

IBM

**ServeRAID Adapter
Installation Instructions and User's Guide**

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Note

Before using this information and the product it supports, be sure to read the general information under Appendix E, "Product Warranties and Notices" on page 175.

cms **Third Edition (December 1997)**

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Safety Information

Before installing this product read the Safety Information booklet.

"Antes de instalar seu produto leia o manual de Informações sobre Segurança."

Před instalací tohoto produktu si přečtěte brožuru s bezpečnostními informacemi.

Læs hæftet med sikkerhedsforskrifter, før du installerer dette produkt.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet sisältävä kirjanen.

Avant d'installer ce produit, reportez-vous au manuel Safety Information.

"Vor dem Installieren dieses Produkts die Broschüre mit den Sicherheitsinformationen lesen."

E termék installálása előtt olvassa el a Bizonsági Tudnivalók kézikönyvét !

Prima di installare questo prodotto, leggere l'opuscolo relativo alla sicurezza.

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"Antes de instalar este produto, leia o folheto de Informações sobre Segurança."

Перед тем как установить этот продукт, прочтите буклет "Инструкция по технике безопасности".

Pred namestitvijo tega izdelka preberite Varnostne informacije.

Antes de instalar este producto consulte el manual de Avisos de seguridad.

Läs dokumentet med säkerhetsföreskrifter innan du installerar den här produkten.

在您安裝本產品之前,請先閱讀「安全資訊」手冊。

About This Book

This book provides information and instructions for using the IBM ServeRAID Adapter and the IBM ServeRAID II Ultra SCSI Adapter, herein referred to as the ServeRAID adapter. It is intended for a network administrator—that is, the individual responsible for configuring, maintaining, managing, and troubleshooting a server using one or more of these adapters. This book also includes information about installing and using the IBM ServeRAID II Ultra SCSI Adapter, discusses disk-array technology, and describes tasks associated with disk arrays.

How This Book Is Organized

Chapter 1, “Introduction,” provides general information about the adapter, the contents of the option package, and the requirements for installation.

Chapter 2, “Installing the IBM ServeRAID Adapter,” provides general information about installing the ServeRAID adapter. This chapter also includes references to other documentation that will provide you with additional instructions, if you need them.

Chapter 3, “Configuring the IBM ServeRAID Adapter,” provides step-by-step procedures for the tasks necessary to configure, add, change, and delete one or more disk arrays. This chapter also tells you how to get started using the configuration program and provides procedures for the common tasks associated with configuring disk arrays. Information about maintaining your disk arrays and instructions for accessing the IBM ServeRAID Mini-Configuration program are also included.

Chapter 4, “Administration and Monitoring Utilities,” provides the installation instructions for the utility for each operating system supported by the IBM ServeRAID Adapter.

Chapter 5, “Using the Administration and Monitoring Utility” provides instructions for using the ServeRAID utilities, such as the Administration and Monitoring utility.

Appendix A, "IBM PC Server POST/BIOS Update Information," provides important information that you will need, if you are installing the IBM ServeRAID Adapter into an IBM PC Server.

Appendix B, "RAID Technology" provides general information about the RAID technology.

Appendix C, "IBM PC ServeRAID Adapter Startup Messages," provides a list of messages that might appear and actions to take on resolving configuration conflicts that are associated with the IBM ServeRAID Adapter.

Appendix D, "Getting Help, Service, and Information," provides instructions on how to obtain service and technical assistance for your ServeRAID adapter and other IBM products that you might plan to use. This chapter also contains toll-free telephone numbers and access information for electronic bulletin boards, online services, and the World Wide Web.

Appendix E, "Product Warranties and Notices," contains product notices and trademarks.

A glossary and index also are included.

Related Publications

During the installation of the IBM ServeRAID adapter, you might need to refer to the following:

- Hot Swap Option Installation Instructions (if applicable)
- The documentation that comes with your server
- The documentation that comes with your operating system

Notices Used in This Book

This book contains notices to highlight information or provide safety information:

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. Introduction

The IBM ServeRAID Adapter and the IBM ServeRAID II Ultra SCSI Adapter, herein referred to as the ServeRAID adapter, are high-performance adapters that interface between the host PCI bus and three independent SCSI buses. The ServeRAID adapter implements redundant array of independent disks (RAID) levels 0, 1, and 5 and can support up to 45 SCSI hard disk drives, with 15 SCSI hard disk drives on each SCSI bus.

The IBM ServeRAID Adapter supports SCSI-3 Ultra Fast/Wide protocol and can support up to 40 MB per second data rate per SCSI bus.

RAID is the technology that groups one or more hard disk drives in a server into an *array* that you can define as one or more *logical drives*. Each logical drive appears to the operating system as a single *physical* drive. This grouping technique greatly enhances logical-drive capacity, access times, and data transfer rates beyond the physical limitations of a single hard disk drive.

As previously mentioned, this book is intended for a network administrator or the individual responsible for configuring, maintaining, managing, and troubleshooting a server. The administrator also should be familiar with RAID and disk-array technology, including hot-swap drives.

Do not open the static-protective bag containing the IBM ServeRAID adapter until instructed to do so.

Note: The illustrations in this publication might look slightly different from your hardware.

In addition to this book, this option package contains:

IBM PC ServeRAID II Adapter

Diskette package containing:

- IBM ServeRAID Configuration Diskette
- IBM ServeRAID Device Driver Diskette
- IBM ServeRAID Administration and Monitoring Diskette
- IBM ServeRAID SCO OpenServer Boot-Time Loadable Diskette (BTLD)

Safety Information Booklet

Contact your place of purchase if anything is missing or damaged.

Important: Be sure to retain your proof of purchase, because it might be required to receive warranty service.

Hardware Installation Requirements

If you are installing the ServeRAID adapter in an IBM Server, you might need to update the system BIOS. Refer to Appendix A, "IBM PC Server POST/BIOS Update Information" on page 153; then, return here and continue.

If your server is a non-disk array IBM PC Server 320, you can install a hot-swap-bay option before you install the adapter. Refer to the installation instructions that come with the hot-swap-bay assembly along with Appendix A, "IBM PC Server POST/BIOS Update Information" on page 153. After you install the hot-swap-bay assembly, return here and continue with the "Installation Overview" on page 3.

Installation Overview

To install your IBM ServeRAID adapter and configure your disk array, you will do the following:

1. Install the adapter.
2. Configure and prepare the disk array.
3. Install the operating system.
4. Install the device drivers.
5. Install the Administration and Monitoring utilities.

Keep the documentation that comes with your server and a small, flat-blade screwdriver handy during the installation process.

If you need some basic information about RAID technology during the installation of this adapter, refer to Appendix B, "RAID Technology" on page 155.

Chapter 2. Installing the IBM ServeRAID Adapter

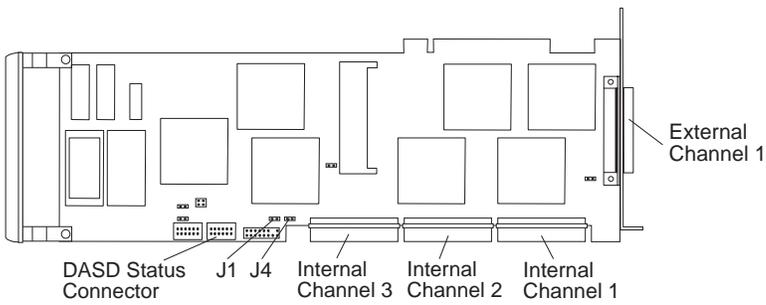
During the installation of your IBM ServeRAID Adapter (hereafter referred to as the ServeRAID adapter or adapter) you will install the adapter (or adapters), connect the necessary SCSI cables, connect internal and external devices, install hot-swap hard disk drives, and revise the configuration information.

After you install the adapter, you will be able to connect the internal SCSI drives in your system to the Channel connectors on your ServeRAID adapter. The IBM ServeRAID Adapter has three internal Channels and one external Channel. The IBM ServeRAID II Ultra SCSI Adapter has three internal Channels and two external Channels. Also, using a separately purchased IBM kit for the IBM PC ServeRAID II Ultra SCSI Adapter, you can add a third external Channel option to your adapter. See page 8 for more information on this option.

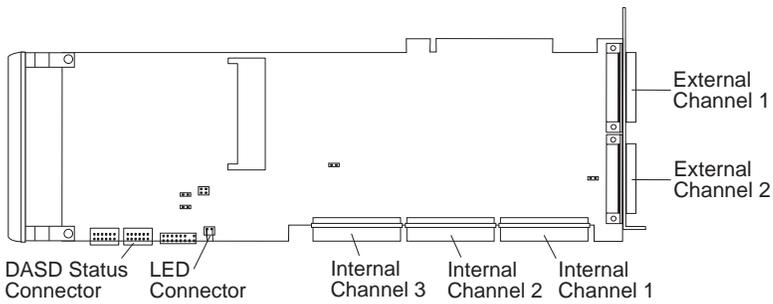
Note: You cannot connect devices to both an internal Channel connector and its corresponding external Channel connector at the same time. For example, you cannot connect devices to both the internal Channel 1 connector and the external Channel 1 connector at the same time.

The following figures show the location of the Channel connectors on your ServeRAID adapter.

IBM ServeRAID Adapter



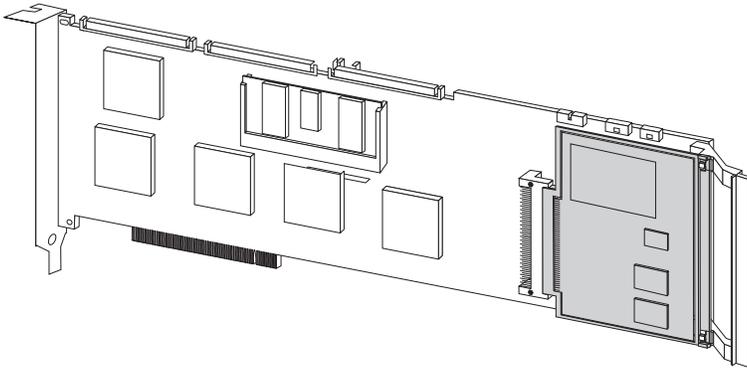
IBM ServeRAID II Ultra SCSI Adapter



Note: The IBM ServeRAID II 8MB/Battery-Backup Cache option only works with the IBM ServeRAID II Ultra SCSI Adapter.

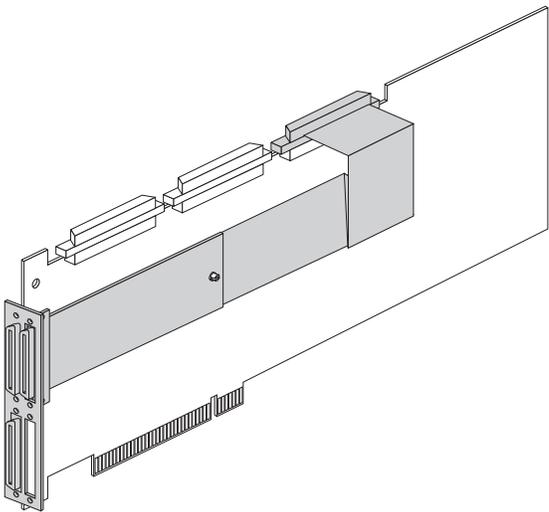
To protect your data in write back mode against power failures, IBM provides the IBM ServeRAID II 8MB/Battery-Backup Cache option, as shown in the following figure. When this option is installed and enabled, the data stored in the ServeRAID cache is protected even if your system incurs a power-outage or other type of power failure. Once the power is restored to the system, the ServeRAID adapter will write any information that was stored in the adapter's cache prior to the power outage, to the hard disk drives.

The battery-backup cache also provides protection in case of adapter failure.



For more information about this option, contact your IBM reseller or IBM marketing representative.

IBM also provides the IBM ServeRAID Bracket w/Channel 3 connector option kit for the IBM ServeRAID II Ultra SCSI adapter, as shown in the following figure. With this option, you can make your internal Channel 3 connector an external connector. This would give you a third external channel option, if you need it for your configuration.



For more information about this option, contact your IBM reseller or IBM marketing representative.

Installing the Adapter

The following instructions guide you through the installation of your IBM ServeRAID Adapter or IBM ServeRAID II Ultra SCSI Adapter. Throughout these installation instructions, these adapters will be referred to as ServeRAID adapters, unless otherwise specified.

Note: If you are installing the ServeRAID adapter in an IBM PC Server or IBM Netfinity Server, go to Appendix A, "IBM PC Server POST/BIOS Update Information" on page 153 before continuing; then, return here and continue.

To install the adapter, do the following:

1. Turn off the server and disconnect all power cords and cables from the server. (Refer to the Safety Information Booklet that comes with your adapter.)
2. Remove the cover from your server. If necessary, refer to the documentation that comes with your server for information about removing the cover.
3. Touch the static-protective package containing the adapter to a metal expansion-slot cover on the server. This reduces any static electricity from the package and from your body.
4. Remove the adapter from the static-protective package, holding the adapter by the edges. Do not touch any exposed components on the adapter.
5. Place the adapter on the bag, on a flat surface.
6. Determine which PCI expansion slot you will use for the adapter.
Choose a slot with the most clearance from any other installed components, such as the microprocessor. If necessary, refer to the documentation that comes with your server for instructions.
7. Remove the expansion-slot cover, if applicable.
8. Insert the adapter in the PCI expansion slot. Press the adapter firmly into the slot so that it is fully seated in the slot.
9. Tighten the expansion-slot screw on the top of the adapter.

Cabling the Adapter

To cable the adapter, do the following:

1. Connect one end of a 68-pin SCSI connector (separately purchased or already in your server) to one of the internal channel connectors on the ServeRAID adapter.

Note: There are external connectors on the adapter. You cannot connect devices to both an internal Channel connector and its corresponding external Channel connector at the same time. For example, you cannot connect devices to both the internal Channel 1 connector and the external Channel 1 connector at the same time.

2. Connect the other end of the SCSI cable to the server's backplane, if applicable. (Refer to the documentation that comes with your server or the system label inside the server cover for the location of the connector on the backplane.)

By default, the ServeRAID adapter assumes the following:

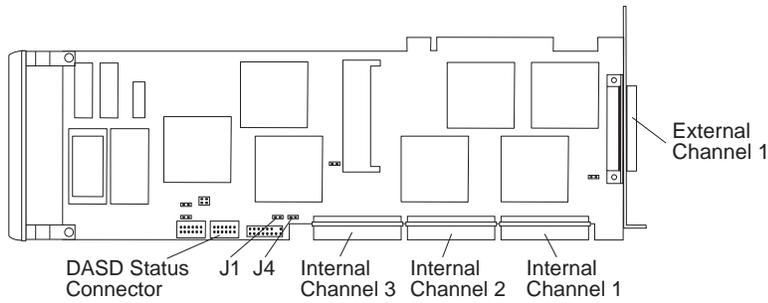
Internal Channel	Connect to Backplane
3	C
2	D
1	E

3. If the backplane in your server has a connector for the DASD status cable, continue with step 4 on page 11; otherwise, go to step 6 on page 13.

