4545 option 3
- http://www.lsilogic.com.

In Europe, you can contact the LSI Logic Technical Support team at:

- eurosupport@lsil.com
- +44.1344.413.441 (English) or +49.89.45833.338 (Deutsch)

1.2 Features

Features of the LSI Logic MegaRAID 320-0X storage adapter include:

- Support for hard drives with capacities of eight Gbytes and above
- Online RAID level migration
- No reboot necessary after expansion (for NT 4.0, FlexRAID® virtual sizing must be enabled)
- More than 200 Qtags per array
- User-specified rebuild rate
- Wide Ultra320 LVD SCSI performance up to 320 Mbytes/s
- 128 Mbyte cache memory
- PCI-X host interface
- Support for RAID levels 0, 1, 5, 10, and 50
- Advanced array configuration and management utilities
- 32 Kbytes x 8 NVRAM for storing RAID system configuration information; the MegaRAID 320 firmware is stored in flash ROM for easy upgrade.
- Battery backup for the onboard cache SDRAM using a daughter card with battery
- Onboard tone generator to indicate events and errors

1.2.1 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 be reinstalled in the same order as in the original configuration. See the *MegaRAID Configuration Software User's Guide* for more information about drive migration.

1.3 Hardware

You can install the MegaRAID 320-0X storage adapter in a special PCI-X expansion slot in a system motherboard that has the LSI Logic 53C1020 or 53C1030 SCSI chip. The following subsection describes the hardware configuration features for the MegaRAID 320-0X storage adapter.

1.3.1 Storage Adapter Configurations

Table 1.1 describes the configurations for the MegaRAID 320-0X storage adapter.

Table 1.1 MegaRAID 320-0X Storage Adapter Features

Specifications	MegaRAID 320-0X
RAID Levels	0, 1, 5, 10, 50
SCSI Device Types	Synchronous or Asynchronous
Devices per SCSI Channel	Up to 15 Wide SCSI devices
SCSI Data Transfer Rate	Up to 320 Mbytes/s per channel
SCSI Bus	LVD or SE
Cache Function	Write-back, Write-through, Adaptive Read Ahead, Non Read Ahead, Read Ahead, Cache I/O, Direct I/O
Multiple Logical Drives/Arrays per Controller	Up to 40 logical drives per controller
Maximum # of MegaRAID 320 Storage Adapters per System	One MegaRAID 320-0X adapter, though other MegaRAID adapters can be supported. A total of up to 12 MegaRAID adapters can be supported, though there may be fewer slots available on the motherboard.
Online Capacity Expansion	Yes
Dedicated and Pool Hot Spare	Yes
Hot Swap Devices Supported	Yes
Non-Disk Devices Supported	Yes
Mixed Capacity Hard Drives	Yes
Cluster Support	No
Hardware Exclusive OR (XOR) Assistance	Yes
Direct I/O	Yes
Architecture	Fusion-MPT

Chapter 2
MegaRAID 320-0X
Hardware Installation

This chapter describes the procedures for installing the MegaRAID 320-0X storage adapter. It contains the following sections:

2.1 Requirements

The following items are required to install a MegaRAID 320-0X storage adapter:

- A host system with the following:
  - Motherboard with a special 64-bit, 3.3 V, PCI or PCI-X expansion slot with an interrupt routing circuitry
  - Support for PCI version 2.2 or later, and PCI-X version 1.1 or later
- MegaRAID 320-0X storage adapter
- Ultra, Ultra2, Ultra160, or Ultra320 SCSI hard disk drives (although backward compatible, SCSI uses the speed of the slowest device on the bus)
- The *U320 Driver Suite* CD with drivers and documentation

LSI Logic strongly recommends using an uninterruptible power supply (UPS).

2.2 Quick Installation

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

Note: Be sure to make a backup of all the data on your hard drives before you install the MegaRAID 320-0X ZCR storage adapter. Failure to do so could result in data loss.

Step 1. Turn power off to the server and all hard drives, enclosures, and system components and remove the PC power cord.

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

Step 3. Check the jumper settings on the adapter.

Step 4. Install the MegaRAID 320-0X storage adapter in a special PCI-X expansion slot.

Step 5. Perform a safety check.

- ◊ Ensure that the MegaRAID 320-0X storage adapter is properly installed.
- ◊ Close the cabinet of the host system.

Step 6. Turn power on after completing the safety check.

2.3 Detailed Installation

This section provides detailed instructions for installing a MegaRAID 320-0X storage adapter.

