InterRAID-8e

Hardware User's Guide

February 1998

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INTERGRAPH
COMPUTER SYSTEMS

Warnings

Changes or modifications made to the system that are not approved by the party responsible for compliance could void the user's authority to operate the equipment.

To reduce the risk of electrical shock, do not attempt to open the equipment unless instructed. Do not use a tool for purposes other than instructed.

There is a danger of explosion if the battery is incorrectly replaced. Replace the battery only with the same or equivalent type as recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

There are no user serviceable parts in the power supply. Refer all servicing of the power supply to qualified service personnel.

To comply with FCC Class B limits, you must use shielded cables with this device.

Notes

This device is designed and manufactured to comply with approved safety standards for information processing and business equipment.

Read all operating instructions before using this device. Keep these instructions for future reference. Follow all warnings on the device or in the operating instructions.

Contents

Preface

The *InterRAID-8e Hardware User's Guide* discusses the enhanced disk array cabinet known as InterRAID-8e. InterRAID-8e features SAF-TE disk array cabinets with Ultra SCSI in single-bus and dual-bus configurations. This guide provides user and technical information and instructions for installing the disk array cabinet for use with Intergraph's servers. It also provides hardware and software installation procedures, specifications, and troubleshooting information.

About This Document

The *InterRAID-8e Hardware User's Guide* is organized as follows:

- Chapter 1, "Getting Started," describes cabinet features and the various Intergraph servers used with the InterRAID-8e cabinet. It describes how to return equipment to Intergraph Computer Systems.
- Chapter 2, "Setting Up InterRAID-8e Deskside," describes setting up the deskside dual-bus cabinets.
- Chapter 3, "Setting Up InterRAID-8e Rack-Mount," discusses setting up the rack-mount single-bus and dual-bus cabinets.
- Chapter 4, "Using the Information Control Panel," discusses the menus of the InterRAID-8e Information Control Panel.
- Chapter 5, "Using the MegaRAID BIOS Configuration Utility," describes using the MegaRAID BIOS Configuration utility to manage the disk arrays.
- Chapter 6, "Using the Power Console GUI," describes using the MegaRAID Power Console graphics user interface to manage the disk arrays.
- Chapter 7, "Using the Power Console Menus," discusses using the Power Console pulldown menus to manage the disk arrays.
- Chapter 8, "Configuring the Disk Array for Performance," discusses the various RAID drive software configurations and their effects on performance.
- Chapter 9, "Troubleshooting," provides LED indications and error conditions that can occur during the Power-On Self Test (POST) diagnostic. It includes solutions to miscellaneous problems and provides troubleshooting guidelines for the host system and disk arrays.
- Chapter 10, "Servicing the Disk Array," provides maintenance procedures for replacing parts of the system.
- Appendix A, "Specifications," includes product specifications.

- Appendix B, “Software Updates,” describes how to update MegaRAID driver and install MegaRAID utilities.
- Appendix C, “RAID Controller,” illustrates the MegaRAID controller and describes features and components.

Document Conventions

Bold	Commands, words, or characters that you key in literally.
Italic	Variable values that you supply, or cross-references.
Monospace	Output displayed on the screen.
SMALL CAPS	Key names on the keyboard, such as D, ALT or F3; names of files and directories. You can type filenames and directory names in the dialog boxes or the command line in lowercase unless directed otherwise.
CTRL+D	Press a key while simultaneously pressing another key; for example, press CTRL and D simultaneously.

Finding Operating System Information

For more information on using the Windows NT operating system, refer to the printed and online Windows NT documentation from Microsoft.

Customer Support

Intergraph Computer Systems offers an assortment of customer support options.

Hardware and Software Support Services

Intergraph Computer Systems provides a variety of hardware services for Intergraph and third-party equipment. Services include warranty upgrades, repair depot service, on-site hardware maintenance, system administration, and network consulting. Hardware purchased from Intergraph Computer Systems includes a factory warranty ranging from 30 days to three years. A detailed warranty description is available on the World Wide Web; see the Support pages at **http://www.intergraph.com/ics**.

Intergraph Computer Systems provides complimentary software support for 30 or 90 days following shipment of a hardware or software product. This includes World Wide Web access, Intergraph Bulletin Board Service access, FAXLink service, and telephone (Help Desk) support. At the end of the complimentary support period, you can purchase other levels of software support.

World Wide Web

You can visit Intergraph Computer Systems on the World Wide Web at **http://www.intergraph.com/ics**. On these pages, you can get news and product information, technical support information, software updates and fixes, and more.

Intergraph Bulletin Board Service

On the Intergraph Bulletin Board Service (IBBS), you can get technical support information, software updates and fixes, and more.

To connect to the IBBS:

1. Set your system's communications protocol for eight (8) data bits, no parity, one (1) stop bit, and any baud rate up to 14,400.
2. Using a modem, call 1-205-730-8786. Outside the United States, call one of the mirror sites listed on World Wide Web; see the Software Support pages at **http://www.intergraph.com**.
3. At the login prompt, key in your user ID. If you have not connected before, key in **new** to create a user ID.
4. Follow the menus to find what you need. The IBBS provides clear choices and online help.

If you have trouble connecting to or using the IBBS, call the Customer Response Center at 1-800-633-7248 (product entry IBBS) or leave a message for the IBBS System Operator at 1-205-730-1413.

FAXLink

To use the FAXLink:

- Call 1-800-240-4300 for information on how to get technical support information using the FAXLink.
- Call 1-205-730-9000 to get documents (up to five per call).

Telephone

To get customer support by telephone:

- In the United States, call the Customer Response Center at 1-800-633-7248 between the hours of 7:00 a.m. and 7:00 p.m. Central Time, Monday through Friday (except holidays).

- Outside the United States, contact your local Intergraph Computer Systems subsidiary or distributor.

Have the following information available when you call:

- Your service number, which identifies your site to Intergraph Computer Systems. You use your service number for warranty or maintenance calls.
- Your Customer Personal Identification Number (CPIN). You get a CPIN the first time you call the Customer Response Center; it is associated with your service number for future call logging.
- The product's name or model number.
- The product's serial number. Software product serial numbers are included in the product packaging. Hardware product serial numbers are on a sticker affixed to the hardware product.
- Your name and telephone number.
- A brief description of the question or problem.

More Support Options

To get information on more customer support options:

- Visit the Support pages on the World Wide Web at **http://www.intergraph.com/ics**.
- For hardware support questions in the United States, call 1-800-763-0242.
- For software support questions in the United States, call 1-800-345-4856.
- Outside the United States, contact your local Intergraph Computer Systems subsidiary or distributor.

1 Getting Started

This chapter provides basic information about the InterRAID-8e disk array cabinet. Read this information before setting up the cabinet. The setup chapters for deskside and rack-mount cabinets assume the system base unit is already set up.

- To set up the deskside cabinet, see Chapter 2, “Setting Up InterRAID-8e Deskside.”
- To set up the rack-mount cabinet, see Chapter 3, “Setting Up InterRAID-8e Rack-Mount.”

InterRAID-8e Features

The following provides a brief description of the features of the InterRAID-8e disk array cabinets.

Door Lock

The front door uses a door lock to prevent unauthorized access to the internal components. Two keys are provided with the cabinet. To unlock the door, insert the key and turn it counterclockwise. To lock the door, turn the key clockwise.

Cabinet Monitoring

The cabinet uses an intelligent interface (microprocessor) to alert the user in the event of an abnormal system condition. The microprocessor resides on the SCSI bus and communicates the level of fault-tolerance to the user through software, LEDs, and audible alarms. The microprocessor monitors the working status of the cabinet’s disk drives, power supplies, cooling fans and temperature, and continually reports to the LEDs and the Information Control Panel.

The microprocessor uses the SCSI Accessed Fault-Tolerant Enclosure (SAF-TE) method to communicate abnormal system conditions. SAF-TE provides more detailed status information than simple working or failed status. SAF-TE allows the microprocessor to report items such as cooling fan speed and temperature.

Information Control Panel

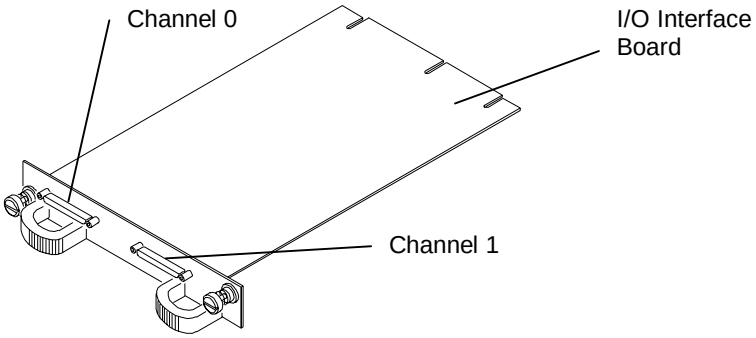
The Information Control Panel (ICP) has a liquid crystal display and five function keys to allow you to monitor the power supplies, fans, microprocessor, and cabinet temperature. You can also silence the audible alarm, view component system status, read the firmware revision level, and establish a passcode to protect SCSI ID options.

Ultra SCSI Bus Termination

The Ultra SCSI bus is the pathway over which disk drive data and status signals transmit between the MegaRAID controller and the disk array cabinet. To function properly, the bus must be terminated at both ends. The MegaRAID controller in the host system provides termination for one end of the bus. The I/O interface boards in the disk array cabinet provides termination for the other end.

I/O Interface Board

The I/O interface board connects between the disk array's bus and the MegaRAID controller board via two 68-pin very high density (VHD) SCSI connectors. The connectors are labeled Channel 0 and Channel 1.



Bus Configurations

The InterRAID-8e cabinet uses Ultra Wide SCSI cable configurations for single-bus or dual-bus operation. Separate internal modules in the disk array cabinet define the bus configuration.

- The InterRAID-8e with the dual-bus module provides two separate channels for the cabinet's disk drive slots. The top or left cabinet slots connect to one of the channels, and the bottom or right slots connect to the other channel.
- The InterRAID-8e with the single-bus module provides one channel for the cabinet's disk drive slots.

MegaRAID Controllers

The MegaRAID controller board that resides in the system base unit incorporates a 32-bit RISC processor. The processor controls all functions including SCSI bus transfers, RAID processing, configuration, data striping, error recovery, and drive building.

The MegaRAID controller features either two or three Ultra SCSI chips that provide the data channels for connecting disk array cabinets. Each chip provides one channel. The use of the channels depends on the cabinet's bus configuration and the system base unit.

- Dual-bus cabinets require two of the channels to be connected (Channel 0 and 1) to the cabinet.
- Single-bus cabinets use only one of the channels (Channel 0).
- Some systems feature internal RAID, which uses one or two of the channels.

Chapters 2 and 3 provide additional information about connecting cabinets to the controller.

Applicable Intergraph Systems

The InterRAID-8e is available in deskside or rack-mount configurations for various systems. The deskside cabinet is available as a dual-bus only. The rack-mount version is available as dual-bus and single-bus, depending on the system to which it is attached. The following table lists the InterRAID-8e cabinets and the applicable systems.

InterRAID-8e Cabinet	Intergraph System
Deskside dual-bus	InterServe 615, 625, 635, 645; InterServe 80; InterServe 8000; TDZ-610
Rack-mount dual-bus	InterServe 615R, 625R; InterServe 8000; StudioZ RAX
Rack-mount single-bus	InterServe 615R, 625R; InterServe 8400

Returning Equipment to Intergraph Computer Systems

Some malfunctioning equipment cannot be repaired in the field, and you must return it to Intergraph Computer Systems for repair. Follow the steps in the next sections to obtain a Returned Goods Authorization (RGA) log number, complete the RGA form and shipping label, and repackage the equipment.

Obtain an RGA Log Number

The RGA log number must be included with the shipment for Intergraph Computer Systems to properly track the repair work and return the equipment.

To obtain an RGA log number:

1. Determine the serial number of the system. The serial number is located on a white bar code identification label on the back of the base unit.
2. Call the Customer Response Center at 1-800-633-7248, and identify your call to the operator as a Warranty Call. Give the operator the serial number of the system, and you will be given an RGA log number.

Complete the RGA Form and Shipping Label

The RGA form must accompany all returned equipment. When the service activity has been completed by Intergraph Computer Systems, the repaired or replaced equipment will be shipped to the address listed on the RGA form.

To complete the RGA form and shipping label:

1. Copy the RGA form at the back of this guide.
2. Complete the form, entering the RGA log number obtained from the Customer Response Center. Ensure that the address in the From section is the location to which you want the equipment to be returned.
3. Pack the equipment as described in this chapter.
4. Place the RGA form in the shipping box containing the equipment.
5. Copy the repair depot shipping labels at the back of this guide.
6. Add the RGA log number to a shipping label and affix it to the shipping box containing the equipment.
7. Ship the box containing the equipment to Intergraph Computer Systems.

NOTE Parts damaged during shipping and parts not covered by the warranty are liable for repair charges.

Repackage Disk Drives for Separate Shipment

If you need to return only the RAID disk drives, but not the disk array cabinet, they can be returned separately. The disk drives cannot be returned in the box that shipped with the cabinet. They must be returned in a specially designed multi-pack box for disk drive shipment. The Intergraph multi-pack box provides the required protection needed when shipping the disk drives by themselves.

CAUTION Pack the RAID disk drives in the Intergraph multi-pack drive box for transportation. If the drives are not packed into this box, they could be damaged during shipment.

If you do not have an Intergraph multi-pack box, call the Intergraph Order Desk at 1-800-543-1054.

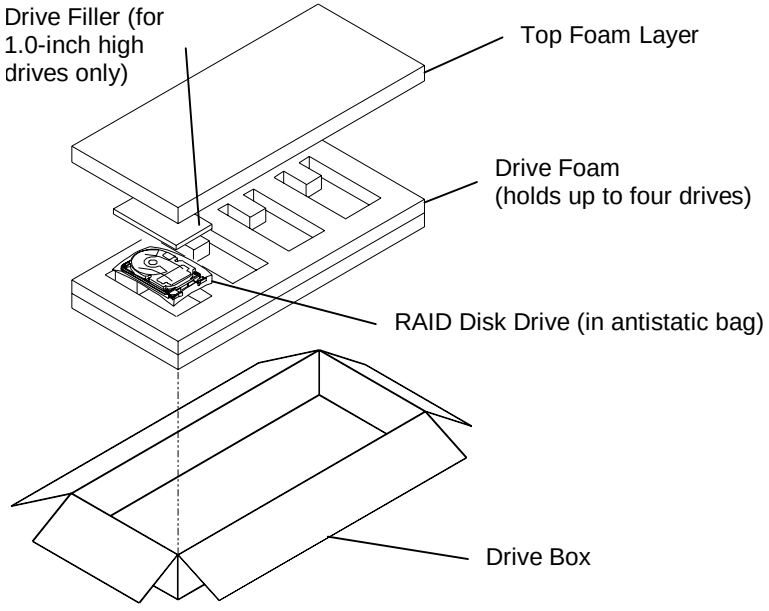
Repackage Disk Drives and Cabinet

Use the original Intergraph packaging in which your equipment was shipped. The disk drive box fits inside the shipping carton.

CAUTION Pack all equipment in the original boxes for transportation to avoid damage during shipment.

To repack the equipment:

1. Power down the disk array cabinet and wait for the RAID disk drives to completely stop spinning. The disk drives could be damaged if removed while still spinning.
2. Remove all of the RAID disk drives from the cabinet. Handle the disk drives carefully and by the edges only.
3. Place each disk drive into an antistatic bag and seal the bag.
4. Place one RAID disk drive into each compartment in the foam. If packing less than four drives, place them in the foam to distribute the weight evenly. See the following figure.



NOTE For 1.0-inch high drives, place a drive filler over each drive.

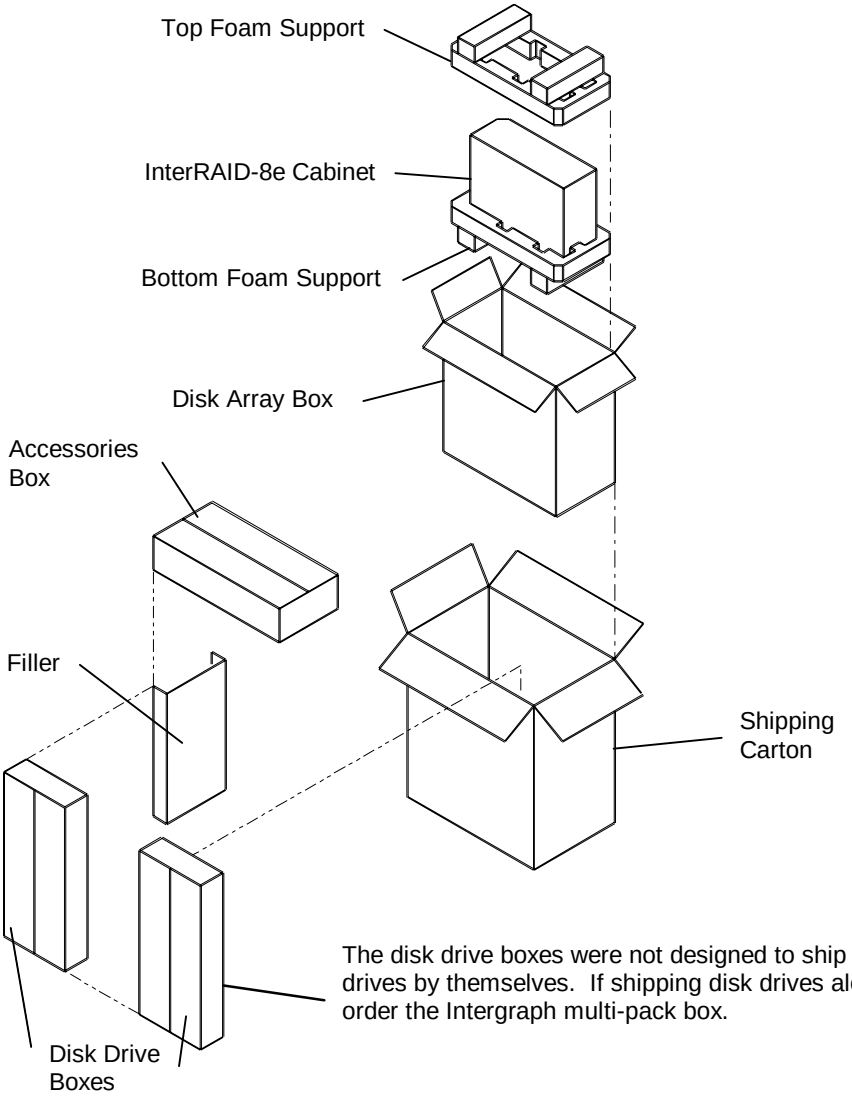
5. Place the top foam layer into the drive box.

CAUTION If the top foam layer is not installed, the drives may move around inside the box causing damage during shipment.

6. Securely tape the drive box closed.

CAUTION Remove all RAID disk drives from a disk array before repacking the cabinet. If you ship a cabinet with disk drives installed, the drives and the cabinet could be damaged.

7. Place the bottom foam support into the disk array box, and then set the cabinet onto the foam. See the following figure.
8. Place the top foam support onto the cabinet.
9. Securely tape the disk array box closed.
10. Place the disk array box into the shipping carton.
11. Place the filler at the end of the disk array box.
12. Place the two disk drive boxes alongside the disk array box.
13. Pack the cables and other miscellaneous parts into the accessories box.
14. Place the accessories box on top of the disk array box.
15. Ensure the RGA form is placed inside the shipping carton.
16. Securely tape the shipping carton.



CAUTION The type of disk drive box that fits inside the shipping carton should be used only when shipping drives with an InterRAID cabinet. Do not use it for shipping disk drives by themselves or damage may occur.

2 Setting Up InterRAID-8e Deskside

This chapter describes setting up the deskside (standalone) InterRAID-8e cabinet. If setting up a rack-mount InterRAID-8e cabinet, see Chapter 3. When setting up the deskside cabinet, you will perform the following tasks:

- Unpack the equipment.
- Install the MegaRAID controller (if not pre-installed in the system base unit).
- Set up the cabinet.
- Connect the cables.
- Install and label the RAID disk drives.
- Power on and configure the system.

Carefully unpack the equipment. The shipping carton contains the following items:

- MegaRAID controller board (if included)
- InterRAID-8e cabinet (dual-bus only)
- Disk drive boxes containing up to four drives
- Diskettes containing configuration and utility software
- Accessories box

The accessories box contains the following items:

- InterRAID-8e cabinet power cord
- Two RAID SCSI cables
- Key for disk array cabinet
- Disk drive labels
- *Drive Labeling* instruction sheet
- *Power Supply Cord Selection* instruction sheet
- *Antistatic Handling* instruction sheet

Retain all packaging materials. Equipment returned for repair must be in the original packaging to obtain warranty service, if provided under your contract agreement.

NOTE If any of the listed parts are missing or damaged, call the Customer Response Center at 1-800-633-7248.

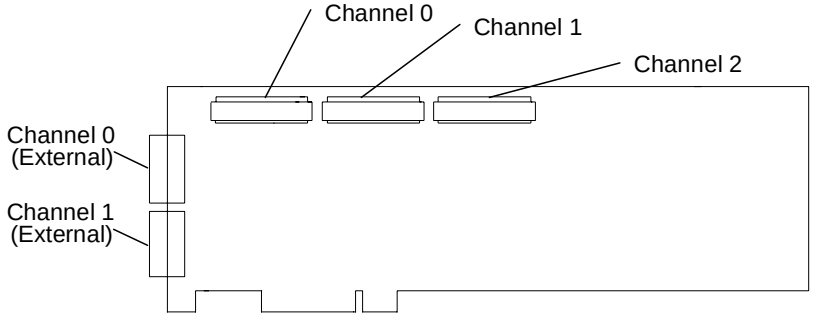
Installing the MegaRAID Controller

If the InterRAID-8e option includes a MegaRAID controller in the shipping carton, follow these instructions to install the controller into the system. Otherwise, go to "Setting up the Cabinet." The following table shows information about the deskside systems that allow the InterRAID-8e option.

System	Primary Controller Slot	Secondary Controller Slots
TDZ-610	Not applicable	Any available PCI
InterServe 6x5 with RAID	PCI Slot 1	Any available PCI
InterServe 6x5 non-RAID	Not applicable	Any available PCI
InterServe 80	Not applicable	Any available PCI
InterServe 8000	PCI Slot 4	PCI Slots 5 through 8

NOTE The systems with "Not applicable" for primary controller slot use a fixed disk drive as the boot drive. All installed MegaRAID controllers are treated as secondary.

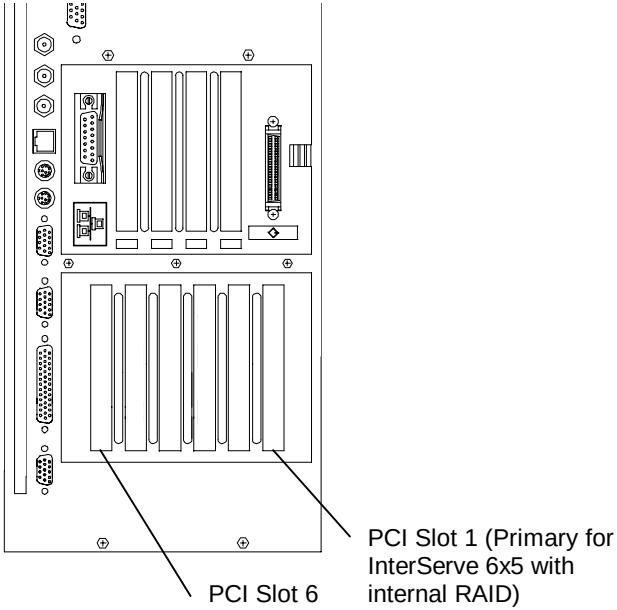
The following figure shows the three channel MegaRAID controller and Channels 0, 1, and 2. The two-channel version of the controller does not include the components for Channel 2.



NOTE For those systems using an internal channel for the internal RAID section, you cannot use the external channel with the same number. For example, the InterServe 8000 uses Channel 0 and Channel 1 for the internal RAID section. Therefore, external Channel 0 and Channel 1 is not available for connection.

TDZ-610 and InterServe 6x5 Systems

The following figure shows the PCI slots of the TDZ-610 and the InterServe 6x5 systems.

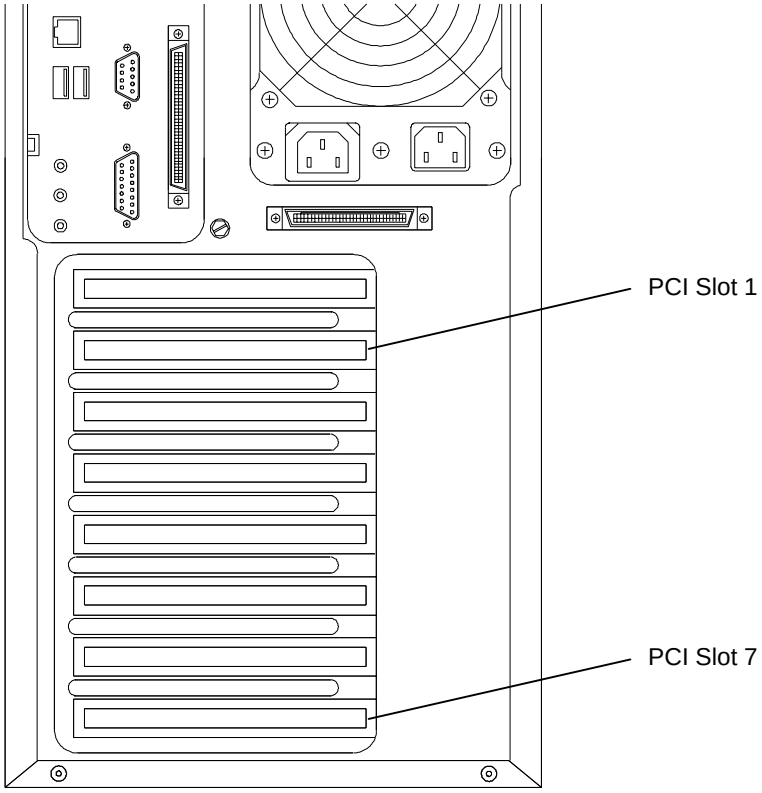


To install the MegaRAID controller:

1. Ensure the system is powered off.
2. Open the base unit by removing the top cover, left side panel, and PCI access panel on the bottom of the unit.
3. Remove the screw and blanking plate from an available PCI slot.
4. Install the MegaRAID controller. Press firmly and evenly over the PCI connector to ensure the board seats completely into the slot.
5. Secure the board with the screw removed from the blanking plate.
6. Close the base unit.
7. Set up the disk array cabinet as described in “Setting up the Cabinet.”

InterServe 80 Systems

The following shows the I/O panel on the back of the InterServe 80 systems.

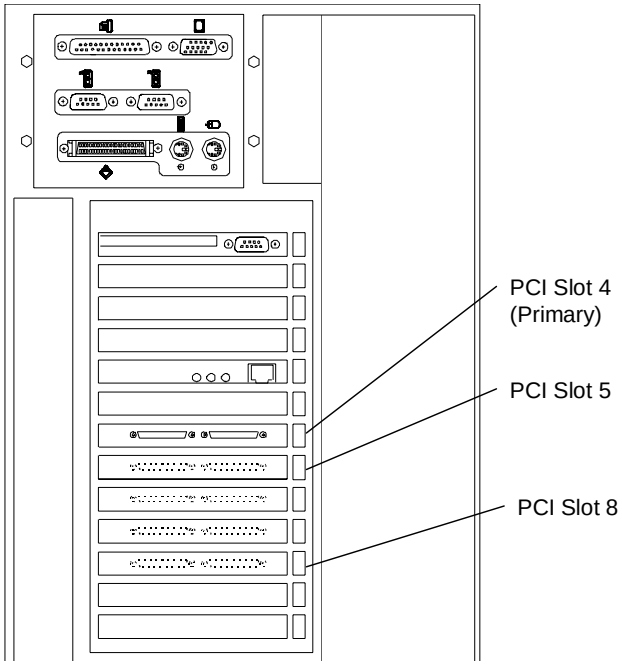


To install the Two-channel MegaRAID controller:

1. Ensure the system is powered off.
2. Remove the top cover and left side panel from the system.
3. Remove the screw and blanking plate from an available PCI slot.
4. Install the MegaRAID controller. Press firmly and evenly over the PCI connector to ensure the board seats completely into the slot.
5. Close the base unit.
6. Set up the disk array cabinet as described in “Setting up the Cabinet.”

