IBM Netfinity®

**ServeRAID™-3H, ServeRAID-3HB, and ServeRAID-3L
Ultra2 SCSI Controllers
Installation and User's Guide**

IBM

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> **Note**
>
> Before using this information and the product it supports, be sure to read the general information under Appendix A, "Product warranties and notices" on page 157.

Contents

About this book

This book provides the information needed to install and configure an IBM® Netfinity® ServeRAID™-3H Ultra2 SCSI Controller, an IBM ServeRAID-3HB Ultra2 SCSI Controller, or an IBM ServeRAID-3L Ultra2 SCSI Controller. You also can use the configuration and reference information in this book to configure the IBM ServeRAID controllers provided on some IBM Netfinity and PC Server system boards.

Note: The IBM ServeRAID product can be either a controller built-in on an adapter card, such as the one in this option package, or a controller that is built-in on the system board of your server. For purposes of consistency in this manual, we will refer to the ServeRAID product as a ServeRAID controller, unless it is specifically noted otherwise.

How this book is organized

Chapter 1, "Getting started," contains introductory information about the IBM ServeRAID-3H and ServeRAID-3L controllers, a content listing for the ServeRAID option package, an installation overview, and general information about RAID technology.

Chapter 2, "Installing and cabling a ServeRAID controller," provides information about the standard features of the ServeRAID-3H and ServeRAID-3L controllers, and instructions for installing and cabling a ServeRAID controller that is on an adapter.

Chapter 3, "Using the configuration programs," explains how to use the IBM ServeRAID Configuration Program and the IBM ServeRAID Mini-Configuration Program. You can refer to the information in this chapter when configuring one or more devices attached to a ServeRAID controller.

Chapter 4, "Installing device drivers and utility programs," contains the instructions needed to install the ServeRAID device drivers and programs provided on the IBM ServeRAID Configuration and Management CD and diskettes that came with the ServeRAID controllers.

Chapter 5, "The ServeRAID Manager program," contains the instructions for using the ServeRAID Manager program under Microsoft® Windows® 95, Windows 98, Windows NT®, or UnixWare.

Chapter 6, "Starting and using the Administration and Monitoring Program," contains instructions for starting and using the ServeRAID Administration and Monitoring Program. You can use these operating-system specific programs to maintain and monitor your ServeRAID subsystem.

Chapter 7, "Starting and using the command line programs," contains instructions for starting and using the IPSSEND and IPSMON command line programs. You can use these operating-system specific programs to maintain and monitor your ServeRAID subsystem.

Chapter 8, "Solving ServeRAID problems," describes the ServeRAID POST error codes and startup messages. This chapter also includes some basic information about rebuilding a defunct drive.

Chapter 9, "Getting help, service, and information," provides information about accessing the IBM Bulletin Boards, HelpCenter®, and World Wide Web sites to obtain future code and information updates for the ServeRAID controllers.

Appendix A, "Product warranties and notices," contains warranty information, product notices, and trademarks.

Notices used in this book

This book contains notices to highlight information as follows:

- **Notes:**

  These notices provide important tips, guidance, or advice.

- **Attention:**

  These notices indicate possible damage to programs, devices, or data. An attention notice is placed just *before* the instruction or situation in which damage could occur.

Chapter 1. Getting started

This book provides the information needed to install and configure an IBM ServeRAID-3H Ultra2 SCSI Controller, an IBM ServeRAID-3L Ultra2 SCSI Controller, or an IBM clarhb.. These high-performance, redundant array of independent disk (RAID) controllers are ideally suited for data-storage environments that require superior performance, flexibility, and reliable data storage. (See "Controller features" on page 14 for more information.)

You also can use the configuration and reference information in this book to configure the IBM ServeRAID controllers provided on some IBM Netfinity and PC Server system boards.

This chapter contains:

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Option package contents

In addition to this book, the ServeRAID option package contains:

- IBM Netfinity ServeRAID-3L Ultra2 SCSI Controller or
  IBM Netfinity ServeRAID-3H Ultra2 SCSI Controller or
  IBM Netfinity ServeRAID-3HB Ultra2 SCSI Controller with battery-backup write cache.

  Attention:
  Do not open the static-protective bag containing the controller until you are instructed to do so.

- IBM ServeRAID Support Package:

  – *IBM ServeRAID Configuration and Management CD*

  – *IBM ServeRAID Device Driver Diskette*

  – *IBM Netfinity Device Drivers for SCO Operating Systems Diskette*

  See Chapter 4, "Installing device drivers and utility programs" on page 47 for more detailed information.

- IBM ServeRAID Channel 3 Cable option kit

  This cable comes with the ServeRAID-3H controller and the ServeRAID-3HB controller only. You can attach this cable to the ServeRAID-3H controller or the ServeRAID-3HB controller to convert the internal SCSI channel connector to an external connector. See "ServeRAID-3H and ServeRAID-3HB controller" on page 15 for more information.

Contact your place of purchase if any items are missing or damaged.

Installation overview

This book contains reference, installation, configuration, and administration information for the IBM ServeRAID-3H controller, ServeRAID-3L controller, and ServeRAID controllers. In addition to this book, you might need to refer to your IBM server documentation for Safety information, connector locations, and for controller and hard disk drive installation instructions.

Note: The IBM ServeRAID product can be either a controller built-in on an adapter card, such as the one in this option package, or a controller that is built-in on the system board of your server. For purposes of consistency in this manual, we will refer to the ServeRAID product as a ServeRAID controller, unless it is specifically noted otherwise.

The information that you will need to install or configure your IBM ServeRAID subsystem depends on the type of ServeRAID controller you are using and your familiarity with RAID technology.

A typical installation and configuration of an IBM ServeRAID subsystem consists of the following steps:

1 Learn about RAID technology.

The "Understanding RAID technology" section in this chapter contains general information about RAID technology. If you already are familiar with the IBM implementation of RAID technology, you might want to start your installation with step 2.

2 Install the ServeRAID-3H or ServeRAID-3L Controller.

Chapter 2, "Installing and cabling a ServeRAID controller" provides information about the standard features of the ServeRAID-3H and ServeRAID-3L controllers, and installation and cabling instructions for the controllers. You will not need the information in this chapter if you are using a ServeRAID controller on an IBM Netfinity or PC Server system board.

3 Use the ServeRAID Configuration Programs to configure your disk arrays.

Chapter 3, "Using the configuration programs" explains how to use the IBM ServeRAID Configuration Program and the IBM ServeRAID Mini-Configuration Program. You can refer to the information in this chapter or the online information in the configuration program when configuring one or more devices attached to a ServeRAID controller.

Attention:
The default setting for the stripe-unit size is 8 KB[1]. If you want to use a different setting, be sure to change the stripe-unit size before you store data in the logical drives. After you store data in the drives, you cannot change the stripe-unit size without destroying data in the logical drives. (See "Stripe-Unit size" on page 4 and page 34 for more information.)

- If you are configuring a ServeRAID-3H Ultra2 SCSI Controller or a ServeRAID-3L Ultra2 SCSI Controller, see Chapter 3, "Using the configuration programs" on page 19 for instructions.

- If you are configuring an IBM ServeRAID controller that came as a standard feature on an IBM Netfinity or PC Server system board, see the installation instructions and CDs provided with your server for information about starting the configuration programs for the server.

4 Install your operating system, ServeRAID device drivers, and ServeRAID utility programs.

You can skip this step if you are installing multiple ServeRAID controllers and you already installed your operating system and the most current versions of the ServeRAID device drivers and utility programs.

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[1] KB equals approximately 1000 bytes.

- To install these files for a ServeRAID-3H Ultra2 SCSI Controller or a ServeRAID-3L Ultra2 SCSI Controller, see the information provided with your operating system and Chapter 4, "Installing device drivers and utility programs" on page 47 for instructions.

- To install these files for an IBM ServeRAID controller that came as a standard feature on an IBM Netfinity or PC Server system board, see the installation instructions and CDs provided with your server for instructions.

After you install the device drivers, refer to one of the following chapters.

- If you are using Windows NT or UnixWare, refer to Chapter 5, "The ServeRAID Manager program" on page 79.

- If you are using any other operating system, refer to Chapter 6, "Starting and using the Administration and Monitoring Program" on page 101.

- If you want to use the command line programs, refer to Chapter 6, "Starting and using the Administration and Monitoring Program" on page 101.

Understanding RAID technology

RAID is the technology of grouping several hard disk drives in a computer into an *array* that you can define as one or more logical drives. Each *logical* drive appears to the operating system as a single drive. This grouping technique greatly enhances logical-drive capacity and performance beyond the physical limitations of a single hard disk drive.

When you group multiple physical hard disk drives into a logical drive, the ServeRAID controller can transfer data in parallel from the multiple drives in the array. This parallel transfer yields data-transfer rates that are many times higher than with nonarrayed drives. This increased speed makes the system better able to meet the *throughput* (the amount of work in a given amount of time) or productivity needs of the multiple-user network environment.

The ability to respond to multiple data requests provides not only an impressive increase in throughput, but also a decrease in response time. The combination of parallel transfers and simultaneous responses to multiple requests allows disk arrays to provide a high level of performance in network environments.

Stripe-Unit size

With RAID technology, data is *striped* across an array of hard disk drives. This data-distribution scheme complements the way the operating system requests data.

The granularity at which data from one file is stored on one drive of the array before subsequent data is stored on the next drive of the array is called the *stripe-unit size.*

You can control the stripe-unit size and maximize the performance of your ServeRAID controller by setting a stripe-unit size to a value that is close to the size of the system I/O requests. You can set the stripe-unit size to 8 KB, 16 KB, 32 KB, or 64 KB. For example, performance in transaction-based environments, which typically involve large blocks of data, might be optimal when the stripe-unit size is set to 32 KB or 64 KB; however, performance in file and print environments, which typically involve multiple small blocks of data, might be optimal when the stripe-unit size is set to 8 KB or 16 KB.

The collection, in logical order of these stripe units, from the first drive of the array to the last drive of the array, is called a *stripe.*

Note: Eight physical drives are supported in an array if the stripe-unit size is set to 32 KB or 64 KB. Sixteen physical drives are supported in an array if the stripe-unit size is set to 8 KB or 16 KB.

Supported RAID levels

Disk arrays are used to improve performance and reliability. The amount of improvement depends on the application programs that you run on the server and the RAID levels that you assign to the logical drives.

The ServeRAID controllers support RAID level-0, RAID level-1, Enhanced RAID level-1 (1E), RAID level-5 and Enhanced RAID level-5 (5E).

Understanding RAID level-0

RAID level-0 stripes the data across all the drives in the array. This offers substantial speed enhancement, but provides for no data redundancy. RAID level-0 provides the largest capacity of the RAID levels offered, because no room is taken up for redundant data or data-parity storage.

RAID level-0 requires a minimum of one drive and, depending upon the stripe-unit size, supports a maximum of eight or 16 drives.

The following illustration shows an example of a RAID level-0 logical drive.

You start with two physical drives.
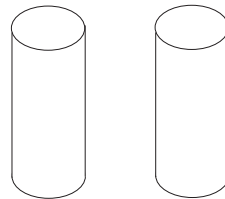
Create an array using the two physical drives.
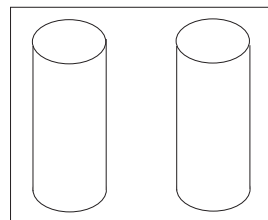
Then, create a logical drive within that array.
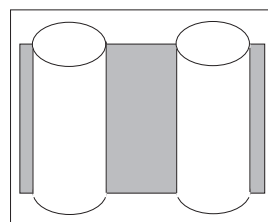
The firmware stripes data across the drives, creating blocks.

Notice that the data is striped across all of the drives in the array, but no redundant data is stored.
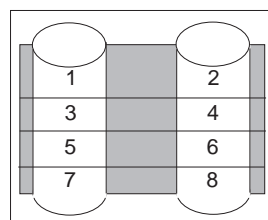
A hard disk drive failure within the array results in loss of data in the logical drive assigned RAID level-0, but only in that logical drive. If you have logical drives in the same array assigned to other RAID levels (1, 1E, 5, or 5E), they will not lose any data.

Note: If your array contains one physical drive, you only can assign RAID level-0.

When you replace a failed drive, the ServeRAID controller rebuilds all of the RAID level-1 and RAID level-5 logical drives automatically onto the replacement hard disk drive. However, any data stored in a failed RAID level-0 logical drive is lost.

Though the risk of data loss is present, you might want to assign RAID level-0 to one of the logical drives to take advantage of the speed offered with this RAID level. You could use this logical drive to enter data that you back up each day and for which safety is not of primary importance, such as data that you can easily re-create. You also might want to use a RAID level-0 logical drive when the work you are doing requires maximum capacity.

Understanding RAID Level-1

RAID level-1 provides 100% data redundancy and requires only two hard disk drives. With RAID level-1, the first half of a stripe is the original data, and the second half of a stripe is a *mirror* (copy) of the data, but written to the other drive in the RAID level-1 array.

Because the data is mirrored, the capacity of the logical drive when assigned RAID level-1 is 50% of the array capacity.

The following illustration shows an example of a RAID level-1 logical drive.
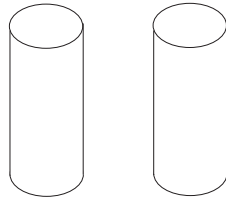
You start with two physical drives.

Create an array using the two physical drives.
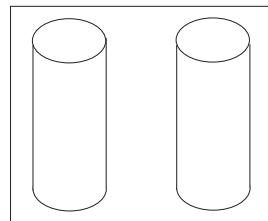
Then, create a logical drive within that array.
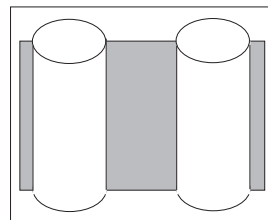
The firmware stripes data across the drives, creating blocks.

Notice that the data on the drive on the right is a mirror copy of the drive on the left.
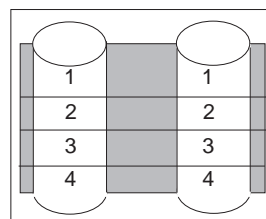
If one of the hard disk drives fails in this example, the ServeRAID controller switches read and write requests to the remaining functional drive in the RAID level-1 array.

Understanding Enhanced RAID Level-1

If you have three or more hard disk drives in the array, you can no longer select RAID level-1, but you can select Enhanced RAID level-1 (also called RAID level-1E).

RAID level-1E combines mirroring with data striping. This RAID level stripes data and copies of the data across all of the drives in the array. As with the standard RAID level-1, the data is mirrored, and the capacity of the logical drive is 50% of the array capacity.

RAID level-1E requires a minimum of three drives and, depending upon the stripe-unit size, supports a maximum of eight or 16 drives.

The following illustration is an example of an Enhanced RAID level-1 logical drive.

You start with three physical drives.
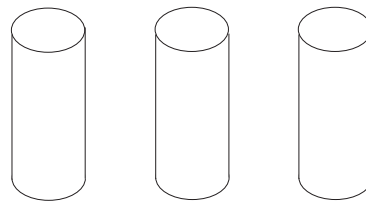
Create an array using the physical drives.
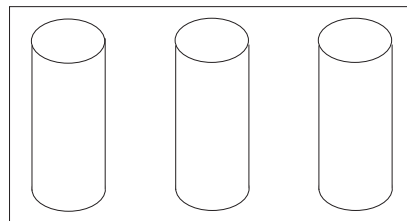
Then, create a logical drive within that array.
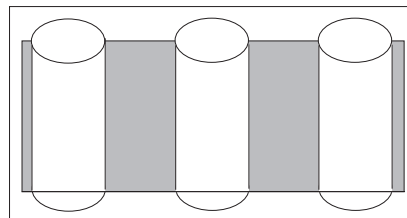
The firmware stripes data across the drives, creating blocks.

Notice that the stripe labeled with $*$ is the data stripe and the stripe labeled with $* *$ is the mirror, or copy, of the preceding data stripe. Also notice that each block on the mirror stripe is shifted one drive.
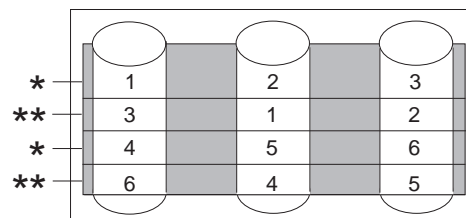
1	2	3
3	1	2
4	5	6
6	4	5

$*$
$**$
$*$
$**$

If one of the hard disk drives fails in this example, the ServeRAID controller switches read and write requests to the remaining functional drives in the RAID level-1E array.

Understanding RAID Level-5

RAID level-5 requires a minimum of three hard disk drives. This RAID level stripes data and parity across all drives in the array. When an array is assigned RAID level-5, the capacity of the array is reduced by one drive (for data-parity storage).

RAID level-5 is generally the most desirable choice, because it offers both data protection and increased throughput. RAID level-5 gives you higher capacity than RAID level-1, but RAID level-1 offers better performance.

The RAID level-5 requires a minimum of three drives and, depending upon the stripe-unit size, supports a maximum of eight or 16 drives.

The following illustration is an example of a RAID level-5 logical drive.

You start with four physical drives.
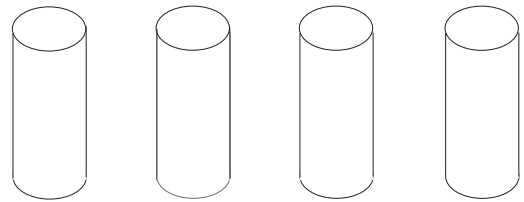
Create an array using three of the physical drives and leaving the fourth as a hot-spare.
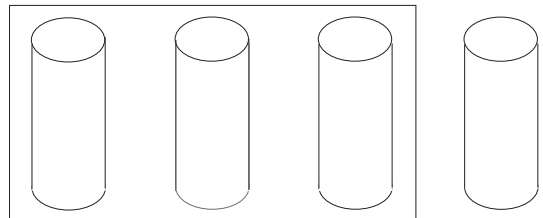
Then, create a logical drive within that array.
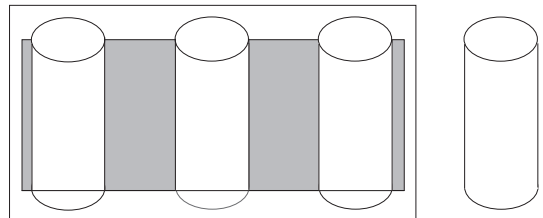
The firmware stripes data across the drives, creating blocks.

Notice that the storage of the data parity (denoted by $*$) also is striped, and it shifts from drive to drive.

A parity block (denoted by $*$) is calculated from the data on other blocks in the same stripe.

*	1	2
3	*	4
5	6	*
*	7	8
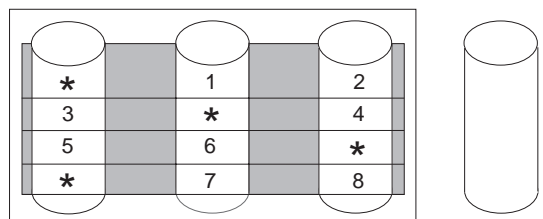
If a hard disk drive fails in the array in this example, the ServeRAID controller switches read and write requests to the remaining functional drives in the RAID level-5 array until the hot-spare finishes rebuilding.
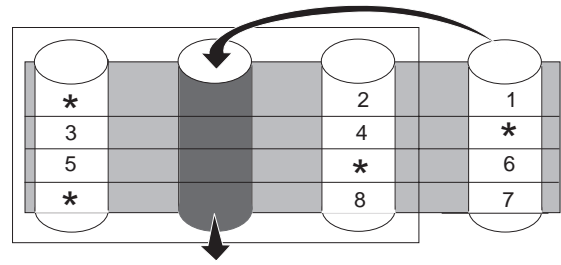
Understanding Enhanced RAID Level-5

Enhanced RAID level-5 (also called RAID level-5E) requires a minimum of four hard disk drives.

RAID level-5E also is firmware-specific. You can think of RAID level-5E as RAID level-5 with a built in spare drive.

Reading from, and writing to, four disk drives is more efficient than three disk drives and, therefore, improves performance. Additionally, the spare drive is actually part of the RAID level-5E array, as shown in the following example below. With such a configuration, you cannot share the spare drive with other arrays. If you want a spare drive for any other arrays, you must have another spare drive for those arrays.

Like RAID level-5, RAID level-5E stripes data and parity across all of the drives in the array. When an array is assigned RAID level-5E, the capacity of the logical drive is reduced by the capacity of two physical drives in the array (that is, one for parity and one for the spare).

RAID level-5E is a very desirable choice, because it offers both data protection and increased throughput, in addition to the built-in spare drive.

Note: For RAID level-5E, you only can have one logical drive in the array. When using RAID level-5E, you can have a maximum of only seven logical drives on the controller.

RAID level-5E requires a minimum of four drives and, depending upon the stripe-unit size, supports a maximum of eight or 16 drives.

The following illustration is an example of a RAID level-5E logical drive.

You start with four physical drives.
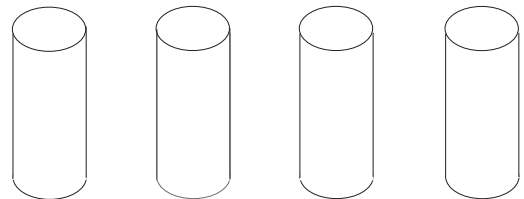
Create an array using all of the physical drives.
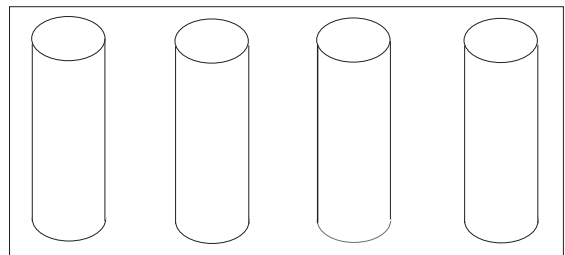
Then, create a logical drive (labeled as 1) within that array.

Notice that the distributed spare drive is the free space (labeled as 2) below the logical drive.
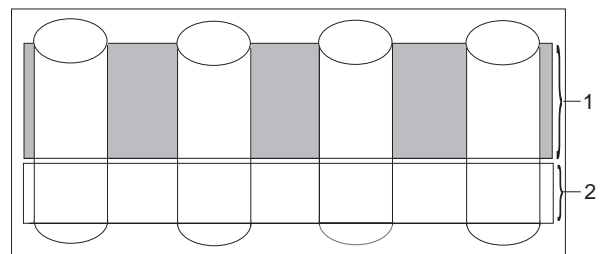
The firmware stripes data across the drives, creating blocks in the logical drive.

The storage of the data parity (denoted by $*$) is striped, and it shifts from drive to drive as it does in RAID level-5.

Notice that the spare drive in the free space is **not** striped.
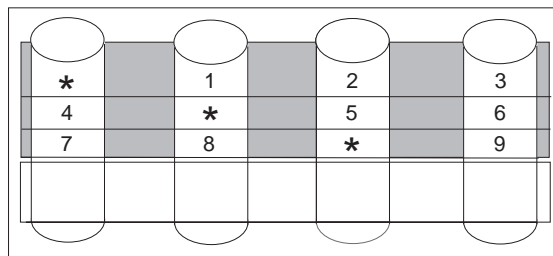
If a hard disk drive fails in the array, the data from the failed drive is compressed into the distributed spare drive. The logical drive remains RAID level-5E.

When you replace the failed drive, the data for the logical drive decompresses and returns to the striping scheme as seen in the previous figure.
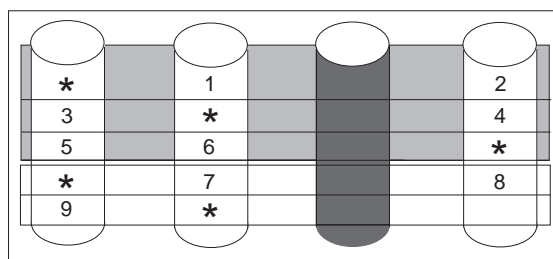
Note: Express Configuration does not default to RAID level-5E. If the user has four hard disk drives, Express Configuration defaults to RAID level-5.

Selecting a RAID level and performance turning

When selecting a RAID level for your system, consider the following:

RAID level	Data Redundancy	Hard Disk Drive Capacity Utilization	Read Performance	Write Performance	Built-in Spare Drive
RAID level-0	No	100%	Excellent	Excellent	No
RAID level-1	Yes	50%	Very Good	Very Good	No
RAID level-1E	Yes	50%	Very Good	Very Good	No
RAID level-5	Yes	67% to 94%*	Excellent	Good	No
RAID level-5E	Yes	50% to 88%*	Excellent	Good	Yes

* Depending on the number of hard disk drives in the array.

Chapter 2. Installing and cabling a ServeRAID controller

This chapter provides installation and cabling instructions for the ServeRAID-3H and ServeRAID-3L controllers. Basic information about the standard features of these controllers is also included.

You will not need the information in this chapter if you are using a ServeRAID controller on an IBM Netfinity or PC Server system board.

This chapter contains:

Controller features

Standard features of the ServeRAID-3H and ServeRAID-3L controllers are as follows.

Feature	ServeRAID-3HB	ServeRAID-3H	ServeRAID-3L
Arrays (max.)	8	8	8
Battery-Backup Write Cache	Yes	No	No
Cache Memory	32 MB	32 MB	4 MB
Hard Disk Drives (max.)	45	45	15
Logical Drives (max.)	8	8	8
Microprocessor	40 MHz	40 MHz	25 MHz
SCSI Channels	3	3	1
SCSI Transfer Speed (max.)	80 MB /sec.	80 MB /sec.	80 MB /sec.
Supported RAID Levels	0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E)	0, 1, 5, Enhanced-1 (1E), Enhanced-5 (5E)	0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E)
System PCI Data Bus	64 bit	64 bit	32 bit

Connector locations

This section provides illustrations of the channel connectors and cable connectors for the ServeRAID-3H, ServeRAID-3HB, and ServeRAID-3L controllers.

The light-emitting diodes (LEDs) on the controllers indicate activity on the SCSI channels and provide diagnostic information for trained service technicians.

ServeRAID-3L controller

The ServeRAID-3L controller has two channel connectors: one internal and one external. These channel connectors share the same SCSI bus. You can attach SCSI devices to either the internal or external channel connector, but you cannot attach devices to both connectors simultaneously.
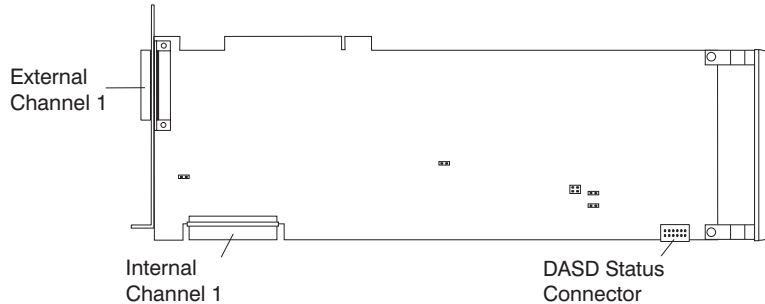
Figure 1. ServeRAID-3L Controller

ServeRAID-3H and ServeRAID-3HB controller

The ServeRAID-3H and ServeRAID-3HB controllers have three independent SCSI channel connectors: Channel 1, Channel 2, and Channel 3. Each of these SCSI channels support up to 15 physical devices.

Note: Only the ServeRAID-3HB controller comes with the battery-backup cache standard. It is an option for the ServeRAID-3H.
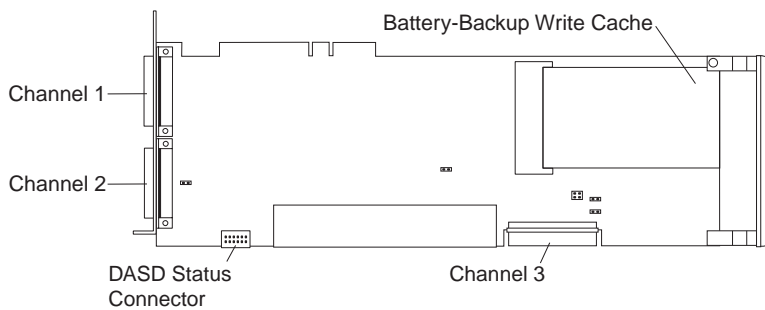
Figure 2. ServeRAID-3H Controller

You can attach internal SCSI devices to the Channel 3 connector, and you can attach external SCSI devices to the Channel 1 and Channel 2 connectors.

If you want to attach external SCSI devices to the Channel 3 connector, use the following illustration to help you install the ServeRAID Channel 3 Cable kit.
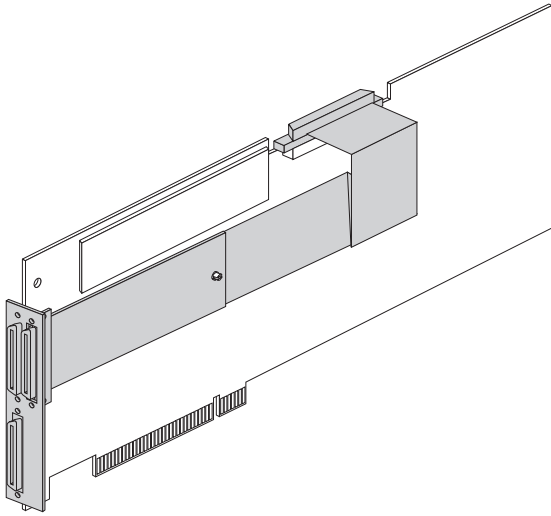
Figure 3. ServeRAID Controller with the Channel 3 Cable Installed

To protect your data when using the write-back mode, the ServeRAID-3HB controller comes with battery-backup write cache standard (it is an option for the other ServeRAID controllers). This device protects the data being stored in the ServeRAID cache memory during a power outage or failure.

Installing the ServeRAID controller

During the installation, you might need a small, flat-blade screwdriver and the documentation that comes with your server.

To install the ServeRAID-3H or ServeRAID-3L controller:

1. Review the Safety Information provided with your IBM server.

   Note: Some IBM Netfinity servers support hot-swap PCI features, which allow you to install or remove PCI controllers without turning off the server. Review the information provided with your server to determine if your model supports these features. If your Netfinity model provides hot-swap PCI support, you do not need to turn off your server to install this controller.

2. If your server model does not support hot-swap PCI, turn off the server; then, disconnect all power cords and cables from the server.

3. Remove the server cover and locate an empty PCI expansion slot for the controller. Choose a slot with the most clearance from any other installed components, such as the microprocessor. If necessary, see your server documentation for more detailed information about the expansion slots.

   Note: For Netfinity 3000 servers, the ServeRAID controllers are supported only when installed in PCI slot 3. *Do not* install these controllers in PCI slots 1 or 2. Before you can install a ServeRAID controller in a Netfinity 3000, you must first remove the standard SCSI controller that comes in PCI slot 3. You can install and use the standard SCSI controller in PCI slots 1 or 2, but devices attached to the standard SCSI controller will no longer provide startup (boot) support.

4. Remove the expansion-slot cover, if applicable.

5. Touch the static-protective package containing the controller to a metal expansion-slot cover on the server. This reduces any static electricity from the package and from your body.

6. Remove the controller from the static-protective package, holding the controller by the edges. Do not touch any exposed components on the controller.

7. Insert the controller in the PCI expansion slot. Press the controller firmly into the slot so that it is fully seated in the slot.

8. Secure the controller by either tightening the expansion-slot screw on the top of the controller or closing the latch, depending on your server.

9. Connect the SCSI cables to the controller. If you intend to attach external devices only, go to step 13. Otherwise, continue with step 10.

10. Connect one end of a 68-pin VHDCI[2] SCSI cable (separately purchased or already in your server) to the internal channel connector on the ServeRAID controller.

    Note: See "Connector locations" on page 14 for the channel connector locations.

11. Connect the other end of the SCSI cable to the hot-swap backplane or to a SCSI device in the server. (See your server documentation or the system label inside the server cover for the location of the SCSI connector on the backplane.)

    Note: When the ServeRAID controller and a SCSI CD-ROM drive are connected to the same SCSI bus (cable), you must enable the ServeRAID bootable (startable) CD-ROM feature before the controller can start a bootable CD-ROM. See "Setting the bootable CD-ROM feature" on page 46 for more information.

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[2] VHDCI stands for Very High Density Connector Interface.

12. If you have drives to install, install them now. See your server documentation for drive installation instructions.

   Notes:

   a. The ServeRAID controllers use SCSI ID 7.

   b. Removable-media devices (such as a CD-ROM) connected to the same ServeRAID controller must all have unique SCSI IDs, even when they are connected to different channels. For example, if you have a CD-ROM drive on Channel 1 set to SCSI ID 6, you must not have a tape drive on Channel 2 or Channel 3 of the same ServeRAID controller set to SCSI ID 6.

13. Install the server cover.

14. If you disconnected the cables and power cords in step 2 on page 17, reconnect the cables and cords. See your server documentation if you need detailed instructions.

15. If you want to attach an external SCSI device to the ServeRAID controller, continue with "Connecting external devices." Otherwise, go to Chapter 3, "Using the configuration programs" on page 19.

Connecting external devices

To attach SCSI devices to an external channel connector on the ServeRAID controller:

1. Connect one end of a 68-pin VHDCI SCSI cable to an external channel connector on the ServeRAID controller.

   Note: See "Connector locations" on page 14 for the channel connector locations.

2. Connect the other end of the SCSI cable to the external SCSI device.

3. Go to Chapter 3, "Using the configuration programs" on page 19.

Chapter 3. Using the configuration programs

This chapter provides instructions for using the IBM ServeRAID Configuration and Mini-Configuration Programs. You can use the information in this chapter and the online information in the configuration programs when configuring one or more devices attached to a ServeRAID controller. If you intend to install an operating system on a logical drive on the ServeRAID controller, you must use the IBM ServeRAID Configuration Program to configure your disk arrays *before* you install the operating system or store data on any hard disk drives attached to the ServeRAID controller.

This chapter contains

Using the ServeRAID Configuration Program

The graphical interface in the ServeRAID Configuration Program makes it easy for you to create, delete, change, or view your ServeRAID configuration.

Before you begin, review the following illustration to become familiar with the layout of the configuration program screens.
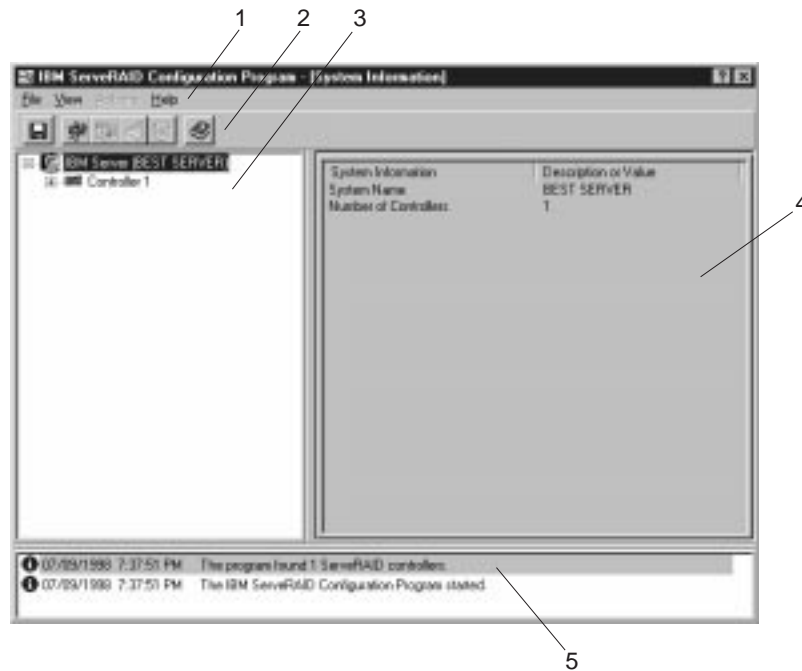
Figure 4. ServeRAID Configuration Screen Layout

Descriptions of the numbered areas are as follows:

1. Menu Bar   Provides standard File, View, Actions, and Help pull-down menus. See "Using the Menu Bar" on page 32 for more information.