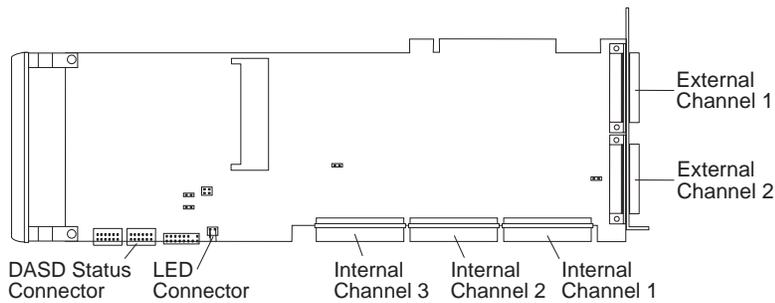
- Connect the appropriate end of the DASD status cable (that comes with this option) to the DASD status connector on the adapter.

Note: The DASD status cable is for IBM Servers using the IBM PC Server Hot Swap Backplane III or the IBM PC Server Hot Swap Backplane (six slot) and is supported only on internal channel connections.

IBM ServeRAID Adapter

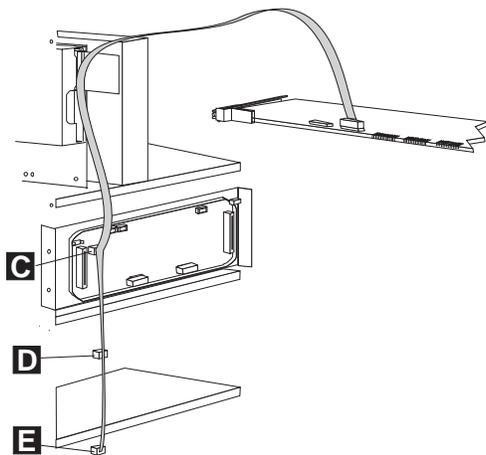


IBM ServeRAID II Ultra SCSI Adapter

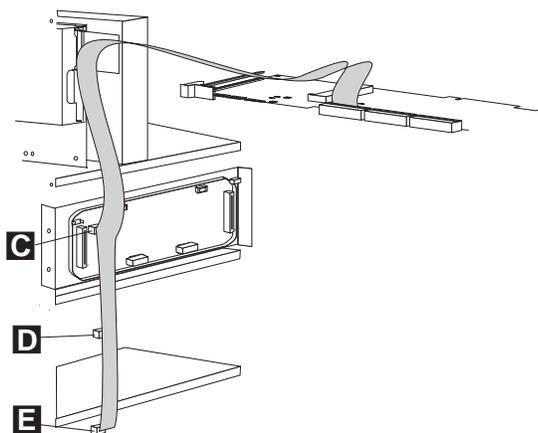


5. Attach connector **C** of the DASD status cable to the server's backplane.

IBM ServeRAID Adapter



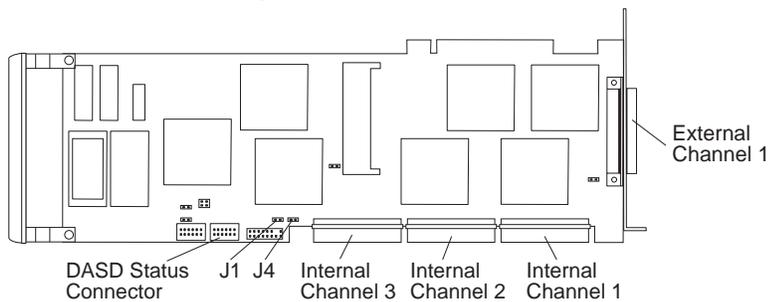
IBM ServeRAID II Ultra SCSI Adapter



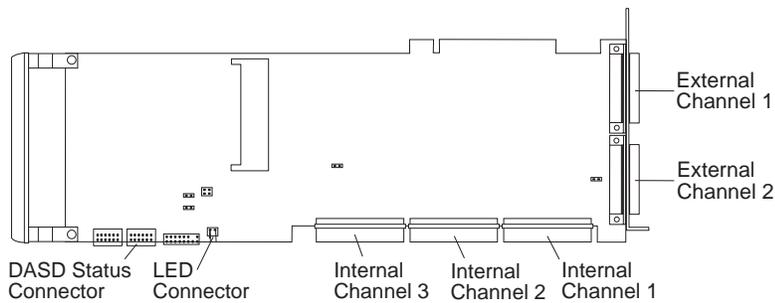
Note: If your server has more than one backplane installed, attach connector **D** to the next backplane and connector **E** to the last backplane.

6. If your server has an LED cable installed, continue with step 7; otherwise, go to step 8.
7. Connect the LED cable to the LED connector pins on the adapter. (On the ServeRAID Adapter, the LED connector is labeled **J4**.)

IBM ServeRAID Adapter



IBM ServeRAID II Ultra SCSI Adapter



8. Install the hot-swap hard disk drives in your server. Refer to the documentation that comes with your server for information about installing hot-swap hard disk drives.
9. Replace the cover of your server. If necessary, refer to the documentation that comes with your server for information about replacing the cover.

10. Replace and reconnect all power cords and cables.
11. If you are attaching an external storage device, continue with “Connecting to an Expansion Tower.” Otherwise, go to Chapter 3, “Configuring the IBM ServeRAID Adapter” on page 15 .

Connecting to an Expansion Tower

If you are connecting an expansion tower, such as an IBM PC Server Enterprise Expansion Enclosure, to your ServeRAID adapter, connect one end of an external 16-bit SCSI cable to the external Channel 1 connector and the other end of the cable to the expansion tower.

Note: There is one external connector on the ServeRAID Adapter, designated as Channel 1. There are two external connectors on the ServeRAID II Ultra SCSI Adapter and they are designated as Channel 1 and Channel 2. (See page 11 for the locations of the Channel connectors.) You cannot connect devices to both the internal Channel 1 connector and the external Channel 1 connector at the same time. The same is true for Channel 2; you cannot connect devices to both the internal Channel 2 and the external Channel 2 connector at the same time.

Refer to the instructions that come with your external enclosure for more information.

After you install the ServeRAID adapter and connect any external devices, continue with Chapter 3, “Configuring the IBM ServeRAID Adapter” on page 15.

Chapter 3. Configuring the IBM ServeRAID Adapter

You must use the ServeRAID configuration program to create and initialize new disk arrays, view the current disk-array configuration, change or delete existing configurations, and perform many other configuration tasks.

You must configure your disk-arrays *before* you install your operating system. Once your disk-arrays are configured and the operating system is installed, messages and warnings are displayed from the Administration and Monitoring utilities or through the NetFinity Alerting function.

In the first part of this chapter, you will find a short overview of RAID technology, hard disk drive capacities, logical drives, and RAID classifications. If you are not familiar with RAID or disk-array technology, be sure to review the information in Appendix B, "RAID Technology" on page 155 where more detailed information is provided.

Following the overview, you will find information explaining the ServeRAID menus, screens, and drive states that you need to understand before you start the ServeRAID configuration program. It is a good idea to review this information before using the configuration program; however, if you are already familiar with the IBM ServeRAID Configuration program, continue with "Using the ServeRAID Configuration Program" on page 25.

Understanding RAID Technology

A disk array is the grouping of one or more physical hard disk drives into one storage area. Using the ServeRAID adapter and its utilities, you can divide the array into one or more logical drives for use by the operating system. The ServeRAID adapter can support up to eight independent arrays.

Disk arrays are used to improve security, 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 adapter supports RAID levels 0, 1, and 5 in disk arrays.

Hard Disk Drive Capacities

Hard disk drive capacities influence the way you create arrays. Drives in an array can be of different capacities (1 GB¹, or 2 GB, for example), but the ServeRAID adapter treats 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 1GB 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. Therefore, the optimal way to create arrays is to use hard disk drives that have the same capacity.

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.

¹ 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.

Each ServeRAID adapter supports up to eight logical drives. 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 that you define 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.

RAID Classifications

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

The ServeRAID adapter supports three, industry-recognized RAID levels, 0, 1, and 5. For more information on RAID technology and RAID levels 0, 1, and 5, see Appendix B, “RAID Technology” on page 155.

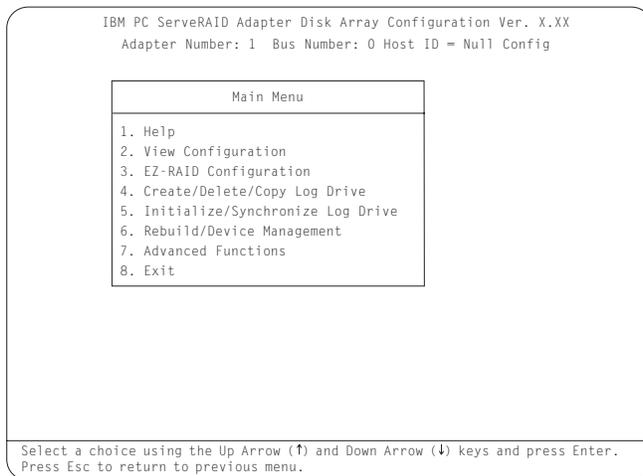
ServeRAID Menus, Screens, and Drive States

The next few pages contain information about the Main Menu, the ServeRAID screens and pop-up windows, the physical device states and the logical drive states that you can encounter while using the IBM ServeRAID adapter.

Main Menu

It is a good idea to understand what each of the selections on the ServeRAID Configuration Main Menu do before going any further.

The following figure shows the Main Menu of the IBM ServeRAID Configuration Program.



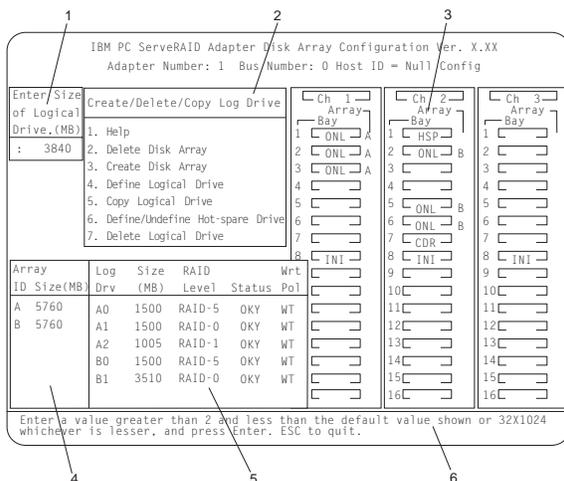
Descriptions of the choices available from the Main Menu are as follows:

1. **Help** provides information about the choices available on the menu. You also can press F1 from any screen to obtain online Help.
2. **View Configuration** displays the existing disk-array configuration information. Refer to “Viewing or Changing the Configuration” on page 50 for more information.
3. **EZ-RAID Configuration** automatically creates a configuration based on the number of physical drives installed in your system. Refer to “EZ-RAID Configuration Option” on page 28 for more information.
4. **Create/Delete/Copy Log Drive** lets you manually create your disk arrays. You can select the drives that you want to include in an array. (Refer to “Configuring a Disk Array” on page 27 for more information.) You also can select this choice to define, delete, or copy logical drives and to define hot-spare drives.

5. **Initialize/Synchronize Log Drive** prepares the drives for data storage. Refer to “Initializing Logical Drives” on page 39 and “Synchronizing Logical Drives” on page 42 for more information.
6. **Rebuild/Device Management** rebuilds RAID level 1 and RAID level 5 logical drives. (Refer to “Maintaining the IBM ServeRAID Adapter” on page 76 for more information.) You also can select this choice to define or change the state of a physical drive, view drive information, and clear the device-event table.
7. **Advanced Functions** lets you change the write policy (the way data is written to the drive), save your configuration information to a diskette, restore your configuration from a diskette, or change the ServeRAID adapter’s parameters. You also can select this choice to run the RAID subsystems diagnostics, initialize the adapter configuration, reset the configuration values to the factory defaults, and select a source (hard disk, NVRAM, Flash) from which to synchronize the ServeRAID adapter’s configuration.
8. **Exit** lets you exit from the Main Menu of the ServeRAID configuration program.

Screens and Pop-Up Windows

When you use the IBM ServeRAID configuration program, different screens appear. The following illustration is a compilation of several ServeRAID Configuration screens.



Descriptions of the labeled areas in this illustration are as follows:

- 1 Pop-up windows that apply to the current menu appear in this area of the screen. For example, when you need to confirm an action, the Confirm pop-up window appears in this area.
- 2 You can select any of the choices on the menu that appears in this window. To make a selection from a menu, type the highlighted number of the menu item, or use the Up Arrow (↑) or Down Arrow (↓) key to highlight the item; then press **Enter**. You can press **Esc** to return to a previous menu, to a previous work area of a screen, or to the Main Menu.
- 3 The Array/Bay selection list shows the bays for the adapter. For each bay that contains a drive, the list indicates the array in which the drive is grouped and the physical drive state. (See “Physical Device States” on page 22 for more information.) For example, in the illustration, the drive in Channel 1, Bay 1 has a drive state of online (**ONL**) and is a part of Array A.

Notes:

- a. The Array/Bay selection list does not reflect the physical configuration of the server. Refer to the documentation that comes with your server for the physical location of the hard disk drives.
 - b. The SCSI IDs for the hot-swap hard disk drives are set by the backplanes. The backplanes allow you to define the IDs as low (0 to 5) or high (8 to 13). Refer to the documentation that comes with your server for information on setting the jumpers on the backplanes.
 - c. The Bay Number corresponds to the SCSI ID of the device plus 1. For example, the ServeRAID adapter (**INI**) uses SCSI ID 7 and its bay number is 8 (7+1).
 - d. The Bay Number that contains INI is reserved for use by the ServeRAID adapter. This bay must not contain drives or other devices. To maintain this restriction, do not set non hot-swap devices to a SCSI ID of the INI bay number minus 1. For example, the previous figure shows the INI for channel 2 in bay number 8; therefore, you cannot set a non hot-swap device such as a CD-ROM drive to SCSI ID 7 (the INI bay number minus 1).
- 4** The Array list indicates the array IDs and the sizes (in megabytes) of the arrays. When a drive is being rebuilt, this list and the Logical Drive list area show the progression of the rebuild process.
 - 5** The Logical Drive list shows the size, RAID level, status, and write policy for each logical drive. (See “Logical Drive States” on page 24 for more information.)
 - 6** This area provides information and instructions about the actions that you can perform on the current screen or pop-up window.