InterServe 8000 Systems

The following shows the I/O panel on the back of the InterServe 8000 systems.



To install the MegaRAID controller:

1. Ensure the system is powered off.
2. Remove the right side panel from the system.
3. Remove the screw and blanking plate from an available PCI slot.

NOTE Install secondary controllers only in PCI slots 5 through 8. If you install secondary controllers in PCI slots 1 through 3, the system will not boot.

4. Install the MegaRAID controller. Press firmly and evenly over the PCI connector to ensure the board seats completely into the slot.
5. Close the base unit.
6. Set up the disk array cabinet as described in “Setting up the Cabinet.”

Setting up the Cabinet

When setting up the deskside cabinet, stand the cabinet on its pre-installed metal foot near the system base unit. The cabinets can be placed side-by-side. Keep the following in mind when selecting a location.

- Allow six inches of space in front of the cabinet for the door to open.
- Allow at least a three-inch clearance in back of the cabinet for air circulation.
- Place the cabinet on a hard, flat surface (not on carpet).
- Ensure the surface will support the weight of the cabinets with all RAID disk drives installed. A fully loaded deskside cabinet weighs approximately 70 pounds.

Connect the cables to the cabinet and to the controller as described next.

Connecting the Cables

This section describes connecting the RAID SCSI cables from the MegaRAID controllers to the disk array cabinets. Information for choosing and connecting a power cord is also included.

NOTE Keep track of the cabinet attached to each channel of the MegaRAID controllers. The drives in each cabinet must be labeled according to their channel and controller as described later in this chapter.

CAUTION The deskside InterRAID-8e can use RAID SCSI cables of only 1 meter. If you attach cables longer than 1 meter to the cabinet, the cabinet and controller will not operate reliably.

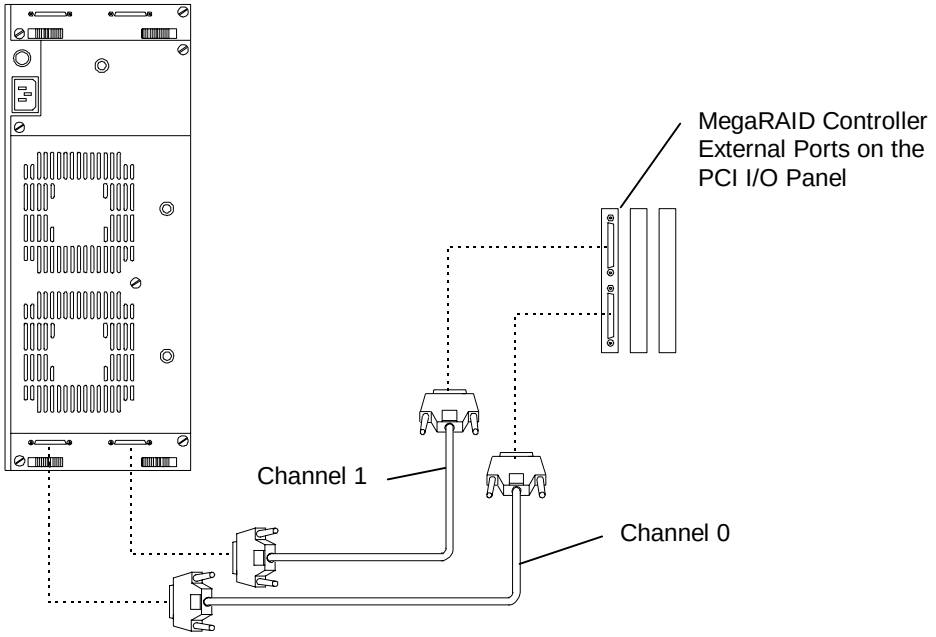
CAUTION The disk array cabinets must not be daisy-chained to each other. If you attach cables in this manner, the cabinet and controller may not operate reliably. Intergraph Computer Systems does not recommend daisy-chaining cabinets.

TDZ-610 and InterServe 6x5 Systems

Connect the RAID SCSI cables to the disk array cabinet and MegaRAID controller as follows.

To connect the cables:

1. Connect a RAID SCSI cable to the Channel 0 port on the cabinet and to the Channel 0 port on the MegaRAID controller. Repeat for the Channel 1 port. See the following figure.



NOTE If necessary, the ports at the top of the deskside disk array cabinet can be used instead of the lower ports.

2. Secure the cables using the thumb screws (finger tight only). Failure to secure the cables properly can result in intermittent problems with the cabinet or the MegaRAID controller.
3. Choose the proper power cord for the cabinet, depending on your country. See the *Power Supply Cord Selection* instruction sheet included in the accessory pack.
4. Connect the power cord to the InterRAID-8e cabinet and to the facility power outlet, AC distribution box, or uninterruptible power supply (UPS).

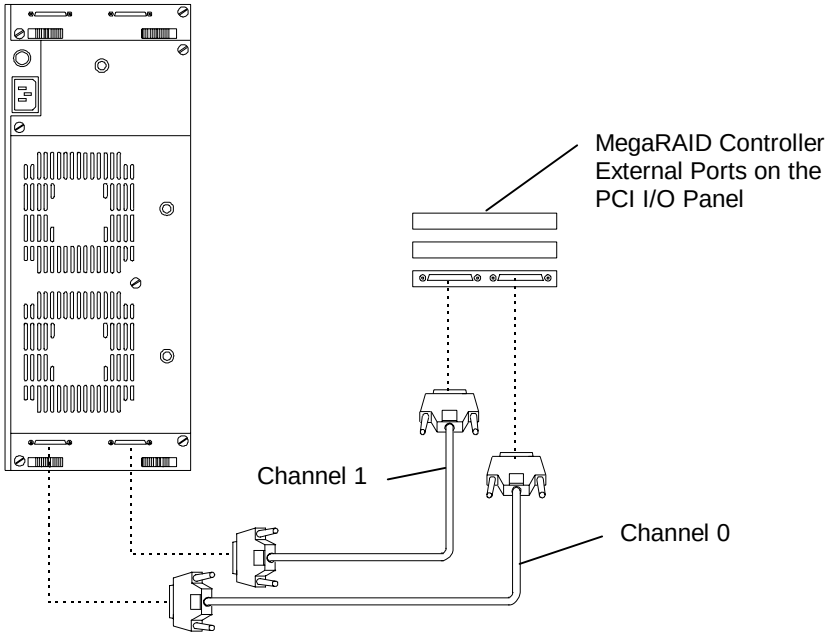
CAUTION If the system does not connect to a UPS, data loss can occur if there is a power failure.

InterServe 80 Systems

Connect the RAID SCSI cables to the disk array cabinet and MegaRAID controller as follows.

To connect the cables:

1. Connect a RAID SCSI cable to the Channel 0 port on the cabinet and to the Channel 0 port on the MegaRAID controller. Repeat for the Channel 1 port. See the following figure.



NOTE If necessary, the ports at the top of the deskside disk array cabinet can be used instead of the lower ports.

2. Secure the cables using the thumb screws (finger tight only). Failure to secure the cables properly can result in intermittent problems with the cabinet or the MegaRAID controller.
3. Choose the proper power cord for the cabinet, depending on your country. See the *Power Supply Cord Selection* instruction sheet included in the accessory pack.
4. Connect the power cord to the InterRAID-8e cabinet and to the facility power outlet, AC distribution box, or uninterruptible power supply (UPS).

CAUTION If the system does not connect to a UPS, data loss can occur if there is a power failure.

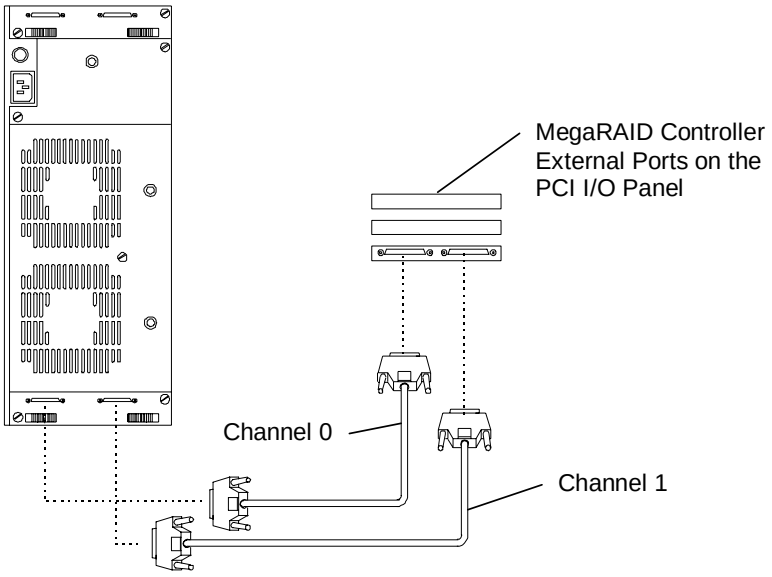
InterServe 8000 Systems

Connect the cables for the secondary controllers as follows.

NOTE Do not connect cables to the external ports of the primary controller, located in PCI Slot 4. The primary controller uses Channel 0 and 1 for the internal RAID section, so a cable cannot be connected to the external Channel 0 and Channel 1 port.

To connect the cables to the system and cabinet:

1. Connect a RAID SCSI cable to the Channel 0 port on the cabinet and to the Channel 0 port on the secondary MegaRAID controller. Repeat for the Channel 1 port. See the following figure.



NOTE If necessary, the ports at the top of the deskside disk array cabinet can be used instead of the lower ports.

2. Secure the cables using the thumb screws (finger tight only). Failure to secure the cables properly can result in intermittent problems with the cabinet or the MegaRAID controller.
3. Choose the proper power cord for the cabinet, depending on your country. See the *Power Supply Cord Selection* instruction sheet included in the accessory pack.
4. Connect the power cord to the InterRAID-8e cabinet and to the facility power outlet, AC distribution box, or uninterruptible power supply (UPS).

CAUTION If the system does not connect to a UPS, data loss can occur if there is a power failure.

Installing and Labeling RAID Disk Drives

The InterRAID-8e cabinet supports up to eight 1.0-inch or 1.6-inch high, 3.5-inch form factor RAID disk drives. Capacities include 4 GB, 9 GB, and higher as the disk drives become available. The slots of the InterRAID-8e cabinet are numbered from 1 to 8, starting with the bottom slot. The drive SCSI ID's of the InterRAID-8e cabinet by default are numbered 0, 1, 2, 4, 5, 6, 8, and 9, starting with the bottom slot. The SCSI ID if SAF-TE card by default is 3.

CAUTION High-capacity RAID disk drives are susceptible to physical shock. Handle all disk drives carefully and avoid unnecessary handling.

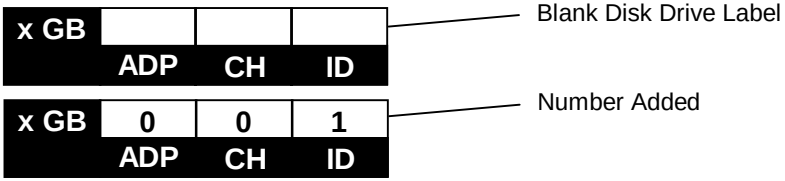
To install and label the RAID disk drives:

1. Unlock the front panel door using the key for the InterRAID-8e cabinet.
2. Remove the RAID disk drives from the drive boxes.

CAUTION Carefully insert the disk drives to avoid damaging the connector.

3. Install the RAID disk drives into the cabinet as follows.
   - Extend the drive latching clips and slide the drive into the slot.
   - Push between the latching clips until the drive connects.
   - Close the drive latching clips until they snap into place, locking the drive into the slot.
4. Label the installed drives as described below. Use the peel-off labels from the *Drive Labeling* instruction sheet and fill in the information for each drive.

   The left side of the disk drive label identifies the disk drive size (in GB). The label has blank spaces for the numbers to indicate the MegaRAID controller board (ADP), channel (CH), and SCSI ID (ID).



NOTE The label sheets do not include the numbers 3 and 7 for SCSI IDs. These ID numbers are used by the disk array cabinet and the MegaRAID controller board.

The lower four RAID disk drives connect to one channel; the upper four RAID disk drives connect to another channel. The following table shows the channel and ID numbers used for drives installed in a cabinet.

Disk Drive Label	Cabinet Slots
ADP *X* CH 1 ID 4	8 (top)
ADP *X* CH 1 ID 2	7
ADP *X* CH 1 ID 1	6
ADP *X* CH 1 ID 0	5
ADP *X* CH 0 ID 4	4
ADP *X* CH 0 ID 2	3
ADP *X* CH 0 ID 1	2
ADP *X* CH 0 ID 0	1 (bottom)

5. If you have additional cabinets, install the disk drives and complete the drive label information as appropriate.

Powering On and Configuring the System

To prevent accidental power off or on, the power switch is recessed and not accessible with the door closed and locked. Before starting the system for the first time, read the following important operating and software notices.

Important Operating Notices

- In some instances, the audible alarm sounds when you power on the InterRAID-8e cabinet. To silence the alarm, press the Menu and Enter keys on the Information Control Panel. See Chapter 9, "InterRAID-8e Power Supply Failures," for information about alarm conditions.
- Always power on the InterRAID-8e cabinet and wait for the audible beep before powering on the system base unit.
- If you turn off the power to the system base unit before completing the setup procedures, you must reload the operating system. Once you power on the system base unit, do not power off the system without completing Windows NT Server installation.
- Always power off the system base unit before powering off the InterRAID-8e cabinet. If you power off the cabinet first, the MegaRAID controller board will read the drives as dead the next time you power on the system.

Important Software Notices

- You must complete the Windows NT Server installation before using the system. Intergraph Computer Systems installs the MegaRAID BIOS configuration and Power Console utilities on your system before shipment. Power Console provides valuable information about the InterRAID-8e disk array, and can help you pinpoint any problems that may occur in disk array operation. Power Console installation is described in Appendix B of this guide, and in the hardware documentation delivered with your server.
- Intergraph Computer Systems recommends that you add a shortcut to Power Console to the Windows NT Startup menu (Start/Programs/Startup). See Windows NT Help for information on adding a shortcut to a menu on the Start menu.
- The MegaRAID controller board has two types of write caching: write-through and write-back. Write-through caching reduces the risk of data loss in the event of a power failure. Write-back caching improves performance, but the drawback is potential data loss if power fails. Intergraph Computer Systems recommends connection to a UPS to guard against data loss.
- Intergraph Computer Systems typically configures the MegaRAID controller board to RAID level 5. MegaRAID controllers support RAID levels 0, 1, 3, 5, 10 (0+1), 30, and 50.

To power on and configure the system:

1. Power on the InterRAID-8e cabinet and wait for the audible beep. After the power-on self-test completes, the Drive Status and Channel Mode LEDs remain green.

NOTE The Power Status LED remains amber and the LCD screen displays Non-Redundant Power when only one power supply is present, or if more than four drives are used with two power supplies.

2. Power on the system base unit and the monitor.
3. Configure the MegaRAID controllers installed in the system. The *System Setup* contains basic information to configure the disk array appropriate for the system. See Chapter 5, “Using the MegaRAID BIOS Configuration Utility” in this document for details about specific procedures.

CAUTION After you configure the RAID disk drives, it is important that you backup the configuration to a diskette. The diskette will be helpful in the event the configuration should become lost. See the “Saving and Restoring a Configuration” section in Chapter 5.”

Use Disk Administrator in Windows NT to partition and format the disk space not used by the operating system. When prompted to create a Signature File, select Yes. See the *Windows NT Server System Guide* for information on using Disk Administrator.

3 Setting Up InterRAID-8e Rack-Mount

This chapter describes setting up the rack-mount InterRAID-8e cabinet. If setting up a deskside (standalone) InterRAID-8e cabinet, see Chapter 2. When setting up the rack-mount cabinet, you will perform the following tasks:

- Unpack the equipment.
- Install the MegaRAID controller (if not pre-installed in the system base unit).
- Install the cabinet in the rack.
- Connect the cables.
- Install and label the RAID disk drives.
- Power on and configure the system.

Carefully unpack the equipment. The shipping carton contains the following items:

- MegaRAID controller board (if included)
- InterRAID-8e cabinet (single or dual-bus)
- Disk drive boxes containing up to four drives
- Diskettes containing configuration and utility software
- Accessories box

The accessories box, included with the cabinet, contains the following items:

- InterRAID-8e cabinet power cord
- Handle brackets and screws
- Rack mounting hardware (shelves, screws, and tinnerman nuts)
- RAID SCSI cable (two cables, if dual-bus)
- Key for disk array cabinet
- Disk drive labels
- *Drive Labeling* instruction sheet
- *Power Supply Cord Selection* instruction sheet
- *Antistatic Handling* instruction sheet

Retain all packaging materials. Equipment returned for repair must be in the original packaging to obtain warranty service, if provided under your contract agreement.

NOTE If any of the listed parts are missing or damaged, call the Customer Response Center at 1-800-633-7248.

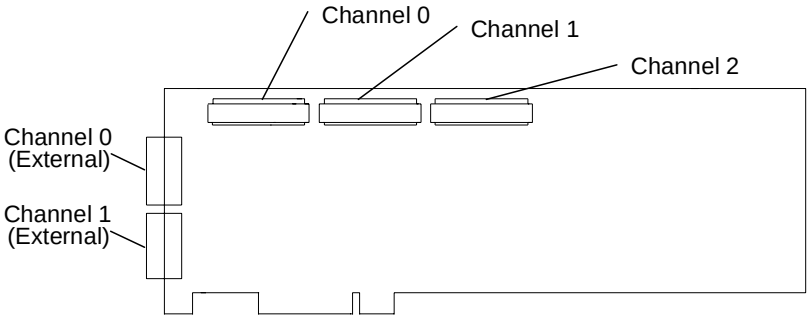
Installing the MegaRAID Controller

If the InterRAID-8e option includes a MegaRAID controller in the shipping carton, follow the instructions in this section to install the controller into the system. Otherwise, go to "Installing the Cabinet into a Rack." The following table shows information about the rack-mount systems that allow the InterRAID-8e option.

System	Primary Controller Slot	Secondary Controller Slots
TDZ-612 RAX	Not applicable	Any available PCI
RenderRAX	Not applicable	Any available PCI
InterServe 6x5R	Not applicable	Any available PCI
InterServe 8400, InterServe 650/660	PCI Slot 4	PCI Slots 5 through 8
StudioZ RAX	Not applicable	PCI Slots 4 though 7
InterServe 8000	PCI slot 4	PCI slots 5 through 8

NOTE The systems with "Not applicable" for primary controller slot use a fixed disk drive as the boot drive. All installed MegaRAID controllers are treated as secondary.

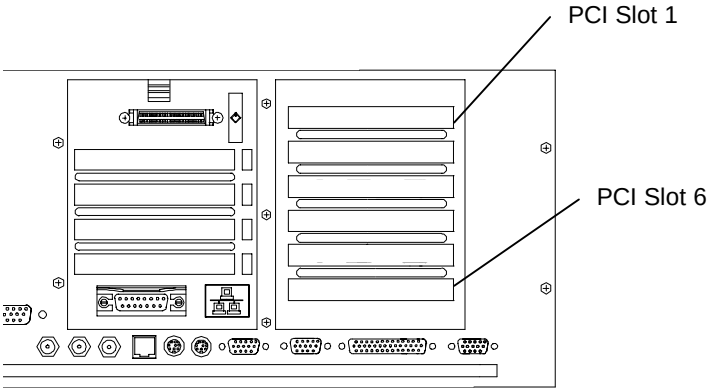
The following figure shows the MegaRAID controller and Channels 0, 1, and 2.



NOTE For those systems using an internal channel for the internal RAID section, you cannot use the external channel with the same number. For example, the InterServe 8000 uses Channel 0 and Channel 1 for the internal RAID section. Therefore, external Channel 0 and Channel 1 is not available for connection.

TDZ-612 RAX, RenderRAX, and InterServe 6x5R Systems

The following shows the I/O panel on the back of the TDZ-612 RAX, RenderRAX, and InterServe 6x5R systems.

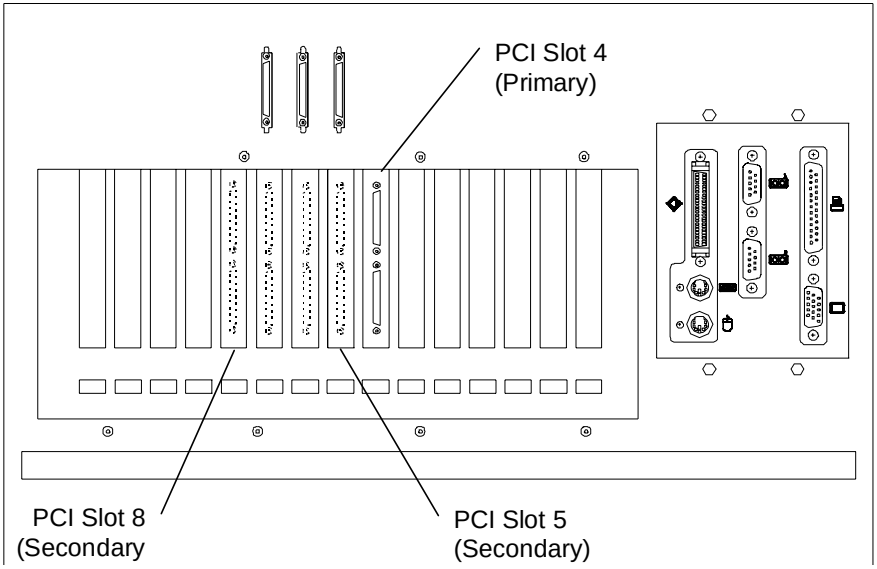


To install the controller:

1. Ensure the system is powered off.
2. Remove the top cover.
3. Remove the screw and blanking plate from an available PCI slot.
4. Install the MegaRAID controller. Press firmly and evenly over the PCI connector to ensure the board seats completely into the slot.
5. Secure the board with the screw removed from the blanking plate.
6. Replace the top cover.
7. Install the disk array cabinet as described in “Installing the Cabinet into a Rack.”

InterServe 8400, InterServe 650/660, and StudioZ RAX Systems

The following shows the I/O panel on the back of the InterServe 8400, InterServe 650/660, and StudioZ RAX systems.



To install the controller:

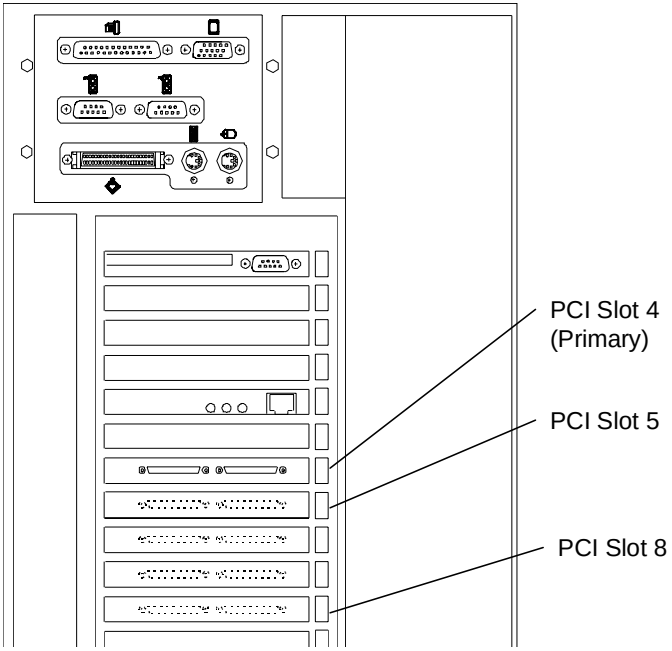
1. Ensure the system is powered off.
2. Remove the top cover from the system.
3. Remove the screw and blanking plate from an available PCI slot.
4. Install the MegaRAID controller. Press firmly and evenly over the PCI connector to ensure the board seats completely into the slot.
5. Secure the board with the screw removed from the blanking plate.
6. If using the Channel 2 connector, see “InterServe 8400 Channel 2 Expansion” for instructions to install and route the Channel 2 access cable.

NOTE Channel 2 expansion is not available for StudioZ RAX systems.

7. Replace the top cover.
8. Install the disk array cabinet as described in “Installing the Cabinet into a Rack.”

InterServe 8000 Systems

The following shows the I/O panel on the back of the InterServe 8000 systems.



To install the controller:

1. Ensure the system is powered off.
2. Remove the right side panel from the system.
3. Remove the screw and blanking plate from an available PCI slot.

NOTE Install secondary controllers only in PCI slots 5 through 8. If you install additional controllers in PCI slots 1 through 3, the system will not boot.

4. Install the MegaRAID controller. Press firmly and evenly over the PCI connector to ensure the board seats completely into the slot.
5. Secure the board with the screw removed from the blanking plate.
6. If using the Channel 2 connector, see “InterServe 8000 Channel 2 Expansion” for instructions to install and route the Channel 2 access cable.
7. Replace the side panel.
8. Install the disk array cabinet as described in “Installing the Cabinet into a Rack.”

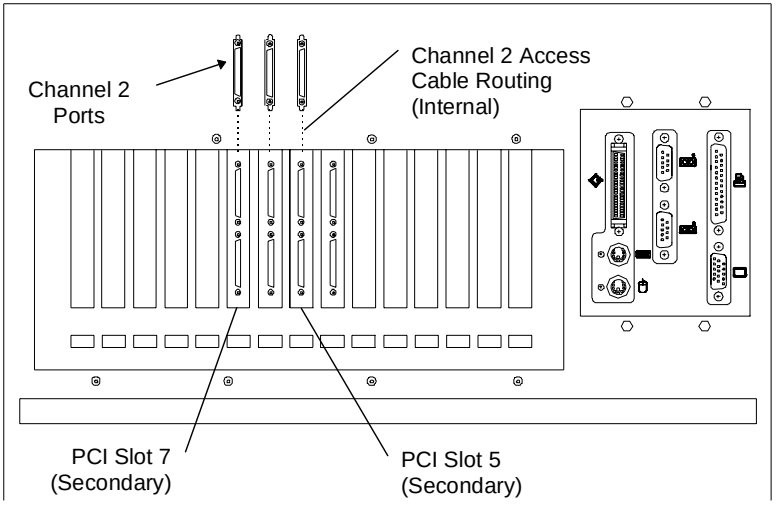
InterServe 8400/650/660 Channel 2 Expansion

The MegaRAID controller has three channels available for cabinet connection. Two of the channels (0 and 1) are available on the back of the controller. The third channel (2) is accessible via the Channel 2 ports above the I/O panel. If the Channel 2 access cable is not installed in the base unit, you must install the cable to use Channel 2 of the controller. To determine if the cable is installed, see if the Channel 2 port has a connector or a metal plate over the port. If a connector is present, the cable is installed. If the metal plate is present, install the access cable if it is included with the disk array cabinet.

NOTE The disk array cabinet attached to the Channel 2 port must be a single-channel cabinet. The following instructions describe how to install the Channel 2 access cables in the base unit. These steps assume the required secondary controllers have been installed and the unit is open.

To install the Channel 2 access cable:

1. Connect the Channel 2 access cables to the Channel 2 connector of the secondary MegaRAID controllers.
2. Connect the other end of the access cables to the Channel 2 ports as follows. See the following figure.
   - Attach the cable from the controller in PCI slot 5 to the right Channel 2 port.
   - Attach the cable from the controller in PCI slot 6 to the middle Channel 2 port.
   - Attach the cable from the controller in PCI slot 7 to the left Channel 2 port.