2. Tool Bar   Provides quick-path icons for common tasks. The icons from left to right are Save the Configuration Event Log, Configure the ServeRAID Controller, Configure for Clustering, Scan for New or Removed Ready Drives, Create an Array, and Help. See "Using the Tool Bar" on page 31 for more information.

3. Main Tree   Provides an expandable tree view of your ServeRAID subsystem. You will perform most of your ServeRAID configuration and maintenance tasks by first selecting the ServeRAID controller, array, logical drive, hot-spare drive, or physical drive objects from this Main Tree.

4. Main Panel   Provides specific device information or configuration instructions. When the configuration program is in the Information mode and you select an object from the Main Tree, detailed information about the object appears in this panel. When the configuration program is in the Configuration mode, the instructions needed to configure your ServeRAID subsystem appear in this panel.

5. Event Viewer   Provides advisory and progressive-status information and messages during the ServeRAID configuration process. Each message appears with a time stamp, a date stamp, and an icon that classifies the severity of the event.

Starting the Configuration Program

The ServeRAID Configuration Program runs in two modes: the *Configuration* mode and the *Information* mode.

In the Configuration mode, you can create disk arrays, create logical drives, and define your hot-spare drives. When this mode is active, only a limited set of functions is available from the Menu and Tool Bars. See "Using the Configuration Mode" on page 22 for more information.

In the Information mode, you can view and modify the existing device and configuration information for your ServeRAID subsystem. When this mode is active, you can use the functions available from the Menu and Tool Bars to customize settings for your ServeRAID controllers. See "Using the Information Mode" on page 26 for more information.

The ServeRAID Configuration Program is provided on the *IBM ServeRAID Configuration and Management CD* packaged with the ServeRAID controller, and it also is provided with the CDs packaged with some IBM server models.

Notes:

1. If you are configuring a ServeRAID controller on a system board, see the installation instructions and CDs provided with your server for information about starting the configuration programs for the server.

2. To gain access to the ServeRAID Configuration or Mini-Configuration programs, you must restart the server.

To start the configuration program:

1. Insert the *IBM ServeRAID Configuration and Management CD* (or the CD that contains the ServeRAID Configuration Program that came with your server) into the CD-ROM drive; then, turn on the server.

    One of the following screens will appear:

    • If the configuration program detects unconfigured ServeRAID controllers, the program starts in the Configuration mode and a screen similar to the following appears.
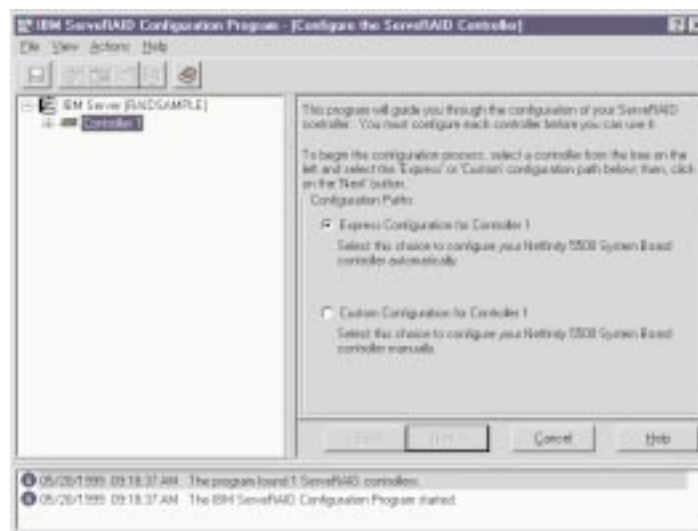
Figure 5. Configuration Mode Screen

Click on the **Cancel** button if you do not wish to configure your ServeRAID controller. This will switch the program from the Configuration mode to the Information mode.

- If the configuration program detects that all ServeRAID controllers in the server are configured, the program starts in the Information mode and a screen similar to the following appears.

Figure 6. Information Mode Screen

Click on the icon on the Tool Bar to switch from the Information mode to the Configuration mode.

2. Continue with one of the following:

- "Using the Configuration Mode"
- "Using the Information Mode" on page 26

Using the Configuration Mode

You can use the Configuration mode to create up to eight independent disk arrays for each ServeRAID controller. The Configuration mode provides two configuration paths: *Express Configuration* and *Custom Configuration*.

Learning about Express Configuration

Express Configuration provides a quick and easy path for you to automatically configure your ServeRAID controller. This choice creates the most efficient ServeRAID configuration based on the number and capacity of the Ready drives available in your system. If four or more Ready drives of the same capacity are available, this choice also will define a *hot-spare drive* for the ServeRAID controller. A hot-spare drive is a physical drive that is defined for automatic use when a similar drive fails.

The Express Configuration choice groups all Ready drives of the same capacity into one or more disk arrays and defines one logical drive for each array. This choice defines the size of the logical drive, based on the amount of free space available, and it assigns the highest RAID level possible, based on the number of physical drives available.

For example, if your server contains one 1024 MB Ready drive, two 2150 MB Ready drives, and four 4300 MB Ready drives, Express Configuration will create three arrays and one hot-spare drive such as the following:

Array A: The total capacity of this array is 1024 MB (1 x 1024 MB) and it contains one 1024 MB RAID level-0 logical drive.

Array B: The total capacity of this array is 4300 MB (2 x 2150 MB) and it contains one 2150 MB RAID level-1 logical drive.

Array C: The total capacity of this array is 12900 MB (3 x 4300 MB) and it contains one 8600 MB RAID level-5 logical drive.

Hot Spare: Express Configuration defines one of the four 4300 MB drives as a hot-spare drive.

> **Note:** A hot-spare drive must be of equal or greater capacity than the drive that it is intended to replace. In this configuration, the 4300 MB drive can replace any failed drives in Array B or Array C.

Using Express Configuration

To use the Express Configuration path:

1. Click on the ServeRAID controller that you want to configure in the Main Tree.

2. If it is not already selected, click on the **Express Configuration** radio button.

3. Click on the **Next** button.

4. Review the information that appears on the Configuration Summary screen.

   Notes:

   a. Some operating systems have size limitations for logical drives. Before you save the configuration, you might want to verify that the size of the logical drive is appropriate for your operating system. See your operating-system documentation for more detailed information.

   b. To change the configuration, click on a **Modify** icon button.

5. Click on the **Apply** button to accept and save the configuration. The configuration is saved in the ServeRAID controller and in the physical drives.

6. If you have multiple controllers repeat steps 1 to 5 for each controller.

7. When you have completed configuration, close the configuration program and remove the CD-ROM from the CD-ROM drive.

8. Restart the system.

9. If you have not already done so, install your operating system. See the server documentation or the documentation provided with your operating system for more information.

After you install your operating system, see Chapter 4, "Installing device drivers and utility programs" on page 47 (or see the installation instructions provided with your server) for information about installing the ServeRAID device drivers and utility programs.

Learning about Custom Configuration

The Custom Configuration path allows you to manually configure your ServeRAID subsystem. Using this path, you can select the drives that you want to include in each array, define the number and size of the logical drives for each array, and select the drives that you want to use as hot spares.

Before you select the Custom Configuration path, consider the following:

- If you are not familiar with the IBM implementation of RAID technology, you might want to review the information provided in "Understanding RAID technology" on page 4 before you begin.

- Each ServeRAID controller supports a maximum of eight arrays.

- Each ServeRAID controller supports a maximum of eight logical drives.

When you create an array, you group hard disk drives into one storage area. You can define this storage area as a single *logical* drive, or you can subdivide it into several logical drives. Each logical drive appears to the operating system as a single physical hard disk drive.

If you have only one array, you can define it as a single logical drive, or you can divide it into several logical drives. Typically, the first logical drive defined on the first ServeRAID controller found by the basic input/output system (BIOS) during startup will be your startup (boot) drive.

If you have two or more arrays, each array can be one logical drive, or you can divide each array into multiple logical drives, as long as the total number of logical drives for all of the arrays does not exceed eight.

Note: Independent of the RAID logical drives, most operating systems allow you to partition the logical drives further.

- The optimal way to create arrays is to use hard disk drives that have the same capacity.

  Hard disk drive capacities influence the way you create arrays. Drives in an array can be of different capacities (1 GB[3], or 2 GB, for example), but RAID controllers treat them as if they all have the capacity of the *smallest* disk drive.

  For example, if you group three 1 GB drives and one 2 GB drive into an array, the total capacity of the array is 1 GB times 4, or 4 GB, not the 5 GB physically available. Similarly, if you group three 2 GB drives and one 1 GB drive into an array, the total capacity of that array is 4 GB, not the 7 GB physically available.

- A hot-spare drive is a disk drive that is defined for automatic use in the event of a drive failure. The hot-spare drive must be of equal or greater capacity than the drive that it is intended to replace. If a physical drive fails and it is part of a RAID level-1, RAID level-1E, RAID level-5, or RAID level-5E logical drive, the ServeRAID controller automatically starts to rebuild the data on the hot-spare drive.

- You can include a maximum of 16 physical drives in an array when the stripe-unit size is set to 8 KB (the default setting) or 16 KB, and you can include a maximum of 8 physical drives in an array when the stripe-unit size is set to 32 KB or 64 KB. (See "Stripe-Unit size" on page 4 and page 34 for more information.)

Using Custom Configuration

To use the Custom Configuration path:

1. Click on the ServeRAID controller that you want to configure in the Main Tree.

2. Click on the **Custom Configuration** radio button.

3. Click on the **Next** button.

4. Using the right mouse button, click on the drive or SCSI Channel icons in the Main Tree to select the drives that you want to add to your arrays, delete from your arrays, or define as hot-spare drives; then, select a choice from the pop-up list.

   or

   Drag the drive or SCSI Channel icon from the Main Tree and drop it on the Array or Hot-Spare Drive icon in the Main Panel on the right. If you change your mind, you can drag the icons back to the Main Tree to remove them from the configuration.

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[3] When referring to hard-disk-drive capacity, GB means approximately 1 000 000 000 bytes; total user-accessible capacity may vary depending on operating environment.

5. After you select the physical drives for your arrays and define your hot-spare drives, click on the **Next** button.

   If you change your mind, you can:

   - Remove a specific drive from a newly defined array or delete an entire newly defined array. To do this, click on the **Back** button, use the right mouse button to click on the specific drive or Array icon in the Main Panel on the right, and then select **Remove from New Array** or **Delete New Array**.

   - Remove a specific hot-spare drive or all newly defined hot-spare drives. To do this, click on the **Back** button, use the right mouse button to click on the Hot-Spare Drive icon in the Main Panel on the right, and then select **Remove New Hot-Spare Drive** or **Remove All New Hot-Spare Drives**.

6. Select a RAID level for the logical drive from the RAID pull-down menu in the Main Panel. (See "Supported RAID levels" on page 5 for descriptions of the supported levels.)

7. Move the sliding bar in the Main Panel from right to left to allot data and parity space for the logical drive, or type in the size in the data field.

   Notes:

   a. You can define from one to eight logical drives.

   b. Some operating systems have size limitations for logical drives. Before you save the configuration, you might want to verify that the size of the logical drive is appropriate for your operating system. See your operating-system documentation for more detailed information.

   c. Typically, the first logical drive defined on the first ServeRAID controller found by system BIOS during startup will be your startup (boot) drive.

8. If free space is available and you want to define another logical drive, click on the **Add Logical Drive** notetab in the Main Panel.

9. Repeat steps 6, 7, and 8 for each logical drive that you want to define in this array; then, continue with step 10.

10. If you are defining multiple arrays, click on the next New Array tree node; then, repeat steps 6, 7, 8 and 9. When you are finished, go to step 11.

11. Click on the **Next** button.

12. Review the information that appears on the Configuration Summary screen.

    Note: To change the configuration, click on a **Modify** icon button.

13. Click on the **Apply** button to accept and save the configuration. The configuration is saved in the ServeRAID controller and on the physical drives.

14. If you have multiple controllers, repeat steps 1 to 13 for each controller.

15. When you have completed configuration, close the configuration program and remove the CD-ROM from the CD-ROM drive.

16. Restart the system.

17. If you have not already done so, install your operating system. See the server documentation or the documentation provided with your operating system for more information.

After you install your operating system, see Chapter 4, "Installing device drivers and utility programs" on page 47 (or the installation instructions provided with your server) for information about installing the ServeRAID device drivers and utility programs.

Using the Information Mode

You can use the Information mode to view the configuration information, ServeRAID controllers, arrays, logical drives, hot-spare drives, and physical drives that make up your ServeRAID subsystem. You also can use this mode to change some of the ServeRAID controller settings.

Viewing the device and configuration information

To view the current settings:

1. Click on the plus (+) box next to the object in the Main Tree to expand that portion of the tree.

2. Click on the icon for the server, ServeRAID controller, array, logical drive, hot-spare drive, or physical drive to view its current settings.

Detailed information about the selected device will appear in the Main Panel on the right. The following pages provide descriptions of the device information that might appear.

System Information Panel

When you select the server from the Main Tree, the following information appears in the Main Panel on the right:

- **System Name** shows the name you assigned to the server.

- **Number of Controllers** shows the total number of ServeRAID controllers found in the server.

ServeRAID Controller Information Panel

When you select a ServeRAID controller from the Main Tree, the following information appears in the Main Panel on the right:

- **Controller Type** shows the type of ServeRAID controller, such as ServeRAID II, ServeRAID-3H, or ServeRAID-3L.

- **BIOS Version** shows the level of basic input/output system code currently installed for the ServeRAID controller.

- **Firmware Version** shows the level of microcode currently installed for the ServeRAID controller.

- **Physical Slot** shows the actual physical slot location for the ServeRAID controller. This slot number might be labeled on the back of your server.

- **Battery Backup Write Cache** provides information about the battery-backup cache device, if it is installed. Possible values for this selection are Installed, Not Installed, Defective, or Replace Battery.

- **Read-Ahead Cache Mode** shows the current setting, Enabled, Disabled, or Adaptive for the read-ahead cache mode. (See page 34 for information on how to change this setting.)

- **Stripe-Unit Size** shows the current setting of 8 KB, 16 KB, 32 KB, or 64 KB for the stripe-unit size. (See "Stripe-Unit size" on page 4 and page 34 for information on how to change this setting.)

- **Rebuild Rate** shows the current setting (High, Medium, or Low) for the rebuild rate. (See page 34 for more information.)

- **Hot-Swap Rebuild** shows the current setting, Enabled or Disabled, for the hot-swap rebuild feature. This feature is set to Enabled when the level of ServeRAID firmware in use supports this feature.

- **Data Scrubbing** shows the current setting, Enabled or Disabled, for the data-scrubbing feature. This feature is set to Enabled when the level of ServeRAID firmware in use supports this feature. The data-scrubbing feature continuously reads all sectors of RAID level-1, RAID level-1E, RAID level-5, and RAID level-5E logical drives "in the background" while your system is running. If a defective sector is found, it is automatically repaired. With this feature Enabled, you no longer need to synchronize RAID level-1 and RAID level-5 logical drives on a weekly basis.

- **Auto-Synchronization** shows the setting for this feature. The auto-synchronization feature always appears as Enabled when the level of ServeRAID firmware in use supports this feature. With this feature Enabled, you no longer need to manually synchronize RAID level-5 logical drives when they are created.

- **Clustering** shows the current setting, Enabled or Disabled, for this feature.

- **ServeRAID Controller Host ID** appears only when the controller is part of a shared-disk cluster or a failover pair.

- **Cluster Partner Host ID** appears only when the controller is part of a shared-disk cluster or a failover pair.

- **Unattended Mode** shows the current setting, Enabled or Disabled, for the unattended mode. If enabled, the server will start and resolve all ServeRAID configuration conflicts automatically. If disabled, the ServeRAID controller stops if any configuration conflicts are found and shows the user a set of options to perform.

- **Number of Arrays** shows the total number of arrays (1 to 8) defined for this ServeRAID controller.

- **Number of Logical Drives** shows the total number of logical drives (1 to 8) defined for this ServeRAID controller.

- **Number of Hot-Spare Drives** shows the total number of hot-spare drives defined for this ServeRAID controller.

Array Information Panel

When you select the Arrays icon from the Main Tree, general information about all configured arrays (such as size, free space, and number of logical drives in each array) appears in the Main Panel on the right.

When you select a specific array from the Main Tree, the following information appears in the Main Panel on the right:

- **Array Letter** shows the letter (A through H) assigned to the array.

- **Array Size in MB** shows the total size, in MB, of the array.

- **Free Space in MB** shows the amount of free space available in the array.

- **Number of Logical Drives** shows the number of logical drives (1 to 8) defined for the array.

- **Number of Physical Drives** shows the number of physical drives grouped in the array.

Logical Drive Information Panel

When you select a logical drive icon, general information about all configured logical drives (such as size, free space, etc.) appears in the Main Panel on the right.

When you select a specific logical drive from the Main Tree, the following information appears in the Main Panel on the right:

- **Logical Drive Number** shows the number (1 to 8) assigned to the logical drive.

- **Array** shows the letter (A through H) assigned to the array in which the logical drive resides.

- **Drive State** shows the current state of the logical drive. See "Logical drive state descriptions" on page 29 for descriptions of the states that might appear in this field.

- **RAID Level** shows the RAID level (0, 1, 1E, 5, or 5E) assigned to the logical drive.

- **Data Space in MB** shows the amount of space in the logical drive defined for data storage.

- **Parity Space in MB** shows the amount of space in the logical drive allocated for parity storage.

- **Date Created** shows the date that you created the logical drive.

- **Write-Cache Mode** shows the current setting, write through or write back, for the logical drive.

- **Battery Backup Write Cache** shows the current setting, Enabled or Disabled, for the battery backup cache device. When the battery backup cache device is installed, write cache is set to the write-back mode.

- **Merge-Group Number** appears if the ServeRAID controller is part of a cluster. The valid settings in the Shared state are 1 through 8. Valid settings in the Non-Shared state are 201 through 215.

- **Merge-Group State** shows the current setting, Shared or Non-Shared, for this parameter.

Hot-Spare Drive Information Panel

When you select the Hot-Spare Drives icon from the Main Tree, information about the total number of functional hot-spare and standby hot-spare drives defined for the ServeRAID controller appears in the Main Panel on the right.

When you select a specific hot-spare drive from the Main Tree, the following information appears in the Main Panel on the right:

- **SCSI ID** shows the SCSI ID assigned to the drive.

- **Channel** shows the SCSI channel to which the hot-spare drive is attached.

- **Drive Type** shows the type of physical drive. For a hot spare, this will always appear as Hard Disk Drive.

- **Size in MB** shows the total capacity of the hard disk drive in MB.

- **Drive State** shows the drive state. For a hot spare, this will always appear as Hot Spare.

- **Vendor** shows characters that represent the drive manufacturer.

- **Product or Model Number** shows characters that represent the product or model number for the drive.

- **Serial Number** shows the serial number for the drive.

- **Firmware Level** shows the current level of microcode in use for the drive.

- **PFA Error** indicates the status, Yes or No, for predictive-failure analysis® alerts. Yes indicates that PFA errors were detected and that you should plan to replace the device. No indicates that PFA errors were not found.

Physical Drive Information Panel

When you select the Physical Drives icon from the Main Tree, information about the total number of drives connected to each channel of the ServeRAID controller appears in the Main Panel on the right.

When you select a specific physical drive from the Main Tree, the following information appears in the Main Panel on the right:

- **SCSI ID** shows the SCSI ID assigned to the drive.
- **Channel** shows the SCSI channel to which the physical drive is attached.
- **Drive Type** shows the type of physical drive (Hard Disk Drive, CD-ROM, Tape, Enclosure, Removable-Media, or Unknown) selected.
- **Drive State** shows the current state of the physical drive. See "Physical drive state descriptions" on page 30 for descriptions of the states that might appear in this field.
- **Size in MB** shows the total capacity of the drive, in MB, if the drive is a hard disk. No value will appear if the physical drive is a CD-ROM, Tape drive, or expansion enclosure.
- **Array Letter** shows the letter (A through H) assigned to the array in which the physical drive resides, if the physical drive is part of an array.
- **Vendor** shows characters that represent the drive manufacturer.
- **Product or Model Number** shows characters that represent the product or model number for the drive.
- **Serial Number** shows the serial number for the drive.
- **Firmware Level** shows the current level of microcode in use for the drive.
- **PFA Error** indicates the status, Yes or No, for predictive-failure alerts. Yes indicates that PFA errors were detected and that you should plan to replace the device. No indicates that PFA errors were not found.

Drive states

This section provides descriptions of the logical and physical drive states.

Logical drive state descriptions: The following table provides descriptions of the valid logical drive states.

Drive State	Meaning
Blocked	During a rebuild operation, the ServeRAID controller sets the state of any RAID level-0 logical drives associated with a failed array to the Blocked state; then, it reconstructs the data that was stored in RAID level-1, RAID level-1E, Raid level-5 and RAID level-5E logical drives. After the Rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. However, the logical drive might contain damaged data. You must either re-create, reinstall, or restore the data from the most recent backup disk or tape to the RAID level-0 logical drive.
Critical Migrating	A logical drive in the critical state that is undergoing a logical drive migration (LDM).
Critical System	The ServeRAID controller uses this reserved state during a logical drive migration (LDM) and the logical drive is in the critical state.

Drive State	Meaning
Critical	A RAID level-1, RAID level-1E, RAID level-5, or level-5E logical drive that contains a defunct physical drive is in the critical state. A critical logical drive is accessible, despite a physical drive failure. **Attention:** If the state of the logical drive is critical, refer to "Rebuilding a defunct drive" on page 147.
Migrating	The logical drive is undergoing a logical drive migration; that is, a change in RAID levels, a change in logical drive size, an increase in free space, or a RAID level-5E compression or decompression.
Offline	The logical drive is offline and not accessible. This state occurs when one of the following is true. • One or more physical drives in a RAID level-0 logical drive is defunct. • Two or more physical drives in a RAID level-1, RAID level-1E, or level-5 logical drive are defunct. • Three or more drives in a RAID level-5E logical drive are defunct. If any of these are true, refer to "Rebuilding a defunct drive" on page 147.
Okay	The logical drive is okay. It is in a good, functional state.
System	The ServeRAID controller uses this reserved state during logical drive migration (LDM).

Physical drive state descriptions: The following table provides descriptions of the valid physical drive states.

Drive State	Meaning
Defunct	A physical hard disk drive in the Online, Hot-Spare, or Rebuild state has become defunct. It does not respond to commands, which means that the ServeRAID controller cannot communicate properly with the drive. If a physical drive has become defunct, refer to "Rebuilding a defunct drive" on page 147.
Hot Spare	A Hot-Spare drive is a hard disk drive that is defined for automatic use when a similar drive fails.
Online	The drive is Online. It is functioning properly and is part of an array.
Rebuilding	The drive is being rebuilt. For more information on rebuilding a drive, refer to "Rebuilding a defunct drive" on page 147.
Ready	The ServeRAID controller recognizes a Ready drive as being available for definition.
Standby	A Standby drive is a hard disk drive that has spun down, a CD-ROM drive, a removable media drive, or an enclosure.
Standby Hot Spare	A Standby Hot Spare is a Hot-Spare drive that the ServeRAID controller has spun down. If an Online drive becomes Defunct and no suitable Hot-Spare drive is available, a Standby Hot-Spare drive of the appropriate size automatically spins up, and enters the Rebuild state.

Changing the ServeRAID configuration settings

To change the settings:

1. Click on the plus (+) box next to the object in the Main Tree to expand the tree.

2. Click on the icon in the Main Tree for the ServeRAID controller, array, logical drive, hot-spare drive, or physical drive that you want to change.

3. Click on **Actions** in the File Menu; then, make a selection from the pull-down menu.

   or

   Using the right mouse button, click on the object in the Main Tree; then, make a selection from the pop-up list.

See "Using the Menu Bar" on page 32 for descriptions of the choices available from the Actions pull-down menu.

Using the Tool Bar

Descriptions of the quick-path icons provided on the Tool Bar are as follows:

Save the Configuration Event Log: This icon appears in the Information mode. When you select this icon, a pop-up window appears and lets you specify a file name and path for the ServeRAID Configuration Event Log.

Note: You might need to update the BIOS code to support this for your server. Updates are available on the World Wide Web. (See page 49 for the instructions needed to access the IBM support page.)
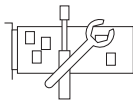
Configure the ServeRAID Controller: This icon appears in the Information mode. When you select this icon, the configuration program switches from the Information mode to the Configuration mode. A message will appear at the bottom of the Main Panel if no Ready drives are available for the selected ServeRAID controller. If this occurs, you can click on the Cancel button to return to the Information mode or select another ServeRAID controller.

Configure for Clustering: This icon appears in the Information mode. You can select this icon to define the ServeRAID controller for use in a dual-node, high-availability, shared-disk cluster environment. Detailed instructions for using the clustering features are provided in the *IBM Netfinity High-Availability Cluster Solution Installation and User's Guide*. You can obtain a copy of this manual at the following address on the World Wide Web:

`http://www.pc.ibm.com/netfinity/clustering`
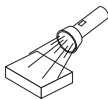
Scan for New or Removed Ready Drives: This icon appears in the Information mode. When you select a ServeRAID controller from the Main Tree and click on this icon, the configuration program will scan the individual channel, or all channels, on the controller for new or removed Ready drives. Use this feature whenever you physically change the configuration of your ServeRAID subsystem, for example, when you physically install or remove one or more SCSI drives.

Create an Array: This icon appears in the Information mode if you select a controller from the Main Tree and that controller has Ready drives available.

Help: This icon appears in both the Information and Configuration modes. Select this icon to access the online ServeRAID Help facility. Task-oriented Help is available from many of the pop-up windows that appear during the configuration process; and, you also can obtain context-sensitive Help by selecting an item and then pressing the **F1** key.

Using the Menu Bar

Descriptions of the choices available from the Menu Bar are as follows:

File   The File pull-down menu contains the following choices in the Information mode:

- **Save Configuration Event Log:** Select this choice to save configuration event information (such as the start time and completion time for a rebuild operation) to a file.

- **Clear Configuration Event Log:** Select this choice to erase the event information stored in the Configuration Event Log.

- **Exit:** Select this choice to exit from the ServeRAID Configuration Program.

View   The View pull-down menu contains the following choices in both the Information and Configuration modes:

- **Small Icons:** This is the default setting. When you select this choice, small icons appear in the Main Tree on the left and the Main Panel on the right.

- **Large Icons:** Select this choice to display large icons in the Main Tree on the left and the Main Panel on the right.

- **Options:** Select this choice to change the Initialization and Synchronization mode, as follows:

  - **Basic:** This is the default setting. When this mode is Enabled, the configuration program automatically initializes each new logical drive and prevents access to the manual initialization and synchronization functions. This choice also forces the synchronization of all new RAID level-5 logical drives attached to older ServeRAID controller models that do not support the auto-synchronization feature.
  - **Advanced:** When Enabled, this choice lets you select to automatically initialize new logical drives and force the synchronization of all new RAID level-5 logical drives before exiting the ServeRAID Configuration Program.

    Attention:
    If you disable Automatic Initialization, the ServeRAID Configuration Program will not initialize each logical drive (by writing zeros to the first 1024 sectors of the logical drive) when it is created. You still must initialize all newly defined logical drives before storing data. If you disable the synchronization feature and the level of firmware being used by the ServeRAID controller does not support the auto-synchronization feature, you still must synchronize all RAID level-5 logical drives before storing data.

Actions All choices available from the Actions pull-down menu also are available from the pop-up lists that appear when you use the right mouse button and click on the object in the Main Tree.

Selecting the ServeRAID controller icon: The following choices appear on the Actions pull-down menu when you select a ServeRAID controller from the Main Tree:

- **Configure the ServeRAID Controller:** This choice is available in the Information mode only. It appears on the pull-down menu when there are Ready drives and logical-drive slots still available for the ServeRAID controller.

- **Restore to Factory Defaults:** This choice is available in both the Configuration and Information modes. Select this choice to delete the ServeRAID controller configuration and reset all parameters to the factory default settings.

  Attention:
  After you restore the factory default settings, you will not have access to any data stored on the logical drives attached to the selected ServeRAID controller.

  This choice deletes the existing configuration information, sets all functional hard disk drives attached to the controller to the Ready state, deletes all logical drives defined for the controller, and resets all parameters to the factory default settings.

- **Copy the Configuration from the Drives to the Controller:** This choice is available in the Information mode only; it copies the configuration information stored on the hard disk drives to the ServeRAID controller. This function is useful when you import previously configured drives from another system, or when you replace the ServeRAID controller.

- **Delete All Arrays:** This choice is available in the Information mode only. It appears on the Actions pull-down menu if arrays are defined for the controller.

- **Configure for Clustering:** This choice is available in the Information mode only. You can select this choice to define the ServeRAID controller for use in a high-availability, shared-disk cluster environment. Detailed instructions for using the clustering features are provided in the *IBM Netfinity High-Availability Cluster Solution Installation and User's Guide*. You can obtain a copy of this manual at the following address on the World Wide Web:

  `http://www.pc.ibm.com/netfinity/clustering`

- **Merge or Unmerge Logical Drives:** This choice is available in the Information mode only. In the event of a failure of one of the two ServeRAID controllers in a failover or cluster environment, you select this choice to unmerge the logical drive or logical drives from the failover or cluster partnership so that you can replace the bad controller. Once the controller is replaced and the system configuration is rebuilt, you can then merge the logical drive or drives back into the failover or cluster partnership.

  Using this selection, you can:

  – Merge Partner Shared Logical Drives
  – Merge Own Shared Logical Drives
  – Unmerge Own Shared Logical Drives
  – Merge Own Nonshared Logical Drives
  – Unmerge Own NonShared Logical Drives

  For more information on failover, refer to "Configuring two ServeRAID 3 controllers in a failover environment (Windows NT 4.0 Only)" on page 37. For more information on clusters, refer to the *IBM Netfinity High Availability for Clustering Using the IBM ServeRAID 3H and 3L ServeRAID Adapters Installation and User's Guide*.

- **Enable Unattended Mode:** This choice is available in the Information mode only. You can select this choice to alter how the ServeRAID startup code (BIOS) handles failures during system startup. Types of failures include: BIOS that cannot communicate with the ServeRAID controller, a physical drive state that has changed, or a logical drive state that has changed.

  You can set the unattended mode to either Enabled or Disabled. The default setting is disabled.

  When unattended mode is disabled and a failure is detected during startup, the server remains at the recovery options screen and waits for the user to respond.

  When unattended mode is enabled and a failure is detected during startup, the server waits for the user to respond within 30 seconds to the recovery options screen. If no user responds, the BIOS automatically selects the first recovery option in the list and continues the system startup process.

- **Enable or Disable Read-Ahead Cache Mode:** These choices are available in the Information mode only.

  You can select this choice if the Adaptive Read-Ahead Cache Mode is not enabled for your controller.

  The default setting is Adaptive. When read-ahead cache is set to Adaptive, the ServeRAID controller continuously evaluates whether to read ahead to the end of the stripe or just read the requested data. Depending on the workload at the time, the method that will provide the best overall performance is automatically selected. For optimal performance, you do not want to override the Adaptive setting for Read-Ahead Cache Mode. However, if you must override the setting, you can do so using IPSSEND utility to set it to Enabled or Disabled.

  When read-ahead cache is set to Enabled, the ServeRAID controller transfers data from a disk to its local cache in increments equal to the stripe-unit size. This provides excellent overall performance when workloads are steady and sequential. However, if the workload is random or the system I/O requests are smaller than the stripe-unit size, reading ahead to the end of the stripe might degrade performance. When read-ahead cache is set to Disabled, the ServeRAID controller transfers data from a disk to local cache in increments equal to the system I/O request size, without reading ahead to the end of the stripe.

- **Change the Rebuild Rate:** This choice is available in the Information mode only. You can select this choice to set the priority for Rebuild operations to High (default), Medium, or Low.

  - When the rebuild rate is set to High, the rebuild I/O request gets high priority in the execution order.

  - When the rebuild request is set from High to Medium in a heavily loaded system, it can increase the rebuild time, but provide better system performance.

  - When the rebuild request is set from High or Medium to Low in a moderate to heavily loaded system, it can increase the disk rebuild time, but provide better system performance.

- **Change the Stripe-Unit Size:** This choice is available in the Information mode only.

  Attention:
  After you configure an array and store data on the logical drives, you cannot change the stripe-unit size without destroying data in the logical drives.

  The stripe-unit size is the amount of data written on a given disk before writing on the next disk. To maximize the overall performance, choose a size that is close to the size of the system I/O request. You can set the stripe-unit size to 8 KB, 16 KB, 32 KB, or 64 KB. When the stripe-unit size is 8 KB (the default setting) or 16 KB, the maximum number of physical drives supported in an array is 16. When the stripe-unit size is 32 KB or 64 KB, the maximum number of physical drives supported in an array is eight. (See "Stripe-Unit size" on page 4 for more information.)

- **Scan for New or Removed Ready Drives:** This choice is available in the Information mode only. When you select this choice, the configuration program scans all channels on the ServeRAID controller for new or removed Ready drives.

- **Identify All Physical Drives:** This choice is available in the Information mode only. When you select this choice, all of the lights on the physical drives connected to the ServeRAID controller will go on.

Selecting the array icon: The following choices appear on the Actions pull-down menu when you select the Arrays icon from the Main Tree:

- **Create an Array:** This choice appears in the Information mode if you select the Arrays icon and Ready drives are available. When you select this choice, the configuration program switches from the Information mode to the Configuration mode.

- **Delete All Arrays:** This choice is available in the Information mode only. It appears on the Actions pull-down menu if you select the Arrays icon from the Main Tree and arrays are defined for the controller.

- **Identify All Arrays:** This choice is available in the Information mode only. When you select this choice, all of the lights on the drives that are part of all of the arrays will go on.

Selecting a specific array icon: The following choices appear on the Actions pull-down menu when you select a specific Array icon from the Main Tree:

- **Delete Array:** This choice is available in the Information mode only. It appears on the Actions pull-down menu when you select a specific array icon from the Main Tree.

- **Identify Array:** This choice is available in the Information mode only. When you select this choice, all of the lights on the drives that are part of the specific array will go on.

Selecting a logical drive icon: The following choices appear on the Actions pull-down menu when you select the Logical Drives icon from the Main Tree:

- **Create a Logical Drive in Array:** This choice appears on the Actions pull-down menu in the Information mode if you select the Logical Drives icon and free space is available in one or more arrays.

- **Identify All Logical Drives:** This choice is available in the Information mode only. When you select this choice, all of the lights on the drives that are part of the logical drive go on.

Selecting a specific logical drive icon: The following choices appear on the Actions pull-down menu when you select a specific Logical Drive icon from the Main Tree:

- **Initialize:** This choice is available in the Information mode only. When you select this choice, the logical drive is initialized if you previously selected Options from the View pull-down menu and disabled the "Automatic Initialization" setting. (For more information, see page 32.)

- **Synchronize:** This choice is available in the Information mode when you select a logical drive from the Main Tree and the following conditions are both true:

  – The ServeRAID controller does not support the auto-synchronization feature.

  – You previously selected Options from the View pull-down menu and disabled the "Synchronize all new RAID level-5 logical drives" setting. (For more information, see page 32.)

  Synchronizing a logical drive verifies that the data redundancy for the logical drive is correct. You must synchronize all RAID level-5 logical drives before storing data. (See page 27 for more information.)

- **Change Write-Cache Mode to Write Through or Write Back:** These choices are available in the Information mode when you select a specific logical drive icon from the Main Tree.

  When this feature is set to the write-through mode, the completion status of a write command is sent *after* the data is written to the hard disk drive. Under certain workloads, you can improve performance by changing this setting to the write-back mode, where the completion status of a write command is sent *after* the data is copied to cache memory, but *before* the data is actually written to the storage device.

  Attention:

  1. You might lose data if a power outage occurs or you restart the system using **Ctrl+Alt+Del** while using the write-back mode without a battery-backup cache device.

  2. If you do not have a battery-backup cache installed and you set this feature to the write-back mode, wait at least 10 seconds after your last operation before you turn off your system or restart the system using **Ctrl+Alt+Del**. Failure to follow this practice can result in lost data.