Physical Device States

Descriptions of the physical device states, which appear in the Array/Bay selection list, are as follows:

State	Meaning
CDR	A CD-ROM drive is installed.
DDD	<p>A physical hard disk drive is defunct (DDD). A drive in the Online (ONL) or Rebuild (RBL) state has become defunct (DDD). It does not respond to commands, which means that the ServeRAID adapter cannot communicate properly with the drive.</p> <p>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:</p> <ol style="list-style-type: none">1. All cables are connected properly to the backplane and to the hard disk drive. Also, check to ensure that all cables inside the server are connected properly.2. The hot-swap drive trays are seated properly in the drive bay.3. Also, refer to Appendix C, "IBM PC ServeRAID Adapter Startup Messages" on page 161. <p>If the hard disk drive still does not function after you perform these steps, replace the drive.</p>
DHS	<p>A drive enters the defunct hot-spare (DHS) state if:</p> <ol style="list-style-type: none">1. A defunct (DDD) drive has been rebuilt to another drive, such as a hot-spare drive.2. A hot-spare (HSP) or standby hot-spare (SHS) drive fails to respond to commands from the ServeRAID adapter.
EMP	No device is present in the bay. This state is represented by dashes (---) on the ServeRAID configuration screen, or a blank space on the Administration and Monitor utility screen.

State	Meaning
HSP	A hot-spare drive is a hard disk drive that is defined for automatic use when a similar drive fails. Refer to “Defining a Hot-Spare Drive” on page 43 for more information.
INI	The INI represents the initiator for the ServeRAID adapter to communicate on each channel.
ONL	The drive is online (ONL). It is functioning properly and is part of an array.
PRC	The device is a generic SCSI controller (for example, a hot-swap backplane that has onboard systems-management support).
RBL	The drive is being rebuilt. For more information on rebuilding a drive, refer to “Understanding How to Rebuild a Drive” on page 84.
RDY	The ServeRAID adapter recognizes a ready (RDY) drive as being available for definition. The ready drive state changes to empty (EMP) when the drive is physically removed from the bay.
SBY	A standby (SBY) drive is a hard disk drive that the ServeRAID adapter has spun down.
SHS	A standby hot-spare is a hot-spare drive that the ServeRAID adapter has spun down. If an online (ONL) drive becomes defunct and no suitable hot-spare drive is available, a standby hot-spare of the appropriate size automatically spins up, and enters the RBL state.
TAP	A tape drive is installed.

Logical Drive States

Descriptions of the logical drive states are as follows:

State	Meaning
CRM	A logical drive undergoing a logical drive migration (LDM) that is in the critical (CRT) state.
CRS	The ServeRAID adapter uses this reserved state during a logical drive migration (LDM).
CRT	A RAID level 1 or 5 logical drive that contains a defunct physical drive is in the critical state. A critical (CRT) logical drive is accessible, despite a physical drive failure.
FRE	The logical drive is not defined.
LDM	The logical drive is undergoing a logical drive migration; that is, a change in RAID levels, a change in logical drive size, or an increase in free space.
OFL	The logical drive is offline (OFL) and not accessible. This state occurs if one or more physical drives in a RAID level 0 logical drive is defunct. This state also occurs when two or more physical drives in a RAID level 1 or 5 logical drive are defunct.
OKY	The logical drive is okay (OKY). It is in a good, functional state.
SYS	The ServeRAID adapter uses this reserved state during logical drive migration (LDM).

If the state of the logical drive is critical (CRT), you must replace and rebuild the defunct drive. Refer to “Understanding How to Rebuild a Drive” on page 84 for more information.

Using the ServeRAID Configuration Program

You can use the IBM ServeRAID configuration program to view the current disk-array configuration, change or delete existing arrays, create and initialize new disk arrays, and perform many other configuration and maintenance tasks.

You must use the ServeRAID configuration program to configure your disk array *before* you partition your hard disk drives and install your operating system. After you configure your disk arrays and install your operating system, return to this manual for information about installing and using the ServeRAID Administration and Monitoring Programs.

Starting the Configuration Program

To start the ServeRAID configuration program, do the following:

1. Insert the IBM ServeRAID Configuration diskette into the primary diskette drive and turn on the system. If the system is already turned on, press **Ctrl+Alt+Del**.

Each time your system starts, the ServeRAID adapter performs a power-on self-test (POST). The POST checks the configuration information for the ServeRAID adapter and for the configured hard disk drives.

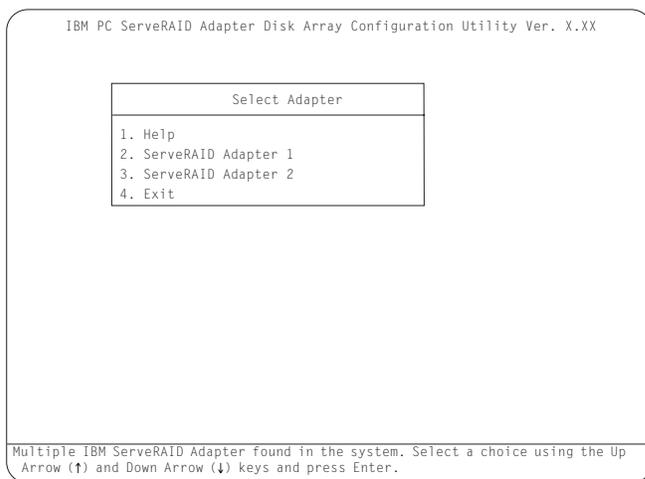
If POST does not detect changes in the adapter configuration or any adapter hardware problems, continue with step 2 on page 26.

If POST detects changes in the adapter configuration or detects an adapter hardware problem, messages appear on the screen. Refer to "IBM PC ServeRAID Adapter POST and Setup Messages" on page 161 and correct the problem. Then, return here and continue with step 2 on page 26.

2. One of the following screens will appear.

If you have more than one ServeRAID adapter installed in your system, the following screen appears.

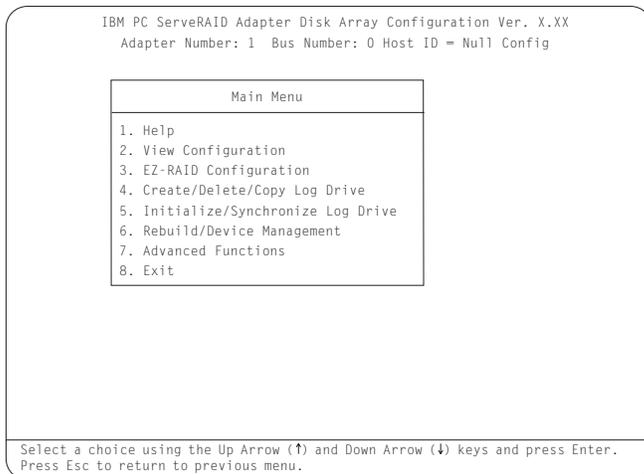
Note: You can install multiple ServeRAID adapters in your server, but you must configure each adapter separately. Refer to the documentation that comes with your server to determine the maximum number of PCI adapters you can install in your server.



Note: In the upper-right corner of the screen, you will see Ver. x.xx. On your screen, the x.xx is replaced with the version number of the configuration program.

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

If you have only one ServeRAID adapter installed in your server, the Main Menu appears, as shown in the following figure.



To make a selection from the Main Menu, type the number of the menu item, or use the Up Arrow (↑) key or Down Arrow (↓) key to highlight your choice; then, press **Enter**. You also can press **Esc** to return to the previous menu, the previous work area of a screen, or to the beginning of the Main Menu.

3. If you are not familiar with the ServeRAID configuration program, refer to "ServeRAID Menus, Screens, and Drive States" on page 17.

Configuring a Disk Array

The ServeRAID adapter supports up to eight independent arrays.

You must use the EZ-RAID configuration option or the Create/Delete/Copy Log Drive option to configure your disk arrays *before* you install your operating system.

The EZ-RAID configuration option provides an easy way for you to quickly configure your disk arrays. This option automatically creates a disk array, based on the number of physical RDY drives in your

system. The EZ-RAID configuration option defines, initializes, and synchronizes the logical drive for you. If four or more RDY drives are available, this option also will define a hot-spare drive. (See “EZ-RAID Configuration Option” on page 28 for more information.)

The Create/Delete/Copy Log Drive option enables you to configure your arrays manually. You can use this option to select the physical drives that you want to include in your disk arrays. You also can use this option to define the logical and hot-spare drives for your array. (See “Creating Your Disk Array Manually” on page 31 for more information.)

For Advanced Users

If you would like to change the stripe-unit size to maximize performance, refer to “Changing the RAID Parameters” on page 62, in particular, stripe-unit size on page 63

EZ-RAID Configuration Option

The EZ-RAID configuration option groups up to eight ready (RDY) drives into one disk array and defines one logical drive. The size of the logical drive depends on the amount of free space available, and the RAID level assigned to the logical drive depends on the number of physical drives available.

The following table provides basic information about how the EZ-RAID configuration option defines a logical drive, based on the number of ready (RDY) drives available.

Physical RDY Drives Available	Logical Drive RAID Level	Hot-Spare Available
1	0	NO
2	1	NO
3	5	NO
4-9	5	YES

For example, if your server contains six drives that are in the RDY state, the EZ-RAID configuration option will use five drives to create one disk array and define it as one RAID level 5 logical drive. The remaining drive is defined as a hot-spare drive.

If you want to use the EZ-RAID configuration option to create multiple disk arrays, you might need to change the device states of some of your drives to prevent them from being included in the first array.

To create a disk array using the EZ-RAID configuration, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. If you want to include all RDY drives in the array, continue with step 3. Otherwise, change the device states of the RDY drives that you do not want to include in the array to SBY. To do this:
 - a. Select **Rebuild/Device Management** from the Main Menu; then, press **Enter**.
 - b. Select **Set Device State** from the next menu; then, press **Enter**.
 - c. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight the drive that you do not want to include in the array; then, press **Enter**.
 - d. When the drive states pop-up window appears, select **SBY**; then press **Enter**.
 - e. Repeat steps 2b through 2d for each RDY drive that you do not want to include in the array; then, press **Esc** to return to the Main Menu.

Note: After you run the EZ-RAID configuration program, you can change the device states back to RDY.
3. Select **EZ-RAID Configuration** from the Main Menu; then, press **Enter**.

Information about the disk-array configuration appears on the screen.

4. When the confirm pop-up window appears, select **Yes**; then press **Enter**. The drives are automatically initialized and, if necessary, synchronized.
5. If you are creating multiple arrays and set some of your devices to another state using the procedure on page 29, use that procedure to set the devices for your next array to RDY; then, return to step 3 on page 29 to create the next array. If you are finished creating your arrays, continue with 6.
6. When the initialization and synchronization process completes, you have completed the required steps for creating a ServeRAID configuration.

Backup the disk-array configuration information to diskette. Refer to “Backup Up Your Disk-Array Configuration” on page 76 for instructions.

7. You are now ready to install your operating system. Refer to the documentation provided with your operating system and your server for more information.

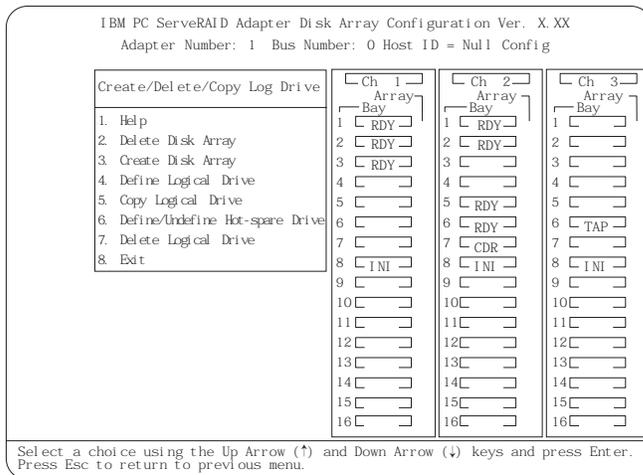
Creating Your Disk Array Manually

You can use the Create/Delete/Copy Log Drive option to create your disk arrays manually. You also can use this option to define the logical drives and hot-spare drives for your array. You must define at least one logical drive for each array.

To create a disk array manually, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Create/Delete/Copy Log Drive** from the Main Menu; then, press **Enter**.

A screen similar to the following appears.



3. Select **Create Disk Array**; then, press **Enter**.

The cursor is active in the Array/Bay selection list.

4. Use the Up Arrow (↑) key or the Down Arrow (↓) key to highlight the drives that you want to include in the array; then, press **Enter**. (You must press **Enter** to select each drive. As you select each drive, the state of that drive changes from RDY (Ready) to ONL (Online).

Notes:

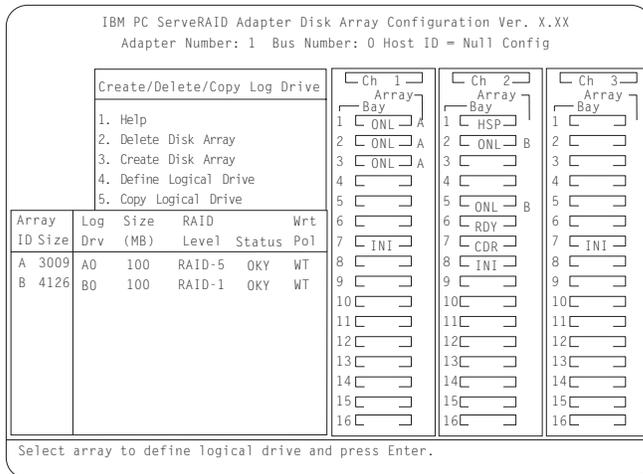
- a. Hard disk drive capacities influence the way you create arrays. Drives in the array can be of different capacities, but the ServeRAID adapter treats them as if they all have the capacity of the *smallest* disk drive. (See “Hard Disk Drive Capacities” on page 16 for more information.)
 - b. If you change your mind after selecting the drives for an array, you can delete the array (by selecting **Delete Disk Array** from the Create/Delete/Copy Log Drive menu); then, begin again.
5. After you select all of the drives that you want to include in the array, press **Esc**. The cursor is active in the menu.
- Note:** When the stripe-unit size is 8 K (the default setting) or 16 K (a manual setting), the maximum number of physical drives in an array is 16. When the stripe-unit size is 32 K or 64 K (both manual settings), the maximum number of physical drives in an array is eight.
6. If you want to create another array, return to step 2 on page 31. Otherwise, continue with step 7.
7. You must define at least one logical drive for each new array. To define a logical drive, continue with “Defining a Logical Drive” on page 33.

Defining a Logical Drive

The ServeRAID adapter supports up to eight logical drives. If you have only one array, you can define it as a single logical drive, or you can divide it into several logical drives. 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.

To define a logical drive, do the following:

1. Select **Define Logical Drive** from the Create/Delete/Copy Log Drive menu; then, press **Enter**. A screen similar to the following appears with the cursor active in the Array selection list.



2. Use the Up Arrow (↑) key or the Down Arrow (↓) key to select the array for the new logical drive; then press **Enter**.

The Select RAID Level pop-up window appears.