3. Close the base unit.
4. Install the disk array cabinet as described in “Installing the Cabinet into a Rack.”

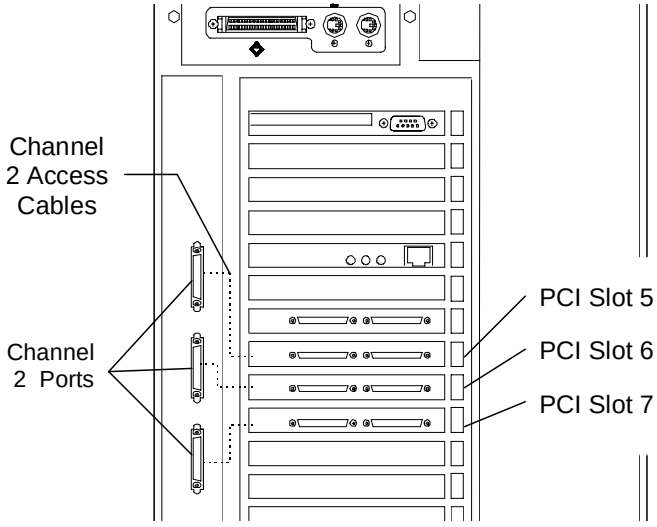
InterServe 8000 Channel 2 Expansion

The MegaRAID controller has three channels available for cabinet connection. Two of the channels (0 and 1) are available on the back of the controller. The third channel (2) is accessible via the Channel 2 port to the left of the I/O panel. If the Channel 2 access cable is not installed in the base unit, you must install the cable to use Channel 2 of the controller. To determine if the cable is installed, see if the Channel 2 port has a connector or a metal plate over the port. If a connector is present, the cable is installed. If the metal plate is present, install the access cable if it is included with the disk array cabinet.

NOTE The disk array cabinet attached to the Channel 2 port must be a single-channel cabinet. The following instructions describe how to install the Channel 2 access cables in the base unit. These steps assume the required secondary controllers have been installed and the unit is open.

To install the Channel 2 access cable:

1. Connect the Channel 2 access cables to the Channel 2 connector of the secondary MegaRAID controllers.
2. Connect the other end of the access cables to the Channel 2 ports as follows. See the following figure.
   - Attach the cable from the controller in PCI slot 5 to the top Channel 2 port.
   - Attach the cable from the controller in PCI slot 6 to the middle Channel 2 port.
   - Attach the cable from the controller in PCI slot 7 to the lower Channel 2 port.



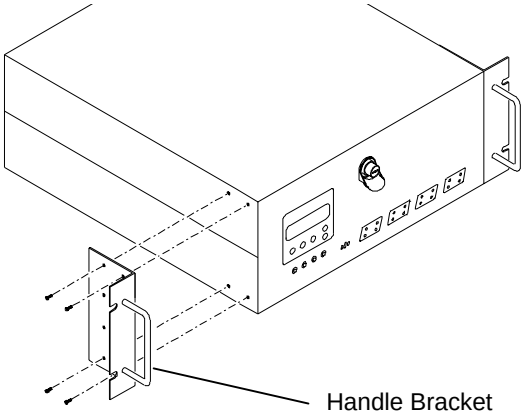
3. Close the base unit.
4. Install the disk array cabinet as described in “Installing the Cabinet into a Rack.”

Installing the Cabinet into a Rack

The InterRAID-8e cabinet requires 4 U vertical mounting space. One U equals 1.75 inches. The Intergraph rack is designed to support the weight of the cabinet when fully loaded with disk drives (weighing approximately 70 pounds). If installing the cabinet into a non-Intergraph rack, ensure the rack can safety support the weight of the cabinet and drives.

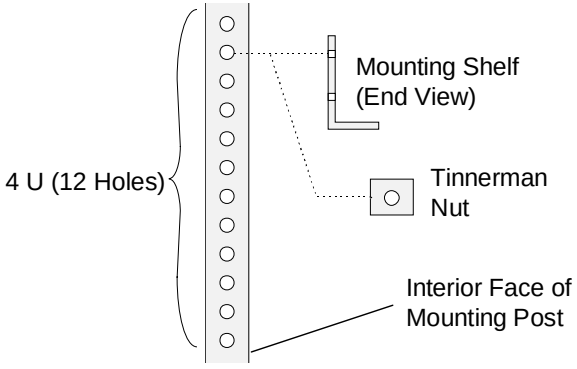
To install the cabinet:

1. Attach the handle brackets to both sides of the InterRAID-8e cabinet. Use the eight panhead screws (four for each bracket) supplied with the InterRAID-8e.

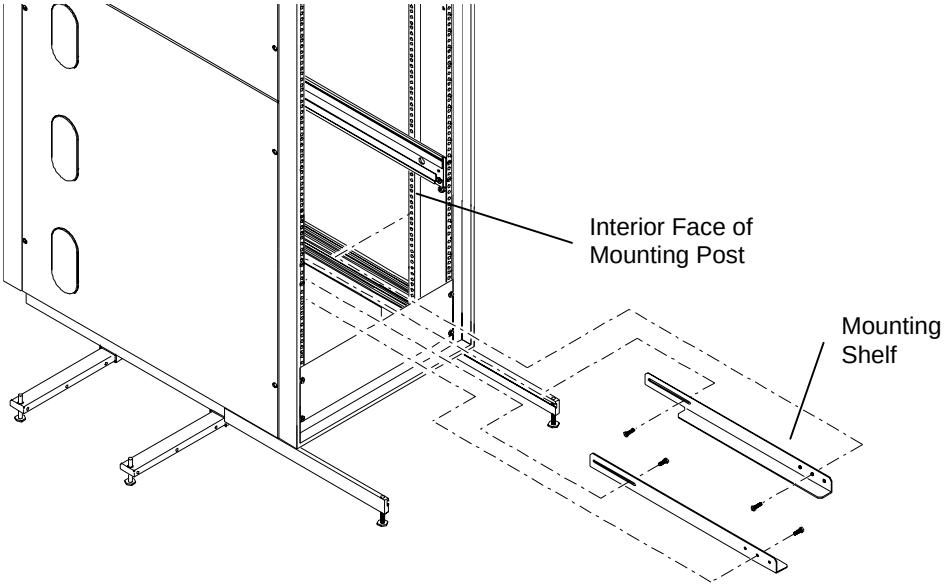


NOTE The sides of the InterRAID-8e cabinet have different hole patterns to match the pattern in each handle bracket.

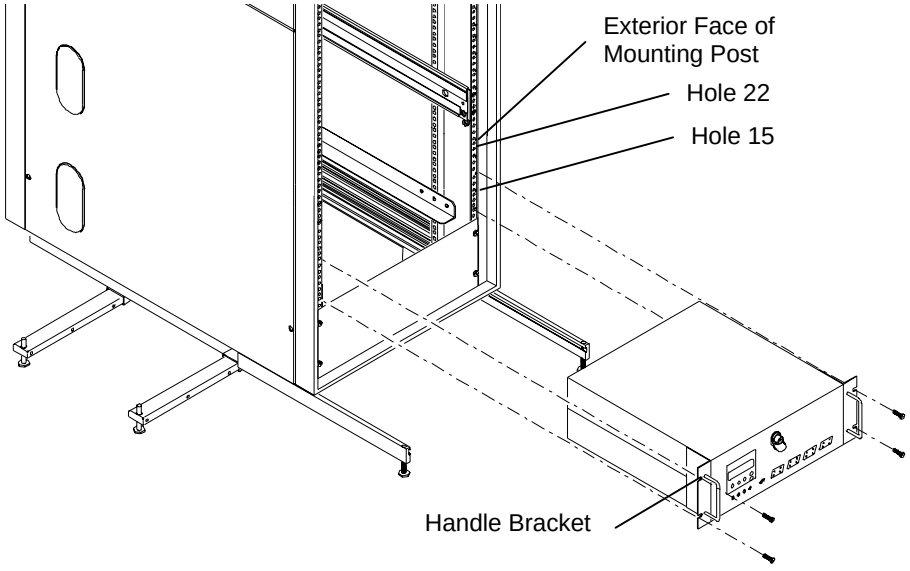
2. Determine the 4 U space (12 holes) in which to install the InterRAID-8e cabinet. The following figure shows where the mounting shelf and tinnerman nut must be installed in a given 4 U space.



3. Using the screws provided, attach the mounting shelves to the rack. See the following figure.



4. Place the InterRAID-8e cabinet on the mounting shelf as shown in the following figure.
5. Install tinnerman nuts on the exterior face of the two front mounting posts. Using the screws provided, secure the handle brackets to the rack.



Connecting the Cables

This section describes the external RAID SCSI cable connections for single-bus and dual-bus disk array cabinets. The single-bus cabinet uses only one channel from the MegaRAID controller. The dual-bus cabinet uses two channels from the MegaRAID controller. The following sections describe the details for connecting the cabinets.

NOTE Single-bus cabinets are not available for the StudioZ RAX systems.

CAUTION The rack-mount disk array cabinet can use RAID SCSI cables up to 2 meters. If you attach cables longer than 2 meters to the cabinet, the cabinet and controller will not operate reliably.

Single-Bus Cabinets

Keep track of the cabinet attached to each channel of the MegaRAID controller. The drives in each cabinet must be labeled according to their channel as described later in this chapter. The channel usage and availability of the primary controller are as follows:

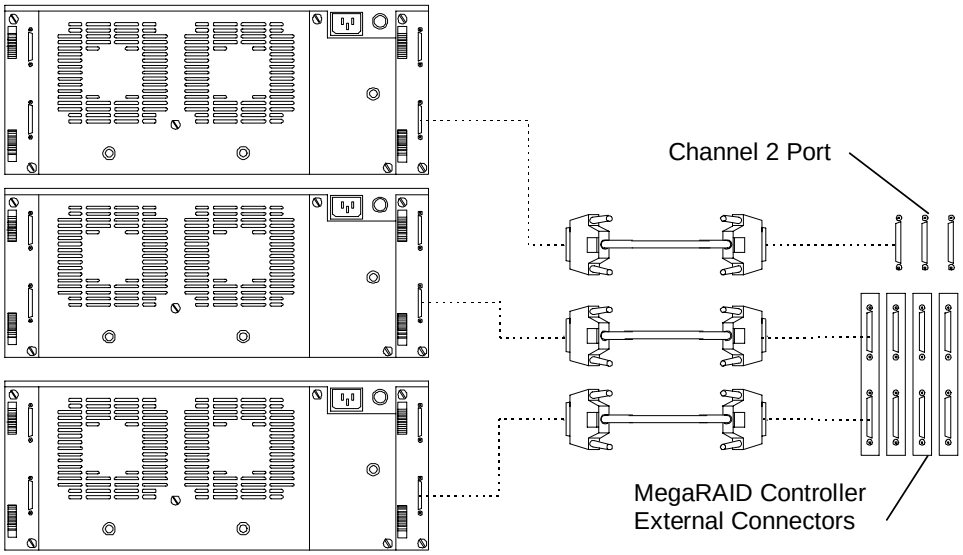
- TDZ-612 RAX, RenderRAX, InterServe 6x5R -- These systems do not use a primary controller.
- InterServe 8400 -- Channels 0 and 1 are used for internal RAID section. Channels 0 and 1 are not available for connecting a cabinet.
- InterServe 8000 -- Channels 0 and 1 are used for internal RAID section. Channels 0 and 1 are not available for connecting a cabinet.

The channels available on secondary controllers are as follows:

- TDZ-612 RAX, RenderRAX, InterServe 6x5R -- Channels 0 and 1 are available for connecting cabinets. Channel 2 is not available.
- InterServe 8400, 8000 -- Channels 0 and 1 are available for connecting cabinets. Channel 2 is available if the Channel 2 access cable is installed.

To connect RAID SCSI cables:

1. Connect the RAID SCSI cable to an available channel on the primary or secondary MegaRAID controller. Connect the other end of the cable to the lower right connector on the InterRAID-8e cabinet.
2. Secure the cables using the thumb screws (finger tight only). Failure to secure the cables properly can result in intermittent problems with the cabinet or the MegaRAID controller.



NOTE Ensure that the 2 meter cables connect to the right side of the InterRAID cabinet. The InterRAID-8e cabinet contains special extender circuitry that supports longer (2 meter) cable lengths connected only on the right side of the cabinet. Do not connect 2 meter cables to the left side of the cabinet.

NOTE The disk array cabinet attached to the Channel 2 port must be a single-bus cabinet.

3. Route the cables through the cable handler (if installed) or other retaining devices, such as clips, cable ties, etc.
4. Choose the proper power cord for the cabinet, depending on your country. See the *Power Supply Cord Selection* instruction sheet included in the accessory pack.
5. Connect the power cord to the InterRAID-8e cabinet and to the facility power outlet, AC distribution box, or uninterruptible power supply (UPS).

CAUTION If the system does not connect to a UPS, data loss can occur if there is a power failure.

Dual-Bus Cabinets

Keep track of the cabinet attached to each channel of the MegaRAID controller. The drives in each cabinet must be labeled according to their channel as described later in this chapter. The cable connections from the primary controller differ for each system as described below. The internal RAID section uses one or two channels of the primary controller, and those channels are not available for attaching an external cable.

- TDZ-612 RAX, RenderRAX, InterServe 6x5R -- These systems do not use a primary controller.

- InterServe 8400 -- Channels 0 and 1 are used for internal RAID section. Channels 0 and 1 are not available for connecting RAID SCSI cables to one disk array cabinet.
- InterServe 8000 -- Channels 0 and 1 are used for internal RAID section. Channels 0 and 1 are not available for connecting a cabinet.

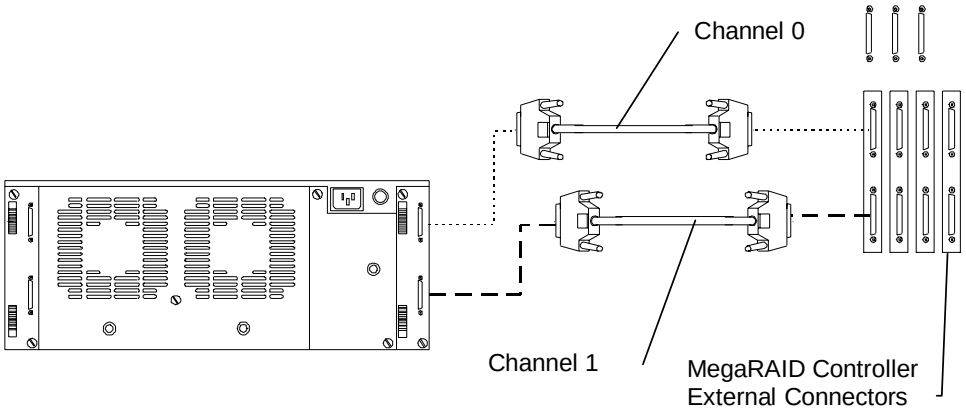
The channels available on secondary controllers are as follows:

- TDZ-612 RAX, RenderRAX, InterServe 6x5R -- Channels 0 and 1 are available for connecting cabinets. Channel 2 is not available.
- InterServe 8400, 8000 -- Channels 0 and 1 are available for connecting cabinets. Channel 2 is available if the Channel 2 access cable is installed.
- StudioZ RAX -- Channels 1 and 2 of the controller in PCI slot 4 are used for the internal RAID section, and Channel 0 is not available. Controllers in PCI slot 5 through 7 use Channels 0 and 1 to connect cabinets, and Channel 2 is not available.

To connect cables:

1. Connect the RAID SCSI cable Channel 0 on the primary or secondary MegaRAID controller. Connect the other end of the cable to the Channel 0 connector on the InterRAID-8e cabinet. Repeat for Channel 1.
2. Secure the cables using the thumb screws (finger tight only). Failure to secure the cables properly can result in intermittent problems with the cabinet or the MegaRAID controller.

The following figure shows connecting cables to Channel 0 and 1 of a controller.



NOTE Ensure that the 2 meter cables connect to the right side of the InterRAID cabinet. The InterRAID-8e cabinet contains special extender circuitry that supports longer (2 meter) cable lengths connected only on the right side of the cabinet. Do not connect 2 meter cables to the left side of the cabinet.

3. Route the cables through the cable handler (if installed) or other retaining devices, such as clips, cable ties, etc.
4. Choose the proper power cord for the cabinet depending on your country. See the *Power Supply Cord Selection* instruction sheet included in the accessory pack.
5. Connect the power cord to the InterRAID-8e cabinet and to the facility power outlet, AC distribution box, or uninterruptible power supply (UPS).

CAUTION If the system does not connect to a UPS, data loss can occur if there is a power failure.

Installing and Labeling RAID Disk Drives

The InterRAID-8e cabinet supports up to eight 1.0-inch or 1.6-inch high, 3.5-inch form factor RAID disk drives. Capacities include 4 GB, 9 GB, and higher as the disk drives become available. The slots of the InterRAID-8e cabinet are numbered from 1 to 8, starting with the right slot.

CAUTION High-capacity RAID disk drives are susceptible to physical shock. Handle all disk drives carefully and avoid unnecessary handling.

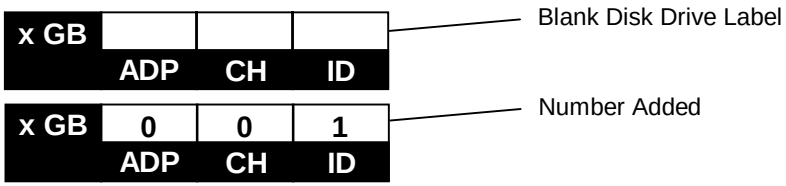
To install and label the RAID disk drives:

1. Unlock the front panel door using the key for the InterRAID-8e cabinet.
2. Remove the RAID disk drives from the drive boxes.

CAUTION Carefully insert the disk drives to avoid damaging the connector.

3. Install the RAID disk drives into the cabinet as follows.
   - Extend the drive latching clips and slide the drive into the slot.
   - Push between the latching clips until the drive connects.
   - Close the drive latching clips until they snap into place, locking the drive into the slot.
4. Label the installed drives as described below. Use the peel-off labels from the *Drive Labeling* instruction sheet and fill in the information for each drive.

   The left side of the disk drive label identifies the disk drive size (in GB). The label has blank spaces for the numbers to indicate the MegaRAID controller board (ADP), channel (CH), and SCSI ID (ID).



NOTE The label sheets do not include the numbers 3 and 7 for SCSI IDs. These ID numbers are used by the disk array and for the MegaRAID controller board.

In a single-bus InterRAID-8e cabinet, all eight RAID disk drives connect to a single channel. Use the following table to label the drives:

Disk Drive Label	Cabinet Slots
ADP *X* CH *X* ID 9	8 (left)
ADP *X* CH *X* ID 8	7
ADP *X* CH *X* ID 6	6
ADP *X* CH *X* ID 5	5
ADP *X* CH *X* ID 4	4
ADP *X* CH *X* ID 2	3
ADP *X* CH *X* ID 1	2
ADP *X* CH *X* ID 0	1 (right)

In a dual-bus InterRAID-8e cabinet, the right four RAID disk drives connect to one channel and the left four RAID disk drives connect to another channel. The following table shows the channel and ID numbers used for drives installed in a cabinet.

Disk Drive Label	Cabinet Slots
ADP *X* CH 1 ID 4	8 (left)
ADP *X* CH 1 ID 2	7
ADP *X* CH 1 ID 1	6
ADP *X* CH 1 ID 0	5
ADP *X* CH 0 ID 4	4
ADP *X* CH 0 ID 2	3
ADP *X* CH 0 ID 1	2
ADP *X* CH 0 ID 0	1 (right)

5. If you have additional cabinets, install the disk drives and complete the drive label information as appropriate.
6. See the *StudioZ RAX System Setup* for specific information about drive labeling.

Powering On and Configuring the System

To prevent accidental power off or on, the power switch is recessed and not accessible with the door closed and locked. Before starting the system for the first time, read the following important operating and software notices.

Important Operating Notices

- In some instances, the audible alarm sounds when you power on the InterRAID-8e cabinet. To silence the alarm, press the Menu and Enter keys of the Information Control Panel. See Chapter 9, "InterRAID-8e Power Supply Failures," for information about alarm conditions.
- Always power on the InterRAID-8e cabinet and wait for the audible beep before powering on the system base unit.
- If you turn off the power to the system base unit before completing the setup procedures, you must reload the operating system. Once you power on the system base unit, do not power off the system without completing Windows NT Server installation.
- Always power off the system base unit before powering off the InterRAID-8e cabinet. If you power off the cabinet first, the MegaRAID controller board will read the drives as dead the next time you power on the system.

Important Software Notices

- You must complete the Windows NT Server installation before using the system. Intergraph Computer Systems installs the MegaRAID BIOS configuration and Power Console utilities on your system before shipment. Power Console provides valuable information about the InterRAID-8e disk array, and can help you pinpoint any problems that may occur in disk array operation. Power Console installation is described in Appendix B of this guide, and in the hardware documentation delivered with your server.
- Intergraph Computer Systems recommends that you add a shortcut to Power Console to the Windows NT Startup menu (Start/Programs/Startup). See Windows NT Help for information on adding a shortcut to a menu on the Start menu.
- The MegaRAID controller board has two types of write caching: write-through and write-back. Write-through caching reduces the risk of data loss in the event of a power failure. Write-back caching improves performance, but the drawback is potential data loss if power fails. Intergraph Computer Systems recommends connection to a UPS to guard against data loss.
- Intergraph Computer Systems typically configures the MegaRAID controller board to RAID level 5. MegaRAID controllers support RAID levels 0, 1, 3, 5, 10 (0+1), 30, and 50.

To power on and configure the system:

1. Power on the InterRAID-8e cabinet and wait for the audible beep. After the power-on self-test completes, the Drive Status and Channel Mode LEDs remain green.

NOTE The Power Status LED remains amber and the LCD screen displays Non-Redundant Power when only one power supply is present, or if more than four drives are used with two power supplies.

2. Power on the system base unit and the monitor.

3. Configure the MegaRAID controllers installed in the system. The *System Setup* contains basic information to configure the disk array appropriate for the system. See Chapter 5, "Using the MegaRAID BIOS Configuration Utility" in this document for details about specific procedures.

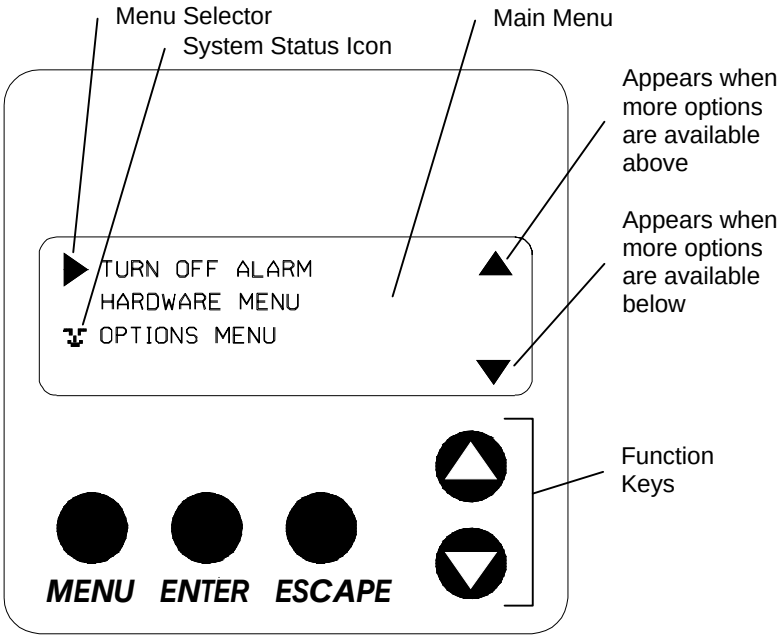
CAUTION After you configure the RAID disk drives, it is important that you backup the configuration to a diskette. The diskette will be helpful in the event the configuration should become lost. See the "Saving and Restoring a Configuration" section in Chapter 5."

4. Use Disk Administrator in Windows NT to partition and format the disk space not used by the operating system. When prompted to create a Signature File, select Yes. See the *Windows NT Server System Guide* for information on using Disk Administrator.

4 Using the Information Control Panel

You can use the Information Control Panel (ICP) to silence the audible alarm, and monitor the power supplies, fans, microprocessor, and cabinet temperature. Other menu functions let you view component system status, read the firmware revision level, and establish a passcode to protect SCSI ID options.

The liquid crystal display provides a four line by twenty character display. Of the five function keys, two move the Menu Selector up or down. The MENU key selects menu options or returns to the main menu, ENTER selects the option indicated by the Menu Selector, and ESCAPE backs up one level or cancels an action.



To display the Main menu, press the MENU key. Use the up and down arrow keys to make your selection, and then press the ENTER key. For example, to silence the alarm, move the cursor to TURN OFF ALARM and press the ENTER key.

System Status Icon

An animated System Status icon appears in the ICP approximately 30 seconds after a static display and indicates system status. It displays a “happy face” and looks left and right when all systems operate normally. If an abnormality occurs within the system, the icon changes to a “sad face” requesting your attention.

Systems Normal

Systems Abnormal

Hardware Menu

The Hardware menu displays the following options:

- Component Status
- Configuration Info
- POST Results
- Internal Temp

Component Status

This option gives a list and current status of the power supplies and fans installed in the InterRAID-8e cabinet. The following is an example display:

```
PWR SPLY 1...OK
PWR SPLY 2...OK
PWR SPLY 3...MISSING
FAN 1........FAILED
FAN 2........OK
FAN SPEED....93%
BUS CONFIG...SINGLE
```

If an error occurs during startup, the alarm sounds a continuous tone. You can display the Component Status menu to verify a suspected failed component. Component status is indicated by OK, Missing, or Failed. If you receive a hardware error, display the ICP Main menu and choose Hardware menu, then select Component Status and use the up or down arrow keys to view a complete list of the components.

During normal operation, if one of the power supplies fails, a continuous alarm sounds and a warning message displays. The message tells you that the state of the power supply system is no longer redundant. Display the Component Status menu to determine which power supply has failed. Identify the failed unit by the power supply LED. Replace the failed power supply to return the system to a redundant state.

Configuration Info

This option displays the cabinet type (SAF-TE) for the InterRAID-8e cabinet, and displays information about the current RAID firmware, including product name, slot assignment, RAM version, ROM version, and ID (in Hex format). The SAF-TE controller executes RAM and ROM firmware code to monitor the cabinet. The following is an example display:

```
PROD: InterRAID-8e      SAF-TE
SLOT 1 CARD:
   I/O INTERFACE
RAM REVISION:           0.xx
ROM REVISION:           1.xx
ID: 64363264h
```

POST Results

This option displays the diagnostics performed during the startup power-on self-test (POST). If an error occurs it displays in the ICP, LEDs blink, and the alarm sounds. The following is an example display:

```
ROM CHKSUM      OK
RAM CHKSUM      OK
RAM R/W         OK
SCSI BUS 0      OK
SCSI BUS 1      OK
PROCESSOR       OK
```

Internal Temp

This option displays the current internal cabinet temperature using the highest indication of two sensors. Cabinet temperature is measured within the drive bay area between drive slots 2 and 3, and between slots 7 and 8. By sensing cabinet temperature in these locations, the system provides maximum protection. The temperature displays in both Fahrenheit and Celsius degrees. The following is an example display:

```
CABINET INTERNAL
TEMPERATURE
96° F/36° C
```

Options Menu

The Options Menu displays the following selections.

- SCSI ID
- Heat Threshold
- SAF-TE Chain ID
- Change Passcode
- Lock (or Unlock)

SCSI ID

SCSI ID displays the ID that is set for each disk drive slot. Intergraph Computer Systems recommends that you do not change any SCSI ID settings, even though SCSI IDs 0 through 15 are available and can be changed at the SCSI ID menu. If you change a SCSI ID setting, you must turn off power to the InterRAID-8e cabinet and wait 30 seconds before turning on power again for those settings to take effect. Be sure to turn off the power to the system base unit before you turn off power to the InterRAID-8e cabinet.

NOTE If you turn off the power to the InterRAID-8e cabinet and then power off the system base unit, the RAID controller will mark offline all drives in the array.

Set Upper and Lower Slot IDs

NOTE Disk drive SCSI IDs cannot be set individually with these menu selections.

Intergraph Computer Systems recommends that you do not change the SCSI ID settings. If necessary, you can set SCSI IDs manually for each group of slots from a pre-defined table of IDs. The currently set IDs will display on the ICP. Refer to the following example:

```
          0     1     2     3
Lower 4   0     1     2     4
          4     5     6     7
          4     5     6     8
          5     6     7     8
```

The IDs will be assigned sequentially beginning with the lowest slot in the group. Choose “Set Lower Slot IDs” or “Set Upper Slot IDs” for the appropriate slots and press the ENTER key.

Reset Default IDs

Choosing the Reset Default IDs option from the SCSI ID menu will automatically set the SCSI IDs to IDs 0, 1, 2, and 4 for the disk drives, and ID 3 for the SAF-TE. SCSI IDs for the drives will be the same for both SCSI bus channels.