- **Unblock the Logical Drive:** This choice appears in the Information mode when you select a specific logical drive that is in the Blocked state. You can select this choice to change the Drive Access setting for the RAID level-0 logical drive from Blocked to Unblocked. During a rebuild operation, the ServeRAID controller sets the state of any RAID level-0 logical drives associated with a failed array to the Blocked state.

  After the Rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. However, the logical drive might contain damaged data. You must either re-create, install, or restore the data from the most recent backup disk or tape to the RAID level-0 logical drive.

- **Delete Logical Drive:** This choice is available in the Information mode when you select a logical drive from the Main Tree When you select this choice, the logical drive is deleted from the array. This choice only is available on the last logical drive in the array.

- **Identify Logical Drive:** This choice is available in the Information Mode only. When you select this choice, all of the lights on the drives that are part of the logical drive will go on.

Selecting the hot-spare drive icon: The following choice appears on the Actions pull-down menu when you select a hot-spare drive from the Main Tree:

- **Identify All Hot-Spare Drives:** This choice is available in the Information mode only. When you select this choice, all of the hot-spare lights go on.

Selecting a specific hot-spare drive icon: The following choice appears on the Actions pull-down menu when you select a specific hot-spare drive from the Main Tree:

- **Remove from Hot-Spare State:** This choice is available in the Information mode only. Select this choice to remove a hot-spare drive from the configuration and set the drive state back to Ready.

- **Identify Hot-Spare Drive:** This choice is available in the Information mode only. When you select this choice, the hot-spare drive light goes on.

Selecting a physical drive icon: The following choices appear on the Actions pull-down menu when you select the physical drive icon from the Main Tree:

- **Scan for New or Removed Ready Drives:** This choice is available in the Information mode only. When you select this choice, the configuration program scans all channels on the ServeRAID controller for new or removed Ready drives.

- **Identify All Physical Drives:** This choice is available in the Information mode only. When you select this choice, all of the lights on the physical drives connected to the ServeRAID controller go on.

Selecting a SCSI channel icon: The following choices appear on the Actions pull-down menu when you select a SCSI Channel icon from the Main Tree:

- **Change the SCSI Transfer Speed:** This choice is available in the Information mode only. It appears when you select a SCSI Channel icon. You can select this choice to change the transfer speed from its default value of Optimal. When the transfer speed is set to Optimal, the ServeRAID controller determines the best transfer speed, based on the types of SCSI drives and storage enclosures in use. Choices available are Ultra2 SCSI, UltraSCSI, Fast SCSI 2, and SCSI 2.

- **Scan for New or Removed Ready Drives:** This choice is available in the Information mode only. When you select this choice, the configuration program scans the individual channel or all channels on the ServeRAID controller for new or removed Ready drives.

- **Identify SCSI Channel:** This choice is available in the Information mode only. When you select this choice, all of the lights on the drives that are part of the SCSI channel you have selected will go on.

Selecting a specific physical drive icon: The following choices appear on the Actions pull-down menu when you select a specific physical drive icon from the Main Tree.

- **Set Drive State to Hot Spare:** This choice is available in the Information mode only. It appears when the physical drive that you select from the Main Tree is in the Ready state. You can select this choice to change its state from Ready to Hot Spare.

- **Set Drive State to Online:** This choice appears in the Information mode, and you can use it to change the state of a drive from Defunct to Online. This only is available if you cannot rebuild the array.

   Attention:
   You might lose data by setting a Defunct physical drive that is part of an array to Online.

- **Replace Drive and Rebuild:** This choice is available in the Information mode only. Select this choice when you want to physically remove a defunct drive from the system and install a good one. If you have a defunct drive, refer to "Rebuilding a defunct drive" on page 147.

- **Remove Defunct Drive:** This choice appears in the Information mode only. After you physically remove a drive, select this choice to delete the drive information from the configuration. If you have a defunct drive, refer to "Rebuilding a defunct drive" on page 147.

- **Replace Defunct Drive:** This choice appears in the Information mode only.

   Note: Always replace a defunct drive with a drive of equal or greater capacity.

   If you have a defunct drive, refer to "Rebuilding a defunct drive" on page 147.

- **Identify Physical Drive:** This choice is available in the Information mode only. When you select this choice, the light on the physical drive goes on.

Help   The following choices are available from the Help pull-down menu:

- **Contents:** Select this choice to access the online Help facility. This choice is available in both the Information and Configuration modes. Task-oriented Help is available from many of the pop-up windows that appear during the configuration process; and, you also can obtain context-sensitive Help by selecting an item and then pressing the **F1** key.
- **About:** Select this choice to view the version number and copyright information for the ServeRAID Configuration Program. This choice is available in both the Information and Configuration modes.

Configuring two ServeRAID 3 controllers in a failover environment (Windows NT 4.0 Only)

You can now configure two ServeRAID 3 controllers in a failover environment when using Windows NT 4.0.

Note: When using the Windows NT version of the ServeRAID Administration and Monitoring Utility in a failover environment, you will see only the active controller in the failover pair on the screen.

The latest version of the ServeRAID 3 device driver includes *fault tolerant* technology. With fault tolerance, two controllers can be paired and connected to the same enclosure in order to provide access to the disk, even after an controller fails.

Hardware requirements

In order to perform fault tolerance with ServeRAID 3, you must use one of the following enclosures:

- IBM PC Server Enterprise Expansion Enclosure (3518), using IBM SCSI-2 Fast/Wide Enhanced Repeater Adapter
- IBM Netfinity Rack Drawer Enclosure (3519), using IBM SCSI-2 Fast/ Wide Enhanced Repeater Adapter
- IBM Netfinity EXP10 Rack Storage Enclosure, using Netfinity EXP10 3m External Auto-Sensing Cable
- IBM Netfinity EXP15 Rack Enclosure

Installation guidelines, considerations, and restrictions

In order to perform fault tolerance with ServeRAID 3, the following guidelines and restrictions must be adhered to.

- A fault-tolerant pair cannot be part of a Microsoft Cluster Server shared cluster.
- You must use two identical ServeRAID 3 controllers to create a fault-tolerant pair. If your server has a ServeRAID controller built-in on the system board, it cannot be used in the fault-tolerant pair.
- All logical drives must have unique shared merge-group numbers.
- Only the active controller in a fault-tolerant pair will appear in the NT Administration and Monitoring utility.
- The adapters must be configured in an active-passive mode, where all logical drives are defined on only one adapter of the pair.
- If both controllers have logical drives configured, they will not be configured as a fault-tolerant pair.
- During the configuration process for a fault-tolerant pair, you must restart the servers.
- A backup controller cannot be hot-added to a system.
- Hot-Spare drives are not supported in a failover environment.
- The controller must be configured as write-through.
- When using multiple fault-tolerant pairs in a system, each set of controllers must have a unique set of controller host IDs and cluster partner IDs.
- An on-board ServeRAID controller cannot be disabled, even if it is not used.

Configuring the controllers in a failover environment

To configure the controllers, do the following:

1. If you have not already done so, turn off the server and install the ServeRAID controllers into your server. If necessary, refer to Chapter 2, "Installing and cabling a ServeRAID controller" on page 13 for instructions. Do not connect the cables between the ServeRAID controllers and the expansion enclosure at this time.

2. Insert the *IBM ServeRAID Configuration CD* (or the configuration CD that came with your server) into the CD-ROM drive; then turn on the server.

   The ServeRAID Configuration Program should open in either the Configuration Mode or the Information Mode. If the program opens in the Information Mode, a screen similar to the following appears. Continue to step 3 on page 40.
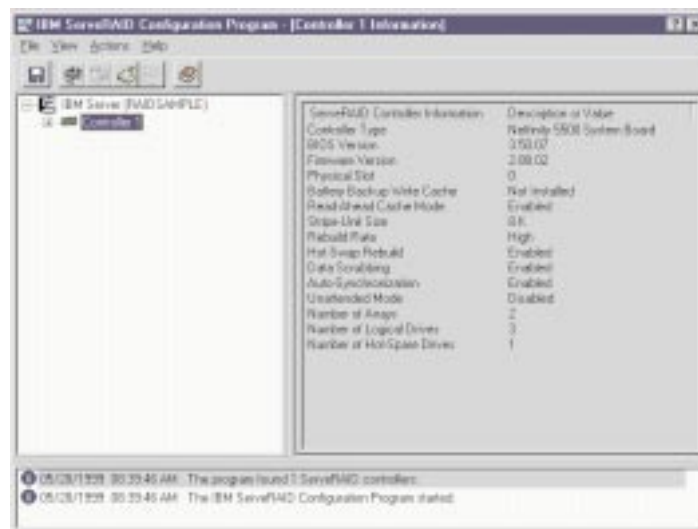
Figure 7. Information Mode Screen

If the program opens in the Configuration Mode, a screen similar to the following appears.

Click on **Cancel** to go to the Information Mode Screen and then continue to 3.
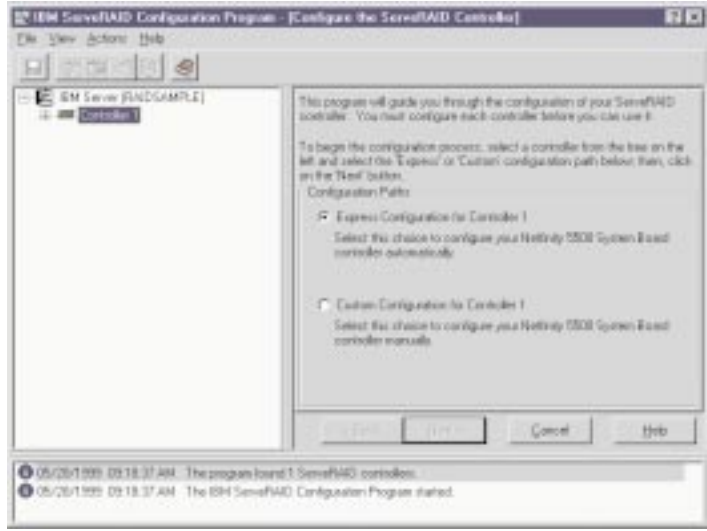
Figure 8. Configuration Mode Screen

> **Important**
>
> The ServeRAID 3 controller should be initialized only one time, when the controller is first installed. Initializing the controller removes all configuration information from NVRAM. This information includes the SCSI IDs, the Controller Host ID and the Cluster Partner Host ID, and the array information. This point is especially important if the Windows NT system startup drive is attached to the IBM ServeRAID controller. If the initialization occurs after the startup drive array has been created, the array information will be removed and the server will no longer start in Windows NT.

3. Using the right mouse button, click on the first ServeRAID controller in the main tree that you are configuring; a pop-up list appears.

4. Click on **Restore to Factory Defaults**

5. When the initialization is complete, a message appears at the bottom of the screen saying that the initialization was successful.

6. Using the right mouse button, click on the second ServeRAID controller in the main tree that you are configuring and a pop-up list appears.

7. Click on **Restore to Factory Defaults**

8. When complete, a message appears at the bottom of the screen saying that the initialization was successful.

Configuring the controllers for failover

To configure the controllers for failover, do the following:

1. Using the right mouse button, click on the first ServeRAID controller in the main tree that you are configuring and the pop-up list appears.

2. Click on **Configure for Clustering**.

3. A window appears. Fill in the following information:

   Note: The name of the Controller Host ID and the Cluster Partner Host ID are case sensitive.

- Controller Host ID - Enter a name to identify the first controller, for example, Name_1.
- Cluster Partner Host ID - Enter a name that you will use to identify the second controller, for example, Name_2.
- Initiator Identifiers (Channels) - The system presets these to seven (7).

4. Click **OK**

5. Using the right mouse button, click on the second ServeRAID controller in the main tree that you are configuring and the pop-up list appears.

6. Click on **Configure for Clustering**.

7. A window appears. Fill in the following information:

- Controller Host ID - Enter the name you chose in step 3 on page 40 to identify the second controller. This is the same name as the Cluster Partner Host ID you set up for the first controller, in this case, Name_2.
- Cluster Partner Host ID - Enter the name you chose in step 3 on page 40 to identify the first controller. This is the same name as the Controller Host ID you set up for the first controller, in this case, Name_1.
- Initiator Identifiers (Channels) - The system presets these to seven (7). Change the values to six (6).
- Record all Controller Host IDs and Cluster Partner Host IDs that you have chosen in a safe place for future reference. You will need this information to recover the configuration if the ServeRAID 3 controller should fail.

8. Click **OK**

9. Exit the Configuration Program by either clicking on the box with the "X" in the upper right corner, or by clicking on **File**, and then **Exit**.

10. Shutdown the server.

Connecting the expansion enclosures

After you configure the controllers, you must connect the expansion enclosures to the ServeRAID controllers.

Important

When connecting the cables, you must connect the same channel connectors on both ServeRAID controllers to the same expansion enclosure. For example, if you connect the cable from Channel 1 on the first ServeRAID controller to the first expansion enclosure, then you must connect the cable from Channel 1 on the second ServeRAID controller to the first expansion enclosure.

Once the cables are connected, restart the server with the Configuration CD still in the CD-ROM drive.

Configuring logical drives

Note: You can create only one logical drive per array in a failover environment.

To configure a logical drive, do the following:

1. Using the right mouse button, click on the ServeRAID controller that you want to configure in the Main Tree and a pop-up window appears.

2. Click on **Configure the ServeRAID Controller**.

3. Click on the **Custom Configuration** radio button.

4. Click on the **Next** button.

   Note: You must have two or more drives for RAID level 1 and three or more drives for RAID level 5 within the same array.

5. Define your logical drives by doing one of the following:

   - Using the right mouse button, click on the drive or SCSI Channel icons in the Main Tree to select the drives that you want to add to your arrays or delete from your arrays; then, select a choice from the pop-up list.

     or

   - Drag the drive or SCSI Channel icon from the Main Tree and drop it on the Array icon in the Main Panel on the right. If you change your mind, you can drag the icons back to the Main Tree to remove them from the configuration.

6. After you select the data drives for your arrays and define your hot-spare drives, click on the **Next** button.

   If you change your mind, you can:

   - Remove a specific drive from a newly defined array or delete an entire newly defined array. To do this:

     a. Click on the **Back** button.

     b. Using the right mouse button, click on the specific drive or Array icon in the Main Panel on the right.

     c. Select **Remove from New Array** or **Delete New Array**.

7. Select a RAID level for the logical drive from the RAID pull-down menu in the Main Panel. (If necessary, refer to Chapter 1, "Getting started" on page 1 for descriptions of the supported levels.)

8. Move the sliding bar in the Main Panel from right to left to allot data and parity space for the logical drive.

   Notes:

   a. You can define only one logical drive per array in a failover environment.

   b. Typically, the first logical drive defined on the first ServeRAID controller found by system BIOS during startup will be your startup (boot) drive.

9. If you have created multiple arrays in step 5, click on another array in the Main Tree and go back to step 7 to configure it. After configuring all of your arrays, continue with the next step.

10. Click on the **Next** button.

11. Review the information that appears on the Configuration Summary screen.

    Note: To change the configuration, click on **Modify**.

12. Click on **Apply** to accept and save the configuration.

Setting Merge Group Numbers

After creating the logical drives, you must assign a Merge Group Numbers to the shared drives. To set the Merge Group Numbers, do the following:

1. Using the right mouse button, click on the ServeRAID controller in the main tree that contains the logical drives and a pop-up list appears.

   Note: The ServeRAID Configuration Program will open in either the the configuration mode screen (Figure 7 on page 39). or the Information Mode Screen, (Figure 8 on page 40). If it opens in

the Information Mode screen, go to 2 on page 43. If it opens in the Configuration Mode Screen, first press Cancel to get to the Information Mode Screen, then repeat step 1 Then, go to step 2 on page 43.

2. Click on **Configure for Clustering**.

   The clustering information window appears.

3. Click on the **Shared** check box for all logical drives that should be able to failover between the two ServeRAID controllers.

4. Click on **Ok**

5. Exit the Configuration Program either by clicking on the box with the "X" in the upper right corner, or by clicking on **File**, and then **Exit**.

6. Shut down the server.

7. Restart the server to make the new configuration become active.

To complete the installation of the failover environment, do the following:

1. Install the ServeRAID device drivers for Windows NT. Refer to Chapter 4, "Installing device drivers and utility programs" on page 47

2. Install Windows NT. Refer to the documentation that came with the Windows NT program.

3. Install the ServeRAID Fault-Tolerant Control Panel Applet. Refer to "IBM ServeRAID fault-tolerant applet" on page 73

Using the ServeRAID Mini-Configuration Program

The ServeRAID Mini-Configuration Program is a quick way to display the current settings for the ServeRAID controller. You also can use this program to perform a limited set of the configuration functions without using the *ServeRAID Configuration CD*.

To access the Mini-Configuration program:

1. Turn on the server. If the server already is turned on, press **Ctrl+Alt+Del**.

2. When the ServeRAID Mini-Configuration prompt appears, press **Ctrl+I**.

3. If your system contains more than one ServeRAID controller, a selection screen will appear. To continue:

    a. Use the Up Arrow (↑) or Down Arrow (↓) key to select an controller.
    b. Press **Enter**.

    If your system contains only one ServeRAID controller, or after you select a ServeRAID controller, the Main Menu appears.

    Descriptions of the choices available from the Main Menu of the Mini-Configuration program are as follows:

    - **View Controller Status** shows the current status of the ServeRAID controller. (See "Viewing the controller status" for more information.)

    - **View Configuration** shows the current configuration information for the ServeRAID controller. (See "Viewing the configuration" on page 45 for more information.)

    - **Advanced Functions** lets you initialize the configuration, import configuration from drives, configure BIOS settings, and view the controller and PCI information. (See "Using the Advanced Configuration functions" on page 45 for more information.)

4. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight your choice; then, press **Enter**.

5. Follow the instructions that appear on the screen.

6. Click on **Exit** to leave the Main Menu.

Viewing the controller status

When you select View Controller Status from the Main Menu, the following information appears on the screen:

- **Unattended** shows the current On/Off state of the Unattended mode.

    – When set to Off, you can choose the recovery method when there is a ServeRAID controller startup error.

    – When set to On, the ServeRAID controller chooses the recovery method when a startup error occurs.

- **Read Ahead** shows the current On/Off state of the Read Ahead Cache mode.

- **BootCD** shows the current On/Off state of the Bootable CD-ROM function. (Refer to "Setting the bootable CD-ROM feature" on page 46.)

- **CompMode** shows the current BIOS compatibility mode. **On** indicates 8 GB Extended; **Off** indicates 2 GB Limited.

- **Clustered** shows the current On/Off state for clustering.

- **BBWC** shows the cache size of the battery-backup write cache, if it is installed (8 = 8MB or 32=32MB) or **No** if there is no battery-backup write cache installed.

- **Boot Blk** shows the version number of the bootable microcode loaded for the ServeRAID controller.

- **Code Blk** shows the current version number of the firmware loaded for the ServeRAID controller.

- **Rebuild Rate** shows the current speed setting for rebuilds: High, Medium, or Low.

- **Number of Defunct Drives** shows the current number of Defunct physical drives.

- **Number of Offline Drives** shows the current number of Offline logical drives.

- **Number of Critical Drives** shows the current number of Critical logical drives.

- **Config. Updates** shows the number of times that the configuration has been changed since it has been initialized. When you initialize the configuration, the Config. Update resets to zero.

- **Locked, Bad Stripe, or Blocked Drive** identifies the logical drives that are affected.

  – **Bad Stripe Drives** indicates the area of a logical drive that is inaccessible.

  – **Locked Stripe Drives** is a reserved field.

  – **Blocked Drives** indicates the logical drives that are blocked. You must unblock a blocked drive before you can use it. See "Logical drive state descriptions" on page 29 for more information.

Viewing the configuration

You can select View Configuration from the Main Menu to view the number of each logical drive, and to view the size, RAID level, state, stripe-unit size, write policy, read-ahead status, and creation date for each logical drive.

Using the Advanced Configuration functions

You can select the Advanced Functions choice to reset the ServeRAID controller, initialize the configuration, import the configuration information from the drives, configure BIOS settings, and view the controller or PCI information.

When you select the Advanced Functions choice from the Main Menu, the following choices appear on the screen.

Attention:
Be careful when making selections from this menu. If you change the configuration, you might lose data.

- **Initialize Configuration** lets you reset the configuration. You will not have access to any data stored on the logical drives attached to the selected ServeRAID controller.

  This choice deletes the existing configuration information, sets all functional hard disk drives attached to the controller to the Ready state, and deletes all logical drives defined for the controller.

  This choice *does not* change any of the ServeRAID controller settings (such as the stripe-unit size, rebuild rate, and so on) from their current or customized values.

- **Import Configuration from Drive** reads the most common configuration from the drives in the system and copies it to the ServeRAID controller NVRAM and EEPROM module.

- **Configure BIOS Settings** lets you modify the BIOS settings, such as the Bootable CD-ROM and BIOS settings, for the ServeRAID controller. (See "Setting the bootable CD-ROM feature" on page 46 for more information.)

Notes:

1. The Multiple Controller mode has two settings: Erase and Shrink. When this parameter is set to Erase, redundant copies of the ServeRAID BIOS are erased. When this parameter is set to Shrink, the extra copies of the ServeRAID BIOS are removed from memory, but stored for future use. When you have multiple ServeRAID controllers installed, you need only one active copy of ServeRAID BIOS. However, to ensure that you will have a copy of the ServeRAID BIOS available if your active copy becomes defective or unavailable, leave the Multiple Controller parameter set to Shrink.

2. Only one controller in the system can support the INT13 extensions.

- **View Controller and PCI Information** shows the ServeRAID controller hardware and PCI register information.

- **Exit** lets you exit the Mini-Configuration program.

Setting the bootable CD-ROM feature

When you attach a CD-ROM drive to the ServeRAID controller and set the Bootable CD-ROM feature to Yes, the ServeRAID controller will attempt to start a CD that has a bootable startup partition, if no other controller in the system is currently using INT13 extensions. Only one controller in the system can support the INT13 extensions.

To enable the Bootable CD-ROM feature:

1. Select **Advanced Functions** from the Main Menu of the Mini-Configuration program.
2. Select **Configure BIOS Settings** from the Advanced Functions menu.
3. Use the Up Arrow (↑) and Down Arrow (↓) keys to highlight **BIOS Support for Bootable CD-ROM**; then, press **Enter** to change No to Yes.
4. Ensure that the screen has Yes next to **BIOS Support for Reading Partition Tables**. If not, use the Up Arrow (↑) and Down Arrow (↓) keys to highlight **BIOS Support for Reading Partition Tables**; then, press **Enter** to change No to Yes.

   Note: You must perform this next step to save the new settings.

5. Highlight **Save Configuration to the ServeRAID Controller**; then, press **Enter**. The program displays a `Configuration Saved` message, and then returns you to the Main Menu of the Mini-Configuration program.
6. Press **Ctrl+Alt+Del** to restart the system.

Chapter 4. Installing device drivers and utility programs

This chapter provides information about the device drivers and utility programs provided on the *IBM ServeRAID Configuration and Management CD* and diskettes that come with the IBM ServeRAID-3L and ServeRAID-3H controllers.

If you are installing files for an IBM ServeRAID controller that came as a standard feature on your IBM Netfinity or PC Server system board, use the installation instructions and CDs provided with your server to install these files.

IBM ServeRAID Configuration and Management CD and diskettes

This section contains information about the ServeRAID device drivers and utility programs provided in the ServeRAID Support Package, which comes with the ServeRAID-3H and ServeRAID-3L controllers. The support package contains the *IBM ServeRAID Configuration and Management CD* and two diskettes.

IBM periodically makes updated versions of the ServeRAID device drivers and utility programs available from the IBM Support page on the World Wide Web.

Note: If you need to update any RAID software, you must update all RAID software at the same time to ensure compatibility with all of the levels of the software. This includes:

- BIOS/Firmware
- Device Drivers
- ServeRAID Manager
- ServeRAID Configuration Program
- Administration and Monitoring Utility
- Command-Line Programs

You can download the most current versions of the ServeRAID device drivers and utility programs or a copy of the *IBM ServeRAID Command Line Programs Diskette* from the following address on the World Wide Web:

http://www.pc.ibm.com/support

(See Chapter 9, "Getting help, service, and information" on page 151 for more information.) If you do not have access to the World Wide Web, contact your place of purchase, your IBM reseller, or your IBM marketing representative for replacement CDs or diskettes.

The *IBM ServeRAID Configuration and Management CD* contains the following:

- ServeRAID Configuration Program. This program runs when you start (boot) the CD.

- ServeRAID Manager program. The installation wizard for this program runs after you have installed your operating system.

- ServeRAID Administration and Monitoring Program. These program files are in the /PROGRAMS/ADMIN directory. See "Administration and Monitoring Program" on page 51 for more information.

- Command-Line Programs. These command-line programs are in the appropriate operating system subdirectory of the /PROGRAMS/CMDLINE directory. See "Command-Line Programs - IPSSEND and IPSMON" on page 74 for more information.

- ServeRAID files needed to install Microsoft Cluster Server (MSCS) when using Windows NT and an IBM ServeRAID-3H Ultra2 SCSI Controller. These files are in the /PROGRAMS/CLUSTER directory on the *IBM ServeRAID Configuration and Management CD.* Detailed instructions for installing and using these files are provided in the *IBM Netfinity High-Availability Cluster Solution Installation and User's Guide*.

The *IBM ServeRAID Device Driver Diskette* contains the following:

- DOS CD-ROM drive device drivers

- Device Drivers and the background-server component for Microsoft Windows NT

- Device Drivers, Administration and Monitoring Program, and the background-server components for OS/2® Warp Server, OS/2 LAN Server, Novell NetWare 3.12, and Novell NetWare 4.1X

The *IBM Netfinity Device Drivers for SCO Operating Systems Diskette* contains the following:

- Device drivers and the background-server component for SCO OpenServer 5.0.0, 5.0.2, and 5.0.4.
- Device Drivers and background-server component for SCO UnixWare 7.0

ServeRAID Manager Program

The ServeRAID Manager program is a new IBM ServeRAID program that monitors your ServeRAID controllers while your operating system is up and running.

Note: The ServeRAID Manager program only works with Windows NT and UnixWare. If you are using another operating system, or you have a system on your network that you want to monitor that uses another operating system, you will need to use the IBM ServeRAID Administration and Monitoring Program to monitor those systems. (See "Administration and Monitoring Program" on page 51 for more information.) However, you can still use the ServeRAID Manager program for all of your other systems.

The ServeRAID Manager Program for Microsoft Windows NT and UnixWare provides a graphical interface similar to the ServeRAID Configuration Program that enables you to monitor ServeRAID configuration changes being performed on your server while your server is fully operational. You can create an array, delete an array, create a logical drive, change the RAID level, dynamically increase the logical drive size, rebuild an array, configure your ServeRAID controllers in a failover environment, configure a cluster, and perform other basic ServeRAID configuration functions.

If you are installing the ServeRAID Manager program on a server using Windows NT, go to "Installing the ServeRAID Manager program for Windows NT."

If you are installing the ServeRAID Manager program on a server using UnixWare, go to "Installing the ServeRAID Manager Program for UnixWare."

Installing the ServeRAID Manager program for Windows NT

To install the ServeRAID Manager program for Windows NT, do the following:

1. Configure your controllers and arrays. See Chapter 3, "Using the configuration programs" on page 19 for information.
2. Install your operating system. See the instructions that came with your server and your operating system for information.
3. Insert the IBM ServeRAID Netfinity Configuration and Management CD into the CD-ROM drive.
4. The installation program starts. Follow the instructions on the screen to install the program.

To use the ServeRAID Manager program, see Chapter 5, "The ServeRAID Manager program" on page 79.

Installing the ServeRAID Manager Program for UnixWare

Note: To use the ServeRAID Manager program with UnixWare, you must have either the Java Runtime Environment (JRE) or the Java Development Kit (JDK) installed on your server.

To install the ServeRAID Manager program for UnixWare, do the following:

Note: To install or remove the ServeRAID Manager package you must have "root" privileges.

1. Configure your controllers and arrays. See Chapter 3, "Using the configuration programs" on page 19 for information.

2. Install your operating system. See the instructions that came with your server and your operating system for information.

3. Insert the IBM ServeRAID Configuration and Management CD into the CD ROM drive.

4. Type the following:

```
mount -r -F cdfs /dev/cdrom/cdromdevicefile /mnt
```

where `cdromdevicefile` is the specific device file for the CD-ROM block device. You can look in the /dev/cdrom directory to determine what this is on your server. An example of what you might see in the directory is c0b0t610.

5. Press **Enter**; then, type:

```
pkgadd -d /mnt/raidman.uw/RaidMan.ds
```

6. Press **Enter**.

7. When the installation is complete, type:

```
umount /mnt
```

8. Press **Enter**. You can now remove the CD-ROM from the drive and then refer to Chapter 5, "The ServeRAID Manager program" on page 79 for information on using the ServeRAID Manager program.

Administration and Monitoring Program

The IBM ServeRAID Administration and Monitoring Program monitors your ServeRAID controllers while your network operating system is up and running.

This section provides information about the IBM ServeRAID Administration and Monitoring Program files provided with the ServeRAID controller. You can use these files with the Windows NT, Windows 95, OS/2, Novell NetWare, SCO OpenServer, and SCO UnixWare operating systems.

Programs for Windows NT and Windows 95

The ServeRAID program files available for Windows NT consist of the ServeRAID Administration and Monitoring Program, device drivers, background-server components, and the IPSSEND and IPSMON command-line programs. (See "Command-Line Programs - IPSSEND and IPSMON" on page 74 for more information.)

The IBM ServeRAID Administration and Monitoring Program for Microsoft Windows NT or Windows 95 is called the WIN32-Based program. This program provides a graphical interface that enables you to monitor ServeRAID configuration changes being performed on your server while your server is fully operational. You can create an array, delete an array, create a logical drive, change the RAID level, dynamically increase the logical drive size, rebuild an array, and perform other basic ServeRAID configuration functions.

You can run the WIN32-Based program in the stand-alone mode *only* on a Windows NT server. Or, you can run the WIN32-Based program remotely on a Windows NT or Windows 95 client and access the client from a server that has TCP/IP, a background-server component (see "Background-Server components" on page 52), and one of the following operating systems installed:

- Microsoft Windows NT
- IBM OS/2 Warp Server and OS/2 LAN Server
- Novell NetWare 3.12 and 4.1X

- SCO UnixWare 7.0
- SCO OpenServer 5.0.X

Background-Server components

The background-server components are operating-system specific program files that enable servers running Windows NT, OS/2, NetWare, OpenServer, or UnixWare to act as the TCP/IP interface for a remote client that has the WIN32-Based program installed.

Notes:

1. Only one remote session at a time can access ServeRAID controllers using the background-server component.

2. It is possible to run multiple background-server components with each component using a different TCP/IP port; however, to avoid damage to your data, you must restrict your administration activities to one remote client and use the other remote clients for monitoring purposes only.

Programs for OS/2 and NetWare

The ServeRAID program files available for the OS/2 and NetWare operating systems consist of the Administration and Monitoring program, device drivers, background-server components, and the IPSSEND and IPSMON command-line programs. (See "Command-Line Programs - IPSSEND and IPSMON" on page 74 for more information.)

The Administration and Monitoring Program files for OS/2 and NetWare run only on the system containing a ServeRAID controller (stand-alone mode). These ServeRAID programs provide a limited subset of the functions provided in the WIN32-Based program, and they install automatically when you install the ServeRAID device driver for OS/2 or NetWare.

A good way to use these operating-system specific programs is to run the OS/2 or NetWare versions of the Administration and Monitoring Program files locally on the server, while using the WIN32-Based program on a remote Windows NT or Windows 95 client. This method enables you to take advantage of the more advanced administration and monitoring functions provided in the WIN32-Based program.

Programs for OpenServer and UnixWare

The ServeRAID program files available for OpenServer and UnixWare consist of device drivers, background-server components, and the IPSSEND and IPSMON command-line programs. (See "Command-Line Programs - IPSSEND and IPSMON" on page 74 for more information.)

The background-server components for SCO operating systems install automatically when you install the ServeRAID OpenServer or UnixWare device drivers.

To use the ServeRAID Administration and Monitoring Program with a SCO operating system, you must first install the WIN32-Based program on a Windows NT or Windows 95 client. Then, attach the Windows NT or Windows 95 client to the same network as the OpenServer or UnixWare system that contains the ServeRAID controller. You must perform all administration functions from the remote WIN32-Based client.

Installing the ServeRAID WIN32-Based program

This section provides instructions for installing the ServeRAID WIN32-Based program.

Before you begin the installation.

- Be sure that your ServeRAID controller is physically installed, properly cabled, and configured.

- Be sure that your network operating system is installed and functional.

- If your network operating system is Windows NT, you can use the ServeRAID WIN32-Based program remotely in the client/server mode or locally in stand-alone mode. Use the instructions in this section and in "Installing ServeRAID device drivers" to install the ServeRAID files.

- The ServeRAID controllers do not support Windows 95. However, you can run the WIN32-Based program remotely on a Windows 95 client attached to a remote server running the OS/2, NetWare, Windows NT, UnixWare, or OpenServer operating system. Use the instructions in this section to install the WIN32-Based program on the Windows 95 client.

- If your network operating system is OS/2, NetWare, OpenServer, or UnixWare, you must run the ServeRAID WIN32-Based program remotely, in the client/server mode.

  Other requirements for this environment include:

  – A Windows NT or Windows 95 client running the IBM ServeRAID WIN32-Based program

    Use the instructions in this section to install the WIN32-Based program.

  – A network adapter with proper cabling for access to the remote systems

  – The TCP/IP networking protocol installed on both the local and remote systems

  – The ServeRAID device driver and background-server component installed on the remote system

    Refer to "Installing ServeRAID device drivers" for more information.

To install the ServeRAID WIN32-Based program:

1. Turn on the system and allow Windows NT or Windows 95 to start.

2. Insert the *IBM ServeRAID Configuration and Management CD* into the CD-ROM drive.

3. Click on **Start**, click on **Run**; then, type the following:

   `z:\programs\admin\setup`

   Note: The *z* represents the letter assignment for the CD-ROM drive that contains the ServeRAID CD.

4. Press **Enter**; then, follow the instructions that appear on the screen to complete the installation.

Refer to Chapter 6, "Starting and using the Administration and Monitoring Program" on page 101 for more information about the WIN32-Based program.

Installing ServeRAID device drivers

This section provides the instructions for installing the device drivers for Windows NT, NetWare, OS/2, OpenServer, and UnixWare.

If you are using Windows NT, you must use the instructions provided in "Installing the background-server component for Windows NT 3.5" on page 56 to install the Windows NT background-server component *after* you install the ServeRAID device driver.

The OS/2 and NetWare Administration and Monitoring Program files and background-server components install automatically when you install the ServeRAID device drivers for OS/2 and NetWare. The UnixWare and OpenServer background-server components install automatically when you install the ServeRAID device drivers for UnixWare and OpenServer.

When using: **Go to:**
Windows NT   "Installing device drivers for Windows NT"
NetWare   "Installing device drivers for NetWare" on page 58
OS/2   "Installing device drivers for OS/2" on page 61
OpenServer   "Installing device drivers for OpenServer" on page 64
UnixWare   "Installing device drivers for UnixWare" on page 67

Installing device drivers for Windows NT

Note: This version of the ServeRAID Configuration Program supports up to 12 ServeRAID controllers when using Microsoft NT.

This section provides two sets of instructions for installing the ServeRAID device driver: one that you can use during the initial Windows NT installation and one that you can use if Windows NT already is installed.

Follow the instructions in "Installing the background-server component for Windows NT 3.5" on page 56 to install the files for Windows NT 3.5X and Windows NT 4.0 after you install the ServeRAID device driver.

Installing the files for Windows NT 3.5

This section provides instructions for installing the device drivers and the background-server component for Windows NT 3.5.

To determine your next step, read the following and then go to the instructions appropriate for your installation.

- If you are installing the files *while* you are installing Windows NT 3.5, go to "Installing the files while installing Windows NT 3.5" on page 55.

- If you are installing the files *after* you have

- These instructions assume that you installed NetWare in the NWSERVER directory.

Installing the files for Windows NT 3.5

This section provides instructions for installing the device drivers and the background-server component for Windows NT 3.5.

To determine your next step, read the following and then go to the instructions appropriate for your installation.

