MegaRAID® and MegaRAID® *Ultra* PCI SCSI Disk Array Controller User's Guide

Preliminary DRAFT

MAN-MR
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Revision History

3/2/96	Initial release.
4/1/96	Revised manual to reflect revised MegaRAID Manager.
7/1/96	Updated list of compatible SCSI devices.
10/31/96	Corrected J15 pinout
2/11/97	Added additional RAID overview information.
4/7/97	Corrections to the manual.

Preface

The MegaRAID PCI Disk Array Controller supports one, two, or three Fast and Wide SCSI channels with data transfer rates up to 20 MBs per channel (MegaRAID Ultra supports data transfer rates of up to 40 MBs). This manual pertains to MegaRAID.

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Cont'd

Package Contents You should have received:

- a MegaRAID PCI SCSI Disk Array Controller,
- a *MegaRAID Ultra User's Guide*,
- software license agreement,
- diskette(s) with the MegaRAID software, and
- a warranty registration card.

Technical Support If you need help installing, configuring, or running the MegaRAID PCI SCSI Disk Array Controller, call American Megatrends technical support at 770-246-8645. Before you call, please complete the ***MegaRAID Problem Report*** form on the next page.

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Phone Numbers The BBS requires no parity, eight data bits, and one stop bit. The characteristics of the BBS phone numbers are:

Phone Number	Characteristics
770-246-8780	28,800 baud rate. Supports v.34.
770-246-8781	28,800 baud rate. Supports v.34.
770-246-8782	Supports HST and v.42.
770-246-8783	Supports HST and v.42.

Web Site We invite you to access the American Megatrends world wide web site at *http://www.megatrends.com.*

MegaRAID Problem Report Form

Customer Information	MegaRAID Information
Name	Today's Date
Company	Date of Purchase
Address	Invoice Number
City/State	Serial Number
Country	Number of Channels
email address	Cache Memory
Phone	Firmware Version
Fax	BIOS Version
System Information	
Motherboard:	BIOS manufacturer:
Operating System:	BIOS Date:
Op. Sys. Ver.:	Video Adapter:
MegaRAID Driver Ver.:	CPU Type/Speed:
Network Card:	System Memory:
Other disk controllers installed:	Other adapter cards installed:
Description of problem:	
Steps necessary to re-create problem: 1. 2. 3. 4.	

Logical Drive Configuration

Logical Drive	RAID Level	Stripe Size	Logical Drive Size	Cache Policy	Read Policy	Write Policy	# of Physical Drives
LD1							
LD2							
LD3							
LD4							
LD5							
LD6							
LD7							
LD8							

Physical Device Layout

	Channel 1	Channel 2	Channel 3
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model#			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model#			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model#			
Firmware level			
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Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model#			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model#			
Firmware level			

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FCC Regulatory Statement

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

Warning: **Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a specific installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, try to correct the interference by one or more of the following measures:

1) Reorient or relocate the receiving antenna.
2) Increase the separation between the equipment and the receiver.
3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4) Consult the dealer or an experienced radio/TV technician for help.

Shielded interface cables must be used with this product to ensure compliance with the Class B FCC limits.

American Megatrends MegaRAID PCI SCSI Disk Array Controller

Model Number: Series 428, 418, or 412

FCC ID Number: IUESER418 or IUESER412.

1 Introduction to RAID

The MegaRAID® and MegaRAID® Ultra PCI SCSI Disk Array Controllers are high performance intelligent PCI-to-SCSI host adapters with RAID control capabilities. MegaRAID provides reliability, high performance, and fault-tolerant disk subsystem management. MegaRAID has two or three Fast and Wide SCSI channels, supporting data transfer rates up to 40 Megabytes per second (MBs) per channel. Each SCSI channel supports up to fifteen SCSI devices.

RAID

RAID (Redundant Array of Independent Disks) is an array of multiple small independent hard disk drives that provide high performance and fault tolerance. A RAID disk subsystem improves I/O performance over a computer using only a single drive. The RAID array appears to the host computer as a single storage unit. I/O is expedited because several disks can be accessed simultaneously. RAID systems improve data storage reliability and fault tolerance compared to single-drive computers. Data loss because of a disk drive failure can be reconstructed from the data on other disk drives, including drives in the same redundant array. RAID has six official disk array models (RAID levels). Each RAID level provides disk fault-tolerance and offers trade-offs in features and performance.

Operating System Drivers MegaRAID includes a DOS software configuration utility and drivers for:

- DOS 5.0 or later,
- Microsoft Windows NT,
- IBM OS/2,
- SCO Unix,
- SCO UnixWare, and
- Microsoft Windows 95.

RAID provides data security through fault tolerance and redundant data storage. The MegaRAID management software configures and monitors RAID disk arrays.

RAID Benefits

RAID has gained popularity because it: improves I/O performance, and increases storage subsystem reliability.

Improved I/O Although disk drive capabilities have improved drastically, actual performance has improved only three to four times in the last decade. Computing performance has improved over 50 times during the same time period.

Increased Reliability The electromechanical components of a disk subsystem operate more slowly, require more power, and generate more noise and vibration than electronic devices. These factors reduce the reliability of data stored on disks.

In This Chapter The following topics are discussed:

Major Topic	Subtopic
MegaRAID is a host-based solution	
RAID overview	
	Consistency check Fault tolerance Disk striping Disk spanning Disk mirroring Parity Hot spares Disk rebuilds
RAID levels	
	Selecting a RAID level RAID 0 RAID 1 RAID 3 RAID 5 RAID 10 RAID 30 RAID 50

MegaRAID is a Host-Based RAID Solution

RAID products are either:

- host-based or
- SCSI-to-SCSI.

The MegaRAID Controller is a host-based RAID solution. MegaRAID is a PCI ISA adapter card that is installed in any available PCI expansion slot in a host network server.

Host-Based

A host-based RAID product puts all of the RAID intelligence on an adapter card that is installed in a network server. A host-based RAID product provides the best performance. MegaRAID is part of the file server, so it can transmit data directly across the computer's buses at data transfer speeds up to 132 MBs. The actual data transfer speed is determined by the number and type of SCSI channels and is usually between 20 and 60 MBs.

Host-based solutions must provide operating system-specific drivers.

SCSI-to-SCSI

A SCSI-to-SCSI RAID product puts the RAID intelligence inside the RAID chassis and uses a plain SCSI Host Adapter installed in the network server. The data transfer rate is limited to the bandwidth of the SCSI channels. A SCSI-to-SCSI RAID product that has two wide SCSI channels that operate at speeds up to 40 MBs must squeeze the data into a single wide SCSI (20 MBs) channel back to the Host computer.

In SCSI-to-SCSI RAID products, the hard drive subsystem uses only a single SCSI ID, which allows you to connect multiple drive subsystems to a single SCSI controller.

RAID Overview

RAID (Redundant Array of Independent Disks) is a collection of specifications that describe a system for ensuring the reliability and stability of data stored on large disk subsystems. A RAID system can be implemented in a number of different versions (or RAID Levels). The standard RAID levels or RAID 0, RAID 1, RAID 3, and RAID 5. MegaRAID supports all standard RAID levels and RAID levels 10, 30, and 50, which are special RAID versions supported only by MegaRAID.

Consistency Check

In RAID, check consistency verifies the correctness of redundant data in an array. For example, in a system with dedicated parity, checking consistency means computing the parity of the two data drives and comparing the results to the contents of the dedicated parity drive.

Fault Tolerance

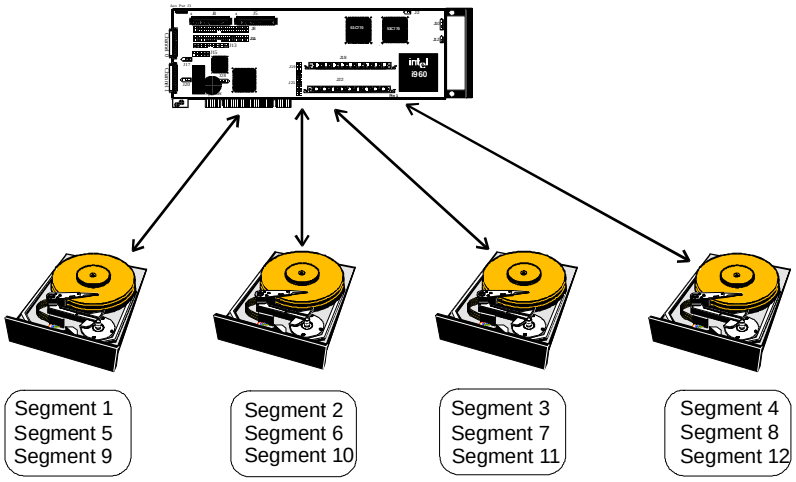
Fault tolerance is achieved through cooling fans, power supplies, and the ability to hot swap drives. MegaRAID provides hot swapping through the hot spare feature. A hot spare drive is an unused online available drive that MegaRAID instantly plugs into the system when an active drive fails.

After the hot spare is automatically moved into the RAID subsystem, the failed drive is automatically rebuilt. The RAID disk array continues to handle request while the rebuild occurs.

Disk Striping

Disk striping writes data across multiple disk drives instead of just one disk drive. Disk striping involves partitioning each drive storage space into stripes that can vary in size from one sector (512 bytes) to 128 KB. These stripes are interleaved in a repeated sequential manner. The combined storage space is composed of stripes from each drive.

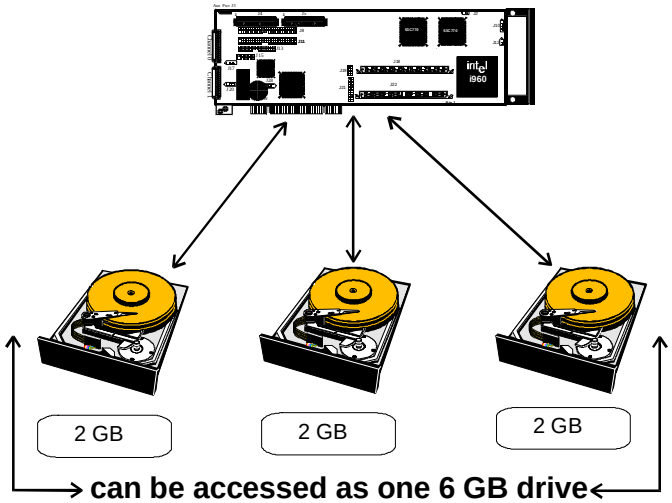
For example, in a four-disk system using only disk striping (as in RAID level 0), segment 1 is written to disk 1, segment 2 is written to disk 2, and so on. Disk striping enhances performance because multiple drives are accessed simultaneously; but disk striping does not provide data redundancy.



Disk Spanning

Disk spanning allows multiple disk drives to function like one big drive. Spanning overcomes lack of disk space and simplifies storage management by combining existing resources or adding relatively inexpensive resources. For example, four 400 MB disk drives can be combined to appear to the operating system as one single 1600 MB drive.

Spanning alone does not provide reliability or performance enhancements. Spanned logical drives must have the same stripe size and must be contiguous. For example logical drives 1 and 2 can be spanned; logical drives 1 and 3 cannot. In the following graphics, spanning turns a RAID 0 array into a RAID 10 array.



Spanning for RAID 10, RAID 30, or RAID 50 Configure RAID 10 by spanning two contiguous RAID 1 logical drives. The RAID 1 logical drives must have the same stripe size.

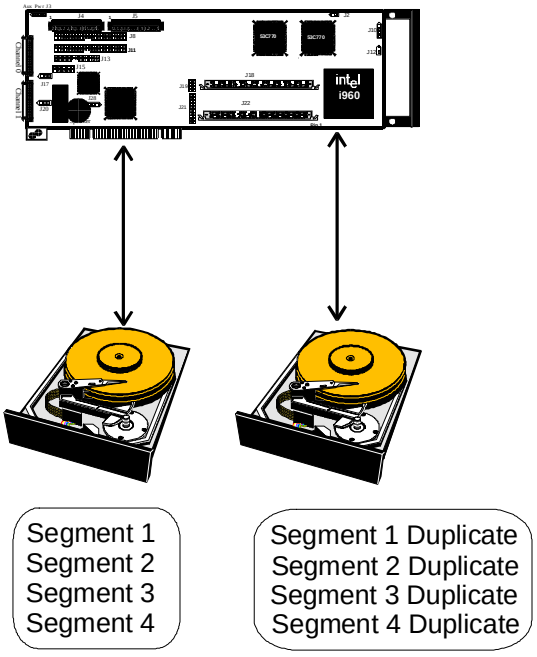
Configure RAID 30 by spanning two contiguous RAID 3 logical drives. The RAID 3 logical drives must have the same stripe size.

Configure RAID 50 by spanning two contiguous RAID 5 logical drives. The RAID 5 logical drives must have the same stripe size.

Disk Mirroring

With mirroring, data written to one disk drive is simultaneously written to another disk drive. If one disk drive fails, the contents of the other disk drive can be used to run the system and reconstruct the failed drive. The primary advantage of disk mirroring is that it provides 100% data redundancy. Since the contents of the disk drive are completely written to a second drive, it does not matter if one of the drives fails. Both drives contain the same data at all times. Either drive can act as the operational drive. If RAID 1 is used, the main data source is the original drive.

Disk mirroring provides 100% redundancy, but is expensive because each drive in the system must be duplicated.



Parity

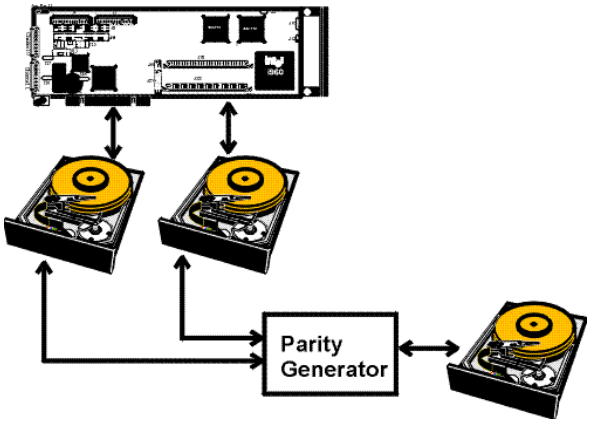
Parity generates a set of redundancy data from two or more parent data sets. The redundancy data can be used to reconstruct one of the parent data sets. Parity data does not fully duplicate the parent data sets. In RAID, this method is applied to entire drives or stripes across all disk drives in an array. The types of parity are:

Type	Description
Dedicated Parity	The parity of the data on two or more disk drives is stored on an additional disk.
Distributed Parity	The parity data are distributed among all the disk drives in the system.

If a single disk drive fails, it can be rebuilt from the parity of the respective data on the remaining drives.

RAID level 3 combines dedicated parity with disk striping. The parity disk in RAID 3 is the third drive on the first channel in the logical array..

RAID level 5 combines distributed parity with disk striping. Parity provides redundancy for one drive failure without duplicating the contents of entire disk drives, but parity generation can slow the write process. A dedicated parity scheme during normal read/write operations is shown below:



Hot Spares

A hot spare is an extra, unused disk drive that is part of the disk subsystem. It is usually in standby mode, ready for service if a drive fails. Hot spares permit you to replace failed drives without system shutdown or user intervention.

MegaRAID implements automatic and transparent rebuilds using hot spare drives, providing a high degree of fault tolerance and zero downtime. The MegaRAID RAID Management software allows you to specify physical drives as hot spares. When a hot spare is needed, the MegaRAID controller assigns the hot spare that has a capacity closest to and at least as great as that of the failed drive to take the place of the failed drive.

Important

Hot spares are only employed in arrays with redundancy, for example, RAID levels 1, 3, 5, 10, 30, and 50.

A hot spare connected to a specific MegaRAID controller can only be used to rebuild a drive that is connected to the same controller.

Disk Rebuild

You rebuild a disk drive by reconstructing the data that had been stored on the drive before the drive failed.

Rebuilding can be done only in arrays with data redundancy such as RAID level 1, 3, 5, 10, 30, and 50.

Standby rebuild (warm spare) is employed in a mirrored (RAID 1) system. If a disk drive fails, an identical drive is immediately available. The primary data source disk drive is the original disk drive.

A hot spare can be used to rebuild disk drives in RAID 3, 5, 10, 30 and 50 systems. If a hot spare is not available, the failed disk drive must be replaced with a new disk drive so that the data on the failed drive can be rebuilt.

The MegaRAID controller automatically and transparently rebuilds failed drives with user-definable rebuild rates. If a hot spare is available, the rebuild starts automatically when a drive fails.

Rebuild Rate The rebuild rate is the fraction of the compute cycles dedicated to rebuilding failed drives. A rebuild rate of 100 percent means the system is totally dedicated to rebuilding the failed drive.

The MegaRAID rebuild rate can be configured between 0% and 100%. At 0%, the rebuild is only done if the system is not doing anything else. At 100%, the rebuild has a higher priority than any other system activity.

Physical Array A physical array is a collection of physical disks governed by the RAID management software.

A physical array appears to the host computer as one or more logical drives.

Logical Drive

A logical drive is a partition in a physical array of disks that is made up of contiguous data segments on the physical disks. A logical drive can consist of any of the following:

- an entire physical array,
- more than one entire array,
- a part of an array,
- parts of more than one array, or
- a combination of any two of the above conditions.

Hot Swap

A hot swap is the manual replacement of a defective physical disk unit while the computer is still running. When a new drive has been installed, you must issue a command to rebuild the drive. MegaRAID can be configured to detect the new disks via fault bus signals and to rebuild the contents of the disk drive automatically.

Stripe Width

Stripe width is the number of disks involved in an array. For example, a four-disk array with disk striping has a stripe width of four.

SCSI Drive States

A SCSI disk drive can be in one of these states:

State	Description
Online	The drive is functioning normally and is a part of a configured logical drive.
Ready	The drive is functioning normally but is not part of a configured logical drive and is not designated as a hot spare.
Hot Spare	The drive is powered up and ready for use as a spare in case an online drive fails.
Fail	A fault has occurred in the drive placing it out of service.
Rebuild	The drive is being rebuilt with data from a failed drive.

Logical Drive States

The logical drive states can be:

State	Description
Optimal	The drive operating state is as good as it can be.
Degraded	The drive operating state is as not as good as it can be.
Failed	The drive has failed.
Offline	The drive is not available to MegaRAID.

Fault Bus

The fault bus is a hardware interface between the host computer and the disk subsystem. The fault bus communicates subsystem error conditions. It improves fault tolerance by providing access to the disk subsystem from any server or connected node.

MegaRAID provides a fault bus connector that informs the controller about subsystem fault conditions, such as a device or power supply failure.

Disk Array Types

The RAID disk array types are:

Type	Description
Software-Based	The array is managed by software running in a host computer using the host CPU bandwidth. The disadvantages associated with this method are the load on the host CPU and the need for different software for each operating system.
SCSI to SCSI	The array controller resides outside of the host computer and communicates with the host through a SCSI adapter in the host. The array management software runs in the controller. It is transparent to the host and independent of the host operating system. The disadvantage is the limited data transfer rate of the SCSI channel between the SCSI adapter and the array controller.
Bus-Based	The array controller resides on the bus (for example, a PCI or EISA bus) in the host computer and has its own CPU to generate the parity and handle other RAID functions. A bus-based controller can transfer data at the speed of the host bus (PCI, ISA, EISA, VL-Bus) but is limited to the bus it is designed for. MegaRAID resides on a PCI bus, which can handle data transfer at up to 132 MBs. In MegaRAID, each channel can handle data transfer rates up to 20 MBs. MegaRAID Ultra supports data transfer rates up to 40 MBs per SCSI channel.

Enclosure Management

Enclosure management is the intelligent monitoring of the disk subsystem by software and/or hardware.

The disk subsystem can be part of the host computer or separate from it. Enclosure management helps you stay informed of events in the disk subsystem, such as a drive or power supply failure. Enclosure management increases the fault tolerance of the disk subsystem.

RAID Levels

There are six official RAID levels (RAID 0 through RAID 5). MegaRAID supports RAID levels 0, 1, 3, and 5. American Megatrends has designed three additional RAID levels (10, 30, and 50) that provide additional benefits. The RAID levels that MegaRAID supports are:

RAID Level	Type
0	Standard
1	Standard
3	Standard
5	Standard
10	MegaRAID only
30	MegaRAID only
50	MegaRAID only

Select RAID Level To ensure the best performance, you should select the optimal RAID level when you create a system drive. The optimal RAID level for your disk array depends on a number of factors:

- the number of drives in the disk array,
- the capacity of the drives in the array,
- the need for data redundancy, and
- the disk performance requirements.

Selecting a RAID Level The factors you need to consider when selecting a RAID level are listed on the next page

Selecting a RAID Level

	Description and Use	Pros	Cons	Drives	Fault Tolerant
0	Data divided in blocks and distributed sequentially (pure striping). Use for non-critical data that requires high performance.	High data throughput for large files	No fault tolerance. All data lost if any drive fails.	Two or more	No
1	Data duplicated on another disk (mirroring). Use for read-intensive fault-tolerant systems	100% data redundancy	Doubles disk space. Reduced performance during rebuilds.	Two	Yes
3	Disk striping with a dedicated parity drive. Use for non-interactive apps that process large files sequentially.	Achieves data redundancy at low cost	Performance not as good as RAID 1	Three or more	Yes
5	Disk striping and parity data across all drives. Use for high read volume but low write volume, such as transaction processing.	Achieves data redundancy at low cost	Performance not as good as RAID 1	Three or more	Yes
10	Data striping and mirrored drives.	High data transfers, complete redundancy	More complicated	2n, where n is greater than 1	Yes
30	Disk striping with a dedicated parity drive.	High data transfers, redundancy	More complicated	Six	Yes
50	Disk striping and parity data across all drives.	High data transfers, redundancy	More complicated	Six	Yes

RAID 0

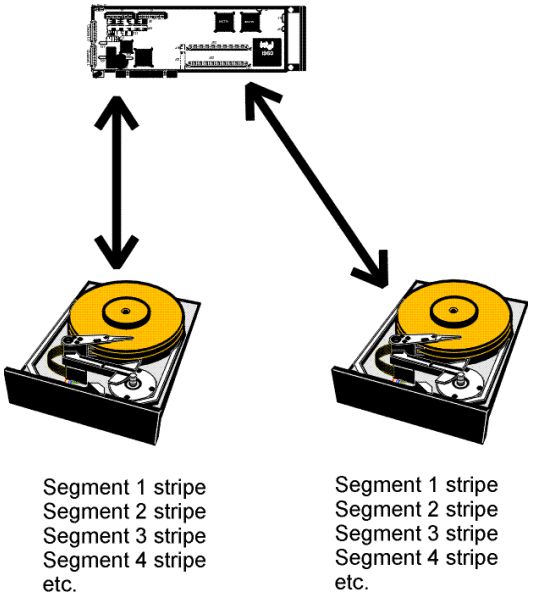
Raid 0 provides disk striping across all drives in the RAID subsystem. RAID 0 does not provide any data redundancy, but does offer the best performance of any RAID level.

Uses RAID 0 provides high data throughput, especially for large files.

Strong Points Provides increased data throughput for large files.

Weak Points Does not provide fault tolerance. All data lost if any drive fails.

Drives One or more.



RAID 1

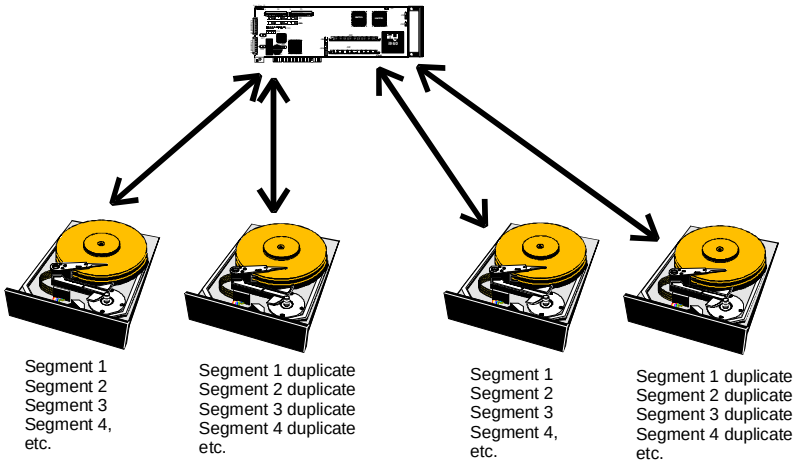
In Raid 1 is selected, MegaRAID duplicates all data from one drive to a second drive. RAID 1 provides complete data redundancy, but at the cost of doubling the required data storage capacity.

Uses Select RAID 1 if disk drive availability is of paramount importance.

Strong Points RAID 1 provides complete data redundancy.

Weak Points RAID 1 requires twice as many disk drives. Performance is impaired during drive rebuilds.

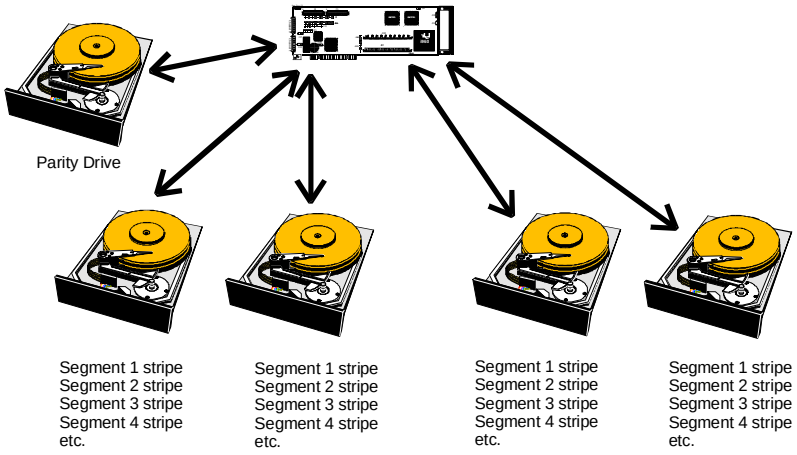
Drives Two drives.



RAID 3

Raid 3 provides disk striping and complete data redundancy though a dedicated parity drive. The disk stripes must be 64 KB in RAID 3. RAID 3 handles data at the block level, not the byte level, so it is ideal for networks that often handle very large files, such as graphic images.

Uses	RAID 3 provides high data throughput, especially for large files.
Strong Points	RAID 3 provides data redundancy and high data transfer rates.
Weak Points	RAID 3 requires an additional parity drive.
Drives	Three or more



RAID 5

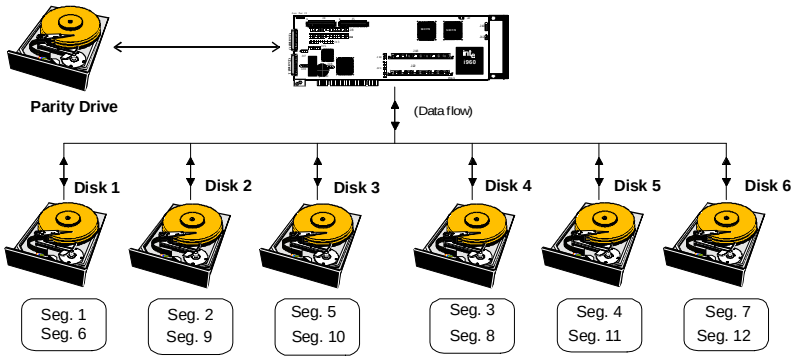
Raid 5 includes disk striping at the byte level and parity. In RAID 5, the parity information is written to several drives. RAID 5 is best suited for networks that perform a lot of small I/O transactions simultaneously.

Uses RAID 5 provides high data throughput, especially for large files. Use RAID 5 for transaction processing applications because each drive can read and write independently. If a drive fails, MegaRAID uses the parity drive to reconstruct all missing information. Use also for office automation and online customer service that requires fault tolerance. Use for any application that has high read request rates but low write request rates.

Strong Points RAID 5 achieves the same level of data redundancy as RAID 1 using only half as much disk capacity.

Weak Points RAID 5 does not provide the best throughput performance. Disk drive performance will be reduced if a drive is being rebuilt.

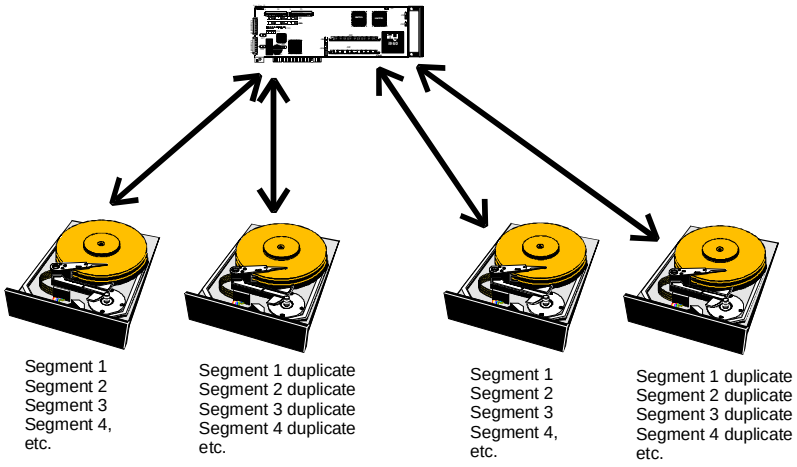
Drives Three or more



RAID 10

Raid 10 is a combination of RAID 0 and RAID 1. RAID 10 has mirrored drives.

Uses	RAID 10 works best for data storage that must have 100% redundancy of mirrored arrays and that also needs the enhanced I/O performance of RAID 0 (striped arrays).
Strong Points	RAID 10 provides both high data transfer rates and complete data redundancy.
Weak Points	RAID 10 requires twice as many drives as all other RAID levels except RAID 1.
Drives	2n, where n is greater than 1.



RAID 30

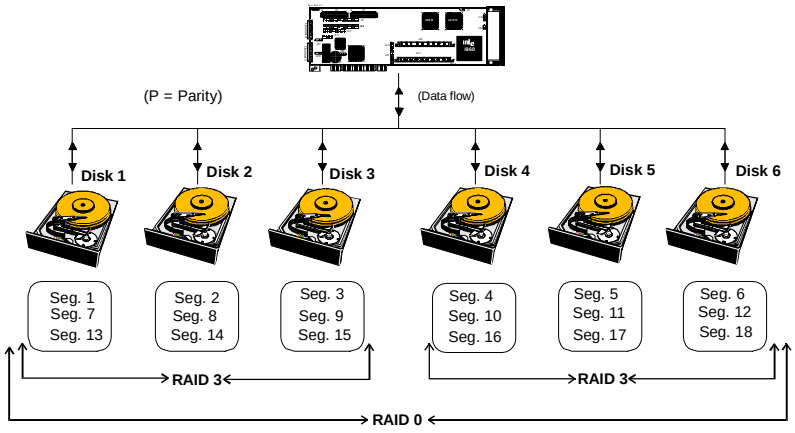
Raid 30 is a combination of RAID 0 and RAID 3. RAID 30 provides high data transfer speeds and high data reliability. RAID 30 is best implemented on two RAID 3 disk arrays with data striped across both disk arrays.

Uses RAID 30 works best when used with non-interactive applications that process large files sequentially, require fault tolerance, and also require high data transfer rates.

Strong Points Provides data reliability and high data transfer rates.

Weak Points RAID 30 is more complex than lower RAID levels and requires more drives.

Drives Six



RAID 50

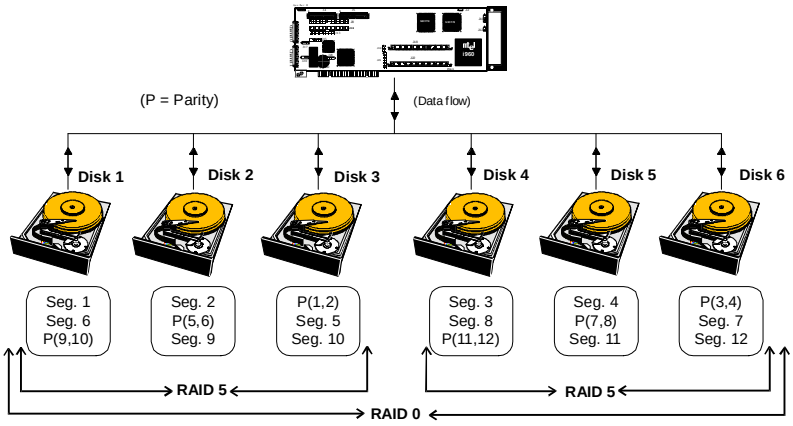
Raid 50 provides the features of both RAID 0 and RAID 5. RAID 50 includes both parity and disk striping across multiple drives. RAID 50 is best implemented on two RAID 5 disk arrays with data striped across both disk arrays.

Uses RAID 50 works best when used with data that requires high reliability, high request rates, and high data transfer performance requirements.

Strong Points RAID 50 provides high data throughput and data reliability.

Weak Points RAID 50 is more complex than other RAID levels and requires more drives.

Drives Six



Summary

This chapter described basic RAID concepts and terminology.

The MegaRAID controller features are described in Chapter 2.

2 MegaRAID Features

MegaRAID is a family of high performance intelligent PCI-to-SCSI host adapters with RAID control capabilities. Up to three SCSI channels are available on the controller. Each channel supports Fast and Wide SCSI, with data transfer rates of up to 20 MBs per channel. MegaRAID Ultra supports data transfer rates up to 40 MBs per SCSI channel. Each SCSI channel supports up to 15 Wide devices and up to seven non-Wide devices.

In This Chapter Topics described in this chapter include:

- configuration features,
- hardware architecture features,
- array performance features,
- RAID management features,
- fault tolerance features,
- utility programs, and
- software drivers.

SMART Technology

The MegaRAID Self Monitoring Analysis and Reporting Technology (SMART) detects up to 70% of all predictable drive failures. SMART monitors internal performance of all motors, heads, and drive electronics. You can recover from drive failures through FlexRAID remapping and online physical drive migration.

Hardware Requirements

MegaRAID can be installed in an IBM AT®-compatible or EISA computer with a motherboard that has 5 volt PCI expansion slots. The computer must support PCI version 2.0 or later. The computer should have an Intel Pentium, Pentium Pro, or more powerful CPU, a floppy drive, a color monitor and VGA adapter card, and a keyboard. A mouse is recommended.

Configuration Features

The MegaRAID configuration features include:

Specification	Feature
RAID Levels	RAID 0, RAID 1, RAID 3, RAID 5, RAID 10, RAID 30, and RAID 50.
SCSI Channels	1, 2, or 3
Maximum number of drives per channel	15
Array interface to host	PCI 2.1
Drive interface	Fast and Wide Ultra SE (SCSI 3)
Upgradable cache size	4 MB, 16 MB, 64 MB, or 128 MB
Cache Function	Write-through, write-back, ARA, NRA, RA
Multiple logical drives/arrays per controller	Up to 8 logical drives per controller
Maximum number of MegaRAID controller per system	6
Online capacity expansion	Yes
Online RAID level migration	Yes
Flashable firmware	Yes
Hot swap devices supported	Yes
Non-disk devices supported	Yes
Mixed capacity hard disk drives supported	Yes
Number of 16-bit internal connectors	3
Number of 16-bit external connectors	2 ultra high density
Internal 8-bit connectors	3
Support for hard disk drives with capacities of more than 8 GB.	Yes
Clustering support (Failover control)	Yes
Online RAID level migration	Yes
Power failure control in OCE and RLM	Yes
No reboot necessary after expansion	Yes
More than 200 Qtags per physical drive	Yes
User-specified programmable rebuild rate	Yes

Hardware Architecture Features

The MegaRAID hardware architecture features include:

Specification	Feature
Processor	Intel i960CA-33
SCSI Controller	Symbios Logic 53C770
AMI ASIC	MG9010
Size of Flash ROM	256 KB
Amount of NVRAM	8 KB
Hardware XOR assistance	Yes
Direct I/O	Yes
Removable battery backed cache memory module	Yes
SCSI bus termination	Automatic, active, single-ended
Single-sided SIMMs only	Yes
Auxiliary TermPWR source	Yes
Direct I/O bandwidth	66 MBs

Array Performance Features

The MegaRAID array performance features include:

Specification	Feature
Host data transfer rate	132 MBs
Drive data transfer rate	40 MBs
Maximum Scatter/Gathers	26 elements
Maximum size of I/O requests	6.4 MB in 64 KB stripes
Maximum Queue Tags per drive	211
Stripe Sizes	4 KB, 8 KB, 16 KB, 64 KB, or 128 KB
Maximum number of concurrent commands	255
Support for multiple initiators	Yes

RAID Management Features

The MegaRAID RAID management features include:

Specification	Feature
Support for SNMP	Yes
Performance Monitor provided	Yes
Remote control and monitoring	Yes
Event broadcast and event alert	Yes
Hardware connector	RS232C and DEC fault bus
Drive roaming	Yes
Support for concurrent multiple stripe sizes	Yes
Windows NT and NetWare server support via GUI client utility	Yes

Fault Tolerance Features

The MegaRAID fault tolerance features include:

Specification	Feature
Enclosure management	SAF-TE compliant
Drive failure detection	Automatic
Drive rebuild using hot spares	Automatic
Maximum operating time while on battery backup	72 hours
Monitoring temperature and voltage in battery backup module	Yes
Parity Generation and checking	Software and hardware

Software Utilities

The MegaRAID software utility features include:

Specification	Feature
Graphical user interface	Yes
Diagnostic utility	Yes
Management utility	Yes
Automatic r advanced RAID wizard configuration	Yes
Bootup configuration via MegaRAID Manager	Yes
Online Read, Write, and cache policy switching	Yes
Internet and intranet support through TCP/IP	Yes
works in heterogeneous environments	Yes

Operating System Software Drivers

The MegaRAID Controller runs under the following operating systems:

- MS-DOS version 3.2 or later (or the PC-DOS equivalent),
- Windows NT version v3.1, 3.5, 3.51, and 4.x,
- Novell NetWare 3.1x and 4.x,
- OS/2 2.x and OS/2 Warp v3.x,
- Banyan networks b6.x, 7.0 (5.54),
- Sun Solaris,
- NextStep,
- SCO UnixWare v2.0 and 2.01, and
- SCO Unix SVR4 ODT 3 and 5.

The DOS drivers for MegaRAID are contained in the firmware on MegaRAID except the DOS ASPI and CD-ROM drivers. In UnixWare, you must use BIOS Setup to configure drives Call American Megatrends technical support at 770-246-8645 for information about drivers for other operating systems.

MegaRAID Specifications

Parameter	Specification
Card Size	12.3" x 4.2" (full length PCI)
Processor	Intel i960CA™ 32-bit RISC processor @ 33 MHz
Bus Type	PCI 2.1
PCI Controller	Custom ASIC
Bus Data Transfer Rate	Up to 132 MBs
BIOS	AMIBIOS MegaRAID BIOS
Cache Configuration	4, 16, 64, or 128 MB through two banks using 70 ns × 36 (72-pin) SIMMs
Firmware	256 KB × 8 flash ROM
Nonvolatile RAM	8 KB × 8 for storing RAID configuration
Operating Voltage	5.00 V ± 0.25 V
SCSI Controller	Up to 3 SCSI controllers for Ultra and Wide support.
SCSI Data Transfer Rate	Up 40 MBs for MegaRAID Ultra GT.
SCSI Bus	Single-ended
SCSI Termination	Active
Termination Disable	Automatic through cable detection
Devices per SCSI Channel	Up to 15 wide or seven non-wide SCSI devices. Up to 6 non-disk SCSI drives per MegaRAID controller.
SCSI Device Types Supported	Synchronous or Asynchronous. Disk and non-disk.
RAID Levels Supported	0, 1, 3, 5,10, 30, and 50
SCSI Connectors	Two or three 68-pin internal high-density connectors for 16-bit SCSI devices. Two or three ultra-high density 68-pin external connector for Ultra and Wide SCSI.
Serial Port	9-pin RS232C-compatible berg
Battery Backup	Through plug-in module *(optional)*

Hardware Requirements

The MegaRAID controller can be installed in an IBM AT®-compatible or EISA computer with a motherboard that has 5 volt PCI expansion slots. The computer must support PCI version 2.0 or later. The computer should have an Intel 486, Pentium, Pentium Pro, or more powerful CPU, a floppy drive, a color monitor and VGA adapter card, and a keyboard. A mouse is recommended.