Notes:

- a. Typically, the first logical drive that you define will be your startup (boot) drive.
 - b. The ServeRAID adapter automatically assigns RAID level 0 to any logical drive defined in an array containing only one hard disk drive. When this is the case, the Select RAID Level pop-up window will not appear.
 - c. If you have two hard disk drives in the array, the Select RAID Level pop-up window appears, but RAID level 5 is not available. You need at least three hard disk drives in an array to assign RAID level 5 to the logical drives.
 - d. The RAID level that you assign to a logical drive can influence the amount of space that the drive requires; therefore, you must assign a RAID level before you enter the size of the logical drive.
 - e. For a description of RAID levels 0, 1, and 5, see Appendix B, "RAID Technology" on page 155.
 - f. You can define up to eight logical drives for your array. If you plan to use the logical-drive migration (LDM) procedure, do not define more than seven logical drives. The LDM procedure requires one free logical drive. (For more information, refer to the README file on the Administration and Monitoring program diskette.)
 - g. If you plan to use the Change RAID Level feature of the LDM, you must assign the same RAID level to all of the logical drives in the array. (For more information, refer to the README file on the Administration and Monitoring program diskette.)
3. Use the Up Arrow (↑) key or the Down Arrow (↓) key to highlight the RAID level you want to assign to the logical drive; then, press **Enter**. The Logical Drive Size pop-up window appears.

If this is the first logical drive you are defining, the Logical Drive Size pop-up window will show the amount of free space available in the array.

Note: Typically, the first logical drive that you define will be your startup (boot) drive.

If you already defined other logical drives for this array, the Allocation Table appears showing the existing logical drive sizes and the amount of free space available.

The size of a logical drive is determined by several factors, but the size must be divisible by the number of data drives in the array. A logical drive in an array can be any size you choose within the size limitations of the array.

Consider the following examples:

Example 1

The array consists of three 1 GB drives. You assign RAID level 0, which uses all the drives in the array for data with no redundant or parity storage; then you type 1 MB. The number 999 will appear in the Size (MB) field, because it is the number closest to and lower than 1000 that is divisible by 3.

Example 2:

The array consists of three 1 GB drives. You assign RAID level 1, which provides disk mirroring and stripes data across all drives in the array. Because the data is mirrored, the capacity of the logical drive is 50 % of the physical capacity of the hard disk drives grouped in the array. If you type 1 MB, the number 999 will appear in the Size (MB) field. The physical capacity used is 2000 MB, twice that of the logical drive size. The number that is closest to and lower than 2000 that is divisible by 3 is 1998. The logical drive size is 999, which is 50% of the physical capacity.

Example 3

The array consists of three 1 GB drives and you assign RAID level 5. Data is striped across all three drives in the array, but the space equivalent to that of one drive is used for redundant storage, leaving the space equivalent to two drives for data. Therefore, if you type 1 MB, the number 1000 remains in the Size (MB) field because it is divisible by

2, which is the space available for data. The physical capacity used is 1500 MB.

4. Type the size, in megabytes, that you want for the logical drive; then, press **Enter**.
5. When the Confirm pop-up window appears, select **Yes**; then, press **Enter**.

Information about the new logical drive appears in the Logical Drive list. If you did not use all of the available free space, you can create another logical drive. You can assign the same or a different RAID level to additional logical drives.

6. When a message stating that all logical drives must be initialized appears, press any key to continue.

Note: To ensure that your server operates correctly, you **must** initialize the new logical drive. A quick initialization of a logical drive erases the first 1024 sectors on the drive and prevents access to any data previously stored on the drive.

7. When the Confirm pop-up window appears, you have two choices.
 - a. Select **Yes** to perform a quick initialization; then, press **Enter**. When the quick initialization is complete, go to step 8.
 - b. Select **No** and go to “Initializing Logical Drives” on page 39 to perform a complete initialization.
8. If you just performed a quick initialization of a RAID level 5 logical drive, and your firmware version is 2.40.xx or later, a message appears stating that the logical drive that you just created is being synchronized in the background and is ready for data storage. Refer to “ServeRAID Adapters and Firmware Versions” on page 154 for an explanation of the firmware versions. You have now completed the required steps for creating a ServeRAID configuration. Continue with step 10 on page 37.

If your firmware version is not 2.40.xx or later, continue with the following steps:

Important

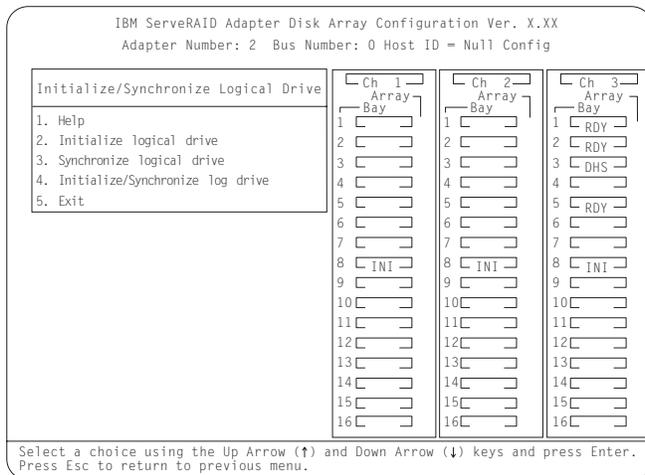
You **must** synchronize a RAID level 5 logical drive before storing data.

If this message appears, you have two choices:

- a. If you want to synchronize the RAID level 5 logical drive now, do the following:
 - 1) Press any key to continue.
 - 2) When the Confirm pop-up window appears, select **Yes** to synchronize the RAID level 5 logical drive; then, press **Enter**.
 - 3) When you are done, go to step 9.
 - b. If you want to define more logical drives and synchronize them at a later time, do the following:
 - 1) Press any key to continue.
 - 2) When the Confirm pop-up window appears, select **No** to synchronize the RAID level 5 logical drive; then, return to “Defining a Logical Drive” on page 33 to define your next logical drive.
 - 3) When you are done defining your logical drives, refer to “Synchronizing Logical Drives” on page 42 to synchronize all of your RAID level 5 logical drives.
9. If you do not have to synchronize any logical drives or you just completed synchronizing them, then you have completed the required steps for creating a ServeRAID configuration.
 10. If you have not already done so, you can now install your operating system. Refer to the documentation provided with your operating system and your server for instructions.

Initializing/Synchronizing Logical Drives at the Same Time

Initializing a logical drive sets the drive to a predetermined state. The initialization process overwrites any data on the drive with zeros and all existing data is lost. The purpose of synchronizing logical drives is to compute and, if necessary, write the parity data on the selected logical drive for RAID level 1 or RAID level 5. If you did not initialize and synchronize your logical drives when they were defined, you can now initialize and synchronize multiple logical drives at the same time. However, you can still initialize and synchronize multiple logical drives in separate steps (refer to “Initializing Logical Drives” on page 39 and “Synchronizing Logical Drives” on page 42 for instructions).



To initialize/synchronize logical drives at the same time, do the following:

1. Select **Initialize/Synchronize Log Drive** from the Main Menu; then, press **Enter**.
2. Select **Initialize/Synchronize Logical Drive** from the next menu; then, press **Enter**.
3. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight a logical drive that you want to initialize/synchronize; then press the Spacebar to select the drive. Continue doing this until you

have selected all of the drives you want to initialize/synchronize; then, press **Enter**.

4. When the Confirm pop-up window appears, select **Yes** to initialize/synchronize the logical drive or drives; then, press **Enter**.

The initialization/synchronization progress appears in the **Pct. Syn.** (percent initialized/synchronized) column of the Logical Drive list.

Note: Once initialization/synchronization starts, it cannot be interrupted.

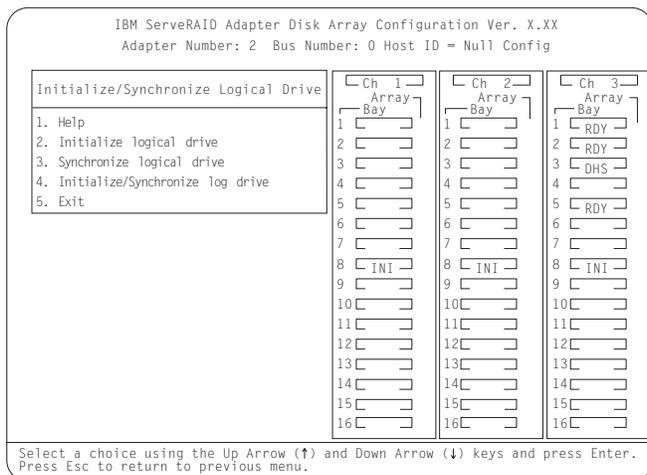
5. Once you have completed initializing/synchronizing your logical drives, you have completed the required steps for creating a ServeRAID configuration.

If you have not already done so, you can now install your operating system. Refer to the documentation provided with your operating system and your server for instructions.

Initializing Logical Drives

Initializing a logical drive sets the drive to a predetermined state. You can initialize multiple logical drives at the same time. The initialization process overwrites any data on the drive with zeros and all existing data is lost.

If you did not initialize your logical drives when you defined them, you must use the following instructions to initialize the drives *before* storing data.



To initialize a logical drive, do the following:

1. Select **Initialize/Synchronize Log Drive** from the Main Menu; then, press **Enter**.
2. Select **Initialize Logical Drive** from the next menu; then, press **Enter**.
3. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight a logical drive that you want to initialize; then press the Spacebar to select the drive. Continue doing this until you have selected all of the drives you want to initialize; then, press **Enter**.

The Confirm pop-up window appears, asking you to confirm your action.

Attention: When you select **Yes** in the Confirm pop-up window, information in the logical drive will be overwritten with zeros. All existing data is lost.

4. Select **Yes** to initialize the logical drive or drives; then, press **Enter**.

The initialization process begins. You can see the progress in the **Pct.Int.** (percent initialized) column of the Logical Drive list.

You can pause the initialization at any time by pressing **Esc**. Press **Esc** to stop the initialization and return to the previous menu. Press **Enter** to continue initializing the drive.

Attention: You do not need to synchronize RAID level 0 or 1 logical drives before storing data. Also, a new feature of the ServeRAID adapter is **Data Scrubbing**. This feature continuously reads all sectors of RAID 1 and RAID 5 logical drives “in the background” while your system is running. If a defective sector is found, it is automatically repaired. As a result of this new feature, you no longer have to synchronize RAID level 1 and RAID level 5 logical drives on a weekly basis.

5. You *must* synchronize all RAID level 5 logical drives before storing data. If you just initialized RAID level 5 logical drives, continue with “Synchronizing Logical Drives” on page 42. Otherwise, continue with step 6.
6. If you have completed initializing your logical drives and do not have any RAID level 5 logical drives to synchronize, then you have completed the required steps for creating a ServeRAID configuration.

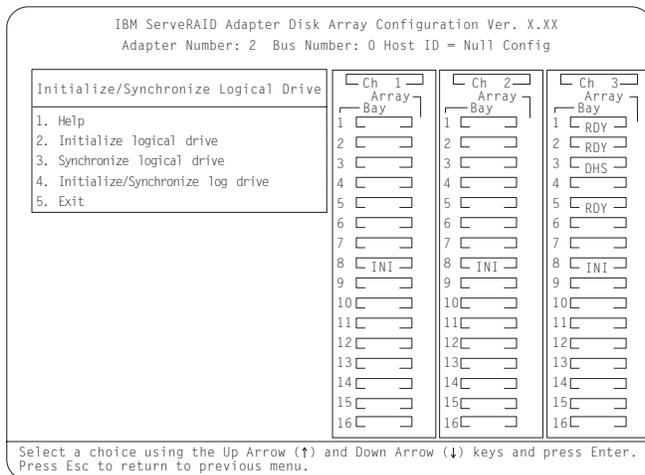
If you have not already done so, you can now install your operating system. Refer to the documentation provided with your operating system and your server for instructions.

Synchronizing Logical Drives

The purpose of synchronizing logical drives is to compute and, if necessary, write the parity data on the selected drive for RAID level 1 or RAID level 5.

It is good practice to synchronize RAID level 1 and RAID level 5 logical drives weekly. This process does not alter data on the drive. However, if the firmware version of your ServeRAID adapter is 2.30 or later, then you do not have to do weekly synchronization because of the Data Scrubbing feature. Refer to Appendix A, "IBM PC Server POST/BIOS Update Information" on page 153 for information on the firmware and code block version of the ServeRAID adapters.

If you did not synchronize your RAID level 5 logical drives when you defined them, you *must* use the following instructions to synchronize the drives before storing data.



To synchronize a logical drive, do the following:

1. Select **Initialize/Synchronize Log Drive** from the Main Menu; then, press **Enter**.
2. Select **Synchronize Logical Drive** from the next menu; then, press **Enter**.

3. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight a logical drive that you want to synchronize; then press the Spacebar to select the drive. Continue doing this until you have selected all of the drives you want to synchronize; then, press **Enter**.
4. When the Confirm pop-up window appears, select **Yes** to synchronize the logical drive or drives; then, press **Enter**.

The synchronization progress appears in the **Pct. Syn.** (percent synchronized) column of the Logical Drive list.

Note: Once synchronization starts, it cannot be interrupted.

5. Once you have completed synchronizing your logical drives, you have completed the required steps for creating a ServeRAID configuration.

If you have not already done so, you can now install your operating system. Refer to the documentation provided with your operating system and your server for instructions.

Defining a Hot-Spare Drive

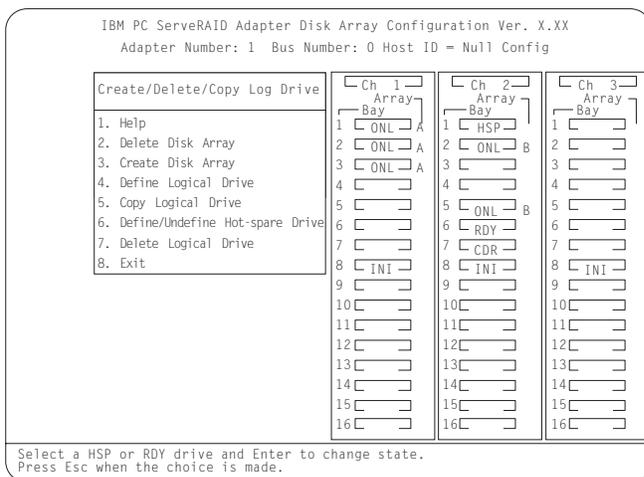
A hot-spare drive is a hard disk drive that is defined for automatic use when a similar drive fails. The drive capacity of the HSP drive must be equal to or greater than the capacity of the drive being replaced.

Note: If you want to have a hot-spare drive (HSP) or a standby hot-spare (SHS) drive and also assign RAID level 5 to one of your logical drives, you must have at least four hard disk drives.