NOTE ID 3 is normally reserved for the InterRAID-8e SAF-TE board. The SAF-TE board contains the control and monitoring electronics for the disk array. The SAF-TE board resides in one of the two slots located in the top bay of the InterRAID-8e cabinet. The SAF-TE board ID uses "OB" to indicate Off Bus (off line) mode. However, if SAF-TE is off line, the LEDs and other error reporting signals will not function properly.

Heat Threshold

NOTE The Heat Threshold value is pre-set at the factory and should not be changed unless directed by Intergraph Computer Systems Technical Support. The default setting is 116 degrees F (47 degrees C).

Choose this option to change the temperature value for the temperature monitoring system. If the temperature exceeds the set value, a Temperature Threshold Exceeded message displays in the ICP. The RAID cabinet alarm sounds continuously until the problem is corrected.

SAF-TE Chain ID

This option is for configuring the SAF-TE board for master and slave modes when cabinets are daisy chained. Intergraph does not recommend daisy chaining InterRAID-8e cabinets. The default setting for SAF-TE Chain ID is None.

Change Passcode

NOTE Lock mode is disabled until a passcode is entered. To enable lock mode, enter the default passcode.

This option allows an administrator to create or change a passcode to protect access to the SCSI ID menu, Heat Threshold, Change Passcode, and Lock (or Unlock) features.

Use the arrow keys to change the code value (0-9) and the ENTER key to move from one field to the next. Then press the ENTER key after you have made your selections. You are prompted to press the ESCAPE key after the passcode is changed for the change to take affect. The new passcode does not take affect until you have returned to the ICP main menu and "Status OK" displays.

NOTE If you lose your passcode, call the Customer Response Center at 1-800-633-7248 and ask that your call be directed to the Solutions Center.

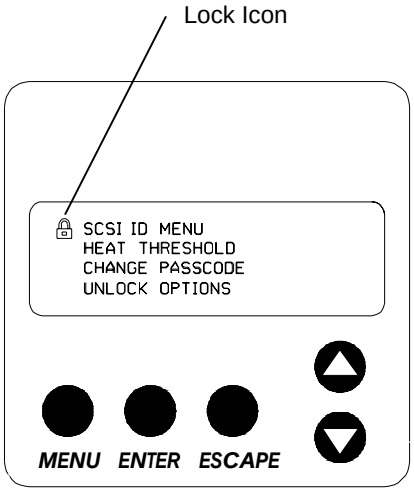
Lock (or Unlock)

This option lets you lock or unlock the Heat Threshold and Change Passcode items found under the Options Menu. The option lets you change and lock the values to protect them from being changed by unauthorized users.

The following is an example display:

```
ENTER 4 DIGIT
PASSCODE
      ▼
      0000
```

Select Lock Options from the Options menu. Use the arrow keys to change the code value (0-9) and the ENTER key to move from one field to the next. Then press the ENTER key after you have made your selections. A lock icon appears in the ICP while the options remain locked, as shown in the following example. You will be prompted that the SCSI ID Menu options are locked until you have cycled the menus back to the ICP main menu and "Status OK" displays.



5 Using the MegaRAID BIOS Configuration Utility

This chapter describes how to use the MegaRAID BIOS Configuration Utility (hereafter referred to as MegaRAID BIOS) to configure disk arrays and logical drives. This utility is executed instead of booting the operating system. Refer to Appendix B, "Software Updates" for installing the MegaRAID BIOS configuration utility.

The topics in this chapter include the following:

- Identifying controller assignments
- Starting MegaRAID BIOS
- Identifying Management menu options
- Exiting MegaRAID BIOS
- Management menu tree
- Configuring arrays and logical drives
- Rebuilding critical logical drives
- Using a pre-loaded SCSI drive "as-is"
- Saving and restoring a configuration

NOTE If you need to load the new driver, follow the applicable instructions in Appendix B, "Software Updates."

Identifying Controller Assignments

CAUTION The number assigned to the controller changes according to the number of installed controllers. Note that MegaRAID BIOS refers to controllers as "Adapters."

MegaRAID BIOS detects the presence of RAID controllers and assigns the controller numbers in a unique way. The assignments also vary depending on the system boot device.

Fixed Hard Disk Drive

Intergraph systems that include a MegaRAID controller but use a fixed disk drive on a separate controller as a boot device are covered in this section.

The following tables show how MegaRAID BIOS lists from one to five installed controllers.

One Controller	PCI Slot	Controller	BIOS Configuration
	1	First	0

Two Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	1
	2	Second	0

Three Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	2
	2	Second	1
	3	Third	0

Four Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	3
	2	Second	2
	3	Third	1
	4	Fourth	0

Five Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	3
	2	Second	2
	3	Third	1
	4	Fourth	0
	5	Fifth	4

InterServe 615, 625, 635, 645 Systems

InterServe 615, 625, 635, 645 systems are shipped from Intergraph Computer Systems with RAID controllers installed in PCI slots 1 through 5 which should remain in these slots. On a system with multiple RAID controllers, always use the RAID controller in PCI slot 1 as the boot controller. On a system with one RAID controller, the controller resides in PCI slot 1.

The following tables show how MegaRAID BIOS lists the installed controllers.

One Controller	PCI Slot	Controller	BIOS Configuration
	1	First	0 (Boot)

Two Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	0 (Boot)
	2	Second	1

Three Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	0 (Boot)
	2	Second	2
	3	Third	1

Four Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	0 (Boot)
	2	Second	3
	3	Third	2
	4	Fourth	1

Five Controllers	PCI Slot	Controller	BIOS Configuration
	1	First	0 (Boot)
	2	Second	3
	3	Third	2
	4	Fourth	1
	5	Fifth	4

InterServe 8400 Systems

InterServe 8400 systems are shipped from Intergraph Computer Systems with RAID controllers installed in PCI slots 4 through 8 which should remain in these slots. On a system with multiple RAID controllers, always use the RAID controller in PCI slot 4 as the boot controller. On a system with one RAID controller, the controller resides in PCI slot 4.

The following tables show how MegaRAID BIOS lists the installed controllers.

One Controller	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)

Two Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	1

Three Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	2
	6	Third	1

Four Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	3
	6	Third	2
	7	Fourth	1

Five Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	3
	6	Third	2
	7	Fourth	1
	8	Fifth	4

InterServe 8000 Systems

InterServe 8000 systems are shipped from Intergraph Computer Systems with RAID controllers installed in PCI slots 4 through 8 which should remain in these slots. On a system with multiple RAID controllers, always use the RAID controller in PCI slot 4 as the boot controller. On a system with one RAID controller, the controller resides in PCI slot 4.

The following tables show how MegaRAID BIOS lists the installed controllers.

One Controller	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)

Two Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	1

Three Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	1
	6	Third	2

Four Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	1
	6	Third	2
	7	Fourth	3

Five Controllers	PCI Slot	Controller	BIOS Configuration
	4	First	0 (Boot)
	5	Second	1
	6	Third	2
	7	Fourth	3
	8	Fifth	4

Starting MegaRAID BIOS

When the system boots, press CTRL+M when the following appears:

```
MEGARAID CONTROLLER  BIOS Version x.xx Aug 1, 1996
Host Adapter-1 Firmware Version x.xx DRAM Size 8 MB
0 Logical Drives found on the Host Adapter
0 Logical Drives handled by BIOS
Press <Ctrl><M> to run MegaRAID BIOS Configuration Utility
```

NOTE If you do not press CTRL+M within a few seconds of the prompt, the system continues the normal boot procedure.

For each MegaRAID controller in the system, the firmware version, DRAM size, and the status of logical drives on that controller displays. When you press CTRL+M, the Management menu displays.

Identifying Management Menu Options

The Management menu options are as follows:

Option	Description
Configure	Configures physical arrays and logical drives
Initialize	Initializes one or more logical drives
Objects	Individually accesses controllers, logical drives, physical drives and SCSI channel settings
Format	Low-level formats a hard disk drive
Rebuild	Rebuilds a failed disk drive
Check Consistency	Verifies that the redundancy data is correct in logical drives using RAID level 1, 3, or 5
Select Adapter	Selects a MegaRAID host adapter (controller)
Disable BIOS	Disables the BIOS

The following table defines some terms you will see while configuring drives and running the MegaRAID BIOS configuration utility.

READY	Disk drive ready for configuration
ONLINE	Disk drive ready for use
REBUILD	Disk drive in rebuild state
OFFLINE	Unformatted drive
PACK	Configured pack
DRIVES	Number of drives in a pack
SIZE	Size of the packs (in megabytes)
HOTSP	Disk drive configured as hotspare (standby) drive
FAIL	Disk drive in fail state

Exiting MegaRAID BIOS

To exit the MegaRAID BIOS configuration utility, press ESC while the Management menu displays. Choose Yes at the prompt to save changes and exit. You must then reboot the system. The MegaRAID BIOS message displays again. Press ESC when the BIOS Configuration Utility prompt displays.

Management Menu Tree

The following is an expansion of the Management menu options. The menu items are explained on the following pages.

- CONFIGURE --
  - Easy Configuration
  - New Configuration
  - View/Add /Delete Configuration
  - Clear Configuration
- INITIALIZE --
- OBJECTS –
  - Adapter --
    - Clear Configuration
    - FlexRAID PowerFail
    - Flexible Dynamic Sizing
    - Disk Spin-up Timings
    - Chip Set Type
    - Cache Flush Timings
    - Rebuild Rate
    - Alarm Control
    - Auto Rebuild
  - Logical Drive --
    - Initialize
    - Check Consistency
    - View/Update Parameters
  - Physical Drive –
    - Rebuild
    - Format
    - Make Online
    - Fail Drive
    - Make Hotspare
    - View Drive Information
    - Synchronous Negotiation
    - SCSI-2 Command Tagging
  - SCSI Channel/ Channels (0, 1, 2) --
    - Terminate High 8 Bits
    - Terminate Wide Channel
    - Disable Termination
    - Set PowerOn Defaults
    - Ultra SCSI
- FORMAT –
- REBUILD --
- CHECK CONSISTENCY --
- SELECT ADAPTER --
- DISABLE BIOS --

Configure Menu

Choose the Configure option from the Management menu to select a method for configuring arrays and logical drives. Intergraph Computer Systems recommends that you view a configuration to prevent accidental modification of data.

Option	Description
Easy Configuration	Select this option 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 option 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/Delete Configuration	Select this option to examine the existing configuration and/or to specify additional arrays and logical drives. View/Add/Delete 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.

Initialize Menu

Choose Initialize from the Management menu to initialize one or more logical drives. Initializing typically follows configuring a new logical drive.

CAUTION Initializing a logical drive destroys all data on the logical drive.

Objects Menu

Choose Objects from the Management menu to access the controllers (adapters), logical drives, physical drives, SCSI channels, and Battery Backup options individually. You can also change certain settings for each object. The Objects menu displays as follows.

```
--------------  Objects  ----------------
Adapter
Logical Drive
Physical Drive
SCSI Channel
Battery Backup
```

Ensure the following important default settings of the Objects menu:

- Under Objects/Adapter/Chip Set Type, ensure “Others” is selected.
- Under Objects/Adapter/Alarm Control, ensure “Disable” is selected.
- Under Objects/Adapter/Spinup Timings/Spinup Parameters, ensure “two drives every six seconds” is selected.
- Under Objects/SCSI Channel/Ultra SCSI, ensure “Enable” is selected for channels connected to InterRAID-8e cabinets only.
- After a logical drive is configured, Under Objects/Logical Drive/Drive #/View-Update Parameters/FlexRAID Virtual Sizing, ensure “Disable” is selected.

Adapter

If your system has more than one MegaRAID controller, choose the Adapter option from the Objects menu to select a MegaRAID controller and to modify the parameters. The following displays:

```
--------------  Adapter x  ----------------
Clear Configuration
FlexRAID PowerFail = DISABLED
Disk Spin-up Timings
Chip Set Type
Cache Flush Timings
Rebuild Rate
Alarm Control
Auto Rebuild = ENABLED
```

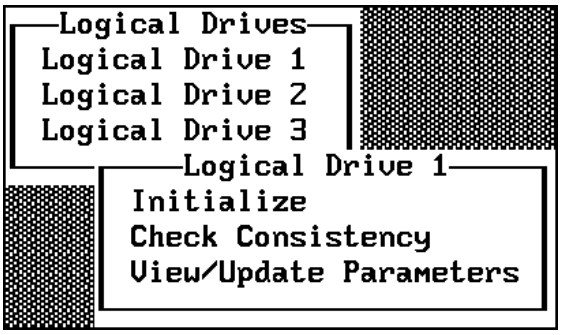
The following table describes the Adapter menu options.

Option	Description
Clear Configuration	Choose this option to erase the current configuration from the controller non-volatile memory.
FlexRAID PowerFail	Choose this option if you have battery backup installed. Default is disabled.
Disk Spin-up Timings	Choose this option to set the method and timing for spinning up the hard disk drives in the system. Default is 2 every 6 seconds.
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. Default is other.
Cache Flush Timings	Choose this option to set the cache flush interval to once every 2, 4, 6, 8, or 10 seconds. Default is 2.

Option	Description
Rebuild Rate	Choose this option to change the rebuild rate for the controller. You can also display the firmware version number.
Alarm Control	Choose this option to enable, disable, or silence the onboard alarm tone generator. Default is disable.
Auto Rebuild	Choose this option to enable automatic rebuild. Default is enabled.

Logical Drive

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

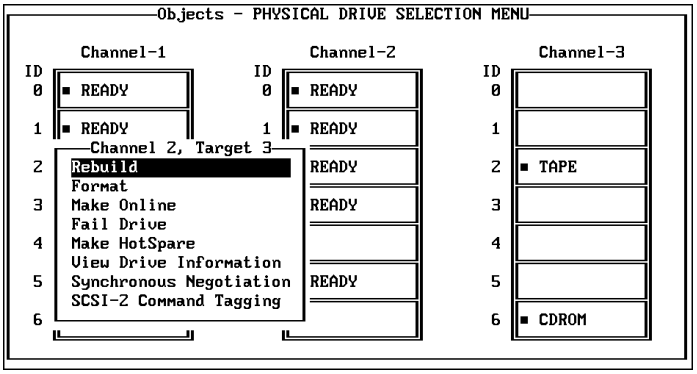


The following table describes the Logical Drives options.

Option	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, read policy, I/O policy, and FlexRAID Virtual Sizing from this menu.

Physical Drive

Choose the Physical Drive option from the Objects menu to select a physical device and to perform the operations listed in the table below. The physical hard disk drives in the system are listed. Move the cursor to the desired device and press ENTER to display the following:



NOTE On systems with two-channel MegaRAID controllers, only two columns representing the two channels will appear on the Physical Drive menu.

The following table describes the Physical Drive options.

Option	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 hotspare.
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.

SCSI Channel

Choose the SCSI Channel option from the Objects menu to select a SCSI channel on the currently selected controller.

The following displays:

```
--------------  Channel x  ----------------
Terminate High 8 Bits
Terminate Wide Channel
Disable Termination
Set PowerOn Defaults
Ultra SCSI = DISABLED
```

The following table describes the SCSI Channel options.

Option	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 MegaRAID 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 channel 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.
Ultra SCSI	Choose this option to enable or disable Ultra SCSI. Default is disabled.

Format Menu

Choose Format from the Management menu to low-level format one or more physical drives.

WARNING Formatting a hard drive destroys all data on the drive.

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 one of the following applies:

- The disk drive was not low-level formatted at the factory.
- There are an excessive number of media errors detected on the disk drive.

You do not need 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 the logical drive(s).

Rebuild Menu

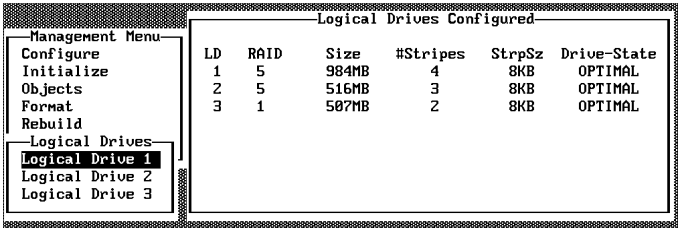
Choose Rebuild from the Management menu to rebuild one or more failed disk drives.

Check Consistency Menu

Choose this option from the Management menu to verify the redundancy data in logical drives using RAID levels 1, 3, or 5.

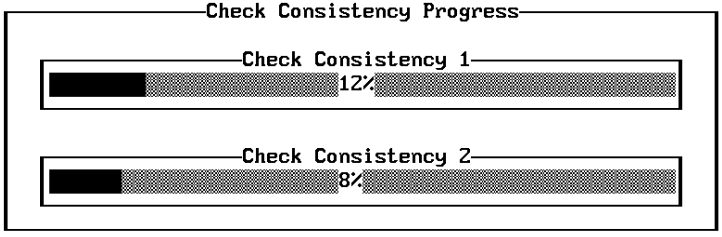
CAUTION Checking consistency could mean loss or corruption of data when an inconsistency is found and corrected.

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.



Press the arrow keys to highlight 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.

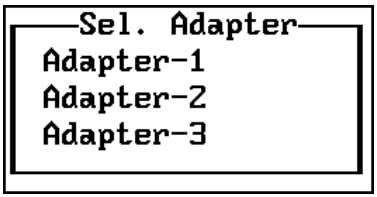
Press F10 to begin the consistency check. A progress indicator for each selected logical drive displays.



When the consistency check is finished, press any key to clear the progress display and press ESC to return to the Management menu.

Select Adapter Menu

This menu item displays only if more than one MegaRAID controller is installed in the system. The following displays when you choose the Select Adapter option from the Management menu:



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

Disable BIOS Menu

Choose this option from the Management menu. This option allows you to toggle between enable and disable BIOS.

Configuring Arrays and Logical Drives

You can configure physical arrays and logical drives with Setup using the following options:

- Easy Configuration
- New Configuration
- View/Add Configuration

Each configuration method requires a different level of user input. Steps 3 through 5 below are discussed for each configuration type. Generally, the operations proceed as follows:

1. Choose a configuration method.
2. Designate hotspares (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.
7. Formatting physical drives.

Choosing a 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
- I/O policy

If there are already logical drives configured when you select Easy Configuration, their configuration information is not disturbed. You can define a maximum of eight (8) logical drives per MegaRAID controller.

New Configuration

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

- RAID level
- Cache write policy
- Read policy
- I/O policy
- Logical drive size
- Spanning of arrays
- FlexRAID Virtual Sizing

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

View/Add Configuration

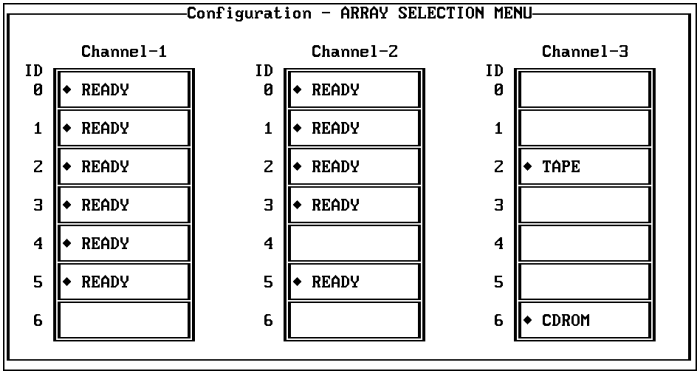
View/Add Configuration allows you to control the same logical drive parameters as New Configuration without disturbing the existing configuration information.

Designating Drives as Hotspares

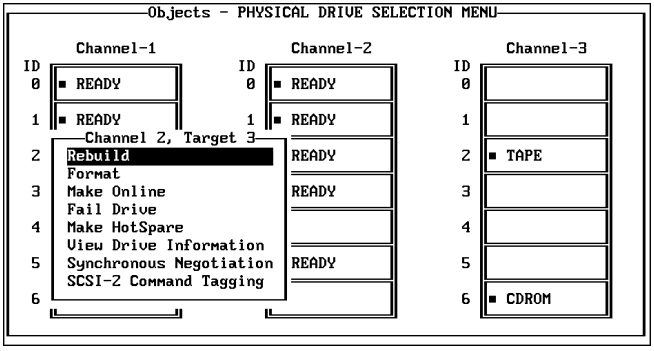
Hotspares are physical drives that are powered up with the RAID drives, and usually stay in a standby state. If a disk drive used in a RAID logical drive fails, a hotspare will automatically take its place and the data on the failed drive is reconstructed on the hotspare. Hotspares can be used for level 1, 3 and 5 RAID. Each MegaRAID controller supports up to eight hotspares. There are two methods for designating physical drives as hotspares:

- Press F4 while creating arrays in Easy, New or View/Add Configuration mode.
- From the Objects/Physical Drive menu, select a physical drive and press ENTER. Then, select Make Hotspare.

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



Press the arrow keys to highlight a disk drive that has a READY indicator and press F4 to designate the drive as a hotspare. The indicator changes to HOTSP. The second method for designating physical drives as hotspares is to select Objects from the Management menu, and 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.



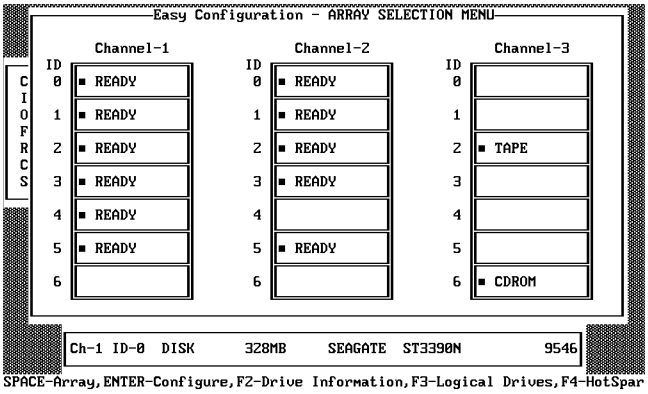
Press the arrow keys to select Make Hotspare and press ENTER. The indicator for the selected drive changes to HOTSP.

Using Easy Configuration

Follow the steps below to create arrays using Easy Configuration. In Easy Configuration, each array is associated with exactly one logical drive. You can define a maximum of eight (8) logical drives per MegaRAID controller.

To use Easy Configuration:

1. Choose Configure from the Management menu.
2. Choose Easy Configuration from the Configure menu. The array selection menu displays:



Hot key information displays at the bottom of the screen. The hot key functions are as follows:

F2 Display the manufacturer data and error count for the highlighted drive.

F3 Display the logical drives that have been configured so far.

F4 Designate the highlighted drive as a hotspare.

3. Press the arrow keys to highlight specific physical drives. Press the spacebar to associate the highlighted 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 array 2, drive 3.

   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 determines the RAID levels that can be implemented with the array.

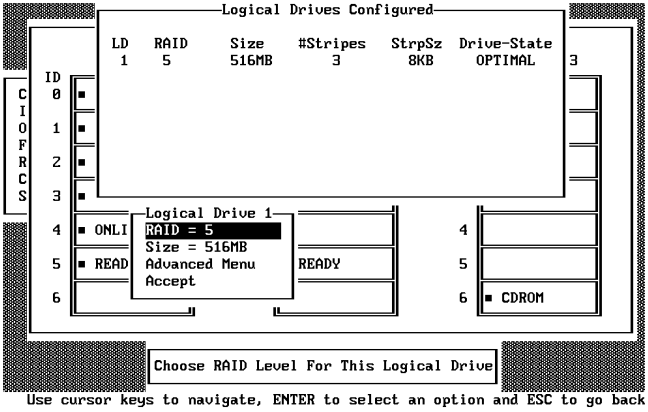
RAID 0 requires one to eight physical drives per array.

RAID 1 requires exactly two physical drives per array.

RAID 3 requires three to eight physical drives per array.

RAID 5 requires three to eight physical drives per array.

4. Press ENTER when you are finished creating the current array. The logical drive configuration screen displays.



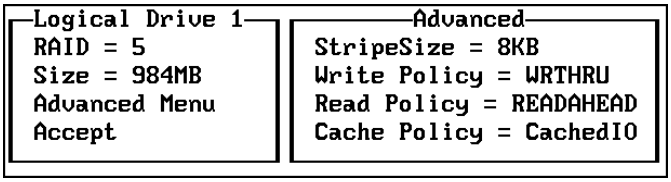
The window at the top of the screen shows the logical drive that is currently being configured as well as any existing logical drives. The column headings are as follows:

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
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.

6. Set the stripe size when this feature becomes available. Set cache write policy, read policy, and I/O (cache) policy from the Advanced Menu from the bottom window of the logical drive configuration screen.



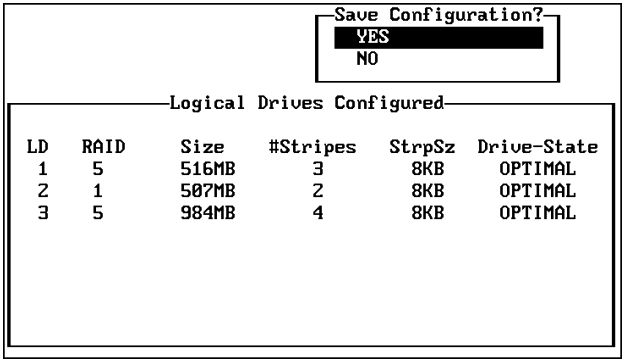
The Advanced menu options are as follows:

Option	Description
Stripe Size	This option sets the stripe size from 2 KB to 128 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.
Read Policy	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.
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.

7. After setting the options, press ESC to exit the Advanced Menu.

8. When you finish defining the current logical drive, highlight Accept from the bottom window of the logical drive configuration screen, and press ENTER. The array selection screen displays if there are any unconfigured disk drives left.

9. Repeat steps 3 through 8 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 displays:



After you respond to the Save prompt, you will return to the Configure menu.

10. Initialize the logical drives you have just configured as discussed later in this chapter.

Using New Configuration

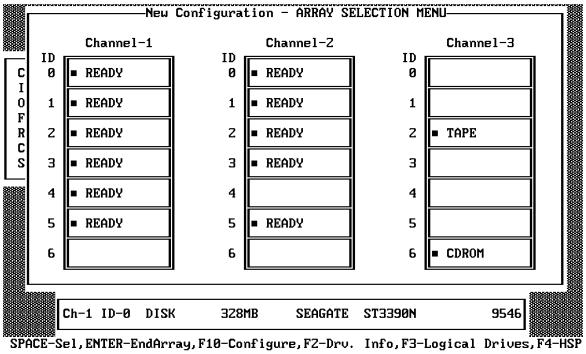
Follow the steps below to create arrays using New Configuration. The New Configuration option allows you to associate logical drives with partial and/or multiple physical arrays (the latter is called spanning of arrays). To use the spanning feature and keep the existing configuration, use View/Add/Delete Configuration.

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

To use New Configuration:

1. Choose Configure from the Management menu.

2. Choose New Configuration from the Configure menu. An array selection menu shows the devices connected to the current controller.



Hot key information appears at the bottom of the screen. The hot key functions are as follows:

F2 Display the manufacturer data and error count for the highlighted drive.

F3 Display the logical drives that have been configured.

F4 Designate the highlighted drive as a hotspare .

F10 Display the logical drive configuration screen.

3. Press the arrow keys to highlight specific physical drives. Press the spacebar to associate the highlighted 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 array 2, drive 3.

   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 are treated as if 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 to eight physical drives per array.

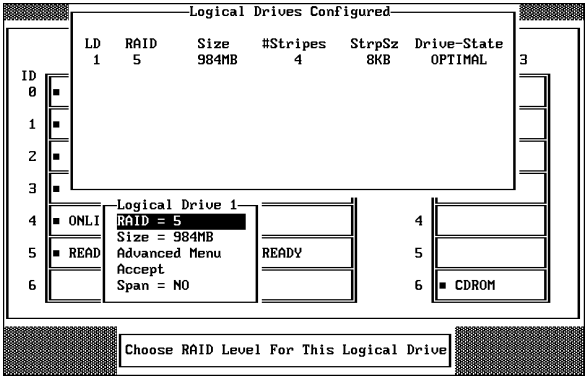
   RAID 1 requires exactly two physical drives per array.

   RAID 3 requires three to eight physical drives per array.

   RAID 5 requires three to eight physical drives per array.

4. Press ENTER when you finish creating the current array. To continue defining arrays, repeat step 3. To begin logical drive configuration, go to step 5.

5. Press F10 to configure logical drives. The logical drive configuration screen displays as shown:



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 as follows:

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
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 displays. 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 from the bottom window of the logical drive configuration screen, and press ENTER. The choices are as follows:

   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.

   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. If 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.

The spanning options are:

Configuring RAID 10, RAID 30, or RAID 50 Logical Drives.