CPU

The MegaRAID controller uses the 32-bit Intel i960CF™ RISC processor running at 33 MHz. This processor directs all functions of the controller including command processing, PCI and SCSI bus transfers, RAID processing, drive rebuilding, cache management, and error recovery.

Cache Memory

The MegaRAID controller cache memory resides in two memory banks requiring 1 MB x 36, 4 MB x 36, 16 MB x 36, or 32 MB x 36 (72-pin) 70 ns industry standard SIMMs. The two SIMM banks are interleaved and use fast page mode. Possible configurations are 4 MB, 16 MB, 64 MB, or 128 MB of cache memory.

If using two SIMM banks, it is better to use the same-size SIMMs in both banks, but SIMMs of different memory capacities are supported. Otherwise, the total cache memory is set to twice the capacity of the smaller of the two SIMMs.

The MegaRAID controller supports write-through or write-back caching, selectable for each logical drive. To improve performance in sequential disk accesses, the MegaRAID controller uses read-ahead caching by default. You can disable read-ahead caching.

MegaRAID BIOS

The BIOS resides on a 256 KB × 8 flash ROM for easy upgrade. The MegaRAID BIOS supports INT 13h calls to boot DOS without special software or device drivers.

The MegaRAID BIOS provides an extensive setup utility that can be accessed by pressing <Ctrl> <M> at BIOS initialization. MegaRAID BIOS Setup is described in Chapter 5.

Custom ASIC

The MegaRAID ASIC (Application Specific Integrated Circuit) is an advanced RAID parity engine that provides PCI bus mastering with a burst data transfer rate of 132 MBs. The ASIC handles data transfer between the PCI bus, the cache, and the SCSI bus. This ASIC supports memory write and invalidate commands on the PCI bus. The ASIC also supports DMA chaining. A separate DRAM bus improves concurrent operation. It also performs RAID parity generation and parity checking in RAID levels 3, 5, 30, and 50. MegaRAID supports the PCI Version 2.1 specification. This ASIC delivers a sustained DTR of more than 50 MBs.

Onboard Speaker

The MegaRAID controller has an onboard tone generator for audible warnings when system errors occur. Audible warnings can be generated through this speaker. The audible warnings are listed later in this manual.

Serial Port

MegaRAID includes a 9-pin RS232C-compatible serial port berg connector, which can connect to communications devices and external storage devices.

SCSI Bus

MegaRAID has one, two, or three Fast and Wide SCSI channels that support single-ended devices with active termination. Both synchronous and asynchronous devices are supported. MegaRAID provides automatic termination disable via cable detection. Each channel supports up to 15 wide or seven non-wide SCSI devices at speeds up to 40 MBs per SCSI channel. MegaRAID supports up to six non-disk devices per controller.

SCSI Connectors

MegaRAID has two types of SCSI connectors:

- one to three 68-pin high density internal connectors and
- two 68-pin external ultra-high-density connectors for SCSI channels 1 and 2.

Up to two connector *types* at a time can be used for each channel.

SCSI Termination

MegaRAID uses active termination on the SCSI bus conforming to Alternative 2 of the SCSI-2 specifications. Termination enable/disable is automatic through cable detection.

SCSI Firmware

The MegaRAID firmware handles all RAID and SCSI command processing and also supports:

Feature	Description
Disconnect/ Reconnect	Optimizes SCSI Bus seek.
Tagged Command Queuing	Multiple tags to improve random access
Scatter/Gather	Multiple address/count pairs
Multi-threading	Up to 255 simultaneous commands with elevator sorting and concatenation of requests per SCSI channel
Stripe Size	Variable for all logical drives: 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB.
Rebuild	Multiple rebuilds and consistency checks with user-definable priority.

RAID Management

These utilities manage and configure the RAID system and MegaRAID, create and manage multiple disk arrays, control and monitor multiple RAID servers, provide error statistics logging, and provide online maintenance facilities. These utilities include:

- General Alert Module,
- FlexRAID,
- Power Console Client,
- MegaRAID BIOS Setup,
- Power Console, and
- MegaRAID Manager.

General Alert This optional utility informs you of system events and failure alerts by pager, program, fax, SNMP, network, audio, email, or native log. See the *General Alert Module Guide* for additional information.

FlexRAID The optional FlexRAID utility allows you reconfigure RAID systems by adding drives or changing RAID levels on-the-fly without bringing the system down.

Power Console Client Power Console Client (optional) allows you to manage and control RAID systems from any computer connected to the RAID server. See the *Power Console Client Guide* for additional information.

MegaRAID BIOS Setup BIOS Setup configures and maintains RAID arrays, formats disk drives, and manages the RAID system. BIOS Setup is independent of any operating system. See Chapter 5 for additional information.

Power Console Power Console runs in Windows NT. It configures, monitors, and maintains multiple RAID servers from any network node or a remote location. See Chapter 7 for additional information.

MegaRAID Manager MegaRAID Manager is a character-based utility that works in DOS, SCO Unix SVR3.2 Release 4.2, SCO UnixWare, OS/2 2.x and OS/2 Warp, Novell NetWare 3.x, and Novell NetWare 4.x.

Fault-Tolerance Features

The MegaRAID fault-tolerance features are:

- fault bus support,
- built-in serial communication interface,
- automatic failed drive detection,
- automatic failed drive rebuild with no user intervention required,
- hot swap manual replacement without bringing the system down,
- SAF-TE compliant enclosure management,
- optional battery backup module provides up to 72 hour data retention,
- battery-backed cache memory.

Fault Bus Support MegaRAID has a separate connector that transmits the following events from the disk subsystem to the host computer:

- host notification of device insertion and removal,
- host notification of fan and power supply failure, and
- fault isolation of failed device with visual indication.

For additional information on using the fault bus, contact American Megatrends technical support.

Detect Failed Drive The MegaRAID firmware automatically detects and rebuilds failed drives. This can be done transparently with hot spares.

Hot Swap MegaRAID supports the manual replacement of a disk unit in the RAID subsystem without system shutdown.

Battery-backed Cache An optional battery module (on a mezzanine card) is available to provide backup power for the cache in case of a power failure. This backup power prevents cache data loss. See the *MegaRAID Battery Backup Module Guide* for additional information.

Compatibility

MegaRAID compatibility issues include:

- server management,
- SCSI device compatibility, and
- software compatibility

Server Management As an SNMP agent, MegaRAID supports all SNMP managers and RedAlert from Storage Dimensions.

SCSI Device Compatibility MegaRAID supports SCSI hard disk drives, CD-ROMs, tape drives, optical drives, DAT drives and other SCSI peripheral devices. Appendix B lists the SCSI devices that have been tested with MegaRAID.

Software All SCSI backup and utility software should work with MegaRAID. Software that has been tested and approved for use with MegaRAID includes Cheyenne®, CorelSCSI®, Arcserve®, and Novaback®. This software is not provided with MegaRAID.

Clustering Support

American Megatrends provides OEM-optional firmware with multi-initiator support. This software provides high system availability by permitting server failover.

Summary

MegaRAID Features were discussed in this chapter.

Hardware installation is discussed in Chapter 3.

3 Hardware Installation

Requirements You must have the following items before installing the MegaRAID controller in a server:

- a MegaRAID Controller,
- a host computer with an available PCI expansion slot,
- the MegaRAID Installation diskettes,
- the necessary SCSI cables and terminators (depends on the number and type of SCSI devices to be attached),
- an Uninterruptible Power Supply (UPS) for the entire system, and
- Fast SCSI 2 or Wide SCSI hard disk drives and other SCSI devices, as desired.

Optional Equipment You may also want to install:

- the MegaRAID Battery Backup Module (highly recommended), and
- SCSI cables that interconnect MegaRAID to external SCSI devices,

Checklist

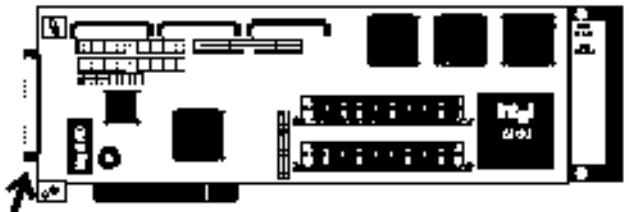
Perform the steps in the installation checklist:

Check	Step	Action
❑	1	Turn all power off to the server and all hard disk drives, enclosures, and system, components.
❑	2	Prepare the host system. See the host system technical documentation.
❑	3	Determine the SCSI ID and SCSI termination requirements.
❑	4	Make sure the jumper settings on the MegaRAID controller are correct. Install the cache memory, if necessary.
❑	5	Install the MegaRAID card in the server and attach the SCSI cables and terminators as needed. Make sure Pin 1 on the cable matches Pin 1 on the connector. Make sure that the SCSI cables you use conform to all SCSI specifications.
❑	6	Perform a safety check. Make sure all cables are properly attached. Make sure the MegaRAID card is properly installed. Turn power on after completing the safety check.
❑	7	Install and configure the MegaRAID software utilities and drivers.
❑	8	Format the hard disk drives as needed.
❑	9	Configure system drives (logical drives).
❑	10	Initialize the logical drives.
❑	11	Install the network operating system drivers as needed.

Identifying the MegaRAID Model

American Megatrends sells several MegaRAID controller models. Determine the MegaRAID controller model that you have purchased by examining the key features shown below:

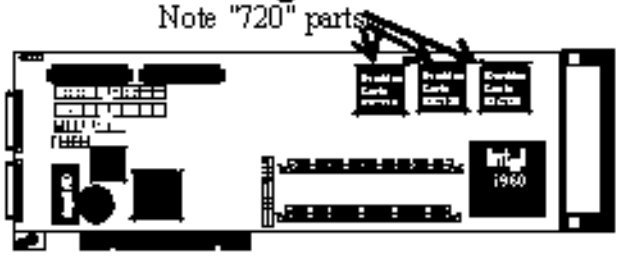
Series 412 MegaRAID Controller



Note single large SCSI connector.

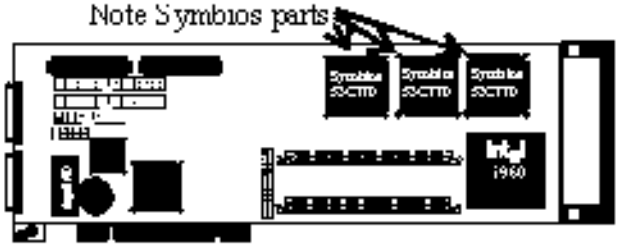
Series 418 MegaRAID Controller

Note "720" parts



Series 428 MegaRAID Controller

Note Symbios parts



Installation Steps

MegaRAID provides extensive customization options. If you need only basic MegaRAID features and your computer does not use other adapter cards with resource settings that may conflict with MegaRAID settings, even custom installation can be quick and easy.

Step	Action	Additional Information
1	Unpack the MegaRAID controller and inspect for damage. Make sure all items are in the package.	If damaged, call American Megatrends technical support at 770-246-8645.
2	Turn the computer off and remove the cover.	
3	Make sure the motherboard jumper settings are correct.	
4	Install cache memory on the MegaRAID card.	4 MB minimum cache memory is required.
5	Check the jumper settings on the MegaRAID controller.	See MegaRAID jumper settings.
6	Set SCSI termination.	
7	Set SCSI terminator power (TermPWR).	
8	Install the MegaRAID card.	
9	Connect the SCSI cables to SCSI devices.	
10	Set the target Ids for the SCSI devices.	
11	Install the battery backup for cache memory.	Optional.
12	Replace the computer cover and turn the power on.	Be sure the SCSI devices are powered up before or at the same time as the host computer.
13	Run MegaRAID BIOS Setup.	Optional.
14	Install software drivers for the desired operating systems.	

Each step is described in detail below.

Cont'd

Step 1 Unpack

Unpack and install the hardware in a static-free environment. The MegaRAID controller card is packed inside an anti-static bag between two sponge sheets. Remove the controller card and inspect it for damage. If the card appears damaged, or if any of items listed below are missing, contact American Megatrends Technical Support at 770-246-8645. The MegaRAID Controller is also shipped with:

- the *MegaRAID User's Guide*,
- the software license agreement,
- the MegaRAID Configuration Utilities diskette for DOS, and
- the warranty registration card.

Step 2 Power Down

Turn off the computer and remove the cover. Make sure the computer is turned off and disconnected from any networks before installing the controller card.

Step 3 Configure Motherboard

Make sure the motherboard is configured correctly for MegaRAID. MegaRAID is essentially a SCSI Controller. Each MegaRAID card you install will require an available PCI IRQ; make sure an IRQ is available for each controller you install.

Step 4 Install Cache Memory

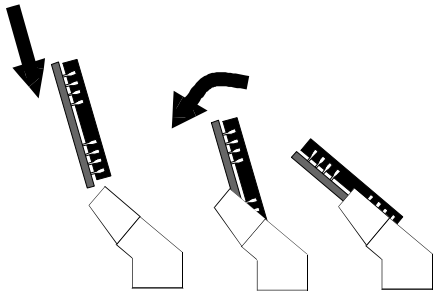
> ***Important***
>
> *A minimum of 4 MB of cache memory is required. The cache memory must be installed before MegaRAID is operational.*

SIMMs Tested with MegaRAID The following SIMMs have been thoroughly tested with MegaRAID:

Manufacturer	Model #	Capacity
IBM	B1D13600A-70	4 MB
IBM	B1D43600A-70	16 MB
PNY	P361000-70	4 MB
PNY	P364000-70	16 MB

Cont'd

Install cache memory (SIMMs) on the MegaRAID controller card. J22 is the Bank 0 SIMM socket and J18 is the Bank 1 SIMM socket. These sockets accept 72-pin SIMMs (× 36-type), available in 1MB × 36, 4 MB x 36, or 16 MB x 36 SIMMs. If only using one SIMM socket, use J22. If using both sockets, make sure that the two SIMMs are the same type and capacity. If SIMMs with different capacities are used, the cache size is twice the capacity of the *smaller* SIMM. Lay the controller card component-side up on a clean static-free surface and install the SIMMs. The SIMMs click into place, indicating proper seating in the socket, as shown below.



Supported Cache Memory Configurations

Bank 0	Bank 1	Total Cache Memory
1 MB × 36	Empty	4 MB
1 MB × 36	1 MB × 36	8 MB
4 MB × 36	Empty	16 MB
4 MB × 36	4 MB × 36	32 MB
16 MB × 36	Empty	64 MB
16 MB × 36	16 MB × 36	128 MB

Step 5 Set Jumpers

Make sure the jumper settings on the MegaRAID card are correct. The MegaRAID jumpers and connectors are:

Connector	Description	Type
J2	PCI Expansion BIOS Enable. The factory setting is Enabled (Jumpered).	two-pin header
J3	Auxiliary TermPWR for SCSI channels	four-pin connector
J4	Channel 1 Wide (16-bit) SCSI	68-pin connector
J5	Channel 2 Wide (16-bit) SCSI	68-pin connector
J6	Channel 3 Wide (16-bit) SCSI; *3-Channel Version Only*	68-pin connector
J7	Channel 3 TermPWR source. The factory setting is the PCI Bus (short Pins 1-2); *3-Channel Version Only*	three-pin header
J8	Channel 1 (8-bit) SCSI	50-pin connector
J9	Channel 3 (8-bit) SCSI; *3-Channel Version Only*	50-pin connector
J10	Disk Activity LED	four-pin connector
J11	Channel 2 (8-bit) SCSI	50-pin connector
J12	Dirty cache LED	two-pin connector
J13	Fault bus connector	26-pin connector
J15	Serial port connector	9-pin connector
J15	*(Series 412 MegaRAID only). Flash BIOS Programming Voltage Selector*	*3-pin header*
J16	*(Series 412 MegaRAID only). Optional External 120-pin SCSI connector*	*120-pin connector*
J26	External 68-pin high-density SCSI channel 2	68-pin connector
J27	External 68-pin high-density SCSI channel 1	68-pin connector
J17	Channel 2 TermPWR source. The factory setting is the PCI Bus (short Pins 1-2).	three-pin header
J18	Bank 1 (odd) SIMM socket	72-pin (× 36) socket
J19	Cache battery backup connector	eight-pin connector
J20	Channel 1 TermPWR source. The factory setting is the PCI Bus (short Pins 1-2).	three-pin header
J21	Cache battery backup connector	20-pin connector
J22	Bank 0 (even) SIMM socket	72-pin (x36) socket
J28	Chipset Selector	3-pin berg

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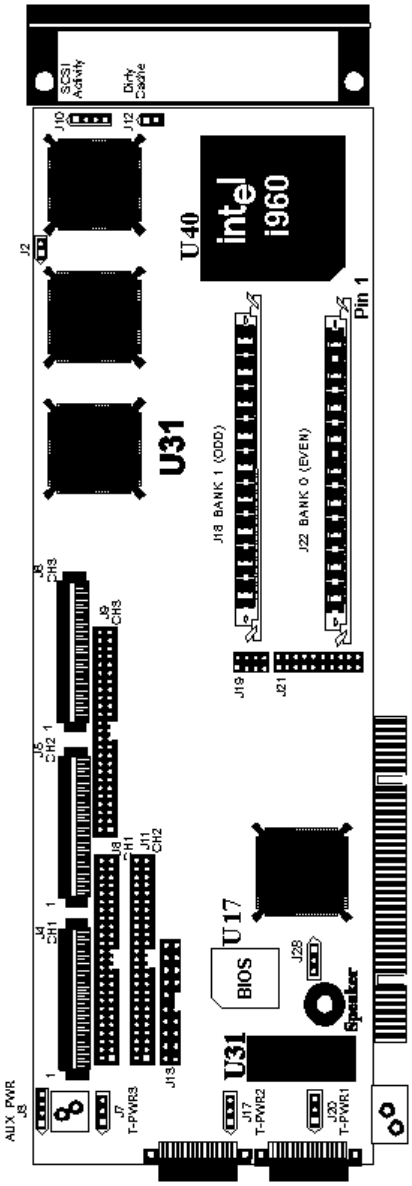
Three-Channel Series 418 MegaRAID Card Layout



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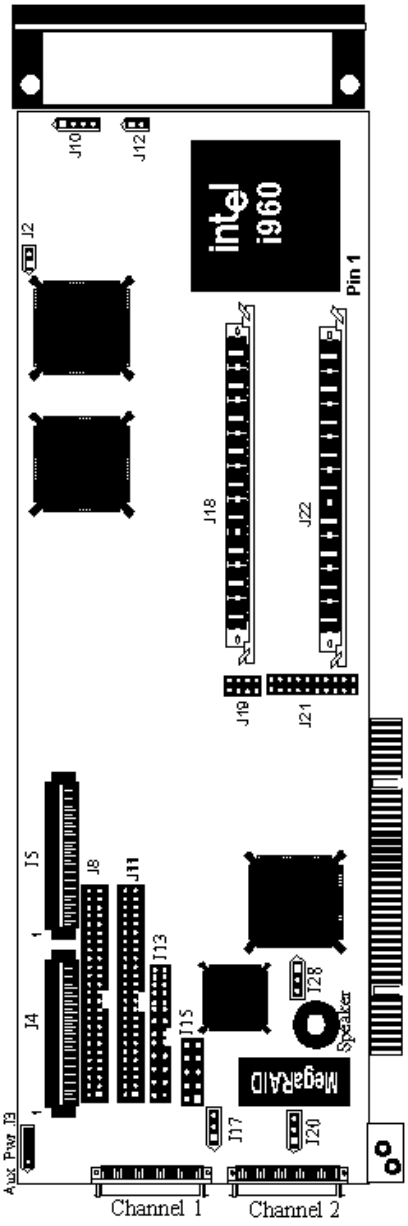
Series 418 2-Channel Card Layout



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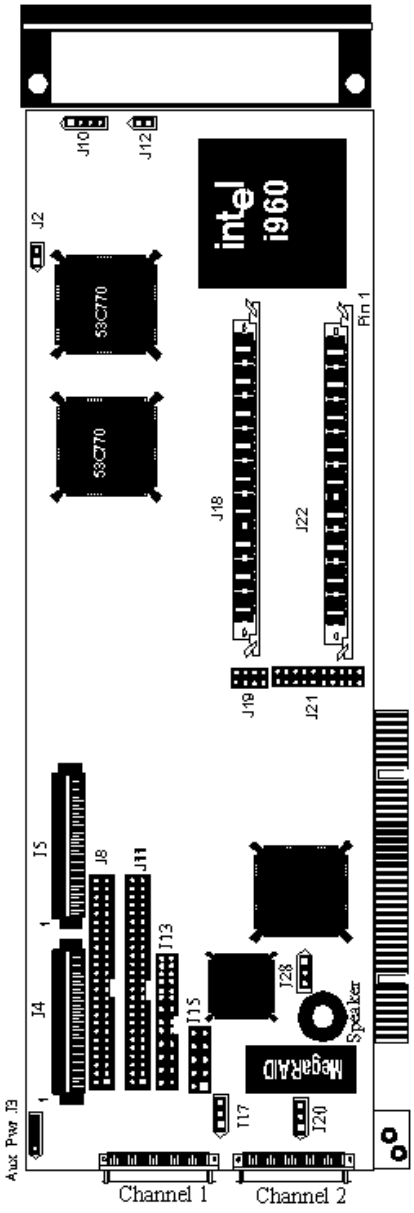
Series 428 MegaRAID Ultra 2-Channel Card Layout



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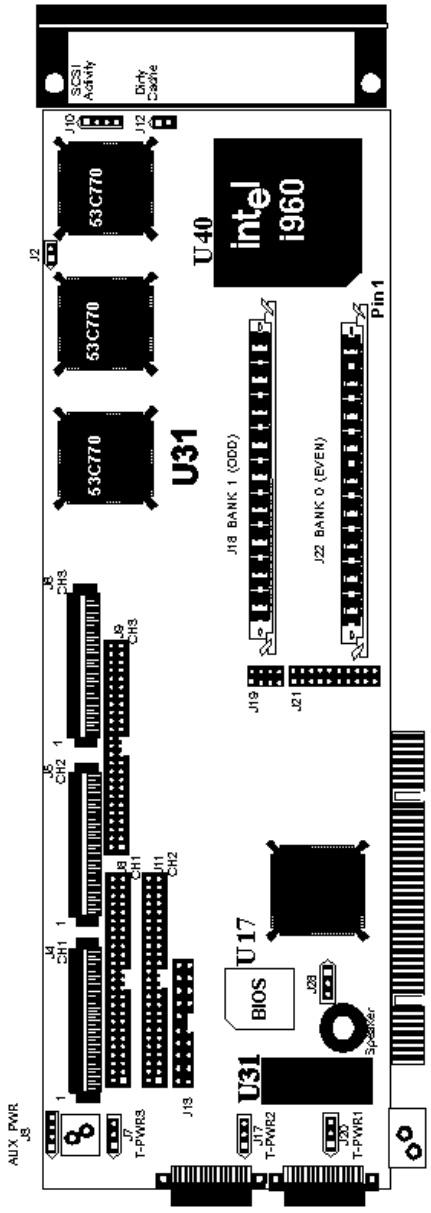
Series 428 MegaRAID Ultra 3-Channel Card Layout



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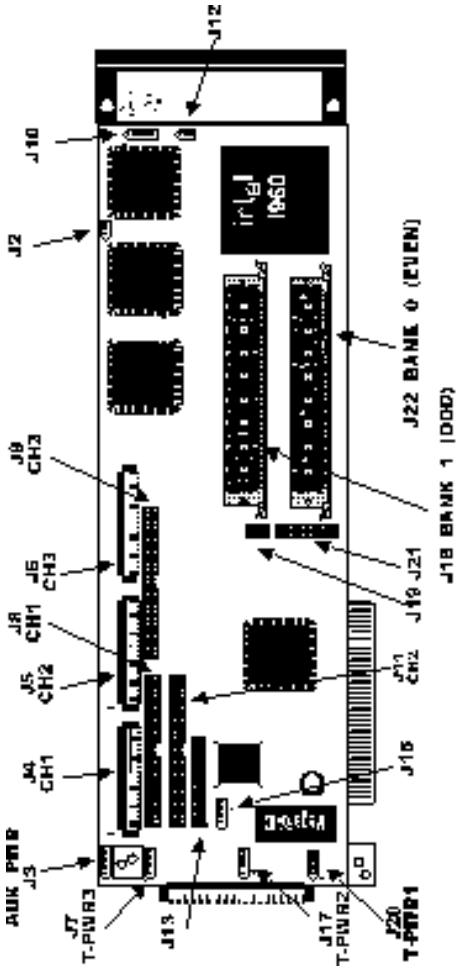
Step 5 Set Jumpers, Continued

Series 412 MegaRAID Card Layout



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J2 Expansion BIOS A jumper is installed on J2 at the factory, enabling the expansion BIOS. Remove the jumper (leave J2 OPEN) to disable the expansion BIOS. If more than one MegaRAID controller is installed in the host system, disable the expansion BIOS by removing the jumper from J2 on *all but one* of the MegaRAID cards. The MegaRAID controller that has the enabled expansion BIOS will handle all MegaRAID controllers in the host system.

J3 Auxiliary TermPWR J3 is the connector for an auxiliary SCSI terminator power (TermPWR) source. J3 accepts a four-pin Molex plug typically used for 3½" floppy disk drives. Use auxiliary TermPWR if:

- the SCSI device does not provide TermPWR,
- you have Wide termination on two or more channels, and
- you are using all three channels on a three-channel card with at least one channel having Wide termination.

Use this connector only when J7, J17, and/or J20 are configured for auxiliary-source SCSI TermPWR.

J16 Connector *J16 is an optional 120-pin SCSI connector only available with the Series 412 MegaRAID.* Attach the AMIRAID cable to J16. This cable allows you to connect three Fast and Wide channels.

> ***Caution***
> Any unused branch of the AMIRAID cable should be fitted with an active single-ended terminator.

AMIRAID Cable The AMIRAID cable must be ordered from American Megatrends at 800-828-9264:

Part Number	Description
CBLR368HD	120-pin to three 68-pin SCSI connectors.
CBLR350HD	120-pin to three high-density 50-pin SCSI connectors.
CBVLR350C	120-pin to three low-density 50pin SCSI connectors.

Cont'd

J7, J17, J20 TermPWR Source J7, J17, and J20 select the TermPWR source for each SCSI channel:

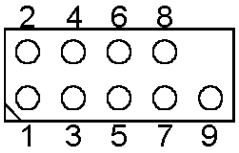
Jumper	TermPWR	Setting Options
J20	SCSI Channel 1	Short Pins 1-2 to have the PCI bus on the host computer provide TermPWR. This is the factory setting. Short Pins 2-3 to use the auxiliary power source (J3 to provide TermPWR). Leave Open to let the SCSI bus provide TermPWR.
J17	SCSI Channel 2	Short Pins 1-2 to have the PCI bus on the host computer provide TermPWR. This is the factory setting. Short Pins 2-3 to use the auxiliary power source (J3 to provide TermPWR). Leave Open to let the SCSI bus provide TermPWR.
J7	SCSI Channel 3	Short Pins 1-2 to provide TermPWR on the PCI bus in the host computer. This is the factory setting. Short Pins 2-3 to use the auxiliary power source (J3 to provide TermPWR). Leave Open to let the SCSI bus provide TermPWR.

J15 Flash BIOS J15 *(Only on the Series 412 MegaRAID*) controls Flash BIOS programming voltage:

J15 Pins	Description
Short Pins 1-2	Normal operation (5 volts).
Short Pins 2-3	12 volts for programming the Flash ROM. *Only short pins 2-3 when programming the Flash ROM.*

J15 Serial Port J15 is a 9-pin berg (Pin 10 is cut) that attaches to a serial cable. The J15 pinout is:

Pin	Signal Description	Pin	Signal Description
1	Carrier Detect	2	Data Set Ready
3	Receive Data	4	Request to Send
5	Transmit Data	6	Clear to b Send
7	Data Terminal Ready	8	Ring Indicator
9	Ground	10	CUT



Cont’d

J10 Hard Disk LED J10 Disk LED J10 is a four-pin connector for the hard disk LED mounted on the computer enclosure. The LED indicates data transfers on any SCSI Channel.

Pin	Description
1	High
2	SCSI Activity Signal
3	SCSI Activity Signal
4	High

J12 Dirty Cache LED J12 is a two-pin connector for an LED mounted on the computer enclosure. The LED indicates when the data in the cache has not yet to been written to the storage devices.

Pin	Description
1	High
2	Dirty Cache Signal

J28 Chipset Selector *J28 is only installed on Series 418 Rev A MegaRAID Controllers with ECN 418.01 implemented.* J28 is a 3-pin header. Specify if the host computer has a motherboard with an Intel Triton chipset, as follows:

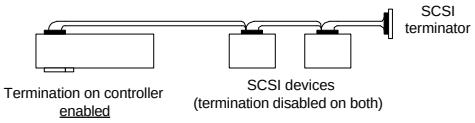
Pins Shorted	Description
Short Pins 1-2	No Intel Triton chipset. This is the factory setting.
Short Pins 2 - 3	Motherboard has Triton chipset.

You must also select the proper chipset in the MegaRAID BIOS Setup utility. The chipset selected must correspond to the J28 setting. Run MegaRAID BIOS Setup. Select *Objects*, then *Adapter*, then *Chipset Type*. Select the option that corresponds to the J28 setting:

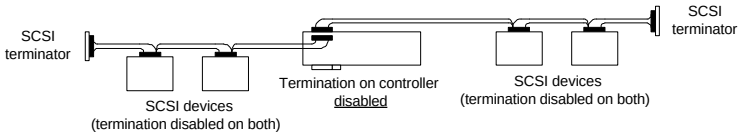
Menu option	J28 Setting
Intel Neptune/Mercury	Short pins 1 and 2
Intel Triton	Short pins 2 and 3
Others	Short pins 1 and 2

Step 6 Set Termination

You must terminate the SCSI bus properly. Set termination at both ends of the SCSI cable. The SCSI bus is an electrical transmission line and must be terminated properly to minimize reflections and losses. Termination should be set at each end of the SCSI cable(s), as shown below.



Setup using one connector for one channel



Setup using two connectors for one channel

If the MegaRAID controller is at one end of a cable for a specific channel, it sets termination automatically at that end. Otherwise, MegaRAID disables its own termination and you must set termination at the cable ends. If another connector on MegaRAID is also used for the same channel, the termination on MegaRAID is disabled automatically and termination should be set on the device at the farthest end of the cable.

For a disk array, set SCSI bus termination so that removing or adding a SCSI device does not disturb termination. An easy way to do this is to connect the MegaRAID card to one end of the SCSI cable for each channel and to connect an external terminator module at the other end of each cable. The connectors between the two ends can connect SCSI devices. Disable termination on the SCSI devices. See the manual for each SCSI device to disable termination. MegaRAID has three connectors for SCSI channels 1 and 2 and two connectors for channel 3 (if channel 3 is present). Use no more than two connectors per channel. If a third connector is used, it compromises SCSI bus impedance-matching.

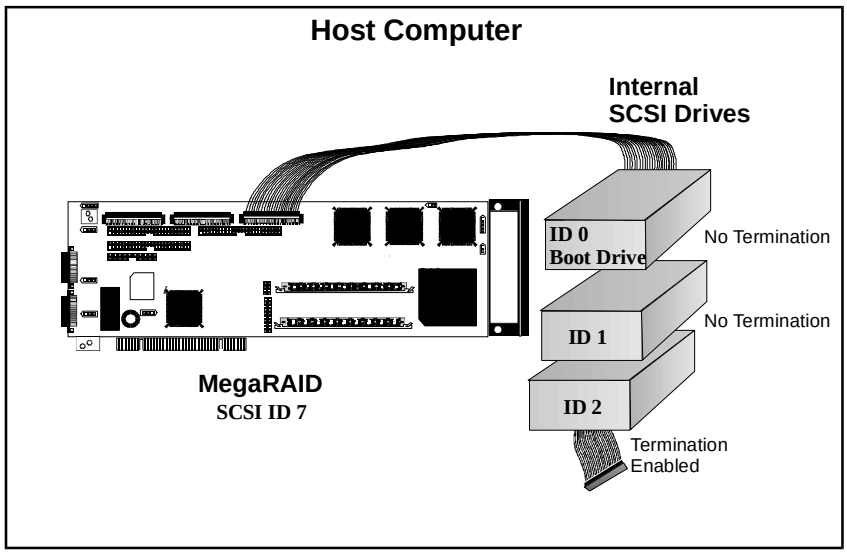
SCSI Termination

The SCSI bus on each SCSI channel is an electrical transmission line and it must be terminated properly to minimize reflections and losses. You complete the SCSI bus by setting termination at both ends.

You can let MegaRAID automatically provides SCSI termination at one end of the SCSI bus for each channel. You can terminate the other end of the SCSI bus by attaching an external SCSI terminator module to the end of the cable for each channel or by attaching a SCSI device that internally terminates the SCSI bus at the end of each SCSI channel.

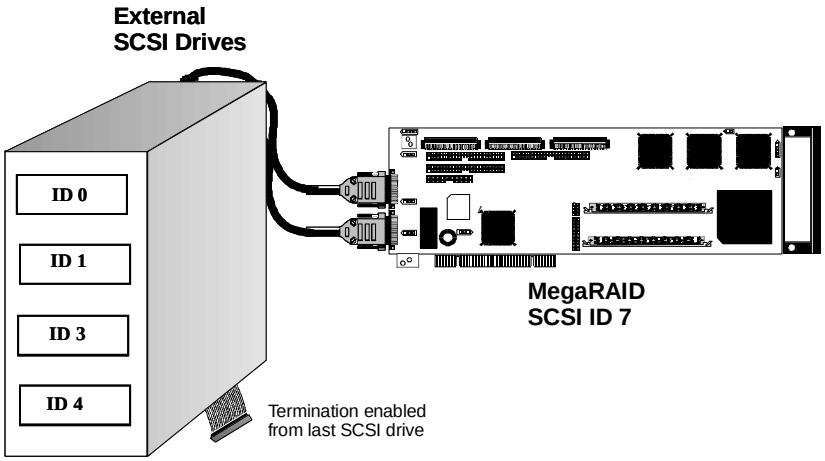
Selecting a Terminator Use ALT-2 type external SCSI terminators on SCSI channels operating at 10 MBs or higher synchronous data transfer.

Terminating Internal SCSI Disk Arrays Set the termination so that SCSI termination and termination power are intact when any disk drive is removed from a SCSI channel, as shown below:

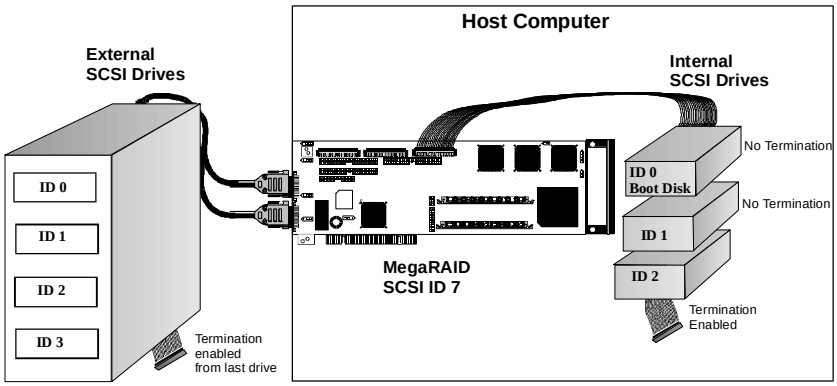


Cont'd

Terminating External Disk Arrays In most array enclosures, the end of the SCSI cable has an independent SCSI terminator module that is not part of any SCSI drive. In this way, SCSI termination is not disturbed when any drive is removed, as shown below:



Terminating Internal and External Disk Arrays You can use both internal and external drives with MegaRAID. You still must make sure that the proper SCSI termination and termination power is preserved, as shown below:

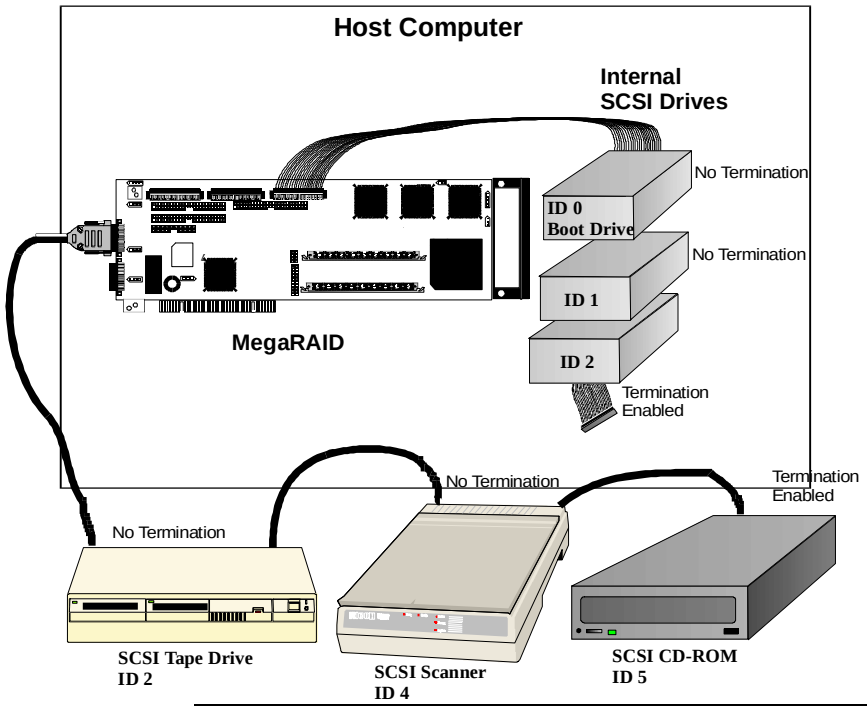


Cont'd

Connecting Non-Disk SCSI Devices SCSI Tape drives, scanners, CD-ROM drives, and other non-disk drive devices must each have a unique SCSI ID regardless of the SCSI channel they are attached to. The general rule for Unix systems is:

- tape drive set to SCSI ID 2,
- CD-ROM drive set to SCSI ID 5, and
- all non-disk SCSI devices attached to SCSI channel 0.

Make sure that no hard disk drives are attached to the same SCSI channel as the non-disk SCSI devices. Drive performance will be significantly degraded if SCSI hard disk drives are attached to this channel.



Step 7 Set SCSI Terminator Power

J20, J17, and J7 control TermPWR for the MegaRAID SCSI channels. See the documentation for each SCSI device for information about enabling TermPWR. The factory settings supply TermPWR from the PCI bus.

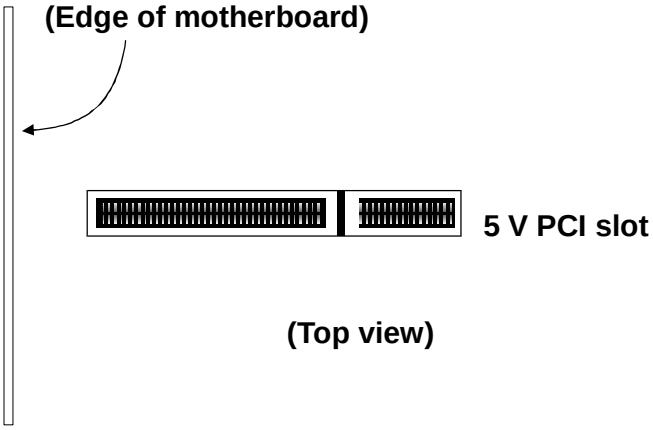
Important

All MegaRAID SCSI channels need TermPWR to operate. If a channel is not being used and no auxiliary power source is connected, change the jumper setting for that channel to supply TermPWR from the PCI bus.