Step 1. Unpack the Adapter

Unpack and remove the storage adapter. Inspect it for damage. If it appears damaged, or if any items listed below are missing, contact your LSI Logic support representative. The MegaRAID 320-0X storage adapter is shipped with:

- ◊ The *U320 Driver Suite* CD, which contains MegaRAID drivers for supported operating systems, an electronic

version of this *User's Guide*, and other related documentation.

- ◊ A license agreement

Step 2. Power Down the System

Turn off the computer and remove the AC power cord. Remove the system's cover. See the system documentation for instructions.

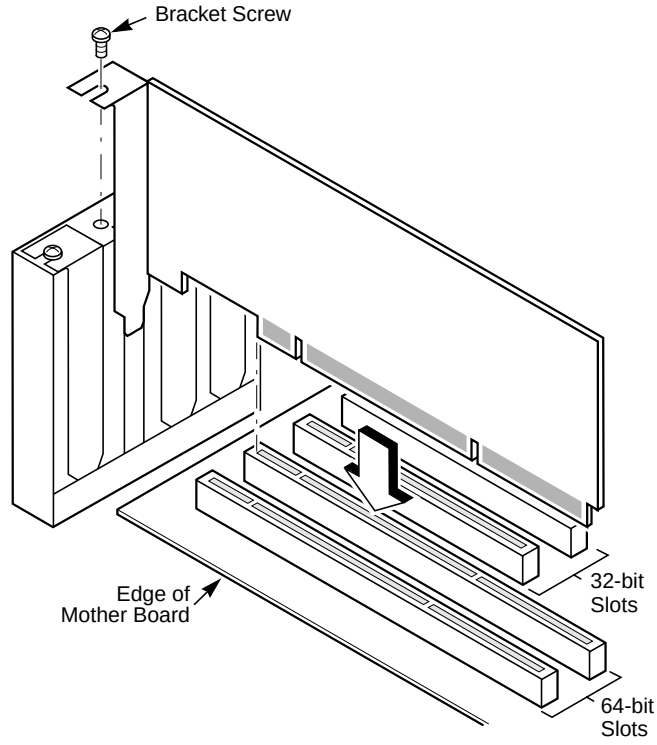
Step 3. Check the Jumpers

Ensure that the jumper settings on your storage adapter are correct. See Chapter 3, "MegaRAID 320-0X Storage Adapter Characteristics," for diagrams of the storage adapters with their jumpers and connectors.

Step 4. Install the MegaRAID 320-0X Storage Adapter

Select the special ZCR 3.3 V, 64-bit PCI-X expansion slot, and align the storage adapter PCI-X bus connector to the slot. Press down gently but firmly until the card is properly seated in the slot, as shown in Figure 2.1, then screw the bracket into the computer chassis.

Figure 2.1 Inserting the MegaRAID 320-0X Card in a PCI Slot



Note: The slot for the MegaRAID 320-0X card is a special ZCR slot on the motherboard.

Step 5. Set the Target IDs.

Set target identifiers (TIDs) on the SCSI devices. Each device in a channel must have a unique TID. Provide unique TIDs for non-disk devices (CD-ROM or tapes), regardless of the channel they are connected to. The MegaRAID 320-0X storage adapter automatically occupies TID 7, which is the highest priority. The arbitration priority for a SCSI device depends on its TID.

Table 2.1 Target ID's

Priority	Highest										Lowest	
TID	7	6	5	. . .	2	1	0	15	14	. . .	9	8

Step 6. Power On Host System

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

During boot, a BIOS message appears. The firmware takes several seconds to initialize. During this time, the storage adapter scans the SCSI channel(s).

The MegaRAID 320 BIOS Configuration Utility (Ctrl-M) prompt times out after several seconds. The second portion of the BIOS message displays the MegaRAID 320-0X storage adapter number, firmware version, and SDRAM memory module size. The numbering of the controllers follows the PCI slot scanning order used by the host motherboard.

To run the MegaRAID Configuration Utility or the WebBIOS utility at this point, press the appropriate keys when this message appears:

```
Press <CTRL><M> to run MegaRAID Configuration Utility, or
Press <CTRL><H> for WebBIOS
```

2.4 After You Have Installed the Storage Adapter

After storage adapter installation, you must configure the storage adapter and install the operating system driver. The *MegaRAID Configuration Software User's Guide* instructs you about the configuration options and how to set them on your storage adapter.