Configure RAID 10 by spanning two to four contiguous arrays, each containing one RAID 1 logical drive. The RAID 1 logical drives must have the same stripe size. For example, you can use the span option to configure up to four pairs of RAID 1 drives. Up to eight physical drives can appear as one large RAID 1 logical drive.

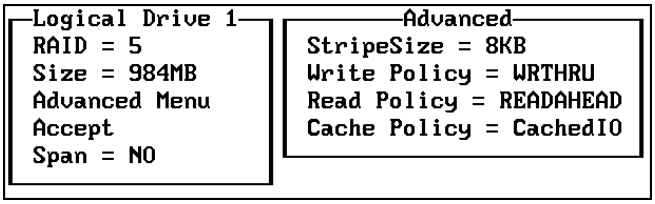
Configure RAID 30 by spanning two to four contiguous arrays, each containing one RAID 3 logical drive. The RAID 3 logical drives must have the same stripe size.

Configure RAID 50 by spanning two to four contiguous arrays, each containing one 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 from the bottom of the logical drive configuration screen, 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, thus 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. Select Advanced from the bottom window of the logical drive configuration screen to set the remaining options.



NOTE For a description of the options, refer to the table in "Using Easy Configuration."

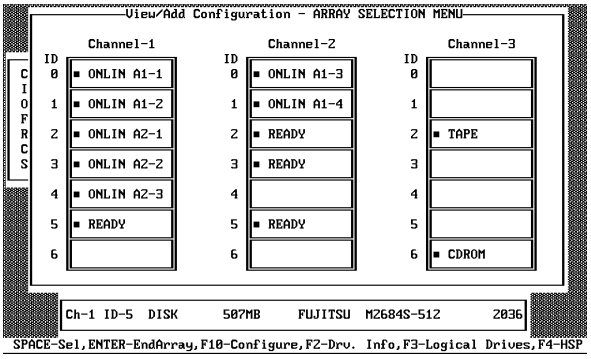
10. After setting the options, press ESC to exit the Advanced Menu.
11. When you finish defining the current logical drive, highlight Accept from the bottom window of the logical drive configuration screen, and press ENTER. If there is space remaining in the arrays, the next logical drive to be configured displays.
12. To configure another logical drive, repeat steps 6 through 9. If the array space has been used up, a list of the existing logical drives displays. Press any key to continue and respond to the Save prompt.
13. Initialize the logical drives you have just configured as discussed later in this chapter.

Using View/Add/Delete Configuration

Follow the steps below to create arrays using View/Add/Delete. View/Add/Delete 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 when you select view to look at the current configuration.

To use view/add/delete configuration:

1. Choose Configure from the Management menu.
2. Choose View/Add/Delete Configuration from the Configure menu. An array selection window displays showing the devices connected to the current controller.



Hot key information appears at the bottom of the screen. The hot key functions are as follows:

F2 Display the manufacturer data and MegaRAID error count for the highlighted drive.

F3 Display the logical drives that have been configured.

F4 Designate the highlighted drive as a hotspare .

F5 Delete a logical drive.

F10 Display the logical drive configuration screen.

3. Press the arrow keys to highlight specific physical drives. Press the spacebar to associate the highlighted 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 array 2, drive 3.

   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 are treated as if 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 to eight physical drives per array.

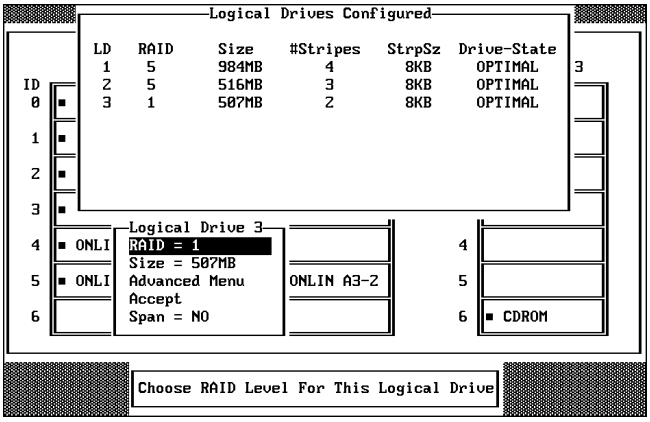
RAID 1 requires exactly two physical drives per array.

RAID 3 requires three to eight physical drives per array.

RAID 5 requires three to eight physical drives per array.

4. Press ENTER when you finish creating the current array. To continue defining arrays, repeat step 3. To begin logical drive configuration, go to step 5.

5. Press F10 to configure logical drives. The logical drive configuration screen displays, 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 as follows:

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
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 displays. 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 from the bottom window of the logical drive configuration screen 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.

   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. If 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.

   The spanning options are:

   Configuring RAID 10, RAID 30, or RAID 50 Logical Drives.

   Configure RAID 10 by spanning two to four contiguous arrays, each containing one RAID 1 logical drive. The RAID 1 logical drives must have the same stripe size. For example, you can use the span option to configure up to four pairs of RAID 1 drives. Up to eight physical drives can appear as one large RAID 1 logical drive.

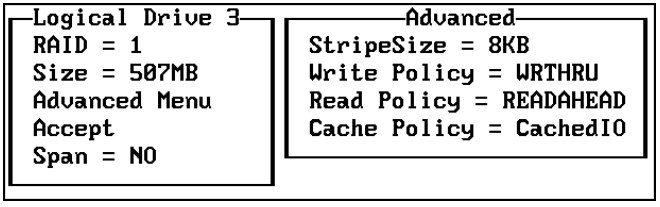
   Configure RAID 30 by spanning two to four contiguous arrays, each containing one RAID 3 logical drives. The RAID 3 logical drives must have the same stripe size.

   Configure RAID 50 by spanning two to four contiguous arrays, each containing one 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 from the bottom window of the logical drive configuration screen 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, thus 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. Select Advanced from the bottom window of the logical drive configuration screen to set the remaining options.



NOTE For a description of the options, refer to the table in "Using Easy Configuration."

10. After setting the options, press ESC to exit the Advanced Menu.
11. When you finish defining the current logical drive, highlight Accept from the bottom window of the logical drive configuration screen, and press ENTER. If there is space remaining in the arrays, the next logical drive ready to be configured displays.
12. To configure another logical drive, repeat steps 6 through 9. If the array space has been used up, a list of the existing logical drives displays. Press any key to continue and respond to the Save prompt.
13. Initialize the logical drives you have just configured as discussed later in this chapter.

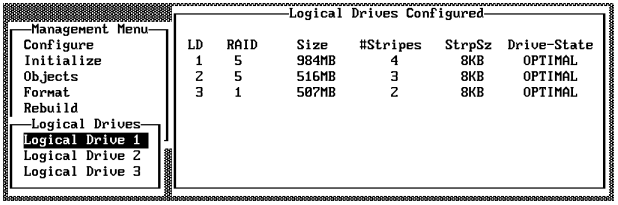
Initializing Logical Drives

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

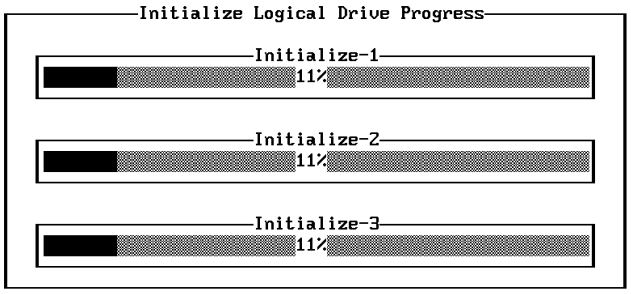
- Batch Initialization
- Individual Initialization

To use batch initialization:

1. Choose Initialize from the Management menu. A list of the current logical drives displays, as shown below:



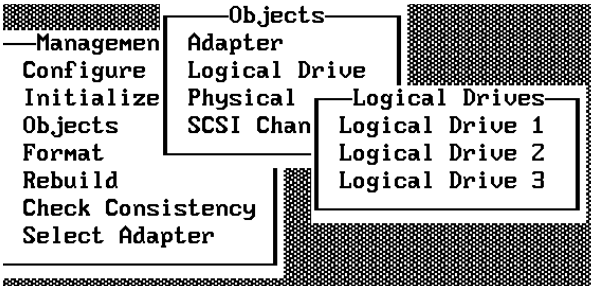
2. Press the arrow keys to highlight all drives. Press the spacebar to select the highlighted logical drive for initialization. Press F2 to select or deselect all logical drives.
3. When you finish selecting logical drives, press F10 and choose Yes at the confirmation prompt. The progress of the initialization for each drive is shown in bar graph format.



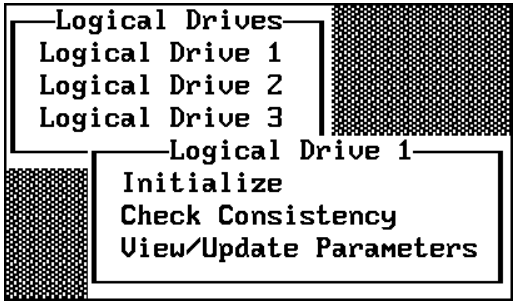
4. When initialization is complete, press any key to continue. Press ESC to return to the Management menu.

To use individual initialization:

1. Choose the Objects option from the Management menu. Choose the Logical Drive option from the Objects menu. The following displays.



2. Select the logical drive to be initialized. The following menu displays:



3. Choose the Initialize option from the action menu. The progress of the initialization displays as a bar graph on the screen.
4. When initialization completes, press any key to return to the previous menu.

Formatting Physical Drives

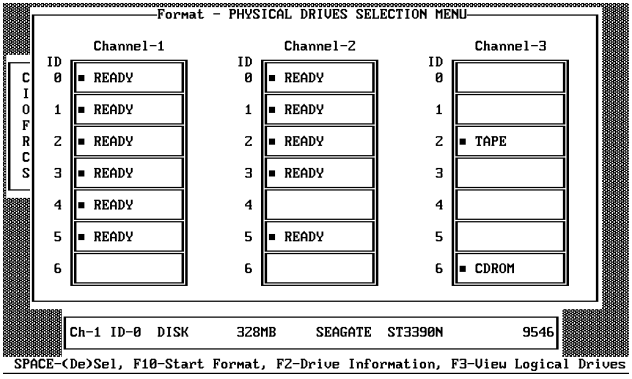
Choose the Format option from the Management menu to low-level format one or more physical drives. A physical drive can be formatted if it is not part of a configuration and is in a Ready state. Since most SCSI drives are factory formatted, do this step only if the drive has an excessive number of media errors.

You can format the physical drives in two ways:

- Batch Formatting
- Individual Formatting

To use batch formatting:

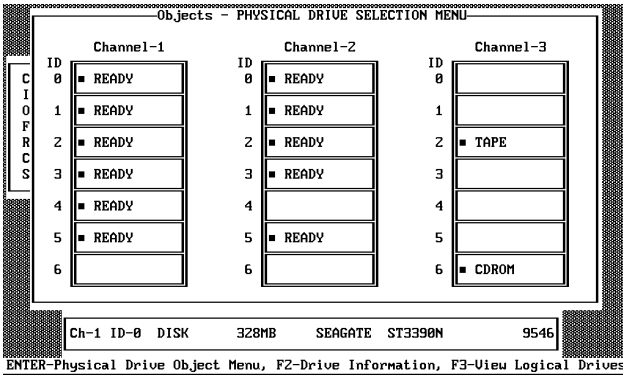
1. Choose Format from the Management menu. A device selection menu displays, showing the devices connected to the current controller:



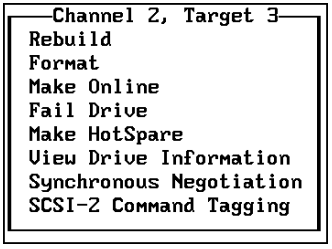
2. Press the arrow keys to highlight all drives. Press the spacebar to select the highlighted physical drive for formatting. The indicators for selected drives flashes.
3. When you are finished selecting physical drives, press F10 and choose Yes at the confirmation prompt. The indicators for the selected 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 return to the Management menu.

To use individual formatting:

1. Choose Objects from the Management menu. Choose the Physical Drive option from the Objects menu. A device selection window displays showing the devices connected to the current controller:



2. Press the arrow keys to highlight the physical drive to be formatted and press ENTER. The following action menu displays:



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 return to the previous menu.

Rebuilding Critical Logical Drives

NOTE Logical drives are sometimes referred to as “a pack.”

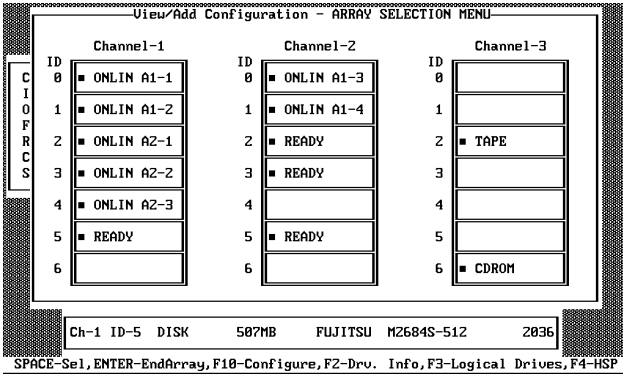
If a disk drive fails in an array that is configured as a RAID 1, 3, or 5 logical drive, you can reconstruct the data that was on the failed drive by first replacing the drive. You can then rebuild the logical drive.

The rebuild types are as follows:

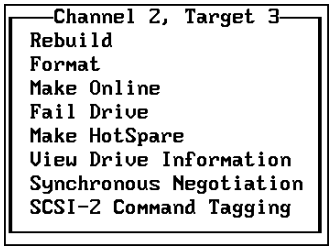
Type	Description
Automatic Rebuild	MegaRAID automatically tries to use hotspares to rebuild failed disk drives. Display the Objects menu, Physical Drive option screen while a rebuild is in progress. The drive indicator for the hotspare disk drive changes to REBLD A[array number]-[drive number], indicating the disk drive to be replaced.
Manual Rebuild	Manual rebuild is necessary if there are no hotspares with enough capacity to rebuild the failed drives.

To rebuild an individual drive using manual rebuild:

1. Choose Objects from the Management menu. Choose Physical Drive from the Objects menu. A device selection window displays showing the devices connected to the current controller:



2. Press the arrow keys to highlight the physical drive to be rebuilt and press ENTER. The following action menu displays:



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 return to the previous menu.

To use batch mode for manual rebuild:

1. Choose Rebuild from the Management 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 highlight all drives to be rebuilt. Press the spacebar to select the highlighted 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 return to the Management menu.

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

CAUTION 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 to which it is connected.

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.

To use a pre-loaded SCSI drive:

1. Connect the SCSI drive to one of the channels on the MegaRAID controller, with proper termination and target ID settings.
2. Boot the system and start Setup by pressing CTRL+M.
3. Choose Easy Configuration from the Configure menu.
4. Press the cursor keys to highlight 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 policy 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 Setup and reboot.

Set the host system to boot from SCSI, if such a setting is available.

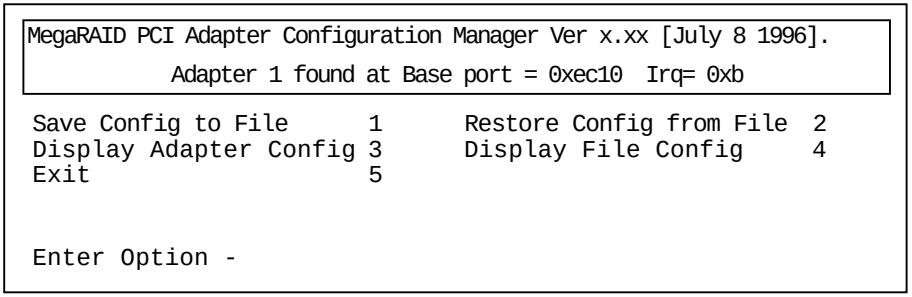
Saving and Restoring a Configuration

The MegaRAID configuration manager allows you to save the MegaRAID controller's drive configurations to a diskette. You should always back up the hardware configuration for every InterRAID cabinet connected to the system. This section also describes how to restore a lost hardware configuration to the MegaRAID controller.

Save Configuration to Diskette

To save a configuration to diskette:

1. Ensure the boot sequence for the system is A:, C:.
2. Insert the bootable MegaRAID diskette containing confmgr.exe into the floppy disk drive.
3. Restart the system. Key in **confmgr** at the command prompt. The MegaRAID PCI Adapter Configuration Manager displays:



4. To save the configuration, key in **1** and follow the instructions on the screen. Use a file name with fewer than twenty characters including the .MEG extension. The following displays:

```
Saving configuration...
Press Any Key to Continue.
```

5. Choose another option, or press **5** to exit.

Restore Configuration to MegaRAID Controller

The MegaRAID configuration manager also allows you to restore to the MegaRAID controller board a configuration that was corrupted or otherwise lost. The restored configuration file must match the hardware configuration. MegaRAID assumes the number of physical drives installed in the InterRAID cabinet is the same as the number of drives configured in the configuration file.

To restore a configuration to the MegaRAID controller:

1. At the MegaRAID PCI Adapter Configuration Manager menu, key in **2**.

CAUTION In the next step, key in only a MegaRAID configuration file. Restoring any other file will overwrite the binary code for setting the registers, causing damage to the RAID controller board. The board must be replaced.

2. Key in the filename for the configuration file at the prompt. Do not include directory paths. If you used a .MEG extension as part of the filename, include the extension. The configuration is read from the file and saved on the RAID controller board.
3. Press **5** to exit the configuration manager.
4. Remove the MegaRAID diskette and restart the system.

6 Using the Power Console GUI

This chapter describes how to use MegaRAID Power Console. Power Console is an object-oriented graphics user's interface (GUI) used to configure and monitor RAID systems locally. Intergraph Computer Systems includes Power Console on the MegaRAID diskette delivered with the InterRAID cabinets.

NOTE If you need to reload the MegaRAID driver, follow the instructions in Appendix B "Software Updates."

Power Console allows you to control and monitor the status of hard disk drives and the RAID enclosure. You should understand basic terminology associated with RAID. Refer to Chapter 8 and the glossary for information on RAID concepts and terminology. The topics in this chapter include:

- Identifying Controller Assignments
- Starting Power Console
- Identifying Power Console Options
- Performing Power Console Tasks
- Securing Power Console

Identifying Controller Assignments

If you have more than one MegaRAID controller (referred to as "Adapter" in Power Console) in a host system, be sure to configure at least one logical drive on every MegaRAID controller in the host system before you access the controllers from Power Console.

NOTE You can also set up the logical drives as discussed in Chapter 5 using the MegaRAID BIOS Configuration utility.

Power Console detects the presence of MegaRAID controllers and assigns the controller numbers in a unique way. The assignments also vary depending on the system's boot device.

Fixed Hard Disk Drive

Intergraph systems that include a MegaRAID controller but use a fixed disk drive on a separate controller as a boot device are covered in this section.

The following tables show how Power Console lists from one to five installed controllers.

One Controller	PCI Slot	Controller	Power Console
	1	First	0

Two Controllers	PCI Slot	Controller	Power Console
	1	First	0
	2	Second	1

Three Controllers	PCI Slot	Controller	Power Console
	1	First	0
	2	Second	1
	3	Third	2

Four Controllers	PCI Slot	Controller	Power Console
	1	First	0
	2	Second	1
	3	Third	2
	4	Fourth	3

Five Controllers	PCI Slot	Controller	Power Console
	1	First	0
	2	Second	1
	3	Third	2
	4	Fourth	3
	5	Fifth	4

InterServe 615, 625, 635, 645 Systems

InterServe 615, 625, 635, 645 systems are shipped from Intergraph Computer Systems with RAID controllers installed in PCI slots 1 through 5 which should remain in these slots. On a system with multiple RAID controllers, always use the RAID controller in PCI slot 1 as the boot controller. On a system with one RAID controller, the controller resides in PCI slot 1.

The following tables show how Power Console lists the installed controllers.

One Controller	PCI Slot	Controller	Power Console
	1	First	0 (Boot)

Two Controllers	PCI Slot	Controller	Power Console
	1	First	0 (Boot)
	2	Second	1

Three Controllers	PCI Slot	Controller	Power Console
	1	First	0 (Boot)
	2	Second	1
	3	Third	2

Four Controllers	PCI Slot	Controller	Power Console
	1	First	0 (Boot)
	2	Second	1
	3	Third	2
	4	Fourth	3

Five Controllers	PCI Slot	Controller	Power Console
	1	First	0 (Boot)
	2	Second	1
	3	Third	2
	4	Fourth	3
	5	Fifth	4

InterServe 8400 and 8000 Systems

InterServe 8400 and 8000 systems are shipped from Intergraph Computer Systems with RAID controllers installed in PCI slots 4 through 8 which should remain in these slots. On a system with multiple RAID controllers, always use the RAID controller in PCI slot 4 as the boot controller. On a system with one RAID controller, the controller resides in PCI slot 4.

The following tables show how Power Console lists the installed controllers.

One Controller	PCI Slot	Controller	Power Console
	4	First	0 (Boot)

Two Controllers	PCI Slot	Controller	Power Console
	4	First	0 (Boot)
	5	Second	1

Three Controllers	PCI Slot	Controller	Power Console
	4	First	0 (Boot)
	5	Second	1
	6	Third	2

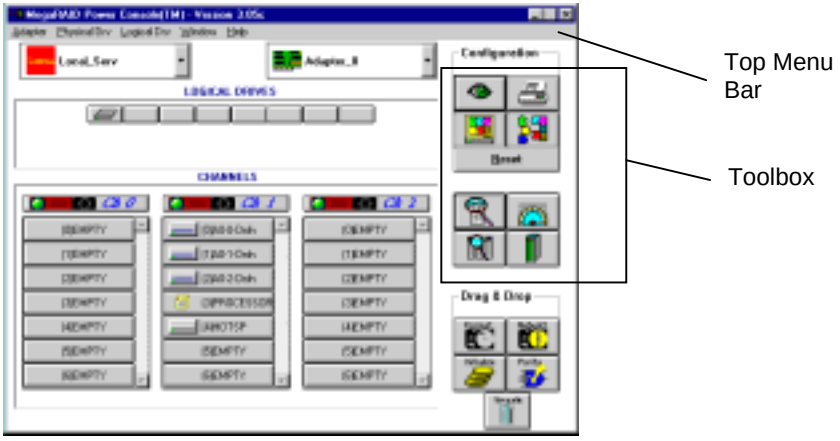
Four Controllers	PCI Slot	Controller	Power Console
	4	First	0 (Boot)
	5	Second	1
	6	Third	2
	7	Fourth	3

Five Controllers	PCI Slot	Controller	Power Console
	4	First	0 (Boot)
	5	Second	1
	6	Third	2
	7	Fourth	3
	8	Fifth	4

Starting Power Console

Select the MegaRAID Power Console icon from the MegaRAID group in the Windows NT screen to display the main menu.

NOTE On systems with two-channel MegaRAID controllers, only two columns representing the two channels will appear on the main menu.



NOTE The toolbox provides convenient access to the features. In lieu of the toolbox you can select the same features using the top menu bar. Chapter 7 describes the options of the top menu bar.

The following table defines some terms you will see while configuring drives and running Power Console.

READY	Disk drive ready for configuration
OPTIMAL	Disk drive ready for use
ONLINE	Disk drive ready for use
REBUILD	Disk drive to be replaced
OFFLINE	Unformatted drive
PACK	Configured pack
DRIVES	Number of drives in a pack
SIZE	Size of the packs (in megabytes)
HOTSP	Disk drive configured as hot spare (standby) drive
EMPTY	No disk drive installed
DEGRADED	A logical drive has encountered a problem
FAIL	A disk drive has failed

Identifying Power Console Options

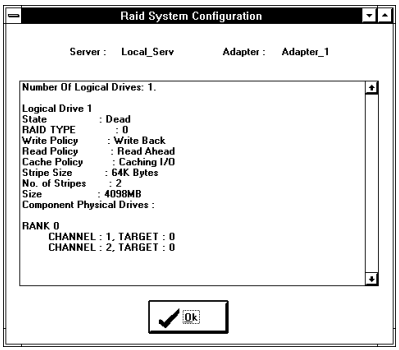
Power Console executes from any workstation and runs under Microsoft Windows NT. The topics discussed in this section include:

- Configuration Icons
- Drag and Drop Icons
- Logical Drives Icons and Logical Drive *x* menu
- Channels Icons and Channel *x* menu

Configuration Icons

The icons are described below.

 **Display configuration**; click on this icon to display the current RAID system configuration. For example:

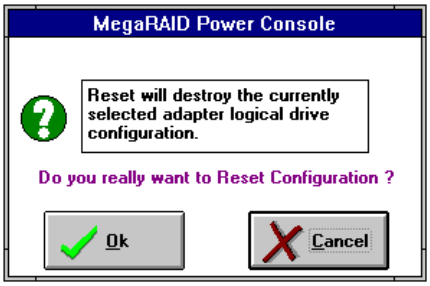


 **Print**; click on this icon to make a hardcopy of the current configuration.

 **Auto configuration**; click on this icon to allow MegaRAID to configure the RAID subsystem.

 **Custom configuration**; click on this icon to allow you to configure the RAID subsystem.

Reset; click on this icon to clear the RAID configuration on the currently selected controller. A confirmation dialog appears as follows:



Click on OK to reset the configuration or Cancel to abort the process.

 **View log**; click here to display a list of MegaRAID activities.

 **Rebuild rate**; click on this icon to set the RAID rebuild drive rate.

 **Rescan**; when you click on this icon, the currently selected MegaRAID controller rescans its SCSI channels to ensure drive configuration information is current.

Drag and Drop Icons

The icons are described below.

Rebuild disk; drag the physical drive icon that represents the drive to be rebuilt to this icon to rebuild the selected drive.

Initialize logical drive; drag the logical drive icon that represents the drive to be initialized to this icon.

CAUTION If you reset your configuration by mistake, you can recover it by reconfiguring the physical drives into the same array and logical drive structure they were in, or by saving the configuration without initializing. Another method is to save the configuration to a floppy.

Logical drive parity check; drag the logical drive icon to this icon to check parity.

CAUTION Any parity inconsistency will automatically be corrected. This could cause loss or corruption of data.

Trash; drag the drive icon that represents the drive to be deleted to this icon, and then drop it.

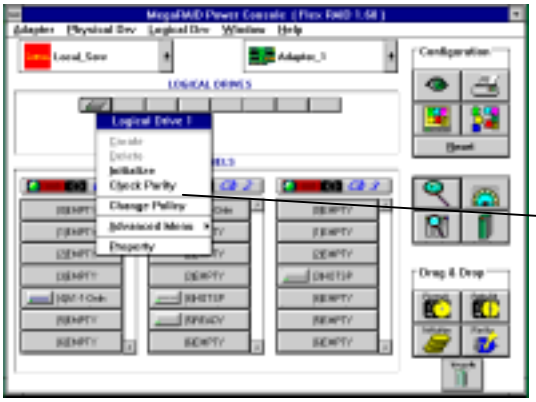
Logical Drives Icons and Logical Drive *x* Menu

The following are the logical drives icons:

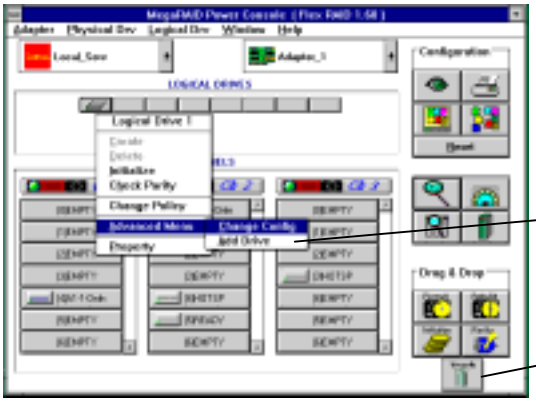
The indictor light on each logical drive icon indicates its status.

- *Green* indicates normal operation.
- *Yellow* indicates that the drive performance is degraded.
- *Red* indicates a failed drive.

With the cursor placed over one of the device icons, click the right mouse button to display the Logical Drive *x* menu. The menu has a list of actions that can be applied to the selected device. Refer to the following figure:



You can perform RAID tasks on preconfigured RAID logical drives without halting system operations. You can select any bolded option from the Logical Drive *x* pull down menu as shown in the following dialog:



Change Config and Add Drive options extend from the Advanced Menu. For more details on these options, refer to "Creating an Array" in this chapter.