- If you are installing the files *while* you are installing Windows NT 3.5, go to "Installing the files while installing Windows NT 3.5" on page 55.

- If you are installing the files *after* you have installed Windows NT 3.5, go to "Installing the files after installing Windows NT 3.5" on page 55.

Installing the files while installing Windows NT 3.5

To install the ServeRAID device driver while installing Windows NT 3.5:

1. Insert the Windows NT startup (boot) diskette into the diskette drive or insert the startable Windows NT CD into the CD-ROM drive; then, restart the server.

2. When the message

   ```
   Setup is inspecting your computer's hardware
   configuration...
   ```

   appears, press the **F6** key.

3. After loading some files, Windows NT displays a window where you can manually specify an adapter. When this window appears, press **S** to specify additional devices.

4. When prompted in the next window, select **Other** from the list.

5. When prompted to insert the `Manufacturer-supplied-hardware support disk`, insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive; then, press **Enter**.

6. Select **IBM ServeRAID Controller (NT 3.51)**; then, press **Enter**. A message similar to the following will appear: `Setup is loading files (IBM ServeRAID Controller (NT 3.51))....`

7. When prompted, press **Enter** to continue.

8. Use the instructions provided in the Windows NT manual to complete the normal installation process.

9. After you complete the installation, be sure to apply the latest Service Pack.

10. Continue with "Installing the background-server component for Windows NT 3.5" on page 56.

Installing the files after installing Windows NT 3.5

To install the ServeRAID device driver after Installing Windows NT 3.5.

1. Insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive.

2. Double click **Windows NT Setup**. from the main folder in Program Manager.

3. Select **Configuration** from the menu; then, select **Add/Remove SCSI Adapter**.

4. Select **IBM ServeRAID Controller**; then, click **Remove**.

5. Click **OK**.

6. Click **OK**.

7. Click **Add**.

8. Click **OK**.

9. Select **Other, driver provided by manufacturer**.

10. In the **Copy manufacturer's files from** field, type:

    ```
    a:\nt3_5
    ```

11. Click **OK**.

12. Continue with "Installing the background-server component for Windows NT 3.5" on page 56.

Installing the background-server component for Windows NT 3.5

This section provides instructions for installing the background-server components for Windows NT 3.5X.

1. Insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive; then, type the following to copy the IPSADM.EXE file to your hard disk:

   ```
   copy a:\nt3_5\ipsadm.exe x:\winnt\system32\ipsadm.exe
   ```

   where x = the drive in which you want to install the programs.

2. Press **Enter**.

3. Type the following to copy the IPSADM.ICO icon file to your hard disk:

   ```
   copy a:\nt3_5\ipsadm.ico x:\winnt\system32\ipsadm.ico
   ```

   where x = the drive in which you want to install the programs.

4. Press **Enter**.

5. Select a group or create a new group to store the program. For example, open the Administrative Tools Group or create a new program group named IPSADM Admin-Monitor.

6. Click on **File**, click on **New**, click on **Personal Item**, and then click on **OK**.

7. Type the following information in the data fields:

Description:	IPSRAID Admin-Monitor
Command Line:	X:\WINNT\SYSTEM32\IPSADM.EXE
	Where x = the drive in which you want to install the programs.
Working Dir:	X:\WINNT\SYSTEM32
	Where x = the drive in which you want to install the programs.

8. Click on **Change Icon**; then, click on **OK** in the information window.

9. Do one of the following:

   - In the Change Icon window, type:

     ```
     x:\winnt\system32\ipsadm.ico
     ```

     where x = the drive in which you want to install the programs.

         or,

   - Click on **Browse** and select X:\WINNT\SYSTEM32\IPSADM.ICO.
     where x = the drive in which you want to install the programs.

10. Click on **OK** for the icon.

11. Click on **OK** for the Personal Item.

12. Double-click on the new icon to access the Administration and Monitoring Program.

Installing the files for Windows NT 4.0

This section provides the instructions for installing the device drivers and the background-server component for Windows NT 4.0.

To determine your next step, read the following and then go to the instructions appropriate for your installation.

- If you are installing the files *while* you are installing Windows NT 4.0, go to "Installing the device drivers while installing Windows NT 4.0" on page 57.

- If you are installing the files *after* you have installed Windows NT 4.0, go to "Installing the device driver after installing Windows NT 4.0" on page 57.

Installing the device drivers while installing Windows NT 4.0

To install the ServeRAID device driver while installing Windows NT 4.0:

1. Insert the Windows NT startup (boot) diskette into the diskette drive or insert the startable Windows NT CD into the CD-ROM drive; then, restart the server.

2. When the message

   ```
   Setup is inspecting your computer's hardware
   configuration...
   ```

   appears, press the **F6** key.

3. After loading some files, Windows NT displays a screen that allows you to manually specify an controller. When this screen appears, press **S** to specify additional devices.

4. When prompted in the next window, select **Other** from the list.

5. When prompted to insert the `Manufacturer-supplied-hardware support disk`, insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive; then, press **Enter**.

6. Select **IBM ServeRAID Controller (NT 4.0)**; then, press **Enter**. A message similar to the following will appear: `Setup is loading files (IBM ServeRAID Controller (NT 4.0))...`

7. When prompted, press **Enter** to continue.

8. Use the instructions provided in the Windows NT manual to complete the normal installation process.

9. After you complete the installation, be sure to apply the latest Service Pack.

10. Continue with "Installing the background-server component for Windows NT 4.0."

Installing the device driver after installing Windows NT 4.0

To install the ServeRAID device driver after Installing Windows NT 4.0:

1. Insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive.

2. From the **Start Menu**, select **Settings**; then, select **Control Panel**.

3. Select **SCSI Adapter**; then, click on the **Drivers** tab.

4. Click on **Add**; then, click on **Have Disk**.

5. In the **Copy manufacturer's files from** field, type:

   ```
   a:\nt4_0
   ```

6. Click on **OK**; then in the next dialog box, click on **OK** again.

7. After the device driver installs, restart the system.

8. Continue with "Installing the background-server component for Windows NT 4.0."

Installing the background-server component for Windows NT 4.0

This section provides instructions for installing the background-server components for Windows NT 4.0.

1. Insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive; then, type the following to copy the IPSADM.EXE file to your hard disk:

   ```
   copy a:\nt4_0\ipsadm.exe x:\winnt\system32\ipsadm.exe
   ```

where x = the drive in which you want to install the programs.

2. Press **Enter**.

3. Type the following to copy the IPSADM.ICO icon file to your hard disk:

   ```
   copy a:\nt4_0\ipsadm.ico x:\winnt\system32\ipsadm.ico
   ```

   where x = the drive in which you want to install the programs.

4. Press **Enter.**

5. Complete the following steps to create a new program shortcut:

   a. Using the right mouse button, click on the Desktop.
   b. Click on **New**; then, click on **Shortcut**.
   c. In the Create Shortcut window type:

      ```
      x:\winnt\system32\ipsadm.exe
      ```

      where x = the drive in which you want to install the programs.
   d. Click on **Next**.
   e. In the Select a Title for the Program window, type:

      ```
      IPSRAID Admin-Monitor Server
      ```

   f. Click on **Finish**.

6. Using the right mouse button, click on the **icon**.

7. Click on **Properties**, click on **Shortcut**, and then click on **Change Icon**.

8. In the Information window, click on **OK**.

9. In the Change Icon window, type:

   ```
   x:\winnt\system32\ipsadm.ico
   ```

   where x = the drive in which you want to install the programs.

10. Click on **OK** for the icon; then, click on **OK** for the program properties.

11. Double-click on the new icon to access the Administration and Monitoring Program.

Installing device drivers for NetWare

Note: This version of the ServeRAID Configuration Program supports up to eight ServeRAID controllers when using NetWare.

This section provides instructions for installing the ServeRAID device drivers while installing NetWare 3.12 or 4.1X, and instructions for installing the ServeRAID device drivers if NetWare 3.12 or 4.1X already is installed.

The Administration and Monitoring Program files and the background-server components for NetWare install automatically when you install the ServeRAID device drivers for NetWare.

Installing the files while installing NetWare 3.12

The ServeRAID device driver for NetWare, IPSRAID.HAM, is in the NetWare directory on the *IBM ServeRAID Device Driver Diskette*. You can use the INSTALL.BAT file, which is also in the NetWare directory on the diskette, to copy all required files to your server directory. The INSTALL.BAT file will modify the STARTUP.NCF file so that it will load the required NetWare modules.

Use the instructions provided in the NetWare 3.12 manual along with the following instructions to install the ServeRAID device driver, background-server component, and Administration and Monitoring Program files while installing NetWare, Version 3.12.

1. Type the following at the command prompt to manually create the directory for NetWare:

   `md server.312`

   Note: The *SERVER.312* is the default NetWare 3.12 directory. If you are using a different path, be sure to specify the same path throughout the entire NetWare installation process.

2. Press **Enter**.

3. Change to the SERVER.312 directory on your hard disk; then, insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive.

4. At the operating-system prompt, type:

   `a:`

   Note: The *a* represents the drive assignment for the diskette drive that contains the ServeRAID diskette.

5. Press **Enter**. Then, type:

   `cd netware`

6. Press **Enter**. Then, type:

   `install`

7. Press **Enter**. Then, follow the instructions that appear on the screen to complete the ServeRAID device driver and program installation.

Installing the files after installing NetWare 3.12

The ServeRAID device driver for NetWare, IPSRAID.HAM, is in the NetWare directory on the *IBM ServeRAID Device Driver Diskette*. You can use the INSTALL.BAT file, which is also in the NetWare directory on the diskette, to copy all of the required files to your server directory. The INSTALL.BAT file will modify the STARTUP.NCF file so that it will load the required NetWare modules.

Use the instructions provided in the NetWare 3.12 manual along with the following instructions to install the ServeRAID device driver, background-server component, and Administration and Monitoring Program files after installing NetWare, Version 3.12.

1. Insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive.

2. Go to the default NetWare 3.12 directory. To do this, type:

   `cd\ server.312`

   Note: The *SERVER.312* is the default NetWare 3.12 directory. If you are using a different path, be sure to specify the same path throughout the installation process.

3. Press **Enter**; then, from the operating-system prompt in the SERVER.312 directory, type:

   `a:`

   Note: The *a* represents the drive assignment for the diskette drive that contains the ServeRAID diskette.

4. Press **Enter**. Then, type:

   `cd netware`

5. Press **Enter**. Then, type:

   `install`

6. Press **Enter**. Then, follow the instructions that appear on the screen to complete the ServeRAID device driver and program installation.

Installing the files while installing NetWare 4.1X

Use the instructions provided in the NetWare 4.1X manual along with the following instructions to install the ServeRAID device driver, background-server component, and Administration and Monitoring Program files while installing NetWare, Version 4.1X.

1. Use the instructions provided in the NetWare manual to begin the installation.

2. When the `Choose the Server Drivers - Disk Driver` prompt appears during the install process, insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive.

3. Select **Select additional or modify selected Disk/LAN drivers**.

4. If IPSRAID appears, select **Deselect a selected driver**.

5. Select **Select an additional driver**; then, press the **Ins** (Insert) key to add an unlisted new device driver.

6. Press **F3** to specify a path; then, type:

   `a:\netware`

   Note: The *a* represents the drive assignment for the diskette drive that contains the ServeRAID diskette.

7. Select **IPSRAID.HAM** from the list of device drivers that appears in the window; then, press **Enter**.

   Note: The IPSRAID.HAM and support files will be copied to the system volume.

8. Select **OK** to overwrite the existing files.

9. Follow the instructions in the NetWare manual to complete the installation.

Installing the files after installing NetWare 4.1X

To install the files after installing NetWare 4.1X, do the following:

Note: If a copy of the device driver already is installed and the operating system is installed on the ServeRAID controller, do the following before starting this procedure:

> 1. Type:
>
>   `Unload IPSRAID`
>
> 2. Press **Enter**; then, to to step 1.

1. From the system console, start the NetWare installation utility program by typing:

   `load install`

2. Press **Enter**.

3. Insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive.

4. Select **Driver options** from the Installation Options list.

5. Select **Configure disk and storage** from the Driver Options pop-up window.

6. Select **Select an additional driver** from the Additional Drivers Actions pop-up window.

7. When the next screen appears, press the **Ins** key to install an unlisted driver.

8. When the next screen appears, press the **F3** key to specify a different path.

9. In the **Specify a directory path** field, type:

```
a:\netware
```

10. When prompted to select a driver to install, select **IPSRAID.HAM**.

11. Select **Yes** when prompted to copy the IPSRAID.HAM driver.

12. When the prompt appears to specify the server boot path, type:

```
c:\nwserver
```

   Notes:

   a. This instruction assumes that you installed NetWare in its default directory. If you did not install NetWare in the NWSERVER directory on drive C, modify step 12 accordingly.

   b. If any of the files you are installing already exist on the server, NetWare will prompt you to save the older files. Although it is not necessary to save the older files, it usually is a good idea.

13. After the installation program copies all files, you can edit parameters (such as the ServeRAID slot number) from the Driver IPSRAID Parameter Actions screen.

14. After you edit the parameters, select **Save Parameters and load driver** to load the ServeRAID device driver.

   Note: If the device driver is not installed already and the operating system is installed on the ServeRAID controller, an error message stating that the device driver failed to load should appear after you did the previous step. If that happened, do the following:

   a. Do step 15

   b. Down the server.

   c. Restart the server by typing the following at the system prompt:

   ```
   server
   ```

   d. The device driver loaded and this procedure is complete.

15. Press **Esc** to exit the installation screens.

Note: If you want NetWare to load the ServeRAID device driver automatically during startup, you must add the appropriate LOAD command (for example, `load ipsraid.ham slot=1`) to the NetWare startup command file (usually C:\NWSERVER\STARTUP.NCF).

Installing device drivers for OS/2

Note: This version of the ServeRAID Configuration Program supports up to eight ServeRAID controllers when using OS/2.

This section provides two sets of instructions for installing the ServeRAID device driver: one that you can use during the initial OS/2 installation and one that you can use if OS/2 already is installed.

The ServeRAID Administration and Monitoring Program files and background-server component for OS/2 install automatically when you install the ServeRAID device driver for OS/2.

Installing the files while installing OS/2

You can use the following instructions to install the ServeRAID device driver and Administration and Monitoring Program files while installing OS/2 Warp Server.

Note: If you install these files on a logical drive that has its write policy set to the write-back mode, wait at least 10 seconds after being prompted to press **Ctrl**+**Alt**+**Del** before you actually press the keys. Waiting 10 seconds or longer gives the ServeRAID controller the time needed to flush all dirty-cache pages out to the hard disk.

To install the ServeRAID files while installing OS/2:

1. Make a copy of the *OS/2 Warp Diskette 1* and label it *Copy of OS/2 Diskette 1*.

2. Copy the IPSRAID.ADD file from the OS2 directory on the *IBM ServeRAID Device Driver Diskette* to the *Copy of OS/2 Diskette 1*.

   If there is not enough space, delete files not needed in your installation (such as proprietary CD-ROM or SCSI device drivers). Make sure you remove all entries referring to any device drivers you delete from the CONFIG.SYS file.

   ┌─ **Important** ──┐

   If you have more than one ServeRAID or SCSI adapter in your system, make sure that the BASEDEV statement for the adapter or controller controlling the startup (boot) device appears first in the CONFIG.SYS file before the BASEDEV statements for other ServeRAID or SCSI adapters.

   └──┘

3. Edit the CONFIG.SYS file on the *Copy of OS/2 Diskette 1* to add the following lines.

   ```
   BASEDEV=IPSRAID.ADD
   SET COPYFROMFLOPPY=1
   ```

4. Install OS/2, but when you are prompted to insert diskette 1, use the updated *Copy of OS/2 Diskette 1*.

5. After you complete the OS/2 installation, insert the *IBM ServeRAID Device Driver Diskette*.

6. From an OS/2 window, type:

   ```
   a:
   ```

   Note: The *a* represents the drive letter assignment for the diskette drive that contains the ServeRAID diskette.

7. Press **Enter**. Then, type:

   ```
   ddinstal
   ```

8. Press **Enter**.

   The OS/2 Device Driver Installation window opens. In the **Source** field type A: (a: is the letter of the diskette drive where the *IBM ServeRAID Device Driver Diskette* is located. In the **Destination** field type the full path where you want the device driver files to be copied.

9. Click on **Install**.

   • The program copies the following ServeRAID device driver and program files to the OS/2 subdirectory on your hard disk: IPSRAID.ADD, IPSADM.EXE, and IPSRADM.EXE.

   • The program copies the ServeRAID IPSRADM.HLP Help file to the \OS2\HELP directory.

10. Edit the CONFIG.SYS file and verify that there is only one copy of the line BASEDEV=IPSRAID.ADD.

    Notes:

    a. If you have more than one ServeRAID or SCSI adapter in your system, make sure that the BASEDEV statement for the adapter or controller controlling the startup (boot) device appears first in the CONFIG.SYS file before the BASEDEV statements for other ServeRAID or SCSI adapters.

    b. After you install any service packs, check the path for the IPSRAID.ADD device driver and verify that the correct device driver is installed.

11. Restart the server.

Installing the files after installing OS/2

You can use the following instructions to install the ServeRAID device driver and Administration and Monitoring Program files after installing OS/2 Warp Server.

To install the ServeRAID files after installing OS/2:

1. After you complete the OS/2 installation, insert the *IBM ServeRAID Device Driver Diskette*.

2. From an OS/2 window, type:

   ```
   a:
   ```

   Notes:

   a. The *a* represents the drive assignment for the diskette drive that contains the ServeRAID diskette.

   b. If you install these files on a logical drive that has its write policy set to the write-back mode, wait at least 10 seconds after being prompted to press **Ctrl**+**Alt**+**Del** before you actually press the keys. Waiting 10 seconds or longer gives the ServeRAID controller the time needed to flush all dirty-cache pages out to the hard disk.

3. Press **Enter**. Then, type:

   ```
   ddinstal
   ```

4. Press **Enter**.

   The OS/2 Device Driver Installation window will appear and prompt you for the source and destination drives. The source directory shows where to insert the *IBM ServeRAID Device Driver Diskette*. The destination directory shows where the program will copy the device driver files.

5. Click on **Install**.

   - The program copies the following ServeRAID device driver statement to your CONFIG.SYS file: BASEDEV=IPSRAID.ADD

   - The program copies the following ServeRAID device driver and program files to the OS/2 subdirectory on your hard disk: IPSRAID.ADD, IPSADM.EXE, and IPSRADM.EXE

   - The program copies the following ServeRAID Help file to the \OS2\HELP directory: IPSRADM.HLP

6. Edit the CONFIG.SYS file and verify that there is only one copy of the line BASEDEV=IPSRAID.ADD.

   Notes:

   a. If you have more than one ServeRAID or SCSI adapter in your system, make sure that the BASEDEV statement for the adapter or controller controlling the startup (boot) device appears first in the CONFIG.SYS file before the BASEDEV statements for other ServeRAID or SCSI adapters.

   b. After you install any service packs, check the path for the IPSRAID.ADD device driver and verify that the correct device driver is installed.

7. Restart the server.

Starting the Administration and Monitoring Program

To start the ServeRAID Administration and Monitoring Program for OS/2:

1. Go to the OS/2 subdirectory on the hard disk drive; then, type:

   `ipsradm` */lf=d:\path\logfile*

   Notes:

   a. Make sure that the path you type exists. The program will not create a path.

   b. *Logfile* is where the program will log messages.

   c. If you omit the */lf* parameter, the program will create the *IPSRADM.LOG* default file in the OS2 subdirectory to log the program messages.

2. Press **Enter**.

3. Use the following steps if you want to define IPSRADM to OS/2:

   a. Open the Templates Folder on the OS/2 Desktop.

   b. Drag a program template onto the Desktop. A Program Settings window will appear.

   c. At the Program page in the **Path and File Name** field, type:

      `c:\os2\ipsradm.exe`

   d. At the General Tab in the **Title** field, type:

      `ADMIN-MONITOR`

4. Close the window.

Installing device drivers for OpenServer

Note: This version of the ServeRAID Configuration Program supports up to eight ServeRAID controllers when using OpenServer.

To use the ServeRAID Administration and Monitoring Program with SCO, you must first install the WIN32-Based version of the Administration and Monitoring Program on a Windows NT or Windows 95 client. Then, attach the Windows NT or Windows 95 client to the same network as the OpenServer systems that contain the ServeRAID controllers. Finally, you must install the ServeRAID device driver and background-server component for OpenServer.

The background-server component for OpenServer installs automatically when you install the ServeRAID OpenServer device driver. This component enables the OpenServer system to act as the TCP/IP interface for the remote WIN32-Based Program. (See "Programs for Windows NT and Windows 95" on page 51 for more information.)

Installing the files for OpenServer

Before you begin the installation, review the following information:

- You must install logical drives as Bus Number 0 when using the MKDEV program, regardless of the channel that the physical drives are on.

- You must install nondisk devices, such as CD-ROM and tape drives, as Bus Numbers 1, 2, or 3 relative to the channel to which they are attached. External Channel 1 connector is Bus Number 1, external Channel 2 connector is Bus Number 2, and internal Channel 3 connector is Bus Number 3.

To configure the default nondisk devices during the initial installation:

1. Redefine the default tape drive in the initial bootstring. For example, to install the IPSRAID BTLD and redefine the tape drive, go to the BOOT prompt and type:

   `link Stp=ips(0, 1, 2, 0)`

   The numbers in parentheses represent the Host Adapter Number, the Bus Number, the SCSI ID, and the LUN respectively.

2. When prompted for the location of the installation CD, change the Bus Number and SCSI ID, as required.

Adding BTLD at boot time: To install the ServeRAID device driver for OpenServer, Version 5.0.X:

1. At the BOOT prompt, type:

   `link`

2. Press **Enter**; then, when asked for the name of the package to load, type:

   `ipsraid`

3. Press **Enter**.

4. After the kernel loads but before it runs, `link` prompts you to insert the *IBM Netfinity Device Drivers for SCO Operating Systems Diskette*.

   While the installation program copies the files, one or both of the following messages might appear:

   Messages:

   a. `Extracting BTLD distribution for ipsraid... /etc/uadmin getdev b ips: No such device (error 19)`

   b. `dynamic linker: dlvr_audit: Cannot open /dev/zero for file /lib/libprot.so.1`

   You can ignore Message A, no action is required. But if Message B appears, you must press **Enter** when prompted to continue the installation.

5. Keep the *IBM Netfinity Device Drivers for SCO Operating Systems Diskette* readily available. You will need it to configure the device driver into the link kit.

For additional information about adding a BTLD at boot time, refer to "Using Boot-Time Loadable Drivers" in the *SCO OpenServer Handbook*.

Adding BTLD after the initial installation

1. Start the server in system maintenance mode, and log in as *root*.

2. Type:

   `installpkg`

3. Press **Enter**; then, select the diskette drive in which you will insert your installation diskette.

4. Insert the *IBM Netfinity Device Drivers for SCO Operating Systems Diskette*, when prompted.

5. When prompted for the name of the package, type:

   `ipsraid`

6. Press **Enter**; then, relink the kernel (as described in "Relinking the kernel" in the *SCO OpenServer Handbook*) by entering the following command:

   `cd /etc/conf/cf.d`

7. Press **Enter**; then type:

   `./link_unix`

8. Press **Enter**.

9. After the kernel rebuilds, the following message appears:

   `The UNIX kernel has been rebuilt.  Do you want this kernel to boot by default?`

   To continue, enter: `y`

   The system backs up the old kernel by moving */UNIX* to */UNIX.OLD*.

10. When the system asks for the kernel environment to be rebuilt, enter: `y`

    The system will respond with a successful message.

11. Use *shutdown* to bring down the system; then, restart the system.

Using an IDE CD-ROM drive to install OpenServer files

This section contains instructions for installing files for OpenServer 5.0.0, OpenServer 5.0.2, and OpenServer 5.0.4 when using an IDE CD-ROM Drive.

Installing the files for OpenServer 5.0.0

To install files for OpenServer 5.0.0 using an IDE CD-ROM drive:

1. Type the following at the `BOOT` prompt:

   `restart ahslink="ATAPI ipsraid" Srom=wd(0,0,0,0)`

2. Insert the ATAPI BTLD diskette when prompted; then, press **r** to replace the *wd* driver.

   The fields for the ATAPI CDROM are:

   Srom=wd(*c,d,l,b*) where:

   > c = primary (0) or secondary (1) IDE/EIDE controller
   >
   > d = master (0) or slave (1) device
   >
   > l = LUN of device (always 0 with ATAPI or wd driver)
   >
   > b = BUS of device (always 0 with ATAPI or wd driver)

Installing the files for OpenServer 5.0.2 and 5.0.4

To install files for OpenServer Versions 5.0.2 or 5.0.4 using an IDE CD-ROM drive:

1. Type the following at the `BOOT` prompt:

   `restart link=ipsraid Srom=wd(0,0,0,0)`

   Note: The ATAPI BTLD (which includes the *wd* driver) is included in OpenServer 5.0.2 and 5.0.4.

   The fields for the ATAPI CDROM are:

   Srom=wd(*c,d,l,b*) where:

   > c = primary (0) or secondary (1) IDE/EIDE controller
   >
   > d = master (0) or slave (1) device
   >
   > l = LUN of device (always 0 with ATAPI or "wd" driver)
   >
   > b = BUS of device (always 0 with ATAPI or "wd" driver)

2. Let the system start normally until it comes to the select Media options.

   - If you are using OpenServer 5.0.2, go to step 3.
   - If you are using OpenServer 5.0.4, go to step 4.

3. To install with OpenServer 5.0.2:

    a. Select Adapter type as **WD**.
    b. Select Media Type as **SCSI CDROM**.
    c. Select ID, BUS and LUN as **0**.
    d. Go to step 5.

4. To install with OpenServer 5.0.4:

    a. Select Media Type as **IDE CDROM Drive**.
    b. Select **Primary Adapter** and **Master Device**.
    c. Go to step 5.

5. You have completed the installation.

Installing device drivers for UnixWare

Note: This version of the ServeRAID Configuration Program supports up to eight ServeRAID controllers when using UnixWare.

The instructions for installing the ServeRAID files when using UnixWare depend on the number of IDE and SCSI disk-storage adapters and controllers installed in the system. If all of the direct-access-storage devices (DASD) in the system are attached to a single disk-storage adapter or controller (such as the ServeRAID controller), you can skip the instructions in this section and go directly to "Installing the files while Installing UnixWare" on page 69 or "Installing the files after Installing UnixWare" on page 70.

If you are attaching devices to multiple disk-storage adapters or controllers (including IDE and SCSI controllers integrated on the system board), use the following instructions.

- If you are installing UnixWare on a drive attached to a ServeRAID controller, follow the instructions in "Installing UnixWare on a ServeRAID drive."

- If you are installing UnixWare on a drive attached to a non-ServeRAID adapter or controller and you intend to store only data on the drives attached to your ServeRAID controllers, follow the instructions in "Installing UnixWare on a non-ServeRAID drive" on page 68.

Installing UnixWare on a ServeRAID drive: Use the following instructions if you are using multiple disk-storage adapters or controllers and you are installing UnixWare on a drive attached to a ServeRAID controller.

Note: If you are not using multiple disk-storage adapters and controllers, go to "Installing the files while Installing UnixWare" on page 69.

1. Install all ServeRAID controllers that you intend to use in your system.

2. Using the ServeRAID Configuration Program, create all of your arrays and define all of your logical drives.

3. Make a list of all of the ServeRAID controllers, including the order and slot number, installed in the system. To do this:

    a. Turn on the server.

    b. When the ServeRAID Mini-Configuration prompt appears, press **Ctrl+I**. When a system contains more than one ServeRAID controller, a selection screen appears.

    c. The menu lists the ServeRAID controllers in order. Select the first ServeRAID controller from the menu.

    d. Select **Advanced Functions** from the Main Menu.

    e. Select **View Controller and PCI Information** from the Advanced Functions menu.

f. Record the slot number for the ServeRAID controller; then, press **Esc** three times to return to the controller selection screen.

g. Repeat step 3c on page 67 through step 3f until you record the slot number for each ServeRAID controller that appears on the selection screen.

4. Turn off the system; then, remove all ServeRAID controllers except the first one on your list.

   Note: If one of the ServeRAID controllers that you need to remove is on the system board, you must do one of the following:

   - If the CD-ROM drive that you are using to install your operating system is attached to the integrated ServeRAID controller, disconnect or remove all disk drives attached to the integrated controller.

   - If only disk drives are attached to the integrated controller, disconnect the SCSI cable from the ServeRAID connector on the system board. See the label inside the server cover for the location of the ServeRAID connector.

5. Remove all other non-ServeRAID IDE and SCSI disk-storage adapters or controllers.

   Note: If one of the disk-storage controllers that you need to remove is on the system board, you must do one of the following:

   - If the CD-ROM drive that you are using to install your operating system is attached to the integrated disk-storage controller, disconnect or remove all disk drives attached to the integrated controller.

   - If only disk drives are attached to the integrated controller, disconnect the cable for the integrated controller from the IDE or SCSI connector on the system board. See the label inside the server cover for the location of the IDE or SCSI controller connector.

6. Follow the instructions in "Installing the files while Installing UnixWare" on page 69; then, return here and continue with step 7.

7. Power down the system.

8. Install any non-ServeRAID disk-storage adapters or controllers in the server; then, attach the drives to the disk-storage adapters and controllers.

9. Install the second ServeRAID controller from the list you created in step 3f; then, attach the drives to the ServeRAID controller.

10. Turn on the system and allow UnixWare to discover the new disk-storage adapters and controllers.

11. Power down the system.

12. Repeat steps 9, 10, and 11 until all ServeRAID adapters, ServeRAID controllers, and drives are installed.

13. You can now partition and format the logical drives attached to the additional ServeRAID adapters and controllers. See the information provided with UnixWare for more instructions.

Installing UnixWare on a non-ServeRAID drive: Use the instructions in this section if you are using multiple disk-storage adapters or controllers, you are installing UnixWare on a drive attached to a non-ServeRAID adapter or controller, and you intend to store only data on the drives attached to your ServeRAID adapters and controllers.

1. Install all ServeRAID controllers that you intend to use in your system.

2. Using the ServeRAID Configuration Program, create all of your arrays and define all of your logical drives.

3. Make a list of all of the ServeRAID controllers, including the order and slot number, installed in the system. To do this:

a. Turn on the server.

b. When the ServeRAID Mini-Configuration prompt appears, press **Ctrl+i**. When a system contains more than one ServeRAID controller, a selection screen appears.

c. The menu lists the ServeRAID controllers in order. Select the first ServeRAID controller from the menu.

d. Select **Advanced Functions** from the Main Menu.

e. Select **View Controller and PCI Information** from the Advanced Functions menu.

f. Record the slot number for the ServeRAID controller; then, press **Esc** three times to return to the controller selection screen.

g. Repeat step 3c through step 3f until you record the slot number for each ServeRAID controller that appears on the selection screen.

4. Turn off the system; then, remove all ServeRAID, IDE, and SCSI disk-storage adapters and controllers except the one attached to the drive where you intend to install UnixWare.

   Note: If one of the disk-storage or ServeRAID controllers that you need to remove is on the system board, do one of the following:

   - If the CD-ROM drive that you are using to install your operating system is attached to the integrated controller, disconnect or remove all disk drives attached to the integrated controller.

   - If only disk drives are attached to the integrated controller, disconnect the SCSI or IDE cable for the integrated controller from the connector on the system board. See the label inside the server cover for the location of the SCSI and IDE cable connectors.

5. Follow the instructions in "Installing the files while Installing UnixWare"; then, return here and continue with
   step 6.

6. Power down the system.

7. Install any non-ServeRAID disk-storage adapters or controllers in the server; then, attach the drives to the disk-storage adapters and controllers.

8. Install the first ServeRAID controller from the list you created in step 3f; then, attach the drives to the ServeRAID controller.

9. Turn on the system and allow UnixWare to discover the new disk-storage adapters and controllers.

10. Power down the system.

11. Repeat steps 8, 9, and 10 until all ServeRAID adapters, ServeRAID controllers, and drives are installed.

12. You can now partition and format the logical drives attached to the ServeRAID adapters and controllers. See the information provided with UnixWare for more instructions.

Installing the files while Installing UnixWare

To install the ServeRAID files while installing UnixWare 7.X:

1. Use the instructions provided with UnixWare to begin the installation.

2. When a message appears asking if you want to install any HBA diskettes, insert the *IBM Netfinity Device Drivers for SCO Operating Systems Diskette*; then, select **Install HBA diskette**.

3. Use the instructions provided in the UnixWare manual to complete the normal installation process.

Installing the files after Installing UnixWare

Use the following instructions to install the ServeRAID files after you install UnixWare, or use these instructions to update a previously installed ServeRAID file with a newer version. You can use the UnixWare Pkgadd or the UnixWare SCOAdmin utility program to install the files.

Installing an HBA diskette file using Pkgadd

1. Insert the *IBM Netfinity Device Drivers for SCO Operating Systems Diskette* into the diskette drive.
2. Type:

   `pkgadd –d /dev/dsk/f0t`

3. Press **Enter**
4. When the message `Insert diskette into Floppy Drive 1` appears, press **Enter**.
5. When the message `Installation of IBM ServeRAID SCSI IHV HBA (ips) was successful` appears, type:

   `q`

6. Press **Enter**; then after the device driver installs, restart the system.

Installing an HBA diskette file using SCOAdmin

1. Insert the *IBM Netfinity Device Drivers for SCO Operating Systems Diskette* into the diskette drive.
2. Start the SCOAdmin utility program by typing **SCOADMIN** at the system prompt.
3. Select **Software_Management**.
4. Select **Application Installer**.
5. Select **Disk_A** from the Install From tab.
6. Click on the **Update View** button if nothing appears in the window.
7. When the icon labeled **ips** appears in the window, click on **Install**.
8. After the device driver installs, restart the system.

Starting the Background-Server components

To start the background-server components:

- If you are using OS/2 or Windows, double-click on the IPSRAID ADMIN-MONITOR icon on the desktop.
- If you are using OpenServer or UnixWare:
    1. Make sure you are logged on as `root`.
        a. If you are not, type:

           `su`

        b. When prompted, enter the `root` password.
    2. Start the background-server component (daemon) running in the background. To do this, type:

       `ipsadm &`

    3. Press **Enter**.

- If you are using Novell NetWare:

  1. Load the remote component. To do this, type:

     ```
     load ipsadm.nlm
     ```

  2. Press **Enter**

     Notes:

     a. To load the NetWare Administration program with NetWare SFT III installed, load IPSADM.NLM in the mirrored server engine. The ServeRAID adapters and controllers in the primary and backup servers will appear to the Administration and Monitoring Program as if they were in one server.

     b. When a rebuild, synchronization, or logical-drive migration is in process, you cannot stop the IPSADM.NLM module by pressing the Esc key. To stop the module during one of these operations, you must unload the IPSADM.NLM module.

Using the Background-Server components

This section provides information about background-server component command-line parameters and logging messages.

Using the Command-Line Parameters

To use the command-line parameters provided in the background-server components, issue the IPSADM command in the following format:

IPSADM *parameter 1 parameter 2* and so on...

Valid command-line parameters for the background-server components are as follows:

–? The –? command displays the help for the valid parameters.

–p:number The –p:*number* command specifies the port number that the server will check for client connections.

 The port number is a parameter used in TCP/IP to distinguish among different services on a single server. The default for the server utility programs is port number 1087. You can use this parameter to change the port number if another service on the system is using 1087.

–s:filename The –s:*filename* command specifies the name of the file that contains security information. For more about security information, see "Background-Server Component Security" on page 72.

–f The –f command specifies to log messages to the default file, IPSADM.LOG.

–f:filename The -f:*filename* command lets you specify the name of a file in which to log messages.

–d The –d command disables the logging of messages to the standard output, which is usually the screen.

Logging messages

Messages generated by the ServeRAID controller consist of startup information, connecting and disconnecting clients, and error messages.

When using the –f, –f:*filename* and –d parameters, you can specify how you want the ServeRAID messages handled. The default is to log messages to the standard output, which is usually the screen. However, you can have these messages logged to other output devices, such as a printer or a text file.