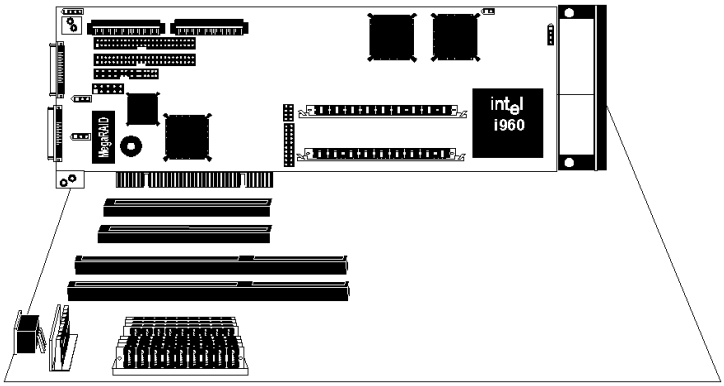
Auxiliary TermPWR Use auxiliary TermPWR if using Wide termination on two or more channels, or if using all three SCSI channels on a three-channel card with at least one channel using Wide termination. Use J3 as an auxiliary SCSI TermPWR source. J3 should be used in conjunction with J7, J17, and J20.

Step 8 Install MegaRAID

Choose a 5 V PCI slot and align the MegaRAID controller card bus connector to the slot. Press down gently but firmly to make sure that the card is properly seated in the slot. The bottom edge of the controller card should be flush with the slot.



Insert the MegaRAID card in a PCI slot as shown below:



Screw the bracket to the computer frame.

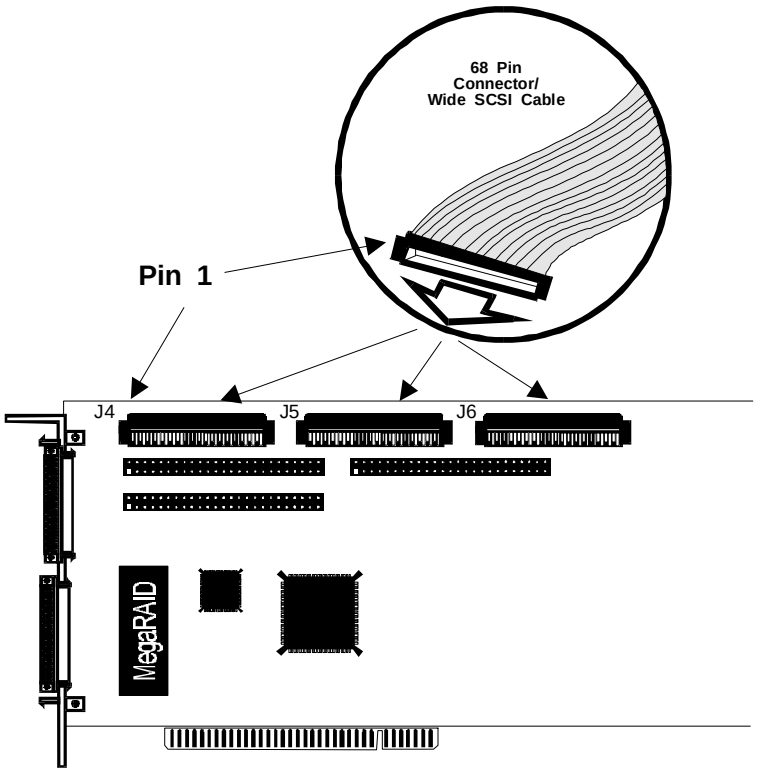
Step 9 Connect SCSI Cables

Connect the SCSI cables to the SCSI Devices. The MegaRAID controller provides three types of SCSI connectors:

J4 is the SCSI Channel 1 internal high-density 68-pin connector for Wide (16-bit) SCSI.

J5 is the SCSI Channel 2 internal high-density 68-pin connector for Wide (16-bit) SCSI.

J6 is the SCSI Channel 3 internal high-density 68-pin connector for Wide (16-bit) SCSI.



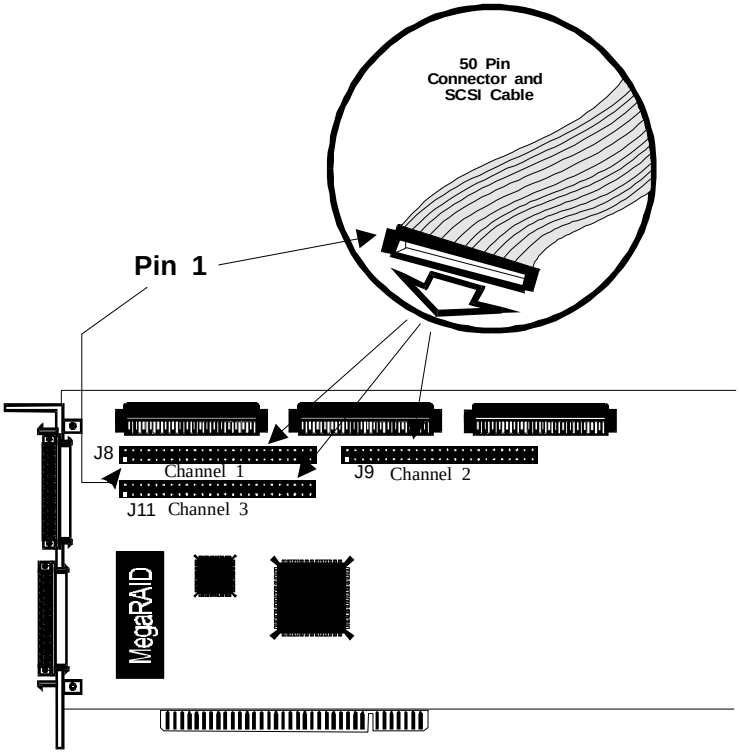
Cont'd

Step 9 Connect SCSI Cables, Continued

50-Pin SCSI Connectors J8 is the 50-pin internal 8 bit SCSI connector for SCSI channel 1.

J11 is the 50-pin internal 8-bit SCSI connector for SCSI channel 2.

J9 is the 50-pin internal 8-bit SCSI connector for SCSI channel 3.



Caution

Do not use more than two types of connectors for each SCSI channel.

Cont'd

J26 Channel 2 External Connector
J27 Channel 1 External Connector J26 and J27 are 68-pin ultra-high density external SCSI connectors. They are on the MegaRAID mounting bracket.

Connect SCSI Devices When connecting SCSI devices:

Action	Description
1	Disable termination on any SCSI device that does *not* sit at the end of the SCSI bus.
2	Configure all SCSI devices to supply TermPWR.
3	Set proper target IDs (TIDs) for all SCSI devices.
4	Distribute SCSI devices evenly across the SCSI channels for optimum performance.
5	The cable length should not exceed three meters for Fast and Wide SCSI (10 MBs) devices or 1.5 meters for Ultra (20 MBs) SCSI devices.
6	The cable length should not exceed six meters for non-Fast SCSI devices.
7	Try to connect all non-disk SCSI devices to a SCSI channel that has no SCSI disk drives connected to it.

Cable Suggestions System throughput problems can occur if SCSI cable use is not maximized. You should:

- use the shortest SCSI cables (no more than 3 meters),
- use active termination,
- avoid clustering the stubs,
- cable stub length should be no more than 0.1 meter (4 inches),
- route SCSI cables carefully,
- use high impedance cables,
- do not mix cable types (choose either flat or rounded and shielded or non-shielded), and
- ribbon cables have fairly good cross-talk rejection characteristics.

Step 10 Set Target IDs

Set target identifiers (TIDs) on the SCSI devices. Each device in a specific SCSI channel must have a unique TID in that channel. Non-disk devices (CD-ROM or tapes) should have unique SCSI IDs *regardless of the channel where they are connected*. See the documentation for each SCSI device to set the TIDs. The MegaRAID controller automatically occupies TID 7 in each SCSI channel. Eight-bit SCSI devices can only use the TIDs from 0 to 6. 16-bit devices can use the TIDs from 0 to 15. The arbitration priority for a SCSI device depends on its TID.

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

Important

Non-disk devices (CD-ROM or tapes) should have unique SCSI IDs regardless of the channel they are connected to.

Step 11 Connect Battery

The optional MegaRAID Battery Backup Module connects to J19 and J21.

Warning

Disconnect battery pack before removing or adding DRAM modules.

If power fails, the module provides backup power for the SIMM banks for a certain length of time depending on the capacity of the SIMMs.

Step 12 Power Up

Replace the computer cover and reconnect the AC power cords. Turn power on to the host computer. Set up the power supplies so 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, the MegaRAID BIOS message appears:

```
MegaRAID Disk Array Adapter BIOS Version x.xx date
Copyright (c) American Megatrends, Inc.
Firmware Initializing... [ Scanning SCSI Device …(etc.)… ]
```

The firmware takes several seconds to initialize. During this time the adapter will scan each SCSI channel. When it is ready, the following lines appear:

```
Host Adapter-1 Firmware Version x.xx DRAM Size 4 MB
0 Logical Drives found on the Host Adapter
0 Logical Drives handled by BIOS
Press <Ctrl><M> to run MegaRAID BIOS Configuration Utility
```

The <Ctrl> <M> prompt times out after several seconds.

The MegaRAID host adapter (controller) number, firmware version, and cache DRAM size are displayed in the second portion of the BIOS message. The numbering of the controllers follows the PCI slot scanning order used by the host motherboard.

Step 13 Run MegaRAID BIOS Setup

Press <Ctrl> <M> to run the MegaRAID BIOS Setup utility. You must configure the RAID subsystem. You can use any of the three configuration utilities. Only MegaRAID Manager allows you to set the chipset type. See Chapter 4 MegaRAID BIOS Setup for information about running BIOS Setup. Additional configuration information is provided in Chapter 5 MegaRAID Manager and Chapter 6 Power Console.

Step 14 Install Operating System Driver

Install the operating system drivers. For DOS, insert the MegaRAID DOS Utilities diskette in drive A (assuming A: is a 3½" drive) and type:

```
A:INSTALL
```

The MegaRAID ASPI driver can be used in the DOS, Windows 3.*x*, and Windows 95 environments. The DOS ASPI driver supports:

- up to six non-disk SCSI devices (each SCSI device must use a unique SCSI ID regardless of the SCSI channel it resides on - with the exception of SCSI ID = 0),
- up to four MegaRAID adapters, and
- virtual DMA services (VDS) for up to eight logical drives.

ASPI Driver *CorelSCSI, Novaback, and PC Tools are not provided with MegaRAID.*

Drivers	Devices Supported	Application Software	Features
MEGASPI.SYS	CD-ROM, tape, optical drives, etc.	CorelSCSI, Novaback, and PC Tools.	VDS

Copy MEGASPI.SYS to your hard disk drive. Add the following line to CONFIG.SYS:

```
device=<path>\MEGASPI.SYS /v
```

Parameters The MEGASPI.SYS parameters are:

Parameter	Description
/h	INT 13h support is not provided.
/v	Verbose mode. All message are displayed on the screen.
/q	Quiet mode. All message except error message are suppressed.

Cont'd

CD-ROM Driver A device driver is provided with MegaRAID for CD-ROM drives operating under DOS, Windows 3.*x*, and Windows 95. The driver filename is AMICDROM.SYS.

The MEGASPI.SYS ASPI manager must be added to the CONFIG.SYS file before you can install the CD-ROM device driver. See the instructions on the previous page for adding the MEGASPI.SYS driver. Copy AMICDROM.SYS to the root directory of the C: drive. Add the following line to CONFIG.SYS, making sure it is preceded by the line for MEGASPI.SYS:

```
DEVICE=C:\AMICDROM.SYS
```

Add the following to AUTOEXEC.BAT. Make sure it precedes the SMARTDRV.EXE line.

```
MSCDEX /D:MSCD001
```

MSCDEX is the CD-ROM drive extension file that is supplied with MS-DOS® and PC-DOS® Version 5.0 or later. See your DOS manual for the command line parameters for MSCDEX.

Summary

This chapter discussed hardware installation. The next chapter describes the MegaRAID BIOS Setup utility. You configure the RAID system via software configuration utilities. The utility programs for configuring MegaRAID are:

Configuration Utility	Operating System
MegaRAID BIOS Setup	independent of the operating system
MegaRAID Manager	DOS SCO UNIX SVR3.2 Novell NetWare 3.x, 4.x UnixWare
Power Console	Microsoft Windows NT

4 Configuring MegaRAID

Configuring SCSI Physical Drives

SCSI Channels Physical SCSI drives must be organized into logical drives. The drive groups and logical drives that you construct must be able to support the RAID level that you select.

Your MegaRAID adapter supports from one to three SCSI channels.

Distributing Drives If your MegaRAID adapter supports more than one SCSI channel, distribute the disk drives among all available channels for optimal performance.

MegaRAID supports SCSI CD-ROM drives, SCSI tape drives, and other SCSI devices as well as SCSI hard disk drives. For optimal performance, all non-disk SCSI devices should be attached to one SCSI channel.

Basic Configuration Rules You should observe the following guidelines when connecting and configuring SCSI devices in a RAID array:

- attach non-disk SCSI devices to a single SCSI channel that does not have any disk drives,
- distribute the SCSI hard disk drives equally among all available SCSI channels except any SCSI channel that is being reserved for non-disk drives,
- you can place up to seven physical disk drives in a drive group,
- a drive group can contain SCSI devices that are assigned to any channel,
- include all drives that have the same capacity to the same drive group,
- make sure any hot spare has a capacity that is at least as large as the largest drive that may be replaced by the hot spare, and
- when replacing a failed drive, make sure that the replacement drive has a capacity that is at least as large as the drive being replaced.

Configuration Plan

Write down the SCSI hard disk drive and SCSI device configuration on the following chart before you begin the hardware installation process:

SCSI ID	Device Description	Termination Enabled?
SCSI Channel 0		
0		
1		
2		
3		
4		
5		
6		
7		
SCSI Channel 1		
0		
1		
2		
3		
4		
5		
6		
7		
SCSI Channel 2		
0		
1		
2		
3		
4		
5		
6		
7		

Plan the System Configuration

Complete the following tables before you install the MegaRAID controller.

Logical Drive Configuration

Logical Drive	RAID Level	Stripe Size	Logical Drive Size	Cache Policy	Read Policy	Write Policy	# of Physical Drives
LD1							
LD2							
LD3							
LD4							
LD5							
LD6							
LD7							
LD8							

Cont’d

Physical Device Layout

Item	Channel 1	Channel 2	Channel 3
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			
Target ID			
Device Type			
Logical Drive Number/ Drive Number			
Manufacturer/Model Number			
Firmware level			

Configuring Drive Groups

Organize the physical disk drives in drive groups after the drives are connected to MegaRAID, formatted, and initialized. Each drive group can consist of one to seven physical disk drives.

MegaRAID supports up to 8 drive groups. The number of drives in a drive group determines the RAID levels that can be supported.

Arranging Drive Groups You must arrange the drive groups to provide additional organization for the drive array. You must arrange drive groups so that you can create system drives that can function as boot devices.

You can sequentially arrange drive groups with an identical number of drives so that the drives in the group are spanned. Spanned drives can be treated as one large drive. Data can be striped across the entire drive group in this way.

You can create spanned drives by using the MegaRAID BIOS Setup utility (see Chapter 4) or the MegaRAID Manager (see Chapter 5).

Creating Hot Spares Any drive that is present, formatted, and initialized but is not included in a drive group or logical drive is automatically designated as a hot spare.

You can also designate drives as hot spares via MegaRAID BIOS Setup (see Chapter 4), the MegaRAID Manager (see Chapter 5), or Power Console (see Chapter 6).

Creating System Drives System drives are the logical drives that are presented to the operating system. You must create one or more logical drives.

The logical drive capacity can include all or any portion of a drive group. The logical drive capacity can also be larger than a drive group. MegaRAID supports up to 8 logical drives.

Assigning RAID Levels

Only one RAID level can be assigned to each logical drive. The drives required per RAID level is:

RAID Level	Minimum Number of Physical Drives	Maximum Number of Physical Drives
0	One	Seven
1	Two	Two
3	Three	Seven
5	Three	Seven
10	Six	Seven
30	Six	Seven
50	Six	Seven

Configuration Strategies

The most important factors in RAID array configuration are: drive capacity, drive availability (fault tolerance), and drive performance.

Unfortunately, you cannot configure a logical drive that optimizes drive capacity, drive availability (fault tolerance), and drive performance. It is relatively easy to choose a logical drive configuration that maximizes one factor at the expense of the other two factors, but your needs are seldom that simple.

Maximize Capacity You can achieve maximum disk drive capacity with RAID 0, but RAID 0 does not provide data redundancy. The drive capacity for each RAID level is shown below. D is the number of drives. N is the drive capacity.

RAID Level	Effective Total Drive Capacity	Example
0	D*N	Two 5 GB drives would provide 10 GB.
1	(D*N)/2	Two 5 GB drives would provide 5 GB.
3	(D-1)*N	Three 5 GB drives would provide 10 GB.
5	(D-1)*N	Three 5 GB drives would provide 10 GB.
10	(D*N)/2	Two 5 GB drives would provide 5 GB.
30	(D-1)*N	Six 5 GB drives would provide 20 GB.
50	(D-1)*N	Six 5 GB drives would provide 20 GB.

Cont'd

Maximizing Drive Availability You can maximize the availability of data on the physical disk drive in the logical array by maximizing the level of fault tolerance. The levels of fault tolerance provided by the RAID levels are:

RAID Level	Fault Tolerance Protection
0	No fault tolerance.
1	Disk mirroring, which provides 100% data redundancy.
3	100% protection through a dedicated parity drive.
5	100% protection through striping and parity. The data is striped and parity data is written across a number of physical disk drives.
10	100% protection through data mirroring.
30	100% protection through data striping. All data is striped across all drives in two or more arrays.
50	100% protection through data striping and parity. All data is striped and parity data is written across all drives in two or more arrays.

Maximizing Drive Performance You can configure an array for optimal performance. But optimal drive configuration for one type of application will probably not be optimal for any other application. A basic guideline of the performance characteristics for RAID drive arrays at each RAID level is:

RAID Level	Performance Characteristics
0	Excellent for all types of I/O activity, but provides no data security.
1	Excellent for write-intensive applications.
3	Excellent for write-intensive applications.
5	Excellent for sequential read operations and sequential write operations. Also good for random read operations.
10	Excellent for all types of I/O activity and RAID 10 provides data security.
30	Good for write-intensive applications and RAID 30 provides excellent data security.
50	Good for write-intensive applications and RAID 50 provides excellent data security.

Configuring Logical Drives

After you have installed the MegaRAID controller in the server and have attached all physical disk drives, perform the following actions to prepare a RAID disk array:

Step	Action
1	Optimize the MegaRAID controller options for your system. See Chapter 3 for additional information.
2	Perform a low-level format the SCSI drives that will be included in the array and the drives to be used for hot spares.
3	Press <Ctrl> <M> to run the MegaRAID Manager.
4	Define and configure one or more logical drives. Select Easy Configuration in MegaRAID Manager or select New Configuration to customize the RAID array.
5	Create and configure one or more system drives (logical drives). Select the RAID level, cache policy, read policy, and write policy.
6	Save the configuration.
7	Initialize the system drives. After initialization, you can install the operating system.

Optimizing Data Storage

Data Access Requirements Each type of data stored in the disk subsystem has a different frequency of read and write activity. If you know the data access requirements, you can more successfully determine a strategy for optimizing the disk subsystem capacity, availability, and performance.

Servers that support Video on Demand typically read the data often, but write data infrequently. Both the read and write operations tend to be long. Data stored on a general-purpose file server involves relatively short read and write operations with relatively small files.

Array Functions You must first define the major purpose of the disk array. Will this disk array increase the system storage capacity for general-purpose file and print servers? Does this disk array support any software system that must be available 24 hours per day? Will the information stored in this disk array contains large audio or video files that must be available on demand? Will this disk array contain data from an imaging system?

You must identify the purpose of the data to be stored in the disk subsystem before you can confidently choose a RAID level and a RAID configuration.

Planning the Array Configuration

Answer the following questions about this array:

Question	Answer
Number of MegaRAID SCSI channels	
Number of physical disk drives in the array	
Purpose of this array. Rank the following factors:	
Maximize drive capacity	
Maximize the safety of the data (fault tolerance)	
Maximize hard drive performance and throughput	
How many hot spares?	
Have you installed the MegaRAID Battery Backup Module?	
Amount of cache memory installed on the MegaRAID	
Are all of the disk drives and the server that MegaRAID is installed in protected by a UPS?	

Using the Array Configuration Planner The following table lists the possible RAID levels, fault tolerance, and effective capacity for all possible drive configurations for an array consisting of one to seven drives.

The following table does not take into account any hot spare (standby) drives. You should always have a hot spare drive in case of drive failure.

RAID 1 and RAID 10 require a multiple of 2 drives. RAID 30 and RAID 50 require at least 6 drives.

Array Configuration Planner

Number of Drives	Possible RAID Levels	Relative Performance	Fault Tolerance	Effective Capacity
1	None	Excellent	No	100%
1	RAID 0	Excellent	No	100%
2	None	Excellent	No	100%
2	RAID 0	Excellent	No	100%
2	RAID 1	Good	Yes	50%
2	RAID 10	Good	Yes	50%
3	None	Excellent	No	100%
3	RAID 0	Excellent	No	100%
3	RAID 1	Good	Yes	50%
3	RAID 3	Good	Yes	50% - 80%
3	RAID 5	Good	Yes	50% - 80%
4	None	Excellent	No	100%
4	RAID 0	Excellent	No	100%
4	RAID 1	Good	Yes	50%
4	RAID 3	Good	Yes	50% - 80%
4	RAID 5	Good	Yes	50% - 80%
4	RAID 10	Good	Yes	50%
5	None	Excellent	No	100%
5	RAID 0	Excellent	No	100%
5	RAID 3	Good	Yes	50% - 80%
5	RAID 5	Good	Yes	50% - 80%
6	None	Excellent	No	100%
6	RAID 0	Excellent	No	100%
6	RAID 1	Good	Yes	50%
6	RAID 3	Good	Yes	50% - 80%
6	RAID 5	Good	Yes	50% - 80%
6	RAID 10	Good	Yes	50% - 80%
6	RAID 30	Good	Yes	50% - 80%
6	RAID 50	Good	Yes	50% - 80%
7	None	Excellent	No	100%
7	RAID 0	Excellent	No	100%
7	RAID 3	Good	Yes	50% - 80%
7	RAID 5	Good	Yes	50% - 80%
7	RAID 30	Good	Yes	50% - 80%
7	RAID 50	Good	Yes	50% - 80%

5 MegaRAID BIOS Setup

Overview

The MegaRAID BIOS Setup utility configures disk arrays and logical drives. Since the utility resides in the MegaRAID BIOS, its operation is independent of the operating systems on your computer.

In This Chapter The topics discussed in this chapter include:

- starting BIOS Setup,
- BIOS Setup menus,
- choosing a configuration method,
- designating drives as hot spares,
- creating physical arrays,
- defining logical drives,
- initializing logical drives,
- using logical drives in your operating system, and
- rebuilding failed disk drives, and
- using a pre-loaded SCSI drive as-is.

Starting MegaRAID BIOS Setup

When the host computer boots, hold the <Ctrl> key and press the <M >key when the following appears:

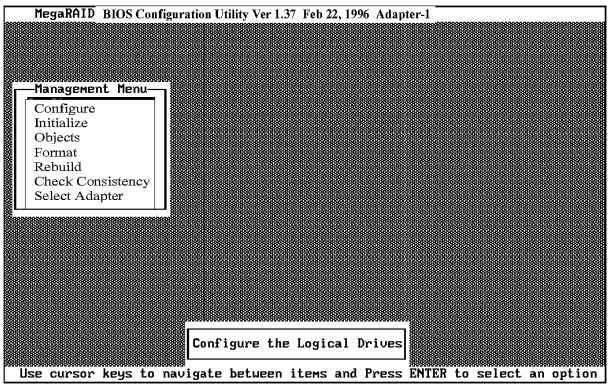
```
Host Adapter-1 Firmware Version x.xx DRAM Size 4 MB
0 Logical Drives found on the Host Adapter
0 Logical Drives handled by BIOS
Press <Ctrl><M> to run MegaRAID BIOS Configuration Utility
```

For each MegaRAID adapter in the host system, the firmware version, DRAM size, and the status of logical drives on that adapter is displayed.

If you do not press <Ctrl> <M> within a few seconds of the prompt, the computer continues the normal boot procedure.

Cont'd

When you press <Ctrl> <M>, the following will be displayed:



BIOS Setup Menu Options The BIOS Setup menu options:

Option	Description
Configure	Choose this option to configure physical arrays and logical drives.
Initialize	Choose this option to initialize one or more logical drives.
Objects	Choose this option to individually access controllers, logical drives, and physical drives.
Format	Choose this option to low-level format hard disk drives.
Rebuild	Choose this option to rebuild failed disk drives.
Check Consistency	Choose this option to verify that the redundancy data in logical drives using RAID level 1, 3, or 5 is correct.
Select Adapter	Choose this option to select a MegaRAID host adapter to work on.

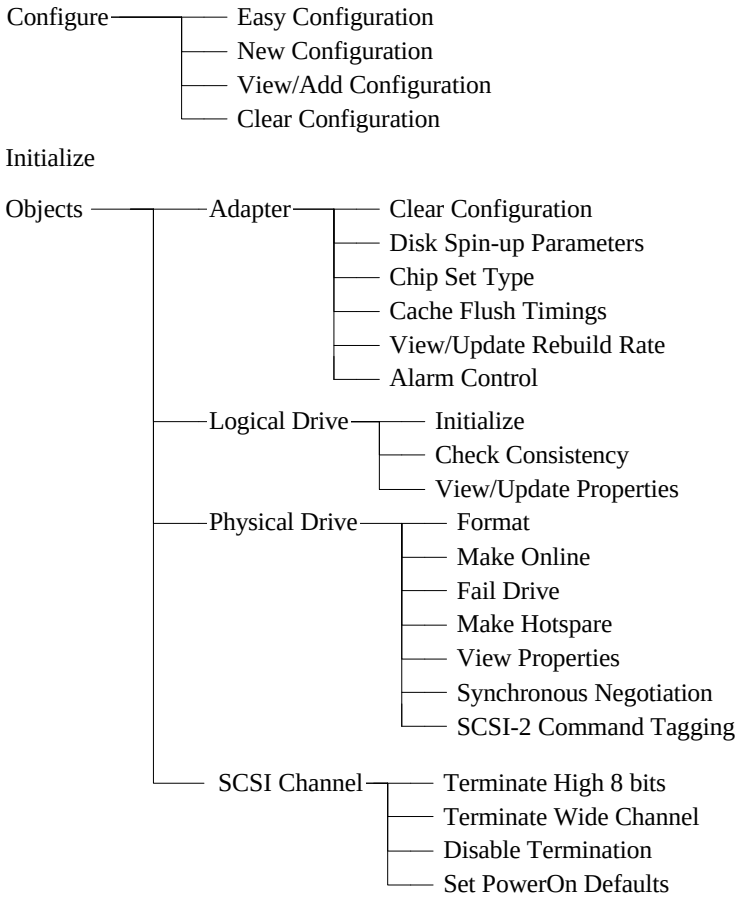
If Using MegaRAID BIOS Setup

To...	Use this menu
configure arrays and logical drives	Configure
initialize logical drives	Initialize
rebuild a disk drive	Rebuild
format a disk drive	Format
use a pre-loaded SCSI drive as-is	Configure

For information about other functions, see the following menu tree and menu descriptions.

MegaRAID BIOS Setup Menu Tree

The following is an expansion of the menus in the MegaRAID BIOS Setup.



The menu items are explained on the following pages.

BIOS Setup Configure Menu

Configure Choose the Configure option to select a method for configuring arrays and logical drives.

Option	Description
Easy Configuration	Select this method to perform a basic logical drive configuration where every physical array you define is automatically associated with exactly one logical drive.
New Configuration	Select this method to discard the existing configuration information and to configure new arrays and logical drives. In addition to providing the basic logical drive configuration functions, New Configuration allows you to associate logical drives with multiple or partial arrays.
View/Add Configuration	Select this method to examine the existing configuration and/or to specify additional arrays and logical drives. View/Add Configuration provides the same functions available in New Configuration.
Clear Configuration	Select this option to erase the current configuration information from the MegaRAID controller non-volatile memory.

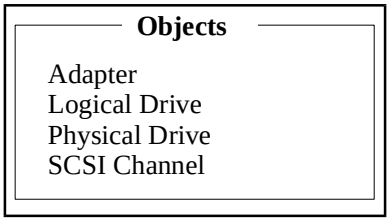
BIOS Setup Initialize Menu

Initialize Choose this option from the BIOS Setup main menu to initialize one or more logical drives. This action typically follows the configuration of a new logical drive. See page 107 for additional information.

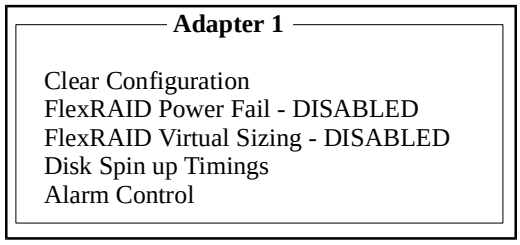
> ***Warning***
>
> Initializing a logical drive destroys all data on the logical drive.

BIOS Setup Objects Menu

Objects Choose the Objects option from the BIOS Setup main menu to access the controllers, logical drives, physical drives, and SCSI channels individually. You can also change settings for each object. The Objects menu options are:



Adapter Choose *Adapter* from the Objects menu to select a MegaRAID controller (if the computer has more than one) and to modify parameters.



The menu options are explained below.

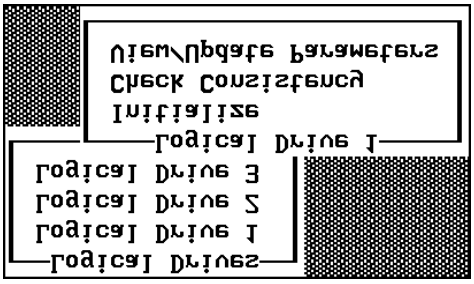
Cont'd

BIOS Setup Objects Menu, Continued

Adapter, cont'd The Objects/Adapter menu options are:

Option	Description
Clear Configuration	Choose this option to erase the current configuration from the controller non-volatile memory.
Disk Spin-Up Timings	Choose this option to set the method and timing for spinning up the hard disk drives in the computer.
Chip Set Type	Choose this option to program the MegaRAID controller for a specific motherboard chip set type, such as Intel Neptune, Intel Saturn, or other chip set.
Cache Flush Timings	Choose this option to set the cache flush interval to once every 2, 4, 6, 8, or 10 seconds.
Rebuild Rate	Choose this option to display the firmware version number. You can also change the rebuild rate for the adapter.
Alarm Control	Choose this option to enable, disable, or silence the onboard alarm tone generator.

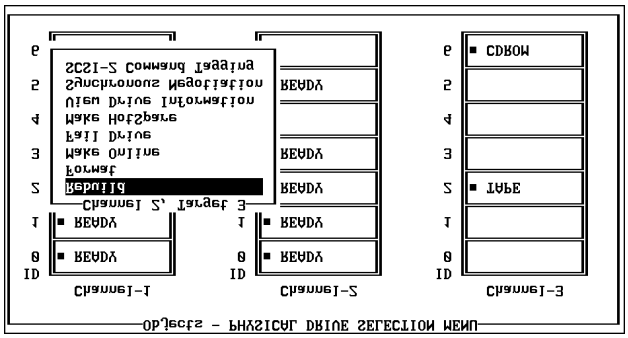
Logical Drive Choose this option from the BIOS Setup Objects menu to select a logical drive and to perform the listed actions.



Logical Drive options	Description
Initialize	Initializes the selected logical drive. Do this for every logical drive that is configured.
Check Consistency	Verifies the correctness of the redundancy data in the selected logical drive. This option is only available if RAID level 1, 3, or 5 is used.
View/Update Parameters	Displays the properties of the selected logical drive. You can modify the cache write policy, the Read policy, and the I/O policy from this menu.

Cont'd

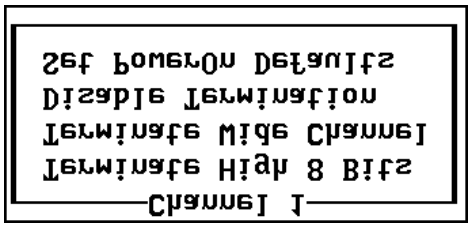
Physical Drive Choose this option from the BIOS Setup Objects menu to select a physical device and to perform the operations listed in the table below. The physical hard disk drives in the computer are listed. Move the cursor to the desired device and press <Enter> to display the following:



Physical Drive Options	Description
Rebuild	Choose this option to rebuild the selected disk drive.
Format	Choose this option to low-level format the selected disk drive.
Make Online	Choose this option to change the state of the selected disk drive to Online.
Fail Drive	Choose this option to change the state of the selected disk drive to Fail.
Make HotSpare	Choose this option to designate the selected disk drive as a hot spare.
View Drive Information	Choose this option to display the manufacturer data for the selected physical device.
Synchronous Negotiation	Choose this option to enable or disable synchronous negotiation for the selected physical device. The default is Enabled.
SCSI-2 Command Tagging	Choose this option to set the number of queue tags per command to 2, 3, or 4, or to disable command tagging. The default setting is 4 queue tags.

Cont'd

SCSI Channel Choose this option from the BIOS Setup Objects menu to select a SCSI channel on the currently selected controller. You can perform the following operations on the selected channel.



Channel Options	Description
Terminate High 8 Bits	Choose this option to enable termination on the selected channel for the upper eight bits and disable termination on the controller for the lower eight bits. This setting is required if the selected SCSI channel is terminated with 8-bit devices at both ends.
Terminate Wide Channel	Choose this option to enable Wide termination for the selected channel. This is required if the MegaRAID controller is at one end of the SCSI bus for the selected channel.
Disable Termination	Choose this option to disable termination on the MegaRAID controller for the selected channel. This option should be used if the selected SCSI channel is terminated with Wide devices at both ends.
Set PowerOn Defaults	Choose this option to have the MegaRAID controller examine its SCSI channels and to set its termination automatically.

BIOS Setup Format Menu

Format Choose the Format option from the BIOS Setup main menu to low-level format one or more physical drives.

> ***Warning***
> Formatting a hard drive destroys all data on the drive.

Formatting Since most SCSI disk drives are low-level formatted at the factory, this step is usually not necessary. You must format a disk only if:

- the disk drive was not low-level formatted at the factory, or
- an excessive number of media errors have been detected on the disk drive.

You do not have to choose Format to erase existing information on your SCSI disks, such as a DOS partition. That information is erased when you initialize the logical drive(s).

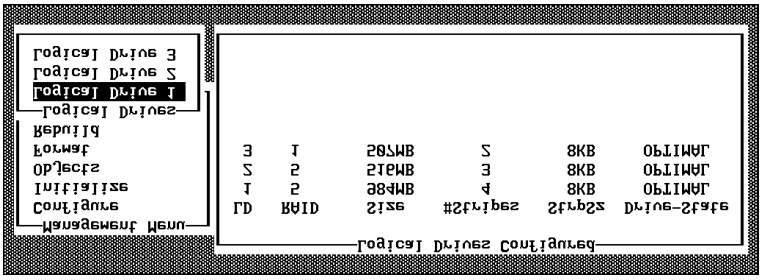
BIOS Setup Rebuild Menu

Rebuild Choose the Rebuild option from the BIOS Setup main menu to rebuild one or more failed disk drives.

BIOS Setup Check Consistency Menu

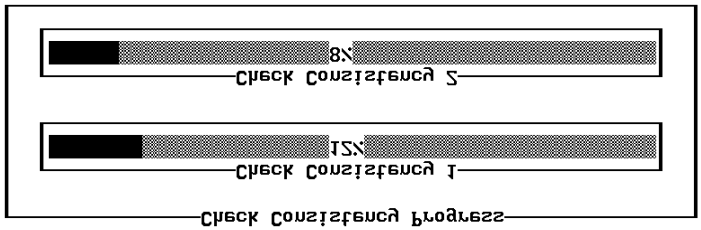
Check Consistency Choose this option to verify the redundancy data in logical drives that use RAID levels 1, 3, or 5.

When you choose Check Consistency, the parameters of the existing logical drives on the current controller and a selection menu listing the logical drives by number appear. If a discrepancy is found, it is automatically corrected, assuming always that the data is correct. However, if the failure is a read error on a data drive, the bad data block is reassigned with the generated data (to a corresponding data block on another data drive or to a corresponding parity block).



Press the arrow keys to choose the desired logical drives. Press the spacebar to select or deselect a drive for consistency checking. Press <F2> to select or deselect all the logical drives.

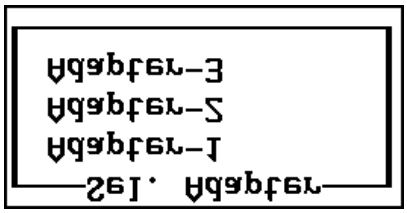
Press <F10> to begin the consistency check. A progress indicator for each selected logical drive is displayed.



When the consistency check is finished, press any key to clear the progress display and press <Esc> to display the main menu.

BIOS Setup Select Adapter Menu

This menu item appears only if more than one MegaRAID host adapter is installed in the computer. The following appears when you choose the Select Adapter option:



Select the MegaRAID adapter that you want to configure from this menu.

Configuring Arrays and Logical Drives

You can configure physical arrays and logical drives with MegaRAID BIOS Setup using:

- Easy Configuration,
- New Configuration, or
- View/Add Configuration.

Each configuration method requires a different level of user input. The general flow of operations for array and logical drive configuration is:

Step	Action
1	Choose a configuration method.
2	Designate hot spares (optional).
3	Create arrays using the available physical drives.
4	Define logical drives using the space in the arrays.
5	Save the configuration information.
6	Initialize the new logical drives.

Choosing the Configuration Method

Easy Configuration In Easy Configuration, each physical array you create is associated with exactly one logical drive, and you can modify the following parameters:

- RAID level,
- stripe size,
- cache write policy,
- Read policy, and
- I/O policy.

If logical drives have already been configured when you select Easy Configuration, the configuration information is not disturbed.

New Configuration In New Configuration, you can modify the following logical drive parameters:

- RAID level,
- stripe size,
- cache write policy,
- Read policy,
- I/O policy,
- logical drive size, and
- spanning of arrays.

If you select New Configuration, the existing configuration information on the selected controller is *destroyed when the new configuration is saved*.

View/Add Configuration View/Add Configuration allows you to control the same logical drive parameters as New Configuration *without disturbing* the existing configuration information

Designating Drives as Hot Spares

Hot Spares

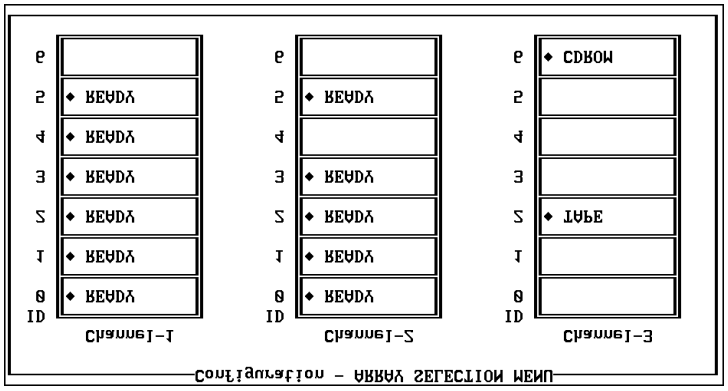
Hot spares are physical drives that are powered up along with the RAID drives and usually stay in a standby state. If a disk drive used in a RAID logical drive fails, a hot spare will automatically take its place and the data on the failed drive is reconstructed on the hot spare. Hot spares can be used for level 1, 3 and 5 RAID. Each MegaRAID controller supports up to eight hot spares.

The methods for designating physical drives as hot spares are:

- press <F4> while creating arrays in Easy, New or View/Add Configuration mode, or
- From the Objects/Physical Drive menu, select a physical drive and press <Enter.> Select Make HotSpare.