Chapter 3
MegaRAID 320-0X Storage Adapter Characteristics

This chapter describes the characteristics of the LSI Logic MegaRAID 320-0X storage adapters. This chapter contains the following sections:

3.1 The MegaRAID 320 Storage Adapter Family

PCI-X is a high-speed standard local bus for interfacing I/O components to the processor and memory subsystems in a high-end PC or server. The component height on the top and bottom of the Ultra320 SCSI host adapters follow the *PCI Local Bus Specification, Revision 2.2,* and *PCI-X Addendum to the PCI Local Bus Specification, Revision 1.0a*. The MegaRAID 320-0X storage adapters are used in PCI-X and PCI computer systems with PCI standard and PCI low-profile bracket types.

3.1.1 Zero-Channel Storage Adapter

The MegaRAID 320-0X is a zero-channel Ultra320 SCSI-to-PCI-X storage adapter. See Figure 3.1 and Table 3.1 for information about the important connectors and headers on the MegaRAID 320-0X storage adapter.

Figure 3.1 MegaRAID 320-0X Layout

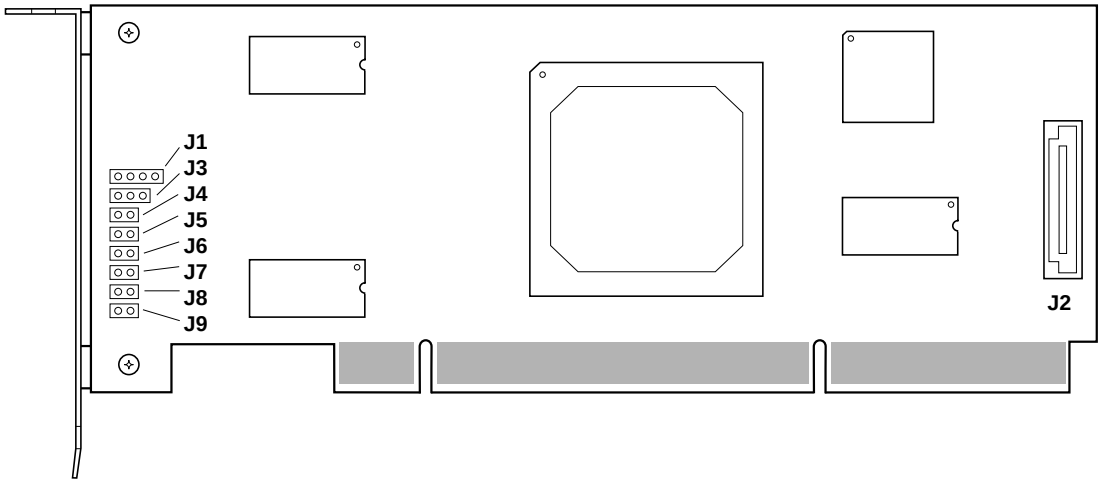


Table 3.1 MegaRAID 320-0X Headers and Connectors

Connector	Description	Type
J1	I^2C	4-pin header Reserved for LSI Logic internal use.
J2	Connector for battery backup daughter card	40-pin connector This connector is for an optional daughter card that provides battery backup on the onboard cache SDRAM.
J3	Universal Asynchronous Receiver/Transmitter (UART) debugging	3-pin connector Reserved for LSI Logic internal use.
J4	Mode select	2-pin connector Reserved for LSI Logic internal use.
J5	Clear NVRAM	2-pin connector Used to clear the contents of the non-volatile random access memory.

Table 3.1 MegaRAID 320-0X Headers and Connectors (Cont.)

Connector	Description	Type
J6	Write-pending Indicator (dirty cache) LED	2-pin header Connector for an LED mounted on the system enclosure. The LED indicates when the data in the cache has yet to be written to the storage devices.
J7	Onboard BIOS Disabled	2-pin header Disables the BIOS so that it won't run on the firmware.
J8	Serial EEPROM	2-pin connector Provides board information, such as serial number, OEM number, revision number, manufacturing data. This eliminates the need to open the system to obtain board information.
J9	NMI (non-maskable interrupt)	2-pin connector Reserved for LSI Logic internal use.

3.2 MegaRAID 320-0X Storage Adapter Characteristics

Table 3.2 shows the general characteristics for all MegaRAID 320-0X storage adapters.

Table 3.2 Storage Adapter Characteristics

Flash ROM[1]	Serial EEPROM[2]	LVD/SE Signaling	Ultra320 SCSI Data Transfers	SCSI Features	SCSI Termination
Yes	Yes	16-bit SE or LVD interfaces	Up to 320 Mbytes/s as well as Fast, Ultra, Ultra2, and Ultra160 speeds; Synchronous offsets up to 62.	Plug n Play Scatter/Gather	Active, Single Ended, or LVD SCSI termination is determined by the motherboard.