The following information provides examples of different formats for using the IPSADM command and the results.

Command	Results
IPSADM	Logs messages to the standard output and not to a file.
IPSADM -f	Logs messages to the standard output and to the IPSADM.LOG file.
IPSADM -f:NEWFILE.LOG	Logs messages to the standard output and to the file that you defined: NEWFILE.LOG.
IPSADM -d	Disables the logging of messages.
IPSADM -f -d	Logs messages to the IPSADM.LOG file; however, messages are not logged to the standard output.

Background-Server Component Security

Security information is maintained in an optional text file on the server. The file stores unencrypted user names and unencrypted passwords; therefore, the file must be kept in a secure directory.

When user names and passwords are entered into the Administration and Monitoring Program (the client), they are encrypted for delivery to the server. The server decrypts the user names and passwords to verify proper access to the ServeRAID controller. If the verification is successful, the controller accepts commands from the client. If no security file is present in the default directory, or the directory specified by the -s parameter, security is disabled. The server component then accepts commands from any client connection.

The security file contains one user name and password combination per line. The strings are separated by a colon (:) and each string has a maximum of eight characters.

Setting up security: To setup security, do the following:

1. Using a text editor (such as Microsoft Notepad), open a text file.

2. In the text file, enter one or more usernames and passwords using the following format:

   ```
   username:password
   username:password
   ```

   The number of usernames and passwords you enter depends on the number of people you want to give access to your computer.

3. Save and name the file. The default filename that the system looks for is `ipsadm.sec`. However, you can name the file anything you want.

To invoke security, type one of the following:

- If you used the default filename, type:

  ```
  run ipsadm
  ```

- If you used your own filename, type:

  ```
  run ipsadm -s filename.ext
  ```

- Press **Enter**.

Background-Server Component name resolution

The server component relies on name resolution to determine the host name from the client that is trying to connect. When a client is trying to access a remote server, the server tries to look up the name of the client connecting. The method used to look up the name is determined by the configuration of the server. Some possible methods for this are Domain Name Servers (DNS) or HOSTS files. With certain configurations, some timing delays might occur due to misconfiguration or inability to access the DNS. If problems persist, check your network configuration.

IBM ServeRAID fault-tolerant applet

If you set up a failover pair, you should install the IBM ServeRAID Fault Tolerant Control Panel Applet. You can use the applet to:

- View the current status of the ServeRAID controllers in the failover environment
- Force the primary controller to fail, which then transfers functionality to the secondary controller

To obtain the applet, go to the IBM web page at:

```
http://www.pc.ibm.com/support
```

To install the applet, do the following:

1. Insert the IBM ServeRAID Configuration and Management CD into the CD-ROM drive.
2. Type the following:

   ```
   z:\programs\failover\setup
   ```

   where z: equals the drive letter for the CD-ROM drive.
3. Follow the instructions on the screen to install the applet.

Once you have installed the applet, you start it by doing the following:

1. Click **Start Programs**, click on **Settings**; then, click on **Control Panel**.
2. Click **IBM Netfinity ServeRAID Failover Applet** and the program starts.

Using the applet screen

To use the applet screen, do one of the following:

- To view the current status, you do not have to do anything. The information is on the opening screen.
- To force a failover, click **Apply** on the failover or switchover selection. If the failover completes successfully, a message appears saying that the `Failover Completed Successfully`.

To exit the applet, click on the either the **X** in the upper right corner of the applet screen, on **Ok**, or on **Cancel**.

Command-Line Programs - IPSSEND and IPSMON

Note: If you are using Windows NT, you do not need to install the IPSMON program.

IPSSEND and IPSMON are advanced command-line programs that you can use to manage your ServeRAID controllers. These utility programs are provided on the the IBM ServeRAID Configuration and Management CD.

You can use the IPSSEND program to view the configuration of a ServeRAID controller, rebuild a defunct drive, initialize logical drives, synchronize logical drives, and perform other functions.

You can use the IPSMON program to monitor a ServeRAID controller for defunct drives, predictive failure analysis (PFA) warnings, rebuild operations, FlashCopy operations, synchronizations, and logical-drive migrations. This program can log a message to the monitor, to a file, or to both the monitor and a file whenever activities occur.

You can use the IPSSEND and IPSMON programs with the following operating systems:

- IBM OS/2 Warp Server and OS/2 LAN Server
- Novell NetWare 3.12, 4.1X, and 5.0
- Microsoft Windows NT
- SCO OpenServer 5.0.X
- SCO UnixWare 7.0

You also can use the IPSSEND program with DOS, but DOS requires the ASPI Manager.

Installing IPSSEND and IPSMON for OS/2, NetWare, or Windows NT

To install these programs for OS/2, NetWare, or Windows NT:

1. Start the server.

2. After the operating system loads, insert the *IBM ServeRAID Configuration and Management CD* into the CD-ROM drive.

3. If you are using NetWare, go to step 5. If you are using Windows NT or OS/2, create an IPSADM directory on your hard disk drive. To do this, go to the operating system command prompt and type:

   ```
   md c:\ipsadm
   ```

   Notes:

   a. The *c* represents the drive where OS/2 or Windows NT is installed.

   b. If you installed the Administration and Monitoring Program files, you already created this directory.

4. Press **Enter**.

5. Copy the IPSSEND.EXE file to your hard disk drive by typing one of the following at the command prompt:

   - For OS/2, type:

     ```
     copy z:\programs\cmdline\os2\ipssend.exe c:\ipsadm
     ```

   - For Windows NT, type:

     ```
     copy z:programs\cmdline\nt\ipssend.exe c:\ipsadm
     ```

   - For NetWare, type:

     ```
     copy z:\programs\cmdline\netware\ipssend.nlm c:\nwserver
     ```

Notes:

    a. The *z* represents the drive assignment for the CD-ROM drive that contains the IBM ServeRAID Configuration and Management CD.

    b. The *c* represents the drive where OS/2, Windows NT, or NetWare is installed.

    c. These instructions assume that you installed NetWare in the NWSERVER directory.

6. Press **Enter**; then, copy the IPSMON.EXE file to your hard disk drive by typing one of the following at the command prompt:

- For OS/2, type:

  `copy z:\programs\cmdline\os2\ipsmon.exe c:\ipsadm`

- For NetWare, type:

  `copy z:\programs\cmdline\netware\ipsmon.nlm c:\nwserver`

  Notes:

      a. The *z* represents the drive assignment for the CD-ROM drive that contains the IBM ServeRAID Configuration and Management CD.

      b. The *c* represents the drive where OS/2 or NetWare is installed.

      c. These instructions assume that you installed NetWare in the NWSERVER directory.

7. Press **Enter**; then, refer to Chapter 6, "Starting and using the Administration and Monitoring Program" on page 101 for information to start and use the IPSSEND and IPSMON programs.

Installing IPSSEND and IPSMON for OpenServer

To install these programs for OpenServer 5.0.X:

1. Insert the *IBM ServeRAID Configuration and Management CD* into the CD-ROM drive.

   Notes:

   Keep the following in mind for the first step:

       a. If you have more than one CD-ROM, you may need to replace `/dev/cd0` with the specific name of the CD-ROM you want to use.

       b. If you currently have something mounted on `/mnt`, you will need to create a new directory and substitute its name for `/mnt` for these instructions.

2. Mount the CD-ROM by typing:

   `mount -f ISO9660 -o rp dev/cd0 /mnt`

3. Copy the program files from the IBM ServeRAID Configuration and Management CD by typing the following:

   `cp /mnt/programs/cmdline/openserv/ipssend /usr/bin/ipssend`

4. Press **Enter**; then, type:

   `chmod 700 /usr/bin/ipssend`

5. Press **Enter**; then, type:

   `chmod 700 /usr/bin/ipsmon`

6. Press **Enter**; then, unmount the CD-ROM by typing:

   `unmount /mnt`

7. Press **Enter**; then, refer to Chapter 6, "Starting and using the Administration and Monitoring Program" on page 101 for information to start and use the IPSSEND and IPSMON programs.

Installing IPSSEND and IPSMON for UnixWare

To install these programs for UnixWare 7.0:

1. Insert the IBM ServeRAID Configuration and Management CD into the CD-ROM drive.

2. Mount the CD-ROM by typing:

   ```
   mount -r -F cdfs /dev/cdrom/c0b0t610 /CD-ROM_1
   ```

   where /dev/cdrom/c0b0t610 is the specific name of your CD-ROM drive. Also, if you currently have something mounted on CD-ROM_1, you need to create a new directory and substitute its name for CD-ROM_1 throughout these instructions.

3. Copy the program files from the IBM ServeRAID Configuration and Management CD by typing the following:

   ```
   cp /CD-ROM_1/programs/cmdline/unixware/ipssend /usr/bin/ipssend
   ```

4. Press **Enter**; then, type:

   ```
   cp /CD-ROM_1/programs/cmdline/unixware/ipsmon /usr/bin/ipsmon
   ```

5. Press **Enter**; then, change the access permissions by by typing the following:

   ```
   chmod 700 /usr/bin/ipssend
   ```

6. Press **Enter**; then, type:

   ```
   chmod 700 /usr/bin/ipsmon
   ```

7. Press **Enter**; then, unmount the CD-ROM by typing:

   ```
   umount /CD-ROM_1
   ```

8. Press **Enter**; then, refer to Chapter 6, "Starting and using the Administration and Monitoring Program" on page 101 for information to start and use the IPSSEND and IPSMON programs.

Installing IPSSEND for IBM DOS

To install IPSSEND for DOS:

Note: A DOS bootable command-line program diskette image is available from the following IBM web page:

   ```
   http://www.pc.ibm.com/support
   ```

   Once you download the diskette image, refer to the README file on the diskette for installation instructions.

1. Create a startable diskette. To do this, insert a blank diskette in diskette drive A; then, type:

   ```
   format a: /s
   ```

2. Press **Enter**.

3. Copy the IPSSEND.EXE file from the DOS directory on the *IBM ServeRAID Configuration and Management CD* to the startable diskette by typing the following:

   ```
   copy z:\programs\cmdline\dos\ipssend.exe a:\ipssend.exe
   ```

Notes:

    a. The *z* represents the drive assignment for the CD-ROM drive that contains the IBM ServeRAID Configuration and Management CD.

    b. The *a* represents the diskette drive where the diskette is installed.

4. Install the ASPI device driver on the startable diskette. To do this, insert the *IBM ServeRAID Device Driver Diskette* in diskette drive A; then, type:

   ```
   a:\dos\uinstall
   ```

5. Press **Enter**. Specify `a:\` as the **Source Drive** and `a:\` as the **Target Path**; then, follow the instructions that appear on the screen.

6. Leaving the startable diskette in the diskette drive, restart the system; then, refer to Chapter 6, "Starting and using the Administration and Monitoring Program" on page 101 for information to start and use the IPSSEND program.

Chapter 5. The ServeRAID Manager program

This chapter provides instructions for using the ServeRAID Manager program. The ServeRAID Manager program helps you simplify the configuration, administration and monitoring of your ServeRAID controllers.

The information in this chapter is a high level explanation of the ServeRAID Manager program and its capabilities. For instructions on specific processes using the ServeRAID Manager, refer to the Online Help system.

Note: The ServeRAID Manager program works with systems using Microsoft Windows NT, Windows 95, Windows 98, and UnixWare. If you have a system that you are monitoring in a network that uses OS/2, Novell NetWare, or SCO OpenServer you must use the IBM Administration and Monitoring Utility to monitor those systems.

Using the ServeRAID Manager program

The graphical interface in the ServeRAID Manager program makes it easy for you to create, delete, change, view and monitor your ServeRAID configuration.

Before you begin, review the following illustration to become familiar with the layout of the ServeRAID Manager program screens.
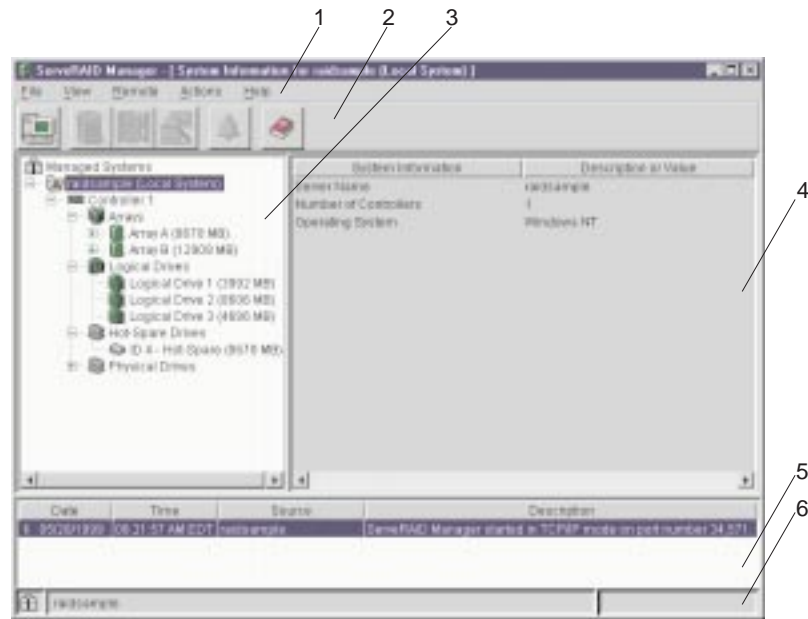
Figure 9. ServeRAID ServeRAID Manager program Screen Layout

Descriptions of the numbered areas are as follows:

1. Menu Bar — Provides File, View, Remote, Actions, and Help pull-down menus. See "Using the Menu Bar" on page 89 for more information.

2. Tool Bar — Provides quick-path icons for common tasks. The icons from left to right are Add Remote System, Create an Array, Configure the Controller, Scan for New or Removed Ready Drives, Silence Repeating Alarm, and Help. See "Using the Tool Bar" on page 89 for more information.

3. Main Tree — Provides an expandable tree view of your ServeRAID subsystem. You will perform most of your ServeRAID configuration and maintenance tasks by first selecting the ServeRAID controller, array, logical drive, hot-spare drive, or physical drive objects from this Main Tree.

4. Main Panel — Provides specific device information or configuration instructions. When the ServeRAID Manager program is in the Information mode and you select an object from the Main Tree, detailed information about the object appears in this panel. When the ServeRAID Manager program is in the Configuration mode, the instructions needed to configure your ServeRAID subsystem appear in this panel.

5. Event Viewer — Provides advisory and progressive-status information and messages during the ServeRAID configuration process and while monitoring systems with ServeRAID controllers. Each message appears with a hostname from where the event originated, a time stamp, a date stamp, and an icon that classifies the severity of the event. The event icons are:

- Information: An "i" inside a blue circle

- Warning: A "!" inside a yellow triangle

- Fatal: An "x" inside a red circle

Warning messages identify potential data-loss situations, and Fatal messages inform you when a failure has occurred. All fatal messages will launch an audible alarm.

6. Status Bar — Provides three types of information in a resizable panel. The panels contain the following information:

- The left panel displays the managed system status, which is either **No problems detected on any system** or **Problems detected on one or more systems**.

- The center panel displays the current tree path.

- The right panel displays a progress meter with the label of the currently selected system and the process that is taking place at the current time.

Starting the ServeRAID Manager Program

The ServeRAID Manager program runs in two modes: the *Information* mode and the *Configuration* mode.

In the Information mode, you can view the existing device and configuration information for the ServeRAID subsystems. When this mode is active, you can use the functions available from the Menu and Tool Bars to customize settings for your ServeRAID controllers. See "Using the Information Mode" on page 83 for more information.

In the Configuration mode, you can create disk arrays, create logical drives, and define your hot-spare drives. When this mode is active, only a limited set of functions is available from the Menu and Tool Bars. See "Using the Configuration Mode" on page 93 for more information.

The ServeRAID Manager program, is provided on the *IBM ServeRAID Netfinity Configuration and Management CD* packaged with the ServeRAID controller, and it also is provided on the configuration CD packaged with some IBM server models.

Starting the ServeRAID Manager program in Windows NT

To start the ServeRAID Manager program in Windows NT:

 1. Click on the ServeRAID Manager program icon on the desktop.

    The program starts in the Information mode and a screen similar to the following appears.

Figure 10. Information Mode Screen

 2. Go to "Using the Information Mode" on page 83

Starting the ServeRAID Manager program in UnixWare

To start the ServeRAID Manager program in UnixWare:

   Note: Ensure you have superuser privileges before starting this procedure.

 1. Get to the directory where you installed the ServeRAID Manager program by typing:

    `cd /opt/Netfinity/RaidMan`

 2. Type the following and then press Enter to start the program:

    `sh RaidMan.sh`

    The program starts in the Information mode and a screen similar to the previous screen appears.

 3. Go to "Using the Information Mode" on page 83

Using the Information Mode

You can use the Information mode to view the configuration information for the managed systems, server, ServeRAID controllers, arrays, logical drives, hot-spare drives, and physical drives that make up your ServeRAID subsystem. You also can use this mode to change some of the ServeRAID controller settings.

Viewing the Device and Configuration information

To view the current settings:

1. Click on the plus (+) box next to the object in the Main Tree to expand that portion of the tree.

2. Click on the icon for the managed system, server, ServeRAID controller, array, logical drive, hot-spare drive, or physical drive to view its current settings.

Detailed information about the selected object will appear in the Main Panel on the right. The following pages provide descriptions of the device information that might appear.

Managed Systems Panel

When you select managed systems from the Main Tree, the following information appears in the Main Panel on the right:

Number of Managed Systems shows the number of managed systems under the parent node, including the local system.

System Information Panel

When you select the server from the Main Tree, the following information appears in the Main Panel on the right:

- **Server Name** reports the system name of the server.
- **Number of Controllers** reports the number of ServeRAID controllers in the server.
- **Operating System** reports the installed operating system.
- **Device Driver Version** reports the ServeRAID device driver level.

ServeRAID Controller Information Panel

When you select a ServeRAID controller from the Main Tree, the following information appears in the Main Panel on the right:

- **Controller Type** reports whether the controller is a ServeRAID, ServeRAID II, ServeRAID-3H, ServeRAID-3HB or ServeRAID-3L. The type only is shown if your BIOS is version 3.0 or later.
- **ServeRAID Number** is the ServeRAID controller number. The number is only shown if the BIOS is earlier than version 3.0.
- **Status** reports whether the controller is working. This row only displays when the controller is not working.
- **BIOS Version** reports the version of the BIOS on the controller. This information only is displayed if the BIOS version is 3.0 or later.

- **Firmware Version** reports the version of the ServeRAID firmware.

- **Physical Slot** shows the actual physical slot location for the ServeRAID controller; for example, PCI slot 4. The slot is only shown if your BIOS is version 3.0 or later.

- **Battery Backup Write Cache** reports whether this feature is Installed, Not Installed, Defective, or Needs Battery. This row only displays if ServeRAID supports a Battery Backup device.

- **Read-Ahead Cache Mode** reports whether this feature is Enabled, Disabled, or Adaptive. Use the IBM ServeRAID Configuration Program to change this feature's settings.

- **Stripe-Unit Size** reports the size setting of 8 KB, 16 KB, 32 KB, or 64 KB. Use the IBM ServeRAID Configuration Program to change this setting.

- **Rebuild Rate** reports the rate setting of High, Medium, or Low. Use the IBM ServeRAID Configuration Program to change this setting.

- **Hot-Swap Rebuild** reports this feature as Enabled. This setting only is shown if the ServeRAID firmware supports Hot-Swap Rebuild.

- **Data Scrubbing** reports this feature as enabled. This feature only is shown if the ServeRAID firmware supports Data Scrubbing.

- **Auto-Synchronization** reports this feature as Enabled. This setting only is shown if the ServeRAID firmware supports Auto-Synchronization.

- **Clustering** reports Enabled or Disabled based on the Cluster Partner ID and Merge Group IDs configuration, if the ServeRAID firmware supports clustering.

- **ServeRAID Controller Host ID** reports the ID if the controller is part of a cluster. Use the IBM ServeRAID Configuration Program to change this ID.

- **Cluster Partner Host ID** reports the ID if the controller is part of a cluster. Use the IBM ServeRAID Configuration Program to change this mode.

- **Unattended Mode** reports whether this setting is Enabled or Disabled. Use the IBM ServeRAID Configuration Program to change this mode.

- **Number of Arrays** reports the number of defined arrays.

- **Number of Logical Drives** reports the number of defined logical drives.

- **Number of Hot-Spare Drives** reports the number of defined hot-spare devices.

- **Number of Ready Drives** reports the number of physical drives available for configuration.

Array Information Panel

When you select the Arrays icon from the Main Tree, the following information appears in the Main Panel on the right.

- **Array** reports the letter of each array.

- **Size** reports the total size, in MB.

- **Free Space** reports the amount of free space available.

- **Logical Drives** reports the number of logical drives in each array.

When you select a specific array from the Main Tree, the following information appears in the Main Panel on the right:

- **Array Letter** reports the letter of the selected array.

- **Array Size in MB** reports the total size, in MB.
- **Free Space in MB** is the amount of free space available, in MB. If the array contains a RAID level-5E logical drive, the free space is 9.
- **Number of Logical Drives** is the number of logical drives in the selected array.
- **Number of Physical Drives** is the number of physical drives in the selected array.

Logical Drive Information Panel

When you select a logical drive from the Main Tree, the following information appears in the Main Panel on the right:

- **Logical Drive** reports the number of each logical drive.
- **Array** reports the letter of the array.
- **Size** reports the logical drive size, in MB,
- **RAID Level** reports the configured level of RAID.

When you select a specific logical drive icon from the Main Tree, the following information appears in the Main Panel on the right:

- **Logical Drive** reports the number of the selected logical drive.
- **Array Letter** reports the letter of the array that contains the selected logical drive.
- **State** reports whether the logical drive state is Blocked, Critical, Critical Migrating, Critical System, Migrating, Offline, Okay, or System.
- **RAID Level** reports the logical drive RAID level. as RAID level-0, RAID level-1, RAID level-1E, RAID Level-5, or RAID level-5E.
- **Data Space in MB** reports the available space for data storage in this logical drive.
- **Parity Space in MB** reports the allocated space for parity storage in the array.
- **Date Created** reports the date the logical drive was created.
- **Write-Cache Mode** reports whether the logical drive is set to write through or write back. Use the IBM ServeRAID Configuration Program to change this setting.
- **Merge-Group Number** displays the merge group number if the controller is part of a cluster. If you have newly created the logical drive, use the Configure for Clustering dialog to change this number. Otherwise, use the IBM ServeRAID Configuration Program.
- **Merge-Group State** displays shared or non-shared if the controller is part of a cluster. If you have newly created the logical drive, use the Configure for Clustering dialog to change this state. Otherwise, use the IBM ServeRAID Configuration Program.

Hot-Spare Drive Information Panel

When you select the Hot-Spare Drives icon from the Main Tree, it reports the total number of hot-spare drives and stand-by hot spare drives in the Main Panel on the right. The number does not include defunct hot-spare drives.

When you select a specific hot-spare drive from the Main Tree, the following information appears in the Main Panel on the right:

- **Drive Type** reports whether the hot-spare drive is a hard disk drive, CD-ROM, tape, removable media, or enclosure.

- **Channel** reports the channel to which the hot-spare drive is connected

- **SCSI ID** reports the selected hot-spare drive SCSI ID.

- **Size in MB** reports the total size of the hot-spare drive, in MB. This information does not appear for CD-ROM, tape, or processor drives.

- **State** reports the hot-spare drive state as Ready, Online, Defunct, Rebuilding, or Hot-Spare Standby.

- **Array Letter** if the drive is defined in an array, reports the letter (A through H) of the array that contains the selected physical drive.

- **Vendor** shows characters that represent the drive manufacturer.

- **Product/Model Number** shows characters that represent the product or model number for the drive.

- **Serial Number** shows the serial number for the drive.

- **Firmware Level** shows the current level of firmware in use for the drive.

- **PFA Error** indicates the status, Yes or No, for predictive-failure alerts. Yes indicates that PFA errors were detected, and NO indicates that PFA errors were not found.

Physical Drive Information Panel

When you select the Physical Drives icon from the Main Tree, it reports the total number of drives connected to each channel of the ServeRAID controller appears in the Main Panel on the right.

When you select a specific physical drive from the Main Tree, the following information appears in the Main Panel on the right:

- **Type** reports whether the physical drive is a hard disk drive, CD-ROM, tape, removable media, or Enclosure.

- **Channel** reports the channel to which the physical drive is connected.

- **SCSI ID** reports the selected physical drive SCSI ID.

- **Size in MB** reports the total size of the physical drive, in MB. This information does not appear for CD-ROM, tape, or processor devices.

- **State** reports the physical drive state as Ready, Online, Defunct, Rebuilding, or Hot-Spare Standby.

- **Array Letter** if the drive is defined in an array, reports the letter (A through H) of the array that contains the selected physical drive.

- **Vendor** shows characters that represent the drive manufacturer.

- **Product/Model Number** shows characters that represent the product or model number for the drive.

- **Serial Number** shows the serial number of the drive.

- **Firmware Level** shows the current level of firmware in use for the drive.

- **PFA Error** indicates the status, Yes or No, for predictive-failure alerts. Yes indicates that PFA errors were detected, and No indicates that PFA errors were not found.

Channel Information Panel

When you select a SCSI Channel icon from the Main Tree, the following information appears in the Main Panel on the right:

- **Number of Drives** reports the number of drives on the SCSI channel. The drives reported can include hard disk drivers, CD-ROM, tape, and removable media.

- **SCSI Transfer Speed** reports the speed as Optimal, Ultra2 SCSI, UltraSCSI, Fast SCSI-2, SCSI-2, or SCSI-1. Use the IBM ServeRAID Configuration Program to change this speed.

- **SCSI Initiator ID** reports the initiator ID for the SCSI channel. Use the IBM ServeRAID Configuration Program to change this speed.

Drive states

This section provides descriptions of the logical and physical drive states.

Logical drive state descriptions: The following table provides descriptions of the valid logical drive states.

Drive State	Meaning
Blocked	During a rebuild operation, the ServeRAID controller sets the state of any RAID level-0 logical drives associated with a failed array to the Blocked state; then, it reconstructs the data that was stored in RAID level-1, RAID level-1E, Raid level-5 and RAID level-5E logical drives. After the Rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. However, the logical drive might contain damaged data. You must either re-create, reinstall, or restore the data from the most recent backup disk or tape to the RAID level-0 logical drive.
Critical Migrating	A logical drive in the critical state that is undergoing a logical drive migration (LDM).
Critical System	The ServeRAID controller uses this reserved state during a logical drive migration (LDM) and the logical drive is in the critical state.
Critical	A RAID level-1, RAID level-1E, RAID level-5, or level-5E logical drive that contains a defunct physical drive is in the critical state. A critical logical drive is accessible, despite a physical drive failure. **Attention:** If the state of the logical drive is critical, refer to "Rebuilding a defunct drive" on page 147.
Migrating	The logical drive is undergoing a logical drive migration; that is, a change in RAID levels, a change in logical drive size, an increase in free space, or a RAID level-5E compression or decompression.
Offline	The logical drive is offline and not accessible. This state occurs when one of the following is true. • One or more physical drives in a RAID level-0 logical drive is defunct. • Two or more physical drives in a RAID level-1, RAID level-1E, or level-5 logical drive are defunct. • Three or more drives in a RAID level-5E logical drive are defunct. If any of these are true, refer to "Rebuilding a defunct drive" on page 147.
Okay	The logical drive is okay. It is in a good, functional state.
System	The ServeRAID controller uses this reserved state during logical drive migration (LDM).

Physical drive state descriptions: The following table provides descriptions of the valid physical drive states.

Drive State	Meaning
Defunct	A physical hard disk drive in the Online, Hot-Spare, or Rebuild state has become defunct. It does not respond to commands, which means that the ServeRAID controller cannot communicate properly with the drive. If a physical drive has become defunct, refer to "Rebuilding a defunct drive" on page 147.
Hot Spare	A Hot-Spare drive is a hard disk drive that is defined for automatic use when a similar drive fails.
Online	The drive is Online. It is functioning properly and is part of an array.
Rebuilding	The drive is being rebuilt. For more information on rebuilding a drive, refer to "Rebuilding a defunct drive" on page 147.
Ready	The ServeRAID controller recognizes a Ready drive as being available for definition.
Standby	A Standby drive is a hard disk drive that has spun down, a CD-ROM drive, a removable media drive, or an enclosure.
Standby Hot Spare	A Standby Hot Spare is a Hot-Spare drive that the ServeRAID controller has spun down. If an Online drive becomes Defunct and no suitable Hot-Spare drive is available, a Standby Hot-Spare drive of the appropriate size automatically spins up, and enters the Rebuild state.

Changing the ServeRAID configuration settings

To change the settings:

1. Click on the plus (+) box next to the object in the Main Tree to expand the tree.

2. Click on the icon in the Main Tree for the ServeRAID controller, array, logical drive, hot-spare drive, or physical drive that you want to change.

3. Click on **Actions** in the File Menu; then, make a selection from the pull-down menu.

   or

   Using the right mouse button, click on the object in the Main Tree; then, make a selection from the pop-up list.

See "Using the Menu Bar" on page 89 for descriptions of the choices available from the Actions pull-down menu.

Using the Tool Bar

Descriptions of the quick-path icons provided on the Tool Bar are as follows:

Add Remote System: This icon appears in the Information mode. Use this to add a remote system to the Main Tree for monitoring and configuration.

Create an Array: This icon appears in the Information mode. If there are Ready drives available, this icon presents a choice of Express or Custom configuration.
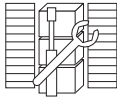
Configure for Clustering: Use this to view the clustering parameters and set merge group IDs for new logical drives.

Scan for New or Removed Ready Drives: Use this to identify new drives as Ready and remove drives as Empty.

Silence Repeating Alarm: Use this to silence the alarm. All Warning and Error events cause an audible alarm to sound every five minutes, notifying you of an event. You can adjust the alarm interval in the User's Preference dialog.

Current Topic: This displays context sensitive help on the panel level.

Using the Menu Bar

Descriptions of the choices available from the Menu Bar are as follows:

File   The File pull-down menu contains the following choices in the Information mode:

- **Clear Configuration Event Log:** Clears the current contents of the event viewer. This option does not clear or delete the event logging file.

- **User Preferences:** Displays a dialog that enables you to specify the following settings:

    – **Initialization Settings**
    – **Remote Access Settings**
    – **Alarm Settings**

- **Exit:** Exits the ServeRAID Manager program.

View   The View pull-down menu contains the following choices in the Information mode:

- **Toolbar:** Turn the Toolbar on or off. The default is On (checked).

- **Status Bar:** Turn the Status Bar on or off. The default is On (checked).

- **Refresh:** Refreshes the display with the latest configuration information.

Remote   The Remote pull-down menu contains the following choices in the Information mode:

- **Add Remote System:** Adds a remote system to the Main Tree for monitoring and configuration.

- **Remove Remote System:** Displays a cascading menu of all the remote systems currently in your Main Tree. You can select one remote system to remove at a time.

Actions   All choices available from the Actions pull-down menu also are available from the pop-up lists that appear when you use the right mouse button and click on the object in the Main Tree.

> **Note:** If there are no valid actions for the object you selected, the Actions menu is grayed out.

Selecting a managed system icon: The following choices appear on the Actions pull-down menu when you select the Managed Systems icon from the Main Tree:

- **Add Remote System:** Add a remote system to the Main Tree for monitoring and configuration.

- **Remove Remote System:** Removes a remote system from the ServeRAID Manager's Main Tree, but does not take it offline. Depending on the settings in the Notification List, you might not monitor the system further.

Selecting a system icon: The following choices appear on the Actions pull-down menu when you select a System Icon from the Main Tree:

- **Remove Remote System:** Removes a remote system from the ServeRAID Manager's Main Tree, but does not take it offline. Depending on the settings in the Notification List, you might not monitor the system further.

- **View Notification Manager:** Displays the Notification Manager window. For more information, see "Notification Manager" on page 93.

- **View Security Manager:** Displays the Security Manager window. For more information, see "Security Manager" on page 96.

Selecting a ServeRAID controller icon: The following choices appear on the Actions pull-down menu when you select a ServeRAID controller from the Main Tree:

Note: For more detailed information on all of these actions, refer to the ServeRAID Manager program online help system.

- **Create Array:** Select this choice to create an array. You will be given the choice to use between Express Configuration and Custom Configuration.

- **Restore to Factory Defaults:** Select this choice to restore all parameters in the configuration to the factory defaults.

- **Copy the Configuration from the Drives to the Controller:** Select this choice to import the most common configuration on all the physical drives into the controller.

- **Delete All Arrays:** Select this choice to erase all the data contained on the logical drives in all of the arrays.

- **Create Logical Drives in Array ?:** Select this choice to create a logical drive in the specified array.

- **Configure the Controller for Clustering:** Select this choice to configure and view RAID settings for clustering computers or using high-availability. This selection is also used for a failover environment.

- **Scan for New or Removed Ready Drives:** Select this choice to scan all SCSI channels or only selected SCSI channels for either hard disk drives that have been added, or Ready drive that have been removed.

- **Identify All Physical Drives:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected icon blink. That is, the hardware light blinks to readily identify itself within the server.

Selecting an array icon: The following choices appear on the Actions pull-down menu when you select the Arrays icon from the Main Tree:

- **Create an Array:** Select this choice to create an array. You will be given the choice to use between Express Configuration and Custom Configuration.

- **Delete All Arrays:** Select this choice to erase all the data contained on the logical drives in all of the arrays.

- **Identify All Arrays:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected array icon blink. That is, the hardware light blinks to readily identify itself within the server.

Selecting a specific array icon: The following choices appear on the Actions pull-down menu when you select a specific array icon from the Main Tree:

- **Delete Array:** Select this choice to erase all the data contained on the logical drive in the specific array.

- **Identify Array:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected array icon blink. That is, the hardware light blinks to readily identify itself within the server.

- **Change RAID Level from ...**   Select this choice to change the RAID level of a logical drive from one level to another. Refer to Logical Drive Migration in the ServeRAID Manager program online help for more information.

  You can change RAID levels from:

  – RAID level-0 to RAID level-5
  – RAID Level from RAID level-1 to RAID level-5
  – RAID Level from RAID level-5 to RAID level-0
  – RAID Level from RAID level-5E to RAID level-5

- **Increase Free Space:** Select this choice to add one, two, or three physical hard disk drives to an existing array so you can create a another logical drive in the array. Refer to Logical Drive Migration in the ServeRAID Manager program online help for more information.

- **Increase Logical Drive Space:** Select this choice to add one, two, or three physical hard disk drives to an existing array so you can expand the size of the logical drives in the array. When increasing logical drive space, the ServeRAID Manager migrates the logical drives such that the logical drives gain additional space, much like adding paper to a notebook. Refer to Logical Drive Migration in the ServeRAID Manager program online help for more information.

Selecting a logical drive icon: The following choices appear on the Actions pull-down menu when you select the Logical Drives icon from the Main Tree:

- **Create a Logical Drive in Array:** Select this choice to create a logical drive in the specified array.

- **Identify Array:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected array icon blink. That is, the hardware light blinks to readily identify itself within the server.

Selecting a specific logical drive icon: The following choices appear on the Actions pull-down menu when you select a specific logical drive icon from the Main Tree:

- **Delete Logical Drive:** Select this choice to erase all the data contained on that logical drive.

- **Initialize Logical Drive:** Select this choice to initialize the selected logical drive. When the ServeRAID Manager initializes the logical drive, it destroys any data contained on that logical drive.

Initialization is usually automatic when you create a logical drive. The ServeRAID Manager displays **Initialize Logical Drive** as an option only when you have deselected the **Automatic Initialization** check box in the User Preference dialog.

- **Synchronize the Logical Drive:** Select this choice to synchronize the specified logical drive. Synchronizing a logical drive verifies that the data redundancy for the logical drive is correct. All RAID level-5 logical drives must be synchronized before storing data.

- **Unblock the Logical Drive:** Select this choice to unblock a RAID level-0 logical drive after a Rebuild operation completes.