Press <F4>

When you choose any configuration option, a list of all physical devices connected to the current controller appears, as shown below:

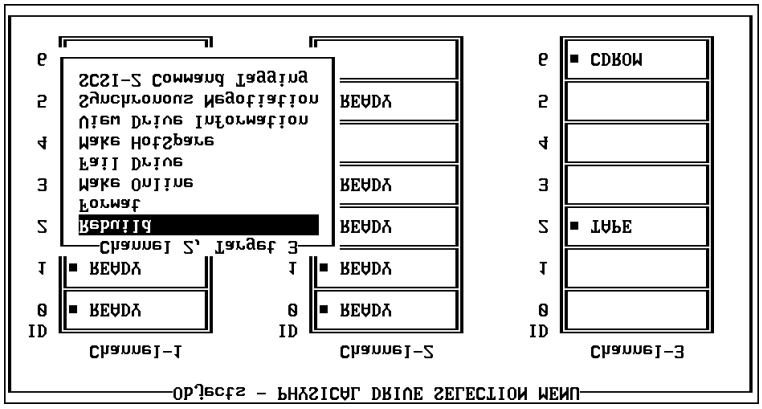


Press the arrow keys to choose a disk drive that has a READY indicator and press <F4> to designate the drive as a hot spare. The indicator will change to HOTSP.

Cont'd

Designating Drives as Hot Spares, Continued

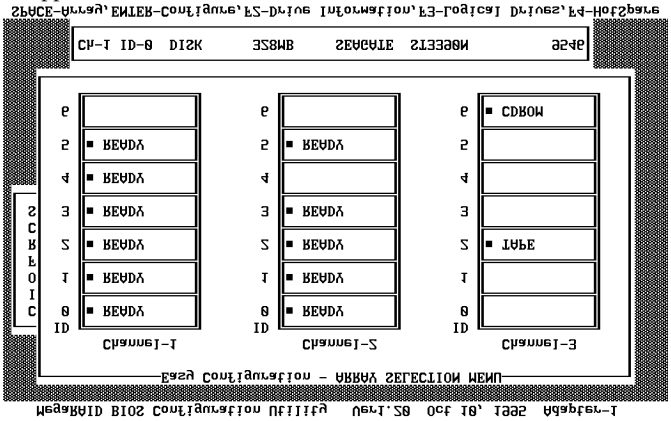
Objects Menu Select Objects from the Management menu, then select Physical Drive. A physical drive selection screen will appear. Select a disk drive and press <Enter> to display the action menu for the drive.



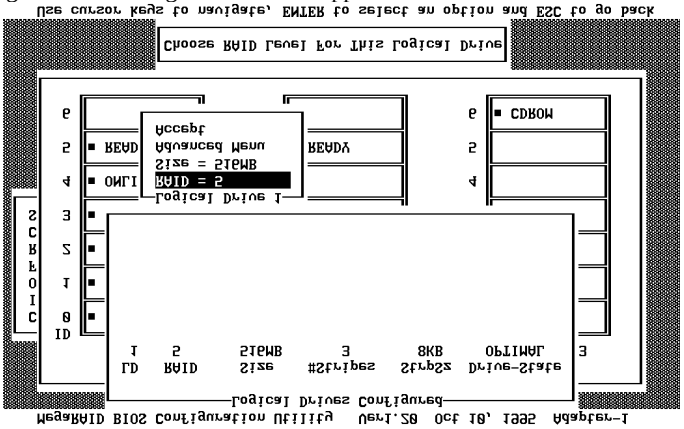
Press the arrow keys to select Make HotSpare and press <Enter>. The indicator for the selected drive changes to HOTSP.

Using Easy Configuration

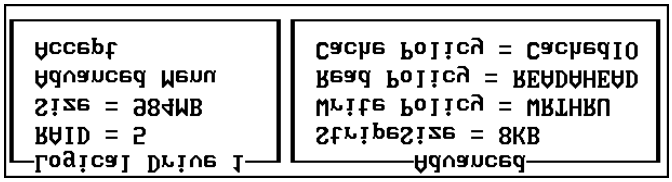
In Easy Configuration, each array is associated with exactly one logical drive. Follow the steps below to create arrays using Easy Configuration:

Step	Action
1	Choose Configure from the MegaRAID BIOS Setup main menu.
2	Choose Easy Configuration from the Configure menu. The array selection menu appears:  Hot key information is displayed at the bottom of the screen. The hot key functions are: <F2> Display the manufacturer data and error count for the selected drive. <F3> Display the logical drives that have been configured. <F4> Designate the selected drive as a hot spare.
3	Press the arrow keys to choose specific physical drives. Press the spacebar to associate the selected physical drive with the current array. The indicator for the selected drive changes from READY to ONLIN A[*array number*]-[*drive number*]. For example, ONLIN A2-3 means disk drive 3 in array 2. Add physical drives to the current array as desired. Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the array are treated as if they have the capacity of the *smallest* drive in the array.

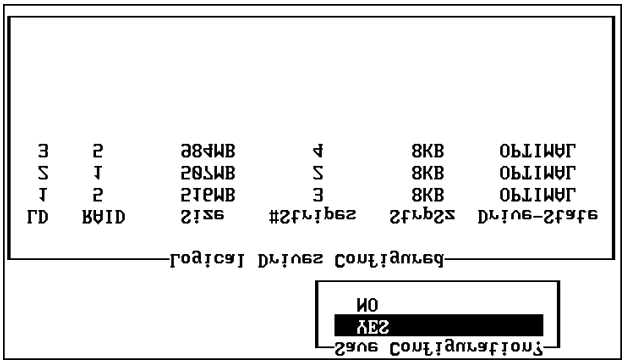
Cont'd

Step	Action
3 cont'd	The number of physical drives in a specific array determine the RAID levels that can be implemented with the array. RAID 0 requires one or more physical drives, RAID 1 requires exactly two physical drives, RAID 3 requires at least three physical drives, and RAID 5 requires at least three physical drives.
4	Press <Enter> when you are finished creating the current array. The logical drive configuration screen appears.  The window at the top of the screen shows the logical drive that is currently being configured as well as any existing logical drives. The column headings are: LD — The logical drive number, RAID — The RAID level, Size — The logical drive size, #Stripes — The number of stripes (physical drives) in the associated physical array, StrpSz — The stripe size, and DriveState — The state of the logical drive.
5	Set the RAID level for the logical drive. Highlight *RAID* and press <Enter>. The available RAID levels for the current logical drive are displayed. Select a RAID level and press <Enter> to confirm. *Do not use* RAID 3 *for any logical drive that is to be used as a DOS volume.*

Cont'd

Step	Action
6	Set the stripe size, cache write policy, Read policy, and I/O (cache) policy from the Advanced Menu.  **Stripe size** This parameter specifies the size of the segments written to each disk in a RAID 0, 3, or 5 logical drive. You can set the stripe size to 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces better read performance, especially if your computer does mostly sequential reads. If you are sure that your computer does random read requests more often, choose a small stripe size. The default is 8 KB. **Write Policy** This option sets the caching method to write-back or write-through. In *Write-back* caching, the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. In *Write-through caching,* the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction. This is the default setting. Write-through caching has a data security advantage over write-back caching. Write-back caching has a performance advantage over write-through caching. *Do not use write-back for any logical drive that is to be used as a Novell* NetWare *volume*. **Read-ahead** This option enables the SCSI read-ahead feature for the logical drive. You can set this parameter to *Normal*, *Read-ahead,* or *Adaptive.* *Normal* specifies that the controller does not use read-ahead for the current logical drive. *Read-ahead* specifies that the controller uses read-ahead for the current logical drive. This is the default setting. *Adaptive* specifies that the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If all read requests are random, the algorithm reverts to Normal, however, all requests are still evaluated for possible sequential operation.

Cont'd

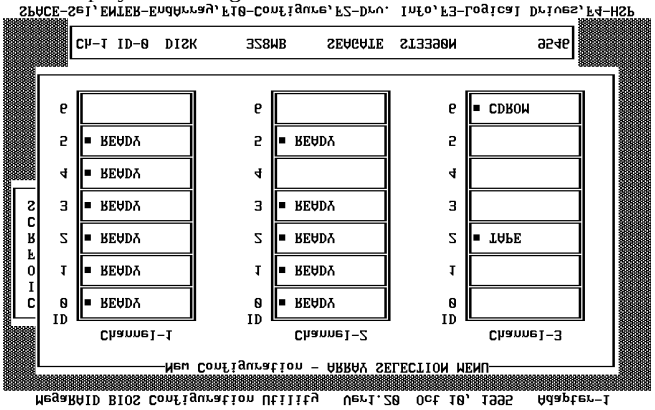
Step	Action
6, cont'd	**Cache Policy** This parameter enables the controller cache during data transfers involving the selected logical drive. *Cached I/O* specifies that the controller cache is used. This is the default setting. *Direct I/O* specifies that the controller cache is not used. Direct I/O does not override the cache policy settings. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. Press <Esc> to exit the Advanced Menu.
7	When you have defined the current logical drive, choose *Accept* and press <Enter>. The array selection screen appears if any unconfigured disk drives remain.
8	Repeat steps 3 through 7 to configure another array and logical drive. MegaRAID supports up to eight logical drives per controller. If you are finished configuring logical drives, press <Esc> to exit Easy Configuration. A list of the currently configured logical drives appears:  After you respond to the Save prompt, the Configure menu appears.
9	Initialize the logical drives you have just configured.

Using New Configuration

The New Configuration option allows you to associate logical drives with partial and/or multiple physical arrays (the latter is called spanning of arrays).

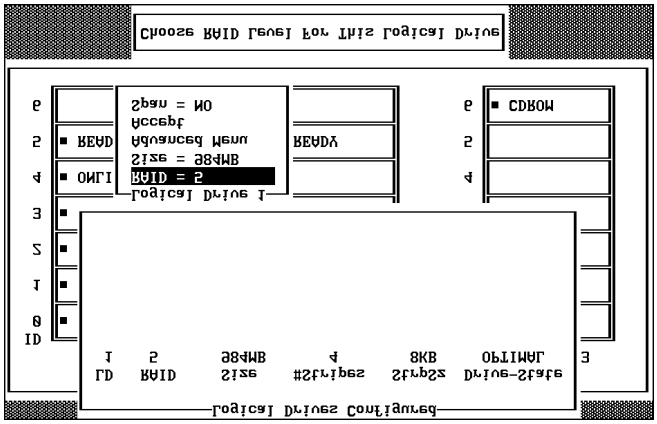
Erases Configuration Choosing the New Configuration option *erases* the existing configuration information on the selected controller.

To use the spanning feature and keep the existing configuration, use View/Add Configuration.

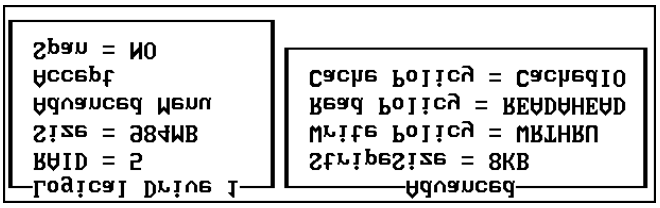
Step	Action
1	Choose Configure from the MegaRAID BIOS Setup main menu.
2	Choose New Configuration from the Configure menu. An array selection window is displayed showing the devices connected to the current controller.  Hot key information appears at the bottom of the screen. The hot key functions are: <F2> Display the manufacturer data and MegaRAID error count for the selected drive. <F3> Display the logical drives that have been configured. <F4> Designate the selected drive as a hot spare. <F10> Display the logical drive configuration screen.

Cont'd

Step	Action
3	Press the arrow keys to choose specific physical drives. Press the spacebar to associate the selected physical drive with the current array. The indicator for the selected drive changes from READY to ONLIN A[*array number*]-[*drive number*]. For example, ONLIN A2-3 means disk drive 3 in array 2. Add physical drives to the current array as desired. Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all the drives in the array is treated as though they have the capacity of the *smallest* drive in the array. The number of physical drives in a specific array determines the RAID levels that can be implemented with the array. RAID 0 requires one or more physical drives per array. RAID 1 requires exactly two physical drives per array. RAID 3 requires at least three physical drives per array. RAID 5 requires at least three physical drives per array.
4	Press <Enter> when you are finished creating the current array. To continue defining arrays, repeat step 3. To begin logical drive configuration, go to step 5.

Step	Action
5	Press <F10> to configure logical drives. The logical drive configuration screen appears, as shown below:  The window at the top of the screen shows the logical drive that is currently being configured as well as any existing logical drives. The column headings are: LD — The logical drive number, RAID — The RAID level, Size — The logical drive size, #Stripes — The number of stripes (physical drives) in the associated physical array, StrpSz — The stripe size, and Drive-State — The state of the logical drive.
6	Set the RAID level for the logical drive. Highlight *RAID* and press <Enter>. A list of the available RAID levels for the current logical drive appears. Select a RAID level and press <Enter> to confirm. *Do not use RAID 3 for any logical drive to be used as a DOS volume.*
7	Set the spanning mode for the current logical drive. Highlight *Span* and press <Enter>. The choices are: CanSpan — Array spanning is enabled for the current logical drive. The logical drive can occupy space in more than one array. NoSpan — Array spanning is disabled for the current logical drive. The logical drive can occupy space in only one array.

Cont'd

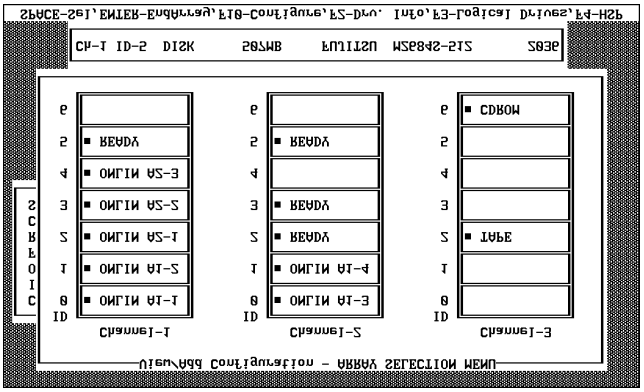
Step	Action
7, cont'd	For two arrays to be spannable, they must have the same stripe width (they must contain the same number of physical drives) and must be consecutively numbered. For example, assuming Array 2 contains four disk drives, it can be spanned only with Array 1 and/or Array 3, and only if Arrays 1 and 3 also contain four disk drives. If the two criteria for spanning are met, MegaRAID automatically allows spanning. If the criteria are not met, the *Span* setting makes no difference for the current logical drive. Highlight a spanning option and press <Enter>.
8	Set the logical drive size. Move the cursor to *Size* and press <Enter>. By default, the logical drive size is set to all available space in the array(s) being associated with the current logical drive, accounting for the *Span* setting and for partially used array space. For example, if the previous logical drive used only a part of the space in an array, the current logical drive size is set to the remaining space by default.
9	Open the Advanced menu to set the remaining options.  **Stripe size** This parameter specifies the size of the segments written to each disk in a RAID 0, 3, or 5 logical drive. You can set the stripe size to 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces higher read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random read requests more often, select a small stripe size. The default stripe size is 8 KB.

Cont'd

Step	Action
9, cont'd	**Write Policy** This option sets the caching method to write-back or write-through. In *Write-back caching,* the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. In *Write-through caching,* the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction. This is the default setting. Write-through caching has a data security advantage over write-back caching, whereas write-back caching has a performance advantage over write-through caching. *Do not use write-back for any logical drive that is to be used as a Novell NetWare volume.* **Read-ahead** This option enables the SCSI read-ahead feature for the logical drive. You can set this parameter to *Normal, Read-ahead,* or *Adaptive.* *Normal* specifies that the controller does not use read-ahead for the current logical drive. *Read-ahead* specifies that the controller uses read-ahead for the current logical drive. This is the default setting. *Adaptive* specifies that the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If all read requests are random, the algorithm reverts to Normal, however, all requests are still evaluated for possible sequential operation. **Cache Policy** This parameter enables the controller cache during data transfers involving the selected logical drive. *Cached I/O* specifies that the controller cache is used. This is the default setting. *Direct I/O* specifies that the controller cache is not used. Direct I/O does not override the cache policy settings. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. Press <Esc> to exit the Advanced Menu.
10	After you define the current logical drive, choose *Accept* and press <Enter>. If space remains in the arrays, the next logical drive to be configured appears. Repeat steps 6 to 9 to configure another logical drive. If the array space has been used, a list of the existing logical drives appears. Press any key to continue and respond to the Save prompt.
11	Initialize the logical drives you have just configured.

Using View/Add Configuration

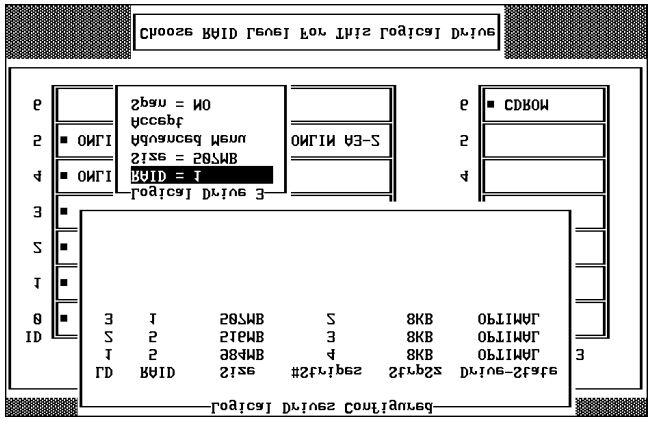
View/Add Configuration allows you to associate logical drives with partial and/or multiple physical arrays (this is called spanning of arrays). The existing configuration is left intact, so you can also use View/Add Configuration simply to look at the current configuration.

Step	Action
1	Choose Configure from the MegaRAID BIOS Setup main menu.
2	Choose View/Add Configuration from the Configure menu. An array selection window is displayed showing the devices connected to the current controller.  Hot key information appears at the bottom of the screen. The hot key functions are: <F2> Display the manufacturer data and MegaRAID error count for the selected drive. <F3> Display the logical drives that have been configured. <F4> Designate the selected drive as a hot spare. <F10> Display the logical drive configuration screen.

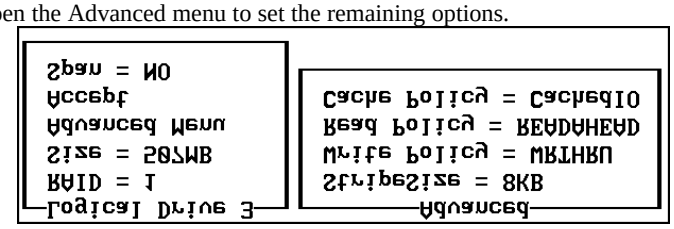
Cont'd

Step	Action
3	Press the arrow keys to choose specific physical drives. Press the spacebar to associate the selected physical drive with the current array. The indicator for the selected drive changes from READY to ONLIN A[*array number*]-[*drive number*]. For example, ONLIN A2-3 means disk drive 3 in array 2. Add physical drives to the current array as desired. Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all the drives in the array is treated as if they have the capacity of the *smallest* drive in the array. The number of physical drives in a specific array determine the RAID levels that can be implemented with the array. RAID 0 requires one or more physical drives per array. RAID 1 requires exactly two physical drives per array. RAID 3 requires at least three physical drives per array. RAID 5 requires at least three physical drives per array.
4	Press <Enter> when you are finished creating the current array. To continue defining arrays, repeat step 3. To begin logical drive configuration, go to step 5.

Cont'd

Step	Action
5	Press <F10> to configure logical drives. The logical drive configuration screen appears, as shown below:  The logical drive that is currently being configured and any existing logical drives are displayed. The column headings are: LD The logical drive number, RAID The RAID level, Size The logical drive size, #Stripes The number of stripes (physical drives) in the associated physical array, StrpSz The stripe size, and Drive-State The state of the logical drive.
6	Set the RAID level for the logical drive. Highlight *RAID* and press <Enter>. The available RAID levels for the current logical drive appear. Select a RAID level and press <Enter> to confirm. *Do not use RAID 3 for any logical drive to be used as a DOS volume.*
7	Set the spanning mode for the current logical drive. Highlight *Span* and press <Enter>. The choices are: *CanSpan* Array spanning is enabled for the current logical drive. The logical drive can occupy space in more than one array. *NoSpan* Array spanning is disabled for the current logical drive. The logical drive can occupy space in only one array.

Cont'd

Step	Action
7, cont'd	For two arrays to be spannable, they must have the same stripe width (they must contain the same number of physical drives) and they must be consecutively numbered. For example, assuming Array 2 contains four disk drives, it can be spanned only with Array 1 and/or Array 3, and only if Arrays 1 and 3 also contain four disk drives. If the two criteria for spanning are met, MegaRAID automatically activates spanning. If the criteria are not met, the *Span* setting makes no difference for the current logical drive. Highlight a spanning option and press <Enter>. **Configuring RAID 10, RAID 30, or RAID 50 Logical Drives** Configure RAID 10 by spanning two contiguous RAID 1 logical drives. The RAID 1 logical drives must have the same stripe size. Configure RAID 30 by spanning two contiguous RAID 3 logical drives. The RAID 3 logical drives must have the same stripe size. Configure RAID 50 by spanning two contiguous RAID 5 logical drives. The RAID 5 logical drives must have the same stripe size.
8	Set the logical drive size. Move the cursor to *Size* and press <Enter>. By default, the logical drive size is set to all available space in the array(s) being associated with the current logical drive, accounting for the *Span* setting and for partially used array space. For example, if the previous logical drive used only a part of the space in an array, the current logical drive size is set to the remaining space by default.
9	Open the Advanced menu to set the remaining options.  **Stripe size** This parameter specifies the size of the segment written to each disk in a RAID 0, 3, or 5 logical drive. You can set the stripe size to 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces higher read performance, especially if your computer does mostly sequential reads. However, if your computer does random read requests more often, choose a smaller stripe size. The default is 8 KB.

Cont'd

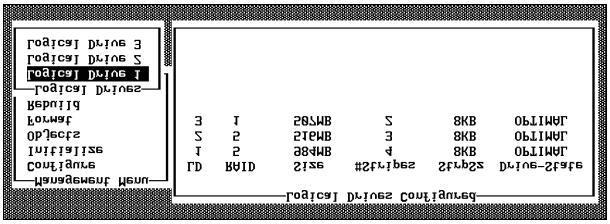
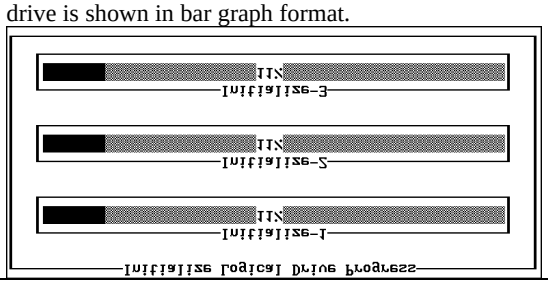
Step	Action
9, cont'd	**Write Policy** This parameter specifies the cache write policy. You can set the write policy to write-back or write-through. In *Write-back* caching, the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. In *Write-through* caching, the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction. This is the default setting. Write-through caching has a data security advantage over write-back caching, whereas write-back caching has a performance advantage over write-through caching. *Do not use write-back for any logical drive to be used as a Novell NetWare volume.* **Read-ahead** This parameter enables the SCSI read-ahead feature for the logical drive. You can set this parameter to *Normal*, *Read-ahead*, or *Adaptive*. *Normal* specifies that the controller does not use read-ahead for the current logical drive. *Read-ahead* specifies that the controller uses read-ahead for the current logical drive. This is the default setting. *Adaptive* specifies that the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If all read requests are random, the algorithm reverts to Normal, however, all requests are still evaluated for possible sequential operation. **Cache Policy** This parameter enables the controller cache during data transfers involving the current logical drive. *Cached I/O* specifies that the controller cache is used. This is the default setting. *Direct I/O* specifies that the controller cache is not used. Direct I/O does not override the cache policy settings. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. Press <Esc> to exit the Advanced Menu.
10	After you define the current logical drive, choose *Accept* and press <Enter>. If space remains in the arrays, the next logical drive to be configured appears. Repeat steps 6 to 9 to configure another logical drive. If all array space is used, a list of the existing logical drives appears. Press any key to continue. Respond to the Save prompt.
11	Initialize the logical drives you have just configured.

Initializing Logical Drives

Initialize each new logical drive you configure. You can initialize the logical drives using:

- *Batch Initialization.* The Initialize option in the main menu lets you initialize up to eight logical drives simultaneously.
- *Individual Initialization.* The Objects/Logical Drive action menu for an individual logical drive has an Initialize option.

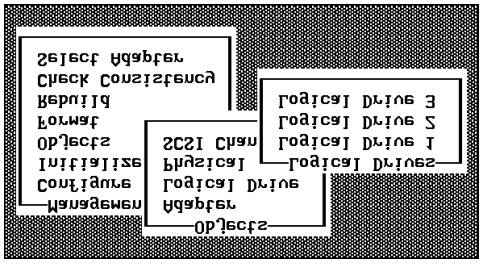
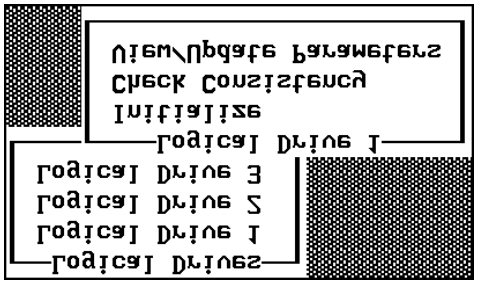
Batch Initialization To initialize logical drives using the batch initialization procedure:

Step	Action
1	Choose Initialize from the BIOS Setup main menu. A list of the current logical drives appears, as shown below: 
2	Press the arrow keys to select all drives. Press the spacebar to select the selected logical drive for initialization. Press <F2> to select/deselect all logical drives.
3	When you are done selecting logical drives, press <F10> and choose *Yes* at the confirmation prompt. The progress of the initialization for each drive is shown in bar graph format. 
4	When initialization is complete, press any key to continue. Press <Esc> to display the main menu.

Cont'd

Initializing Logical Drives, Continued

Individual Initialization To initialize logical drives using the individual initialization procedure:

Step	Action
1	Choose the Objects option from the MegaRAID BIOS Setup main menu. Choose the Logical Drive option from the Objects menu. 
2	Select the logical drive to be initialized. The following appears: 
3	Choose the Initialize option from the action menu. Initialization progress appears as a bar graph on the screen.
4	When initialization completes, press any key to display the previous menu.

Using Logical Drives in the Operating System

For information on an operating system other than DOS, see the software manual accompanying the drivers for that operating system. To use the logical drive(s) in DOS:

Step	Action
1	Exit MegaRAID BIOS Setup and reboot the computer.
2	Run DOS FDISK and configure one or more partitions using the logical drives.
3	Format the partitions with the FORMAT command.

Formatting Physical Drives

You can do low-level formatting of SCSI drives using BIOS Setup.

Since most SCSI disk drives are low-level formatted at the factory, this step is usually not necessary. Usually, you must format a disk if:

- the disk drive was not low-level formatted at the factory, or
- an excessive number of media errors have been detected on the disk drive.

Media Errors Check the View Drive Information screen for the drive to be formatted. You can view this screen by choosing Objects from the Management menu. Select the Physical Drives option, and choose a device. Press <F2>.

The error count is displayed at the bottom of the properties screen. If you feel that the number of errors is excessive, you should probably format the disk drive. If more than 32 media errors were detected, MegaRAID automatically puts the drive in FAIL state. This occurs even in a degraded RAID set. The errors are displayed as they occur. In cases such as this, formatting the drive can clear up the problem.

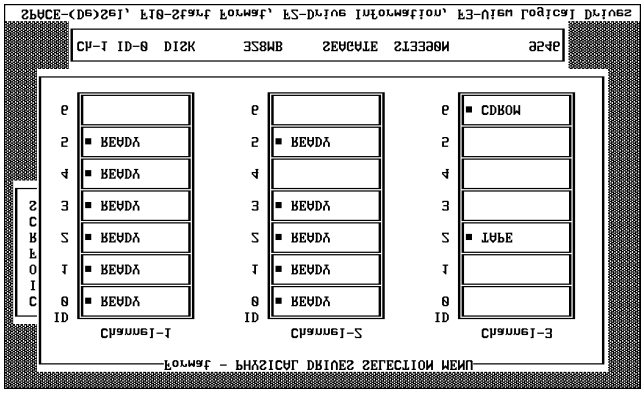
You do not have to choose Format to erase existing information on your SCSI disks, such as a DOS partition. That information is erased when you initialize logical drives.

Formatting Drives You can format the physical drives using:

- *Batch Formatting.* The Format option in the MegaRAID Manager main menu lets you format up to eight disk drives simultaneously.
- *Individual Formatting.* Choose the Format option from Objects on the Physical Drive action menu for an disk physical drive.

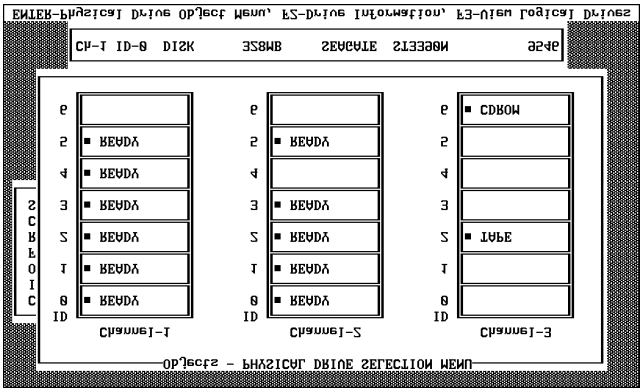
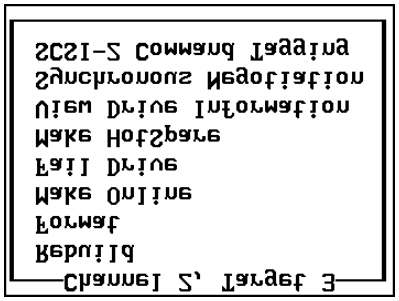
Cont'd

Batch Formatting

Step	Action
1	Choose Format from the BIOS Setup management menu. A device selection window is displayed showing the devices connected to the current controller, as shown below: 
2	Press the arrow keys to select all drives. Press the spacebar to select the selected physical drive for formatting. The indicators for selected drives flashes.
3	When you are done selecting physical drives, press <F10> and choose *Yes* at the confirmation prompt. The indicators for the selected drives changes to FRMT[*number*], where *number* reflects the order of drive selection. Formatting may take some time, depending on the number of drives you have selected and the drive capacities.
4	When formatting is complete, press any key to continue. Press <Esc> to display the main menu.

Cont'd

Individual Formatting

Step	Action
1	Choose the Objects option from the MegaRAID BIOS Setup main menu. Choose the Physical Drive option from the Objects menu. A device selection window is displayed showing the devices connected to the current controller, as shown below: 
2	Press the arrow keys to select the physical drive to be formatted and press <Enter>. The following action menu appears: 
3	Choose the Format option from the action menu and respond to the confirmation prompt. Formatting can take some time, depending on the drive capacity.
4	When formatting completes, press any key to display the previous menu.

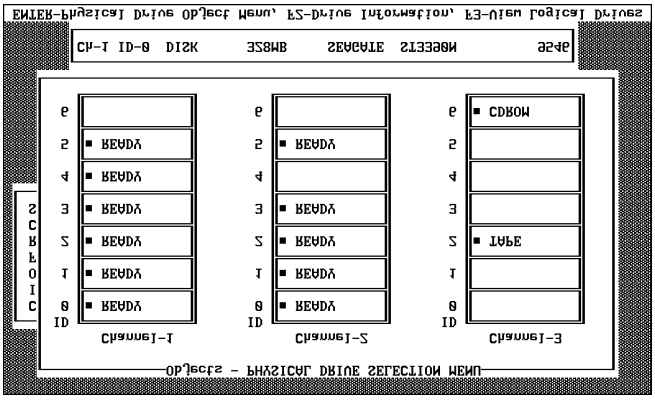
Rebuilding Failed Disk Drives

If a disk drive fails in an array that is configured as a RAID 1, 3, or 5 logical drive, you can recover the lost data by rebuilding the drive. If a spare that is rebuilding fails, MegaRAID starts a new rebuild using a second spare, if available. The capacity of the second spare must be equal to or greater than the failed drive.

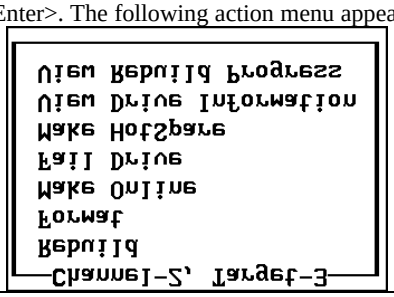
Rebuild Types The rebuild types are:

Type	Description
Automatic Rebuild	If you have configured hot spares, MegaRAID automatically tries to use them to rebuild failed disks. Display the Objects/Physical Drive screen while a rebuild is in progress. The drive indicator for the hot spare disk drive has changed to REBLD A[*array number*]-[*drive number*], indicating the disk drive being replaced by the hot spare.
Manual Rebuild	Manual rebuild is necessary if no hot spares with enough capacity to rebuild the failed drives are available. Select the MegaRAID Manager main menu Rebuild option or the Rebuild option on the Objects/Physical Drive menu.

Manual Rebuild – Rebuilding an Individual Drive

Step	Action
1	Choose the Objects option from the MegaRAID Manager main menu. Choose Physical Drive from the Objects menu. A window is displayed that shows the devices connected to the current controller: 

Cont'd

Step	Action
2	Press the arrow keys to select the physical drive to be rebuilt and press <Enter>. The following action menu appears: 
3	Choose the Rebuild option from the action menu and respond to the confirmation prompt. Rebuilding can take some time, depending on the drive capacity.
4	When rebuild completes, press any key to display the previous menu.

Manual Rebuild – Batch Mode

Step	Action
1	Choose Rebuild from the MegaRAID Manager main menu. A device selection window is displayed showing the devices connected to the current controller. The failed drives have FAIL indicators.
2	Press the arrow keys to select all drives to be rebuilt. Press the spacebar to select the selected physical drive for rebuild.
3	After selecting the physical drives, press <F10> and select Yes at the confirmation prompt. The indicators for the selected drives changes to *REBLD*. Rebuilding can take some time, depending on the number of drives you have selected and the drive capacities.
4	When rebuild is complete, press any key to continue. Press <Esc> to display the main menu.

Using a Pre-loaded SCSI Drive "As-is"

Important

To use a pre-loaded drive in the manner described here, you must make it the first logical drive defined (for example: LD1) on the controller it is connected to.

You may have a SCSI disk drive that is already loaded with software. The drive may be a boot disk containing an operating system. You can use the MegaRAID controller as a SCSI adapter for such a drive by performing the following steps:

Step	Action
1	Connect the SCSI drive to one of the channels on the MegaRAID controller, with proper termination and TID settings.
2	Boot the computer and start BIOS Setup by pressing <Ctrl> <M>.
3	Choose *Easy Configuration* from the Configure menu.
4	Press the cursor keys to select the pre-loaded drive.
5	Press the spacebar. The pre-loaded drive should now become an array element.
6	Press <Enter>. You have now declared the pre-loaded drive as a one-disk array. Display the logical drive configuration screen.
7	Set the read policy and cache option on the Advanced menu.
8	Exit the Advanced menu. Highlight *Accept* and press <Enter>.
9	Press <Esc> and choose *Yes* at the Save prompt.
10	Exit BIOS Setup and reboot.
11	Set the host system to boot from SCSI, if such a setting is available.

Exiting MegaRAID BIOS Setup

Press <Esc> when the MegaRAID BIOS Setup management menu is displayed to exit MegaRAID BIOS Setup. Choose Yes at the prompt. You must then reboot the computer. The MegaRAID BIOS message appears again. Press <Esc> when the BIOS Configuration Utility prompt appears.

6 MegaRAID Manager

Overview

MegaRAID Manager is a character-based, non-GUI utility that configures and monitors RAID systems. MegaRAID Manager runs under MS-DOS 3.2 or later and MS-DOS-compatible operating systems, including: Novell NetWare 3.x, Novell NetWare 4.x, and SCO UNIX 3.2.4.

In This Chapter The topics discussed in this chapter include:

- starting MegaRAID Manager,
- MegaRAID Manager menus,
- choosing a configuration method,
- designating drives as hot spares,
- creating physical arrays,
- defining logical drives,
- initializing logical drives,
- using logical drives in your operating system, and
- rebuilding failed disk drives.

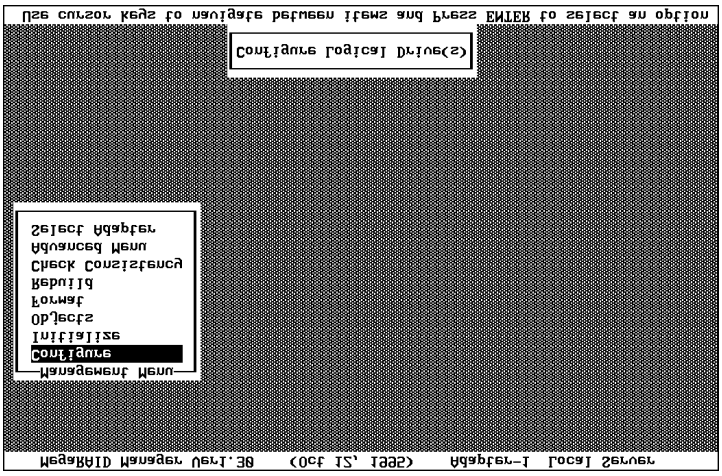
Starting MegaRAID Manager

To start MegaRAID Manager, make sure the program file is in your file path and type the appropriate command:

In...	Type this:
DOS	`megaconf`
NetWare	`load megamgr`
SCO UNIX	`megamgr`
Other	See the software guide for the operating system.

Cont'd

The following appears when MegaRAID Manager is started:



Main Menu Options The MegaRAID Manager options are:

Option	Description
Configure	Choose this option to configure arrays and logical drives.
Initialize	Choose this option to initialize one or more logical drives.
Objects	Choose this option to individually access controllers, logical drives, and physical drives.
Format	Choose this option to low-level format hard disk drives.
Rebuild	Choose this option to rebuild failed disk drives.
Check Consistency	Choose this option to verify that the redundancy data in logical drives using RAID level 1, 3, or 5 is correct.
Advanced Menu	Choose this option to run the Enclosure Management and Diagnostics functions.

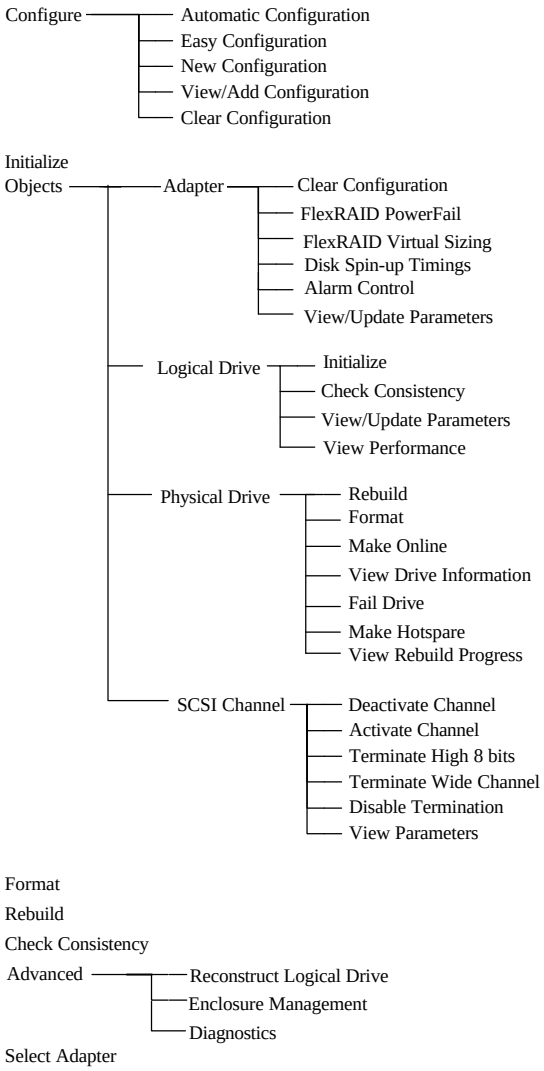
If Using MegaRAID Manager

To...	Use this menu
configure arrays and logical drives	Configure
initialize logical drives	Initialize
rebuild a disk drive	Rebuild
format a disk drive	Format

For information about other functions, see the following menu tree and menu descriptions.