You can use the Create/Delete/Copy Log Drive menu to define a RDY drive as a hot-spare drive (see next page) or you can change the state of a SBY, DHS, SHS, or RDY drive to HSP (see “Changing the Device States” on page 61.)

To define a RDY drive as a hot-spare drive, do the following:

1. Start the ServeRAID configuration program (see “Starting the Configuration Program” on page 25).
2. Select **Create/Delete/Copy Log Drive** from the Main Menu; then, press **Enter**. A screen similar to the following appears.



3. Select **Define/Undefine Hot-spare Drive**; then, press **Enter**. The cursor becomes active in the Array/Bay selection list.
4. Use the Up Arrow (↑) key or the Down Arrow (↓) key to highlight the RDY drive you want to define as the hot spare (HSP); then, press **Enter**.
The drive state changes from RDY to HSP. You can press **Enter** again to toggle between the HSP and RDY state.
5. Press **Esc** to make the change; then press **Esc** again to return to the Main Menu.
6. Back up the disk-array configuration information to diskette. Refer to “Backup Up Your Disk-Array Configuration” on page 76 for instructions.

Enabling or Disabling Hot-Swap Rebuild

Note: The Hot-Swap Rebuild feature is available only on some versions of the ServeRAID adapter. If it appears on your **Display/Change Adapter Parameters** menu under the **Advanced Functions** menu, then this feature is available for use on your adapter.

The default setting for the hot-swap rebuild parameter is Disable. When you set the hot-swap rebuild parameter to Enable, the ServeRAID adapter can automatically rebuild a defunct (DDD) drive when you replace it.

The ServeRAID adapter will rebuild a defunct drive automatically when all of the following conditions exist:

- The hot-swap rebuild parameter is set to Enable
- The defunct drive is part of a RAID 1 or RAID 5 logical drive
- The capacity of the replacement drive is equal to or greater than the capacity of the defunct drive
- No rebuild, synchronization, or RAID level change operation is in progress

When these requirements are met, the ServeRAID adapter automatically initiates a rebuild of the drive without user intervention.

To enable or disable hot-swap rebuild, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.

3. Select **Display/Change Adapter Parameters** from the Advanced Functions menu; then, press **Enter**.

A screen similar to the following appears:

IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX			
Adapter Number: 1 Bus Number: 0 Host ID = BIOSNull Cfg			
Display/Change Adapter Parameter	Ch 1 Array Bay	Ch 2 Array Bay	Ch 3 Array Bay
1. Help	1 []	1 [ONL] A	1 []
2. Display Adapter Status	2 []	2 [RDY]	2 []
3. Change Adapter Host/SCSI ID	3 []	3 [RDY]	3 []
4. Set BIOS Compatibility Mapping	4 []	4 [RDY]	4 []
5. Set Channel -> Bank Mapping	5 []	5 [RDY]	5 []
6. Enable/Disable Hot Swap Rebuild	6 []	6 [RDY]	6 []
7. Exit	7 []	7 [CDR]	7 []
	8 [INI]	8 [INI]	8 [INI]
	9 []	9 []	9 []
	10 []	10 []	10 []
	11 []	11 []	11 []
	12 []	12 []	12 []
	13 []	13 []	13 []
	14 []	14 []	14 []
	15 []	15 []	15 []
	16 []	16 []	16 []

Select a choice using the Up Arrow (↑) and Down Arrow (↓) keys and press Enter. Press Esc to return to previous menu.

4. Select **Enable/Disable Hot Swap Rebuild**; then, press **Enter**.

A screen similar to the following appears:

IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX			
Adapter Number: 1 Bus Number: 0 Host ID = BIOSNull Cfg			
Display/Change Adapter Parameter	Ch 1 Array Bay	Ch 2 Array Bay	Ch 3 Array Bay
1. Help	1 []	1 [ONL] A	1 []
2. Display Adapter Status	2 []	2 [RDY]	2 []
3. Change Adapter Host/SCSI ID	3 []	3 [RDY]	3 []
4. Set BIOS Compatibility Mapping	4 []	4 [RDY]	4 []
5. Set Channel -> Bank Mapping	5 []	5 [RDY]	5 []
6. Enable/Disable Hot Swap Rebuild	6 []	6 [RDY]	6 []
7. Exit	7 []	7 [CDR]	7 []
	8 [INI]	8 [INI]	8 [INI]
	9 []	9 []	9 []
	10 []	10 []	10 []
	11 []	11 []	11 []
	12 []	12 []	12 []
	13 []	13 []	13 []
	14 []	14 []	14 []
	15 []	15 []	15 []
	16 []	16 []	16 []

Hot Swap Rebuild State	
Disabled	
1. Enable Hot Swap Rebuild	[]
2. Disable Hot Swap Rebuild	[]

Select a choice using the Up Arrow (↑) and Down Arrow (↓) keys and press Enter. Press Esc to return to previous menu.

5. Use the Up Arrow (↑) and Down Arrow (↓) key to highlight your selection - enable or disable; then, press **Enter**.

6. Press **Esc** to return to the Advanced Functions menu.
7. Back up the disk-array configuration information to diskette.
Refer to “Backup Up Your Disk-Array Configuration” on page 76 for more information.

Enabling or Disabling the Battery-Backup Cache

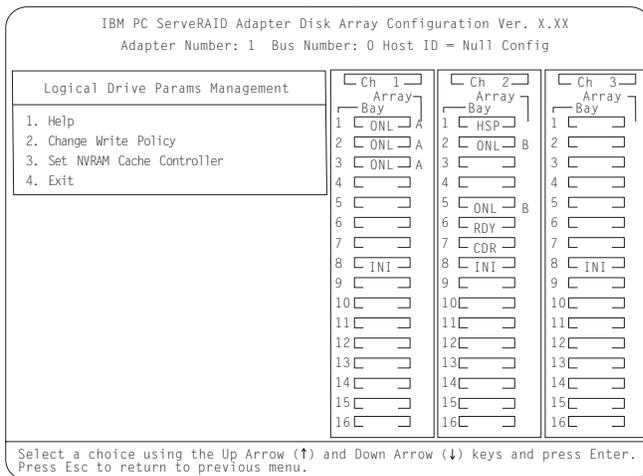
Note: To use the battery-backup cache, you must install an IBM ServeRAID II 8MB/Battery-Backup Cache option onto your IBM ServeRAID II Ultra SCSI Adapter. This option is not available for the IBM ServeRAID adapter.

The default setting for the battery-backup cache is Enable. With the battery-backup cache set to enable, the ServeRAID adapter automatically stores data into the battery-backup cache before storing it to the hard disk drives. Therefore, the data is protected in case the system loses power before it has a chance to write the data to the hard disk drives. Then, once the system is restarted, the stored data is written to the hard disk drives.

To enable or disable the battery-backup cache, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **Logical Drive Params Management** from the Advanced Functions menu; then, press **Enter**.

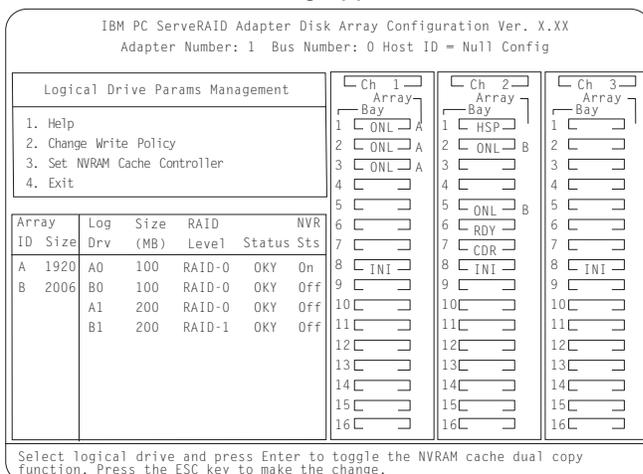
A screen similar to the following appears:



Note: If you are going to enable the battery-backup cache for a logical drive, you must set the logical drive to write back mode. To change the logical drive to write back mode, see “Changing the Write Policy” on page 65. When you are done, return here to enable the battery-backup cache.

4. Select **Set NVRAM Cache Controller**; then, press **Enter**.

A screen similar to the following appears:



5. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight the logical drive you are selecting; then, press **Enter**. Pressing **Enter** toggles the NVR Sts (battery-backup cache) selection On and Off. Select On to enable the battery-backup cache or select Off to disable the battery-backup cache.
6. Press **Esc** after you make your selections.
7. When the Confirm pop-up window appears, select **Yes** to enable the battery-backup cache for the selected logical drive; then, press **Enter**.
8. Press **Esc** to return to the previous menu. Continue to press **Esc** to return to the Main Menu.

Viewing or Changing the Configuration

This section contains the following information and instructions for using the ServeRAID configuration program to view or change your configuration.

“Viewing the Disk-Array Configuration” on page 51

“Viewing the Drive Information” on page 52

“Viewing or Changing the ServeRAID Adapter Parameters” on page 54

“Changing the Device States” on page 61

“Changing the RAID Parameters” on page 62

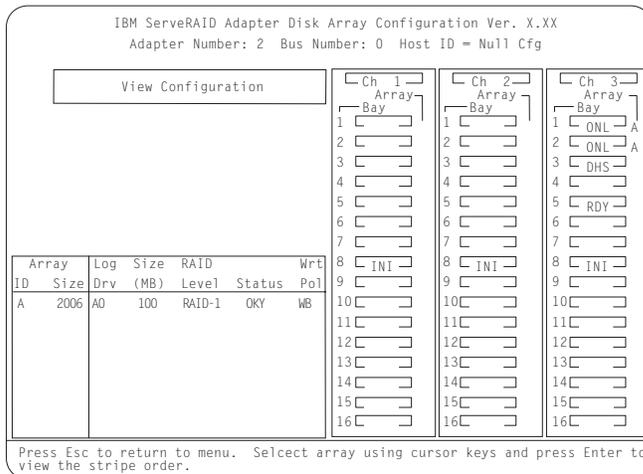
“Changing the Write Policy” on page 65

You also can use the Administration and Monitoring utility to view or change your existing configuration.

Viewing the Disk-Array Configuration

To view the current disk-array configuration, do the following:

1. Start the ServeRAID configuration program (see “Starting the Configuration Program” on page 25).
2. Select **View Configuration** from the Main Menu; then, press **Enter**. A screen similar to the one below appears showing the current disk-array configuration information.



3. To see the stripe order (the channel and bay numbers of the physical drives that make up the logical drives):
 - a. Press **Enter**. The stripe order will appear in a separate window.
 - b. Press any key to return to the View Configuration screen.
4. Press **Esc** to return to the Main Menu.

Viewing the Drive Information

You can use the ServeRAID configuration program to view the vendor ID, model number, serial number, and capacity of each hard disk drive attached to the ServeRAID adapter.

You also can use this option to view information about the number and type of events that occurred. The Device Event Table, in nonvolatile random-access memory (NVRAM), collects event information for each hard disk drive attached to the ServeRAID adapter.

To view drive information, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Rebuild/Device Management** from the Main Menu; then, press **Enter**.
3. Select **Display Drive Information** from the next menu; then, press **Enter**.

The cursor becomes active in the Array/Bay selection list.

A screen similar to the following appears.

IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX
Adapter Number: 1 Bus Number: 0 Host ID = Null Config

Drive information	Ch 1 Array Bay	Ch 2 Array Bay	Ch 3 Array Bay
Vendor ID : IBM	1 ONL A	1 HSP B	1
Model/Product: DFHSS2W 4141	2 ONL A	2 ONL B	2
Serial Number: 00019846	3 ONL A	3	3
Capacity : 2150 MB	4	4	4
Soft Event : 0	5	5 ONL B	5
Hard Event : 0	6	6 RDY B	6
Parity Event : 0	7	7 CDR	7
Misc Event : 0	8 INI	8 INI	8 INI
	9	9	9
	10	10	10
	11	11	11
	12	12	12
	13	13	13
	14	14	14
	15	15	15
	16	16	16

Select drive using the Up Arrow (↑) and Down Arrow (↓) keys.
Press Esc to return to the previous menu.

4. Use the Up Arrow (↑) key or the Down Arrow (↓) key to highlight the drives in the Array/Bay selection list.

When you highlight the drive, the drive information appears as follows:

Vendor ID displays the name of the manufacturer or vendor.

Model/Product displays the 4-digit model number, the 4-digit product number, the 2-digit ROM code revision level, and the 2-digit RAM code revision level.

Serial Number displays the unit serial number of the device.

Capacity displays the size of the device.

Soft Event displays the number of SCSI Check Condition status messages returned from the Drive (except for Unit Attention and SCSI parity errors) since the Device Event Table was last cleared.

Hard Event displays the number of SCSI I/O processor events that occurred on the drive since the Device Event Table was last cleared. It also indicates if the drive exceeded the Predictive Failure Analysis (PFA) threshold.

Notes:

- a. If a PFA event is detected it appears beside the hard event information.
- b. If the drive exceeded the PFA threshold, continue with the operation and call for service within 24 hours. As a precaution, backup your RAID level 0 logical drives.

Parity Event displays the number of parity events that occurred on the SCSI bus since the Device Event Table was last cleared.

Misc Event displays the number of other events (such as selection timeout, unexpected bus free, or SCSI phase event) that have occurred on the drive since the Device Event Table was last cleared.

5. Press **Esc** to return to the Main Menu.

Viewing or Changing the ServeRAID Adapter Parameters

You can use the ServeRAID configuration program to view or change the ServeRAID adapter parameters.

To display or change the adapter parameters, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **Display/Change Adapter Params** from the next menu; then, press **Enter**.

A screen similar to the following appears:

The screenshot shows the 'IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX' interface. At the top, it displays 'Adapter Number: 1 Bus Number: 0 Host ID = BIOSNull Cfg'. The main menu is titled 'Display/Change Adapter Parameter' and lists seven options: 1. Help, 2. Display Adapter Status, 3. Change Adapter Host/SCSI ID, 4. Set BIOS Compatibility Mapping, 5. Set Channel -> Bank Mapping, 6. Enable/Disable Hot Swap Rebuild, and 7. Exit. To the right of the menu are three columns representing Channel 1, Channel 2, and Channel 3. Each channel has an 'Array' and 'Bay' section. Channel 1 shows bays 1-16 with 'INI' status. Channel 2 shows bays 1-16 with 'ONL' and 'RDY' status. Channel 3 shows bays 1-16 with 'INI' status. At the bottom, instructions state: 'Select a choice using the Up Arrow (↑) and Down Arrow (↓) keys and press Enter. Press Esc to return to previous menu.'