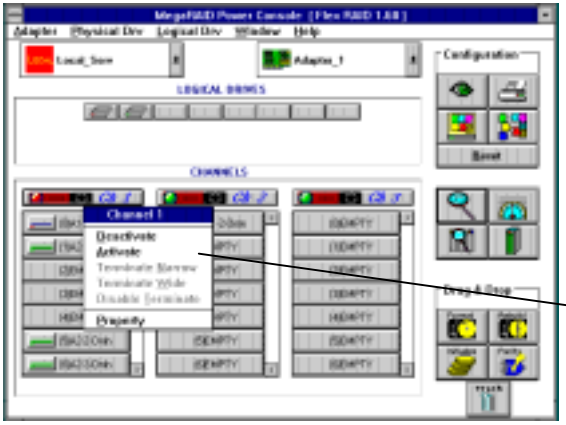
NOTE The trash can icon in the lower right corner of the MegaRAID Power Console dialog is available for you to use. For example, to delete a physical drive from a RAID logical drive, drag and drop a physical drive over the trash can icon.

Channels Icons and Channel *x* Menu

The channels icons consist of a stack of drive icons where each device on a SCSI channel is represented by a disk, CD-ROM, or tape drive icon. The channel indicator light on each channel icon indicates the status of that channel.

- *Green* indicates normal operation.
- *Yellow* indicates that the drive performance is degraded.
- *Red* indicates a failed drive.

With the cursor over a configured device, click the right mouse button to display the Channel *x* pull down menu. The menu lists the bolded options available for that physical device.



The Deactivate option lasts for 60 seconds when invoked. During this period, the RAID controller ceases to issue commands on the SCSI bus for a selected channel. By idling the bus activity in this manner, it assures data integrity when hot swapping disk drives.

CAUTION After a drive fails, do not place the drive back ONLINE or you will get data errors. You should investigate why the device went offline and correct the problem.

Performing Power Console Tasks

The topics in this section include:

- Viewing Information
- Selecting Adapter_*x*
- Creating an Array

- Changing RAID Level
- Configuring a Hotspare
- Rebuilding a Drive
- Removing a Drive
- Selecting Change Policy

Viewing Information

Status Logs

Power Console allows you to control and monitor the status of hard disk drives and the RAID enclosure. Power Console also logs messages to the system's application log file. To view Power Console logs from the Power Console main menu, select View Log icon to display the View Log file.

Enclosure and Device Status

Power Console allows you to monitor the fan status, power supply status, and temperature status. Each separate enclosure displays the status of a SCSI channel. A green light on a channel or drive indicates optimal conditions. Red indicates a failed channel or drive.

To view enclosure and device status:

1. From the Power Console main menu, select Adapter in the top menu bar to display the pull down menu.
2. Select Enclosure Management. The following dialog displays.

3. Place the cursor over the physical device icon you want to view and click the right mouse button. The device information dialog displays as follows.

4. Sequence through the IDs on each channel by selecting Previous or Next.
5. When finished viewing device information, select OK.

Selecting Adapter_*x*

You must select the proper RAID controller board (Adapter_*x* in Power Console main menu) before you can monitor or configure the RAID controller.

To select an adapter (RAID controller):

1. Select Adapter_*x*, where *x* is the RAID controller board number.
2. Select OK at the “Do you want to change Adapter?” dialog.

Creating an Array

You can configure multiple hard disk drives into one single volume, or array, to achieve faster performance and fault tolerance. There are a number of ways the disk drives can be grouped into a specific RAID level. Each logical drive in a RAID system has a set of features and performance tradeoffs.

CAUTION Once you start a RAID level operation, no other operation can be started until the present operation completes.

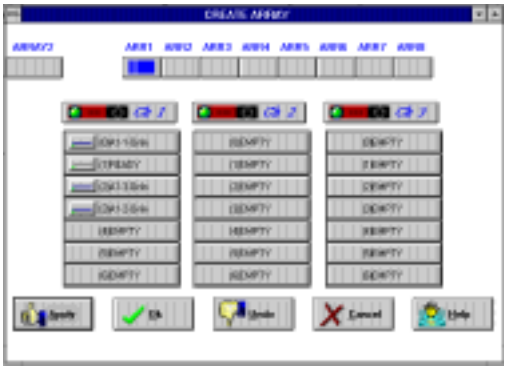
Power Console allows you to create the following RAID levels online.

RAID Level	Description	Application	Drives Needed
0	Data divides into blocks and distributes sequentially among drives (striping).	Data collection from external sources at very high transfer rate. Fault tolerance is not required.	One to eight
1	Data written to one drive is duplicated on another drive (mirroring).	Read-intensive, fault-tolerant systems.	Two
3	Disk striping with dedicated parity drive.	Non-interactive applications that process large files sequentially and require fault tolerance.	three to eight
5	Disk striping with distributed parity.	High read request rates and low write request rates, such as transaction processing, office automation, and online customer service requiring fault tolerance.	three to eight
10	Striping of mirrored array, a combination of levels 1 and 0 (for example, by spanning two contiguous RAID 1 logical drives).	Data storage that justifies the 100% redundancy of mirrored arrays and needs the enhanced I/O performance of striped arrays.	Four, Six or Eight
30	Striping of two or more RAID 3 arrays. RAID Level 30 is a combination of 3 and 0 (for example, by spanning two contiguous RAID 3 logical drives).	Non-interactive applications that process large files sequentially, requiring fault tolerance and high speed.	At least six
50	RAID Level 50 is a combination of 5 and 0 (for example, by spanning two contiguous RAID 5 logical drives).	Data that requires highly reliable storage, high request rates, and high data transfer performance.	At least six

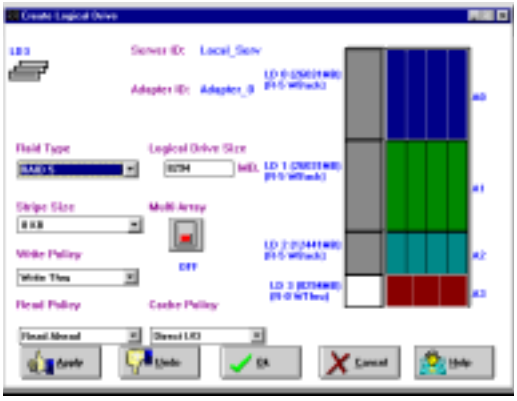
NOTE Look at the Power Console main menu to determine if the physical drives are in “Ready” state. Verify before you start the create array process.

To create an array:

1. From Adapter in the top menu bar of the Power Console main menu, select Configuration.
2. Select Custom Configuration. Power Console will scan the configuration and display a dialog similar to the following.



3. Select each one of the physical drives labeled as “Ready” to create your new array. As you click on the drive icon, it is assigned a value, for example, (1)A1-1.
4. Select Apply. The row of drive icons at the top of the dialog updates to inform you it is creating ARR*x*, where *x* is the number assigned by the system for the new array.
5. Select OK. The Create Logical Drive dialog displays as shown below.



6. Select the appropriate values for RAID type, Stripe Size, Write Policy, Read Policy and Cache Policy.
7. Select Apply to activate the new settings in the Create Array menu.
8. Select OK. The following message displays:

   ```
   Save Configuration?
   ```

9. Select OK. The following message displays:

   ```
   Would you like to initialize?
   ```

10. Press Y for Yes (or N for No).

NOTE Initialization takes at least 10 minutes.

11. Select OK at the Initialize Logical Drive dialog.
12. Restart the system.
13. Access Disk Administrator under Windows NT.
14. Partition and format the new logical drive. The drive is now ready to be used by the system.
15. Select the MegaRAID Power Console icon from the MegaRAID group in the Windows NT screen.
16. Place the cursor over the new logical drive icon you created and click the right mouse button.
17. Select Property. The Logical Drive Property dialog displays as follows.

18. When finished viewing, select OK.

Changing RAID Level

CAUTION Be sure you backup all data before changing RAID levels.

You can change RAID levels of an existing system drive without degrading the RAID subsystem. For example, you can convert a 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, the software reconstructs the RAID subsystem without halting the system.

NOTE You can also convert a RAID 3 logical drive to a RAID 5 logical drive or vice versa. But you cannot change between RAID levels 10, 30, and 50.

The following table lists the RAID levels you can initiate. Remember that this is a time-consuming operation.

If RAID system is...	You can change to...	When You...
RAID 3 or RAID 5 Optimal	RAID 3 or RAID 5 Optimal	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 0	Add drives or delete a drive.
RAID 1 Degraded	RAID 0	If a drive fails, you can configure an Optimal RAID 0 system.
RAID 0	RAID 3	Add drives.
RAID 0	RAID 0	Add drives.

The Advanced Menu from the Logical Drive *x* pulldown menu allows you to change a configuration or add a drive to an existing configuation. You can define a maximum of eight (8) logical drives per RAID controller.

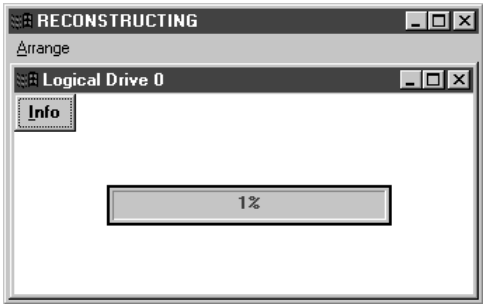
Change Config

Change Config from the Advanced Menu of the Logical Drive *x* pulldown menu allows you to change the RAID level and convert a logical drive from degraded to optimal.

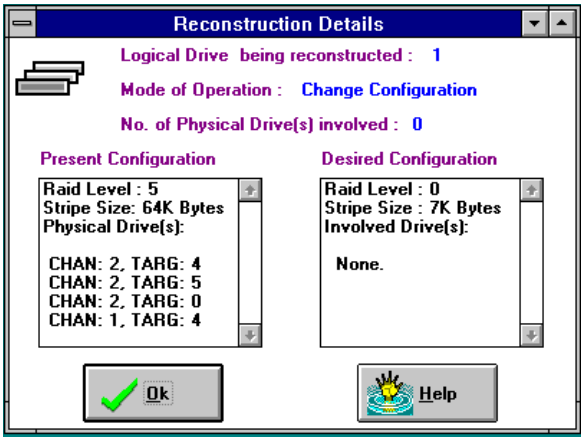
To change a RAID level:

1. From the Power Console main menu, place the cursor over the logical drive icon you want to convert and click the right mouse button. The Chnl *x* Trgt *x* pull down menu displays.
2. Select Advanced Menu, and then select Change Config. The following dialog displays:

3. Configure the drive for the appropriate RAID stripe or level.
4. Select Apply. The Reconstructing dialog displays as follows:



5. Click on the Info button of the Reconstructing dialog to display detailed information about the reconstruction operation being performed, as shown next:



6. Review the changes that have been made and select OK when finished.

Add Drive

Add Drive from the Advanced Menu of the Logical Drive *x* pulldown menu allows you to add a physical drive to a configured logical drive.

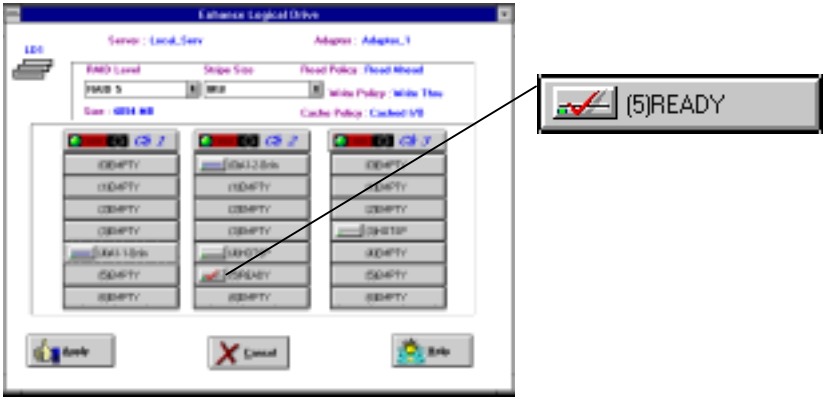
- The state of the RAID subsystem being modified must be Optimal.
- The logical drive state must be Optimal.
- The physical drive state must be Ready.

- An Optimal RAID 0 logical drive can be converted to an Optimal RAID 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.

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

To add a drive:

1. From MegaRAID Power Console, place the cursor on the logical drive where the physical drive (in Ready state) is to be added, and click the right mouse button.
2. Select Advanced Menu from the Logical Drive *x* menu.
3. Select Add Drive. The following dialog displays:



4. Select the physical drive (in Ready state) to be added using the left button. A check appears on the drive.
5. Select Apply. The Reconstructing Dialog displays. You can click on the Info button to display detailed information about the reconstruction operation being performed.
6. Review the changes that have been made and select OK when finished.

Configuring a Hotspare

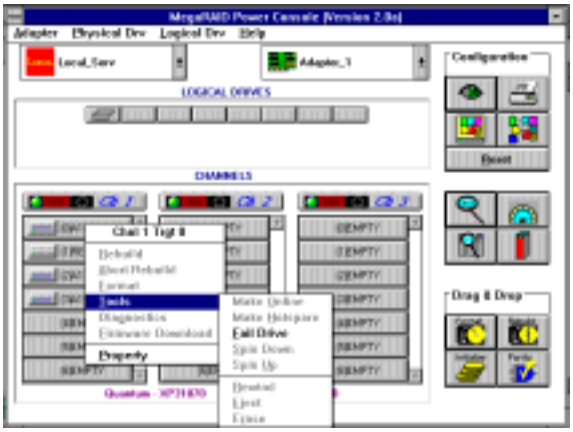
Hotspares are physical drives that are powered up with the RAID drives and usually are placed in a standby, or hotspare, state. The drive to be made a hotspare must have the same or greater capacity than the other drives in the RAID array.

NOTE A 4 GB drive will not function correctly as a hotspare for a 9 GB drive. Different sizes are allowed in a pack, but all drives in a stripe should be the same size.

Hotspares can be used for RAID levels 1, 3 and 5. To make a drive a hotspare, more than one logical drive must be configured.

To configure a hotspare:

1. From the Power Console main menu, place the cursor over the physical device icon you want to become a hotspare and click the right mouse button. The Chnl *x* Trgt *x* pull down menu displays.
2. Select Tools from the pull down menu as shown.



3. Select Make Hotspare from the Tools submenu.

NOTE When you select a device icon, the drive type and the capacity of the selected drive displays at the bottom of the Power Console main menu.

To undo configuration of a hotspare:

1. From the Power Console main menu, place the cursor over the hot spare icon you want to deconfigure
2. Select Tools from the pull down menu.
3. Select Fail Drive from the Tools submenu.

Rebuilding a Drive

RAID levels 1, 3, or 5 provide data redundancy. If a drive in a RAID group fails, data integrity is maintained. If more than one fails (drive not accessible) data loss can occur and the array becomes critical. You must replace the failed drive and rebuild to a hotspare immediately to prevent data loss.

NOTE The rebuild process takes place while the RAID system is still running. Performance will be affected depending on the rebuild rate.

Manual

To rebuild a drive manually:

1. Replace the failed drive with a new drive.
2. From the Power Console main menu, place the cursor over the failed drive icon you want to rebuild. Drag the icon to the Rebuild icon, and drop it.

NOTE To stop the rebuild process at any time, select Abort from the rebuild dialog. The logical drive will revert to array critical.

Automatic

If you created a Hotspare, and Auto Rebuild was configured as Enabled, the RAID controller will automatically rebuild the failed drive to a hotspare.

To determine if rebuild has been enabled (default), restart the system and press CTRL+M when prompted during the MegaRAID BIOS. Then access Management>Objects>Adapter and verify that Auto Rebuild is set to Enabled.

Removing a Drive

You can change the configuration of any logical drive by removing a physical drive from a configured logical drive.

CAUTION Ensure that you do not remove the logical drive where the operating system is located.

To remove a physical drive from a logical drive:

1. Drag the physical drive icon from the MegaRAID Power Console to the trash can. The Change RAID Level dialog displays.

NOTE The following is a time-consuming operation.

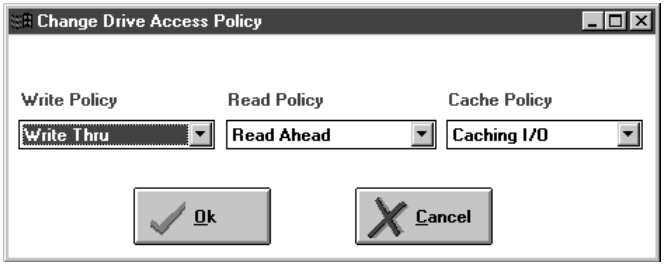
2. Select the RAID level that will allow the new RAID configuration to become Optimal.
3. Select Apply. The Reconstructing Dialog displays. You can click on the Info button to display detailed information about the reconstrucion operation being performed.
4. Review the changes that have been made and select OK when finished.

Selecting Change Policy

You can select Change Policy from the Logical Drive *x* pulldown menu to change the write, read, and cache policies of a selected array.

To change a RAID policy:

1. From the Power Console main menu, place the cursor on the logical drive for which you want to change the RAID policy, and click the right mouse button.
2. Select Change Policy from the Logical Drive *x* pulldown menu. The following dialog displays:



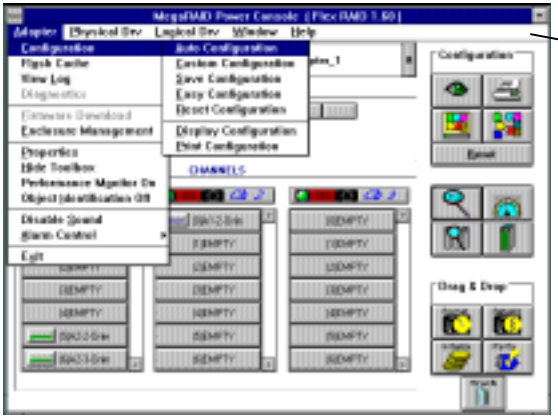
3. Select the down arrow button under each policy (Write, Read, or Cache) to display a list of the available policies for an array. Click on a new policy to select it.
4. Select OK when you have completed all policy changes.

Securing Power Console

Access to Power Console should be limited only to specified users because it is not protected with a password. Use the Windows NT administrator utilities to assign permissions to allow only selected personnel to copy, move, delete, or execute a power console file. Log in as guest to make sure the permission changes are saved.

7 Using the Power Console Menus

This chapter describes the MegaRAID Power Console options of the top menu bar.

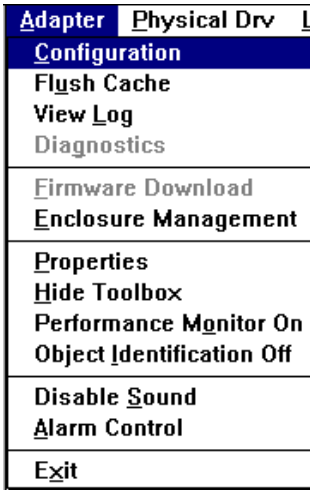


The Power Console menu options are as follows:

Option	Description
Adapter	Choose this option for MegaRAID controller-related functions. You can configure logical drives, flush cache, view the log file, run diagnostics, view RAID enclosure, view properties of the MegaRAID controller, display or hide the toolbox, invoke the performance monitor, toggle object identification, enable or disable sound, enable or disable alarm control, and exit Power Console.
Physical Drv	Choose this option to rebuild, abort rebuild, and format. You can run diagnostics, select tools, select enclosure management, or display the properties of the physical drives.
Logical Drv	Choose this option to create, initialize, check parity, and display the properties of logical drives.
Window	Choose this option to view the progress of a disk rebuild, diagnostic, initialization, parity check, or reconstruction, and view the performance monitor.
Help	Choose this option to display online help information and the Power Console revision level.

Adapter Menu

The following figure shows the Adapter menu.



The following is an expansion of the Adapter menu options. The menu items are explained on the following pages.

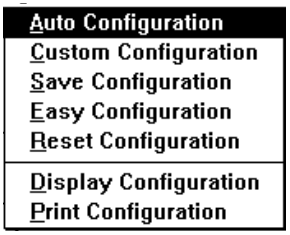
The Adapter menu options are as follows.

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 and thereby save data.
View log	Select this option to display an event log. The events are stored in the RAID.log file.
Diagnostics	This option not available.
Firmware Download	This option not available.
Enclosure Management	Select this option to manage the drives in each physical RAID drive cabinet. A picture of a RAID enclosure displays from which you can display the real-time state of each RAID channel. You can monitor online the addition and removal of devices in the enclosure.
Properties	Select this option to display the controller properties, including BIOS and firmware versions, rebuild rate, and cache memory size.
Hide/Display	Select this option to display the toolbox if it is not displayed on the

Option	Description
Toolbox	Power Console dialog, or to remove the toolbox from the dialog 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 toggle the Object Identification feature on or off. Object identification is a feature that identifies all objects displayed in the Power Console dialog.
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 Control.
Enable/Disable Alarm Control	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 from the submenu of Configuration.

Configuration

The following figure shows the submenu of the Configuration option under Adapter.



The following options are available from this submenu.

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.

Option	Description
	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 or four 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 displays. 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.
Easy Configuration	With this option, each array you create is automatically treated as exactly one logical drive. The Logical Drive Property dialog 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.
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 and 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.

Flush Cache

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

View Log

Select this option from the Adapter menu to display the MegaRAID event log. The events (errors) are stored in the RAID.log file.

Diagnostics

This option in not available.

Firmware Download

This option in not available.

Enclosure Management

Select this option from the Adapter Menu to manage the physical drives in the RAID drive cabinets. Each enclosure displays the status of a SCSI channel. A red light on a drive indicates a failed channel or drive. Green indicates optimal conditions.

NOTE Click on any device displayed on the enclosure management dialog to display device information, as shown:

Properties

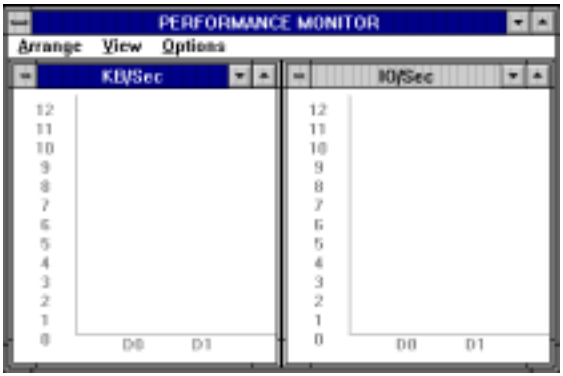
Select this option from the Adapter menu to display the RAID controller properties. A dialog similar to the following appears:

Hide/Display Toolbox

The configuration toolbox can be removed from the Power Console dialog by clicking on Hide Toolbox in the Adapter menu. The option will then change to Display Toolbox.

Performance Monitor On/Off

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



Object Identification On/Off

Select this item from the Adapter menu to turn the object identification feature (“bubble help”) on or off. This feature identifies icons in the Power Console dialog.

Enable/Disable Sound

Choose this option from the Adapter menu to enable or disable the onboard tone generator. To silence a sounding alarm, choose Disable Sound and Disable Alarm Control.

Enable/Disable Alarm Control

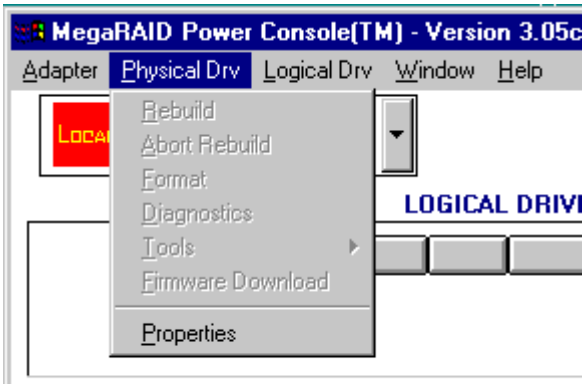
Choose this option from the Adapter menu to enable or disable the audible alarms and warnings.

Exit

Choose this item from the Adapter menu to exit the Power Console program.

Physical Drv Menu

The Power Console Physical Drv menu is as follows:

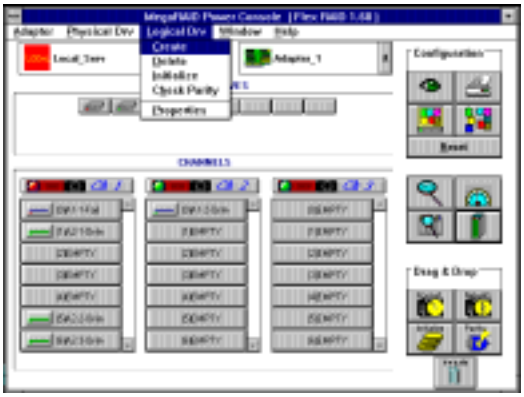


The Physical Drv menu options are as follows.

Option	Description
Rebuild	Select this option to rebuild one or more failed disk drives. 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. 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 affected.
Abort Rebuild	Select this option to stop the rebuild process at any time. The drive will revert to its original status before the rebuild began.
Format	Formatting is not supported in Power Console. It is recommended that you format drives using the MegaRAID BIOS Configuration Utility.
Diagnostics	This option is not available.
Tools	Choose this option to fail a drive, make a hotspare, enable narrow SCSI, enable wide SCSI, and perform other actions.
Firmware Download	This option is not available.
Properties	Select this option to display the disk drive properties.

Logical Drv Menu

The Power Console Logical Drv (Drive) menu is as follows:



The following table lists the menu options available for selection.

Option	Description
Create	Select this option to create arrays.
Delete	Deleting a logical drive is not supported in Power Console.
Initialize	Select this option to initialize logical drives.
Check Parity	Select this option to check parity.
Properties	Select this option to display the logical drive properties.

Create

You can choose the Create option from the Logical Drv menu to create arrays. A dialog such as the following appears.

Select the array to be created by clicking on ARR1 - ARR8 at the top of the dialog. Select the drives to be included in the array by clicking on the device icons displayed in the middle of the dialog. You can define a maximum of eight (8) logical drives per MegaRAID controller. You can select the RAID type, stripe size, write policy, read policy, and cache policy. You can also include SCSI devices from more than one channel in the new array.

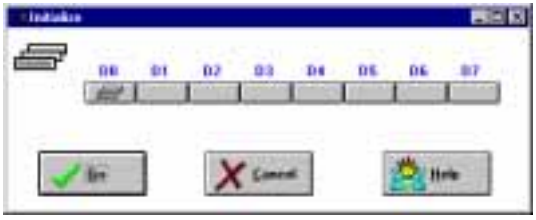
NOTE The physical drives to be included in the array must be in Ready state.

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 before you can use them.

Initialize

Choose this option from the Logical Drv menu to initialize logical drives. A dialog such as the following appears. Choose the logical drives to be initialized and click on the Go button.

CAUTION 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.

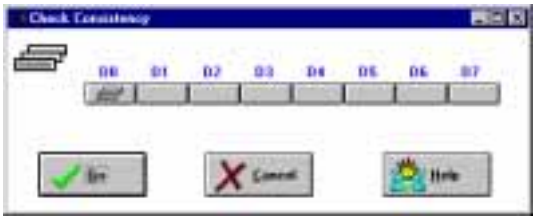


Check Parity

Choose Check Parity from the Logical Drv menu to make sure that parity is correct for the selected drives. A dialog such as the following appears. Click on the logical drive (D1 - D8) you want to check and a checkmark appears. 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.

CAUTION The controller will automatically resolve any inconsistent parity. This could cause loss or corruption of data.



Properties

Choose Properties from the Logical Drv menu to display the logical drive properties of a selected logical drive. A dialog such as the following appears. Each logical drive can be displayed by selecting the Previous or Next buttons.

Window

Choose this option from Power Console to view the progress of a disk rebuild, diagnostic, initialization, parity check, reconstruction or to view the performance monitor. Window also displays a dialog of active windows that can be expanded or collapsed.

NOTE Inactive windows are grayed out.

Help

Choose Help from the Power Console top menu bar to display help on a topic. You can also display the revision level of Power Console.

8 Configuring the Disk Array for Performance

This chapter discusses RAID performance and configuration methods of the hard disk drives. Included are examples for striped, mirrored, and other performance options and a brief discussion of database applications. Also included are the differences in RAID mode performance and data integrity.