MegaRAID Manager Menu Tree

The following is an expansion of the menus in MegaRAID Manager.



The menu items are explained on the following pages.

MegaRAID Manager Configure Menu

Configure Choose the Configure option to select a method for configuring arrays and logical drives.

Option	Description
Auto Configuration	Select this method to have the MegaRAID controller automatically configure arrays and logical drives for you.
Easy Configuration	Select this method to perform a basic logical drive configuration where every physical array you define is automatically associated with exactly one logical drive.
New Configuration	Select this method to discard the existing configuration information and to configure new arrays and logical drives. In addition to providing the basic logical drive configuration functions, New Configuration allows you to associate logical drives with multiple or partial arrays.
View/Add Configuration	Select this method to examine the existing configuration and/or to specify additional arrays and logical drives. View/Add Configuration provides the same functions as New Configuration.
Clear Configuration	Select this option to erase the current configuration information from the MegaRAID controller non-volatile memory.

MegaRAID Manager Initialize Menu

Initialize Choose this option from the MegaRAID Manager main menu to initialize one or more logical drives. This action typically follows the configuration of a new logical drive.

MegaRAID Manager Objects Menu

Objects Choose the Objects option from the MegaRAID Manager main menu to access the controllers, logical drives, physical drives, and SCSI channels individually. You can also change certain settings for each object. The Objects menu options are described below.

Cont'd

Adapter Choose the Adapter option from the Objects menu to select a MegaRAID controller (if your computer has more than one) and to modify parameters.

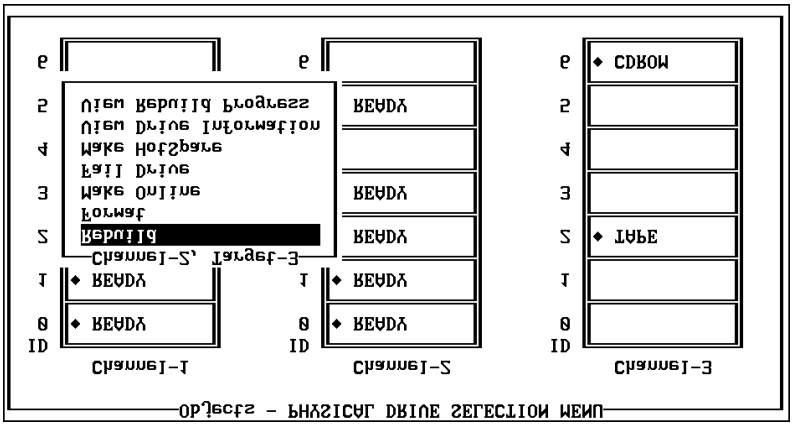
Option	Description
Clear Configuration	Choose this option to erase the current configuration from the controller non-volatile memory.
FlexRAID PowerFail	Choose this option to allow drive reconstruction to continue when the system restarts if a power failure occurs.
FlexRAID Virtual Sizing	Set this option to *Enabled* before adding a physical drive to a logical drive. After you have created a logical drive set, the partition of the drive should be as large as the virtual size of the logical drive.
Disk Spin-Up Timings	Choose this option to set the method and timing for spinning up the hard disk drives in the computer.
Alarm Control	Choose this option to enable, disable, or silence the onboard alarm tone generator.
View/Update Parameters	Choose this option to display the firmware version number and the cache memory size. You can also change the rebuild rate for the adapter through this option.

Logical Drive Choose this option from the MegaRAID Manager Objects menu to select a logical drive and to perform the listed actions.

Logical Drive Options	Description
Initialize	Choose this option to initialize the selected logical drive. This should be done for every logical drive you configure.
Check Consistency	Choose this option to verify the correctness of the redundancy data in the selected logical drive. This option is only available if RAID level 1, 3, or 5 is used.
View/Update Parameters	Choose this option to display the properties of the selected logical drive; you can modify the cache write policy, the Read policy, and the I/O policy from this menu.

Cont'd

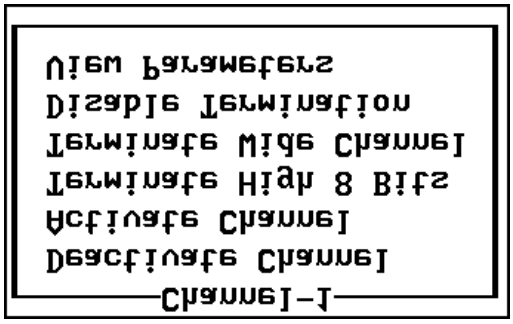
Physical Drive Choose this option from the MegaRAID Manager Objects menu to select a physical device and to perform the operations listed in the table below. When you choose this option, a selection menu is displayed showing the physical drives in the computer. Move the cursor to the desired device and press <Enter>. The following appears:



Physical Drive Options	Description
Rebuild	Choose this option to rebuild the selected disk drive.
Format	Choose this option to low-level format the selected hard disk drive.
Make Online	Choose this option to change the state of the selected hard disk drive to Online.
Fail Drive	Choose this option to change the state of the selected disk drive to Fail.
Make HotSpare	Choose this option to designate the selected disk drive as a hot spare.
View Drive Information	Choose this option to see the manufacturer data for the selected physical device.
View Rebuild Progress	Choose this option to see the progress of the rebuild process for the selected disk drive.

Cont'd

SCSI Channel Choose this option from the MegaRAID Manager Objects menu to select a SCSI channel on the currently selected controller. You can perform the following operations on the selected channel.



Channel Options	Description
Deactivate Channel	Choose this option to deactivate the selected channel.
Activate Channel	Choose this option to activate the selected channel. Be sure that TermPWR is provided for all active channels.
Terminate High 8 Bits	Choose this option to enable termination on the selected channel for the upper eight bits and disable termination on the controller for the lower eight bits. This setting is required if the selected SCSI channel is terminated with 8-bit devices at both ends.
Terminate Wide Channel	Choose this option to enable Wide termination for the selected channel. This is required if the MegaRAID controller is at one end of the SCSI bus for the selected channel.
Disable Termination	Choose this option to disable termination on the MegaRAID controller for the selected channel. This option should be used if the selected SCSI channel is terminated with Wide devices at both ends.
View Parameters	Choose this option to view the termination and active status of the selected channel.

MegaRAID Manager Format Menu

Format Choose the Format option from the MegaRAID Manager main menu to low-level format one or more physical drives.

Formatting Since most SCSI disk drives are low-level formatted at the factory, this step is usually not necessary. You typically must format a disk if:

- the disk drive was not low-level formatted at the factory, or
- an excessive number of media errors have been detected on the disk drive.

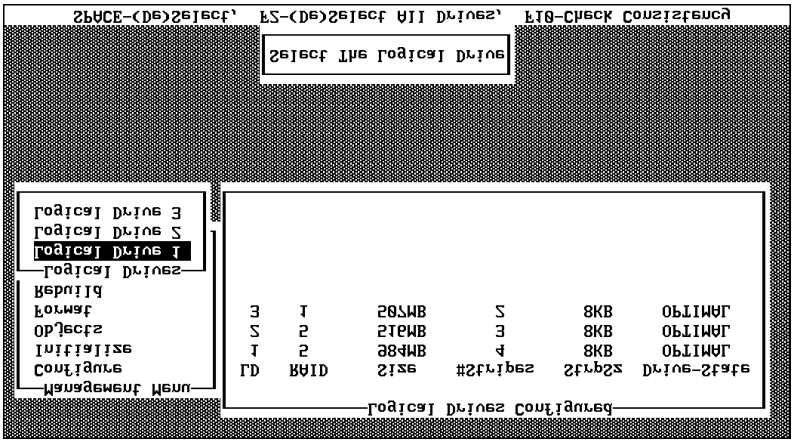
You do not need to use the Format option if you simply want to erase existing information on your SCSI disks, such as a DOS partition. That information is erased when you initialize the logical drive(s).

MegaRAID Manager Rebuild Menu

Rebuild Choose the Rebuild option from the MegaRAID Manager main menu to rebuild one or more failed disk drives.

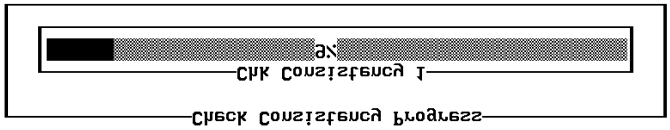
MegaRAID Manager Check Consistency Menu

Check Consistency Choose this option to verify the redundancy data in logical drives using RAID levels 1, 3, or 5. When you choose Check Consistency, the parameters of the existing logical drives on the current controller appear. The logical drives are listed by number.



Press the arrow keys to select the desired logical drives. Press the spacebar to select or deselect a drive for consistency checking. Press <F2> to select or deselect all the logical drives.

Press <F10> to begin the consistency check. A progress indicator for each selected logical drive appears, as shown below:



When the consistency check is finished, press any key to clear the progress display and press <Esc> to display the main menu.

MegaRAID Manager Advanced Menu

Reconstruct Logical Drive You can select or deselect a logical drive. Choose this option before you add or remove a physical drive.

Enclosure Management When implemented, this option is used to monitor an external enclosure containing SCSI devices. MegaRAID can monitor the fan speed, power supply voltage, and temperature, appropriate signals from the enclosure.

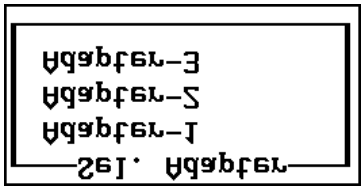
For additional information on the implementation of the Enclosure Management signals, contact American Megatrends, Inc. at 770-246-8645.

Beside each SCSI device listing, a diamond-shaped indicator shows the condition of that device. A green diamond indicates normal operation. A red diamond indicates failure. If the fan, temperature or power supply goes bad, the word for the device will change from green to red.

Diagnostics This option has not yet been implemented.

MegaRAID Manager Select Adapter Menu

This menu item appears only if more than one MegaRAID host adapter is installed in the computer. The following appears when you choose the Select Adapter option:



Select the MegaRAID adapter that you want to configure from this menu.

Configuring Arrays and Logical Drives

You can configure physical arrays and logical drives with MegaRAID Manager using:

- Auto Configuration,
- Easy Configuration,
- New Configuration, or
- View/Add Configuration

Each configuration method requires a different level of user input. The general flow of operations for array and logical drive configuration is:

Step	Action
1	Choose a configuration method.
2	Designate hot spares (optional).
3	Create arrays using the available physical drives.
4	Define logical drives using the space in the arrays.
5	Save the configuration information.
6	Initialize the logical drives.

Choosing the Configuration Method

Automatic Configuration In Automatic Configuration, the MegaRAID controller examines the physical drives connected to it and automatically configures them into arrays and logical drives.

If logical drives have already been configured when you select Auto Configuration, the configuration information is not disturbed.

Cont'd

Choosing the Configuration Method, Continued

Easy Configuration In Easy Configuration, each physical array you create is associated with exactly one logical drive, and you can modify the following parameters:

- RAID level,
- stripe size
- cache write policy,
- Read policy, and
- I/O policy.

If logical drives have already been configured when you select Easy Configuration, the configuration information is not disturbed.

New Configuration In New Configuration, you can modify the following logical drive parameters:

- RAID level,
- stripe size
- cache write policy,
- Read policy,
- I/O Policy,
- logical drive size, and
- spanning of arrays.

If you select New Configuration, the existing configuration information on the selected controller is *destroyed when the new configuration is saved*.

View/Add Configuration View/Add Configuration allows you to control over the same logical drive parameters as New Configuration *without disturbing* the existing configuration information.

Designating Drives as Hot Spares

Hot Spares

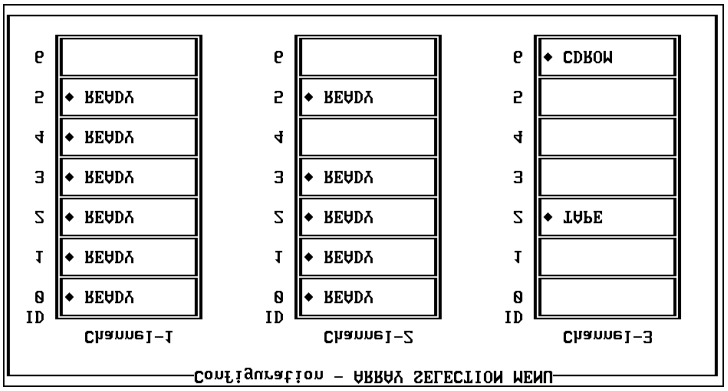
Hot spares are physical drives that are powered up along with the RAID drives and usually stay in a standby state. If a disk drive used in a RAID logical drive fails, a hot spare will automatically take its place and the data on the failed drive is reconstructed on the hot spare. Hot spares can be used for level 1, 3 and 5 RAID. Each MegaRAID controller supports up to eight hot spares.

The two methods for designating physical drives as hot spares are:

- press <F4> while creating arrays in Easy, New or View/Add Configuration mode, or
- Highlight a drive using the space bar and press <Enter>. Select Make HotSpare.

Press <F4>

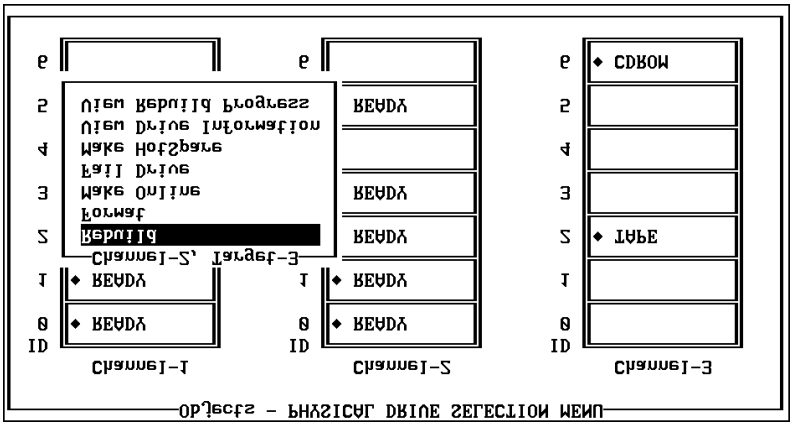
When you choose any configuration option in the Configure menu, all physical devices connected to the current controller appear:



Press the arrow keys to select a disk drive that has a READY indicator and press <F4> to designate it as a hot spare. The indicator changes to HOTSP.

Cont'd

Objects Menu Select Objects from the Configure menu, then select Physical Drive. A physical drive selection screen will appear. Press the spacebar to select a disk drive and press <Enter> to display the action menu for the drive.



Press the arrow keys to select *Make Hot Spare* and press <Enter>. The indicator for the selected drive changes to HOTSP.

Using Auto Configuration

Configuration Guidelines In Auto Configuration, MegaRAID examines the physical drives connected to it and automatically configures them into arrays and logical drives. MegaRAID uses the following configuration guidelines in the following sequence:

Step	Action
1	Gather drives with the same capacity into groups of five, four, or three. These groups become arrays associated with RAID level 5 logical drives.
2	Gather pairs of drives with the same capacity together. These pairs become arrays associated with RAID 1 logical drives.
3	Configure any remaining single disk drives as arrays associated with RAID 0 logical drives.

Logical Drive Settings The logical drive settings will be:

Parameter	Setting
Stripe size	8 KB
Write Policy	Write-through
Read Policy	Readahead
Cache Policy	Cached I/O
Spanning	Off

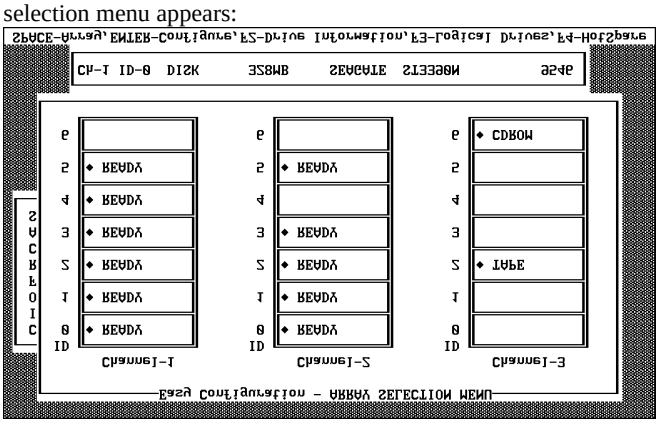
The write policy, read policy, and cache policy can be changed by the user after configuration is complete.

User Actions Perform the following steps when using auto configuration:

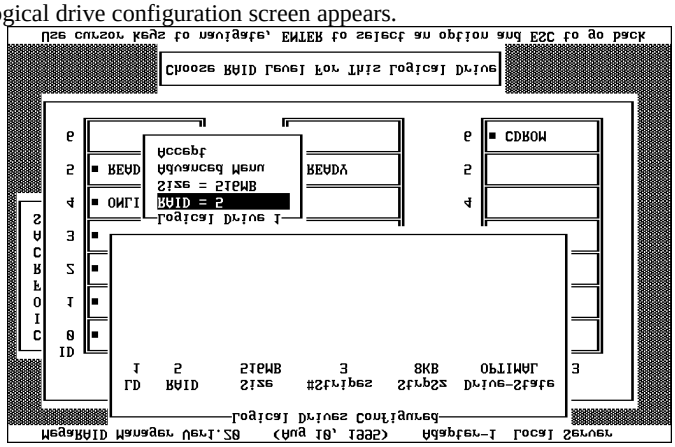
Step	Action
1	Designate hot spares (optional, but if chosen, should be done first).
2	Choose Configure from the MegaRAID Manager main menu.
3	Choose Auto Configuration from the Configure menu and respond to the confirmation prompt. The logical drives that result from Auto Configuration are displayed on the screen with a save prompt. Choose *Yes* to save the configuration.
4	If you chose *Yes* at the space prompt, initialize the logical drives.

Using Easy Configuration

In Easy Configuration, each array is associated with exactly one logical drive. Follow the steps below to create arrays using Easy Configuration:

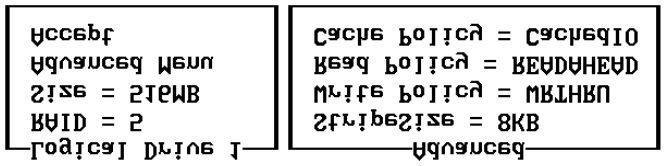
Step	Action
1	Choose Configure from the MegaRAID Manager main menu.
2	Choose Easy Configuration from the Configure menu. The array selection menu appears:  The hot key information appears at the bottom of the screen. The hot key functions are: <F2> Display the manufacturer data and MegaRAID error count for the selected drive. <F3> Display the logical drives that have been configured. <F4> Designate the selected drive as a hot spare.
3	Press the arrow keys to select specific physical drives. Press the spacebar to associate the selected physical drive with the current array. The indicator for the selected drive changes from READY to ONLIN A[*array number*]-[*drive number*]. For example, ONLIN A2-3 means disk drive 3 in array 2. Add physical drives to the current array as desired. Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all the drives in the array is treated as though they have the capacity of the *smallest* drive in the array.

Cont'd

Step	Action
3 cont'd	The number of physical drives in a specific array determine the RAID levels that can be implemented with the array. RAID 0 requires one or more physical drives, RAID 1 requires exactly two physical drives, RAID 3 requires at least three physical drives, and RAID 5 requires at least three physical drives.
4	Press <Enter> when you are finished creating the current array. The logical drive configuration screen appears.  The window at the top of the screen shows the logical drive that is currently being configured as well as any existing logical drives. The column headings are: LD The logical drive number, RAID The RAID level, Size The logical drive size, #Stripes The number of stripes (physical drives) in the associated physical array, StrpSz The stripe size, and Drive-State The state of the logical drive.
5	Set the RAID level for the logical drive. Highlight *RAID* and press <Enter>. The available RAID levels for the current logical drive are displayed. Select a RAID level and press <Enter> to confirm. *Do not use RAID 3 for any logical drive that is to be used as a* DOS volume.

Cont'd

Step	Action
6	Set the stripe size, cache write policy, Read policy, and I/O (cache) policy from the Advanced Menu.



Stripe size This parameter specifies the size of the segments written to each disk in a RAID 0, 3, or 5 logical drive. You can set the stripe size to 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size provides better read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random read requests more often, choose a small stripe size. The default stripe size is 8 KB.

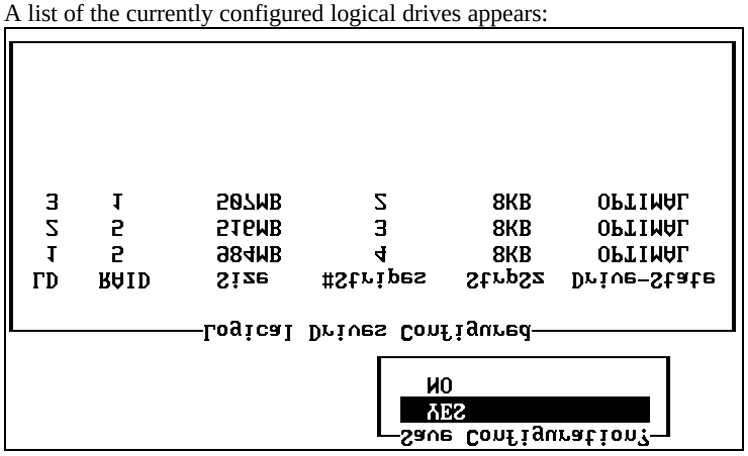
Write policy This parameter specifies the cache write policy. You can set the write policy to write-back or write-through.

In *Write-back* caching, the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction.
In *Write-through* caching, the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction. This is the default setting.
Write-through caching has a data security advantage over write-back caching, whereas write-back caching has a performance advantage over write-through caching. *Do not use write-back for any logical drive that is to be used as a* Novell NetWare volume.

Read-ahead This parameter enables the SCSI read-ahead feature for the logical drive. You can set this parameter to *Normal*, *Read-ahead,* or *Adaptive.*

Normal specifies that the controller does not use read-ahead for the current logical drive.
Read-ahead specifies that the controller uses read-ahead for the current logical drive. This is the default setting.
Adaptive specifies that the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If all read requests are random, the algorithm reverts to Normal, however, all requests are still evaluated for possible sequential operation.

Cont'd

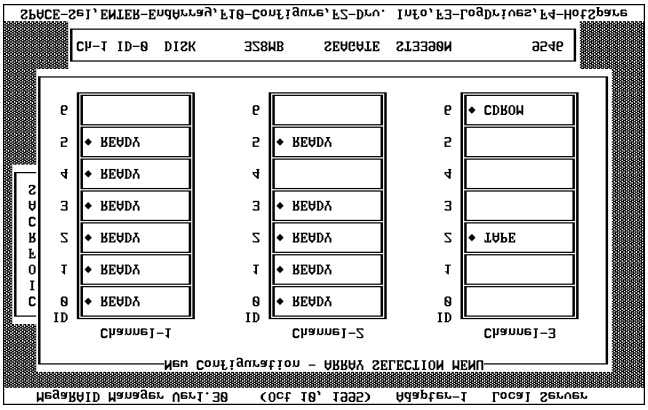
Step	Action
6, cont'd	**Cache policy** This parameter enables the controller cache during data transfers involving the current logical drive. *Cached I/O* specifies that the controller cache is used. This is the default setting. *Direct I/O* specifies that the controller cache is not used. Direct I/O does not override the cache policy settings. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. Press <Esc> to exit the Advanced Menu.
7	When you are finished defining the current logical drive, select *Accept* and press <Enter>. The array selection screen appears if any unconfigured disk drives remain.
8	Repeat steps 3 through 7 to configure another array and logical drive. MegaRAID supports up to eight logical drives per controller. If you are finished configuring logical drives, press <Esc> to exit Easy Configuration. A list of the currently configured logical drives appears:  After you respond to the Save prompt, the Configure menu appears.
9	Initialize the logical drives you have just configured.

Using New Configuration

The New Configuration option allows you to associate logical drives with partial and/or multiple physical arrays (the latter is called spanning of arrays).

Erases Configuration Choose the New Configuration option to *erase* the existing configuration information about the selected controller.

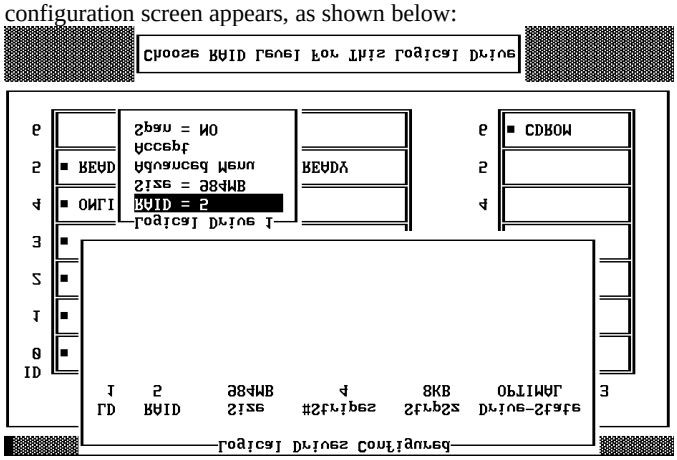
To use the spanning feature and keep the existing configuration, use View/Add Configuration.

Step	Action
1	Choose Configure from the MegaRAID Manager main menu.
2	Choose New Configuration from the Configure menu. An array selection window is displayed showing the devices connected to the current controller.  Hot key information appears at the bottom of the screen. The hot key functions are: <F2> Display the manufacturer data and MegaRAID error count for the selected drive. <F3> Display the logical drives that have been configured. <F4> Designate the selected drive as a hot spare. <F10> Display the logical drive configuration screen.

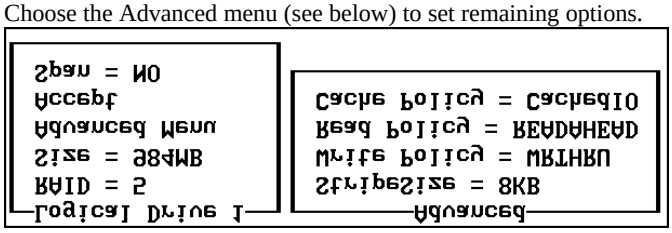
Cont'd

Step	Action
3	Press the arrow keys to select specific physical drives. Press the spacebar to associate the selected physical drive with the current array. The indicator for the selected drive changes from READY to ONLIN A[*array number*]-[*drive number*]. For example, ONLIN A2-3 means disk drive 3 in array 2. Add physical drives to the current array as desired. Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all the drives in the array is treated as though they have the capacity of the *smallest* drive in the array. The number of physical drives in a specific array determine the RAID levels that can be implemented with the array. RAID 0 requires one or more physical drives per array. RAID 1 requires exactly two physical drives per array. RAID 3 requires at least three physical drives per array. RAID 5 requires at least three physical drives per array.
4	Press <Enter> when you are finished creating the current array. To continue defining arrays, repeat step 3. To begin logical drive configuration, go to step 5.

Cont'd

Step	Action
5	Press <F10> to configure logical drives. The logical drive configuration screen appears, as shown below:  The window at the top of the screen shows the logical drive that is currently being configured as well as any existing logical drives. The column headings are: LD — The logical drive number, Raid — The RAID level, Size — The logical drive size, #Stripes — The number of stripes (physical drives) in the associated physical array, StrpSz — The stripe size, and Drive-State — The state of the logical drive.
6	Set the RAID level for the logical drive. Highlight *RAID* and press <Enter>. The available RAID levels for the current logical drive are listed. Select a RAID level and press <Enter> to confirm. *Do not use RAID 3 for any logical drive to be used as a* DOS volume.
7	Set the spanning mode for the current logical drive. Highlight *Span* and press <Enter>. The choices are: CanSpan — Array spanning is enabled for the current logical drive. The logical drive can occupy space in more than one array. NoSpan — Array spanning is disabled for the current logical drive. The logical drive can occupy space in only one array.

Cont'd

Step	Action
7, cont'd	For two arrays to be spannable, they must have the same stripe width (they must contain the same number of physical drives) and the arrays must be consecutively numbered. For example, assuming Array 2 contains four disk drives, it can be spanned only with Array 1 and/or Array 3, and only if Arrays 1 and 3 also contain four disk drives. If the two criteria for spanning are met, MegaRAID allows spanning. If the criteria are not met, the Span setting makes no difference for the current logical drive. Highlight the spanning option and press <Enter>. **Configuring RAID 10, RAID 30, or RAID 50 Logical Drives** Configure RAID 10 by spanning two contiguous RAID 1 logical drives. The RAID 1 logical drives must have the same stripe size. Configure RAID 30 by spanning two contiguous RAID 3 logical drives. The RAID 3 logical drives must have the same stripe size. Configure RAID 50 by spanning two contiguous RAID 5 logical drives. The RAID 5 logical drives must have the same stripe size.
8	Set the logical drive size. Move the cursor to Size and press <Enter>. By default, the logical drive size is set to all available space in the array(s) being associated with the current logical drive, accounting for the *Span* setting and for partially used array space. For example, if the previous logical drive used only a part of the space in an array, the current logical drive size is set to the remaining space by default.
9	Choose the Advanced menu (see below) to set remaining options.  **Stripe size** This parameter specifies the size of the segment written to each disk in a RAID 0, 1, 3, or 5 logical drive. You can set the stripe size to 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces better read performance, especially if your computer does mostly sequential reads. If you are sure that your computer does random reads more often, select a small stripe size. The default stripe size is 8 KB.

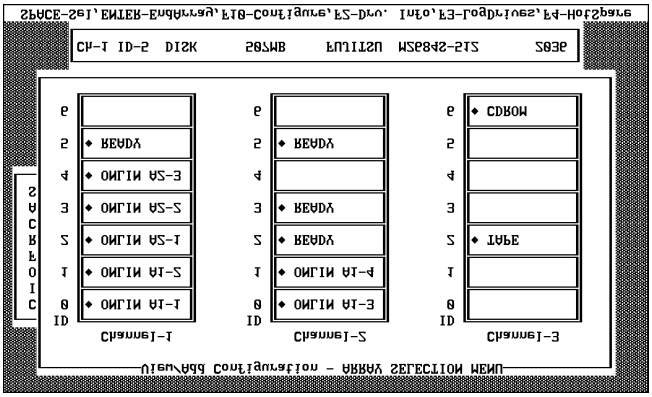
Cont'd

Step	Action
9, cont'd	**Write Policy** This parameter specifies the cache write policy. You can set the write policy to write-back or write-through. In *Write-back* caching, the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. In *Write-through* caching, the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction. This is the default setting. Write-through caching has a data security advantage over write-back caching. Write-back caching has a performance advantage over write-through caching. *Do not use write-back for any logical drive that is to be used as a Novell NetWare volume.* **Read-ahead** This parameter specifies that the SCSI read-ahead feature is used for the logical drive. You can set this parameter to *Normal*, *Read-ahead*, or *Adaptive.* *Normal* specifies that the controller does not use read-ahead for the current logical drive. *Read-ahead* specifies that the controller uses read-ahead for the current logical drive. This is the default setting. *Adaptive* specifies that the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If all read requests are random, the algorithm reverts to Normal, however, all requests are still evaluated for possible sequential operation. **Cache Policy** This parameter enables the controller cache during data transfers involving the selected logical drive. *Cached I/O* specifies that the controller cache is used. This is the default setting. *Direct I/O* specifies that the controller cache is not used. Direct I/O does not override the cache policy settings. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. Press <Esc> to exit the Advanced Menu.
10	After the current logical drive is defined, select *Accept* and press <Enter>. If space remains in the arrays, the next logical drive to be configured appears. Repeat steps 6 to 9 to configure another logical drive. If all array space has been used, a list of the existing logical drives appears. Press any key to continue and respond to the Save prompt.
11	Initialize the logical drives you have just configured.

Using View/Add Configuration

View/Add Configuration allows you to associate logical drives with partial and/or multiple physical arrays. This is called array spanning.

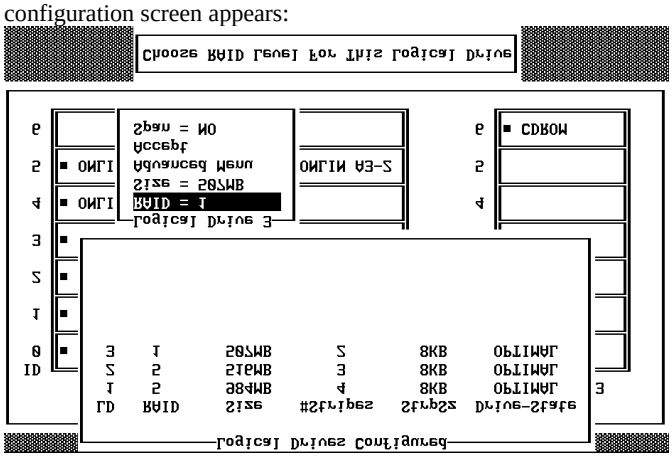
The existing configuration is left intact, so you can also use View/Add Configuration simply to look at the current configuration.

Step	Action
1	Choose Configure from the MegaRAID Manager main menu.
2	Choose View/Add Configuration from the Configure menu. An array selection window (shown below) is displayed showing the devices connected to the current controller.  Hot key information appears at the bottom of the screen. The hot key functions are <F2> Display the manufacturer data and MegaRAID error count for the selected drive. <F3> Display the logical drives that have been configured. <F4> Designate the selected drive as a hot spare. <F10> Display the logical drive configuration screen.

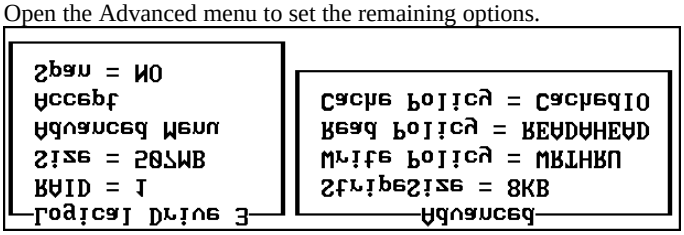
Cont'd

Step	Action
3	Press the arrow keys to select the physical drives. Press the spacebar to select physical drives to be associated with the current array. The indicator for the selected drive changes from READY to ONLIN A[*array number*]-[*drive number*]. For example, ONLIN A2-3 means disk drive 3 in array 2. Add physical drives to the current array as desired. Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the array are treated as if they have the capacity of the *smallest* drive in the array. The number of physical drives in a specific array determine the RAID levels that can be implemented with the array. RAID 0 requires one or more physical drives per array. RAID 1 requires exactly two physical drives per array. RAID 3 requires at least three physical drives per array. RAID 5 requires at least three physical drives per array.
4	Press <Enter> to end the selection process. To continue defining arrays, repeat step 3. To begin logical drive configuration, go to step 5.

Cont'd

Step	Action
5	Press <F10> to configure logical drives. The logical drive configuration screen appears:  The window at the top of the screen shows the logical drive that is currently being configured as well as any existing logical drives. The column headings are: LD — The logical drive number, Raid — The RAID level, Size — The logical drive size, #Stripes — The number of stripes (physical drives) in the associated physical array, StrpSz — The stripe size, and Drive-State — The state of the logical drive.
6	Set the RAID level for the logical drive. Highlight *RAID* and press <Enter>. The available RAID levels for the current logical drive are displayed. Select a RAID level and press <Enter> to confirm. *Do not use RAID 3 for any logical drive to be used as a* DOS volume.
7	Set the spanning mode for the current logical drive. Highlight *Span* and press <Enter>. The choices are: *CanSpan* Array spanning is enabled for the current logical drive. The drive can occupy space in more than one array. *NoSpan* Array spanning is disabled for the current logical drive. The drive can occupy space in only one array.

Cont'd

Step	Action
7, cont'd	For two arrays to be spannable, they must have the same stripe width (they must contain the same number of physical drives) and must be consecutively numbered. For example, assuming Array 2 contains four disk drives, it can be spanned only with Array 1 and/or Array 3, and only if Arrays 1 and 3 also contain four disk drives. If the two criteria for spanning are not met, the *Span* setting makes no difference for the current logical drive. Highlight a spanning option and press <Enter>. **Configuring RAID 10, RAID 30, or RAID 50 Logical Drives** Configure RAID 10 by spanning two contiguous RAID 1 logical drives. The RAID 1 logical drives must have the same stripe size. Configure RAID 30 by spanning two contiguous RAID 3 logical drives. The RAID 3 logical drives must have the same stripe size. Configure RAID 50 by spanning two contiguous RAID 5 logical drives. The RAID 5 logical drives must have the same stripe size.
8	Set the logical drive size. Move the cursor to *Size* and press <Enter>. By default, the logical drive size is set to all available space in the array(s) being associated with the current logical drive, accounting for the *Span* setting and for partially used array space. For example: if the previous logical drive used only a part of the space in an array, the current logical drive size is set to the remaining space by default.
9	Open the Advanced menu to set the remaining options.  **Stripe size** This parameter sets the size of the segment written to each disk in a RAID 0, 1, 3, or 5 logical drive. You can set the stripe size to 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces better read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random reads more often, select a small stripe size. The default stripe size is 8 KB.

Cont'd

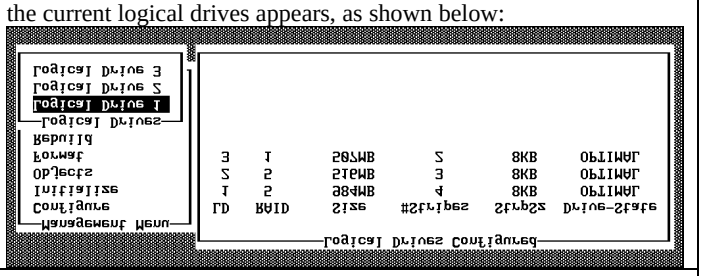
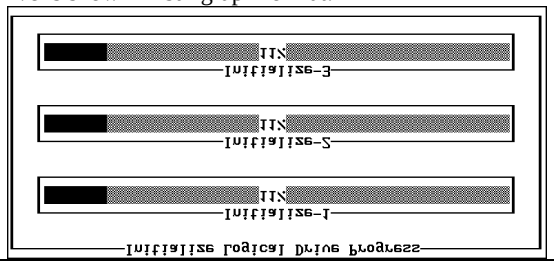
Step	Action
9, cont'd	**Write Policy** This parameter sets the cache write policy. You can set the write policy to write-back or write-through. In *Write-back* caching the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. In *Write-through* caching, the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction. This is the default setting. Write-through caching has a data security advantage over write-back caching, whereas write-back caching has a performance advantage over write-through caching. *Do not use write-back for any logical drive to be used as a Novell NetWare volume.* **Read-ahead** This parameter enables the SCSI read-ahead feature for the logical drive. Set this parameter to *Normal, Read-ahead,* or *Adaptive.* *Normal* specifies that the controller does not use read-ahead for the current logical drive. *Read-ahead* specifies that the controller uses read-ahead for the current logical drive. This is the default setting. *Adaptive* specifies that the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If all read requests are random, the algorithm reverts to Normal, however, all requests are still evaluated for possible sequential operation. **Cache Policy** This parameter enables the controller cache during data transfers involving the current logical drive. *Cached I/O* specifies that the controller cache is used. *Direct I/O* specifies that the controller cache is not used. Direct I/O does not override the cache policy settings. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. Press <Esc> to exit the Advanced Menu.
10	When you are finished defining the current logical drive, select Accept and press <Enter>. If space remains in the arrays, the next logical drive to be configured appears. Repeat steps 6 to 9 to configure another logical drive. If the array space is used, a list of the existing logical drives appears. Press any key to continue. Respond to the Save prompt.
11	Initialize the logical drives you have just configured.