Descriptions of the choices available from this menu are as follows:

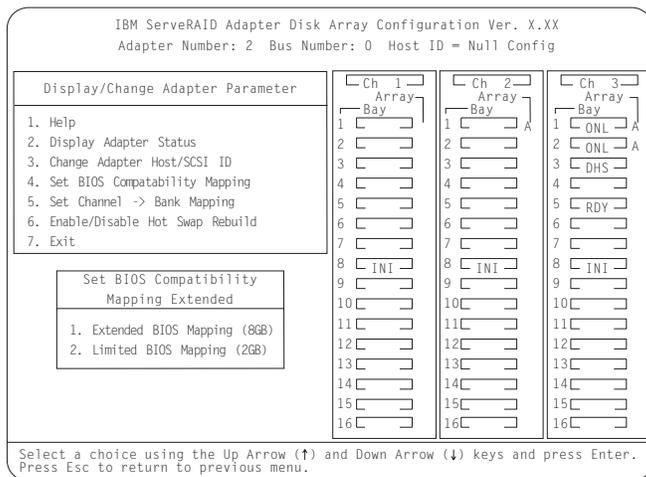
Help provides information about the choices on the menu. You also can press F1 from any screen to obtain online Help.

Display Adapter Status lets you view the current settings (On or Off) for Unattended Mode, CD-ROM Boot, and Read Ahead. You can also select this choice to view information about BIOS Compatibility Mapping, logical drive sizes, and

logical drives that are blocked or have a bad stripe. (See “Changing the RAID Parameters” on page 62 for more information.)

Change Adapter Host/SCSI ID lets you change the SCSI configuration ID or the SCSI transfer rate for the ServeRAID adapter. You can change the ServeRAID adapter host configuration ID to any 12 characters. If you are using Ultra Fast/Wide SCSI-3 drives, you can change the default SCSI transfer rate from the default setting of 10 MHz to a maximum of 20 MHz. When the transfer rate is set to 20 MHz, the SCSI bus in the ServeRAID adapter provides a data transfer rate of up to 40 MB per-second (MB means approximately 1 000 000 bytes). In addition, this choice lets you change the number of drives in a group that will start up simultaneously, and set the startup delay in seconds between groups of drives.

Set BIOS Compatibility Mapping lets you set the basic input/output system (BIOS) mapping from 8 GB (default setting) to 2 GB. Use 2 GB for compatibility with previous IBM SCSI adapters.



Set Channel - Bank Mapping lets you specify which direct access storage device (DASD) bank is connected to each of the internal Channels on the ServeRAID adapter. This mapping is critical for the correct operation of the

Administration and Monitoring program, which uses the settings to identify drives, control power to specific drives, and operate the SCSI LEDs.

The following example displays the default mapping when three backplanes, each set to the default SCSI ID setting, are installed.

Channel → Bank Mapping				
	Low ID	High ID	Low (Reverse)	High (Reverse)
CH 1	:	:	:	:
CH 2	:	:	:	:
CH 3	:C	:D	:E	:

When Reverse ID is supported, up to three banks can be daisy chained. You must select this option to define the SCSI IDs used in each bank.

When two backplanes are daisy-chained in your array, the SCSI ID jumpers must be set to different settings. That is, if one bank is set to LOW, then the other bank must be set to HIGH, or Reverse. If your subsystem supports Reverse ID, the following displays:

Channel → Bank Mapping				
	Low ID	High ID	Low (Reverse)	High (Reverse)
CH 1	:	:	:	:
CH 2	:	:	:	:
CH 3	:C	:D	:E	:

You must also specify the setting of the SCSI ID backplane jumper. (Refer to the documentation that comes with your server for setting backplane SCSI ID jumpers.)

In the above example, Banks C, D, and E are connected to channel 3 and the SCSI IDs are set to LOW, HIGH, and LOW Reverse (also see Scenario 4 on page 59).

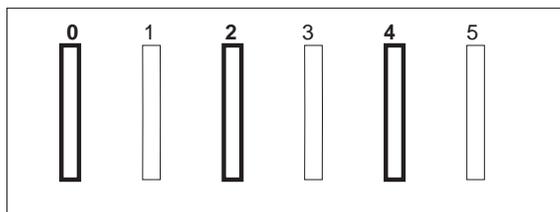
Notes:

- a. If you install additional external SCSI devices, each external SCSI device must have unique IDs. This enables the adapter to identify the external devices.
- b. If you need to set SCSI IDs for SCSI devices, refer to the documentation that comes with the device.
- c. When you view the configuration screens for the ServeRAID adapter, remember that the Bay Number in the Array/Bay selection list corresponds to the SCSI ID number plus 1. Thus, a hard disk drive with SCSI ID 8 is found in the leftmost drive bay; the drive state is shown in Bay 9.
- d. The order in which the server scans the SCSI devices is based on the SCSI IDs. The scanning sequence proceeds from 0 to the highest-numbered SCSI ID.

Consider the following examples:

If you install three half-high drives in a hot-swap bank, each half-high drive occupies two bays in the bank, covering two of the connectors on the backplane. The drive tray connects to the leftmost of the two connectors.

The following figure shows the connectors viewed from the front of the server.

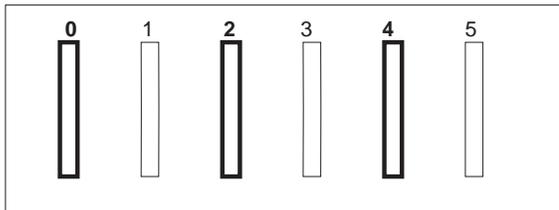


Example 1:

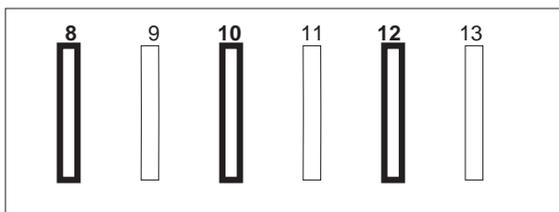
If you are not daisy-chaining, each bank will be connected to a separate connector on the ServeRAID adapter and all drives will show up as 0, 2, and 4. The default setting is set to LOW.

Example 2:

Banks D and E are daisy-chained and the jumper on backplane D is set to LOW. The half-high drives in Bank D will have their SCSI IDs set to 0, 2, and 4.

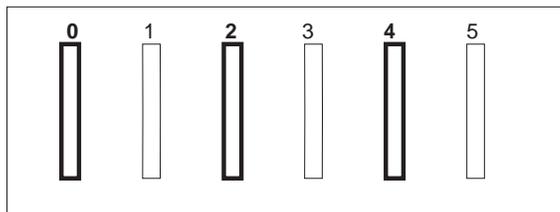


The jumper on backplane E is set to HIGH. The half-high drives in Bank E will have their SCSI IDs set to 8, 10, and 12.

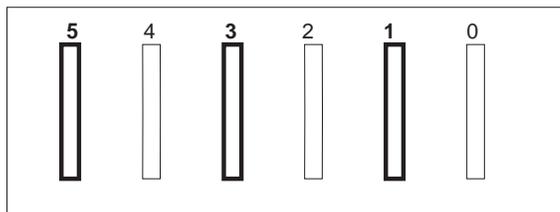


Example 3:

Banks D and E are daisy-chained and the jumper on backplane D is set to LOW. The half-high drives in Bank D will have their SCSI IDs set to 0, 2, and 4.

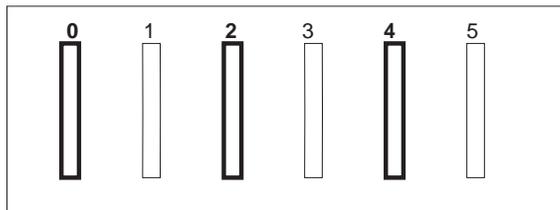


The jumper on backplane E is set to LOW Reverse. The half-high drives in Bank E will have their SCSI IDs set to 5, 3, and 1.

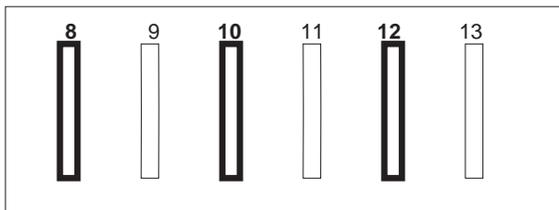


Example 4:

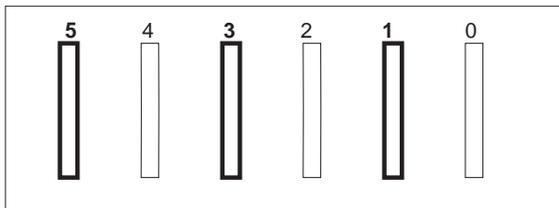
Banks C, D, and E are daisy-chained to support up to nine half-high drives and connected to channel 3. The jumper on bank C is set to LOW. The half-high drives in Bank C will have their SCSI IDs set to 0, 2, and 4.



The jumper on backplane D is set to HIGH. The half-high drives in Bank D will have their SCSI IDs set to 8, 10, and 12.



The jumper on backplane E is set to LOW Reverse. The half-high drives in Bank E will have their SCSI IDs set to 5, 3, and 1.



Attention:

If you are using Reverse, remember that the drives are not arranged sequentially in the bays. Removing the wrong hard disk drive can cause loss of all data in the array.

4. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight your choice; then, press **Enter**.
5. Press **Esc** to return to the Advanced Functions menu.
6. Back up the disk-array configuration information to diskette. Refer to “Backup Up Your Disk-Array Configuration” on page 76 for instructions.

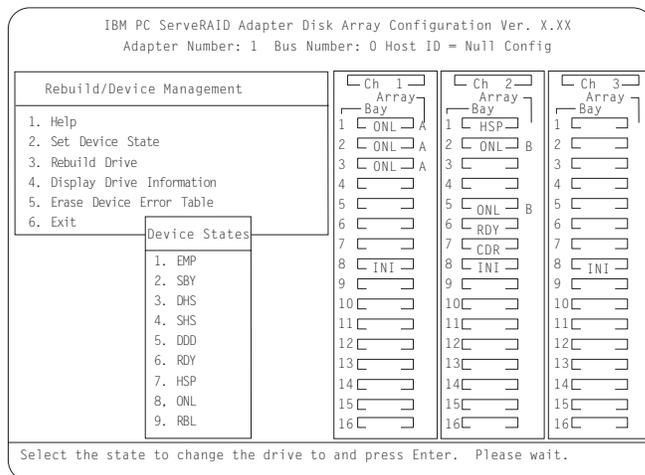
Changing the Device States

You can use the ServeRAID configuration program to change the state of a physical hard disk drive attached to the ServeRAID adapter.

To change the state of a physical hard disk drive, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Rebuild/Device Management** from the Main Menu; then, press **Enter**.
3. Select **Set Device State** from the next menu; then, press **Enter**. The cursor becomes active in the Array/Bay selection list.
4. Use the Up Arrow (↑) key or the Down Arrow (↓) key to highlight the appropriate drive; then, press **Enter**.

A screen similar to the following appears:



The Drive States pop-up window lists all hard disk drive states. (See “Physical Device States” on page 22 for more information.)

The following table shows the current device states and the valid alternate device states that you can assign. For example, you can change the state of a standby hot-spare drive from SHS to HSP or DHS.

Note: Setting a DDD drive that is part of a CRT logical drive to ONL without performing a Rebuild operation will result in loss of data. Refer to “Understanding How to Rebuild a Drive” on page 84 for more information.

Device States	Alternate 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

5. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight a valid alternate drive state; then, press **Enter**. The new state appears in the Array/Bay selection list.
6. If you want to change the state of another drive, return to step 4 on page 61. Otherwise, continue with step 7.
7. Press **Esc** to return to the Main Menu.
8. Back up the disk-array configuration information to diskette. Refer to “Backup Up Your Disk-Array Configuration” on page 76 for instructions.

Changing the RAID Parameters

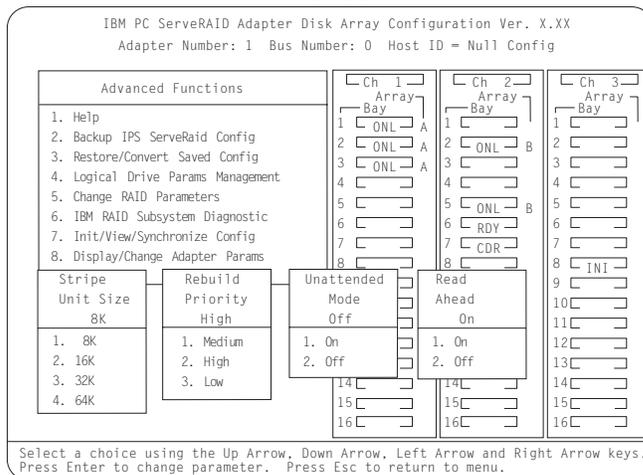
You can use the ServeRAID configuration program to set the stripe-unit size, to set the rebuild priority, to turn unattended mode on or off, or to turn read-ahead on or off.

To change the RAID parameters, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).

2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **Change RAID parameters** from the next menu; then, press **Enter**.

A screen similar to the following appears:



Descriptions of the RAID parameters that you can change are as follows:

Stripe-Unit Size: The default setting is 8 K data bytes.

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.

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

You can set the stripe-unit size to 8 K, 16 K, 32 K, or 64 K.

- When the stripe-unit size is set to 8 K or 16 K, the maximum number of drives in an array is 16.
- When the stripe-unit size is set to 32 K or 64 K, the maximum number of drives in an array is eight.

Rebuild Priority: The default setting is High.

The rebuild priority can be set to High, Medium, or Low.

- When the rebuild priority 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.

Unattended Mode: The default setting is Off.

You can enable the ServeRAID adapter BIOS to automatically accept changes in the configuration without user input.

When Unattended Mode is Off, the program waits for user input when an event is detected.

When Unattended Mode is set to On, the ServeRAID adapter pauses briefly to permit a user to override the default action; then, the adapter BIOS makes the necessary changes. This mode is useful when the server operates remotely.

When Unattended Mode is set to On, the ServeRAID adapter BIOS “chooses” an action that is equivalent to pressing one of the following function keys.

Note: When F5 is selected, non-responding ONL and RBL drives will become DDD, RDY and SBY drives will become EMP, and HSP drives will become DHS.

F5: The server continues the startup operation after identifying a defunct drive. For example, an HSP drive failed to respond during POST. Startup continues, but the ServeRAID adapter changes the state of the HSP drive to DHS.

F6: When a drive is removed from the server (for example, for maintenance or security), but is returned to a different

bay, the ServeRAID adapter adjusts the configuration to the drive's new location.

F7: A ServeRAID adapter, with stored configuration information that does not match that of the configured drives present, imports the configuration information from the drives.

Read Ahead: The default setting is On.

Normally, the ServeRAID adapter 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 is set to Off, the ServeRAID adapter 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.

You can change the read-ahead setting without destroying data in a logical drive.

4. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight the parameter you want to change; then, press **Enter**.
5. Press **Esc** to return to the Advanced Functions menu.
6. Back up the disk-array configuration information to diskette. Refer to "Backup Up Your Disk-Array Configuration" on page 76 for instructions. The backup procedure also saves the RAID parameters to diskette.