  During a rebuild operation, the ServeRAID controller sets the state of any RAID level-0 logical drive associated with a failed array to the Blocked state. Then, it reconstructs the data that was stored in RAID level-1 and RAID level-5 logical drives. After the Rebuild operation completes, you can unblock the RAID level-0 logical drive and access them once again. However, the logical drive might contain corrupt data. You must either re-create, re-install, or restore the data from the most recent backup disk or tape to the RAID level-0 logical drive.

- **Identify Logical Drives:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected logical drive icon blink. That is, the hardware light blinks to readily identify itself within the server.

Selecting a hot-spare drive icon: The following choice appears on the Actions pull-down menu when you select a hot-spare drive from the Main Tree:

- **Identify All Hot-Spare Drives:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected hot-spare drive icon blink. That is, the hardware light blinks to readily identify itself within the server.

Selecting a physical drive icon: The following choices appear on the Actions pull-down menu when you select the Physical Drives icon from the Main Tree:

- **Scan for New or Removed Drives:** Select this choice to scan all SCSI channels or only selected SCSI channels for either hard disk drives that have been added, or Ready drive that have been removed.

- **Identify All Physical Drives:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected icon blink. That is, the hardware light blinks to readily identify itself within the server.

Selecting a specific physical drive icon: The following choices appear on the Actions pull-down menu when you select a specific physical drive icon:

- **Identify Physical Drive:** Select this choice and the ServeRAID Manager program makes the physical drive associated with the selected physical drive icon blink. That is, the hardware light blinks to readily identify itself within the server.

- **Create Hot-Spare:** Select this choice to create a hot-spare drive from the specified Ready physical drive.

- **Delete Hot-Spare:** Select this choice to delete a hot-spare drive from the configuration by setting the drive to Ready. If you have physically removed the drive, the ServeRAID Manager program removes the drive from the configuration.

- **Remove the Defunct Drive:** Select this choice to remove the specified defunct drive from the configuration. Use this action on defunct drives that are not part of any array.

- **Replace the Defunct Drive:** Select this choice once you have installed a replacement hard disk drive. The ServeRAID Manager program sets the new drive to Hot-Spare.

- **Replace Drive and Rebuild:** Select this choice to rebuild a new drive you have installed to replace a defunct drive.

- **Set Drive State to Online:** Select this choice to set a defunct physical drive to online. The ServeRAID Manager displays `Set Drive State to Online` as an option only when the defunct drive is part of an array and when there are no Critical logical drives in the array. Note: When you set a Defunct drive to Online, there is a high risk of data loss.

- **Identify All Physical Drives:** Select this choice and the ServeRAID Manager program makes the physical drives associated with the selected icon blink. That is, the hardware light blinks to readily identify itself within the server.

Help   The following choices are available from the Help pull-down menu:

- **Current Topic:** Displays context sensitive help on the panel level.
- **Index:** Displays the help system index. You can use the index to search the help system for a topic.
- **Contents:** Displays the help system table of contents. You can use the contents to acquaint yourself with help system topics.
- **About RAID Manager:** Displays the ServeRAID Manager version number, copyright, and legal information.

Using the Configuration Mode

You can use the Configuration mode to create up to eight independent disk arrays for each ServeRAID controller. Refer to the online help for detailed information on using the Configuration Mode.

Logical Drive Migration

The logical drive migration (LDM) feature dynamically changes the current logical drive structure. You can use this feature to:

- Change the RAID level
- Increase the free space in a disk array
- Change the size of a logical drive

Refer to the online help for detailed information on using Logical Drive Migration.

Notification Manager

Notification Manager is a tool used to notify other systems running the ServeRAID Manager of all events that occur on the local system. The user of the system enters system names in the Notification List. Each system in the list is notified of all events that occur on the local system.

The types of events generated by the Notification Manager include:

- Progress information, such as rebuilds, synchronizations, and migrations.

- Problems, such as defunct disk drives and PFA errors.

- Changes to the local configuration, such as creating a hot-spare or defining a logical drive.

Notification Manager Screen

Before we continue, review the following figure to become familiar with the layout of the Notification Manager Screen.
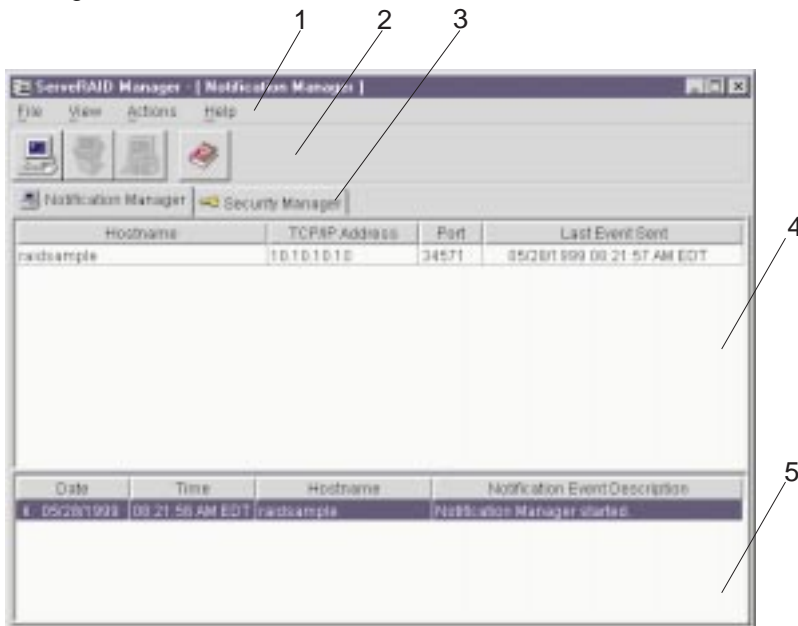
Descriptions of the numbered areas are as follows:

1. Menu Bar

Provides standard File, View, Actions, and Help pull-down menus. See "Notification Manager Menu Bar" for more information.

2. Tool Bar

Provides quick-path icons for common tasks. The icons from left to right are Add Host, Delete Host, Modify Host, and Help. See "Using the Tool Bar" on page 95 for more information.

3. Notetabs

Provides an easy method to switch between the Notification Manager screen and the Security Manager screen.

4 Notification List (Main Panel)

Provides a list of hostnames that will be notified of all events on the local system.

5. Events List

Displays the Notification Manager events.

Notification Manager Menu Bar

Descriptions of the choices available from the Menu Bar for the Notification Manager are as follows:

File   The File pull-down menu contains the following choices:

- **Clear Event Log:** Select this choice to clear the current contents of the Notification Manager Event Viewer. This option does not clear or delete the event logging file.

- **Exit:** Select this choice to exit from the ServeRAID Notification Manager.

View   The View pull-down menu contains the following choice:

- **Tool Bar:** Turns the the tool bar on and off. The default is On (checked).

Actions   The Actions pull-down menu contains the following choices::

- **Add System:** Select this choice to add a new system to the Notification list. Every new system you add to the list is notified of all events that occur on this system.
- **Delete System:** Select this choice to delete the selected system from the notification list.
- **Modify System:** Select this choice to modify the selected remote system's hostname, TCP/IP address, or port number.
- **Send Test Event:** Select this choice to send a test event to the selected remote system.

Help   The following choices are available from the Help pull-down menu:

- **Current Topic:** Displays context sensitive help on the panel level.
- **Index:** Displays the help system index. You can use the index to search the help system for a topic.
- **Contents:** Displays the help system table of contents. You can use the contents to acquaint yourself with help system topics.
- **About RAID Manager:** Displays the ServeRAID Manager version number, copyright, and legal information.

Using the Tool Bar

Descriptions of the quick-path icons provided on the Tool Bar are as follows:

Add System: Select this icon to add a new system to the Notification list. Every new system you add to the list is notified of all events that occur on this system.

Delete System: Select this icon to delete the selected system from the notification list.

Modify System: Select this icon to modify the selected remote system's hostname, TCP/IP address, or port number.

Current Topic: When you select this icon, it displays context sensitive help on the panel level.

Understanding the Notification List

The Notification List has four columns of information:

- **Hostname**: The TCP/IP hostname to notify for each event. If you double-click on this column, the Modify System Properties dialog box displays.

- **TCP/IP**: The TCP/IP address to notify for each event. If you double-click on this column, the Modify System Properties dialog box displays.

- **Port**: The TCP/IP port number the ServeRAID Monitor uses to communicate with the remote system's ServeRAID Manager. If you double-click on this column, the Modify System Properties dialog displays.

- **Last Event Sent**: The last date and time the Notification Manager sent, or tried to send, and event to a system. If you double-click on this column, the Last Event Sent dialog displays.

  If the Notification Manager did not successfully send the event to the system:

  – An event is logged in the Notification manager Event Viewer.

  – An red circle with an **X** displays in this column.

Understanding the Notification Event Viewer and events

The Notification Event Viewer has four columns. You can double-click on any event in the Event Viewer and the Notification Event Detail dialog displays. The dialog presents the same information as the Event Viewer, but in a larger, easier to read screen.

- **Type**: The type of event (Information, Warning, or Error).
- **Date**: The date the event occurred.
- **Time**: The time the event occurred.
- **Hostname**: The system for which the event was generated.
- **Notification Manager Event**: The event description.

Security Manager

The Security Manager allows you to give users the ability to configure and view controller information from remote systems.

The Security Manager is enabled by default. You must configure at least one user name and password before any user can connect to the local system. You can disable the Security Manager by selecting Disable Security from the Actions menu. By disabling the Security Manager, any user can establish a connection with the local system and modify the RAID subsystem.

Security Manager Screen

Before we continue, review the following figure to become familiar with the layout of the Security Manager Screen.
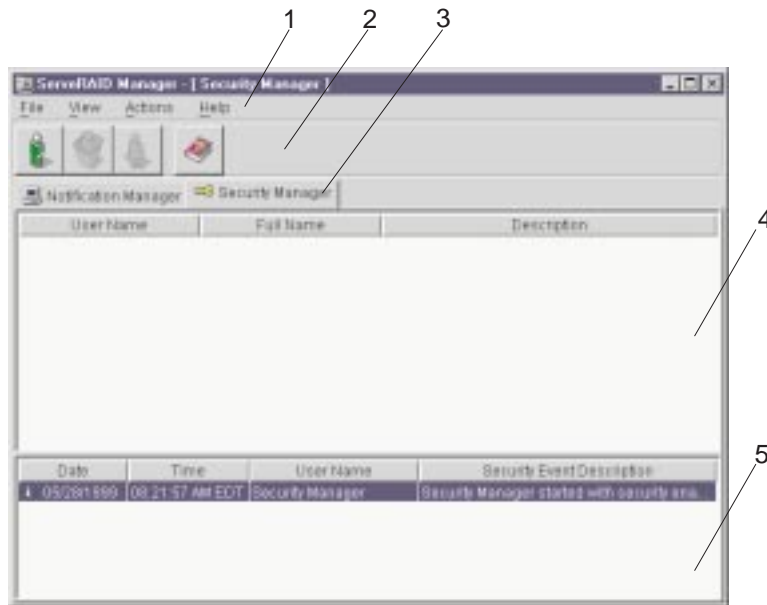
Descriptions of the numbered areas are as follows:

1. Menu Bar

Provides standard File, View, Actions, and Help pull-down menus. See "Security Manager Menu Bar" for more information.

2. Tool Bar

Provides quick-path icons for common tasks. The icons from left to right are Add User, Delete User, Modify User, and Help. See "Using the Tool Bar" on page 98 for more information.

3. Notetabs

Provides an easy method to switch between the Security Manager screen and the Notification Manager screens.

4 Security List (Main Panel)

Displays a list of the users that have access to the local system.

Events List

Displays the Security Manager events.

Security Manager Menu Bar

Descriptions of the choices available from the Menu Bar for the Security Manager are as follows:

File   The File pull-down menu contains the following choices:

- **Clear Event Log:** Select this choice to clear the current contents of the Security Manager Event Viewer. This option does not clear or delete the event logging file.

- **Exit:** Select this choice to exit from the Security Manager Program.

View   The View pull-down menu contains the following choices:

- **Tool Bar:** Turns the tool bar on and off. The default is On (checked).

Actions The Actions pull-down menu contains the following choices:

- **Add User:** Select this choice to permit a new user access to the local system.

- **Delete User:** Select this choice to revoke access to the local system for a selected user.

- **Modify User:** Select this choice to modify a selected user's user name or password.

Help   The following choices are available from the Help pull-down menu:

- **Current Topic:** Displays context sensitive help on the panel level.
- **Index:** Displays the help system index. You can use the index to search the help system for a topic.
- **Contents:** Displays the help system table of contents. You can use the contents to acquaint yourself with help system topics.
- **About RAID Manager:** Displays the ServeRAID Manager version number, copyright, and legal information.

Using the Tool Bar

Descriptions of the quick-path icons provided on the Tool Bar are as follows:

Add User: Select this icon to permit a new user access to the local system.

Delete User: Select this icon to revoke access to the local system for a selected user.

Modify User: Select this icon to modify a selected user's user name and password.

Help: When you select this icon, it displays context sensitive help on the panel level.

Understanding the Security List

There are three important items in the Security List:

- **Username**: The login name for a user connecting from a remote system. The username is not case sensitive.

- **Full Name**: The full name of the user.

- **Description**: A description of the user, for example, the user's professional title.

Understanding the Security Event Viewer and events

The Security Event Viewer has four columns. You can double-click on any event in the Event Viewer and the Security Event Detail dialog appears. The dialog presents the same information as the Event Viewer, but in a larger, easier to read screen.

- **Type**: The type of event (Information, Warning, Error).

- **Date**: The date the event occurred.

- **Time**: The time the event occurred.
- **Username**: The user name for which the event was generated.
- **Description**: The description.

Chapter 6. Starting and using the Administration and Monitoring Program

This chapter provides the information needed to start and use the ServeRAID Administration and Monitoring Program.

This chapter contains:

Starting and Using the Administration and Monitoring Program

Before you start the ServeRAID Administration and Monitoring Program, review the following illustration to become familiar with the layout of its Main screen.
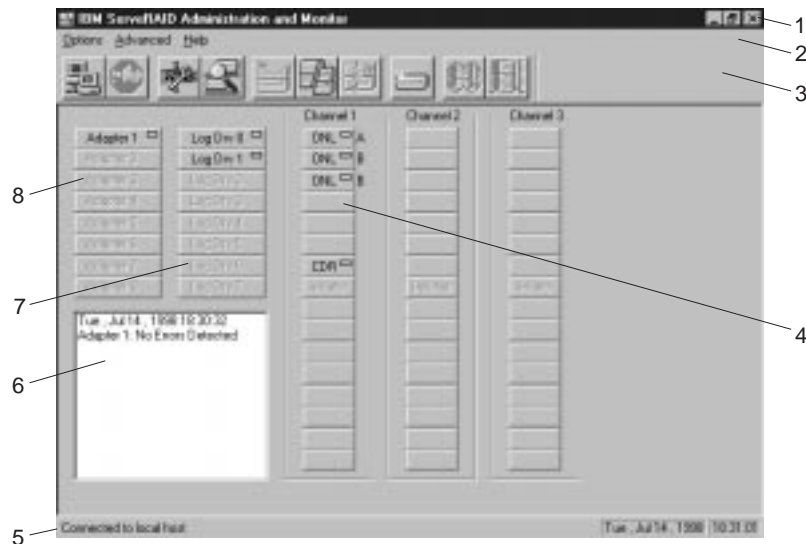
Figure 11. Administration and Monitoring Screen Layout

Descriptions of the numbered areas are as follows:

1. Title Bar   Displays the title of the application, along with the minimize icon, the maximize icon, and the close icon.

2. Menu Bar   Displays the pull-down menus for all supported functions.

3. Tool Bar   Displays the icons for the commonly used functions.

4. Device Area   Displays the state of each device connected to the physical channels of the ServeRAID controller, and if applicable, its array identifier.

5. Status Bar   Displays help for the area where the cursor is currently pointing. Also displays the date and time.

6. Status Window   Displays messages regarding the operational status of each controller.

7. Logical Drive Area   Displays the number of logical drives created and the status of the logical drive.

8. Adapter Area   Displays the number and status of the installed ServeRAID controllers

To start the Administration and Monitoring Program:

 1. Do one of the following:

    • Double-click on the IBM ServeRAID Administration icon

        or

    • Select **IBM ServeRAID Administration** from the Start menu.

 2. The Administration and Monitoring Program starts in stand-alone mode. After this program loads, you can access the ServeRAID controllers.

    When the Main window appears:

- If you are running the program in the stand-alone mode and you have ServeRAID controllers installed in your system, the current settings of the installed controllers will appear on the screen.

- If you are running the program from a client with no ServeRAID controllers, a message will appear stating that no ServeRAID controllers are installed in your system.

3. To access the server that contains the ServeRAID controllers, select **Network Settings** from the Options menu.

4. When the window appears prompting for Stand-alone or Client/Server, click on the **Client/Server** button.

5. In the edit box, type in the host name of the server that you want to access.

   `or`

   Select the host name from the pull-down list; then, click on **Connect**.

   Note: If security is enabled on the server, you must enter a valid user name and password.

Using the Administration and Monitoring Program

You can use the Administration and Monitoring Program to monitor your ServeRAID controllers, view the ServeRAID configuration and associated devices, rebuild an array, create a logical drive, create an array, delete an array, dynamically increase the logical-drive size, change RAID levels, and much more.

Using the Options Pull-Down Menu

The following choices are available from the Options pull-down menu on the Main Screen of the Administration and Monitoring Program:

- Network Settings
- General Options
- Alert Options

Network settings

If you want to monitor the ServeRAID controllers across a network, you must switch to client/server mode.

You can use the Network Settings dialog box to select and connect to servers in your network that contain IBM ServeRAID controllers.

To select and connect to a server:

1. Click on the ⊞ icon on the Tool Bar or select **Network Settings** from the **Options** pull-down menu. A screen similar to the following appears.
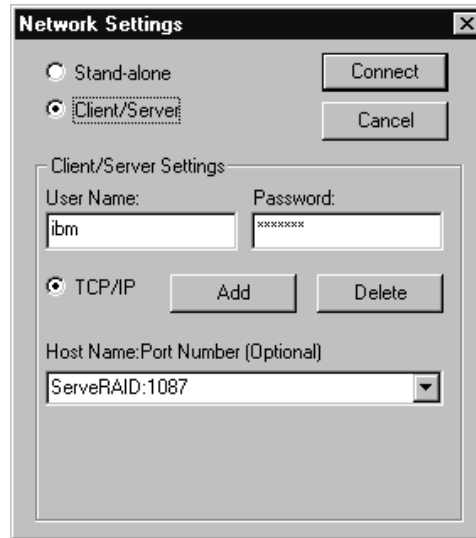
2. Click on the **Client/Server** radio button.

3. If security is enabled on the server to which you are connecting, type in your **User Name** and **Password** as defined by the security file on the server to which you are connecting. (Refer to "Background-Server Component Security" on page 72 for information on the security file).

4. Type in either the **Host Name** or the TCP/IP **Address** of the system, or select it from the pull-down list.

   Note: If your server was started on any port other than the default (1087), after the Host Name or TCP/IP Address that you just entered, type in a colon and the correct port number for your configuration (for example: ServeRAID:1088).

5. Click on **Connect** to initiate a connection with the remote system.

General options

When you select General Options from the Options pull-down menu, a screen similar to the following appears.
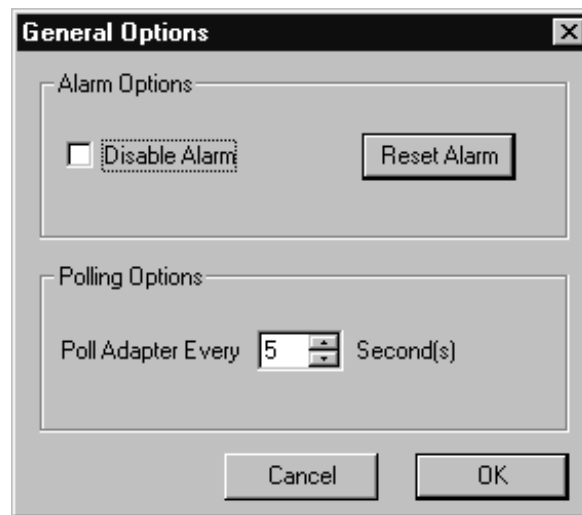
You can use this screen to:

- Enable or Disable the alarm
- Reset the alarm
- Set the polling options

Enabling or disabling the alarm: The alarm alerts you to a failure in the system. It sounds if any of the following conditions occur:

- A DDD hard disk drive is found.
- A Predictive Failure Analysis (PFA) error occurs.
- A ServeRAID controller is not responding.

To enable or disable the alarm, click on the box for **Disable Alarm** on the **General Options** screen. Placing a check in the check box disables the alarm; removing the check enables the alarm.

Resetting the alarm:

Resetting the alarm turns off the alarm for the current failure without disabling the feature.

To reset the alarm, you can either click on the ⬡ icon or click on **Reset Alarm** on the General Options screen.

Polling options: The ServeRAID controller will *poll*, or check, your server at a specified time interval for any changes that may have occurred in the server.

You can choose how often the controller polls the server by specifying a time interval on the options menu, from five to 60 seconds. The default time interval setting is five seconds.

The program will poll for the following events:

- Rebuild started
- Rebuild completed
- Synchronization started
- Synchronization completed
- Migration started
- Migration completed
- PFA error detected
- Dead drive detected
- Controller is not responding to commands

Alert options

The Netfinity Alerts Dialog allows system administrators who are using the IBM Netfinity Manager Program to configure the ServeRAID Administration and Monitoring Program to notify the Netfinity Alert Manager of various activities occurring on the server.

To configure the settings for the Netfinity Manager alerts:

1. Open the Options pull-down menu.

2. Click on **Alert Options**.

3. Click on **Netfinity Alerts**. A screen similar to the following appears.

Note: The default setting for the Netfinity Manager alerts is disabled.

4. To enable all Netfinity Manager alerts, click on the check box next to Enable Netfinity Alerts.

5. To disable any of the Netfinity Manager alerts:

   a. Ensure there is a check in the check box next to Enable Netfinity Alerts.

   b. Click on the check box next to the specific alert or alerts you want disabled.

6. To test the Netfinity Manager integration, click on the **Send Test Alert** button. This will send a Netfinity Manager alert to the Alert Manager with a test message.

   When you enable Netfinity Manager Alerts, the ServeRAID controller will relay the following three types of messages to the Netfinity Alert Manager:

   a. Information
      - Rebuild started
      - Rebuild completed
      - Synchronization started
      - Synchronization completed
      - Migration started
      - Migration completed
   b. Warning
      - PFA error detected
   c. Critical
      - Dead drive detected
      - Controller is not responding to commands

   By knowing what these types of messages are, you can configure the Netfinity Manager program with instructions for monitoring the server configuration and the appropriate action to take if an alert is given. For example, you could set the Netfinity Manager program to dial a specified phone number, should a defunct drive be detected on any server across the network. See the documentation provided with Netfinity Manager for more information.

Using the administration functions

This section provides information about using the following ServeRAID administration functions:

- Array administration
- Logical drive administration
- Logical drive migration administration
- Physical drive administration
- Adapter administration

Array administration

This section provides information about creating and deleting disk arrays.

Creating disk arrays:

You can use disk arrays to improve security, performance, and reliability.

To create a disk array:

1. Click on the ▱ icon on the Tool Bar or select **Manage Disk Arrays** from the Advanced pull-down menu; then, select **Create Disk Array**. A screen similar to the following appears.

Select Ready Drives

Select 1 or more RDY (Ready) drives that will be used to create the new array

Cancel   OK

2. Select one or more Ready (RDY) drives for the new disk array from the Main screen of the Administration and Monitoring Program.

   To select a RDY drive, click the desired RDY button from the device area. A disk array identifier appears beside each RDY drive added to the disk array.

   If you change your mind about a selected drive, select the button again to remove the selected drive from the disk array.

3. Click on **OK** to define a logical drive for the new array. A screen similar to the following appears.

Create Logical Drive

Array ID	Free Space (MB)	Raid Level	Requested Space	
B	2150	1	2150	OK / Cancel

4. Select the appropriate RAID level from the pull-down list.

   Note: The number of hard disk drives in the array determines the RAID levels available for the array.

   - If the array contains one hard disk drive, you can select only RAID level-0 for the logical drive.

   - If the array contains two hard disk drives, you can select RAID level-0 or RAID level-1 for the logical drive.

   - If the array contains three or more hard disk drives, you can select RAID level-0, RAID level-1, or RAID level-5 for the logical drive.

5. Enter the **Requested Space** in the entry field.

   The ServeRAID program uses the maximum available space for the selected RAID level to calculate the default value that it assigns.

   Note: The actual logical drive size might be slightly different from what you type in the **Requested Space** field. The RAID level and the number of hard disk drives determine the size of the logical drive. For example, a disk array consisting of three, 1 GB hard disk drives with a requested RAID level-0 logical drive of 1000 MB will actually contain only 999 MB because the data is striped across all three drives, with 333 MB on each drive.

6. Click on **OK** to create the disk array.

Deleting disk arrays:

Deleting a disk array deletes all logical drives that are defined in that disk array. All data and programs on the logical drives in the disk array will be lost during this procedure.

To delete a disk array:

1. Click on the [icon] on the Tool Bar or select **Manage Disk Arrays** from the Advanced pull-down menu; then, select **Delete Disk Array**. A screen similar to the following appears.
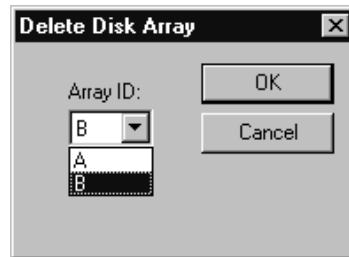
2. Select the desired disk array ID from the pull-down list.

   Attention:
   Before proceeding, ensure that you have backed up any data and programs that you want to save.

3. Click on **OK** to delete the disk array.

Note: For some operating systems, deleting a disk array and its associated logical drives might change the drive-letter assignments of the remaining drives when you restart the system.

Logical drive administration

This section provides the information needed to create logical drives, initialize and synchronizing logical drives, or access blocked logical drives.

Creating logical drives:
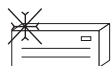
Each ServeRAID controller supports a maximum of 8 logical drives. Depending upon the stripe-unit size being used, you can combine a maximum of 8 or 16 physical drives into each logical drive.

To create a logical drive:

1. Click on the [icon] icon on the Tool Bar or select **Manage Logical Drive** from the Advanced pull-down menu; then, select **Create Logical Drive**. A screen similar to the following appears.

2. Select the desired disk array ID from the pull-down list.

3. Select the appropriate RAID level from the pull-down list.

   Note: The number of hard disk drives in the array determines the RAID levels available for the array.

- If the array contains one hard disk drive, you can select only RAID level-0 for the logical drive.
- If the array contains two hard disk drives, you can select RAID level-0 or RAID level-1 for the logical drive.
- If the array contains three or more hard disk drives, you can select RAID level-0, RAID level-1, or RAID level-5 for the logical drive.

4. Enter the **Requested Space** in the entry field.

   The ServeRAID program uses the maximum available space for the selected RAID level to calculate the default value that it assigns.

   Note: The actual logical drive size may be slightly different from what you type in the **Requested Space** field. The RAID level and the number of hard disk drives determine the size of the logical drive. For example, a disk array consisting of three, 1 GB hard disk drives with a requested RAID level-0 logical drive of 1000 MB will actually contain only 999 MB because the data is striped across all three drives, with 333 MB on each drive.

5. Click on **OK** to create the logical drive.

Notes:

1. If you plan to use the Logical Drive Migration (LDM) feature, *do not* define more than seven logical drives. The LDM feature requires one free logical drive to perform the migration. Refer to "Logical drive migration administration" on page 111 for more information.

2. If you plan to use the Change RAID Level function of the LDM feature, you must assign the same RAID level to all logical drives within a single disk array. Refer to "Change RAID levels" on page 111 for more information.

Initializing logical drives: Initializing a logical drive erases the first 1024 sectors on the drive and prevents access to any data previously stored on the drive.

To initialize a logical drive:

1. Select the desired logical drive from the Main screen of the Administration and Monitoring Program.

2. Click on **Initialize** to initialize the drive.

3. If you have initialized a RAID level-5 drive, you must synchronize to ensure data integrity. Go to "Synchronizing logical drives."

Synchronizing logical drives: The purpose of synchronizing logical drives is to compute and write the parity data on the selected drives.

If the type of ServeRAID controller you are using does not support the auto-synchronization and data-scrubbing features, manually synchronize your RAID level-1 and RAID level-5 logical drives weekly. This does not alter data on the drive.

Synchronizing a logical drive verifies that the data redundancy for the logical drive is correct.

To synchronize a logical drive:

1. Select the desired logical drive from the Main screen of the Administration and Monitoring Program.

2. Click on **Synchronize** to synchronize the drive.

3. The synchronization begins automatically and reports progress information on the screen.

Adapter 1 Synchronization Progress

Log Drv 0
Log Drv 1
Log Drv 2 [||||||||||||||||||] 42%
Log Drv 3
Log Drv 4
Log Drv 5
Log Drv 6
Log Drv 7
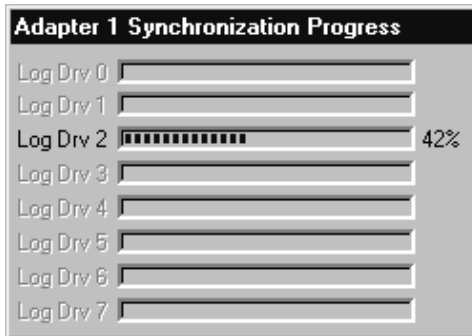
> **Note:** Only one synchronization command can be active at a time.

Unblocking logical drives: When the ServeRAID controller performs a Rebuild operation on an array, it reconstructs the data that was stored in RAID level-1 and RAID level-5 logical drives. However, the ServeRAID controller cannot reconstruct the data that was stored in any RAID level-0 logical drives in that array. The data in the RAID level-0 logical drives is blocked when the ServeRAID controller detects that the array is valid, but the data might be damaged.

After the Rebuild operation completes, you can unblock the RAID level-0 logical drives and access them once again. But remember, the logical drive might contain damaged data. You must either re-create, install, or restore the data from the most recent backup disk or tape.

To unblock a blocked drive:

1. Select the blocked logical drive from the Main screen of the Administration and Monitoring Program.

2. Click on **Unblock** to unblock the drive.

3. Initialize all unblocked logical drives before using them. See "Initializing logical drives" on page 110.

4. Restore the data to the drive from your most recent backup disk or tape.

Logical drive migration administration

The logical drive migration (LDM) feature dynamically changes the current logical drive structure. You can use this procedure to change the RAID level, increase the free space in a disk array, or change the size of a logical drive.

To use the LDM feature, you must have at least two logical drives available: one free (FRE) logical drive and one source logical drive that is in the okay (OKY) state. During the LDM procedure, the ServeRAID controller changes the state of the FRE logical drive to SYS; then, temporarily uses the SYS drive to perform the migration. When the migration procedure completes, the ServeRAID controller changes the state of the SYS drive back to FRE.

Change RAID levels:

You can change (migrate) the RAID levels of currently defined logical drives. To use the Change RAID Level feature, all of the logical drives within the array must be the same RAID level.

The ServeRAID controllers support changing RAID levels as follows:

- Change two or more drives set to RAID level-0 to RAID level-5 by adding one hard disk drive

- Change two or more drives set to RAID level-1 to RAID level-5 by adding one hard disk drive

- Change from RAID level-5 to RAID level-0 by removing one hard disk drive
- Change from RAID level-5E to RAID level-5.

To change the RAID level of an existing disk array:

Note: If you are migrating to RAID level-0, the last drive defined in the array becomes RDY.

1. Click on the icon on the Tool Bar or select **Manage Disk Arrays** from the Advanced pull-down menu; then, select **Logical Drive Migration**. A screen similar to the following appears.
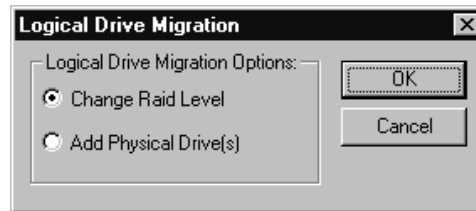
2. Select **Change RAID Level**.

3. Click on **OK**.
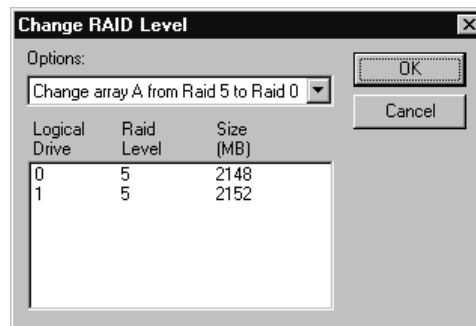
4. Select a migrating option from the pull-down list.

   Note: The affected logical drives appear, based on the migrating option you select.

5. Click on **OK** to proceed.

6. Click on **OK** to verify the operation.

7. Select a Ready (RDY) drive to add to the array, if you are migrating to RAID level-5.

Adding a physical drive:

You can expand currently defined arrays by adding one to three new hard disk drives.

The ServeRAID controllers support adding new space to a disk array in the following scenarios:

* You can increase the free space in a disk array without changing the size of the logical drives. This is useful when you need to add logical drives to your existing disk arrays. Refer to the following illustration.
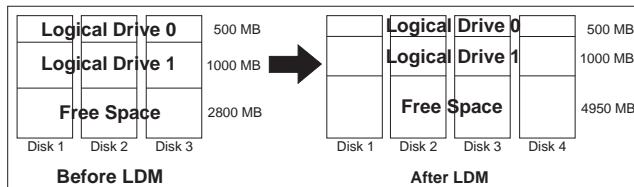
For example, an existing disk array uses three, 2150 MB hard disk drives that are configured as two RAID level-5 logical drives (one 500 MB and 1000 MB) and 2800 MB of free space. If you use the logical drive migration procedure and add a 2150 MB hard disk drive to increase the amount of free space, the end result will be two RAID level-5 logical drives (one 500 MB and one 1000 MB) and with 4950 MB of free space.

* You can increase the size of all the logical drives proportionally in a disk array. This is useful when you want to increase the size of the currently defined logical drives. Refer to the following illustration.
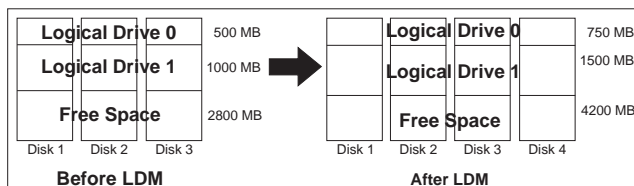
For example, an array uses three 2150 MB hard disk drives that are configured as two RAID level-5 logical drives (one 500 MB and 1000 MB) and 2800 MB of free space. If you use the logical drive migration procedure and add a 2150 MB hard disk drive to proportionally increase the size of the disk array, the end result will be two RAID level-5 logical drives (one 750 MB and 1500 MB) and 4200 MB of free space.

To add a physical device:

1. Click on the icon on the Tool Bar or select **Manage Disk Arrays** from the Advanced pull-down menu; then, select **Logical Drive Migration**. A screen similar to the following appears.
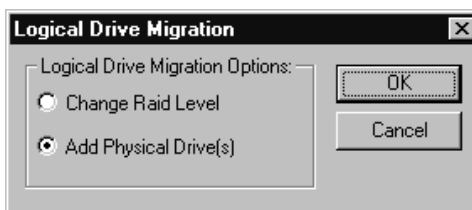
2. Select **Add Physical Drive(s)**.

   A prompt appears requesting that you select from 1 to 3 Ready (RDY) drives to add to the existing array.

3. Click on the appropriate RDY drives on the Main screen. An **X** appears beside the selected drives.

4. When you are finished selecting drives, click on **OK**.
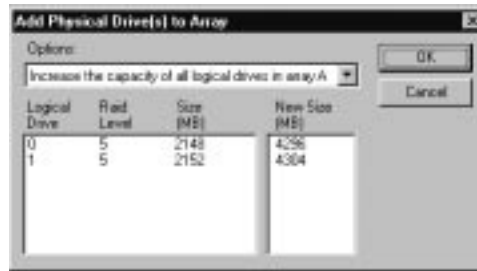
5. Select one of the available expansion options from the pull-down list.