Initializing Logical Drives

You should initialize each new logical drive you configure. You can initialize the logical drives in two ways:

- *Batch Initialization.* The Initialize option in the main menu lets you initialize up to eight logical drives simultaneously.
- *Individual Initialization.* The Objects/Logical Drive action menu for an individual logical drive has an Initialize option.

Batch Initialization

Step	Action
1	Choose Initialize from the MegaRAID Manager main menu. A list of the current logical drives appears, as shown below: 
2	Press the arrow keys to select all drives to be initialized. Press the spacebar to select the selected logical drive for initialization. Press <F2> to select or deselect all the logical drives.
3	When you have selected the logical drives, press <F10> and choose *Yes* at the confirmation prompt. The progress of the initialization for each drive is shown in bar graph format. 
4	When initialization is complete, press any key to continue. Press <Esc> to display the main menu.

Cont'd

Initializing Logical Drives, Continued

Individual Initialization

Step	Action
1	Choose the Objects option from the MegaRAID Manager main menu. Choose the Logical Drive option from the Objects menu, shown below: 
2	Select the logical drive to be initialized.
3	Choose Initialize from the Action menu. The progress of the initialization appears as a graph on the screen.
4	When initialization completes, press any key to display the previous menu.

Using Logical Drives in the Operating System

For information on an operating system other than DOS, see the software manual accompanying the drivers for that operating system. To use the logical drive(s) in DOS:

Step	Action
1	Exit MegaRAID Manager and reboot the computer.
2	Run DOS FDISK and configure one or more partitions using the logical drives.
3	Format the partitions with the FORMAT command.

Formatting Physical Drives

You can do low-level formatting of SCSI drives using MegaRAID Manager.

Since most SCSI disk drives are low-level formatted at the factory, this step is usually not necessary. You typically must format a disk if:

- the disk drive was not low-level formatted at the factory, or
- an excessive number of media errors have been detected on the disk drive.

Media Errors Check the properties screen for the drive you wish to format. You can check this screen by choosing Objects from the Physical Drive menu, pressing the arrow keys to select the selected drive and pressing <F2>.

The error count appears at the bottom of the properties screen. If you feel that the number of errors is excessive, you should probably format the disk drive. If more than 32 media errors were detected, MegaRAID automatically puts the drive in FAIL state. In cases such as this, formatting the drive can clear up the problem.

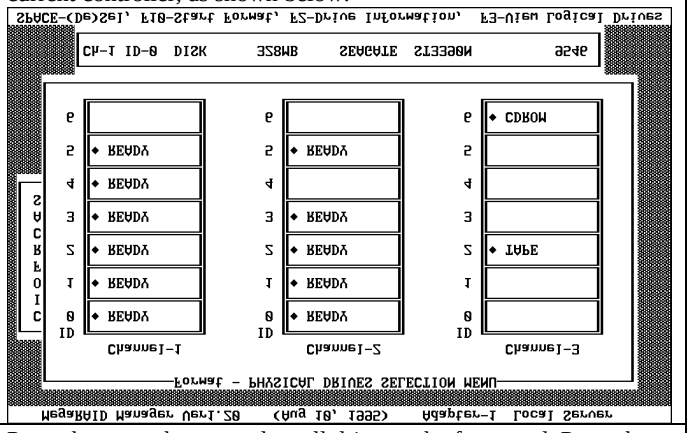
You do not have to use the Format option to erase existing information on your SCSI disks, such as a DOS partition. That information is erased when you initialize logical drives.

Formatting Drives You can format the physical drives using:

- *Batch Formatting.* The Format option in the MegaRAID Manager main menu lets you format up to eight disk drives simultaneously.
- *Individual Formatting.* Choose the Format option from Objects on the Physical Drive action menu for an individual disk drive.

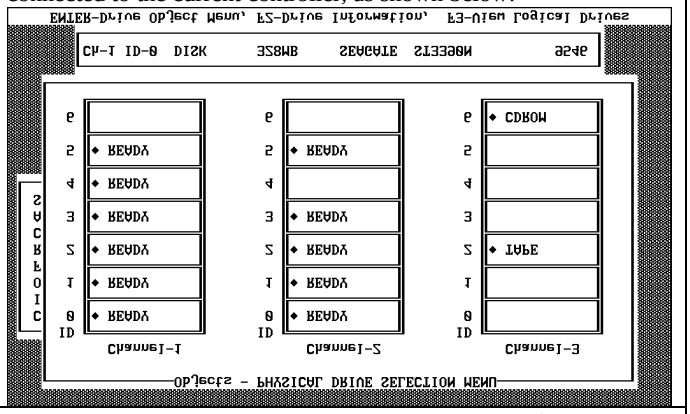
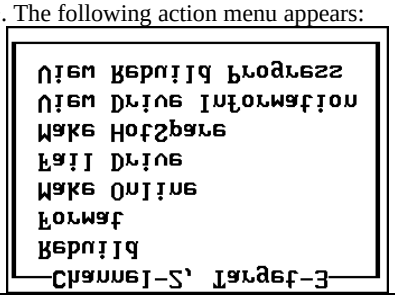
Cont’d

Batch Formatting

Step	Action
1	Choose Format from the MegaRAID Manager main menu. A device selection window is displayed showing the devices connected to the current controller, as shown below: 
2	Press the arrow keys to select all drives to be formatted. Press the spacebar to select the selected physical drive for formatting. The indicators for selected drives flashes.
3	When you have selected the physical drives, press <F10> and choose *Yes* to the confirmation prompt to begin formatting. The indicators for the selected drives changes to FRMT[*number*], where *number* reflects the drive selection order. Formatting can take some time, depending on the number of drives you have selected and the drive capacities.
4	When initialization is complete, press any key to continue. Press <Esc> to display the main menu.

Cont'd

Individual Formatting

Step	Action
1	Choose the Objects option from the MegaRAID Manager main menu. Choose the Physical Drive option from the Objects menu. A device selection window is displayed showing the devices connected to the current controller, as shown below: 
2	Press the arrow keys to select the physical drive to be formatted and press <Enter>. The following action menu appears: 
3	Choose the Format option from the action menu and respond to the confirmation prompt. Formatting can take some time, depending on the drive capacity.
4	When formatting completes, press any key to display the previous menu.

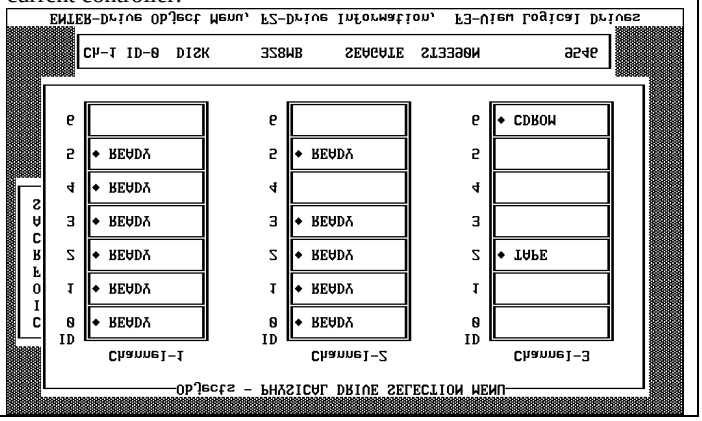
Rebuilding Failed Disk Drives

If a disk drive fails in an array that is configured as a RAID 1, 3, or 5 logical drive, you can recover the lost data by rebuilding the drive.

Rebuild Types The rebuild types are:

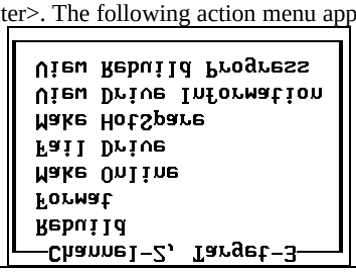
Type	Description
Automatic Rebuild	If you have configured hot spares, MegaRAID automatically tries to use them to rebuild failed disks. Display the Objects/Physical Drive screen while a rebuild is in progress. The drive indicator for the hot spare disk drive has changed to REBLD A[*array number*]-[*drive number*], indicating the disk drive being replaced by the hot spare.
Manual Rebuild	Manual rebuild is necessary if no hot spares with enough capacity to rebuild the failed drives are available. Select the MegaRAID Manager main menu Rebuild option or the Rebuild option on the Objects/Physical Drive menu.

Manual Rebuild – Rebuilding an Individual Drive

Step	Action
1	Choose the Objects option from the MegaRAID Manager main menu. Choose Physical Drive from the Objects menu. A device selection window is displayed showing the devices connected to the current controller: 

Cont'd

Rebuilding Failed Disk Drives, Continued

Step	Action
2	Press the arrow keys to select the physical drive to be rebuilt and press <Enter>. The following action menu appears: 
3	Choose the Rebuild option from the action menu and respond to the confirmation prompt. Rebuilding can take some time, depending on the drive capacity.
4	When rebuild completes, press any key to display the previous menu.

Manual Rebuild – Batch Mode

Step	Action
1	Choose Rebuild from the MegaRAID Manager main menu. A device selection window is displayed showing the devices connected to the current controller. The failed drives have FAIL indicators.
2	Press the arrow keys to select all drives to be rebuilt. Press the spacebar to select the selected physical drive for rebuild.
-3	After selecting the physical drives, press <F10> and type Yes at the confirmation prompt. The indicators for the selected drives changes to *REBLD*. Rebuilding can take some time, depending on the number of drives you have selected and their capacities.
4	When rebuild is complete, press any key to continue. Press <Esc> to display the main menu.

Exiting MegaRAID Manager

To exit MegaRAID Manager, press <Esc> at the main menu and choose *Yes* at the prompt. A message appears if uninitialized logical drives remain in the system.

7 Power Console

Overview

Power Console is an object-oriented GUI utility that configures and monitors RAID systems locally or over a network with several servers. Power Console can be executed from any workstation. Power Console allows you to control and monitor the status of hard disk drives, tape drives, and CD-ROM drives. Power Console runs under Microsoft Windows, Windows 95, and Windows NT.

In This Chapter The topics discussed in this chapter include:

- starting Power Console,
- Power Console menus,
- choosing a configuration method,
- designating drives as hot spares,
- creating physical arrays,
- defining logical drives,
- initializing logical drives,
- using logical drives, and
- rebuilding failed disk drives.

Windows NT Users If you have more than one MegaRAID controller in a host system, make sure at least one logical drive is configured on every MegaRAID controller in the host system before you access these controllers from Power Console in Windows NT. You can set up these logical drives using BIOS Setup (see chapter 4).

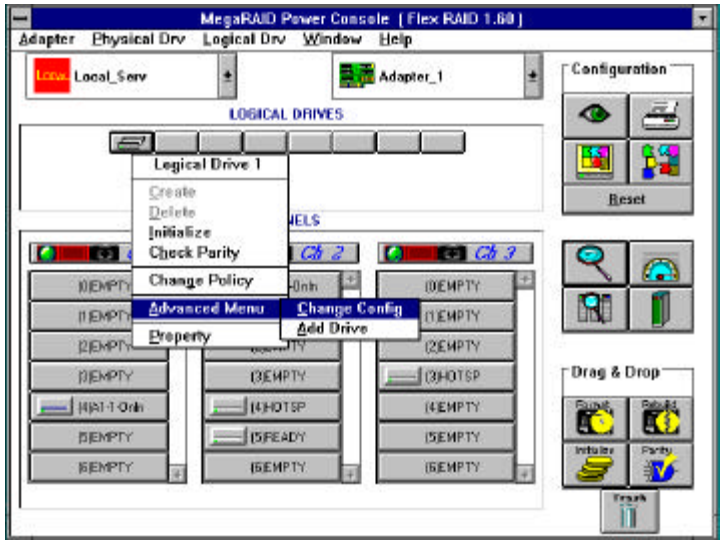
Installing Power Console Insert the MegaRAID Installation diskette in floppy drive A: (or B:). From the DOS prompt, type

```
A:(or B):SETUP
```

and press <Enter>. Follow the instructions on the screen to install the Power Console utility.

Cont'd

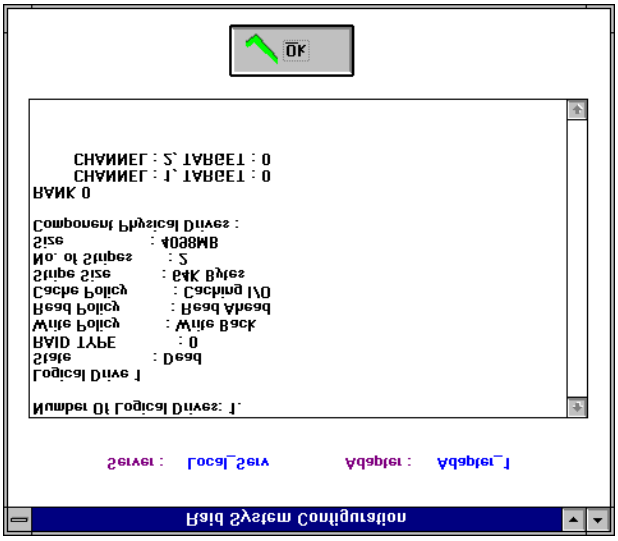
Running Power Console Double-click on the Power Console icon from the MegaRAID program group on the Windows screen. The following appears:

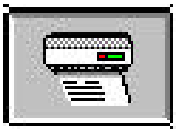


Power Console Icons

Power Console includes several toolbox icons at the top of the screen. These buttons provide easy access to Power Console features. You can remove the toolbox from the screen by clicking on Hide Toolbox in the Adapter menu. The buttons are described below.

The Display Configuration icon is shown to the left. Click on this icon to display the current RAID system configuration, for example:



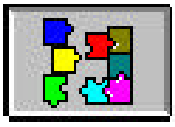


The print icon is shown to the left. Click on this icon to print the current configuration.

Cont'd

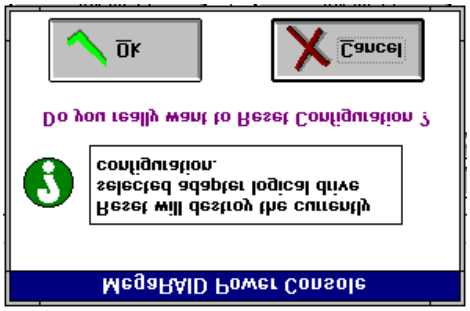
Power Console Icons, Continued

The auto configuration icon is shown to the left. Click on this icon to allow MegaRAID to automatically configure the RAID subsystem.



The custom configuration icon is shown to the left. Click on this icon to allow MegaRAID to automatically configure the RAID subsystem.

The reset button is shown to the left. Click on this icon to clear the RAID configuration on the currently selected controller. A confirmation screen will appear:



Click on OK in the confirmation screen when it appears to reset the configuration.

The display log icon is shown to the left. Click here to display a list of MegaRAID activities.

Cont'd

Power Console Icons, Continued

The rebuild rate icon is shown to the left. Click on this icon to set the RAID rebuild drive rate.

The rescan icon is shown to the left. When you click on this icon, the currently selected MegaRAID controller rescans its SCSI channels to make sure that all drive configuration information is current.

The enclosure management icon is shown to the left. Click on this icon to display the enclosure management screen. Enclosure management displays the drive temperature, drive fan status, and other information.

The hard disk drive format icon is shown to the left. Drag the drive icon that represents the physical drive to be formatted to this icon to format the selected drive.

The rebuild disk icon is shown to the left. Drag the drive icon that represents the drive to be rebuilt to this icon to rebuild the selected drive.

Cont’d

Power Console Icons, Continued

The initialize logical drive icon is shown to the left. Drag the logical drive icon that represents the drive to be initialized to this icon.

> ***Important***
> If you have inadvertently reset your configuration, you can recover it by immediately re-configuring the physical drives involves into the EXACT same array and logical drive structure in which they had been, and by saving the configuration *without* initializing.

The logical drive parity check icon is shown to the left. Drag the logical drive icon to this icon.

The change RAID level icon is shown to the left. Drag the drive icon that represents the drive to be changed to this icon.

Logical Drives

The logical drive icons are shown above. You can select one or more logical drive icons to group drives into RAID arrays. The button on the logical drive icon indicates its status:

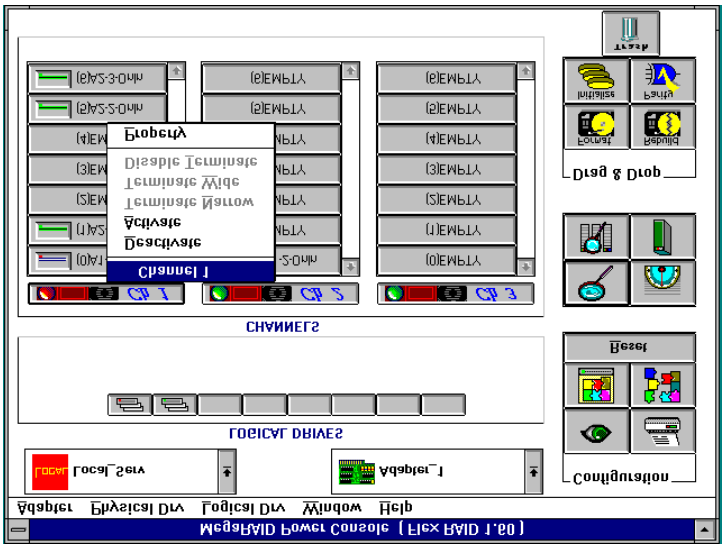
Color	Meaning
Green	The drive is operational.
Yellow	The drive performance is degraded.
Red	Failed drive.

With the cursor over a configured logical drive, right-click the mouse for a pull-down menu of action options for that logical drive.

Cont'd

Channels

The channel icon consists of a stack of drive icons. Each drive on the SCSI channel is represented by a disk, CD-ROM, or tape icon. With the cursor over one of the channel bars, click the right mouse button to display a list of actions that can be applied to that channel, as shown below:



The channel indicator light on each channel icon indicates the status of that channel:

Color	Meaning
Green	The drives in the channel are operating normally.
Yellow	One or more logical drives are degraded.
Red	Failed logical drive

The “Deactivate” option only lasts for 60 seconds when invoked.

Power Console Menu Options

Main Menu Options The Power Console menu options are:

Option	Description
Adapter	Choose this option for adapter-related functions. You can configure logical drives, enable the speaker, toggle object identification, invoke the performance monitor, and display the toolbar by selecting an item from this menu.
Physical Drv	Choose this option to rebuild, format, and display the properties of the physical drives.
Logical Drv	Choose this option to create, delete, initialize, display the properties of, and check parity of logical drives.
Window	Choose this option to view the progress of a disk rebuild, diagnostic, initialization, parity check, reconstruction or to view the performance monitor.
Help	Choose this to display information on Power Console.

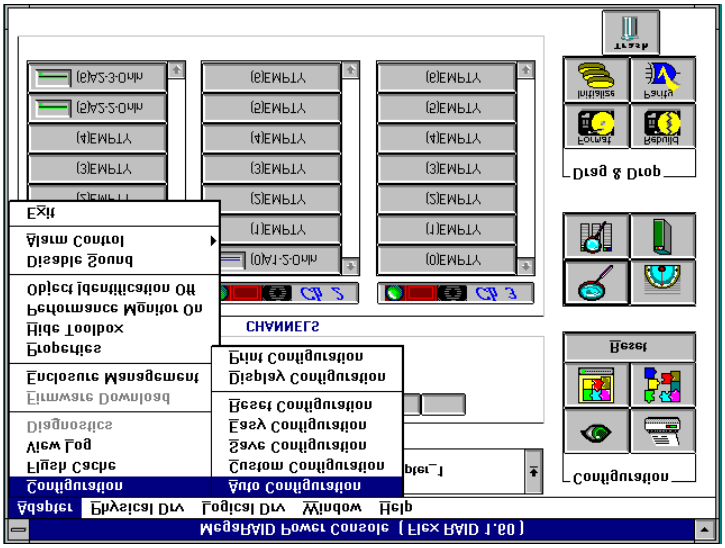
Power Console Adapter Menu

The options on the Power Console Adapter menu are described below. The Power Console Adapter menu is shown on the following page.

Option	Description
Configuration	Select this option to configure or reconfigure RAID arrays and drives.
Flush Cache	Select this option to force the MegaRAID controller to send the contents of cache memory to the logical drives.
View Log	Select this option to display an event log.
Diagnostics	This option is not yet implemented.
Firmware Download	This option is not yet implemented.
Enclosure Management	Select this option to manage the drives in each physical RAID drive cabinet. A picture of a RAID enclosure is displayed. The actual real-time state of each RAID channel is displayed. You can monitor the addition and removal of devices in the enclosure online.
Properties	Select this option to display the adapter properties, including the firmware and BIOS versions, the rebuild rate, and cache memory size.
Hide/Show Toolbox	Select this option to display the toolbox if it is not displayed on the Power Console screen, or to remove the toolbox from the screen if it is already displayed.
Performance Monitor On/Off	Select this option to display a graphical representation of the performance of a logical drive. You can select a bar graph or a line graph.
Object Identification On/Off	Select this option to turn the Object Identification feature on if it is not already on. Select this option to turn it off it is on. Object identification is a Power Console feature that identifies all objects displayed on the screen.

Option	Description
Enable/Disable Sound	Select this option to enable or disable the onboard speaker. To silence the speaker when it is activated, you must choose Disable Sound *and* Disable Alarm.
Enable/Disable Alarm	Select this option to enable or disable the system alarm when a drive failure occurs.
Exit	Select this option to quit Power Console. You cannot exit if disk operations are ongoing. *New configurations are not saved unless the Save Configuration option was selected.*

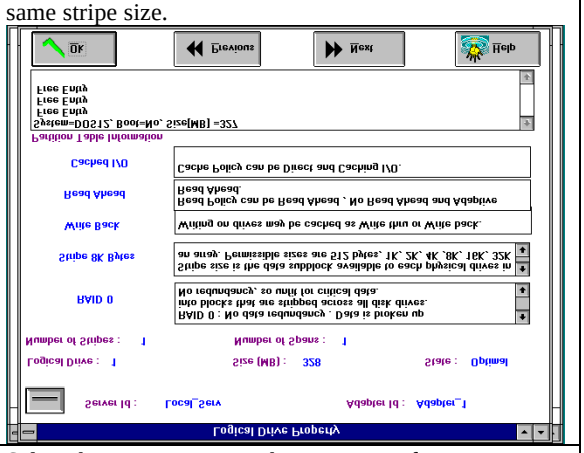
Configuring Drives Choose Configure from the Adapter menu to configure RAID arrays and logical drives. The following screen appears:



Cont'd

Power Console Adapter Menu, Continued

Option	Description
Auto Configuration	Select this option to automatically configure RAID arrays and logical drives. This option generates the simplest RAID configuration possible with the current physical drives attached to the selected adapter. Auto configuration: 1. Attempts to gather physical drives of the same size into groups of five. 2. Attempts to gather the remaining drives into groups with up to three drives per group. 3. Groups the remaining drives into groups of two drives each and single drives. 4. Combines each group of three or more drives into a RAID 5 logical drive. 5. Combines each group of two drives into a RAID 1 logical drive. 6. Designates single physical drives as RAID 0 logical drives. The drive configuration that results from auto configuration is displayed. Select OK to program this configuration in the MegaRAID firmware. All new configurations are added to existing configurations. Any existing logical drive configuration is not changed.
Custom Configuration	Select this option to delete existing configuration information and configure new arrays and logical drives into different groups. You can perform logical drive configuration functions and associate logical drives with multiple or partial arrays. You must first create an array. Arrays are groups of physical drives that define the stripe width common to one RAID type. Arrays are combined into logical drives. Logical drives can be created out of part of an array or can be a combination of several arrays if the arrays have the same properties.
Save Configuration	Select this option to save the new RAID drive configuration.

Option	Description
Easy Configuration	With this option, each array you create is automatically treated as exactly one logical drive. The Create Logical Drive screen (see below) appears when you select this option. Select the physical drives that will make up the logical drive. Select the RAID type, stripe size, and write policy. **Configuring RAID 10, RAID 30, or RAID 50 Logical Drives** Configure RAID 10 by spanning two contiguous RAID 1 logical drives. The RAID 1 logical drives must have the same stripe size. Configure RAID 30 by spanning two contiguous RAID 3 logical drives. The RAID 3 logical drives must have the same stripe size. Configure RAID 50 by spanning two contiguous RAID 5 logical drives. The RAID 5 logical drives must have the same stripe size. 
Reset Configuration	Select this option to erase the current configuration information from the MegaRAID controller non-volatile memory. The current RAID configuration becomes invalid after you select this option. *Use this option carefully. This option should be used only when configuring a new system.*
Display Configuration	Select this method to display the configuration. You can also display other arrays and logical drives.
Print Configuration	Select this option to print the current RAID drive configuration.

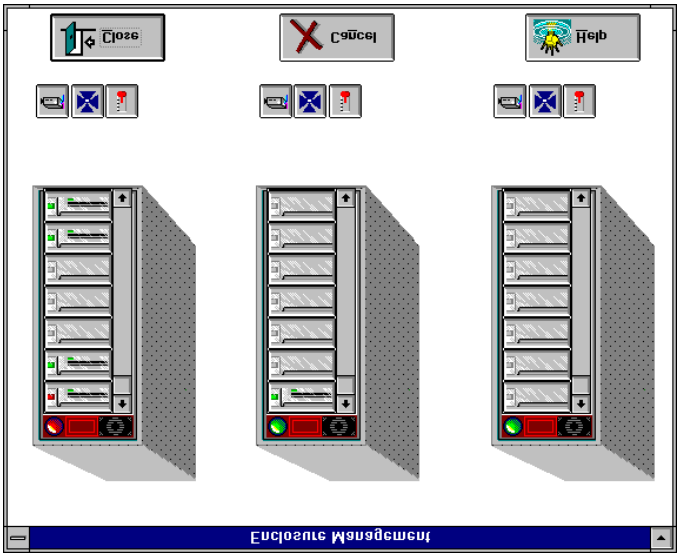
Cont'd

Power Console Adapter Menu, Continued

Flush Cache If the MegaRAID system must be powered down rapidly, you must flush the contents of the cache memory to preserve data integrity.

View Log Select this option to display the MegaRAID event log.

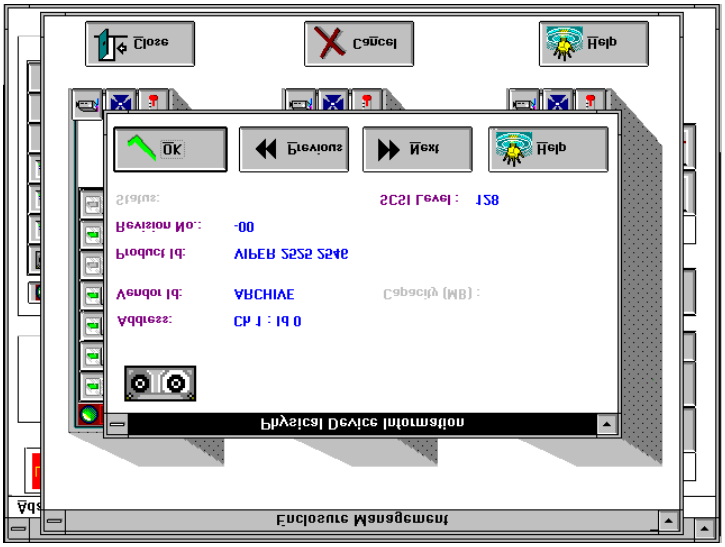
Enclosure Management Select this option to manage the physical drives in the RAID drive cabinets. Each enclosure displays the status of the physical drives in the enclosure. You can remove and insert hard drives. A red light on a drive indicates a failed channel or drive. Green indicates optimal conditions.



Cont'd

Power Console Adapter Menu, Continued

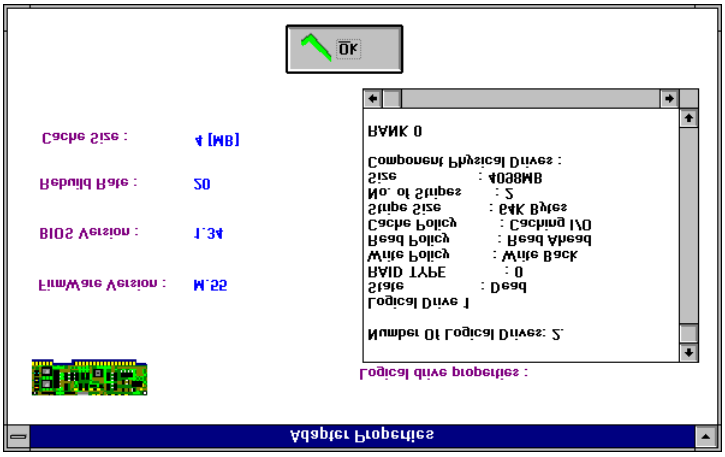
Displaying Information Click on any device displayed on the enclosure management screen to display device information, as shown below:



Cont'd

Power Console Adapter Menu, Continued

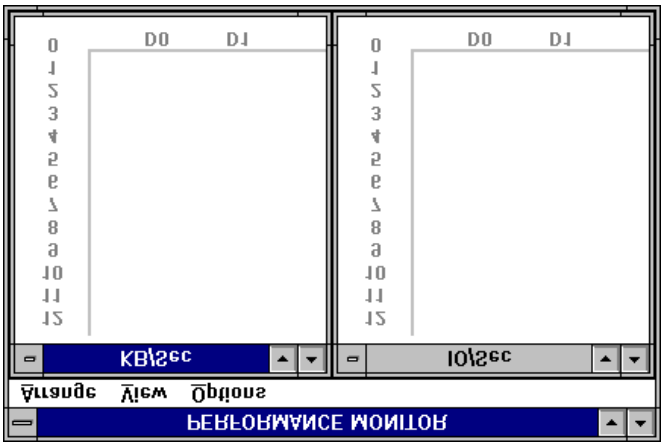
Properties Select this option to display the adapter properties. A screen like the following appears:



Cont’d

Power Console Adapter Menu, Continued

Performance Monitor Click the left mouse button on a drive icon and select Performance Monitor to display a graphic representation of drive performance. A sample Performance Monitor screen follows. You can choose different logical drives, the type of graph, and the screen arrangement from the Performance Monitor menus.



Object Identification Select this item to turn the object identification feature ("bubble help") on or off. This feature identifies icons in the Power Console screens.

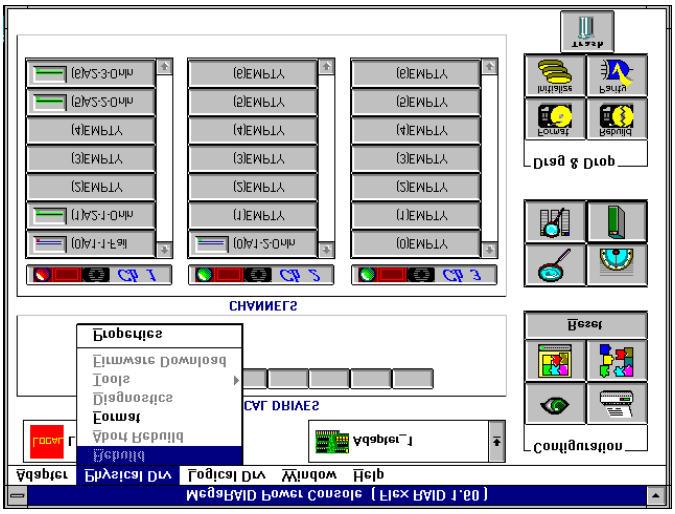
Enable/Disable Sound Choose this option to enable or disable the onboard tone generator. To silence a sounding alarm, choose Disable Sound *and* Disable Alarm.

Enable/Disable Alarm Choose this option to enable or disable the audible alarms and warnings.

Exit Choose this item to leave Power Console.

Power Console Physical Drive Menu

The Power Console Physical Drive menu is shown below:



Rebuild

Choose the Rebuild option from the Power Console main menu to rebuild one or more failed disk drives. Select *Abort Rebuild* to stop the rebuild process at any time. The drive will revert to its original status before the rebuild began.

A RAID 1, 3, or 5 configuration has built-in redundancy. If a drive in a RAID group fails, the RAID subsystem continues to work but no additional redundancy is provided. Another drive failure will bring the system down. But the failed drive can be replaced and added into the RAID system by rebuilding the drive. Select Rebuild to perform this function. The rebuild process can take place while the RAID system is still running, although performance may be slightly affected.

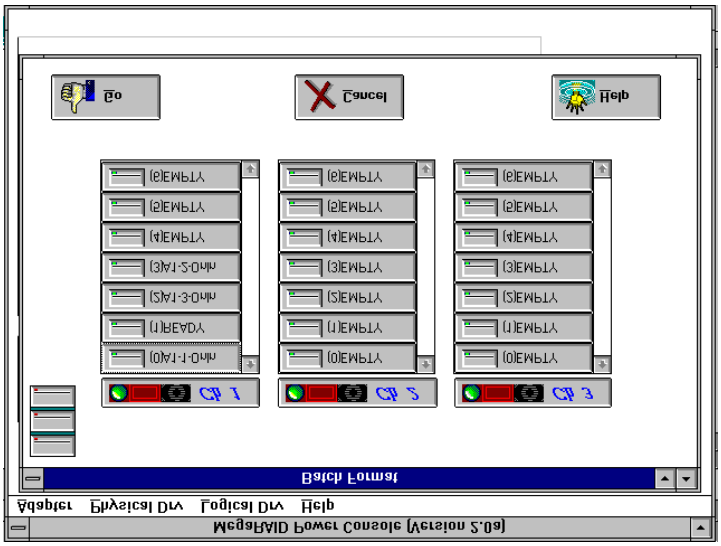
Cont'd

Power Console Physical Drive Menu, Continued

Format This option low-level formats one or more physical drives. A physical drive can be formatted if it is not part of a configuration and is in a Ready state. Since most SCSI drives are factory formatted, do this only if the drive:

- was not low-level formatted at the factory, or
- has an excessive number of media errors.

Do not use Format to erase information or partitions on a SCSI drive. That information is erased when you initialize the logical drive(s).



Diagnostics This option is not yet implemented.

Tools Choose this option to fail a drive, make a hot spare, enable narrow SCSI, enable wide SCSI, and perform other actions.

Firmware Download This option is not yet implemented.

Properties Choose this option to display drive properties.

Cont'd

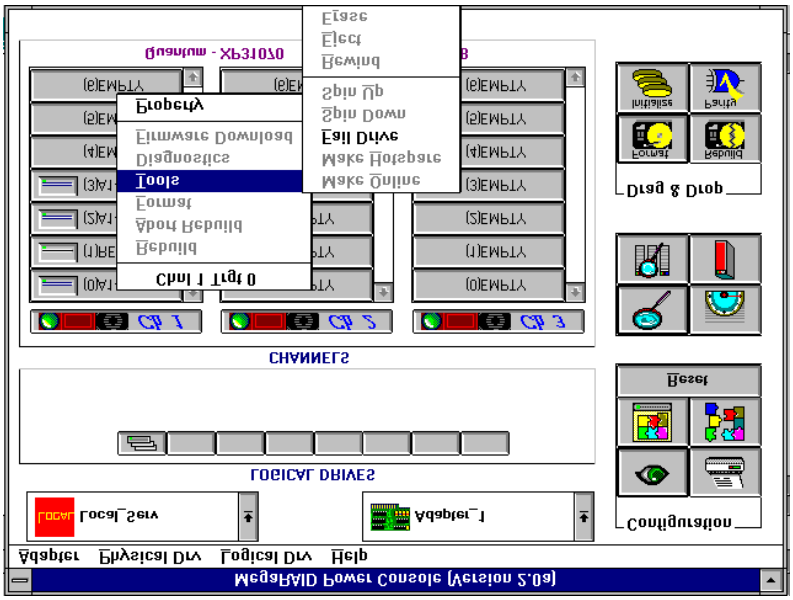
Designating Drives as Hot Spares

Hot Spares

Hot spares are physical drives that are powered up along with the RAID drives and usually are placed in a standby state.

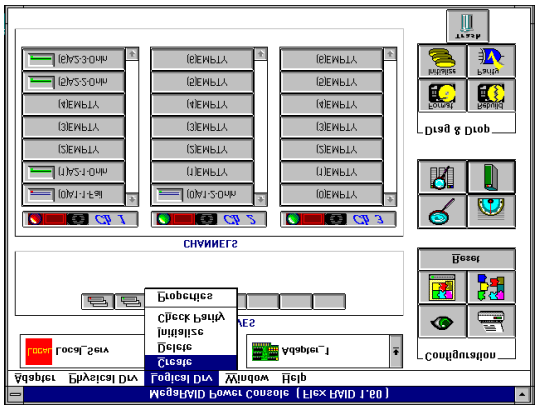
Hot spares can be used for RAID levels 0, 1, 3 and 5. To make a drive a hot spare, more than one logical drive must be configured. Click on the drive icon of the drive to be made the hot spare. Select *Tools* from the menu. *Select Make Hotspare* from the Tools submenu.

> ***Important***
>
> The drive to be made a hot spare must have a the same or a greater capacity than the other drives in the RAID array.



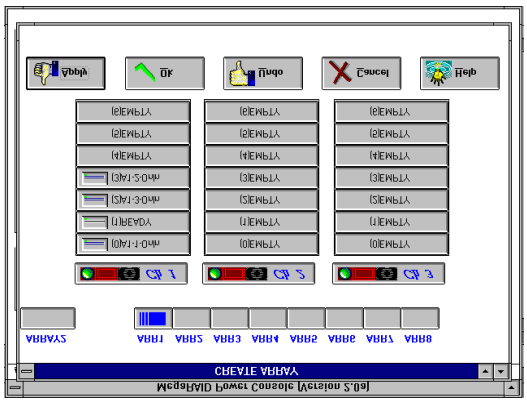
Power Console Logical Drive Menu

The Logical Drive Menu is shown below:



Create Array

Choose the Create option to create arrays. A screen such as the following appears. You can select the RAID type, stripe size, write policy, read policy, and cache policy.



Select the array to be created by clicking on ARR1 - ARR8 at the top of the screen. Select the drives to be included in the array by clicking on the device icons displayed in the middle of the screen. You can include SCSI devices from more than one channel in the new array.

Cont'd

Power Console Logical Drive Menu, Continued

Physical Drive Type When you select the icon for a SCSI device from the SCSI channels display in the middle of the above screen, the drive type and the capacity of the selected drive is displayed at the bottom of the screen.

Array Properties Click on Apply to configure the new array. Verify that the appropriate drives are included in the array and click on OK. You must also initialize these drives.

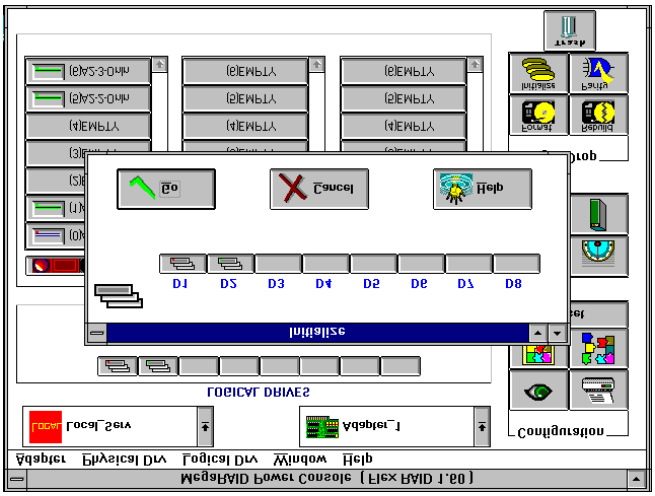
Delete Choose this option to remove a RAID array. A screen similar to the Create Array screen appears. Choose the array (ARR1 - ARR8) to be deleted and click on the OK button.

Cont'd

Power Console Logical Drive Menu, Continued

Initialize Choose this option to initialize logical drives. A screen such as the following appears. Choose the logical drives to be initialized and click on the Go button.

> ***Warning***
>
> Power Console allows you to initialize a drive at any time. Make sure that the drive being initialized does not hold live data. All data will be lost.