Changing the Write Policy

When you configure a logical drive, the ServeRAID adapter sets the write policy to *write-through* (WT) mode, where 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 write policy to *write-back* (WB) mode, where the completion status of a write command is sent *after* the data is copied

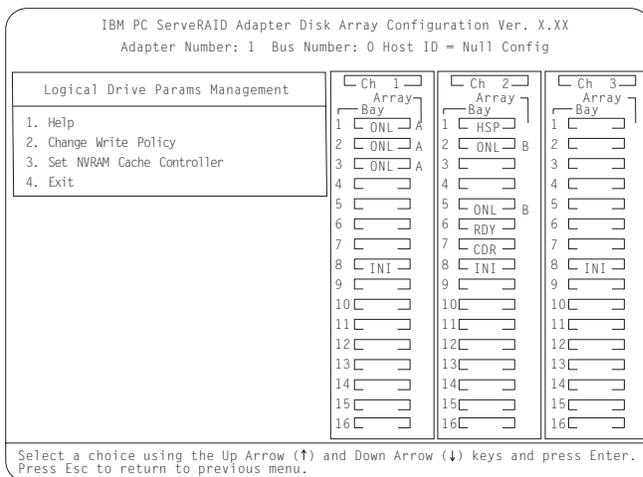
to cache memory, but *before* the data is actually written to the storage device.

Although you might gain performance with write-back mode, it creates a greater risk of losing data due to a power failure. If a ServeRAID adapter failure occurs while data is in the cache, then the data is lost. This is because the system gets a completion status message when the data reaches cache memory, but *before* data is actually written to the hard disk drive.

To change the write policy, do the following:

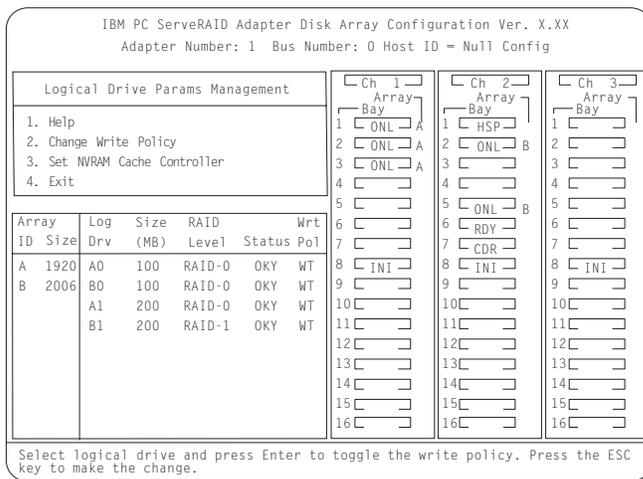
1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **Logical Drive Params Management** from the Advanced Functions menu; then, press **Enter**.

A screen similar to the following appears.



4. Select **Change Write Policy** from the Advanced Functions menu; then, press **Enter**. The cursor becomes active in the Logical Drive list.

A screen similar to the following appears:



5. Locate the **Wrt pol** field in the Logical Drive list.

The write policy is shown as either write-through (WT), which is the default setting, or write-back (WB).

6. Select the logical drive whose write policy you want to change.

Attention: If you do not have a battery-backup cache installed and enabled and you change the write policy to WB, wait at least 10 seconds after your last operation before you turn off your system. Failure to follow this practice can result in lost data.

7. Press **Enter** to change the write policy. (You can press **Enter** to toggle between WT and WB.)

A screen similar to the following will appear with the WT changed to WB for the logical drive you changed.

IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX
Adapter Number: 1 Bus Number: 0 Host ID = Null Config

<p style="text-align: center;">Logical Drive Params Management</p> <p>1. Help 2. Change Write Policy 3. Set NVRAM Cache Controller 4. Exit</p>	<p style="text-align: center;">Ch 1 Array Bay</p> <p>1 <input type="checkbox"/> ONL A 2 <input type="checkbox"/> ONL A 3 <input type="checkbox"/> ONL A 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> INI 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11 <input type="checkbox"/> 12 <input type="checkbox"/> 13 <input type="checkbox"/> 14 <input type="checkbox"/> 15 <input type="checkbox"/> 16 <input type="checkbox"/></p>	<p style="text-align: center;">Ch 2 Array Bay</p> <p>1 <input type="checkbox"/> HSP B 2 <input type="checkbox"/> ONL B 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> ONL B 6 <input type="checkbox"/> RDY 7 <input type="checkbox"/> CDR 8 <input type="checkbox"/> INI 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11 <input type="checkbox"/> 12 <input type="checkbox"/> 13 <input type="checkbox"/> 14 <input type="checkbox"/> 15 <input type="checkbox"/> 16 <input type="checkbox"/></p>																															
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Array ID</th> <th>Size</th> <th>Log Drv</th> <th>Size (MB)</th> <th>RAID Level</th> <th>Status</th> <th>Wrt Pol</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>1920</td> <td>A0</td> <td>100</td> <td>RAID-0</td> <td>OKY</td> <td>WB</td> </tr> <tr> <td rowspan="3">B</td> <td rowspan="3">2006</td> <td>B0</td> <td>100</td> <td>RAID-0</td> <td>OKY</td> <td>WT</td> </tr> <tr> <td>A1</td> <td>200</td> <td>RAID-0</td> <td>OKY</td> <td>WT</td> </tr> <tr> <td>B1</td> <td>200</td> <td>RAID-1</td> <td>OKY</td> <td>WT</td> </tr> </tbody> </table>	Array ID	Size	Log Drv	Size (MB)	RAID Level	Status	Wrt Pol	A	1920	A0	100	RAID-0	OKY	WB	B	2006	B0	100	RAID-0	OKY	WT	A1	200	RAID-0	OKY	WT	B1	200	RAID-1	OKY	WT		
Array ID	Size	Log Drv	Size (MB)	RAID Level	Status	Wrt Pol																											
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		A1	200	RAID-0	OKY	WT																											
		B1	200	RAID-1	OKY	WT																											

Select logical drive and press Enter to toggle the write policy. Press the ESC key to make the change.

8. Press **Esc**. The Confirm pop-up window appears.
9. Select **Yes** to save the changes, or select **No** to return the setting to its original state; then, press **Enter**.
10. Back up the disk-array configuration information to diskette. Refer to "Backup Up Your Disk-Array Configuration" on page 76 for more information.

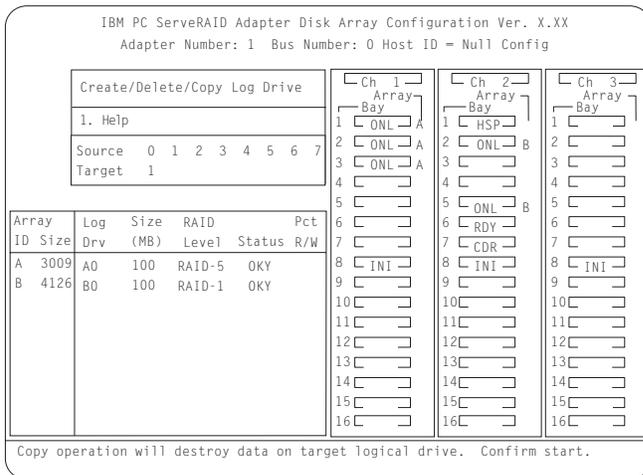
Copying Logical Drives and Disk Arrays

You can use the ServeRAID configuration program to make backup copies of the logical drives and disk arrays in your server. You also might want to use this option to create a duplicate copy of a logical drive or array for use in another system.

Copying a Logical Drive

You can use this option to create a backup copy of an existing logical drive, or to duplicate data for use in another system.

The copy logical drive option does not copy the RAID configuration information. If you want to copy an existing array for use in another system, use the instructions provided in “Copying an Existing Disk Array” on page 71.



Note: If you have a RAID 5 logical drive, make sure your target drive is synchronized *before* starting this procedure.

To copy a logical drive, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).

2. Select **Create/Delete/Copy Log Drive** from the Main Menu; then, press **Enter**.
3. Select **Copy Log Drive** from the next menu; then, press **Enter**.

Notes:

- a. The size of the target logical drive must be equal to or greater than the source logical drive.
- b. You can select up to four source/target pairs at a time.
4. From the Logical Drive list, use the Up Arrow (↑) or Down Arrow (↓) keys to highlight the source logical drive that you want to copy from; then, press the **Spacebar** to select the drive.
5. From the Logical Drive list, use the Up Arrow (↑) or Down Arrow (↓) keys to highlight the target logical drive that you want to copy to; then, press the **Spacebar** to select the drive.
6. Press **Enter** to start the copy process. The Confirm pop-up window appears.

Attention: When you select **Yes** in the Confirm pop-up window, information in the target logical drive will be overwritten with information from the source logical drive. All existing data on the target logical drive is lost.

7. Select **Yes** to copy the logical drive; then, press **Enter**.

IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX
Adapter Number: 1 Bus Number: 0 Host ID = Null Config

Confirm 1. No 2. Yes	Create/Delete/Copy Log Drive 1. Help Source 0 1 2 3 4 5 6 7 Target 1	Ch 1 Array Bay 1 ONL A 2 ONL A 3 ONL A 4 5 6 7 8 INI 9 10 11 12 13 14 15 16	Ch 2 Array Bay 1 HSP B 2 ONL B 3 4 5 ONL B 6 RDY 7 CDR 8 INI 9 10 11 12 13 14 15 16	Ch 3 Array Bay 1 2 3 4 5 6 7 8 INI 9 10 11 12 13 14 15 16
----------------------------	---	---	---	---

Array ID	Size	Log Drv	Size (MB)	RAID Level	Status	Pct R/W
A	3009	A0	100	RAID-5	OKY	
B	4126	B0	100	RAID-1	OKY	

Copy operation will destroy data on target logical drive. Confirm start.

The copy process appears in the percent Read/Write (Pct. R/W) column of the Logical Drive list.

Copying an Existing Disk Array

Use the following instructions to create a complete copy (including the RAID configuration information) of an existing array.

To copy an existing disk array, do the following:

1. **Backup** the configuration to a diskette (refer to “Backup Up Your Disk-Array Configuration” on page 76).

For example, if you want a copy of Array A to use on another system, create Array B that is identical to Array A. (See “Creating Your Disk Array Manually” on page 31.)

2. Copy all logical drives from the source array to the target array.

For example, if you made an identical copy of Array A and that copy is Array B, you should copy all logical drives in Array A to Array B. (See “Copying a Logical Drive” on page 69.)

3. From the source system:

Physically remove the hard disk drives that contain the copy from the source system; then, install them in the target system.

Note: Ensure that you install the drives in the same bays on the target system that the drives of the source array occupy in the source system.

4. Insert the ServeRAID Configuration Diskette into the primary diskette drive of the target system; then, turn on the system.
5. Using the diskette that contains the backup copy of the source configuration (you created this diskette in step 1), *restore* the configuration to the target system. (See “Restoring the Disk-Array Configuration” on page 77.)

Deleting Logical Drives and Disk Arrays

This section contains instructions for deleting logical drives and disk arrays. In all cases, when you delete an array or its associated logical drives, all data and programs in the array are lost. Before proceeding, back up any data and programs that you want to save. You might want to use a high-speed back up device, such as a tape drive, to back up large amounts of data.

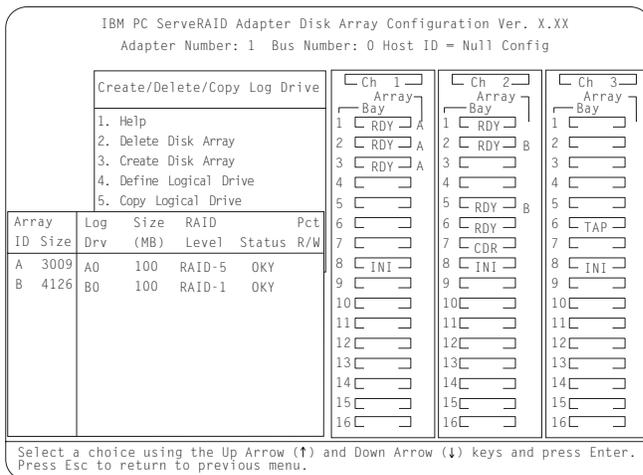
Deleting a Logical Drive

In some operating systems, deleting a logical drive might change the drive letters assigned to the existing logical drives.

To delete a logical drive, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Create/Delete/Copy Log Drive** from the Main Menu; then, press **Enter**.

A screen similar to the following appears.



IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX
Adapter Number: 1 Bus Number: 0 Host ID = Null Config

Create/Delete/Copy Log Drive				
1.	Help			
2.	Delete Disk Array			
3.	Create Disk Array			
4.	Define Logical Drive			
5.	Copy Logical Drive			

Array ID	Size	Log Drv	Size (MB)	RAID Level	Status	Pct R/W
A	3009	A0	100	RAID-5	OKY	
B	4126	B0	100	RAID-1	OKY	

Ch 1	Ch 2	Ch 3
Bay Array	Bay Array	Bay Array
1 RDY A	1 RDY B	1
2 RDY A	2 RDY B	2
3 RDY A	3	3
4	4	4
5	5 RDY B	5
6	6 RDY B	6 TAP
7	7 CDR	7
8 INI	8 INI	8 INI
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16

Select a choice using the Up Arrow (↑) and Down Arrow (↓) keys and press Enter.
Press Esc to return to previous menu.

3. Select **Delete Logical Drive**; then, press **Enter**.

4. Use the Up Arrow (↑) key or the Down Arrow (↓) key to highlight the logical drive you want to delete; then, press **Del**. The Confirm pop-up window appears.

Attention: All the data and programs in the logical drive are lost during this procedure. Before proceeding, back up any data and programs that you want to save.

5. Select **Yes** to delete the logical drive, or select **No** if you do not want to delete the drive; then, press **Enter**.
6. Select **Exit** or press **Esc** to return to the Main Menu.
7. Back up the disk-array configuration information to diskette. Refer to “Backup Up Your Disk-Array Configuration” on page 76 for instructions.

Deleting a Disk Array

Deleting a disk array deletes all logical drives that are defined in that disk array. All data and programs in the array are lost once you perform this procedure.

To delete a disk array, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).

2. Select **Create/Delete/Copy Log. Drive** from the Main Menu; then, press **Enter**. A screen similar to the following appears.