   The screen will show a list of the affected logical drives with their new sizes.

6. Click on **OK**.

Physical device administration

This section provides the information needed to set device states and rebuild devices.

Setting physical device states: The following table shows the valid device states and valid alternative states.

Device State	Alternative States
EMP	RDY SBY
SBY	RDY EMP HSP SHS
DHS	EMP HSP SHS
SHS	HSP DHS
DDD	ONL RBL
RDY	EMP HSP SHS SBY
HSP	RDY SHS DHS
ONL	DDD
RBL	DDD ONL

To set or change the physical device state:

1. Select the device from the Main screen of the Administration and Monitoring Program.

2. Click on the radio button that indicates the desired state.

   Note: If you set a DDD drive to ONL without performing a Rebuild (RBL) operation and that drive is part of a critical (CRT) logical drive, your system might lose data.

3. Click on **Set Device State**.

Rebuilding a device: When a hard disk drive goes defunct (DDD), a Rebuild operation is required to reconstruct the data for the device in its respective disk array. The ServeRAID controllers can reconstruct RAID level-1 and RAID level-5 logical drives, but they cannot reconstruct data stored in RAID level-0 logical drives. To prevent data integrity problems, the ServeRAID controllers set the RAID level-0 logical drives to *Blocked* during a Rebuild operation. After the Rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. But remember, the logical drive might contain damaged data. (Refer to "Unblocking logical drives" on page 111 for more information.)

To perform a Rebuild operation:

1. Click on the DDD device on the Main screen of the Administration and Monitoring Program.

2. Click on **Rebuild Device**.

3. Select a RDY drive to use to reconstruct the data, or click on **OK** to use the same drive slot and SCSI ID if you have physically replaced the defunct drive.

4. The reconstruction begins automatically and reports progress information on the screen.

Notes:

1. The ServeRAID controller can perform only one Rebuild operation at a time.

2. If the array contains a critical (CRT) logical drive, the Rebuild operation changes the hard disk drive state from DDD to RBL. After the Rebuild operation completes, the hard disk drive state changes from RBL to ONL. (If you rebuild to a RDY drive, the DDD drive is removed from the disk array and becomes a defunct hot-spare (DHS).)

3. The hard disk drive being rebuilt must be the same size or larger than the failed drive.

4. If a hot-spare (HSP) drive is available, a Rebuild operation will start automatically.

5. If multiple hot-spare (HSP) drives are available, the ServeRAID controller searches all the drives on each channel for a hot-spare drive of the appropriate size. The first appropriate hot-spare drive found enters the Rebuild (RBL) state.

Adapter administration

This section provides instructions for copying the drive configuration to the ServeRAID controller, copying the ServeRAID controller configuration to the drives, initializing the controller configuration, and scanning for new drives.

Copying the drive configuration to the controller:
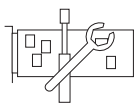
 You can copy the configuration stored on the hard disk drives to the ServeRAID controller.

This operation is useful when drives are imported from other systems.

To copy the configuration:

1. Click on the icon on the Tool Bar or select **Adapter Configuration** from the Advanced pull-down menu. A screen similar to the following appears.
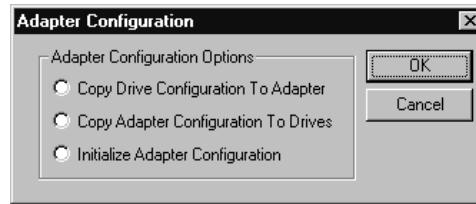
2. Select **Copy Drive Configuration to Adapter**.

3. Click on **OK**.

Copying the controller configuration to the drives:
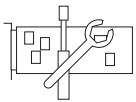
 You can copy the configuration stored for the ServeRAID controller to all configured hard disk drives.

To copy the configuration:

1. Click on the icon on the Tool Bar or select **Adapter Configuration** from the Advanced pull-down menu. A screen similar to the following appears.
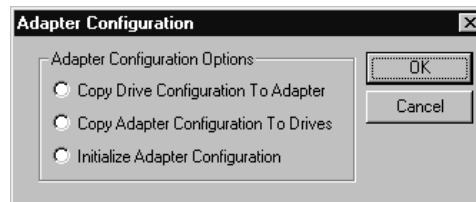
2. Select **Copy Adapter Configuration to Drives**.

3. Click on **OK**.

Initializing the controller:
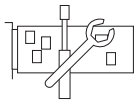
Initializing the controller configuration clears all the logical drives and resets all the functional hard disk drives to the Ready (RDY) state.

This operation is useful when you want to start over and create a new configuration.

To initialize the controller:

1. Click on the [icon] icon on the Tool Bar or select **Adapter Configuration** from the Advanced pull-down menu. A screen similar to the following appears.

> **Adapter Configuration**
>
> Adapter Configuration Options
> - ○ Copy Drive Configuration To Adapter
> - ○ Copy Adapter Configuration To Drives
> - ○ Initialize Adapter Configuration
>
> [OK]
> [Cancel]
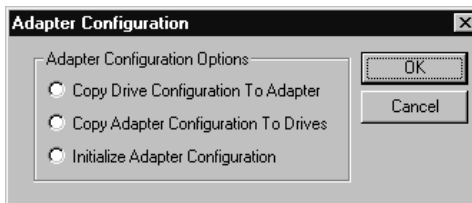
2. Select **Initialize Adapter Configuration**.

   Attention:
   After you initialize the configuration, you will not have access to any data stored on the logical drives attached to the selected ServeRAID controller.

   This choice deletes the existing configuration information, sets all functional hard disk drives attached to the controller to the Ready state, and deletes all logical drives defined for the controller.

   This choice *does not* change any of the ServeRAID controller settings (such as the stripe-unit size, rebuild rate, and so on) from their current or customized values.

3. Click on **OK**.

Scanning for new drives: You can scan for new devices attached to the ServeRAID controller.

To scan for new drives, click on the [icon] icon on the Tool Bar or select **Scan For New Drives** from the Advanced pull-down menu.

Using the monitoring functions

This section contains instructions for using the Administration and Monitoring Program to monitor the ServeRAID controller status information, event logs, logical drive information, and physical device information.

Monitoring the controller status information

A green or red light on the screen indicates the currently active controller button. (Green indicates that the ServeRAID controller is responding and red indicates that it is not responding.) If there is more than one ServeRAID controller in the system, click once on the appropriate controller to make it active.

You can then monitor the status by clicking on the active controller button on the Main screen of the Administration and Monitoring Program.

Note: You might need to use the scroll bar and scroll down to see all of the items that appear on this screen.

Descriptions of the information that appears on the screen are as follows:

Adapter Number The active controller (1 to 12).

Number of Logical Drives The number of defined logical drives (0 to 8).

Unattended Mode **Off** - The user chooses the recovery method when there is a ServeRAID startup error.

On - The controller chooses the recovery method when there is a ServeRAID startup error.

Code Block Version The current version number of the firmware loaded on the controller.

Boot Block Version The current version number of the bootable microcode loaded on the controller.

Concurrent Commands The maximum number of concurrent commands supported.

Maximum Devices Supported The maximum number of devices supported.

Flash Program Count The current number of times the flash EEPROM has been written.

Defunct Disk Count The current number of defunct hard disk drives.

Rebuild Rate The current setting (Low, Medium, or High) of the rebuild rate.

Hot-Swap Rebuild The current state (Enabled or Disabled) of the hot-swap rebuild feature.

Offline Logical Drive Count The current number of offline logical drives.

Configuration Update Count The number of times that the ServeRAID configuration has been updated.

NVRAM Battery Backup Device The current state of the battery-backup cache (installed, not installed, or defective).

Monitoring the device event logs

The ServeRAID controllers store information concerning various events in the event logs. There are four types of event logs: a device event log, a hard event log, a soft event log, and a configuration event log.

To view the hard, soft, or device event logs:

1. Click on the **controller** on the Main screen of the Administration and Monitoring Program.

2. Select an event log button from the bottom of the screen.

The Device Event Log contains event counters for each attached physical device, as follows:

- Parity Event - The ServeRAID controller detected a parity event while transferring data on the SCSI bus. A large number of parity events might indicate a problem with the SCSI cable, connectors, or terminators on the SCSI channel.

- Soft Event - These events are detected by the SCSI device and reported to the ServeRAID controller through the SCSI Check Condition status.

- Predictive Failure Analysis (PFA) - The device has signaled the controller that it might fail in the near future.

- Hard Event - These events are detected by the ServeRAID controller. The most likely cause of a hard event is a problem with the SCSI cabling, termination, or controller seating. If one of these is not the problem, have the system serviced.

- Misc Event - These miscellaneous events are detected by the ServeRAID controller. These events do not include parity, soft, PFA, or hard events. The most likely cause of a miscellaneous event is a cable, termination, or connector problem.

Note: Under normal operating conditions, the event logs will contain entries that are not errors.

Monitoring the logical drive information

You can monitor the logical drive information by clicking on the desired logical drive button on the Main screen of the Administration and Monitoring Program.

Descriptions of the information that appears on the Logical Drive Information screen are as follows:

Logical Drive Number	The number of the logical drive.
Blocked	**No** - The logical drive is accessible.
	Yes - The logical drive is not accessible.
Part of Array	The identifier of the logical drive disk array (A, B, C, D, E, F, G, H).
Part of Merge Group	The identifier of the logical drive merge group (1 through 254).
Date Created	The date the logical drive was created.
State	The current state (see "Logical drive state descriptions" on page 29 for more information).
Size	The size in megabytes.
RAID Level	RAID level (0, 1, or 5).
Write Policy	**WT** - Write-through.
	WB - Write-back.
NVRAM Battery Backup	**Enable** - The battery-backup cache is On.
	Disable - The battery-backup cache is Off.
Read Ahead	**Off** - Disk Read-Ahead is inactive.
	On - Disk Read-Ahead is active.
Stripe-Unit Size	The size of each stripe unit per hard disk (8, 16, 32, 64).
Number of Chunks	The number of hard disk drives that make up the logical drive.
Stripe Order	The channel and SCSI ID of the physical drives that make up the logical drive.

Monitoring the physical device information

You can monitor the physical device information by clicking on the desired device button on the Main screen of the Administration and Monitoring Program.

Descriptions of the fields that might appear on the Device Management screen are as follows.

Note: The number of fields that appear on the Device Management screen depend on the physical device selected.

Channel	The channel to which the device is connected (1, 2, or 3).

SCSI ID   The SCSI ID (0 to 15).

Vendor   The manufacturer of the physical device.

Serial Number The manufacturer identifier.

Size   The size in megabytes.

State   The current state (see "Physical drive state descriptions" on page 30 and "Logical drive state descriptions" on page 29 more information).

Soft Event   The number of soft events reported from the device event log.

Hard Event   The number of hard events reported from the device event log.

Misc Event   The number of miscellaneous events reported from the device event log.

Parity Event The number of parity events reported from the device event log.

PFA Event   **Yes** - device indicates predictive failure analysis event.

No - device does not indicate predictive failure analysis error.

Chapter 7. Starting and using the command line programs

This chapter provides the information needed to start and use the IPSSEND and IPSMON command line programs. It includes the new `FLASHCOPY` command.

This chapter contains:

Starting the IPSSEND program

You can run the IPSSEND program from the operating system command line.

To start the IPSSEND program:

- If you are using OS/2 or Windows NT:

    1. Type:

        c:\ipsadm\ipssend
    2. Press **Enter**.

        Note: The *c* represents the drive where OS/2 or Windows NT is installed.

- If you are using NetWare:

    1. From the console, type:

        load ipssend

    2. Press **Enter**.

- If you are using DOS:

    1. Insert the bootable IPSSEND diskette into diskette drive A; then, type:

        a:\ipssend

    2. Press **Enter**.

- If you are using OpenServer or UnixWare:

    1. Type:

        /usr/bin/ipssend

    2. Press **Enter**.

Using the IPSSEND program

When you run the IPSSEND program with no command-line parameters, a list of available functions and their specific parameters appears. All functions require a minimum set of parameters to run the command. If you run the IPSSEND program with a specific function but without its required parameters, specific help for that function will appear on the monitor.

There are four basic types of IPSSEND commands:

- Server roll-out commands
- Error-recovery commands
- Problem-isolation and debug commands
- RAID configuration commands
- FLASHCOPY commands

Server Roll-Out commands

The IPSSEND server roll-out commands include the following:

BACKUP   Use the BACKUP command to save a ServeRAID controller configuration to a diskette or to a hard disk drive. The ServeRAID controller configuration must be valid.

Supported operating systems: Windows NT, OS/2, NetWare, DOS, OpenServer, and UnixWare.

Command:
`IPSSEND BACKUP` *Controller Filename Oparm*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Filename* with the path and file name where the configuration is to be written
- *Oparm* with the optional parameter, NOPROMPT, to override the user prompt

COPYLD   Use the COPYLD command to copy a source logical drive to a target logical drive. The size of the target logical drive must be greater than or equal to the size of the source logical drive.

Supported operating system: DOS

Command:
`IPSSEND COPYLD` *Controller Source Target Oparm*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Source* with the source logical drive number
- *Target* with the target logical drive number
- *Oparm* with the optional parameter, NOPROMPT, to override the user prompt

RESTORE   Use the RESTORE command to load a configuration from a file stored on a diskette or a hard disk drive. The configuration must be a valid configuration file from the BACKUP option on the *IBM ServeRAID DOS Configuration Utility Program Diskette* or IPSSEND. This operation overwrites the existing configuration information stored for the ServeRAID controller.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND RESTORE` *Controller Filename Oparm*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Filename* with the path and file name where the configuration is to be written
- *Oparm* with the optional parameter, NOPROMPT, to override the user prompt

INIT   Use the INIT command to initialize the first 0.5 MB of a logical drive. This process will erase the partition tables on the drive, and all data on the logical drive will be lost.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND INIT` *Controller DriveNum Oparm*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *DriveNum* with the logical drive number (1 to 8)
- *Oparm* with the optional parameter, NOPROMPT, to override the user prompt

INITSYNC   Use the INITSYNC command to initialize and synchronize a logical drive at the same time. This command works only on RAID level-1 and level-5 logical drives. The command will erase the entire logical drive, and all data on the logical drive will be lost.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
IPSSEND INITSYNC *Controller DriveNum Oparm*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *DriveNum* with the logical drive number (1 to 8)
- *Oparm* with the optional parameter, NOPROMPT, to override the user prompt

SYNCH   Use the SYNCH command to synchronize the parity information on redundant logical drives. If the parity information is inconsistent, the IPSSEND program will repair it automatically.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
IPSSEND SYNCH *Controller Scope DriveNum*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Scope* with Drive for a single logical drive
- *DriveNum* with the logical drive number (1 to 8)

Error-Recovery commands

The IPSSEND error-recovery commands include the following:

GETSTATUS   Use the GETSTATUS command to display the current logical-drive status for the most recent rebuild, synchronization, or logical-drive migration. The status includes such information as the remaining size of the logical drive, the percentage completed for the function in process, or information about the most recently completed logical-drive function.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
IPSSEND GETSTATUS *Controller*

Replace:

   Controller with the ServeRAID controller number (1 to 12)

REBUILD   Use the REBUILD command to rebuild a designated disk drive. This command is valid for disk arrays that contain one or more logical drives that are in the critical (CRT) state. Progress is indicated during the rebuild operation, but you can also use the GETSTATUS command to obtain progress information about the rebuild.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
IPSSEND REBUILD *Controller DCh DSID NCh NSID*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *DCh* with the channel number for the Defunct drive (1 to 3)
- *DSID* with the SCSI ID for the Defunct Drive
  (0 to 15)
- *NCh* with the channel number for the New Drive (1 to 3)
- *NSID* with the SCSI ID for the New Drive
  (0 to 15)

SETSTATE Use the SETSTATE command to change the state of a physical device from its current state to a new state.

Attention:
You must be very careful when you use this command. For example, you might lose data if you reset a Defunct (DDD) device to Online (ONL) without first performing a Rebuild operation.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND SETSTATE` *Controller Channel SID NState*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Channel* with the channel number for the drive (1 to 3)
- *SID* with the SCSI ID for the drive (0 to 15)
- *NState* with the new state for the drive. Valid states are: EMP for Empty, RDY for Ready, HSP for Hot Spare, SHS for Standby Hot Spare, DDD for Defunct Disk Drive, DHS for Defunct Hot Spare, RBL for Rebuild, SBY for Standby, and ONL for Online. (See "Setting physical device states" on page 114 for more information.)

UNBLOCK Use the UNBLOCK command to gain access to a blocked logical drive. RAID level-0 logical drives become blocked if they are in an array that contains RAID level-1 or level-5 logical drives and the array is being rebuilt. Because the RAID level-0 logical drives cannot be rebuilt, the data stored on the RAID level-0 logical drives is damaged and should not be accessed. After you issue the UNBLOCK command, you must re-create or restore the data previously stored on the RAID level-0 logical drives.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND UNBLOCK` *Controller DriveNum*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *DriveNum* with the logical drive number (1 to 8)

Problem-Isolation and Debug commands

The IPSSEND problem-isolation and debug commands include the following:

CERTIFY Use the CERTIFY command to verify the media of a hard disk drive. If the program finds a media error, it reassigns the sectors. A summary of reassignments and PFA errors appears upon completion of the verification.

Supported operating system: DOS

Command:
IPSSEND CERTIFY *Controller Channel SID*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Channel* with the channel number for the device (1, 2, or 3)
- *SID* with the SCSI ID for the device (0 to 15)

ERASEEVENT Use the ERASEEVENT command to clear all logged entries in the designated event log. See GETEVENT help for information about the contents of the Device Event Log and the Controller Soft and Hard Event Logs.

Supported operating systems: Windows NT, O/S2, Netware, OpenServer, UnixWare, and DOS

Command:
IPSSEND ERASEEVENT *Controller Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with one of the following:
    - DEVICE for the Device Event Log
    - SOFT for the ServeRAID controller Soft Event Log
    - HARD for the ServeRAID controller Hard Event Log

GETBST Use the GETBST command to display the number of bad stripes in the bad stripe table for each logical drive.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, Unixware, and DOS.

Command:
IPSSEND GETBST *Controller*

Replace:

Controller with the ServeRAID controller number (1 to 12)

FMSTATUS Use the FMSTATUS command to display the progress of a format operation currently processing.

Supported operating system: DOS

Command:
IPSSEND FMSTATUS *Controller Channel SID*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Channel* with the channel number for the device (1, 2, or 3)
- *SID* with the SCSI ID for the device (0 to 15)

FORMAT Use the FORMAT command to perform a low-level format of a hard disk drive.

Attention:

1. When you issue this command, all data on the drive will be lost.

2. Once a FORMAT command is issued, do not stop it. If a FORMAT process is stopped due to the system being reset, turned off, power outage, or by some other means, the hard disk drive that was being formatted will not respond to any commands except for the FORMAT command. Thus, the ServeRAID controller will

not be able to recognize them anymore. To recover the drive, refer to "Troubleshooting an incomplete format of a hard disk drive" on page 148.

Supported operating system: DOS

Command:
`IPSSEND FORMAT` *Controller Channel SID*

<u>Replace:</u>

- *Controller* with the ServeRAID controller number (1 to 12)
- *Channel* with the channel number for the device (1, 2, or 3)
- *SID* with the SCSI ID for the device (0 to 15)

GETEVENT   Use the GETEVENT command to display information about various unexpected events. IBM uses the Soft and Hard Event Logs for development and debugging purposes only. The Device Event Log contains event counters for each attached physical device. These counters include:

- Parity: An unexpected event while transferring data on the SCSI bus. This usually indicates a problem with the SCSI cable, connectors, or terminators.

- Soft: A SCSI device detected a *check condition* event.

- Hard: The SCSI controller detected an unexpected event. The controller is the most likely cause.

- Misc: The ServeRAID controller detected an event that was most likely caused by the device.

The Device Event Log also provides predictive failure analysis (PFA) alerts, which indicate that the device has signaled the ServeRAID controller that it might fail in the near future.

Supported Operating Systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND GETEVENT` *Controller Options*

<u>Replace:</u>

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with one of the following: DEVICE for Device Event Log, SOFT for the ServeRAID controller Soft Event Log, or HARD for the ServeRAID controller Hard Event Log.

SELFTEST   The SELFTEST command is used to direct a controller or a device to perform its self-test.

Supported operating systems: DOS

Command:
`IPSSEND SELFTEST` *Controller Options*

<u>Replace:</u>

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with AD for the ServeRAID controller self-test or PD `Channel SID` for the Device self-test.

    Note: *Channel* represents the drive channel and *SID* represents the SCSI ID for the device.

STARTDELY   Use the STARTDELY command to set the number of drives in a group to start up simultaneously and to set the delay in seconds between the startup of these groups of drives.

Supported operating systems: DOS

Command:
`IPSSEND STARTDELY` *Controller Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with a question mark (?) to display concurrent drive startup count: Drive Count (1 to 16) and Delay Time (3 to 15 seconds).

RAID Configuration commands

The IPSSEND RAID configuration commands include the following:

DRIVEVER   Use the DRIVEVER command to display the vendor ID, microcode version, and serial number of a SCSI device. The IPSSEND program retrieves this information directly from the device.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND DRIVEVER` *Controller Channel SID*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Channel* with the channel number for the device (1, 2, or 3)
- *SID* with the SCSI ID for the device (0 to 15)

GETCONFIG   Use the GETCONFIG command to display the ServeRAID controller configuration information. This includes information about the firmware version; initiator ID and rebuild rate; logical drive status, RAID level, and size; and physical device type, SCSI ID, and PFA error.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND GETCONFIG` *Controller Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with one of the following: AD for controller information, LD for logical drive information, PD for physical device information, AL (default) for all information.

HSREBUILD   Use the HSREBUILD command to set the ServeRAID controller hot-swap rebuild feature on. Use a question mark (?) to display the current status of the hot-swap rebuild feature.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, UnixWare, and DOS

Command:
`IPSSEND HSREBUILD` *Controller Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)

READAHEAD
- *Options* with ON to enable the hot-swap rebuild feature, or ? to display the status of the hot-swap rebuild feature.

READAHEAD Use the READAHEAD command to enable, disable, or set the adaptive mode for the ServeRAID controller's read-ahead feature.

Supported operating systems: Windows NT and DOS.

Command:
IPSSEND READAHEAD *Controller Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with one of the following:
    - *On* to enable the feature
    - *Off* to disable the feature
    - *Adaptive* to allow the controller to determine the best mode to use at any given time.
    - *?* to display the current read-ahead feature mode being used.

STRIPESIZE Use the STRIPESIZE command to set the ServeRAID controller's stripe size to 8K, 16K, 32K, or 64K.

Supported operating systems: DOS

Command:
IPSSEND STRIPESIZE *Controller Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with one of the following:
    - *8*, *16*, *32*, or *64*
    - *?* to display the current stripe size being used

UNATTENDED Use the UNATTENDED command to enable or disable the ServeRAID controller's unattended feature.

Supported operating systems: Windows NT, OS/2, NetWare, OpenServer, Unixware, and DOS.

Command:
IPSSEND UNATTENDED *Controller Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with one of the following:
    - *On* to enable the feature
    - *Off* to disable the feature
    - *?* to display the current setting of this feature

FLASHCOPY commands (for Windows NT only)

The FLASHCOPY command can be used to create a quick backup copy of logical drive data. You can use the backup copy for tasks such as tape backup and multi-server rollout (for example, drive cloning). The FLASHCOPY command sets up a link between the source and target logical drives, and then creates a snapshot impression of the source data on the target logical drive.

To create the snapshot impression, the size of the target logical drive must be equal to or larger than the source logical drive, and the partition type must be the same on the source and target logical drives.

Once the snapshot impression is created, the target logical drive will contain a copy of the source logical drive data, and the source logical drive can be put back into use. Changes made to the data of the source logical drive will not affect the data on the target logical drive, and changes to the data of the target logical drive will not affect the data on the source logical drive.

Important

Before using FLASHCOPY, please read the following guidelines and considerations.

- Normal I/O functions can be performed on the source drive while the FLASHCOPY operation is in progress. If you are doing a FLASHCOPY BACKUP, do not write to the target logical drive until the BACKUP process is complete.

- You only can have one operating system partition per logical drive.

- The source and target drives must be on the same ServeRAID controller.

- When the FLASHCOPY command completes, the target drive will be an exact image of the source drive at the time the FLASHCOPY command was issued. The partition format and size of the target drive will be identical to the source drive.

- The logical drive size must be smaller than, or equal to, 124 GB.

- For optimal performance, the FLASHCOPY target logical drive should be the same size as the source logical drive.

- There is a NOPROMPT option that allows you to run some of the FLASHCOPY commands without getting any prompts.

The IPSSEND FLASHCOPY options are:

Note: You can type `IPSSEND FLASHCOPY <Option>` for information about any of the options.

MAP   Correlates RAID logical drives to the operating system drive partitions.

BACKUP   Performs a snapshot of your source logical drive to your target logical drive with complete data copy.

NOBACKUP   Performs a snapshot of your source logical drive to your target drive without complete data copy. (Normally used as a temporary source for backups to a tape drive.)

STOP   Ends the FLASHCOPY BACKUP process or breaks the NOBACKUP link between the source and target logical drives.

DELETE   Deletes the specified array.

IMPORT   Adds a logical drive to an existing configuration. Note that the IMPORT commmand cannot be used if the system is configured for a cluster.

The following information shows you how to use the FLASHCOPY command.

FLASHCOPY MAP   Use the FLASHCOPY MAP command to correlate the ServeRAID logical drives to the operating system drive partitions.

Supported operating systems: Windows NT

Command:
`IPSSEND FLASHCOPY` *Controller* MAP

<u>Replace:</u>

- *Controller* with the ServeRAID controller number (1 to 12)

Following is a sample result of this command:

Logical Drive #	Array	Partition	Available for FLASHCOPY
1 1000 MB	A	C:	No (see note 2)
2 200 MB	B	E:	No (see note 1)
3 500 MB	C	F:	No (see note 1)
3 200 MB	D	G: H:	No (see note 3)

Note 1: There currently is a FLASHCOPY link between source logical drive 2 and target logical drive 3. Use the STOP command to break this link. Once the link is broken, you can re-issue the FLASHCOPY BACKUP or FLASHCOPY NOBACKUP command.

Note 2: This logical drive is not available for a FLASHCOPY process. It does not meet one or more of the following logical drive requirements for the FLASHCOPY process:

- It must not be the boot partition

- It must not have any open files

- It must not contain any memory-paging files

You can override these requirements by using the FORCE option. See the FLASHCOPY BACKUP and FLASHCOPY NOBACKUP commands for more details.

Note 3: This logical drive is not available for a FLASHCOPY process. It does not meet one or more of the following logical drive requirements for the FLASHCOPY process.

- It must be smaller than 124 GB

- It must not be in the Blocked state

- It must have one partition.

- A synchronization, Rebuild, or a logical drive migration is in progress.

- It must be in the OKAY or CRITICAL state.

FLASHCOPY BACKUP Use the FLASHCOPY BACKUP command to make a quick snapshot impression of the source logical drive. Once the copy is created, the source logical drive is ready for immediate use.

When the process completes, the target logical drive contains a copy of the source logical drive data that existed at the exact time you issued the FLASHCOPY BACKUP command.

A link between the source logical drive and the target logical drive will exist until all the data is copied. Once all of the source data is copied to the target logical drive (determined by the GETSTATUS command) the link is automatically broken and you can use the DELETE or IMPORT commands to move the target logical drive to another system.

Notes:

1. Only one FLASHCOPY BACKUP can be in process on a ServeRAID controller. If a BACKUP is in process, you cannot issue another BACKUP or NOBACKUP command until the previous BACKUP process is completed or until the BACKUP link is broken. You can use the STOP command to break the link between the source and target drives.

2. For the BACKUP command to function properly, the target logical drive must have the same partition type as the source logical drive.

3. Do not attempt to write to the target logical drive until the BACKUP process is complete.

Supported operating systems: Windows NT

Command:
IPSSEND FLASHCOPY *Controller* BACKUP *Source Target Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Source* with the source logical drive number (1 to 8)

  Use the MAP command to correlate the ServeRAID logical drive number to the operating system partition.
- *Target* with the target logical drive number (1 to 8)

  Use the MAP command to correlate the ServeRAID logical drive number to the operating system partition.
- *Options*: include:

  – *POLL* lets you see the progress of the BACKUP command.

  – *FORCE* lets you create a FLASHCOPY of a source logical drive that is the boot partition, contains open files, or contains a memory paging file. Using the FORCE option will not guarantee file consistency between the source and target logical drive.

  – *NOPROMPT* overrides the user prompt.

FLASHCOPY NOBACKUP Use the FLASHCOPY NOBACKUP command to create a quick snapshot impression of the source logical drive. Once the snapshot is created, the source logical drive is ready for immediate use.

The target logical drive will contain a snapshot of the source logical drive data that existed at the exact time you issued the FLASHCOPY NOBACKUP command.

A link between the source logical drive and the target logical drive will exist until you issue the STOP command. Once you issue the STOP command, the target logical drive contents are no longer valid. The NOBACKUP command is useful if you want a snapshot of your data to perform a tape backup.

You can use the MAP command to determine if a logical drive is available for the FLASHCOPY NOBACKUP process.

Notes:

1. Only one FLASHCOPY NOBACKUP link can exist on a ServeRAID controller. If a NOBACKUP link exists, you cannot issue another BACKUP or NOBACKUP command until existing link is broken. You can use the STOP command to break the link between the source and target logical drives.

2. For the NOBACKUP command to function properly, the target logical drive must have the same partition type as the source logical drive.

3. Do not attempt to write to the target logical drive until the NOBACKUP link is broken.

Supported operating systems: Windows NT

Command:
IPSSEND FLASHCOPY *Controller* NOBACKUP *Source Target Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Source* with the source logical drive number (1 to 8).

  Use the MAP command to correlate the ServeRAID logical drive number to the operating system partition.
- *Target* with the target logical drive number (1 to 8).

  Use the MAP command to correlate the ServeRAID logical drive number to the operating system partition.
- *Options* include:

  – *Force* lets you create a FLASHCOPY of a source logical drive that is the boot partition, contains open files, or contains a memory paging file. Using the FORCE option will not guarantee file consistency between the source and target logical drive.

  – *NOPROMPT* overrides the user prompt.

FLASHCOPY STOP Use the FLASHCOPY STOP command to break the link between the source logical drive and a target logical drive. Once you issue the STOP command, the target logical drive contents are no longer valid. After you issue the STOP command, reformat your target logical drive.

Supported operating systems: Windows NT

Command:
IPSSEND FLASHCOPY *Controller* STOP *Source Target*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Source* with the source logical drive number (1 to 8).
- *Target* with the target logical drive number (1 to 8).
- *Option* with NOPROMPT if you want to override the user-prompt.

FLASHCOPY DELETE Use the FLASHCOPY DELETE command to delete an array. This is useful when you have used the FLASHCOPY BACKUP command and you want to move the target array to another system. After you delete the array, you can move the drives to the other system; then, you can issue the IMPORT command to add the array to the existing configuration of the other system.

You can use the ServeRAID Manager program to identify the array you want to delete. This program can blink the LEDs for the drives that belong to the specific array.

┌─ **Important** ───┐

If your target logical drive is running with Write-Back Cache Enabled, wait 10 minutes after the FLASHCOPY BACKUP completes before issuing a FLASHCOPY DELETE command. This ensures that all data has been moved from the controller cache to the logical drive.

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Supported operating systems: Windows NT

Command:
IPSSEND FLASHCOPY DELETE *Controller Array ID Option*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Array ID* with the Array ID (A to H)
- *Option* with NOPROMPT if you want to override the user-prompt.

FLASHCOPY IMPORT   Use the FLASHCOPY IMPORT command to merge logical drive information from new physical drives when they are added to the system.

Note: The number of physical drives you add must be equal to the number of physical drives that were in the original defined logical drive.

You can use this command to incorporate a target array after a FLASHCOPY BACKUP command is completed.

Notes:

1. The stripe-size of the logical drives being imported, must be the same as the stripe-size of the controllers.

2. The number of physical drives you add must be equal to the number of physical drives that were in the original defined logical drive.

Supported operating systems: Windows NT

Command:
IPSSEND FLASHCOPY *Controller* IMPORT *Options*

Replace:

- *Controller* with the ServeRAID controller number (1 to 12)
- *Options* with ALL to specify all logical drives or a valid logical drive number (1 to 8)

Starting the IPSMON program

You can run the IPSMON program from the operating system command line.

To start the IPSMON program:

- If you are using OS/2 or Windows NT:

    1. Type:

       c:\ipsadm\ipsmon

    2. Press **Enter**.

       Note: The *c* represents the drive where OS/2 or Windows NT is installed.

- If you are using Novell NetWare:

    1. From the console, type:

       load ipsmon

    2. Press **Enter**.

- If you are using SCO OpenServer or UnixWare:

    1. Type:

        `/usr/bin/ipsmon`

    2. Press **Enter**.

Using the IPSMON program

When you start this monitoring program, it immediately begins polling all ServeRAID controllers for specific conditions. If a condition being monitored is found, this program logs a message to the monitor, to a file, or to both the monitor and a file.

The IPSMON program uses command-line parameters to determine where to log the messages. If you need help, you can type the `IPSMON -?` command for a list of valid parameters.

If you start this program without any command-line parameters, the IPSMON program will log the messages to the IPSMON.LOG file, and the messages will not appear on the monitor.

The valid parameters for IPSMON are:

- **-f:*filename***

    Use the -f parameter to specify the name of the file in which to record messages. The default file name is IPSMON.LOG.

- **-s**

    Use the -s parameter to display messages on the standard output (usually the monitor).

- **-?**

    Use the -? parameter to obtain a current list of valid parameters.

After you start the IPSMON program, the program will continuously poll the ServeRAID controllers until you take one of the following actions:

- If you are using Windows NT or OS/2, press **Ctrl**+**C**.

- If you are using NetWare, type: `unload ipsmon` at the system console.

- If you are using OpenServer or UnixWare, press the **Del** key to cancel the program.

During operation, the program will log various messages. Each message will contain an alert code and a location specifier.

- The alert code begins with the message type and number. For example, INF, WRN, or CRT, followed by the message number.

- After the alert code comes the location specifier:

    A specifies the controller number

    SID specifies the SCSI ID (if required)

    C specifies the channel number (if required)

For example, a message of CRTxxx:A2C3SID04 signifies that a Critical condition (CRTxxx) was found on Controller 2 (A2), Channel 3 (C3), SCSI ID 4 (SID04).

The IPSMON program can log the following messages, based on the required condition.

Information Messages:
 <Date and Time> INF000:A1C-SID-- no errors detected
 <Date and Time> INF001:A1C-SID-- rebuild started
 <Date and Time> INF002:A1C-SID-- rebuild completed
 <Date and Time> INF003:A1C-SID-- synchronization started
 <Date and Time> INF004:A1C-SID-- synchronization completed
 <Date and Time> INF005:A1C-SID-- migration started
 <Date and Time> INF006:A1C-SID-- migration completed

Warning Messages:
 <Date and Time> WRN001:A2C3SID12 PFA Error detected

Critical Messages:
 <Date and Time> CRT001:A3C2SID04 dead drive detected
 <Date and Time> CRT002:A1C-SID-- not responding to commands

Chapter 8. Solving ServeRAID problems

This chapter describes the ServeRAID text and numeric messages that might appear during startup. This chapter also includes some basic information about rebuilding a defunct drive.

In addition to the information provided in this chapter, you might want to use the ServeRAID IPSSEND program to help isolate ServeRAID problems. See "Using the IPSSEND program" on page 122 and "Problem-Isolation and Debug commands" on page 125 for information about using the IPSSEND program.

ServeRAID controller messages

This section lists the ServeRAID messages that might appear during system startup.

The ServeRAID controllers provide a Device Event Log that collects statistics on the number and types of events that occur on a selected hard disk drive. After correcting a problem with the disk array, clear the log so that you can identify any subsequent errors quickly. For information about clearing the event log, see "ERASEEVENT" on page 126.

All hard disk drives contain unique identifiers, such as the drive serial number and manufacturer. During configuration, the ServeRAID controller stores this information.