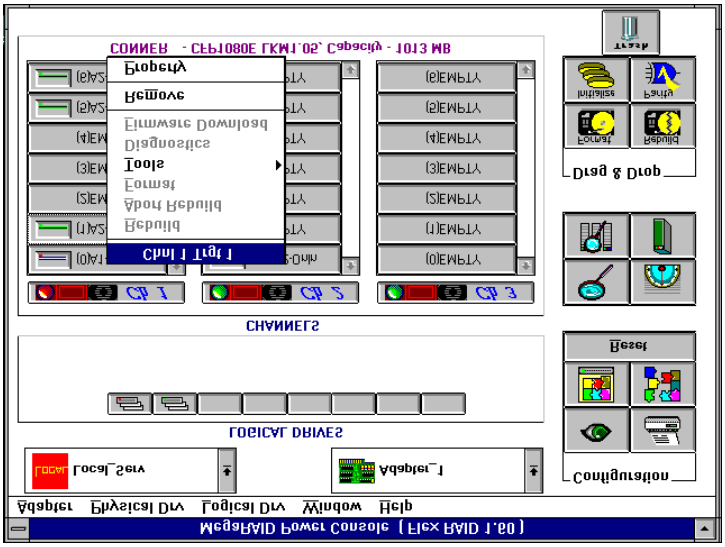


You can also initialize a drive by dragging the drive icon to the Format icon and dropping it.

Cont'd

Power Console Logical Drive Menu, Continued

Channel Information Position the cursor on one of the SCSI channels and click on the right mouse button to display information about the SCSI channel, as shown in the following sample screen:



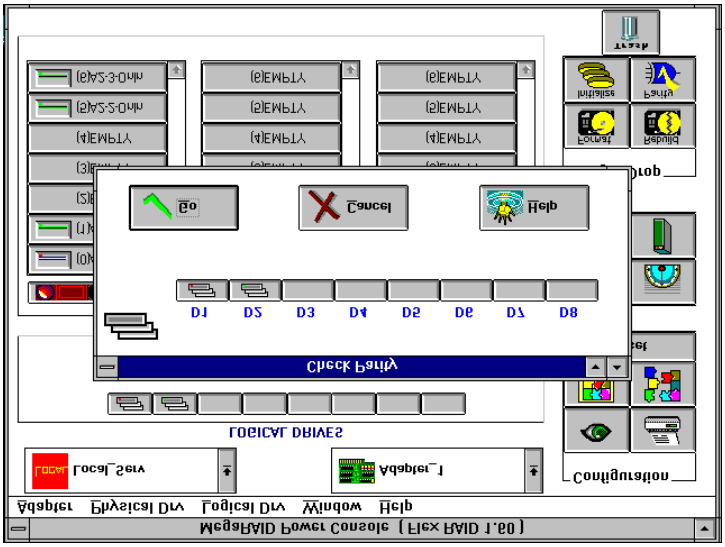
Cont'd

Power Console Logical Drive Menu, Continued

Check Parity

Choose Check Parity to make sure that parity is correct for the selected drives. A screen such as the following appears. Click on the drive to be checked (D1 - D8) and click on the Go button.

RAID levels 1, 3, and 5 use an extra drive to store parity data blocks. Parity is checked between these parity data blocks and the selected drives when you select this option.



Cont'd

Properties Choose Properties to display the logical drive properties of the selected logical drive. A screen such as the following appears. Each logical drive can be displayed by selecting the Previous or Next buttons.

Securing Power Console under Windows NT

To secure Power Console utility while running in Windows NT:

Step	Action
1	Log in as the Administrator.
2	Run File Manager.
3	Select the path containing the Power Console executable.
4	Pull down the Security menu in File Manager and choose PERMISSIONS.
5	When the permission dialog box appears, assign the LIST permission to all Groups except Administrator, Backup Operators, System, and Creator Owner.
6	In the Permission dialog box, select REPLACE PERMISSIONS ON SUBDIRECTORIES to apply the permissions that you are setting here to the subdirectories as well.
7	After you have set Permissions, choose OK and exit file manager. Now log in as a guest and make sure the permission changes have been saved.

If you follow these instructions, only those who are part of the selected groups can delete, copy, move, or execute any power console file.

8 Troubleshooting

Problem	Suggested Solution
Some operating systems do not load in a computer with a MegaRAID adapter.	Check the system BIOS configuration for PCI interrupt assignments. Make sure some Interrupts are assigned for PCI. Initialize the logical drive before installing the operating system.
One of the hard drive in the array fails often	Check the drive error counts using Power Console. Format the drive. Rebuild the drive If the drive continues to fail, replace the drive with another drive with the same capacity.
Pressed <Ctrl> <M>. Ran Megaconf.exe and tried to make a new configuration. The system hangs when scanning devices.	Check the drives IDs on each channel to make sure each device has a different ID. Check the termination. The device at the end of the channel must be terminated. Replace the drive cable.
Multiple drives connected to MegaRAID using the same power supply. There is a problem spinning the drives all at once.	Set the drives to spin on command. This will allow MegaRAID to spin two devices simultaneously.
Pressing <Ctrl> <M> or running megaconf.exe does not display the Management Menu.	These utilities require a color monitor.
At system power-up with the MegaRAID installed, the screen display is garbled.	At least 1 MB of memory must be installed in bank 0 (the lower memory socket) before power-up. For proper cache memory operation, you should install at least 4 MB of memory in MegaRAID.
Cannot flash or update the EEPROM.	Make sure that Pins 2-3 of J5 are shorted on the MegaRAID adapter card. If J5 is OK, you may need a new EEPROM.
The MegaRAID BIOS and firmware banner does not appear.	Make sure that J2 (Enable Expansion BIOS) is jumpered on at least one of the MegaRAID controllers in the system.

Problem	Suggested Solution
`Firmware Initializing...` appears and remains on the screen.	Make sure that TERMPWR is being properly provided to each peripheral device populated channel. Make sure that each end of the channel chain is properly terminated using the recommended terminator type for the peripheral device. The channel is automatically terminated at the MegaRAID card if only one cable is connected to a channel. Make sure that (on a channel basis) that only two type of cables are connected at any one time. Both internal SCSI connectors on a channel can used, but both internal SCSI connectors and the external SCSI connector for the same channel cannot be used. Make sure that memory modules are rate at 70 ns or faster. Make sure that the MegaRAID controller is properly seated in the PCI slot.
What is the maximum number of MegaRAID adapters per computer?	Currently, all the utilities and drivers support up to four MegaRAID adapters per system.
What SCSI IDs can a non-hard disk device have and what is maximum number allowed per adapter?	Non-hard disk devices can only accommodate SCSI IDs 1, 2, 3, 4, 5 or 6, regardless of the channel used. A maximum of six non-hard disk devices are supported per MegaRAID adapter.
Why does a failed logical array still get a drive assignment?	To maintain the DOS Path statement integrity.

DOS ASPI Driver Error Messages

Message	Corrective Action
American Megatrends Inc. ASPI Manager has NOT been loaded.	The ASPI manager is not loaded. One of the failure codes listed below is displayed next.
Controller setup FAILED error code=[0xab]	Correct the condition that caused the failure. The failure codes are: 0x40 No MegaRAID adapters found 0x80 Timed out waiting for interrupt to be posted 0x81 Timed out waiting for MegaRAID Response command. 0x82 Invalid command completion count. 0x83 Invalid completion status received. 0x84 Invalid command ID received. 0x85 No MegaRAID adapters found or no PCI BIOS support. 0x90 Unknown AMIBIOS Setup completion error 0x91 No ASPI accessible devices.
No non-disk devices were located	The driver did not find any non-hard drive devices during scanning. A SCSI device that is not a hard disk drive, such as a tape drive or CD-ROM drive, must be attached to this SCSI channel. The SCSI ID must be unique for each adapter and cannot be SCSI ID 0. The supported SCSI IDs are 1, 2, 3, 4, 5, and 6.
'ERROR: VDS support is *INACTIVE* for MegaRAID logical drives	The /h option is appended to driver in CONMFIG.SYS or this driver is used with a BIOS that is earlier than v1.10

9 FlexRAID

The MegaRAID FlexRAID advanced RAID management utility provides an innovative and powerful new RAID management method. FlexRAID provides on the fly RAID migration, creating almost limitless adaptability and expansion of any logical drive while the system remains operational.

Adding FlexRAID To add FlexRAID support, you must have new MegaRAID firmware version 1.53 or later and version 1.1 or later of the FlexRAID utilities for Windows NT and Novell NetWare. FlexRAID support is provided for Windows NT Version 3.5 or later and Novell NetWare.

All American Megatrends at 1-800-828-9264 for additional information about the firmware version numbers and MegaRAID software utilities that support FlexRAID.

FlexRAID Capabilities FlexRAID allows you to:

- add drives to any OPTIMAL RAID logical drive,
- convert from RAID 0 or 1 to RAID 1, 3, or 5 by adding a physical drive,
- restripe logical drives,
- change from a DEGRADED redundant logical drive to an OPTIMAL RAID 0 logical drive,
- convert a RAID 5 logical drive to a RAID 3 logical drive,
- convert a RAID 3 logical drive to a RAID 5 logical drive,
- remove any physical drive from a logical drive, and
- change a RAID 1, 3, or 5 logical drive to a RAID 0 logical drive

Cont’d

Operating Environment FlexRAID runs on a Microsoft Windows NT server or Novell NetWare server that supports one to four MegaRAID controllers. FlexRAID allows you to perform sophisticated RAID operations on preconfigured RAID logical drives.

Operating System	Program
Windows NT	NRAID.EXE
Novell NetWare	MEGAMGR.NLM

FlexRAID Features

Restriping FlexRAID allows you to change the stripe size of a configured logical drive without halting the system. All available stripe sizes are displayed. All you have to do is select a new stripe size. FlexRAID reconstructs the RAID subsystem with the new stripe size. The available stripe sizes include: 1 KB, 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB.

Change Degraded Drives to Optimal Drives FlexRAID allows you to convert any degraded RAID 1, RAID 3, or RAID 5 logical drive to an OPTIMAL RAID 0 logical drive. After you select the degraded logical drive to be optimized, FlexRAID reconstructs the RAID subsystem without halting the system.

Convert RAID 5 to RAID 3 FlexRAID allows you to convert any RAID 5 logical drive to a RAID 3 logical drive without halting the system.

You can also convert any RAID 3 logical drive to a RAID 5 logical drive.

Cont'd

FlexRAID Features, Continued

Remove a Physical Drive from a Logical Drive FlexRAID allows you to change the configuration of any logical drive by removing a physical drive from the configured logical drive. You can change an OPTIMAL RAID 5, RAID 3, or RAID 1 logical drives to an OPTIMAL RAID 0 drive.

Adding a Drive FlexRAID allows you to add a physical drive to a configured logical drive.

The logical drive state must be OPTIMAL. The physical drive state must be READY. An OPTIMAL RAID 0 logical drive can be converted to an OPTIMAL RAID 0, RAID 1, RAID 3, or RAID 5 logical drive by adding one or more physical drives. An OPTIMAL RAID 1 logical drive can be converted to an OPTIMAL RAID 0, RAID 3, or RAID 5 logical drive.

You can also convert between RAID 3 and RAID 5 by adding additional physical drives to the logical drive.

RAID Migration

Moving from one RAID level to another was more involved in previous implementations of RAID. If a drive failed in an OPTIMAL RAID 3 or RAID 5 configuration, the RAID subsystem was degraded and the drive had to be rebuilt before the RAID subsystem could return to an OPTIMAL RAID 3 or RAID 5 level.

FlexRAID Makes It Easy FlexRAID allows many ways to move between RAID levels without degrading the RAID subsystem. FlexRAID provides an IOCTL devoted to RAID level migration, an IOCTL to control the migration rate, and another IOCTL to display the migration progress.

Cont'd

FlexRAID Migration Paths The FlexRAID migration paths are:

If the RAID system is	You can change to	When You
RAID 3 or RAID 5 OPTIMAL	RAID 3 or RAID 5 OPTIMAL	Change stripe size, or add drives.
RAID 3 or RAID 5 OPTIMAL	RAID 0	Stop parity.
RAID 3 or RAID 5 OPTIMAL	RAID 0	Delete a drive, or add drives.
RAID 3 or RAID 5	RAID 0 OPTIMAL	If a drive fails, you can configure an OPTIMAL RAID 0 system.
RAID 1 OPTIMAL	RAID 3 or RAID 5 OPTIMAL	Add drives.
RAID 1 OPTIMAL	RAID 1 OPTIMAL	Change the stripe size.
RAID 1 OPTIMAL	RAID 0	Add drives. Delete a drive.
RAID 1 Degraded	RAID 0	If a drive fails, you can configure an OPTIMAL RAID 0 system.
RAID 0	RAID 3 or RAID 5 OPTIMAL	Add drives.
RAID 0	RAID 1 OPTIMAL	Add a drive.
RAID 0	RAID 0	Change the stripe size, or add drives.

10 Running FlexRAID on a Windows NT Server

Installing FlexRAID with Windows NT

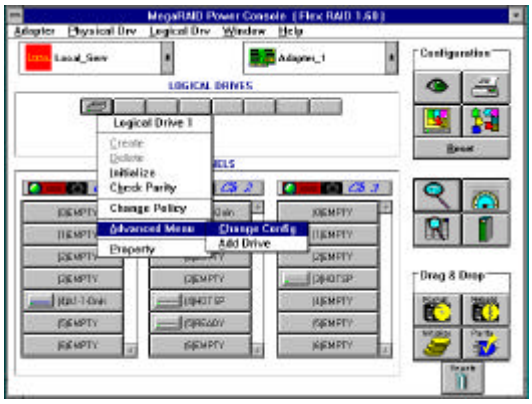
Insert the American Megatrends FlexRAID / Power Console diskette in drive A: (or B:). Select drive A: (or B:) in File Manager. Double-click on SETUP.EXE. Follow the instructions displayed on the screen.

Running FlexRAID in Windows NT

Running the FlexRAID software utility support in Windows NT Version 3.51 or later requires MegaRAID Power Console with FlexRAID support.

The FlexRAID user interface is part of the MegaRAID Power Console utility. See the *MegaRAID User's Guide* for additional information about Power Console.

Click the right mouse button on the logical drive to be changed. A menu that lists all FlexRAID options appears, as shown below:



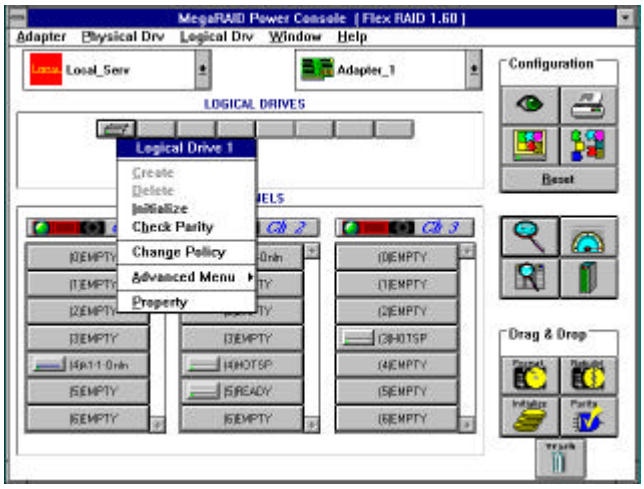
Cont'd

> ***Important***
>
> *After a FlexRAID operation has started and is under way, no other operation can be started until the FlexRAID operation completes.*

Rebuild Rate The Power Console Rebuild Rate icon (shown to the left) controls the rate of reconstruction for a FlexRAID operation.

Windows NT FlexRAID Main Screen

The FlexRAID main screen is a menu that appears when you select a logical drive, then click the right mouse button. The FlexRAID menu is shown below:



Windows NT FlexRAID Icons and Menus

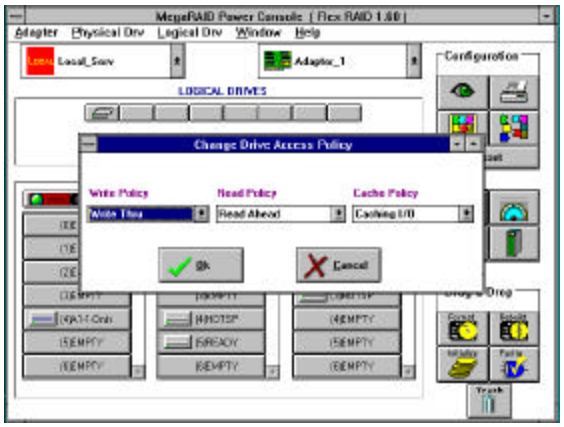
The FlexRAID toolbox buttons and menus are almost exactly the same as the Power Console icons and menus. See *the MegaRAID User's Guide* for additional information about the toolbar icons.

The logical drive menu and the trash can icon at the bottom of the screen are the only difference between the FlexRAID screen and the Power Console screen.

Drag and drop a physical drive on the trash can icon to delete a physical drive from a RAID logical drive.

Changing RAID Policy in Windows NT

Click on Change Policy on the FlexRAID menu to change the write, read, or cache policy for the selected array. The following screen appears:



Cont'd

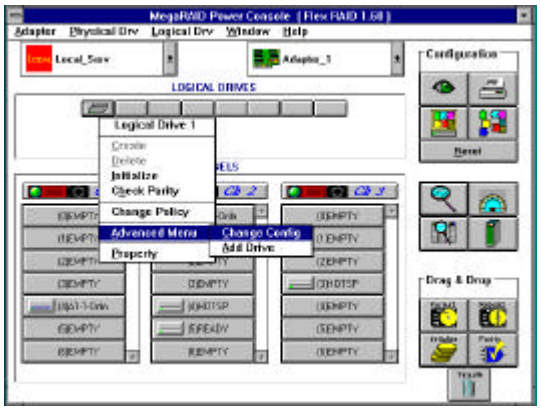
Change Write Policy Click on the down arrow button under Write Policy to display a list of the available write policies for this array. Click on a new write policy to select it. Click on OK when you have completed all policy changes.

Change Read Policy Click on the down arrow button under Read Policy to display a list of the available read policies for this array. Click on a new read policy to select it. Click on OK when you have completed all policy changes.

Change Cache Policy Click on the down arrow button under Cache Policy to display a list of the available read policies for this array. Click on a new cache policy to select it. Click on OK when you have completed all policy changes.

Adding a Physical Drive to a Logical Drive in Windows NT

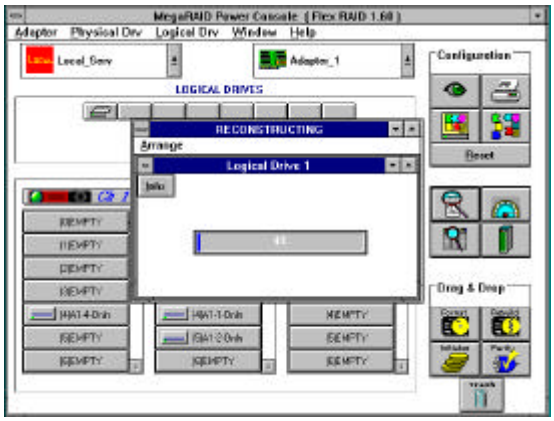
Select the logical drive where the physical drive is to be added and click the right mouse button while the logical drive is highlighted. Select Advanced Menu. The following appears:



Select *Add Drive*. Select the drives to be added from the following screen, which appears next:

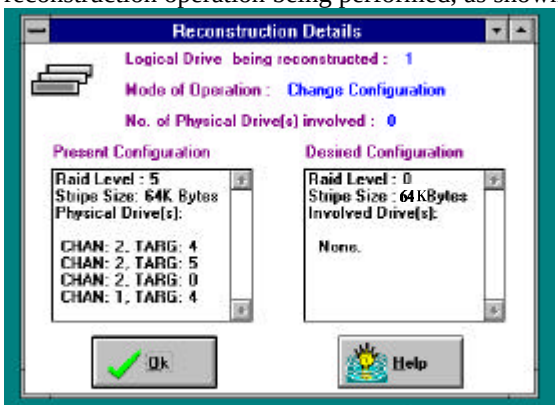
> ***Important***
> *The state of the physical drive to be added must be READY. The state of the RAID subsystem being modified must be OPTIMAL.*

After you select the drive(s) to be added, the Reconstructing screen appears, as shown below:



Information

Click on the Info button to display detailed information about the reconstruction operation being performed, as shown below:



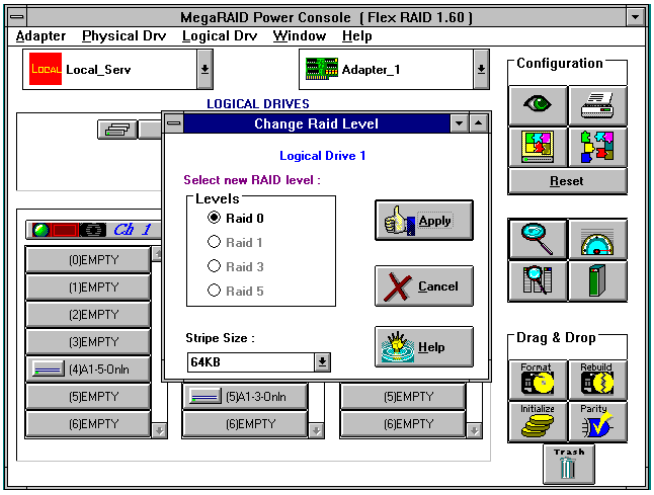
Cont'd

Adding a Physical Drive to a Logical Drive in Windows NT, Continued

Confirming Changes Select OK after you have completed the RAID configuration changes. Review the changes that have been made and select *OK* when finished.

Removing a Physical Drive from a Logical Drive in Windows NT

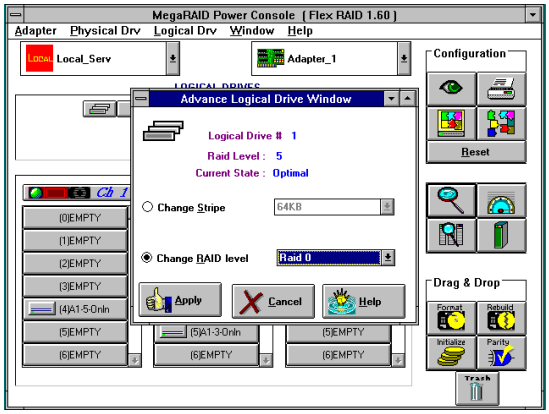
Drag the physical drive icon to the trash can at the bottom of the screen to remove a drive from a logical drive. Select the RAID level that will allow the new RAID configuration to become OPTIMAL from the dialog box that appears next (see below):



Important

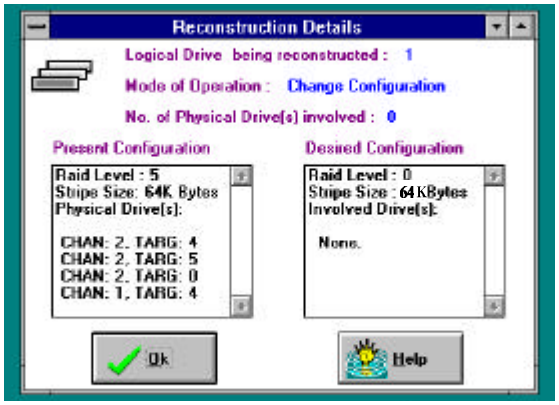
The state of the physical drive to be added must be READY. The state of the RAID subsystem being modified must be OPTIMAL.

From the FlexRAID menu, select *Change RAID Configuration.* The following appears:



Cont'd

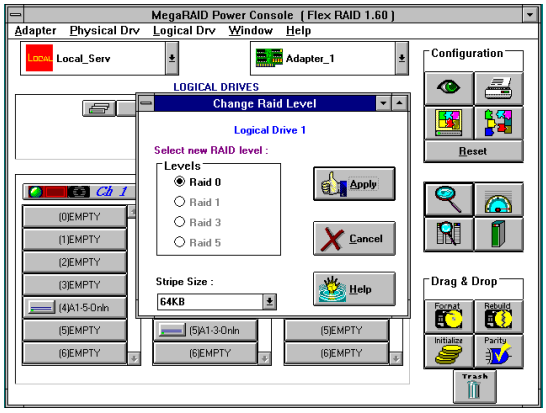
Information Click on the Info button to display detailed information about the reconstruction operation being performed, as shown below:



Confirming Changes Select OK after you have completed the RAID configuration changes. The following screen then appears. Review the changes that have been made and select *OK* when finished.

Restriping a Logical Drive in Windows NT

To change the stripe size, select the logical drive where the physical drive is to be added and click the right mouse button while the logical drive is highlighted. Select Advanced Menu, then select Change Config. The following appears.



Select a new stripe size by clicking on the Stripe Size box. The available stripe sizes are:

- 1 KB,
- 2 KB,
- 4 KB,
- 8 KB,
- 16 KB,
- 32 KB,
- 64 KB, or
- 128 KB.

Changing Stripe Sizes *This feature has not yet been implemented.*

11 Running FlexRAID in Novell NetWare and DOS

The features for running FlexRAID under Novell NetWare have been incorporated into the MegaRAID Manager (MEGAMGR.NLM).

Installing FlexRAID under NetWare

Follow the Novell NetWare installation instructions in the *American Megatrends MegaRAID User's Guide.* FlexRAID for Novell NetWare is provided in the new version of MEGAMGR.NLM, the MegaRAID Manager.

Make sure you remove any previous versions of MEGAMGR.NLM before installing the new MEGAMGR.NLM.

New MegaRAID Manager Features

The FlexRAID for Novell NetWare MegaRAID Manager features include:

- drive reconstruction can continue even if a power failure occurs,
- converting RAID levels, and
- adding or removing physical drives.

Cont'd

Converting RAID Levels FlexRAID for Novell NetWare can perform the same sort of RAID migration possible using FlexRAID for Windows NT.

Select Advanced Menu from the MegaRAID Monitor Management Menu. Select Reconstruct Logical Drive. Select Change RAID Levels. The valid RAID levels that you can change to are displayed. Select the new RAID level. Then select Reconstruct from the Adapter submenu on the MegaRAID Manager Objects menu.

Virtual Sizing Virtual Sizing allows the FlexRAID utility to determine the drive capacity. The operating system reports the drive capacity as determined by FlexRAID. Select Virtual Sizing from the MegaRAID Manager Adapter menu. Select Enabled. Select Advanced Menu from the MegaRAID Monitor Management Menu, as shown below. Select Reconstruct Logical Drive.

> ***Important***
> *The physical drive must be in the READY state before it can be added to a logical drive.*
> *No FlexRAID operation can be started while a drive is being reconstructed.*

After you have created a logical array set, the drive partition can be as large as the full size of the logical drive. However, this is the full virtual drive size, not the actual physical drive size.

Cont'd

Removing Physical Drives To remove a drive from a logical drive, select the drive to be removed from the Reconstruct screen by pressing the spacebar. The physical drive must be in the ONLINE state before it can be removed from a logical drive.

Select Reconstruct from the Reconstruct submenu. The reconstruction process starts, removing the physical drive from the logical drive.

Changing Stripe Sizes *This feature has not yet been implemented.*

New MegaRAID Manager Menu Features

Adapter Menu The following items have been added to the MegaRAID Manager Adapter menu:

Item	Description
FlexRAID Power Fail	The settings are *Enabled* or *Disabled.* Choose this option to allow drive reconstruction to continue when the system restarts if a power failure occurs.
FlexRAID Virtual Sizing	Virtual Sizing allows FlexRAID to set the drive capacity. Operating systems report the drive capacity as set by FlexRAID. The settings are *Enabled* or *Disabled*. You must set this option to *Enabled* before adding a physical drive to a logical drive. After you have created a logical drive set, the drive partition should be as large as the virtual size of the logical drive (not the actual physical drive size). For example: Virtual Sizing is Enabled and a 10 GB drive is available. The drive can be reported as having a capacity of 80GB (but 70 GB is reported as Used and is not available. You would actually have a 70 GB drive).

Cont'd

Objects Menu The following new options appear on the Adapter submenu, which is selected by choosing Adapter from the Objects menu:

Item	Description
Reconstruct Logical Drives	You can select or deselect a logical drive. Choose this option before you add or remove a physical drive. The physical drive must be in the READY state before you can add it to a logical drive. The physical drive must be in the ONLINE state to remove it from a logical drive.
Reconstruct Menu	From the menu that appears when you select this option, you can: change RAID levels, change the Stripe size (not yet implemented), or Reconstruct a logical drive. A screen that shows the reconstruction progress appears after the operation has begun. You cannot select any other operation while a logical drive is being reconstructed.

12 MegaRAID Drivers

The MegaRAID PCI SCSI Disk Array RAID Controller is installed in any IBM AT®-compatible computer with a PCI local bus. MegaRAID can operate under MS-DOS® or any DOS-compatible operating system using the standard AT BIOS INT 13h Hard Disk Drive interface. To operate with other operating systems, you must install software drivers. MegaRAID provides software drivers for the following operating systems:

- DOS ASPI drivers,
- Microsoft Windows NT™ Versions 3.1, 3.5, and 4.0,
- Microsoft Windows 95™,
- Novell NetWare® Version 3.x and 4.x,
- SCO® Unix® SVR 3.2. V4.2., MPX 3.0, SCO Unix SVR 3.2 V5.0, and SMP 5.0
- IBM® OS/2® Version 2.x and OS/2 Warp Version 3.0, and
- SCO UnixWare™ V2.x.

DOS ASPI Driver

The ASPI drivers for the American Megatrends MegaRAID PCI SCSI Disk Array Controller can be used in a DOS, Microsoft Windows™ 3.x, and Microsoft Windows 95™ environment.

Features

The DOS ASPI driver supports:

- up to six non-hard disk drive SCSI devices (each SCSI device must use a unique SCSI ID regardless of the SCSI channel it resides on - with the exception of SCSI ID = 0),
- up to four SCSI adapters will be scanned for non-hard disk drive SCSI devices), and
- provides virtual DMA (VDS) services for up to eight logical drives.

ASPI Driver

This list includes all devices except hard disk drives. *The Application software listed below is not provided with MegaRAID.*

Drivers	Devices Supported	Application Software	Features
MEGASPI.SYS	CD-ROM, tape, optical drives, etc.	CorelSCSI®, Novaback®, and PC Tools®	VDS

Installing

Copy MEGASPI.SYS to the hard disk drive. Add the following line to CONFIG.SYS

```
device=C:\path\MEGASPI.SYS /v
```

Parameters

The MEGASPI.SYS parameters are:

Parameter	Description
/h	INT 13h support is not provided.
/v	Verbose mode. All message are displayed on the screen.
/q	Quiet mode. All message except error message are suppressed.

DOS CD-ROM Driver

With the MegaRAID adapter card, American Megatrends provides a device driver for CD-ROM drives operating under DOS. The driver is the AMICDROM.SYS file.

Installing

The MEGASPI.SYS ASPI manager must be added to the CONFIG.SYS file before you can install the CD-ROM device driver. See the instructions on the previous page for adding the MEGASPI.SYS driver.

Copy AMICDROM.SYS to the root directory of the C: drive in your computer. Using any DOS text editor, add the following to CONFIG.SYS:

```
DEVICE=C:AMICDROM.SYS
```

Add the following to AUTOEXEC.BAT. Make sure it is before the SMARTDRV.EXE line.

```
MSCDEX /D:MSCD001
```

MSCDEX is the Microsoft CD-ROM drive extension file that is supplied with MS-DOS® and PC-DOS® Version 5.0 or later.

DOS ASPI Driver Error Messages

Message	Corrective Action
American Megatrends Inc ASPI Manager has NOT been loaded.	The ASPI manager is not loaded. One of the failure codes listed below is displayed next.
Controller setup FAILED error code=[0xab]	Correct the condition that caused the failure. The failure codes are: 0x40 No MegaRAID adapters found 0x80 Timed out waiting for interrupt to be posted 0x81 Timed out waiting for the MegaRAID to respond. 0x82 Invalid command completion count. 0x83 Invalid completion status received. 0x84 Invalid command ID received. 0x85 No PCI BIOS support. 0x90 Unknown error. 0x91 No ASPI accessible devices.
No non-disk devices were located	The driver did not find any non-hard drive devices during scanning. A SCSI device that is not a hard disk drive, such as a tape drive or CD-ROM drive, must be attached to this SCSI channel. The SCSI ID must be unique for each adapter and cannot be SCSI ID 0. The supported SCSI IDs are 1, 2, 3, 4, 5, and 6.
'ERROR: VDS support is *INACTIVE* for MegaRAID logical drives	_ /h is appended to the driver command in CONFIG.SYS, or _ this driver is used with a BIOS that is earlier than v1.10, or _ no logical drives are configured on the MegaRAID controller.

Windows NT Drivers

The MegaRAID Windows NT version 3.11 and version 3.5x software drivers are provided on the MegaRAID Windows NT driver diskette. These two drivers are miniport drivers.

Features The MegaRAID Windows NT drivers support:

- four SCSI adapters per host system,
- eight logical drives per adapter, and
- six non-disk devices per adapter. Use SCSI IDs 1 through 6 for non-disk devices.

Driver Files The MegaRAID Windows NT driver files are:

File	Description
MRAID311.SYS	The Windows NT V3.1 driver.
MRAID35X.SYS	The Windows NT V3.5 driver.
OEMSETUP.INF	Used by Windows NT Setup to add SCSI Drivers.
TXTSETUP.OEM	Used by Windows NT for fresh installation

Driver Installation There are two methods of installing the MegaRAID Windows NT drivers:

- fresh installation and
- adding to an existing installation.

Cont'd

Fresh Installation Use fresh installation if you are installing Windows NT for the first time and want to include the MegaRAID drivers and utilities.

> ***Important***
>
> With the current MegaRAID Windows NT drivers, you can only perform a fresh installation of Windows NT if you are running Windows NT 3.51 or 4.x.
>
> If you want to perform a fresh installation of Windows NT V3.11, you must:
>
> - delete OEMSETUP.INF, TXTSETUP.OEM, and MRAID35X.SYS from the MegaRAID diskette,
> - copy the contents of the NT311 subdirectory on the MegaRAID Windows NT Driver diskette to the root directory of the MegaRAID diskette before you can do a fresh installation of Windows NT V3.11.

Perform the following steps to do a fresh installation if running Windows NT V3.51 or Windows NT V4.X:

Step	Action
1	Follow the standard Windows NT installation procedures.
2	When prompted to choose between Standard and Custom setup, select Custom Setup.
3	The installation procedure scans for a disk controller. Choose S to skip detection.
4	Select Specify additional SCSI adapters.
5	Choose Other... from the list of displayed devices.
6	The installation program will prompt for the Manufacturer supplied hardware support disk. Insert the MegaRAID Windows NT diskette and follow the Windows NT Setup instructions on the screen.

Cont'd

Add to an Installation If you are already running Windows NT and want to add the MegaRAID Windows NT Driver and Utilities, insert the MegaRAID Windows NT driver diskette in diskette drive A: (or B:).

Run the Windows NT File Manager. Click on the A: (or B:) drive to display the contents of the MegaRAID Windows NT diskette. Click on SETUP.EXE and follow the instructions on the screen. This procedure will install the MegaRAID drivers for either Windows NT 3.11 or Windows NT V3.5x, depending on which version you are running. You must reboot the computer after MegaRAID Windows NT driver installation has completed successfully.

Configure Logical Drive Logical drives can be configured on the MegaRAID SCSI adapter via the MegaRAID Power Console, a GUI RAID Management Utility.

The Logical drives can be configured in Windows NT using Disk Administrator.

See the *MegaRAID User's Guide* for additional information about Power Console.

Non-Disk Devices Non-disk SCSI devices can be installed on any SCSI channel on the adapter.

The SCSI ID for the non-disk devices must be between 1 and 6 must be unique irrespective of the channel.

Configuring SNMP Support

Step	Action
1	Copy MEGASNMP.DLL from the MegaRAID SNMP and Windows NT diskette to %systemroot%\system32.
2	At the command prompt, type REGEDT32 and press <Enter> to run the registry database editor. You must be extremely careful to use REGEDT32 only as specified here. You can easily destroy the Windows NT configuration by misusing REGEDT32.
3	Display HKEY_LOCAL_MACHINE ---> SOFTWARE ---> Microsoft
4	Add the following using the Add_Key Option in Edit Menu at the top of the window. Key Name = ami Class = REG_SZ
5	Click on ami. This is the new key that is added after the above procedure.
6	In the empty window on the right, press the <Ins> key. Specify: Value Name = *Path* Data Type = REG_EXPAND_SZ String = %SystemRoot%\System32\MEGASNMP.dll
7	Go to HKEY_LOCAL_MACHINE --> SYSTEM ---> CurrentControlSet ---> Services ---> SNMP ---> Parameters ---> ExtensionAgents In the right window, Press the <Ins> key and add this entry: Value Name = “NetValue” Data Type = REG_SZ String = SOFTWARE\Microsoft\ami The new extension agent is linked to the MEGASNMP.DLL entry added in the previous step. The Value Name in step 7 should be one greater than the already existing number of entries in the ExtensionAgents in the right window.
8	Exit the Registry Window.
9	net stop snmp net start snmp
10	The MEGARAID MIB should be visible from the remote SNMP Manager now.

Novell NetWare 3.1x and 4.x Drivers

The MegaRAID Novell NetWare driver and utilities support logical drives configured on the MegaRAID SCSI Adapter. Non-disk devices are supported through the ASPI Interface. This driver supports up to four MegaRAID Adapters.

> ***Important***
> The logical drives configured on the host adapter are registered with the operating system as separate logical units on Target ID 0.

Driver/Utility Files The MegaRAID Novell NetWare driver files are:

File	Description
MEGA4_XX.HAM	This is the MegaRAID host adapter module (HAM). It conforms to the Novell NetWare 4.x NPA architecture. This driver supports the NPA Diagnostics option via the *NWDIAG* flag, specified on the command line when the driver is loaded. The driver works as a reentrant module and registers one adapter when the NetWare LOAD command is issued to load the driver. It also provides an IOCTL mechanism used by the ASPI driver and the MegaRAID configuration and management utility to interact with the MegaRAID Adapter.
MEGA4XX.DSK MEGA3_1X.DSK	These MegaRAID host adapter module drivers conform to the Novell NetWare 4.1 and 3.1x DDFS architecture. These drivers are reentrant modules. They register one adapter every time the NetWare LOAD command is issued. They also provide an IOCTL mechanism used by the ASPI driver and MegaRAID Manager to interact with MegaRAID.
MEGASPI.DSK	This is the ASPI driver that handles non-disk devices. Non-disk devices are supported on all SCSI adapters. The target ID of non-disk devices must be 1 through 6 on any SCSI adapter. Non-disk devices can be distributed across SCSI channels, but must have unique target IDs.
MEGAMGR.NLM	This is the MegaRAID Configuration and Management utility. *Do not unload this NLM using the UNLOAD console command.* See the *MegaRAID User's Guide* for additional information about MegaRAID Manager.
MEGAMON.NLM	The MegaRAID Monitor reports events on the adapter. Event categories are: Severe, Warning, and Information. The notification is broadcast to the supervisor, displayed locally on the console, and displayed remotely.

Cont'd

Driver Installation All utilities and ASPI drivers expect the driver to pass the requests to the adapter. The driver must be loaded before it can load the NLMs. Install utilities and drivers in this order:

1	DRIVER - HAM or DSK. See the note below.
2	Load MEGASPI.DSK, MEGAMON.NLM and MEGAMGR.NLM in any order after the above modules are loaded.