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

The MegaRAID 320-0X storage adapter ensures data integrity by intelligently validating the integrity of the SCSI domain. The storage adapters also use Fusion-MPT architecture that allows for thinner drivers and better performance.

3.3 Technical Specifications

The design and implementation of the MegaRAID 320-0X storage adapter minimize electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge. The storage adapter carries the CE mark, C-Tick mark, FCC Self-Certification logo, Canadian Compliance Statement, Korean MIC, Taiwan BSMI, and Japan VCCI, and meets the requirements of CISPR Class B.

3.3.1 Storage Adapter Specifications

Table 3.3 lists the specifications for the MegaRAID 320-0X storage adapter.

Table 3.3 MegaRAID 320-0X Storage Adapter Specifications

Specification	MegaRAID 320-0X
Processor (PCI Controller)	64-bit/200 MHz Intel 80321 I/O processor internal bus interface
Operating Voltage(s)	3.3 V, 5 V, +12 V, –12 V Note: The –12 V power is used only for powering the RS232 (serial port) transceiver. The +12 V is used only if the optional battery backup daughtercard is mounted.
Card Size	Low-Profile, half-length PCI adapter card size (6.6" X 2.536")
Array Interface to Host	PCI-X
PCI Bus Data Transfer Rate	Up to 1064 Mbytes/s at 64-bit/133 MHz
Serial Port	3-pin RS232C-compatible connector (for manufacturing use only)
SCSI Controller(s)	One LSI53C1020 or LSI53C1030 SCSI controller
SCSI Bus Termination	Active, single-ended or LVD Note: See the motherboard user's guide for SCSI bus termination information.
Termination Disable	Automatic through cable and device detection Note: See the motherboard user's guide for termination disable information.
Cache Configuration	Integrated 256 Mbyte of DDR SDRAM @ 100 MHz
Double-Sided Dual Inline Memory Modules (DIMMs)	On-board memory.
Size of Flash ROM for Firmware	1 Mbyte or 2 Mbyte flash ROM. 1 Mbyte is the standard size.
Nonvolatile Random Access Memory (RAM)	32 Kbyte for storing RAID configuration.

3.3.2 Array Performance Features

Table 3.4 displays the MegaRAID 320-0X array performance features:

Table 3.4 Array Performance Features

Specification	MegaRAID 320-0X
PCI Host Data Transfer Rate	Up to 1064 Mbytes/s
Drive Data Transfer Rate	Up to 320 Mbytes/s
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	2, 4, 8, 16, 32, 64, or 128 Kbyte
Maximum Number of Concurrent Commands	255

3.3.3 Fault Tolerance Features

Table 3.5 displays the MegaRAID 320-0X fault tolerance features:

Table 3.5 MegaRAID 320-0X Fault Tolerance Features

Specification	MegaRAID 320-0X
Support for SMART [1]	Yes
Optional Battery Backup for Cache Memory [2]	Yes. Up to 72 hours data retention for 64 Mbyte.
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 predictable disk drive failures. SMART also monitors the internal performance of all motors, heads, and drive electronics.
2. The data retention time listed in the table is for 64 Mbyte of cache memory. If the cache memory is larger than that, the data retention time is shorter.

3.3.4 Electrical Characteristics

This section provides the power requirements for the MegaRAID 320-0X storage adapter. Table 3.6 lists the maximum power requirements under normal operation.

Table 3.6 Maximum Power Requirements

Storage Adapter	PCI/PCI-X +5.0 V	PCI/PCI-X +3.3 V	PCI PRSNT1#/ PRSNT2# Power	Over the Operating Range
MegaRAID 320-0X	5 A	0.0 A	25 W	0 ˚C to 55 ˚C

The MegaRAID 320-0X storage adapters have the following thermal, atmospheric, and safety characteristics.

3.3.5 Thermal and Atmospheric Characteristics

For all MegaRAID 320-0X storage adapters, the thermal and atmospheric characteristics are:

- Temperature range: 0 ˚C to 55 ˚C (dry bulb)
- Relative humidity range: 20% to 80% noncondensing
- Maximum dew point temperature: 32 ˚C

The following parameters define the storage and transit environment for the MegaRAID 320-0X storage adapter:

- Temperature range: – 40 ˚C to + 115 ˚C (dry bulb)
- Relative humidity range: 20% to 80% noncondensing

3.3.6 Safety Characteristics

The MegaRAID 320-0X storage adapter meets or exceeds the requirements of UL flammability rating 94 V0. Each bare board is also marked with the supplier's name or trademark, type, and UL flammability rating. Since these boards are installed in a PCI-X bus slot, all voltages are below the SELV 42.4 V limit.