ServeRAID startup messages

During power-on self-test (POST), the ServeRAID controller compares the stored configuration information to the configuration that is actually present. If a discrepancy exists, one or more status messages appear after POST completes, but before the operating system loads.

Notes:

1. When the ServeRAID controller requires your input, a list of function keys will appear below the message.

2. Where the "Action" information tells you to start the IBM ServeRAID configuration program, insert the *IBM ServeRAID Configuration and Management CD* into the CD-ROM drive; then, restart the server. The action column also provides general information about the message.

3. Where *SID* and *ch* appear in these messages, *SID* shows the SCSI ID for the device and *ch* shows the channel to which the device is attached.

4. Where *m* or *n* appears in these messages, a number will appear in the actual message.

This following pages list, in alphabetical order, messages associated with the ServeRAID subsystem.

A new drive was installed.

Explanation: When the ServeRAID controller detects a new drive that is not part of the current configuration, the following message appears:

x new Ready drives not found
where *x* is the number of Ready drives found.

Action: This is an information message. No action is required.

Auto rearrange.

Explanation: Auto rearrange is enabled or disabled.

Action: This is an information message. No action is required.

Configured drives are missing.

Explanation: When the ServeRAID controller detects that a previously configured drive is missing, the following message appears:

x Online drives not responding
where *x* is the number of drives not responding.

Example of a possible message:

    Online Drive on Channel 3 SCSI ID 3 is not responding.

Action: Press one of the following keys:

F2   Detailed Description. Press this key for a detailed description of the problem, such as the example message above.

F4   Retry. Press this key after correcting a problem. For example, press F4 after you turn on the external storage enclosure that contains the hard disk drive.

F5   Change the configuration and set the drives(s) to defunct. Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct (DDD) or empty (EMP).

You can also press F5 when you must remove a drive, RAID level-1 and RAID level-5 logical drives are present, and performance in a degraded mode is acceptable. The ServeRAID controller will assign the drive a state of defunct (DDD), but the server can complete startup. However, the array will remain in Critical mode and the potential for data loss will exist until you replace and rebuild the defunct drive. To prevent the loss of data, replace and rebuild the defunct drive in a timely manner.

Note: A hard disk drive in the DDD state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:

1. All cables are connected properly to the backplane and to the hard disk drive. Also, ensure that all cables inside the server are connected properly.

2. The hot-swap drive trays are seated properly in the drive bay.

3. If you have not already attempted to rebuild the drive, try rebuilding it. See "Rebuilding a defunct drive" on page 147 for more information.

After you perform these steps, if the hard disk drive does not function properly, replace the drive.

F10   Continue booting without changing the configuration. Press this key to continue without change to the configuration.

Configured drives are not in the configured location.

Explanation: When the ServeRAID controller detects that a previously configured drive is present, but the drive is in a new location, the following message appears:

x Online drive(s) has been rearranged
where *x* is the number of drives that have been rearranged.

For example:

Examples of possible messages are:

```
Online Drive on Channel 3 SCSI ID 4 moved to Channel 3 SCSI ID 3
Online Drive on Channel 3 SCSI ID 3 moved to Channel 3 SCSI ID 4
```

Action: Press one of the following keys:

F2   Detailed Description. Press this key for a detailed description of the problem, such as the example messages above.

F4   Retry. Press this key after correcting a problem. For example, press F4 after you move the hard disk drive to its previously assigned location.

F5   Change the configuration and set the drive(s) defunct. Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct (DDD) or empty.

Note: A hard disk drive in the DDD state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:

1. All cables are connected properly to the backplane and to the hard disk drive. Also, ensure that all cables inside the server are connected properly.

2. The hot-swap drive trays are seated properly in the drive bay.

3. If you have not already attempted to rebuild the drive, try rebuilding it. See "Rebuilding a defunct drive" on page 147 for more information.

After you perform these steps, if the hard disk drive does not function properly, replace the drive.

F6   Change the configuration and accept the rearrange. Press this key to modify the configuration to match the current drive location.

You might remove the hot-swap drives from the server for security or maintenance reasons. If you replace the drives but install them in different drive bays, you can press **F6** to accept the new locations, and the ServeRAID controller will update the configuration.

F10   Continue booting without changing the configuration. Press this key to continue without change to the configuration.

Controller is not responding to commands. No logical drives are installed.

Explanation: The ServeRAID controller is not operational.

Action: Have the system serviced.

Error: Cannot disable this controller BIOS.

Explanation: The ServeRAID controller was unable to prevent an extra copy of its BIOS code from being stored on the server. This condition occurs when the server contains multiple ServeRAID controllers.

Action: This is an information message. No action is required.

Installation stopped.

Explanation: The server cannot access the ServeRAID controller.

Action: This is a follow-on message to a preceding message. Follow the "Action" instructions for the preceding message to resolve the problem.

New controller installed in a configured server or drives are imported

Explanation: When the ServeRAID controller detects that the identifiers of the drives do not match the controller configuration information, the following message appears:

x Online drive(s) found with mismatch configuration

Examples of possible messages:

```
Configuration mismatch Channel 1 SCSI ID 0 with Host ID
Configuration mismatch Channel 2 SCSI ID 0 with Host ID
```

Action: Press one of the following keys:

F2   Detailed Description. Press this key for a detailed description of the problem, such as the example messages above.

F4   Retry. Press this key after correcting the problem. For example, press F4 after you move the hard disk drive to its previously assigned location, or after you install the original hard disk drives back in the server.

F5   Change the configuration and set the drive(s) defunct Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct (DDD) or empty (EMP).

     Note: A hard disk drive in the defunct state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:

      1. All cables are connected properly to the backplane or system board, and to the hard disk drive. Also, ensure that all cables inside the server are connected properly.

      2. The hot-swap drive trays are seated properly in the drive bay.

      3. If you have not already attempted to rebuild the drive, try rebuilding it. See "Rebuilding a defunct drive" on page 147 for more information.

     After you perform these steps, if the hard disk drive does not function properly, replace the drive.

F7   Import configuration information from drive.

Pressing this key will reboot the server. Press this key to import the configuration information from the drive and to update the configuration information for the ServeRAID controller. This choice is useful when you replace the ServeRAID controller in an existing ServeRAID subsystem.

You also might press F7 if you replace a whole set of drives with drives that were configured in another server with a ServeRAID controller.

Note: When you install drives in a server that has no logical drives defined, the F7 choice will not appear. The ServeRAID controller does not contain any logical drives in its factory configuration. Therefore, F7 will not appear. In this case, do the following:

1. Restart the server and press **Ctrl**+**I** to enter the Mini-Configuration program (see "Using the ServeRAID Mini-Configuration Program" on page 44).

2. Select **Advanced Functions**.

3. Select **Import Configuration from Drives to Adapter** and follow the instructions on the screen.

Battery-Backup Write Cache Not Responding

Explanation: BIOS code detected a bad or failed battery-backup write cache.

Action: Press **F9** to remove the battery-backup write cache from the configuration, or press **F10** to exit without change.

Battery-Backup Write Cache Replacement

Explanation: The ServeRAID controller detects that the battery-backup write cache is defective.

Action: Press **F8** if you replaced the battery-backup write cache, or press **F10** if you have not replaced the battery-backup write cache.

Recoverable configuration error

Explanation: The configuration data stored in NVRAM does not match the configuration data stored in the EEPROM.

Action:

1. Press **Ctrl**+**Alt**+**Del** to restart the system.

2. Start the ServeRAID Mini-Configuration Program. (See "Using the ServeRAID Mini-Configuration Program" on page 44 for instructions.)

3. Select **Advanced Functions** from the Main Menu; then, select **Import Configuration from Drive(s)**. (See "Using the Advanced Configuration functions" on page 45 for more information.)

WARNING: *n* **logical drives are critical;** *n* **logical drives are offline.**

Explanation: One or more hard disk drives have failed.

Action: Replace the defunct drives as soon as possible to prevent data loss.

Your server has an error due to a Blocked Logical Drive.

Explanation: One or more logical drives are in a blocked state. A blocked logical drive cannot be accessed. See "Logical drive state descriptions" on page 29 for additional information.

Action: Press **F4** to unblock the logical drive, or press **F5** to continue without unblocking.

ServeRAID POST messages

The following numeric POST messages appear in hexadecimal format.

1xxx to 7xxx

Explanation: The POST detected an internal error.

Action: Have the system serviced.

2601 to 260B

Explanation: The POST detected an error with the ServeRAID subsystem.

Action: Have the system serviced.

2610

Explanation: The POST detected an error with the ServeRAID controller hardware.

Action: Have the system serviced.

2620

Explanation: The POST detected that a ServeRAID configuration or hard disk error occurred.

Action: Start the *IBM ServeRAID Configuration and Management CD* and view the existing device and configuration information for your ServeRAID subsystem. If you can not locate and correct the configuration problem or the failing device, or if the problem persists, have the system serviced.

8xxx to Bxxx

Explanation: The POST detected an error with the SCSI interface.

Action: Verify that the SCSI cables are correctly connected, and the SCSI termination is set properly for each installed SCSI device.

If you can not locate and correct the SCSI problem, or if the problem persists, have the system serviced.

ServeRAID ISPR, BCS, and ECS codes

Once the ServeRAID POST completes, register information appears on the screen in hexadecimal format, as follows:

```
Hardware:  ISPR=aaaa  BCS=bb  ECS=cc
```

ISPR displays the four digit Interrupt Status Report Register code, BCS displays the Basic Configuration Status Register code, and ECS displays the Extended Configuration Status Register code.

If no errors occur:

ISPR (*aaaa*) = EF10
BCS (*bb*) = 0F or 09
ECS (*cc*) = 00

If an error occurs, refer to: "ISPR (Interrupt Status Port Register) codes" on page 143 for the ISPR error codes and "Basic and Extended Configuration Status Codes" on page 144 for the BCS and ECS error codes.

ISPR (Interrupt Status Port Register) codes

1xxx

Explanation: A flash checksum error occurred.

Action: Have the system serviced.

2xxx

Explanation: A code DRAM error occurred.

Action: Have the system serviced.

3xxx

Explanation: A NVRAM error occurred.

Action: Have the system serviced.

4xxx

Explanation: A timer/cache memory controller error occurred.

Action: Have the system serviced.

5xxx

Explanation: A cache memory controller error occurred.

Action: Have the system serviced.

6xxx

Explanation: A cache DRAM error occurred.

Action: Have the system serviced.

7xxx

Explanation: A host/local PCI bus interface error occurred.

Action: Have the system serviced.

8xxx

Explanation: A SCSI I/O port error occurred.

Action: Have the system serviced.

9xxx

Explanation: A SCSI termination error occurred.

Action: Check cable connections and device termination. If the problem persists, have the system serviced.

Axxx

Explanation: A SCSI I/O port error occurred.

Action: Have the system serviced.

Bxxx

Explanation: A SCSI bus interface error occurred.

Action: Have the system serviced.

Basic and Extended Configuration Status Codes

BCS	ECS	Explanation and Possible Recovery Action
Code not in table	Code not in table	**Explanation:** The ServeRAID controller is not functioning properly. **Action:** Have the system serviced.
00	01	**Explanation:** Invalid flash configuration. **Action:** Start the *IBM ServeRAID Configuration and Management CD* and follow the instructions that appear on the screen. If no instructions appear or if the problem persists, have the system serviced.
00	02	**Explanation:** Invalid NVRAM configuration. **Action:** Start the *IBM ServeRAID Configuration and Management CD* and follow the instructions that appear on the screen. If no instructions appear or if the problem persists, have the system serviced.
00	03	**Explanation:** Invalid flash and NVRAM configuration. **Action:** Start the *IBM ServeRAID Configuration and Management CD* and follow the instructions that appear on the screen. If no instructions appear or if the problem persists, have the system serviced.
01	08	**Explanation:** No configuration was found in drives or Online/Rebuild drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	18	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	28	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	38	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	48	**Explanation:** No configuration was found in drives; or, Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	58	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	68	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
01	78	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	88	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	98	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	A8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	B8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	C8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	D8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	E8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	F8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
07	08	**Explanation:** Online/Rebuild drives are not responding. **Action:** Press F4, F5, or F10.
07	0C	**Explanation:** Online/Rebuild drives are not responding and a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	18	**Explanation:** Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
07	1C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding and a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	28	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
07	2C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.

BCS	ECS	Explanation and Possible Recovery Action
07	38	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
07	3C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	48	**Explanation:** Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, or F10.
07	4C	**Explanation:** Online/Rebuild drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	58	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	5C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	68	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	6C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	78	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	7C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
09	00	**Explanation:** No error occurred. **Action:** No action is required.
09	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
09	20	**Explanation:** Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
09	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
0F	00	**Explanation:** No error occurred. **Action:** No action is required.
0F	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.

BCS	ECS	Explanation and Possible Recovery Action
0F	20	**Explanation:** Ready/Standby drives are not responding.
		Action: Press F4, F5, or F10.
0F	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding.
		Action: Press F4, F5, or F10.

Rebuilding a defunct drive

A hard disk drive will go defunct (DDD) whenever there is a loss of communication between the controller and the hard disk drive. This can be caused by any of the following:

- An improperly connected cable, hard disk drive, or controller

- A loss of power to a drive

- A defective cable, backplane, hard disk drive or controller

In all cases, the communication problem needs to be resolved and then a Rebuild operation is required to reconstruct the data for the device in its respective disk array. The ServeRAID controllers can reconstruct RAID level-1 and RAID level-5 logical drives, but they cannot reconstruct data stored in RAID level-0 logical drives.

To prevent data integrity problems, the ServeRAID controllers set the RAID level-0 logical drives to Blocked during a Rebuild operation. After the Rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. But remember, the logical drive might contain damaged data.

Steps for recovering from defunct (DDD) drives

If the defunct drives are not part of an array, contact your IBM service representative.

If the defunct drives are part of an array, do the following:

- If more than one hard disk drive is defunct in an array, contact your IBM service representative.

- If a rebuild is in progress, wait until the rebuild is complete.

- If a rebuild is not in progress and only one hard disk drive in the array is defunct, do the following:

    1. Verify the cables, hard disk drives, and controllers are installed properly.

    2. Attempt to rebuild the defunct (DDD) hard disk drive by performing a hot-swap rebuild. Refer to "Rebuilding a hot-swap drive" for instructions.

    3. If the rebuild fails, contact your IBM service representative.

Rebuilding a hot-swap drive

A Hot-Swap Rebuild refers to a rebuild operation that is started by the ServeRAID controller when it detects that a drive, which is part of an array and in the defunct (DDD) state, has been removed and reinserted on the SCSI cable or backplane. The reinsertion of the hard disk drive, whether it is the same drive or a new drive, will trigger the ServeRAID controller to start the rebuild. During the rebuild, the drive being rebuilt appears in the Rebuild (RBL) state and the logical drive remains as Critical (CRT) until the hard disk drive has completed a successful rebuild.

On IBM servers, when a Hot-Spare drive is available, the data rebuild operation will begin automatically without the requirement to replace the failed drive.

Steps to start a hot-swap rebuild

To start a hot-swap rebuild, do the following:

1. Gently, remove the hard disk drive from the server, using the handle of the hot-swap tray, but do not remove the drive completely. If necessary, refer to the documentation that came with your server on how to remove a hard disk drive.

2. Wait 20 seconds to allow the disk drive to completely spin down.

   Note: When power is removed from a hot-swap drive, the drive immediately parks the heads, locks the actuator in the "landing zone," and begins spinning down. However, the spinning down of the disk may require up to 20 seconds after power is removed. Do not move the drive while it is spinning down. Moving the drive while it is spinning down may damage the drive.

3. Gently reinstall the hard disk drive into the server. Make sure it is completely installed in the backplane connector.

Troubleshooting an incomplete format of a hard disk drive

When performing a format of a hard disk drive and the format process is stopped due to a system reset, system shutdown, power outage, or by some other means, the hard disk drive becomes inoperable.

To enable the hard disk drive to communicate with the ServeRAID controller again, do the following:

1. Note the channel of the ServeRAID controller that the hard disk drive is connected.

2. Note the SCSI ID of the hard disk drive.

3. Use the IPSSEND FORMAT command to format the hard disk drive. It's syntax is:
   `IPSSEND FORMAT` *Controller Channel SID*

   Replace:

   - *Controller* with the ServeRAID controller number (1 to 12)
   - *Channel* with the channel number for the device (1, 2, or 3)
   - *SID* with the SCSI ID for the device (0 to 15)

   Once the FORMAT is complete, the ServeRAID controller will be able to recognize the drive again.

Troubleshooting a failure in a failover-environment

The device driver attempts to failover to the secondary controller in a failover environment whenever it is unable to send a command to the primary controller and the primary controller does not respond to a reset command.

Note: Loose cables or defective hard disk drives will not cause a failover to occur.

Replacing a non-hot-plug controller in a failover pair

If the failed controller is not in a hot-plug PCI slot, do the following to replace it:

1. Shutdown the server.

2. Replace the failed controller.

3. Follow the steps to reconfigure a second controller.

    - To initialize the controller, do steps 6 to 8 on page 40.

    - To configure the controller for failover, do steps 5 to 10 on page 41.

If the failed controller is in a hot-plug slot, refer to the documentation that comes with the server for instructions for replacing it.

Chapter 9. Getting help, service, and information

If you need help, service, technical assistance, or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you.

For example, IBM maintains pages on the World Wide Web where you can get information about IBM products and services, find the latest technical information, and download device drivers and updates.

Help is also available from bulletin boards and online services, as well as by fax and telephone. This section provides information about these sources.

Services available and telephone numbers listed are subject to change without notice.

Before you call for service

Many computer problems can be solved without outside assistance, by using the online help or by looking in the online or printed documentation that comes with your computer or software. Also, be sure to read the information in any README files that come with your software.

Most computers, operating systems, and application programs come with documentation that contains troubleshooting procedures and explanations of error messages. The documentation that comes with your computer also contains information about the diagnostic tests you can perform.

If you receive a POST error code when you turn on your computer, refer to the POST error-message charts in your hardware documentation. If you do not receive a POST error code, but suspect a hardware problem, refer to the troubleshooting information in your hardware documentation or run the diagnostic tests.

If you suspect a software problem, consult the documentation (including README files) for the operating system or application program.

Getting customer support and service

Purchasing an IBM Netfinity hardware product entitles you to standard help and support during the warranty period. If you need additional support and services, a wide variety of extended services are available for purchase that address almost any need.

Using electronic support services

If you have a modem, you can get help from several popular services. Bulletin boards and online information services provide assistance through question-and-answer message areas, live chat rooms, searchable databases, and more.

Technical information is available on a wide range of topics. In addition, the latest device driver updates are available.

The IBM Bulletin Board System (BBS) can be reached 24 hours a day, 7 days a week. Modem speeds of up to 14 400 baud are supported. Long distance telephone charges might apply. To access the IBM BBS:

- In the U.S., call 1-919-517-0001.
- In Canada:
  - In Montreal, call 514-938-3022.
  - In Toronto, call 905-316-4255 or 416-956-7877.
  - In Vancouver, call 604-664-6464.
- In the U.K., call 01256 336655.

Using the World Wide Web

On the World Wide Web, the IBM Personal Computing Web site has up-to-date information about IBM Personal Computer products and support. The address for the IBM Personal Computing home page is:

```
http://www.pc.ibm.com
```

You can find support information for your IBM products, including supported options, on the IBM Personal Computing Support page at:

```
http://www.pc.ibm.com/support
```

If you select Profile from the support page, you can create a customized support page that is specific to your hardware, complete with Frequently Asked Questions, Parts Information, Technical Hints and Tips, and Downloadable Files. You will have the information you need, all in one place. In addition, you can choose to receive e-mail notifications whenever new information becomes available about your registered products. You also can access online support forums, which are community sites monitored by IBM support staff.

For information about specific Personal Computer products, visit the following pages:

```
http://www.pc.ibm.com/us/netfinity/

http://www.pc.ibm.com/us/desktop/

http://www.pc.ibm.com/us/intellistation/

http://www.pc.ibm.com/us/thinkpad/

http://www.pc.ibm.com/us/options/

http://www.pc.ibm.com/us/aptiva/
```

You can select a country-specific Web site from these pages.

Getting information by fax

If you have a touch-tone telephone and access to a fax machine, in the U.S. and Canada you can receive by fax marketing and technical information on many topics, including hardware, operating systems, and local area networks (LANs). You can call the IBM Automated Fax System 24 hours a day, 7 days a week. Follow the recorded instructions, and the requested information will be sent to your fax machine.

To access the IBM Automated Fax System, do the following:

- In the U.S., call 1-800-426-3395.
- In Canada, call 1-800-465-3299.

Getting help online

Online Housecall is a remote communication tool that allows an IBM technical-support representative to access your system by modem. Many problems can be remotely diagnosed and corrected quickly and easily. In addition to a modem, a remote-access application program is required. This service is not available for servers. There might be a charge for this service, depending on the request.

For more information about configuring your system for Online Housecall:

- In the U.S., call 1-800-772-2227.
- In Canada, call 1-800-565-3344.
- In all other countries, contact your IBM reseller or IBM marketing representative.

Getting help by telephone

During the warranty period, you can get help and information by telephone through the IBM PC HelpCenter. Expert technical-support representatives are available to assist you with questions you might have on the following:

- Setting up your computer and IBM monitor
- Installing and setting up IBM options purchased from IBM or an IBM reseller
- Arranging for service (on-site or carry-in)
- Arranging for overnight shipment of customer-replaceable parts

In addition, if you purchased an IBM PC Server or IBM Netfinity Server, you are eligible for IBM Start Up Support for 90 days after installation. This service provides assistance for:

- Setting up your network operating system
- Installing and configuring interface cards
- Installing and configuring network adapters

Please have the following information ready when you call:

- Machine Type and Model
- Serial numbers of your computer, monitor, and other components, or your proof of purchase
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information for your system

If possible, be at your computer when you call.

These services are available 24 hours a day, 7 days a week.[4]

Country		Telephone number
Austria	Österreich	1-546 585 075
Belgium - Dutch	Belgie	02-717-2504
Belgium - French	Belgique	02-717-2503
Canada	Canada	1-800-565-3344
Denmark	Danmark	03-525-6905
Finland	Suomi	9-22-931805
France	France	01-69-32-40-03
Germany	Deutschland	069-6654-9003
Ireland	Ireland	01-815-9207
Italy	Italia	02-4827-5003
Luxembourg	Luxembourg	298-977-5060
Netherlands	Nederland	020-504-0531
Norway	Norge	2-305-3203
Portugal	Portugal	01-791-5147
Spain	España	091-662-4270
Sweden	Sverige	08-632-0063
Switzerland - German	Schweiz	01-212-1810
Switzerland - French	Suisse	022-310-0418
Switzerland - Italian	Svizzera	091-971-0523
United Kingdom	United Kingdom	01475-555555
U.S.A. and Puerto Rico	U.S.A. and Puerto Rico	1-800-772-2227

In all other countries, contact your IBM reseller or IBM marketing representative.

Getting help around the world

If you travel with your computer or need to move it to another country, you can register for International Warranty Service. When you register with the International Warranty Service Office, you will receive an International Warranty Service Certificate that is honored virtually worldwide, wherever IBM or IBM resellers sell and service IBM PC products.

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[4] Response time will vary depending on the number and complexity of incoming calls.

For more information or to register for International Warranty Service:

- In the U.S. or Canada, call 1-800-497-7426.
- In Europe, call 44-1475-893638 (Greenock, U.K.).
- In Australia and New Zealand, call 61-2-9354-4171.

In all other countries, contact your IBM reseller or IBM marketing representative.

Purchasing additional services

During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and name might vary by country.

900-Number operating system and hardware support line

In the U.S., if you prefer to obtain technical support on a pay-as-you go basis, you can use the 900-number support line. The 900-number support line provides support for IBM PC products that are out of the warranty period.

To access this support, call 1-900-555-CLUB (2582). You will be notified of the charge per minute.

Network and server support line

Network and Server Support is available for simple or complex networks made up of IBM servers and workstations using major network operating systems. In addition, many popular non-IBM adapters and network interface cards are supported.

This service includes all of the features of the Enhanced PC Support Line, plus:

- Installing and configuring client workstations and servers
- Identifying system problems and correcting problems on the client or the server
- Using IBM and non-IBM network operating systems
- Interpreting documentation

You can purchase this service on a per-call basis, as a multiple-incident package, or as an annual contract with a 10-incident limit. For more information about purchasing Network and Server Support, see "Ordering support line services."

Ordering support line services

The Network and Server Support Line services are available for products on the Supported Products list. To receive a Supported Products list:

- In the U.S.:
    1. Call 1-800-426-3395.
    2. Select document number 11683 for Network and Server support.

- In Canada, contact IBM Direct at 1-800-465-7999, or:
    1. Call 1-800-465-3299.
    2. Select the HelpWare® catalog.

- In all other countries, contact your IBM reseller or IBM marketing representative.

For more information or to purchase these services:

- In the U.S., call 1-800-772-2227.
- In Canada, call 1-800-465-7999.
- In all other countries, contact your IBM reseller or IBM marketing representative.

Warranty and repair services

You can upgrade your standard hardware warranty service or extend the service beyond the warranty period.

Warranty upgrades in the U.S. include:

- Carry-in service to on-site service

   If your warranty provides carry-in repair service, you can upgrade to on-site repair service, either standard or premium. The standard upgrade provides a trained servicer within the next business day (9 a.m. to 5 p.m., local time, Monday though Friday). The premium upgrade provides 4-hour average response, 24 hours a day, 7 days a week.

- On-site service to premium on-site service

   If your warranty provides for on-site service, you can upgrade to premium on-site service (4-hour average on-site response, 24 hours a day, 7 days a week).

You also can extend your warranty. Warranty and Repair Services offers a variety of post-warranty maintenance options, including ThinkPad® EasyServ Maintenance Agreements. Availability of the services varies by product.

For more information about warranty upgrades and extensions:

- In the U.S., call 1-800-426-4968.
- In Canada, call 1-800-465-7999.
- In all other countries, contact your IBM reseller or IBM marketing representative.

Ordering publications

Additional publications are available for purchase from IBM. For a list of publications available in your country:

- In the U.S., Canada, and Puerto Rico, call 1-800-879-2755.
- In other countries, contact your IBM reseller or IBM marketing representative.

Appendix A. Product warranties and notices

This appendix contains warranty statements, emissions notices, general-information notices, and trademarks.

Warranty Statements

The warranty statements consist of two parts: Part 1 and Part 2. Part 1 varies by country. Part 2 is the same for both statements. Be sure to read both the Part 1 that applies to your country and Part 2.

- **United States, Puerto Rico, and Canada (Z125-4753-05 11/97)**
  (Part 1 - General Terms on page 157)
- **Worldwide except Canada, Puerto Rico, Turkey, and United States (Z125-5697-01 11/97)**
  (Part 1 - General Terms on page 159)
- **Worldwide Country-Unique Terms**
  (Part 2 - Country-Unique Terms on page 161)

IBM Statement of Limited Warranty for United States, Puerto Rico, and Canada (Part 1 - General Terms)

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. **The terms of Part 2 may replace or modify those of Part 1**. *The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.*

> **Machine -** IBM Netfinity ServeRAID-3H, ServeRAID-3HB, or ServeRAID-3L Ultra2 SCSI Controllers
>
> **Warranty Period* -** Three Years
>
> **Contact your place of purchase for warranty service information. Some IBM Machines are eligible for On-site warranty service depending on the country where service is performed.*

The IBM Warranty for Machines
IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications. The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period IBM or your reseller, if approved by IBM to provide warranty service, will provide repair and exchange service for the Machine, without charge, under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded. The replacement may not be new, but will be in good working order.

Extent of Warranty
The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES

GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

Unless specified otherwise, IBM provides non-IBM machines **WITHOUT WARRANTIES OF ANY KIND.**

Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service

To obtain warranty service for the Machine, contact your reseller or IBM. In the United States, call IBM at 1-800-772-2227. In Canada, call IBM at 1-800-565-3344. You may be required to present proof of purchase.

IBM or your reseller provides certain types of repair and exchange service, either at your location or at a service center, to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. IBM may repair the failing Machine or exchange it at its discretion.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item.

Any feature, conversion, or upgrade IBM or your reseller services must be installed on a Machine which is 1) for certain Machines, the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided
    a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides,
    b. secure all programs, data, and funds contained in a Machine,
    c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations, and
    d. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Production Status

Each IBM Machine is manufactured from new parts, or new and used parts. In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's appropriate warranty terms apply.

Limitation of Liability

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and

2. the amount of any other actual direct damages, up to the greater of U.S. $100,000 (or equivalent in local currency) or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

   This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS OR SAVINGS), EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

IBM Statement of Warranty Worldwide except Canada, Puerto Rico, Turkey, United States (Part 1 - General Terms)

This Statement of Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. **The terms of Part 2 may replace or modify those of Part 1**. *The warranties provided by IBM in this Statement of Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.*

> **Machine -**   IBM Netfinity ServeRAID-3H, ServeRAID-3HB, or ServeRAID-3L Ultra2 SCSI Controllers
>
> **Warranty Period* -**   Three Years
>
> **Contact your place of purchase for warranty service information. Some IBM Machines are eligible for On-site warranty service depending on the country where service is performed.*

The IBM Warranty for Machines

IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications. The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period IBM or your reseller, if approved by IBM to provide warranty service, will provide repair and exchange service for the Machine, without charge, under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded. The replacement may not be new, but will be in good working order.

Extent of Warranty

The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

Unless specified otherwise, IBM provides non-IBM machines **WITHOUT WARRANTIES OF ANY KIND.**

Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND.**

Warranty Service

To obtain warranty service for the Machine, contact your reseller or IBM. You may be required to present proof of purchase.

IBM or your reseller provides certain types of repair and exchange service, either at your location or at a service center, to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. IBM may repair the failing Machine or exchange it at its discretion.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item.

Any feature, conversion, or upgrade IBM or your reseller services must be installed on a Machine which is 1) for certain Machines, the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided
   a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides,
   b. secure all programs, data, and funds contained in a Machine,
   c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfil their obligations, and
   d. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Production Status

Each IBM Machine is manufactured from new parts, or new and used parts. In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's appropriate warranty terms apply.

Limitation of Liability

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and

2. the amount of any other actual direct damages, up to the greater of U.S. $100,000 (or equivalent in local currency) or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

   This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS OR SAVINGS), EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Part 2 - Worldwide Country-Unique Terms

<u>ASIA PACIFIC</u>

AUSTRALIA: The IBM Warranty for Machines: The following paragraph is added to this Section:
The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other legislation and are only limited to the extent permitted by the applicable legislation.

Extent of Warranty: The following replaces the first and second sentences of this Section:
The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, operation in other than the Specified Operating Environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible.

Limitation of Liability: The following is added to this Section:
Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

PEOPLE'S REPUBLIC OF CHINA: Governing Law: The following is added to this Statement:
The laws of the State of New York govern this Statement.

INDIA: Limitation of Liability: The following replaces items 1 and 2 of this Section:
1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

NEW ZEALAND: The IBM Warranty for Machines: The following paragraph is added to this Section:
The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: The following is added to this Section:
Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

<u>EUROPE, MIDDLE EAST, AFRICA (EMEA)</u>

The following terms apply to all EMEA countries.

The terms of this Statement of Warranty apply to Machines purchased from an IBM reseller. If you purchased this Machine from IBM, the terms and conditions of the applicable IBM agreement prevail over this warranty statement.

Warranty Service
If you purchased an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchased an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

The applicable laws, Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided. However, the laws of Austria govern this Statement if the warranty service is provided in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Federal Republic of Yugoslavia, Georgia, Hungary, Kazakhstan, Kirghizia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, and Ukraine.

The following terms apply to the country specified:

EGYPT: Limitation of Liability: The following replaces item 2 in this Section:

2. as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim.

Applicability of suppliers and resellers (unchanged).

FRANCE: Limitation of Liability: The following replaces the second sentence of the first paragraph of this Section:
In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: (items 1 and 2 unchanged).

GERMANY: The IBM Warranty for Machines: The following replaces the first sentence of the first paragraph of this Section:
The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this Section:
The minimum warranty period for Machines is six months.

In case IBM or your reseller are unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: The second paragraph does not apply.

Warranty Service: The following is added to this Section:
During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Production Status: The following paragraph replaces this Section:
Each Machine is newly manufactured. It may incorporate in addition to new parts, re-used parts as well.

Limitation of Liability: The following is added to this Section:
The limitations and exclusions specified in the Statement of Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

In item 2, replace "U.S. $100,000" with "1.000.000 DEM."

The following sentence is added to the end of the first paragraph of item 2:
IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

IRELAND: Extent of Warranty: The following is added to this Section:
Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: The following replaces items one and two of the first paragraph of this Section:
1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and 2. the amount of any other actual direct damages, up to the greater of Irish Pounds 75,000 or 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section:
IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY: Limitation of Liability: The following replaces the second sentence in the first paragraph:
In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than: (item 1 unchanged) 2)as to any other actual damage arising in all situations involving non-performance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim.

Applicability of suppliers and resellers (unchanged).

The following replaces the second paragraph of this Section:
Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: (items 1 and 2 unchanged) 3) indirect damages, even if IBM or your reseller is informed of their possibility.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND: Limitation of Liability: The following is added to this Section:
IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.

TURKIYE: Production Status: The following replaces this Section:
IBM fulfils customer orders for IBM Machines as newly manufactured in accordance with IBM's production standards.

UNITED KINGDOM: Limitation of Liability: The following replaces items 1 and 2 of the first paragraph of this Section:
1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;
2. the amount of any other actual direct damages or loss, up to the greater of Pounds Sterling 150,000 or 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

The following item is added to this paragraph:
3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

Applicability of suppliers and resellers (unchanged).

The following is added to the end of this Section:
IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default will be limited to damages.

NORTH AMERICA

CANADA: Warranty Service: The following is added to this Section:
To obtain warranty service from IBM, call **1-800-465-6666**.

UNITED STATES OF AMERICA: Warranty Service: The following is added to this Section:
To obtain warranty service from IBM, call **1-800-IBM-SERV**.

Notices

References in this publication to IBM products, programs, or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Subject to IBM's valid intellectual property or other legally protectable rights, any functionally equivalent product, program, or service may be used instead of the IBM product, program, or service. The evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM, are the responsibility of the user.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

> IBM Director of Licensing
> IBM Corporation
> North Castle Drive
> Armonk, NY 10504-1785
> U.S.A.

Year 2000 readiness and instructions

This is a Year 2000 Readiness Disclosure.

A product is Year 2000 Ready if the product, when used in accordance with its associated documentation, is capable of correctly processing, providing and/or receiving date data within and between the 20th and 21st centuries, provided all other products (for example, software, hardware, and firmware) used with the product properly exchange date data with it.

This IBM PC hardware product has been designed to process four-digit date information correctly within and between the 20th and 21st centuries. If your IBM computer is on when the century changes, you should turn it off and then back on again once, or restart the operating system, to ensure that the internal clock resets itself for the new century.

This IBM PC product cannot prevent errors that might occur if software you use or exchange data with is not ready for the Year 2000. IBM software that comes with this product is Year 2000 Ready. However, software from other companies might come with this IBM PC product. IBM cannot take responsibility for the readiness of that software. You should contact the software developers directly if you wish to verify readiness, understand limitations, or look for any software updates.

To learn more about IBM PC products and the Year 2000, visit our Web site at http://www.ibm.com/pc/year2000. The information and tools there can help you with your Year 2000 transition plan, especially if you have multiple IBM PCs. IBM encourages you to check periodically for updated information.

Trademarks

The following terms are trademarks of the IBM Corporation in the United States or other countries:

IBM	Netfinity
OS/2	ServeRAID
HelpCenter	IntelliStation
HelpWare	Netfinity Manager
ThinkPad	Predictive Failure Analysis

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Federal Communications Commission (FCC) Statement

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

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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

United Kingdom telecommunications safety requirement

Notice to Customers

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

European community directive conformance statement

This product is in conformity with the protection requirements of EC Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electro-magnetic compatibility.

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

Industry Canada Class A Emission Compliance Statement

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

Avis de conformité à la réglementation d'Industrie Canada

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

Australia and New Zealand Class A Statement

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

Taiwanese electromagnetic interference (EMI) statement

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

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