Follow the instructions in the *Novell NetWare Installation Guide* to install NetWare on the server. If installing Novell NetWare using MegaRAID as a primary adapter:

Step	Action
1	Connect the hard disks and CD-ROM if installing NetWare from a CD-ROM to MegaRAID. Configure MegaRAID and initialize all drives by running MegaRAID BIOS Setup or MegaRAID Manager. See the *MegaRAID User's Guide* for additional information.
2	Create a small active DOS partition on the first logical drive. Format the drive and transfer DOS to that drive. Boot from this drive connected to MegaRAID. This drive should appear as Drive C:.
3	If installing the operating system from a CD-ROM, you may need DOS CD-ROM drivers. Install the CD-ROM drivers and make sure that the CD-ROM drive can be accessed from DOS.
4	*Perform this step only if using Novell NetWare 4.x (NOT v4.11).* Follow the Novell NetWare 4.x installation instructions. Insert the MegaRAID DOS/ Novell 3.X,4.X/OS2/Windows 95 diskette when needed.
5	Install NetWare 3.1x as specified in the NetWare manuals.
6	Copy the driver files from the MegaRAID DOS, Novell NetWare/Windows/Windows 95diskette to the directory where SERVER.EXE runs. The files differ for each NetWare version.

7	Run NetWare. Load the MegaRAID NetWare drivers by typing
	`Load c:\novell\mega3_1X`
	Or you can add the following to STARTUP.NCF:
	`load c:\novell\mega3_1X`
	and add the following lines to *AUTOEXEC.NCF:*
	`load c:\novell\megaspi`
	MEGAMON.NLM and MEGAMGR.NLM should be loaded when needed. *Do not use the UNLOAD Console Command to unload MEGAMGR.NL*M. If using the NPA driver for NetWare 4.1 only, load Mega4_XX.HAM. Get the latest versions of NWPA.NLM and SCSIHD.CDM from Novell. If using the DDFS driver for NetWare 4.xx:, load Mega4_xx.DSK for NetWare 4.x. If using the DDFS driver for NetWare 3.xx, load Mega3_1X.DSK for NetWare 3.1x.

Novell NetWare 3.x SNMP

The Novell NetWare SNMP Services NLM file is MEGASNMP.NLM. This file provides NetWare SNMP services.

- Installing,
- loading, and
- configuring

the NetWare SNMP NLM for NetWare v3.11 is described below. NetWare v4.0 already contains the SNMP NLM.

Installing NetWare SNMP on a NetWare v3.11 Server

Prerequisites The NetWare SNMP service interface toolkit includes a NetWare 3.11 SNMP Agent Update diskette that updates NetWare SNMP on NetWare x3.11 servers. This SNMP Agent depends on the AFTER311 NLM. You must load the TCP/IP NLM if the SNMP management stations use IP as a transport mechanism.

You must always use the NetWare SNMP installation program on the Update diskette when installing NetWare SNMP. This installation program contains version checking code to prevent existing versions of the correct NetWare SNMP files from being overwritten. The NetWare MultiProtocol Router v2.0 or later, WAN Links v2.0 or later, and NetWare v4.0 already contain correct versions of the NetWare SNMP and related SNMP files. The NetWare SNMP NLM depends on other NLM files (liked the TCP/IP NLM), so you must use the installation program on the Update diskette.

Where to Install Install the NetWare SNMP either on the server where it will run (a local installation) or from a workstation attached to the server (a remote location).

Installing NetWare SNMP Software Locally

Step	Action
1	Type LOAD INSTALL and press <Enter> from the server console.
2	Select Product Options from the Install NLM screen.
3	Press the <Ins> key to add a new product.
4	Insert the Update diskette in floppy drive A: and press <Enter>.
5	After installation completes, press <Enter> to display the main menu.
6	Select System Options.
7	Select Edit AUTOEXEC.NCF file.
8	Add the following line to the AUTOEXEC.NCF file: LOAD SNMP You can include command line options as necessary. These options are described later.
9	Press <Esc> to exit.
10	Type Y to save the edits to the AUTOEXEC.NCF file.
11	Press <Esc> to leave the main menu.
12	Press <Esc> to exit the Install NLM.
13	Bring down the server as follows: type DOWN and press <Enter>. Type EXIT and press <Enter>.
14	Restart the server by typing SERVER and pressing <Enter>.

Installing NetWare SNMP Software Remotely

Step	Action
1	Log in to the server where you are installing NetWare SNMP and complete the following steps. Create the SYS:SNMP-1 directory on the server by typing the following commands at the workstation. Type MAP Q:=SYS: and press <Enter. Type Q: and press <Enter>. Type MD SNMP-1 and press <Enter> Type CD SNMP-1 and press <Enter>.
2	Insert the Update diskette in floppy drive A: and copy the files and subdirectories from the Update diskette to the SYSLSNMP-1 directory. Type XCOPY /S /A A: *.* Q:\SNMP-1 and press <Enter>.
3	Type RCONSOLE and press <Enter>.
4	Load the Install NLM. Type LOAD INSTALL and press <Enter>.
5	Select Product Options from the Install NLM screen. Press the <Ins> key to add a new product.
6	Type SYS:SNMP-1 and press <Enter> when prompted. When the installation completes, press <Esc> to display the main menu.
7	Select System Options. Select Edit AUTOEXEC.NCF file.
8	Add the following line to the AUTOEXEC.NCF file: LOAD SNMP You can include command line options as necessary. These options are described later. Press <Esc> to exit.
9	Type Y to save the edits to the AUTOEXEC.NCF file. Press <Esc> to exit the main menu.
10	Press <Esc> to exit the Install NLM.

Step	Action
11	Bring down the server as follows: type DOWN and press <Enter>. Type EXIT and press <Enter>.
12	Restart the server by typing SERVER and pressing <Enter>.

Loading NetWare SNMP

After the NetWare SNMP is installed, it loads automatically when the server starts. You can also explicitly start NetWare SNMP by typing the LOAD command. Type

```
LOAD SNMP options
```

and press <Enter>. The options, described on the following page, allow you to establish the community name used in SNMP traps. NetWare SNMP also provides default community names for the monitor (read-only) and control (read/write) communities. NetWare SNMP uses these names for access control. The community names in a request message from an SNMP management station must match the names established by NetWare SNMP.

If NetWare SNMP receives a request protocol data unit (PDU) that has an unknown community name, NetWare SNMP does not respond to the request. For example: if the community name is secret and NetWare receives a SETRequest PDU with the community name public, NetWare SNMP discards the SETRequest PDU and does not respond.

Disabling Community Types When a community type is disabled, no management entity can access information for that community. For example: if the control community is disabled, no one can use NetWare SNMP to do SET operations on the data that NetWare manages.

Changing Options You can change options by typing the LOAD command while NetWare SNMP is running.

You can also modify the LOAD SNMP line in the AUTOEXEC.NCF file to include different default options.

NetWare LOAD Command Options

The NetWare LOAD command line options are not case-sensitive. Just type the first character of the option name. The communityName is an arbitrary 1-32 character case-sensitive ASCII string that can include any character except tab, space, [,], =, :, :, or #.

Option	Syntax	Description
MonitorCommunity	M=communityName	Describes the read-only community that can do GET and GET NEXT operations. The default is public.
ControlCommunity	C=CommunityName	Describes the read/ writecommunity that can do SET, GET, and GET NEXT operations. The default is disabled. When the control community is disabled, all write access is disabled.
TrapCommunity	T=CommunityName	Describes the community name for traps. The default is public. If the trap community is disabled, NetWare SNMP does not send traps.

Enabling Access by One Community Name Enter the option parameter followed by an equal sign and the community name. Thereafter, the community name offered by the SNMP management station must match this new community name or NetWare SNMP denies access for the request.

Enabling Access by Any Community Name Enter the option parameter followed by an equal sign and no community name. Thereafter, any community name offered by the SNMP management station is accepted by NetWare SNMP.

Disabling Access to a Community Enter the option parameter with no equal sign.

Configuring NetWare SNMP for MIB-II Information

You can set several MIB-II variables in the SYS:\ETC\SNMP.CFG file. Edit the SYS:\ETC\SNMP.CFG file using any ASCII text editor. Follow the instructions in the file comments. The MIB-II variables are:

Variable	Description
SysName	Specifies the system name.
SysLocation	Specifies the system location.
SysContact	Specifies the name of the system administrator or other person who should be contacted about system problems or maintenance.

Loading MEGASNMP.NLM. The SNMP MIB must be compiled at the SNMP Manager Workstation. No compilation is necessary at the NetWare Server.

MEGASNMP.NLM should be loaded after SNMP.NLM has been loaded. Type the following at the DOS prompt to enable Set and Traps:

```
LOAD SNMP Trap = Control = verbose
```

Now load MEGACSNMP.NLM.

Edit SYSTEM:\ETC\TRAPTARG.CFG to include the IPX addresses of the workstations running SNMP Managers.

Configuring NetWare to Send Traps to Applications

To receive traps sent by NetWare SNMP, make sure your management station address is listed in the IP or IPX section of the SYS:\ETC\TRAPTARG.CFG file. You can edit the file using any ASCII text editor. Follow the instructions in the file comments.

SCO Unix SVR 3.2. V4.2., MPX 3.0, SCO Unix SVR 3.2 V5.0, and SMP 5.0

The MegaRAID SCSI Unix software driver and utilities for SCO Unix can also be used for Open Desktop (ODT) 3.0. When installing with ODT, some of the responses are different.

Unix Driver Features The MegaRAID SCO Unix driver (**amird**) is an MSCSI (Modular SCSI) host adapter driver. It supports:

- up to four host adapters per host system,
- up to eight logical drives per adapter,
- up to six non-disk devices per adapter, and
- IOCTLS for managing the adapter environment

SCO Unix Driver Files If the installation is successful, the following files are added:

File	Description
/etc/megamgr	megamgr is an executable file that provides an object-oriented hierarchical interface to the SCSI adapter. Megamgr configures new drives, reconstructs failed disks (if they are part of the redundant logical drives), displays adapter and disk performance, and manages channels and adapters. See the *MegaRAID User's Guide* for information about MegaRAID Manager.
/etc/amirdmon	amirdmon is a monitoring utility that is activated when the computer enters multi-user mode. It tracks the adapter state changes, displays the state change messages, and posts mail to *root.*
/etc/conf/pack.d/ amird/Driver.o	Driver.o is the MegaRAID SCO Unix driver.
/etc/conf/pack.d/ amird/Space.c	Space.c contains the MegaRAID driver configurable parameters
System Files	The MegaRAID driver entries are added to the following directories: /etc/conf/cf.d/mscsi, /etc/conf/cf.d/mdevice, and /etc/conf/sdevice.d/amird

Cont'd

SCO Unix MPX Driver, Continued

SCO Unix Driver Installation There are two types of installation:

- fresh installation and
- adding to an existing installation.

Fresh Installation Perform the following steps if MegaRAID is installed as the primary adapter and this is a new installation of the operating system. These steps focus on driver installation. See the *SCO Unix Installation Guide* for detailed installation information.

Step	Action
1	Run MegaRAID BIOS Setup. Press <Ctrl> <M> at BIOS initialization. Configure the logical drives.
2	Insert the SCO Unix Volume N1 (boot diskette) in the floppy drive and boot the computer.
3	Type `link` at the boot prompt and press <Enter>.
4	When prompted for the package to install, type `amird` and press <Enter>.
5	Please insert the fd (60) amird volume and press <Return> or 'q' to quit: Insert the MegaRAID SCO Unix diskette in the floppy drive and press <Enter>.
6	Follow the standard SCO Unix installation instructions. The following appears: `The BTLD packages will now be extracted. Please insert the amird volume and press <enter>` Insert the MegaRAID SCO Unix diskette and press <Enter>.

7	Follow the SCO Unix instructions. The following packages are on this disk:
	`NAME DESCRIPTION`
	`amird AMIRD SCO Unix 3.2.4.2 PCI RAID Adapter Driver ver 1.00`
	`Please enter the names of the packages you wish to install, or q to quit`
	`[default : amird]:`
	
	appears. Press <Enter>. Wait for the power off message.

Cont’d

Add to Installation If Installing MegaRAID as a secondary adapter on an existing SCO installation:

Step	Action
1	Type installpkg at the shell prompt.
2	When prompted for the package to install, type amird.
3	Insert the MegaRAID SCO Unix diskette in the floppy drive.
4	Follow the Unix instructions. If installing a second MegaRAID controller, nothing new is required. The drivers that have already been installed can handle the new adapter.

Adding New Devices To add a new device to the adapter, execute the SCO Unix mkdev utility. You can add up to eight logical drives.

Logical drives are mapped to SCO Unix on SCSI ID 0 Logical Units 0 through 7.

Logical drive 0 is mapped to SCSI ID =0, LUN =0. Logical drive 1 is mapped to SCSI ID = 0, LUN = 1, and so on.

Non-disk SCSI devices can be installed on any channel on the adapter. SCSI IDs for non-disk SCSI devices must be a unique number from 1 through 6.

UnixWare V2.x Drivers

Follow the standard installation procedure as specified in the *SCO UnixWare 2.0 Installation Handbook* to install the MegaRAID UnixWare drivers.

Unix Driver Features The MegaRAID UnixWare driver is a **PDI** SCSI host adapter driver. It supports:

- up to four host adapters per host system,
- up to eight logical drives per adapter,
- up to five non-disk devices per adapter (SCSI ID 0 and SCSI ID1 are reserved for SCSI disk devices), and
- IOCTL for managing the adapter environment

Fresh Installation Insert the MegaRAID UnixWare HBA diskette 1 of 1 when the UnixWare installation prompts for an HBA diskette. Follow the screen instructions to complete the installation

Upgrade Installation Insert the MegaRAID UnixWare driver diskette and type

```
pkgadd -d diskette1
```

at the command line prompt. Follow the screen instructions to complete the installation.

UnixWare Files

File	Description
/etc/megamgr	megamgr is an executable file that provides an object-oriented hierarchical interface to the SCSI adapter. megamgr configures new drives, reconstructs failed disks (if they are part of the redundant logical drives), displays adapter and disk performance, and manages channels and adapters. See the *MegaRAID User's Guide* for information about MegaRAID Manager.
/etc/amirdmon	amirdmon is a monitoring utility that is activated when the computer enters multi-user mode. It tracks the adapter state changes, displays the state change messages, and posts mail to *root* and */dev/console.*

OS/2 V.2.x and Warp V.3.0 Drivers

Perform the following steps to install the MegaRAID OS/2 drivers:

Step	Action
1	Insert the MegaRAID DOS/Novell NetWare 3.X, 4.X /OS2/ Windows 95 diskette in the A: drive. Copy the MRAID.ADD file from the MegaRAID diskette to the C: drive.
2	Add the following line to the CONFIG.SYS file in the MegaRAID DOS/Novell NetWare 3.X,4.X/OS2/Windows 95 diskette: BASEDEV=MRAID.ADD
3	Follow the standard OS/2 driver installation procedures. See the *IBM OS/2 Installation Guide* for additional information.
4	After installation has completed, copy the MEGACONF.EXE file from the MegaRAID DOS/Novell NetWare 3.X, 4.X/ OS2/Windows 95 diskette to the /OS/2 directory.
5	Run MEGACONF.EXE to execute the MegaRAID OS/2 driver installation utility.

Windows 95 Drivers

Windows 95 must be completely installed before you can install the MegaRAID Windows 95 driver. See the INSTALL.DOC file on the MegaRAID DOS/Novell NetWare 3.X, 4.X/ OS2/Windows 95 driver diskette for the latest installation information.

If MegaRAID Not Installed

MegaRAID Windows 95 Driver Installation Steps

Step	Action
1	Install the MegaRAID controller
2	Boot Windows 95. The message PCI Mass Storage Controller found. Insert floppy with above files. Appears. Insert the MegaRAID DOS/Novell NetWare 3.X, 4.X/ OS2/Windows 95 driver diskette in drive A: and click on the OK button.
3	Restart the computer when prompted by Windows 95. The MegaRAID Windows 95 driver will be loaded after Windows 95 is restarted.

Configuring MegaRAID in Windows 95 You must run the MegaRAID BIOS Setup utility by pressing <Ctrl> <M> from DOS to configure MegaRAID when running Windows 95.

You cannot use the MegaRAID Configuration Utility when running Windows 95.

If MegaRAID and Windows 95 are Installed

To install the MegaRAID Windows 95 drivers when the MegaRAID controller and Windows 95 have already been installed:

Step	Action
1	Click on the Start button. Select Settings. Select Control Panel. Select *System* from Control Panel and then select *Device Manager*.
2	Select *Other devices*. Select *Delete.*
3	Select PCI Mass Storage Controller.
	Restart the computer when prompted by Windows 95.
	Insert the MegaRAID DOS/Novell NetWare 3.X,4.X/OS2/ Windows 95 diskette in drive A:. Follow the instructions on the screen.
4	The MegaRAID Windows 95 driver will be loaded after Windows 95 is restarted.

Installing the MegaRAID Banyan Vines Driver

Banyan Vines Driver Installation The Banyan Vines installation procedure is listed below. The MegaRAID Banyan Vines installation driver is on a diskette in the installpkg format.

Step	Action
1	Select Option 10 System Maintenance From The Operator Menu. Then select Option 11 Access Unix From The System Maintenance Menu. Enter the user name and the user password.
2	Insert the MegaRAID Driver diskette in the floppy drive. Type installpkg at the Unix prompt. Follow the instructions on the screen to complete the installation process.
3	A message will be displayed indicating a successful or unsuccessful driver installation.
4	Run idbuild to rebuild the Unix kernel and reboot the system.

Installing the MegaRAID Solaris v2.5 Driver

In this release of the MegaRAID Solaris driver, the MegaRAID controller can act as a primary boot adapter or as a secondary adapter.

Modules The MegaRAID Sun Solaris drivers contain the following modules:

File	Description
mega_bef	BEF driver. A boot driver for Solaris.
mega.conf	Solaris SCSI host bus adapter driver.
Mega	SCSA Driver configuration file
megamgr	MegaRAID host adapter configuration utility for Solaris.

Directory Information

Directory	Explanation
\scsa	contains the SCSA driver for MegaRAID.
\bef	contains boot driver for MegaRAID.
\app	contains driver installation script and MegaRAID Configuration utility.

Installing MegaRAID as a Secondary Adapter

Step	Action
1	Type mkdir /mega at the Unix prompt and press <Enter>. Type mkdir /mega/i386 at the Unix prompt and press <Enter>.
2	Copy the SCSA driver "mega" from the MegaRAID Solaris Driver diskette to /mega/i386.
3	Copy the SCSA driver configuration file mega.con from the MegaRAID Solaris driver diskette to /mega.
4	Rename "mega.con" to "mega.conf".
5	Copy the SCSA driver installation script "install.sh" from the MegaRAID Solaris driver diskette to /mega. Add Run "sh install.sh".
6	Solaris does not support multiple LUNs. Since all MegaRAID logical drives sit on LUN ID 0, all LUNs should be supported.
7	Edit the /kernel/drv/cmdk.conf file. Add lines For LUNs 0 through 7 with SCSI ID 0.
8	Reboot the system.

Cont'd

Installing the MegaRAID Solaris v2.5 Driver, Continued

Installing MegaRAID As A Primary Boot Adapter Follow the Sun Solaris SCSI RAID Host Adapter procedures to install MegaRAID as a primary boot adapter.

Adding Multiple Logical Drives To add several logical drives, edit the /kernel/drv/cmdk.conf file.

Add lines For LUNs 0 through 7 ID 0.

No Sun Support Sun does not provide third party adapter support for Sun Solaris V2.5 drivers, but the MegaRAID SCSA and BEF drivers do not have any additional constraints as long as you have patched Sun Solaris Version 2.5 for third party adapter support.

Installing And Running the MegaRAID Configuration Utility

megamgr is the MegaRAID configuration utility.

Step	Action
1	Copy the MegaRAID Configuration Utility megamgr from the MegaRAID Solaris driver diskette to any user directory.
2	Specify the path of the MegaRAID node in the Solaris /devices directory to run megamgr. Type ./megamgr /devices/pci@0,0/pci1011,21@8 at the Unix prompt and press <Enter>.

Known Problems

Problem	Solution
Solaris V2.5 does not support multiple LUNs	Install MegaRAID with a single logical drive configured. Change the /kernel/cmdk.conf file for Multiple LUN support. Reboot the system. Then configure additional logical drives.

Cont'd

Changes The following changes have been made in the MegaRAID Solaris driver:

Older Version	Newer Version	Fix
1.01	1.02	Check Consistency sometimes hung the system when started during a heavy load.
1,00	1.01	megamgr sometimes produced a core dump if the Physical Drives option was selected from the Objects menu.

A SCSI Cables and Connectors

Cable Considerations

MegaRAID Single-Ended Ultra SCSI Understanding the cable requirements, termination and stub lengths is key to the successful implementation of a Ultra-SCSI subsystem.

SCSI Cables - Up to Four Devices The total external SCSI cable length for single-ended when using up to 4 Ultra-SCSI devices (maximum. capacitance of device = 25pf) should be less than or equal to:

```
(3 meter-(SCSI signal length on the MegaRAID)-(SCSI length
in storage box)

= (3 meter - 0.305 meter - SCSI length in storage box)

= 2.695 - SCSI length in Storage box
```

SCSI Cables - More than Four Devices The total external SCSI cable length for single-ended when using from five to eight Ultra-SCSI devices (max. cap of device = 25pf) should be less than or equal to:

```
(1.5 meter-(SCSI signal length on MegaRAID)-(SCSI length in storage
box)

= (1.5 meter - 0.305 meter - SCSI length in storage box)

= 1.195 - SCSI length in Storage box
```

Spacing Devices The SCSI devices should be uniformly spaced between terminators with the end devices located as close as possible to the terminators.

SCSI Signal Path The SCSI signal path is a controlled impedance environment with the following characteristic impedance:

```
90 ohms +/- 6 ohms for the REQ and ACK signals

90 ohms +/- 10 ohms for all other signals
```

Termination and Stub Placement for MegaRAID Ultra Adapters

Termination placement For a well behaved SCSI bus/cabling system, there should be termination enabled at both ends of the SCSI bus. Avoid adding terminators in the middle of the bus. The end devices must be located as close as possible to the terminators. Active terminators must be used. Terminators employing a 220 ohm resistor to 5 Volts and a 330 ohm resistor to ground on each signal shall not be used.

Stub length The stub length shall not exceed 0.1 meter. The spacing of devices on the SCSI bus should be at least three times the stub length to avoid stub clustering.

Cables Teflon flat ribbon cables give the best performance in the Ultra-SCSI environment. These cables should be used for all internal cabling. To minimize discontinuities and signal reflections, the use of cables with different impedance's on the same bus should be minimized.

SCSI Connectors

MegaRAID provides several different types of SCSI connectors for each channel. The connectors are:

- 68-pin high density,
- 50-pin low density, and a
- 120-pin high density external connector.

68-Pin High Density SCSI Connectors

Each of the two SCSI channels on the MegaRAID Controller has a 68-pin high density 0.050 inch pitch unshielded connector.

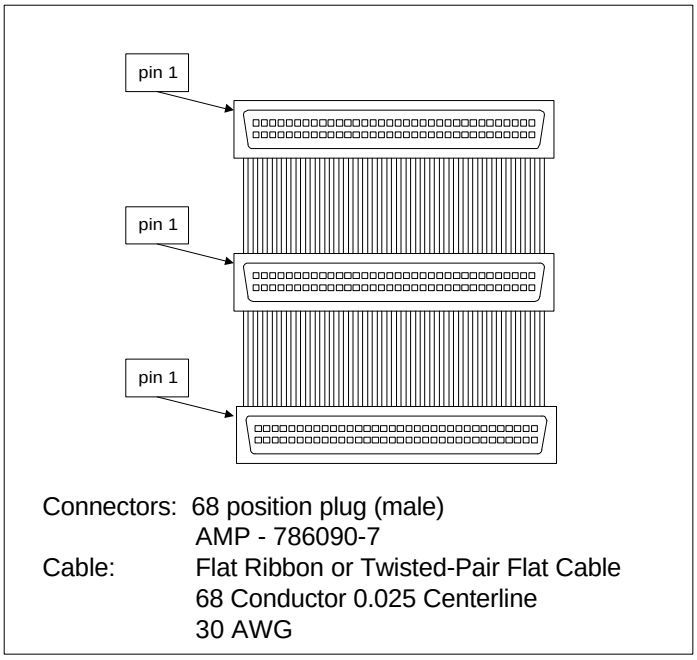
These connectors provide all signals needed to connect MegaRAID to wide SCSI devices. The connector pinouts are for a single-ended primary bus (P-CABLE) as specified in SCSI-3 Parallel Interface X3T9.2, Project 885-D, revision 12b, date July 2, 1993.

The cable assemblies that interface with this 68-pin connector are:

- flat ribbon or twisted pair cable for connecting internal wide SCSI devices,
- flat ribbon or twisted pair cable for connecting internal and external wide SCSI devices,
- cable assembly for converting from internal wide SCSI connectors to internal non-wide (Type 2) connectors,
- cable assembly for converting from internal wide to internal non-wide SCSI connectors (Type 30), and
- cable assembly for converting from internal wide to internal non-wide SCSI connectors.

Cont'd

Cable Assembly for Internal Wide SCSI Devices The cable assembly for connecting internal wide SCSI devices is shown below:

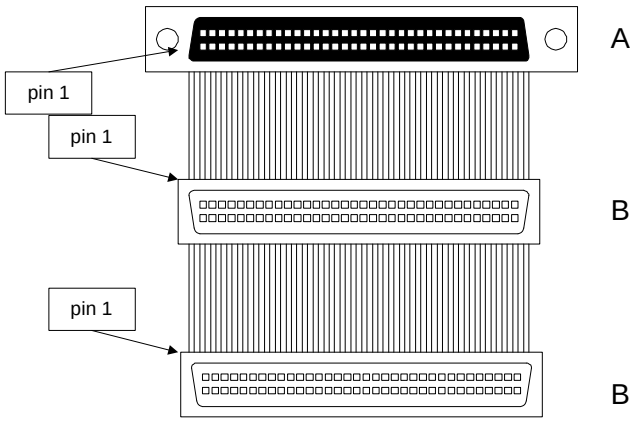


Connectors: 68 position plug (male)
AMP - 786090-7
Cable: Flat Ribbon or Twisted-Pair Flat Cable
68 Conductor 0.025 Centerline
30 AWG

Cont'd

68-Pin High Density Connectors, Continued

Connecting Internal and External Wide Devices The cable assembly for connecting internal wide and external wide SCSI devices is shown below:



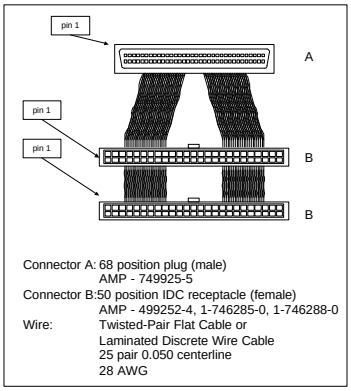
Connector A: 68 position panel mount receptacle
with 4-40 holes (female)
AMP - 786096-7
NOTE: To convert to 2-56 holes, use screwlock kit 749087-1, 749087-2, or 750644-1 from AMP
Connector B: 68 position plug (male)
AMP - 786090-7
Cable: Flat Ribbon or Twisted-Pair Flat Cable
68 Conductor 0.025 Centerline
30 AWG

Cont'd

Converting Internal Wide to Internal Non-Wide (Type 2) The cable assembly for converting internal wide SCSI connectors to internal non-wide SCSI connectors is shown below:

68 POSITION CONNECTOR CONTACT NUMBER		50 POSITION CONNECTOR CONTACT NUMBER
6		1
40		2
7		3
41		4
*		
*		
*		
49		20
16		21
50		22
17	OPEN	23
51	OPEN	24
18	OPEN	25
52		26
19		27
*		
*		
*		
29		47
63		48
30		49
64		50

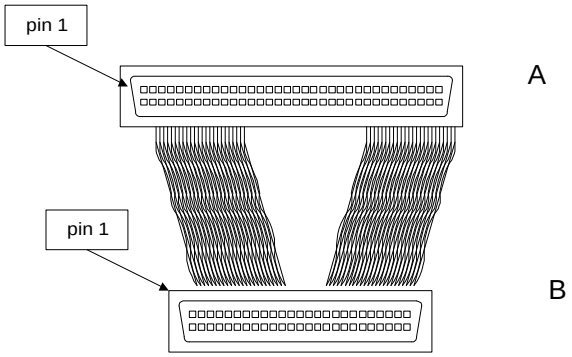
TABLE 1: CONNECTOR CONTACT CONNECTION FOR WIDE TO NON-WIDE CONVERSION



Connector A: 68 position plug (male)
AMP - 749925-5
Connector B: 50 position IDC receptacle (female)
AMP - 499252-4, 1-746285-0, 1-746288-0
Wire: Twisted-Pair Flat Cable or
Laminated Discrete Wire Cable
25 pair 0.050 centerline
28 AWG

Cont'd

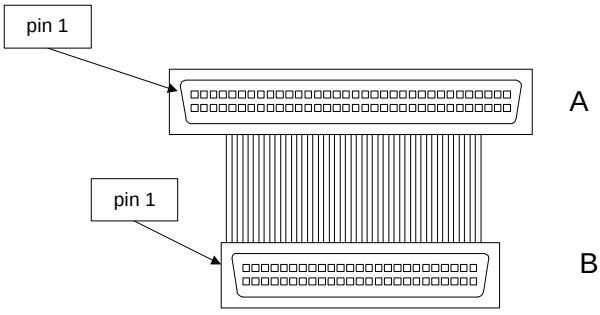
Converting Internal Wide to Internal Non-Wide (Type 30) The cable assembly for connecting internal wide SCSI devices to internal non-wide SCSI devices is shown below:



Connector A: 68 position plug (male)
AMP - 749925-5
Connector B: 50 position plug (male)
AMP - 749925-3
Wire: Twisted-Pair Flat Cable or
Laminated Discrete Wire Cable
25 pair 0.050 centerline
28 AWG

Cont'd

Converting from Internal Wide to Internal Non-Wide (Type 3) The cable assembly for connecting internal wide SCSI devices to internal non-wide (Type 3) SCSI devices is shown below:



Connector A: 68 position plug (male)
AMP - 786090-7
Connector B: 50 position plug (male)
AMP - 786090-7
Wire: Flat ribbon or twisted-pair flat cable
50 conductor 0.025 centerline
30 AWG

50-Pin Low Density Connectors

Each channel has a 50-pin low density 0.100 inch pitch shrouded connector. These connectors provide all signals needed to connect MegaRAID to non-wide SCSI devices. The connector contact assignments of these connectors conform to the connector contact assignments for the single-ended low density primary bus (A-CABLE) as specified in SCSI-2 X3T9.2, Project 375R, revision 10K, dated April 28, 1993.

Cables that mate to this 50-pin low density connector are standard items provided by most cable manufactures.

120-Pin High Density External Connector

This external connector is provided to connect external devices to all two SCSI channels. All SCSI signals for each channel is provided by this connector. Contact an American Megatrends salesperson for additional information.

SCSI Cables

Cable Length To achieve optimal performance, the length of the SCSI cables should be limited to 10 meters for all SCSI devices operating at 10 MBs or faster.

SCSI Cable Vendors

Manufacturer	Telephone Number
Cables To Go	Voice: 800-826-7904 Fax: 800-331-2841
System Connection	Voice: 800-877-1985
Technical Cable Concepts	Voice: 714-835-1081
GWC	Voice: 818-579-0888

High-Density 68-Pin SCSI Connector and P-Cable Single-Ended Cable Pinout

Signal	Connector Pin	Cable Pin	Cable Pin	Connector Pin	Signal
GROUND	1	1	2	35	-DB(12)
GROUND	2	3	4	36	-DB(13)
GROUND	3	5	6	37	-DB(14)
GROUND	4	7	8	38	-DB(15)
GROUND	5	9	10	39	-DB(P1)
GROUND	6	11	12	40	-DB(0)
GROUND	7	13	14	41	-DB(1)
GROUND	8	15	16	42	-DB(2)
GROUND	9	17	18	43	-DB(3)
GROUND	10	19	20	44	-DB(4)
GROUND	11	21	22	45	-DB(5)
GROUND	12	23	24	46	-DB(6)
GROUND	13	25	26	47	-DB(7)
GROUND	14	27	28	48	-DB(P)
GROUND	15	29	30	49	GROUND
GROUND	16	31	32	50	GROUND
TERMPWR	17	33	34	51	TERMPWR
TERMPWR	18	35	36	52	TERMPWR
RESERVED	19	37	38	53	Reserved
GROUND	20	39	40	54	GROUND
GROUND	21	41	42	55	-ATN
GROUND	22	43	44	56	GROUND
GROUND	23	45	46	57	-BSY
GROUND	24	47	48	58	-ACK
GROUND	25	49	50	59	-RST
GROUND	26	51	52	60	-MSG
GROUND	27	53	54	61	-SEL
GROUND	28	55	56	62	-C/D
GROUND	29	57	58	63	-REQ
GROUND	30	59	60	64	-I/O
GROUND	31	61	62	65	-DB(8)
GROUND	32	63	64	66	-DB(9)
GROUND	33	65	66	67	-DB(10)
GROUND	34	67	68	68	-DB(11)

Cont’d

High-Density 68-Pin SCSI Connector and P-Cable Single-Ended Cable Pinout, Continued

High-Density Connector The following facts apply to the information in the High-Density SCSI connector table on the previous page:

- A hyphen before a signal name indicates that signal is active low.
- The connector pin refers to the conductor position when using 0.025 inch centerline flat ribbon cable with a high-density connector (AMPLIMITE .050 Series connectors).
- Eight-bit devices connected to the P-Cable must leave the following signals open: -DB (8), -DB (9), -DB (10), -DB (11), -DB(12), -DB (13), -DB (14), -DB 15), and -DB (P1).
- All other signals should be connected as defined.

Caution

Lines labeled RESERVED should be connected to GROUND in the bus terminator assemblies or in the end devices on the SCSI cable.

RESERVED lines should be open in the other SCSI devices, but can be connected to GROUND.

50-Pin SCSI Connector and A-Cable Single-Ended Cable Pinout

Signal	Connector Pin	Cable Pin	Cable Pin	Connector Pin	Signal
GROUND	1	1	2	2	-DB(0)
GROUND	3	3	4	4	-DB(1)
GROUND	5	5	6	6	-DB(2)
GROUND	7	7	8	8	-DB(3)
GROUND	9	9	10	10	-DB(4)
GROUND	11	11	12	12	-DB(5)
GROUND	13	13	14	14	-DB(6)
GROUND	15	15	16	16	-DB(7)
GROUND	17	17	18	18	-DB(8)
GROUND	19	19	20	20	-DB(P)
GROUND	21	21	22	22	GROUND
RESERVED	23	23	24	24	GROUND
OPEN	25	25	26	26	RESERVED
RESERVED	27	27	28	28	TERMPWR
GROUND	29	29	30	30	RESERVED
GROUND	31	31	32	32	GROUND
GROUND	33	33	34	34	-ATN
GROUND	35	35	36	36	GROUND
RESERVED	37	37	38	38	-BSY
GROUND	39	39	40	40	-ACK
GROUND	41	41	42	42	-RST
GROUND	43	43	44	44	-MSG
GROUND	45	45	46	46	-SEL
GROUND	47	47	48	48	-C/D
GROUND	49	49	50	50	-REQ

Low-Density Connector A hyphen before a signal name indicates that signal is active low. The conductor number is the conductor position when using 0.050 inch centerline flat ribbon cable with a low-density connector (CHAMP or AMP-LATCH) or when using 0.025 inch centerline flat ribbon cable with a high-density connector (AMPLIMITE .050 Series connectors). Use other cable types to implement equivalent contact assignments.

Lines labeled RESERVED should be connected to GROUND in the bus terminator assemblies or in the end devices on the SCSI cable. RESERVED lines should be open in other SCSI devices but can be connected to GROUND.

B Audible Warnings

MegaRAID has an onboard tone generator that indicates events and errors.

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, 3, or 5 configuration failed.
One second on and one second off	A logical drive is running in degraded mode.	One drive in a RAID 3 or 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, 3, or 5 configuration failed and was rebuilt.

Glossary

Array Management Software Software that provides common control and management for a disk array. Array Management Software most often executes in a disk controller or intelligent host bus adapter, but can also execute in a host computer. When it executes in a disk controller or adapter, Array Management Software is often called firmware.

Asynchronous Operations Operations that bear no relationship to each other in time and can overlap. The concept of asynchronous I/O operations is central to independent access arrays in throughput-intensive applications.

Channel An electrical path for the transfer of data and control information between a disk and a disk controller.

Cold Swap The substitution of a replacement unit in a disk subsystem for a defective one, where power must be removed from the subsystem to do the substitution.

Data Transfer Capacity The amount of data per unit time moved through a channel. For disk I/O, bandwidth is expressed in megabytes per second (MBs).

Disk A non-volatile, randomly addressable, rewritable mass storage device, including both rotating magnetic and optical disks and solid-state disks, or non-volatile electronic storage elements. It does not include specialized devices such as write-once-read-many (WORM) optical disks, nor does it include so-called RAM disks implemented using software to control a dedicated portion of a host computer volatile random access memory.

Cont’d

Disk Array A collection of disks from one or more disk subsystems combined with array management software. It controls the disks and presents them to the array operating environment as one or more virtual disks.

Disk Striping A type of disk array mapping. Consecutive stripes of data are mapped round-robin to consecutive array members. A striped array (RAID Level 0) provides high I/O performance at low cost, but provides lowers data reliability than any of its member disks.

Disk Subsystem A collection of disks and the hardware that connects them to one or more host computers. The hardware can include an intelligent controller or the disks can attach directly to a host computer I/O a bus adapter.

Double Buffering A technique that achieves maximum data transfer bandwidth by constantly keeping two I/O requests for adjacent data outstanding. A software component begins a double-buffered I/O stream by issuing two requests in rapid sequence. Thereafter, each time an I/O request completes, another is immediately issued. If the disk subsystem is capable of processing requests fast enough, double buffering allows data to be transferred at the full-volume transfer rate.

GB Shorthand for 1, 000, 000,000 (10 to the ninth power) bytes.

Host-based Array A disk array with an Array Management Software in its host computer rather than in a disk subsystem.

Cont'd

Host Computer Any computer that disks are directly attached to. Mainframes, servers, workstations, and personal computers can all be considered host computers.

Hot Swap The substitution of a replacement unit in a disk subsystem for a defective one, where the substitution can be performed while the subsystem is running (performing its normal functions). Hot swaps are manual.

I/O Driver A host computer software component (usually part of the operating system) that controls the operation of peripheral controllers or adapters attached to the host computer. I/O drivers communicate between applications and I/O devices, and in some cases participates in data transfer.

Logical Disk A set of contiguous chunks on a physical disk. Logical disks are used in array implementations as constituents of logical volumes or partitions. Logical disks are normally transparent to the host environment, except when the array containing them is being configured.

Mapping The conversion between multiple data addressing schemes, especially conversions between member disk block addresses and block addresses of the virtual disks presented to the operating environment by Array Management Software.

MB (Megabyte) An abbreviation for 1,000,000 (10 to the sixth power) bytes.

Cont’d

Multi-threaded Having multiple concurrent or pseudo-concurrent execution sequences. Used to describe processes in computer systems. Multi-threaded processes allow throughput-intensive applications to efficiently use a disk array to increase I/O performance.

Operating Environment The operating environment includes the host computer where the array is attached, any I/O buses and adapters, the host operating system, and any additional software required to operate the array. For host-based arrays, the operating environment includes I/O driver software for the member disks, but does not include Array Management Software, which is regarded as part of the array itself.

Partition An array virtual disk made up of logical disks rather than physical ones.

Rebuild The regeneration of all data from a failed disk in a RAID level 1, 3, 4 5, or 6 array to a replacement disk. A disk rebuild normally occurs without interruption of application access to data stored on the array virtual disk.

Replacement Disk A disk available for use as or used to replace a failed member disk in a RAID array.

Replacement Unit A component or collection of components in a disk subsystem that are always replaced as a unit when any part of the collection fails. Typical replacement units in a disk subsystem includes disks, controller logic boards, power supplies, and cables. Also called a hot spare.

SAF-TE (SCSI Accessed Fault-Tolerant Enclosure. An industry protocol for managing RAID enclosures and reporting enclosure environmental information.

SMARTer System Management and Reporting Technologies with Error Recovery. An industry standard protocol for reporting server system information.