Appendix A
Audible Warnings

The MegaRAID SCSI 320-0X RAID controller has an onboard tone generator that indicates events and errors.

Table A.1 Audible Warnings and Descriptions

Tone Pattern	Meaning	Examples
Three seconds on and one second off	A logical drive is offline.	One or more drives in a RAID 0 configuration failed. Two or more drives in a RAID 1 or 5 configuration failed.
One second on and one second off	A logical drive is running in degraded mode.	One drive in a RAID 5 configuration failed.
One second on and three seconds off	An automatically initiated rebuild has been completed.	While you were away from the system, a disk drive in a RAID 1, or 5 configuration failed and was rebuilt.

Appendix B
Glossary of Terms and Abbreviations

Active Termination	The electrical connection required at each end of the SCSI bus, composed of active voltage regulation and a set of termination resistors. Ultra SCSI, Ultra2 SCSI, Ultra160 SCSI, and Ultra320 SCSI require active termination.
BIOS	Basic Input/Output System. Software usually kept as firmware (ROM based), that provides basic read/write capability. The system BIOS on the mainboard of a computer is used to boot and control the system. The SCSI BIOS on your host adapter acts as an extension of the system BIOS.
Configuration	Refers to the way a computer is setup; 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.
Differential SCSI	A hardware configuration for connecting SCSI devices. It uses a pair of lines for each signal transfer (as opposed to Single-Ended SCSI which references each SCSI signal to a common ground).
Domain Validation	Domain Validation is a software procedure in which a host queries a device to determine its ability to communicate at the negotiated Ultra320 data rate.
EEPROM	Electronically Erasable Programmable Read-Only Memory. A memory chip typically used to store configuration information. See NVRAM.
External SCSI Device	A SCSI device installed outside the computer cabinet. These devices are connected together 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 now.

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 Bus Adapter (HBA) A circuit board or integrated circuit that provides a device connection to the computer system.

Internal SCSI Device A SCSI device installed inside the computer cabinet. These devices are connected together using an unshielded ribbon cable.

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

NVRAM Non-volatile Random Access Memory. Actually an EEPROM (Electronically Erasable Read-Only Memory chip) used to store configuration information. See EEPROM.

PCI and PCI-X Peripheral Component Interconnect (PCI) and Peripheral Component Interconnect-extended. A high performance local bus specification that allows 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. The PCI-X Local Bus supports a 64-bit data path at 133 MHz.

Peripheral Devices A piece of hardware (such as a video monitor, disk drive, printer, or CD-ROM) used with a computer and under the computer's control. SCSI peripherals are controlled through a SCSI storage adapter (host adapter).

SCSI Bus A storage adapter (host adapter) and one or more SCSI peripherals connected by cables in a linear configuration. The adapter may exist anywhere on the bus, allowing connection of both internal and external SCSI devices. A system may have more than one SCSI bus by using a multi-channel adapter or by using multiple adapters.

SCSI Device	Any device that conforms to the SCSI standard and is attached to the SCSI bus by a SCSI cable. This includes SCSI storage adapters (host adapters) and SCSI peripherals.
SCSI ID	A way to uniquely identify each SCSI device on the SCSI bus. Each SCSI bus has eight available SCSI IDs numbered 0 through 7 (or 0 through 15 for Wide SCSI). The storage adapter (host adapter) usually gets the highest ID (7 or 15) giving it priority to control the bus.
Single-Ended SCSI	A hardware specification for connecting SCSI devices. It references each SCSI signal to a common ground. This is the most common method (as opposed to differential SCSI, which uses a separate ground for each signal).
TolerANT	A technology developed and used by LSI Logic to improve data integrity, data transfer rates, and noise immunity through the use of active negation and input signal filtering.
Ultra SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 20 Mbytes/s over an 8-bit SCSI bus and up to 40 Mbytes/s over a 16-bit SCSI bus.
Ultra2 SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 40 Mbytes/s over an 8-bit SCSI bus, and up to 80 Mbytes/s over a 16-bit SCSI bus.
Ultra160 SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 160 Mbytes/s over a 16-bit SCSI bus.
Ultra320 SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 320 Mbytes/s over a 16-bit SCSI bus.
VHDCI	Very High-Density Cable Interconnect. This cable is used to connect external connectors to your storage adapter.

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