RAID Technology

Redundant Arrays of Independent Disks (RAID) increases system performance and gives an extra level of data protection. The basic idea of RAID technology is to use multiple hard disk drives as a single logical drive. Several hard disk drives are arranged into a pack and then defined as a logical system drive. Data may then be striped or mirrored across the physical drives. Striping spreads data across three or more drives, which allows more disk drive heads to access data, and thereby improves data throughput. Mirroring places a copy of the data on two mirrored drives to offer data protection in the event a hard disk drive should fail.

Striped RAID Performance

You can achieve performance improvement on a multi-channel RAID controller for striped data (such as RAID 0 or RAID 5) when the drives in the packs span the input/output (I/O) channels. For example, perform the following when creating a pack containing four hard disk drives:

- Place the first disk drive in the pack on the first I/O channel of the RAID controller.
- Place the second disk drive in the pack on the second I/O channel of the RAID controller.
- Place the third disk drive in the pack on the first I/O channel of the RAID controller.
- Place the fourth disk drive in the pack on the second I/O channel of the RAID controller.

Performance will benefit because the separate channels work independently of each other. Multiple I/O requests can occur simultaneously since they are on separate channels of the controller.

An extension of this technique is to stripe not only across multiple SCSI channels on a single controller but to stripe across multiple controllers. You can accomplish this by combining drives on individual controllers in the manner described above. Then, create one (or more) logical drive on each RAID controller and use the disk striping capabilities built into Windows NT Server to stripe these logical drives together into a logical volume.

Mirrored RAID Performance

When mirroring data (such as RAID 1), the packs should not span the channels. You should create two packs, each on its own channel. For example, perform the following using four 4 GB disk drives:

- Put the first disk drive into the first pack on the first I/O channel of the RAID controller.
- Put the second disk drive into the first pack on the first I/O channel of the RAID controller.
- Put the third disk drive into the second pack on the second I/O channel of the RAID controller.
- Put the fourth disk drive into the second pack on the second I/O channel of the RAID controller.

Notice that mirroring increases the size to 8 GB. By creating two packs on separate channels and mirroring the first pack to the second pack, the mirrored data writes simultaneously as the original data. Simultaneous writing results in improved performance. However, if you do not keep the packs on separate channels, performance will degrade because one channel will possibly have to sequentially write the original data and the mirrored data.

Other Performance Options

Other I/O options that can help performance are SCSI-2 Command Tagging, Write Back policy, and Read Ahead policy. Careful distribution of data can also increase performance.

SCSI-2 Command Tagging intelligently orders the seeks which improves performance for random accesses. Write Back and Read Ahead policies allow files to be read and written most efficiently for those applications accessing large, sequential data and striping across multiple disks and RAID controller channels.

SCSI-2 Command Tagging

This option allows the I/O subsystem to queue requests and reorder them into the most efficient order before retrieving them from the disk.

Write-Back Policy

The Write-Back option under write policy allows disk writes to be cached and written when the RAID controller or disk drive is ready to write. The MegaRAID controller receives data in cache and signals the software that it has already written the data to the disk. Write-Back boosts performance, but a danger exists that some data could be lost if the power supply is disrupted during writing. Always protect the data by using a battery backup on the RAID controller or an uninterruptible power supply (UPS).

Read Ahead Policy

Under normal operation, the Read Ahead option under read policy can improve performance for sequentially accessed data. The Read Ahead option prefetches sequential data, assuming that the operating system asks for the prefetched data. Reduced performance can occur for randomly accessed data.

Database Applications

Place frequently accessed data at the beginning of the disks where the I/O rate generally will be faster and require less seeking time. Also, place I/O-intensive tables at the beginning of the disk. Use tablespaces in Oracle, or segments and devices in Microsoft SQL Server and Sybase Systems to segregate the data for placement on the disk.

To estimate the amount of I/O for tables in the database, use the following formula where A = table record length, B = number of rows returned in a query, and C = number of times required to access the table:

A x B x C

For maximum performance in a database, Log or Redo Log access is sequential I/O data; you should separate sequential I/O data from random I/O data.

Data access is usually random for On-line Transaction Processing (OLTP) applications. The optimal performance strategy is to stripe the data across devices to distribute the I/O data and minimize I/O contention. OLTP applications perform operations on small blocks of data randomly spread across multiple data pages.

Decision Support Systems (DSS) and Data Warehouse applications may benefit from large block I/O if they are performing large sequential reads of adjacent data pages. Refer to the documentation for your database system to determine if you can modify the I/O block size.

RAID Mode Performance and Data Integrity Differences

Three RAID modes provide improved data integrity through data redundancy: RAID 1, RAID 5, and RAID 3. RAID 0 does not provide data redundancy.

RAID 1 (mirroring) has the smallest impact on performance. It provides neither a severe performance penalty nor a boost. However, mirroring requires 50% of the raw disk space in the pack for data redundancy.

RAID 5 (striped data with parity) has improved performance on reads. Write performance is less due to the time required to calculate parity by performing read-modify-writes on small block transfers. RAID 5 is more efficient than RAID 1 in terms of the disk space used for redundancy. A RAID 5 stripe with *N* disks uses *N*-1 disks for data, and only one disk for parity and redundancy information.

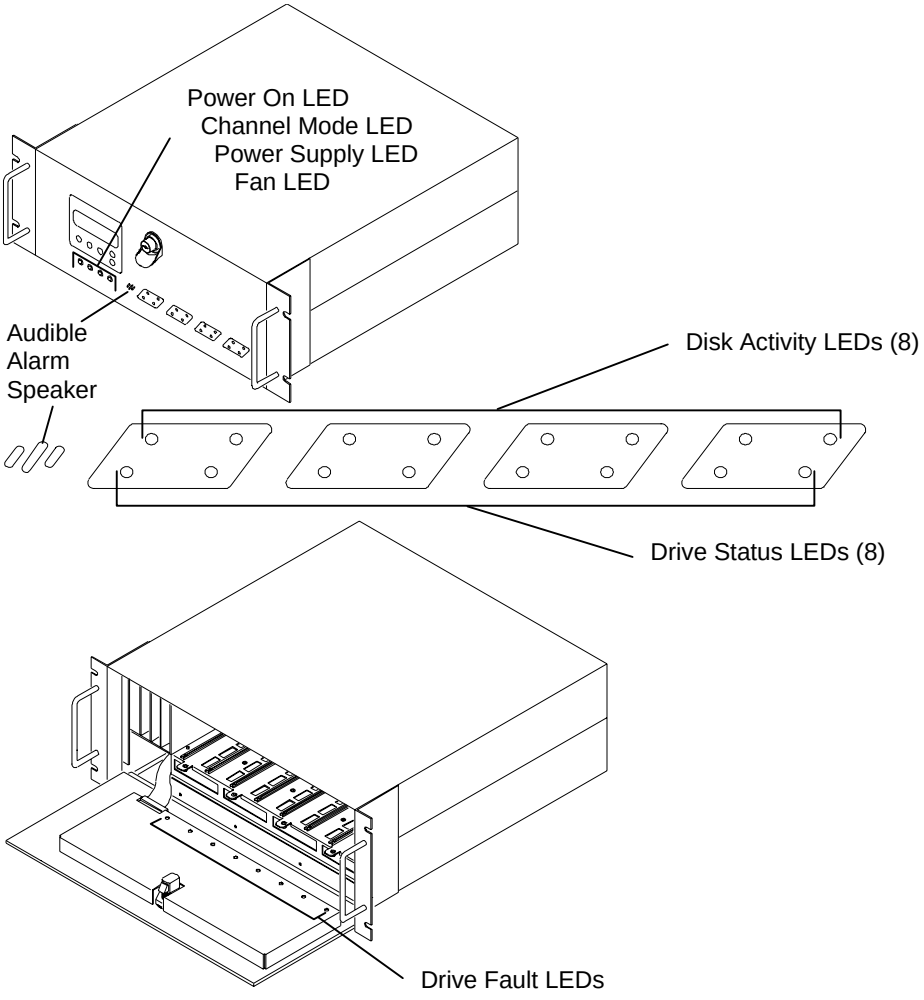
RAID 3 is similar to RAID 5, except it stores all parity information on a single disk in the pack rather than distribute it among the disks as in RAID 5. RAID 3 performance and space-efficiency characteristics are similar to RAID 5, but RAID 3 provides better performance for large-block, sequential transfers when using the Controller Read Ahead option.

RAID 0 (striped data without parity) provides no data redundancy, and thus, no assurance of data integrity. Data distributes across multiple disk drives; consequently, a failure in any of the disk drives could result in loss of that data. RAID 0 provides less data integrity than a single disk drive. However, the performance improvements available through the use of RAID 0 are greatest. It allows concurrent access to multiple disks on both reads and writes without the write performance penalty associated with RAID 5.

9 Troubleshooting

This chapter lists status conditions for the disk array light-emitting diodes (LEDs) and describes failures that might occur during the disk array's Power-On Self Test (POST). It also provides hardware and software troubleshooting for various problems.

The following figure shows the InterRAID-8e LED locations.



InterRAID-8e LEDs

The following describes the InterRAID-8e LEDs.

Power On LED

When green, this LED indicates the system is powered on and in normal operating mode.

Channel Mode LED

This LED indicates the status of the disk array by changes in its color and state. The following table gives the status of the drives attached to a MegaRAID controller.

LED	InterRAID-8e (SAF-TE Cabinet)
Steady green	Disk array in fault tolerant state
Steady amber	Disk drive rebuild in progress in the disk array; or failed disk drive present in the disk array
Alternating green and amber	Firmware checksum error*

*Firmware has become corrupted. Call the Customer Response Center at 1-800-633-7248.

Power Supply LED

This LED indicates the status of the power supplies in the cabinet.

LED	InterRAID-8e
Steady green	Normal operation
Steady amber	One power supply failed, or only one power supply present, or more than four drives present with two power supplies present
Off	All power supplies failed

NOTE See Chapter 9, “InterRAID-8e Power Supply Failures,” for information about alarm conditions when a power supply fails.

Fan LED

This LED indicates the status of the fans in the cabinet.

LED	InterRAID-8e
Steady green	Normal operation
Steady amber	One or more fans failed

NOTE The audible alarm sounds when a fan fails.

Disk Activity LEDs

The eight Disk Activity LEDs on the front of the cabinet indicate activity, such as reads or writes, on each of the installed drives. For the rack-mount cabinet, the Disk Activity LEDs are the upper set of LEDs. For the tower-based cabinet the Disk Activity LEDs are the set on the right side.

When the InterRAID-8e cabinet door is closed, you cannot view the individual Disk Activity LEDs on the installed drives. Therefore, the cabinet door has a corresponding Disk Activity LED for each installed disk drive to allow you to view the activity of each drive with the cabinet door closed. Refer to the disk drive manufacturer's specifications for information pertaining to the Disk Activity LED.

Drive Status LEDs

The eight Drive Status LEDs on the front of the cabinet indicates the status of each of the installed drives. For the rack-mount cabinet, the Disk Status LEDs are the lower set of LEDs. For the tower-based cabinet the Disk Status LEDs are the set on the left side. The following table shows the status indications for disk drives in an InterRAID-8e cabinet attached to a MegaRAID controller.

LED	InterRAID-8e (SAF-TE Cabinet)
Steady green	Disk drive assigned to an array and ready
Blinking green	Disk drive not assigned to an array ; or hot spare present
Steady amber	Disk drive rebuild in progress*; or array critical**
Blinking amber	Disk drive failed
Off	Disk drive not installed or not seated

* Steady amber on all drives in array (logical drive) being rebuilt.
** Steady amber on critical array , blinking amber on failed drive.

NOTE Refer to “Rebuilding Critical Logical Drives” in Chapter 5 for information on how to rebuild a critical pack.

Drive Fault LEDs

When amber, the Drive Fault LEDs on back of the cabinet door opposite the drive slots indicate the disk drive installed in that slot failed.

Power-On Self Test

Immediately upon power on, the InterRAID-8e disk array performs the Power-On Self Test (POST). If POST does not detect a failure, all LEDs light steady green and the alarm sounds one short beep. If POST detects a failure, a message displays on the system monitor. The failures do not compromise the data integrity of the disk drives.

NOTE You can view the POST failures from the Information Control Panel (Chapter 4). If a failure occurs, the system monitor pauses momentarily, displays the failure, and then continues with POST. To view the results, select Hardware Menu at the Main Menu and choose POST Results.

Microprocessor Failures

If POST detects a microprocessor failure, one of the following messages displays on the system monitor.

```
RAM Read/Write

ROM Checksum

Register Read/Write Failures
```

If any of these failures occurs, the channel mode LED blinks amber eight times and the alarm sounds eight beeps. Then, the channel mode LED changes to steady green and the system attempts to resume normal operation. If the failures occur consistently, return the cabinet to Intergraph Computer Systems for repair. Contact the Customer Response Center at 1-800-633-7248.

Failure	Description
RAM Read/Write	One or more bytes of the microprocessor RAM failed a read and write test.
ROM Checksum	The microprocessor ROM failed to generate the proper checksum.
Register Read/Write	One or more of the microprocessor’s registers are defective.

RAM Checksum Failure

If POST detects a firmware failure, the following message displays.

```
RAM Checksum
```

The channel mode LED alternately blinks green and amber indefinitely. This indicates corrupted firmware stored in non-volatile RAM. Intergraph Computer Systems must load new firmware to correct the failure. Call the Customer Response Center at 1-800-633-7248 for support.

SCSI Bus Access Failure

If the POST detects a failure on the InterRAID-8e disk array, the following message displays:

```
SCSI Bus Access Failure
```

The channel mode LED blinks amber four times and the alarm sounds four beeps. Either the SCSI controller failed to respond to a reset command or another device has control of the SCSI bus. After the alarm sounds, the microprocessor attempts to initialize the SCSI controller. Normal operations will be impossible while the SCSI controller remains unresponsive.

Power cycling the cabinet (turning the cabinet off, waiting 30 seconds, then powering on again) may resolve the failure. Next, try reseating cables and RAID disk drives. The cabinet requires service if this failure persists. Contact the Customer Response Center at 1-800-633-7248.

NOTE The InterRAID-8e disk array will not respond to the RAID controller firmware if a SCSI Bus Access failure occurs.

Hardware and Software Failures

This section contains some miscellaneous InterRAID-8e cabinet and system related failures encountered and solved by Intergraph Computer Systems.

InterRAID-8e Power Supply Failures

The Non-Redundant Power message displays on the Information Control Panel and the audible alarm sounds for the following two conditions:

- Non-redundant power
- Power supply failures

Non-Redundant Power

The InterRAID-8e cabinet ships with two power supplies installed. The two power supplies provide ample power for all eight disk drive bays in the cabinet. Two power supplies, however, only provide power supply redundancy for up to four disk drives. If you install more than four disk drives in the cabinet, you can order a third power supply to regain power supply redundancy.

For a cabinet with two power supplies and more than four disk drives, the status LCD displays “Status OK, non-redundant power” and the power supply LED on the front of the cabinet turns amber. The cabinet operates safely in this state, but in the event of a power supply failure the remaining power supply may not be sufficient to operate the cabinet and associated disk drives in all circumstances. The following table illustrates power supply requirements and options based on the number of installed disk drives:

Number of Power Supplies	Less Than Four Disk Drives	More Than Four Disk Drives
1	Non-redundant	Additional power supply needed
2	Redundant	Non-redundant
3	Redundant	Redundant

Power Supply Failures

A failed power supply can be identified by checking the Power LED of the power supply. The Power LED is located on the end of the power supply, visible from the back of the cabinet. Replace a failed power supply as soon as possible.

Windows NT Server Failure

Intergraph Computer Systems has encountered problems when testing systems running Windows NT Server using multiple RAID disk arrays. These problems appear to be caused by limitations in Windows NT Setup, and are currently under investigation. Use the temporary solutions provided until a fix becomes available.

- You cannot install Windows NT Server if a system is configured with three or more RAID controllers on which the RAID disk arrays have been initialized. If you must re-install Windows NT Server, remove all but the primary RAID controller (the controller where the operating system will reside) and install Windows NT Server. Then, replace the remaining controllers and continue with system configuration.
- Installation of Windows NT Server may fail if you configured the RAID disk arrays on a system to contain more than one initialized system drive. If this happens, try the installation again. During the second installation, make sure to reformat the system drive (do not select Setup's "Leave file system intact" option).

If you encounter any other problems using multiple RAID disk arrays on an Intergraph system running Windows NT Server, contact the Customer Response Center at 1-800-633-7248 for help.

Formatting RAID Disk Drives

Because of anomalies associated with formatting RAID disk drives when using MegaRAID Power Console, Intergraph Computer Systems recommends that you use MegaRAID BIOS Setup to format RAID disk drives in your InterRAID-8e disk array.

CAUTION These anomalies, while intermittent, can exhibit severe symptoms, including temporary system lockups and a permanent hang of Power Console.

Creating a RAID Disk Drive Stripe Set

On systems such as the StudioZ RAX, you may create a stripe set for the RAID disk drives. Intergraph Computer Systems recommends the following procedure after the system hardware and software have been set up and configured for use.

To create a RAID disk drive stripe set:

1. From Windows NT Administrative Tools menu or program group, run Disk Administrator.
2. When informed that the disk configuration has changed, click OK.
3. If asked to write a signature to one of the disks, click Yes. Repeat as many times as this dialog displays.
4. A disk configuration window displays, showing the system drive and two unrecognized drives (the RAID disk drives). Select both unrecognized drives by first clicking the shaded rectangle representing one of the drives, then pressing CTRL and clicking the shaded rectangle representing the other drive.
5. From the Partition menu, select Create Stripe Set.

6. In response to the question in the dialog that displays, click OK.
7. From the Partition menu, select Commit Changes Now.
8. When asked to save the changes, click Yes.
9. When asked to restart the system, click Yes.
10. When asked to update the emergency repair information, click OK.
11. When asked to restart the system, click OK.
12. After the system has restarted, log on to Windows NT and run Disk Administrator.
13. Select the newly created RAID disk drive stripe set by clicking one of the rectangles (drives) representing the stripe set.
14. From the Tools menu, select Format.
15. Select NTFS as the file system type; then select Start.
16. In the next dialog that displays, select OK.
17. In the next dialog that displays, select Yes.
18. When told formatting is complete, select OK.
19. Select Close to close the Format dialog.
20. From the Partition menu, select Exit.

After creating the stripe set, you should save the disk configuration information for future use (for example, if you have to reinstall the operating system). Refer to Disk Administrator Help for instructions on saving and restoring the disk configuration information.

Troubleshooting

This section provides the troubleshooting solutions for various problems that might occur with the host system and InterRAID-8e disk arrays. If problems persist, or are not covered in this chapter, call the Customer Response Center at 1-800-633-7248.

Host System

This section applies to general problems involving the host system.

Error: System fails to power on

Reason	Solution
Power cord not connected properly, or power cord fault.	Verify that the power cord properly connects to the power receptacle, or replace power cord if necessary.
Power not supplied at the outlet.	Verify power to the outlet has not been interrupted. Test the outlet with a known working appliance.
Power not supplied from the UPS.	Verify UPS connection and proper operation.
Power switch not in the proper position.	Be sure that the power switch on the front of the system base unit is in the ON position.

Error: System hangs when scanning devices

Reason	Solution
Cable connection fault.	When connecting the RAID SCSI cable to the RAID controller board, first seat the connector completely and then carefully tighten the thumbscrews. Avoid cross-threading the thumb screws. Check the final connection to ensure that the cable is fully seated.

Error: “No ROM Basic” message displays

Reason	Solution
RAID controller board not correctly identified as the boot device.	Change the operating system boot device parameter in the system BIOS. Refer to your system’s hardware documentation for BIOS information.

InterRAID-8e

This section applies to the InterRAID-8e disk arrays.

Error: Host System hangs when scanning devices

Reason	Solution
Cable connection fault.	When connecting the RAID SCSI cable to the RAID controller board, first seat the connector completely and then carefully tighten the thumbscrews. Avoid cross-threading the thumb screws. Check the final connection to ensure that the cable is fully seated.
Drive cable fault.	Replace the drive cable.

Error: InterRAID-8e drive fails, same physical drive each time

Reason	Solution
One disk drive in the array fails often. Too many media errors on drive.	Check the drive error counts using InterRAID-8e utilities. Format the drive. Rebuild the drive. If the drive continues to fail, replace the drive with another drive with the same capacity and rebuild.

Error: InterRAID-8e fails to power on

Reason	Solution
Power cord not connected properly, or power cord fault.	Verify that the power cord properly connects to the power receptacle, or replace power cord if necessary.
Power not supplied at the outlet.	Verify power to the outlet has not been interrupted. Test the outlet with a known working appliance.
Power not supplied from the UPS.	Verify UPS connection and proper operation.
Power switch not in the proper position.	Be sure that the power switch on the InterRAID-8e is in the ON position.
Fuse fault.	Replace fuse in the InterRAID-8; refer to Chapter 10, “Servicing the Disk Array.”

Error: Installation aborted

Reason	Solution
One or more drives failed to spin up in time during the power up sequence.	First, power off the system base unit. Power off the cabinet. Then, power on the cabinet and wait for the beep and the drives to cycle. Power on the system base unit.

Error: Drive Status LED not functioning properly

Reason	Solution
RAID SCSI cable not properly connected.	Verify that the RAID SCSI data cable is properly connected to the RAID controller.

Error: Drive Status LED blinking amber (Channel Mode LED steady amber or blinking amber)

Reason	Solution
A disk drive assigned to a pack has failed, or a rebuild operation is in progress. Disk array is in a non-fault tolerant state.	Replace the failed disk drive, rebuild the disk array.

Error: Drive Status LED off (Channel Mode LED steady amber or blinking amber)

Reason	Solution
Disk drive is missing. Disk array not in a fault-tolerant state.	Insert a disk drive and begin an array rebuild.

Error: Drive Status LED blinking green (Channel Mode LED steady green)

Reason	Solution
Disk drive not assigned into a pack.	Assign the disk drive to a pack, if desired; otherwise, the hotspare will be used in the event of a disk failure. Refer to Chapter 4, “Using the Information Control Panel.”

Error: Information Control Panel displays, "Non-redundant Power"

Reason	Solution
Power supply failure.	Identify the failed component using the "Component Status" menu of the Information Control Panel menu. Replace the failed component according to the maintenance procedures in Chapter 10.
Only one power supply in cabinet.	Two power supplies are necessary for redundancy and minimum configuration. Install the second power supply.

Error: ICP displays, "Temperature Threshold Exceeded"

Reason	Solution
Cooling fan failed.	Identify the failed fan using the Information Control Panel. Refer to Chapter 10, "Servicing the Disk Array," for details on replacing the cooling fan.
Cooling fan vent blocked, inadequate ventilation.	Remove blockage to allow air flow, or move system to location with better ventilation.

Error: ICP displays, "Hardware Error"

Reason	Solution
Cooling fan failed.	Identify the failed fan using the Information Control Panel. Refer to Chapter 10, "Servicing the Disk Array," for details on replacing the cooling fan.

Error: Power-On Self Test (POST) fails

Reason	Solution
Component failure.	Select "POST Results" in the Information Control Panel menu. Contact the Customer Response Center at 1-800-633-7248.

10 Servicing the Disk Array

This chapter provides instructions for replacing the following parts:

- MegaRAID controller
- Disk drives
- Power supplies
- Cooling fans
- Fuse
- Cabinet

Refer to your system's hardware documentation for instructions on opening the base unit, taking precautions against electrostatic discharge, and installing option boards.

NOTE Purchase replacement parts from Intergraph Computer Systems to maintain proper specifications. If replacing the MegaRAID controller board, refer to the hardware documentation delivered with the system for instruction on opening the base unit.

Precautions

Static electricity can damage the components inside a system base unit or a RAID disk array cabinet. To minimize the possibility of electrostatic discharge, observe the following precautions when working with the internal components of a system or a cabinet.

- Touch the bare metal of the base unit or cabinet to discharge any accumulated static charge.
- Avoid servicing the system in areas known to have electrostatic problems, such as on rugs and carpets.
- Handle all printed circuit boards as little as possible and by the edges only. Leave the boards in their protective packaging until you install them.
- Do not drop, jar, or bump the disk drives. Handle all disk drives by the edges, and avoid touching connector pins or printed circuit board components.
- Always turn off power to the system base unit before turning off power to the cabinet, and leave the power cord connected to maintain ground.

If you do not heed these precautions, your system or replacement parts could be damaged and your warranty voided.

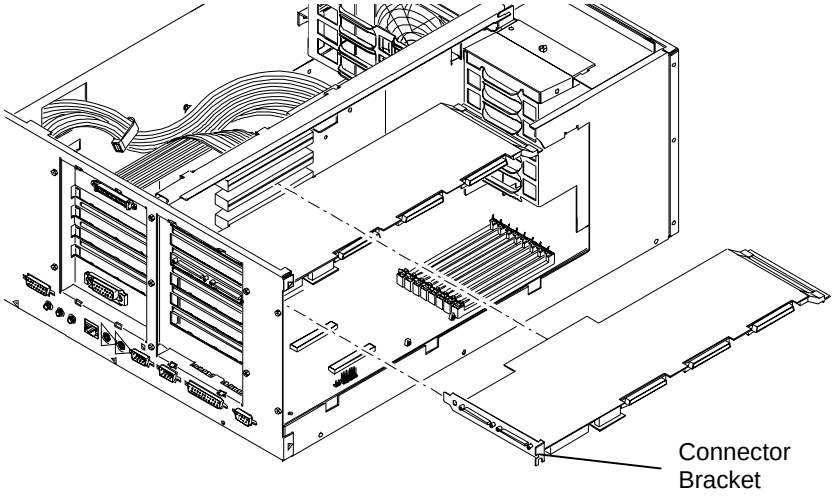
Replacing a MegaRAID Controller

Use this section to replace a failed MegaRAID controller board in a system base unit.

CAUTION Before turning off power to the server, back up the current RAID configuration to diskette, if possible. Refer to the "Saving and Restoring a Configuration" section in Chapter 5.

To replace a MegaRAID controller board:

1. Open the system's base unit.
2. Using a quarter-inch nutdriver, remove the retaining screw from the connector bracket; then, remove the defective board.
3. Install the new MegaRAID controller board into the same PCI slot in the system's base unit. The following figure is an example.



4. Secure the MegaRAID controller board with the screw removed previously.
5. Close the system's base unit.

Replacing Disk Drives

CAUTION High-capacity RAID disk drives are especially susceptible to physical shock. Handle all disk drives carefully and avoid unnecessary handling.

Use this section to replace the disk drives of an InterRAID-8e cabinet. The InterRAID-8e has hot-swap disk drives. You do not have to turn off power to the InterRAID-8e cabinet or the system to replace a disk drive.

CAUTION Establish a ground by first touching the metal chassis of the cabinet before handling or installing computer components.

To replace a disk drive:

1. Remove the new disk drive from its packaging and antistatic bag. Save the packaging material.
2. Note the drive label on the failed disk drive. Remove the matching numbers from the label sheet and affix them to the front of the new disk drive.
3. Extend the drive latching clips to disengage the failed drive from the disk array; then slide the disk drive out of the cabinet.
4. Install the new disk drive by extending the drive latching clips and sliding the disk drive into the drive slot. Place your thumb on the drive label and push the drive in until it connects. Close the drive latching clips until they snap into place, locking the drive into the slot.

Using the packaging materials from the replacement disk drive, repackage the failed drive and return it to Intergraph Computer Systems. Refer to "Returning Equipment to Intergraph Computer Systems" in Chapter 1.

Replacing Power Supplies

The InterRAID-8e has hot-swap power supplies. You do not have to turn off power to the InterRAID-8e cabinet to replace a power supply.

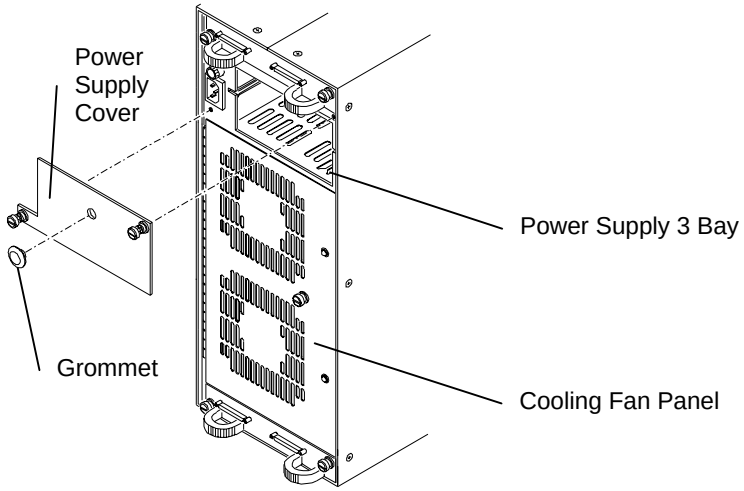
When inserting a power supply into a system, push it in completely until fully seated. Close the extraction lever. If the power supply does not power on, pull the power supply out, wait at least 45 seconds, and push it back into place. The DC OK LED on the back of the power supply illuminates to indicate that the power supply has powered on.

If using devices that require excessive power, you must add a third power supply to maintain redundant operation. The cabinet is currently limited to 13 watts power consumption per slot for redundancy. A third power supply will increase this to 30 watts.

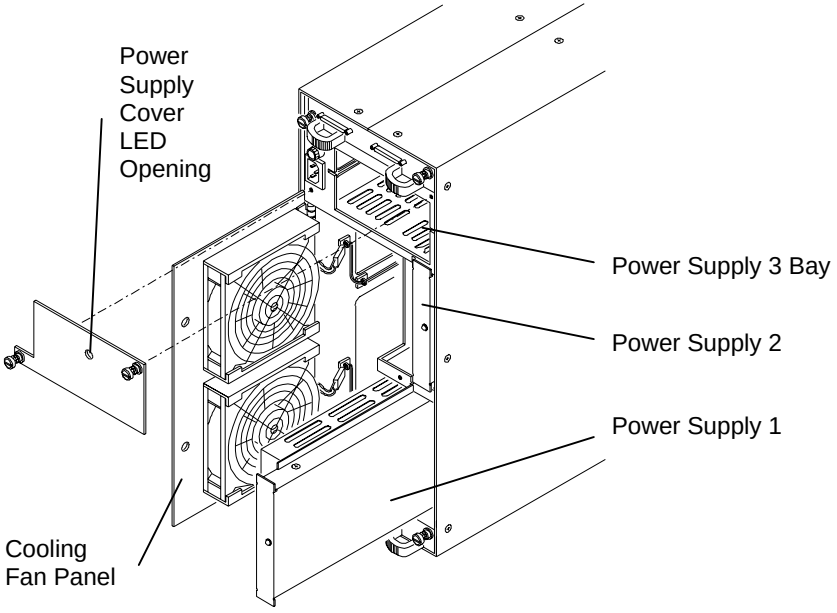
To replace a power supply:

1. Locate the failed power supply at the back of the cabinet. The LED for a failed power supply will be unlit.
2. If replacing power supply 3, use a flat-blade screwdriver to loosen the power supply cover screws. Open the power supply 3 bay.

   If installing a new power supply in bay 3, remove the grommet from the LED opening in the power supply cover.



If replacing power supply 1 or 2, use a flat-blade screwdriver to loosen the power supply cover screws. Open the cooling fan panel.



3. Grasp the handle of the failed power supply and pull the supply out of the cabinet.
4. Remove the new power supply from its packaging. Save the packaging material.
5. Slide the new power supply into the cabinet until it locks.

NOTE If you must remove the top power supply from bay 3, do so as described above and store the power supply in a static protective package.

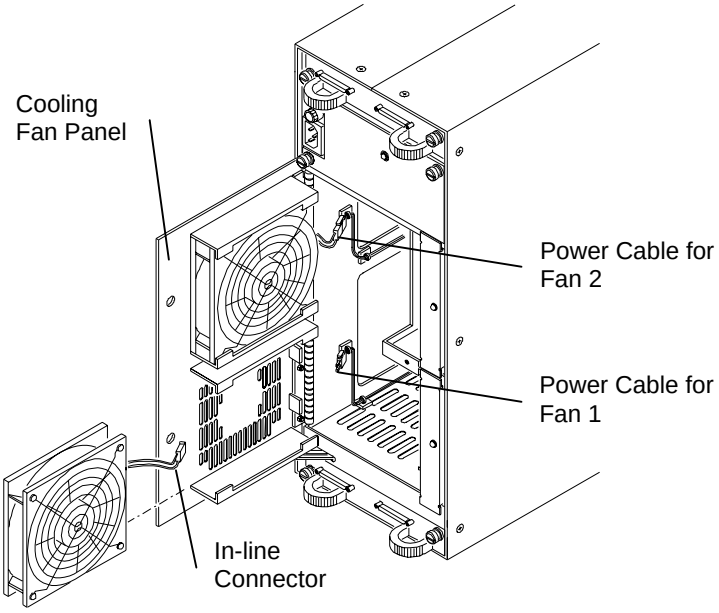
6. Replace the power supply cover or close the cooling fan panel. Lift the latch located at the bottom of the cooling fan panel to release the cooling fan panel, allowing it to close.
7. Using the packaging materials from the replacement power supply, repackage the failed power supply and return it to Intergraph Computer Systems. Refer to "Returning Equipment to Intergraph Computer Systems" in Chapter 1.

Replacing Cooling Fans

The InterRAID-8e has hot-swap cooling fans. You do not have to turn off power to the InterRAID-8e cabinet to replace the cooling fans.

To replace a cooling fan:

1. Locate the failed cooling fan at the back of the cabinet. The failed cooling fan will not be running.
2. Using a slotted screwdriver, loosen the two screws holding the failed cooling fan panel to the back of the cabinet, and then open the panel.



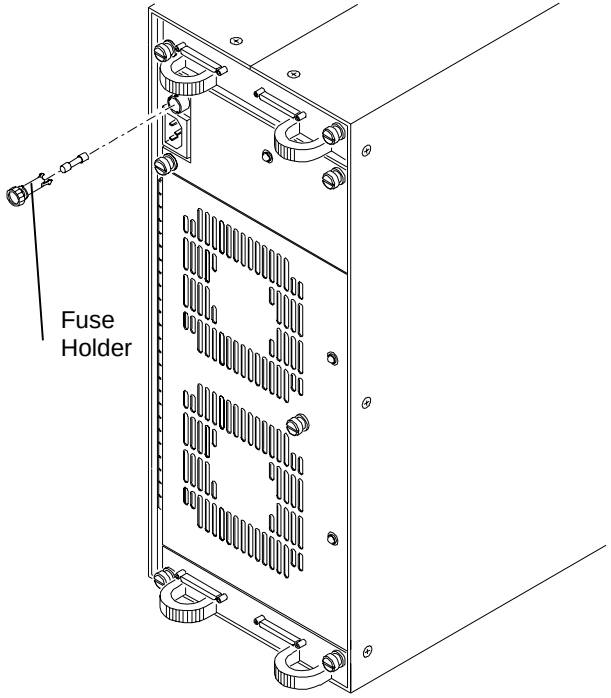
3. Disconnect the in-line connector of the power cable for the failed fan.

4. Using a No. 2 Phillips screwdriver, remove the four screws that secure the fan to the cooling fan panel, and then remove the failed cooling fan.
5. Remove the new cooling fan from its packaging. Save the packaging material.
6. Align the fan mounting holes with those on the cooling fan panel and secure the fan using the four screws.
7. Reconnect the in-line connector of the power cable.
8. Close the cooling fan panel and tighten the two screws to secure the panel to the back of the cabinet.

Replacing a Fuse

WARNING Disconnect power before replacing a fuse.

1. Locate the fuse holder on the back panel of the InterRAID-8e cabinet.



2. Using a small coin or flat blade screwdriver, turn the fuse holder counter-clockwise one quarter turn, releasing the holder from its locked position; then remove the fuse holder.
3. Separate the fuse from the fuse holder.

4. Insert a replacement fuse of identical type and rating (250V 10A) into the fuse holder.
5. Insert the fuse holder into the cabinet and secure it. Push in while turning clockwise one quarter turn, locking it into place. Do not overtighten.

Replacing Cabinets

Follow these instructions to replace an InterRAID-8e cabinet.

To replace a cabinet:

1. Remove the new cabinet from its packaging and inspect the shipment. Save the packaging material.
2. Open the door of the old cabinet. Note the position of each disk drive in the old cabinet. The drives are labeled with an ID number.
3. Place the new cabinet adjacent to the old cabinet.
4. Shut down and turn off power to the system base unit; then, turn off power to the cabinet to be replaced.
5. Disconnect the AC power cord and RAID SCSI cable(s) from the old cabinet.
6. Connect the AC power cord and RAID SCSI cable(s) to the new cabinet.
7. Remove the disk drives from the old cabinet and install them in the new cabinet, in exactly the same order as they were in the old cabinet.
8. Note the jumper configurations on the termination interface cards in the old cabinet. Set the jumpers on the new cards in the new cabinet to match the previous configuration.
9. If you have a third power supply unit installed in the old cabinet, remove and install it in the new cabinet.
10. Turn on power to the new cabinet.
11. Turn on power to the system base unit.
12. Using the packaging materials from the new cabinet, repackage the old cabinet and return it to Intergraph Computer Systems. Refer to “Returning Equipment to Intergraph Computer Systems” in Chapter 1.

A Specifications

This appendix provides the specifications for InterRAID-8e disk array cabinets. The specifications are subject to change without notice.

NOTE Refer to the system's documentation for the system base unit specifications.

The following specifications apply to the InterRAID-8e cabinet.

Power Requirements:	100 - 240 VAC (auto-sensing), 50 - 60 Hz, 6 Amperes typical, 3 x 150 watts
Mean Time Between Data Loss:	5,000,000 hours
Dimensions (H x W x L):	18.75 inches x 7.00 inches x 23.25 inches
Weight (disk drives not installed):	51.0 pounds
Number of Drives Supported:	8
Interface Transfer Rate:	40 MB per second
System Interface:	Ultra Wide SCSI
Drive Interface:	Ultra Wide SCSI with SCA
Hard Disk Drive Termination:	Auto-terminating
Hard Disk Drive SCSI ID:	Auto-setting
Electromagnetic Interference (EMI) Emissions Requirements:	FCC, Part 15, Class A; VDE 0871, Class B
Safety Requirements:	UL1950; CSA C22.2 #950; TUV / EN60950; CE

B Software Updates

This appendix describes how to update the MegaRAID driver and utilities. The MegaRAID driver and Power Console graphics user interface reside on one diskette. The MegaRAID BIOS configuration utility is on a separate diskette.

Updating the MegaRAID Driver

The MegaRAID driver provides an interface for administering the InterRAID disk array products. After configuring the Windows NT operating system, you must install the updated Intergraph MegaRAID driver. An icon will be automatically created in the Power Console program group.

To install the updated MegaRAID driver for use with Windows NT 3.5x:

1. Boot the system and log in as administrator.
2. At Program Manager, open Windows NT Setup.
3. From the Options menu, select Add/Remove SCSI Adapters.
4. Select the MegaRAID driver; then, select Remove.
5. Select OK at the Warning dialog; then, select OK again.
6. At the Warning dialog, select Add; then, select OK. Windows NT Setup displays a list of adapters.
7. Scroll to “OTHER (Requires disk from a hardware manufacturer).”
8. Insert the diskette containing MegaRAID NT driver into the floppy disk drive, and select OK. The Select OEM Option dialog displays with the MegaRAID adapter highlighted.
9. Select OK. Setup displays the Select SCSI Adapter Option dialog.
10. Select Install. Setup displays a message that the driver is already present on the system.
11. Select New; then, select Continue at the prompt to specify the path to the adapter files.
12. At the SCSI Adapter Menu, select Close.
13. From the Options menu, select Exit.
14. Reboot the system.

To install the updated MegaRAID driver for use with Windows NT 4.x:

1. Boot the system and log in as administrator.
2. Open Control Panel.
3. Select SCSI Adapters icon.
4. Click the Drivers tab.
5. Select the MegaRAID driver.
6. Click Remove to remove the old driver.
7. Click the Drivers tab again.
8. Click Add.
9. Click Have Disk.
10. Follow the instruction on the screen to install the updated driver. This will create a MegaRAID program item.
11. Remove the diskette containing the MegaRAID driver from the disk drive.
12. Reboot the system.

Installing MegaRAID Utilities

Intergraph Computer Systems installs the MegaRAID BIOS configuration and Power Console utilities on your system before shipment. In the event you need to reload the Windows NT operating system, you can reinstall the MegaRAID utilities. A menu item will be automatically created in the Power Console program group.

Intergraph Computer Systems strongly recommends that you install the MegaRAID Power Console software on your server. ICS also recommends that you add a shortcut to Power Console to the Windows NT Startup menu (Start/Programs/Startup). See Windows NT Help for information on adding a shortcut to the Start menu.

To install MegaRAID utilities for use with Windows NT 3.5x or 4.x:

1. Boot the system and log in as administrator.
2. Insert the diskette containing the MegaRAID utilities into the floppy disk drive.
3. For Windows NT 3.5x, at the A: command prompt, key in the following:

   setup

   For Windows NT 4.x, select Start. Then, select Run and key in the following:

   a:\setup

4. Respond yes or no appropriately to the questions about Windows NT. At the Welcome dialog, select Next. The destination path dialog displays.

NOTE The files are copied into the displayed default directory or a specified directory you designate after selecting Browse.

5. To copy the files to the displayed destination directory, select Next. Otherwise, select Browse and type a new directory path. Setup also displays a message that the driver is already present on the system.
6. Remove the diskette containing the MegaRAID utilities from the disk drive.
7. Reboot the system.

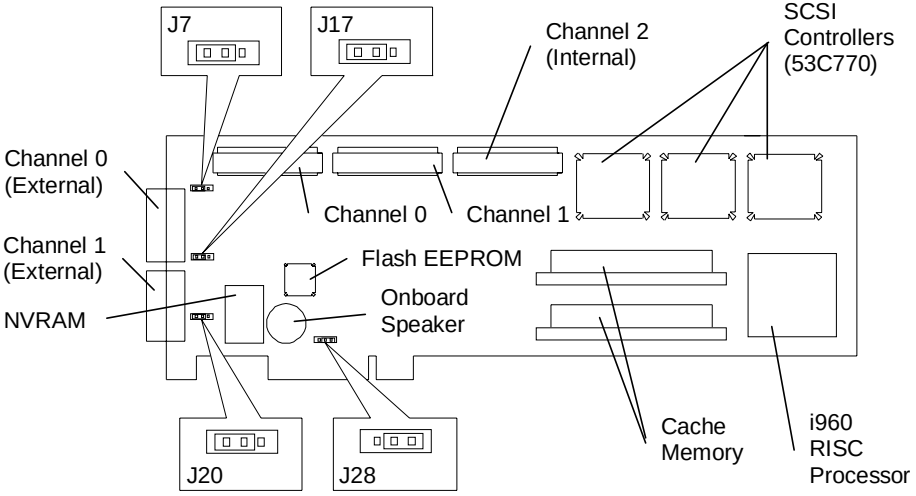
C RAID Controller

The InterRAID-8e controller is a high-performance PCI SCSI controller that manages the disk array of the host server. The controller is available in two-channel and three-channel versions.

MegaRAID Controller

MegaRAID has three independent RAID SCSI bus channels (0, 1, and 2), each using a separate 53C770 SCSI controller. This allows the system to read or write data on several disk drives simultaneously. The MegaRAID controller board without the battery backup option is shown in the following figure.

NOTE On the two-channel MegaRAID controller, the components for the internal Channel 2 are not populated.



CAUTION Ensure jumpers are installed as shown or erratic operation will occur.

Channel 2 is the default internal RAID SCSI connector except in InterServe 80 and InterServe 8000 systems. The internal RAID of these systems are configured for dual-busses and will use Channels 1 and 2 of the MegaRAID controller.

Features

The MegaRAID controller has the following features:

- PCI Bus Interface
- AT Compatible BIOS
- MegaRAID Controller Firmware
- RAID SCSI Bus

PCI Bus Interface

The MegaRAID controller interfaces to its host system through the PCI bus. The PCI bus allows 32-bit high speed transfers and supports a burst data rate of over 130 MB per second.

AT Compatible BIOS

The MegaRAID controller has an Advanced Technology (AT) compatible BIOS containing a set of special programs which receive control of the system when it is first powered on. The MegaRAID controller then intercepts all INT13 BIOS calls and translates them into the appropriate RAID control codes.

MegaRAID Controller Firmware

The MegaRAID controller firmware programs, stored on the flash EEPROM, are executed by the i960 RISC processor. The flash EEPROM allows the system firmware to be upgraded without replacing any hardware.

NOTE If the firmware becomes lost, contact the Customer Response Center for assistance. Only qualified service personnel should update the firmware.

RAID SCSI Bus

The RAID SCSI bus connects the disk drives and internal devices to the MegaRAID controller. The MegaRAID controller is Ultra Wide SCSI. The Ultra Wide SCSI feature is enabled for InterRAID-8e.

Components

The MegaRAID controller uses the following components:

i960 RISC Processor

The processor is a 32-bit Intel i960C RISC microprocessor. The processor controls all functions of the MegaRAID controller including SCSI bus transfers, PCI bus transfers, RAID processing, configuration, data striping, error recovery, and drive rebuilding.

Cache Memory

The cache memory subsystem on the MegaRAID controller board has a total of 8 MB of DRAM.

PCI Connector

The PCI connector inserts into the PCI slot of the server system board. This connector carries all the PCI bus signals between the MegaRAID controller board and the system board.

Flash EEPROM

Flash EEPROM stores the MegaRAID firmware programs and the configuration data. Since it is re-writeable, it allows the firmware to be upgraded without replacing any hardware. As the disk configurations change (for example, when a drive fails) the flash EEPROM records the changes. The flash EEPROM retains the firmware and configuration data after the system is powered off.

SCSI Controller

To manage the data flow on the RAID SCSI bus, three 53C770 SCSI controllers are used for MegaRAID. One SCSI RAID controller is assigned to each channel.

External RAID SCSI Connector

The external RAID SCSI connectors for MegaRAID are 68-pin ultra high density connectors.

Onboard Speaker

The MegaRAID controller has an onboard tone generator for audible warnings when system failures occur. The default setting is Disabled.

Glossary

Advanced Technology (AT)
A class of computers and processors using the 80286 microprocessor and 16-bit bus.

asynchronous operations
Operations that have 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.

bad block table
A table of information on bad blocks encountered during the rebuild and write-back processes of hard disk drives in a RAID system.

Basic Input Output System (BIOS)
A program permanently stored in the flash EPROM on the server mother board, or in the flash EEPROM on the RAID controller board.

boot disk drive
The RAID disk drive(s) containing the operating system.

cache
A high-speed memory buffer that contains the most recently accessed data from the DRAM memory system.

cache flush
An operation where all unwritten blocks in a write-back cache are written to the target disk. This operation is necessary before powering down the system.

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

consistency check
The process whereby the integrity of redundant data is verified. For example, a consistency check of a mirrored drive will ensure the data on both drives of the mirrored pair are exactly the same.

disconnect/reconnect
A function to allow a target SCSI device (typically a disk drive that received a request to perform a relatively long I/O operation) to disconnect the SCSI bus so that the controller can send commands to other devices. When the operation completes and the SCSI bus is needed by the target device again, it is reconnected.

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 mirroring

One disk drive serving as the mirror image of another disk drive. When data is written to one drive, it is also written to the other. Both drives, therefore, contain exactly the same information and either drive can provide user data if the other drive fails.

disk spanning

Several disk drives appearing as one large disk drive. This virtual disk drive can then store data across the disk drives without the user being concerned about which drive contains what data.

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 lower data reliability than any of its member disks.

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.

dual-bus

A SCSI cable configuration of two busses with a dual-bus module installed to link all drives in the cabinet to two separate channels.

duplexing

The use of two controllers to drive a disk drive subsystem. If a controller fails, the other is available to provide disk I/O. And, depending on how the controller software is written, both controllers may work together to read and write data simultaneously to different drives.

Dynamic Random Access Memory (DRAM)

A memory device architecture providing large amounts of memory storage using Single Inline Memory Modules (SIMMs). After powering on the system, the majority of data needed to operate is retrieved from the disk drives and stored in DRAM. DRAM loses its contents when powered down.

expansion slot
A connector on the system board used for adding option cards.

fault-tolerant
Resistant to failure. For example, a RAID 1 mirrored subsystem is fault-tolerant because it can still provide disk I/O if one of the disk drives in a mirrored system fails.

firmware
A computer program or instruction, such as a microprogram, used so often that it is stored in read-only memory instead of being included in software.

floppy disk
A portable, removable disk storage device used to store programs and files.

format
a process that prepares a disk to hold data.

hard disk drives
Disk storage devices used to store programs and files.

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

hotspare
One of the most important features the controller provides to achieve automatic, non-stop service with a high degree of fault tolerance. Rebuild occurs when a SCSI disk drive fails and both of the following conditions are true: (1) A standby SCSI disk drive of identical size is found attached to the same controller; and (2) All of the system drives that are dependent on the failed disk are redundant system drives, for example, RAID 1, RAID 2, RAID 5.

hot swap
Replacing a defective unit in a disk subsystem while the subsystem is running (performing its normal functions). Hot swaps are manual.

Light Emitting Diode (LED)
A light on the control panel to indicate power, disk activity, or system status.

logical drive
A set of contiguous blocks on a physical disk drive. Logical drives are used in array implementations as part of logical volumes or partitions. Logical drives are normally transparent to the host environment, except when the array containing them is being configured. Logical drive and system drive are used interchangeably.

mirroring

The 100% duplication of data on one disk drive to another disk drive. Each disk is the mirror image of the other.

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.

parity

Also known as “Rotated XOR Redundancy”, which refers to a method of providing complete data redundancy while requiring only a fraction of the storage capacity normally associated with redundancy.

Peripheral Component Interconnect (PCI) bus

A standard bus interface that allows connection between PCI-based peripheral devices and expansion cards. The PCI bus offers a large number of bus interface features, the most desirable being high-speed data transfer rates that are close to or exceed local bus or CPU bus speeds.

physical pack

A group of individual disk drives (preferably identical) that are logically tied to each other and are addressed as a single unit. A physical pack can have one or more system drives in it.

primary RAID controller

The RAID controller board in the system base unit that connects to the boot disk drives of the primary disk array.

RAID 0

An array configuration where data is striped across multiple drives offering faster read/write performance than a single drive. No redundancy is provided.

RAID 0+1

See RAID 10.

RAID 1

An array configuration where data is mirrored across pairs of drives. All data is 100% duplicated.

RAID 10

An array configuration where data is striped across drives as in RAID 0. Each stripe is then mirrored as RAID 1. This combination of RAID 0 and RAID 1 is also referred to as "RAID 0+1" or "RAID 1+0".

RAID 3

An array configuration where data is striped across a minimum of three physical drives. For data fault tolerance, one dedicated drive is encoded with parity.

RAID 30

An array configuration where data is striped across two RAID 3 arrays using RAID 0. This combination of RAID 0 and RAID 3 is sometimes referred to as "RAID 0+3" or "RAID 3+0".

RAID 5

An array configuration where data is striped across a minimum of three physical drives. For data fault tolerance and improved performance over RAID 3, parity is distributed over all drives.

RAID 50

An array configuration where data is striped across two RAID 5 arrays using RAID 0. This combination of RAID 0 and RAID 5 is sometimes referred to as "RAID 0+5" or "RAID 5+0".

RAID controller

The controller board that routes data to and from the CPU. Disk array controllers perform all RAID algorithms onboard the controller.

RAID SCSI

Also known as Fast Wide SCSI-2 or Ultra SCSI, RAID SCSI is a version of the Small Computer System Interface version 2 that provides 16-bit bandwidth, and all other SCSI-2 capabilities.

rebuild

The regeneration of all data from a failed disk in a RAID level 1, 3, 5, 10 (0 +1), 30, or 50 array to a replacement disk. A disk rebuild normally occurs without interruption of application access to data stored on the array virtual disk.

Reduced Instruction Set Computer (RISC)

A processor with a small number of machine language instructions. Because the number of instructions are few, the RISC processor can perform faster than conventional processors.

Redundant Array of Independent Disks (RAID)

A method of managing data when more than one hard disk is installed in the system. RAID protects the disk from failure and increases performance.

redundancy

Multiple devices (power supplies or disk drives) that maintain system operation in the event of a single device failure.

replacement disk
A disk drive available to replace a failed member disk drive in a RAID array.

replacement table
Information regarding hard disk drives replaced through standby replacement.

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 hotspare.

rotated XOR redundancy
Also known as parity, which refers to a method of providing complete data redundancy while requiring only a fraction of the storage capacity normally associated with redundancy.

SAF-TE
An industry standard acronym for SCSI Accessed Fault-Tolerant Enclosure.

secondary RAID controller
The RAID controller in the system base unit that connect to additional disk arrays.

session
The period of time between any two consecutive system shutdowns.

single-bus
A SCSI cable configuration of one bus with a single-bus module installed to link all drives in the cabinet to a single channel.

Single Inline Memory Module (SIMM)
A printed circuit card containing integrated circuits.

Small Computer System Interface (SCSI)
A bus interface that was designed for connecting peripheral devices, primarily high-speed data storage devices such as CD-ROM drives and hard disk drives.

Small Computer System Interface (SCSI) drive
A disk drive equipped with a small computer system interface (SCSI). Each disk drive will be assigned a SCSI address (or SCSI ID), which is a number from 0 to 15. The SCSI address uniquely identifies the drive on the SCSI channel.

smart cabinet
The predecessor to SAF-TE, a method of monitoring the cabinet environment using a SCSI ID.

spanning

A case where a system drive starts and ends at different physical packs. Spanning allows multiple packs to be combined into one logical drive. This allows the user to create RAID 1 packs from two to eight disk drives if larger array sizes are required.

standby drive

Refer to “hotspare.”

standby replacement of disks

Also known as hotspare. This feature is one of the most important features the controller provides to achieve automatic, non-stop service with a high degree of fault-tolerance.

state of SCSI drive

A SCSI drive’s current operational status. At any given time, a SCSI drive can be in one of four states: ONLINE, STANDBY, DEAD, or REBUILD. The controller stores the state of the attached SCSI drives in its non-volatile memory. This information is retained even after power-off. Hence, if a SCSI drive is labeled DEAD in one session, it will stay in the DEAD state until a change is made either by using a system level utility or after a rebuild.

stripe order

The order in which SCSI drives appear within a physical pack.

stripe width

The number of SCSI drives within a physical pack.

striping

Data spread across multiple physical disks offering faster read/write performance than a single drive.

system drive

A section of disk storage space which may, or may not, be physically located on a single disk drive or physical pack that is presented to the host operating system as a single physical drive. Under DOS, for example, a system drive can be partitioned using “fdisk.” A system drive can start from any point on a physical pack and end at any point either on the same, or on a different, physical pack. A system drive located on a physical pack made up of one or two SCSI drives can only be configured under RAID 0 or RAID 1. For RAID 5, a physical pack must have at least three SCSI drives in it. System drive and logical drive are used interchangeably.

system drive ID

An ID assigned to a system drive, as defined by using the configuration utility, starting from the first system drive enabled. The ID starts from 0 and goes up to 7.

target ID

The SCSI ID of a device attached to the disk array controller. Each SCSI channel can have up to sixteen SCSI devices (target ID from 0 to 15) attached to it.

Uninterruptible Power Supply (UPS)

A battery power source connected to the system and the AC power source that protects a system from unexpected power interruptions.

write-through cache

A cache writing strategy whereby data is written to the SCSI drive before a completion status is returned to the host operating system. This caching strategy is considered more secure since a power failure will be less likely to cause loss of data. However, in most environments, a write-through cache results in a slightly lower performance.

write-back cache

A cache writing strategy whereby write operations result in a completion signal being sent to the host operating system when the cache (not the disk drive) receives the data to be written. The target SCSI drive receives the data at a more appropriate time which increases controller performance.

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INTERGRAPH
COMPUTER SYSTEMS

Returned Goods Authorization (RGA) Form

Date Returned _____ **Base Serial No.** _____
(On white bar code ID plate on back of base unit)

RGA No. _____ (From Intergraph Customer Response Center)

From **Customer Name** _____

Customer Contact _____ **Phone** _____

Mail Address _____

_____

_____

_____

Reason for Return _____

_____

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_____

_____

_____

NOTE All returned equipment MUST be shipped in original Intergraph Computer Systems packaging to obtain warranty service.

WARNING **Back up disk drives before returning equipment. Intergraph Computer Systems is not responsible for data lost in shipping or repair process.**

TO Repair Depot RGA No. _____

Intergraph Corporation

9805 Kellner Road

Huntsville AL 35894

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