IBM PC ServeRAID Adapter Disk Array Configuration Ver. X.XX
Adapter Number: 1 Bus Number: 0 Host ID = Null Config

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Confirm</td></tr> <tr><td>1. No</td></tr> <tr><td>2. Yes</td></tr> </table>	Confirm	1. No	2. Yes	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Create/Delete/Copy Log Drive</td></tr> <tr><td>1. Help</td></tr> <tr><td>2. Delete Disk Array</td></tr> <tr><td>3. Create Disk Array</td></tr> <tr><td>4. Define Logical Drive</td></tr> <tr><td>5. Copy Logical Drive</td></tr> </table>	Create/Delete/Copy Log Drive	1. Help	2. Delete Disk Array	3. Create Disk Array	4. Define Logical Drive	5. Copy Logical Drive	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Ch 1 Array Bay</td></tr> <tr><td>1 RDY A</td></tr> <tr><td>2 RDY A</td></tr> <tr><td>3 RDY A</td></tr> <tr><td>4</td></tr> <tr><td>5</td></tr> <tr><td>6</td></tr> <tr><td>7</td></tr> <tr><td>8 INI</td></tr> <tr><td>9</td></tr> <tr><td>10</td></tr> <tr><td>11</td></tr> <tr><td>12</td></tr> <tr><td>13</td></tr> <tr><td>14</td></tr> <tr><td>15</td></tr> <tr><td>16</td></tr> </table>	Ch 1 Array Bay	1 RDY A	2 RDY A	3 RDY A	4	5	6	7	8 INI	9	10	11	12	13	14	15	16	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Ch 2 Array Bay</td></tr> <tr><td>1 RDY B</td></tr> <tr><td>2</td></tr> <tr><td>3</td></tr> <tr><td>4</td></tr> <tr><td>5 RDY B</td></tr> <tr><td>6 RDY B</td></tr> <tr><td>7 CDR</td></tr> <tr><td>8 INI</td></tr> <tr><td>9</td></tr> <tr><td>10</td></tr> <tr><td>11</td></tr> <tr><td>12</td></tr> <tr><td>13</td></tr> <tr><td>14</td></tr> <tr><td>15</td></tr> <tr><td>16</td></tr> </table>	Ch 2 Array Bay	1 RDY B	2	3	4	5 RDY B	6 RDY B	7 CDR	8 INI	9	10	11	12	13	14	15	16	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Ch 3 Array Bay</td></tr> <tr><td>1</td></tr> <tr><td>2</td></tr> <tr><td>3</td></tr> <tr><td>4</td></tr> <tr><td>5</td></tr> <tr><td>6 TAP</td></tr> <tr><td>7</td></tr> <tr><td>8 INI</td></tr> <tr><td>9</td></tr> <tr><td>10</td></tr> <tr><td>11</td></tr> <tr><td>12</td></tr> <tr><td>13</td></tr> <tr><td>14</td></tr> <tr><td>15</td></tr> <tr><td>16</td></tr> </table>	Ch 3 Array Bay	1	2	3	4	5	6 TAP	7	8 INI	9	10	11	12	13	14	15	16
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Select a choice using the Up Arrow (↑) and Down Arrow (↓) keys and press Enter. Press Esc to return to previous menu.

3. Select **Delete Disk Array**; then, press **Enter**.
4. Press the Up Arrow (↑) key or the Down Arrow (↓) key to highlight the array you want to delete; then, press **Del**. The Confirm pop-up window appears.

Attention: All the data and programs in the array are lost during this procedure. Before proceeding, ensure that you have backed up any data and programs that you want to save.
5. Select **Yes** to delete the array, or select **No** if you do not want to delete the array; then, press **Enter**.

If you delete an array of (Online) ONL drives, the states of the ONL drives change to Ready (RDY). If the array contains a defunct drive (DDD), the state of the DDD drive changes to Defunct Hot-spare (DHS).

You can reset the drive state as follows:

If the drive is good, change the device state from DHS to HSP; then, select the drive again and change the device state from HSP to RDY. (See “Changing the Device States” on page 61.)

If the drive is defective, physically replace the defunct drive with a good drive; then, set the state for the new drive state to Ready (RDY). (Refer to the documentation that comes with your server for information on replacing a hard disk drive; then, see “Changing the Device States” on page 61.)

6. Select **Exit** or press **Esc** to return to the Main Menu.
7. Back up the disk-array configuration information to diskette.
Refer to “Backup Up Your Disk-Array Configuration” on page 76 for instructions.

Maintaining the IBM ServeRAID Adapter

This section contains the following information and instructions for using the ServeRAID configuration program to maintain your disk-array configuration.

“Backup Up Your Disk-Array Configuration”

“Restoring the Disk-Array Configuration” on page 77

“Converting Your Adapter Configuration” on page 79

“Testing the RAID Subsystem” on page 80

“Clearing the Device Event Table” on page 82

“Formatting Drives” on page 81

“Replacing a Faulty Drive” on page 82

“Understanding How to Rebuild a Drive” on page 84

“Initialize, View, or Synchronize the ServeRAID Configuration” on page 87

Backup Up Your Disk-Array Configuration

The disk-array configuration is *vital* information. To protect this information, back up the information to diskette as soon as you complete your tasks.

The ServeRAID adapter maintains a record of the disk-array configuration information in its nonvolatile RAM (NVRAM) and in an electrically erasable programmable read-only memory (EEPROM) module.

Attention: Dynamic changes in the configuration of your disk arrays can occur due to hot-spare drive replacement or other drive maintenance activities. It is important that you back up the disk-array configuration information frequently, to keep the backup information on the diskette current.

You need a blank, 3.5-inch formatted diskette to create a backup copy.

To back up the disk-array configuration information, do the following:

1. Label a blank diskette "Disk Array Configuration Backup" and date it.
2. Start the ServeRAID configuration program (refer to "Starting the Configuration Program" on page 25).
3. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
4. Select **Backup IPS ServeRAID Config**; then, press **Enter**. (The disk-array configuration is also known as the *IBM ServeRAID (IPS) configuration*.)
5. Remove the ServeRAID configuration diskette from the drive and insert the blank diskette that you labeled in step 1.
6. When a pop-up window appears with a default file name of CONFIG, you can change the file name by typing over the default; then, press **Enter**. The Backup program assigns a file-name extension of *.ips*.
7. Remove the backup diskette from the drive and store it in a safe place.
8. Insert the *IBM ServeRAID Configuration* diskette.
9. Press **Esc** to return to the Main Menu.

Restoring the Disk-Array Configuration

To restore the disk-array configuration information in the ServeRAID adapter, use the IBM ServeRAID Configuration diskette and an up-to-date Disk Array Configuration Backup diskette.

Note: Dynamic changes in the configuration of your disk arrays occur due to hot-spare drive replacement or other drive maintenance activity. Because of this, the configuration backup information on the diskette might be different from that stored in the ServeRAID adapter. Therefore, it is important that you back up the disk-array configuration information frequently, to keep the backup information on the diskette current.

To restore the ServeRAID configuration information, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **Restore/Convert Saved Configuration**; then, press **Enter**.
4. Insert your Disk-Array Configuration Backup diskette into the primary drive; then, press **Enter**.
5. A list of backup file names appear. Use the Up Arrow (↑) and Down Arrow (↓) keys to select the file name that you want to restore; then, press **Enter**.
6. The Confirm pop-up window appears.
Select **Yes** to restore the configuration information, or select **No** to return to the previous menu; then, press **Enter**.
7. Press **Esc** to return to the Main Menu.

Converting Your Adapter Configuration

When you replace an IBM RAID adapter or IBM SCSI-2 Fast/Wide Streaming RAID adapter with a ServeRAID adapter, you can keep the current disk array configuration.

Notes:

1. Backup all valuable data before attempting a configuration import from the PCI RAID or Streaming RAID adapter to the ServeRAID adapter.
2. In some cases, this feature may not work and a warning message will appear on the screen.

To convert your adapter's configuration, do the following:

1. Verify that your previous disk array configuration is backed up on a diskette.
2. Replace your adapter with the ServeRAID adapter, if it is not already replaced.

Note: The ServeRAID adapter has three channels, but your previous adapter might have only two channels. Ensure that you connect the channels in the same order before continuing. Refer to Chapter 2, "Installing the IBM ServeRAID Adapter" on page 5 for the location of the ServeRAID channels.

3. Start the ServeRAID configuration program (refer to "Starting the Configuration Program" on page 25).
4. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
5. Select **Restore/Convert Saved Config.**; then, press **Enter**.
6. Insert your backup diskette in the diskette drive; then, press **Enter**.

A list of backup file names appears.

7. Use the Up Arrow (↑) or Down Arrow (↓) keys to select the filename to be converted; then, press **Enter**. A Confirm pop-up window appears.

8. Select **Yes** to convert the configuration information. Select **No** to return to the previous menu.
9. Press **Esc** to return to the Main Menu.

After a successful conversion, the corresponding device drivers must be updated for the ServeRAID adapter. Refer to the README file on the *IBM ServeRAID Device Drivers and Utilities* diskette for instructions.

Testing the RAID Subsystem

You can use the RAID Subsystem diagnostic utility to test the ServeRAID adapter and the devices connected to the adapter.

To run the RAID diagnostic utility, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then press **Enter**.
3. Select **IBM RAID Subsystem Diagnostic**; then, press **Enter**.
4. Select the diagnostic test that you want to run; then, press **Enter**.

Descriptions of the diagnostic tests available are as follows:

Run Adapter Self-test tests the ServeRAID adapter. Restart your server after the self-test is complete.

SCSI Device Self-test runs diagnostic tests on the SCSI devices attached to the ServeRAID adapter.

Drive Media Test verifies that all sectors on the hard disk drive can be accessed. The drive must be in the RDY or HSP state.

Format Drive performs a low-level format on a hard-disk drive. For more information, see “Formatting Drives” on page 81.

5. Follow the instructions on the screen.

Formatting Drives

The Format Drive option performs a low-level format on a hard disk drive. If you install a new hard disk drive that requires a standard format, use your operating system Format command to format your drive. You can use the Format Drive option to low-level format hard disk drives that are in the Ready (RDY), Empty (EMP), Standby (SBY), Standby Hot-Spare (SHS), or Hot-Spare (HSP) states. This option can low-level format multiple drives simultaneously.

To perform a low-level format, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **IBM RAID Subsystem Diagnostics** from the Advanced Functions menu; then, press **Enter**.

Attention: A low-level format erases all data and programs from the hard disk drive. Before proceeding, back up any data and programs that you want to save.

4. Select **Format Drive**; then, press **Enter**.

You can perform a low-level format on more than one drive at a time.

Note: If formatting is interrupted, the state of the drive being formatted might appear as Empty (EMP) in the Array/Bay selection list. If this occurs, select the drive and format it again.

5. Follow the instructions that appear on the screen. When the message similar to `Formatting Complete` appears, press **Esc** to return to the Main Menu.

Clearing the Device Event Table

The device event table, located in the ServeRAID adapter, collects statistics on the number and type of events that occurred on all of the hard disk drives attached to the ServeRAID adapter.

After you correct a disk-array problem, you might want to clear the Device Event Table so that you can quickly identify any subsequent events.

To clear the Device Event Table, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Rebuild/Device Management** from the Main Menu; then, press **Enter**.
3. Select **Erase Device Event Table** from the next menu; then, press **Enter** to clear the table.

Replacing a Faulty Drive

To avoid the loss of critical data, it is important that you replace and rebuild a defunct (DDD) drive promptly.

Results of a Hard Disk Drive Failure

The results of hard disk drive failures depend on the configuration of your disk arrays and the number of drives that fail. Before you remove or replace a DDD drive, review the following examples.

Example 1

One hard disk drive in an array becomes defunct, but a hot-spare (HSP) drive of at least the same size exists.

The hot-spare drive takes over immediately, if the failing drive is part of a redundant (RAID level 1 or RAID level 5) logical drive.

The RAID level 1 and RAID level 5 logical drives within the array change to the critical (CRT) state and remain in the CRT state until the rebuild process completes.

The RAID level 0 logical drives within the array change to the offline (OFL) state.

All data in the RAID level 0 logical drives within the array is lost.

Example 2

One hard disk drive in an array becomes defunct, but an appropriate hot-spare (HSP) drive is not available.

The RAID level 1 and RAID level 5 logical drives within the array change to the CRT state. Data is not lost from logical drives in the CRT state, but you must replace the DDD hard disk drive promptly to avoid the loss of data.

The RAID level 0 logical drives within the array change to the OFL state.

All data in the RAID level 0 logical drives within the array is lost.

Example 3

Multiple drives within an array become defunct.

All logical drives in the array change to the offline (OFL) state.

All data in the array is lost, regardless of the RAID levels assigned to the logical drives.

Replacing a Faulty Drive

To replace a faulty drive, do the following:

1. Before you remove or replace a drive that you suspect is defective, verify that the drive is defective. To do this:
 - a. Check the drive for damage.

Note: Most hard disk drives come with LEDs on the drive or on the drive tray that explain the current status of the drives. Refer to the documentation that comes with your server and with your hard disk drives to determine the status of your drives.

- b. Verify that the drive is positioned correctly.
 - c. Verify that you can remove the drive safely.
2. Physically replace the drive or use an existing RDY drive that has a capacity equal to or greater than the drive you are replacing. To do this:

Attention: Removing the wrong hard disk drive can cause loss of all data in the array.

- a. To physically replace the defective hard disk drive, refer to the instructions in the documentation that comes with your server; then, follow the instructions in “Understanding How to Rebuild a Drive.”
 - b. Rebuild the defunct drive to an existing Ready (RDY) drive.

Note: You can use the Administration and Monitoring programs to identify a defunct drive and designate a replacement drive without restarting the server.

Understanding How to Rebuild a Drive

This section contains guidelines and instructions for rebuilding a defunct (DDD) drive using the ServeRAID configuration program.

If you are using the Administration and Monitoring Utility, review the guidelines and information in this section; then, see “Physical Device Administration” on page 138 for instructions.

General Information about the Rebuild Process

A physical hard disk drive can enter the rebuild (RBL) state if:

You physically replace a defunct drive that is part of the critical (CRT) logical drive.

When you physically replace a defunct drive in a critical (CRT) logical drive, the ServeRAID adapter rebuilds the data on the new physical drive *before* it changes the logical drive state back to Okay (OKY).

The ServeRAID adapter adds a hot-spare or a standby hot-spare drive to the array and changes its state from HSP or SHS to RBL.

A ready or standby drive replaces a defunct drive that is part of the critical (CRT) logical drive.

The ServeRAID adapter will rebuild a defunct drive automatically when all of the following conditions exist:

The physical drive that failed is part of a RAID level 1 or RAID level 5 logical drive.

A HSP or SHS drive with a capacity equal to or greater than the capacity of the defunct drive is available the moment the drive fails.

No rebuild, synchronization, or LDM operation is in process.

If multiple hot-spare drives are available, the ServeRAID adapter searches all bays for a hot-spare drive of the appropriate size. The first drive that meets this requirement enters the rebuild state.

Guidelines for Rebuilding a Drive

Before you rebuild a drive, review the following guidelines:

The replacement hard disk drive must have a capacity equal to or greater than the failed drive.

If the hard disk drive being rebuilt is part of a RAID level 0 logical drive, the RAID level 0 drive is blocked.

- If you use the ServeRAID configuration program to initiate the rebuild process, the program unblocks the blocked RAID level 0 drive at the end of the rebuild process. If the rebuild process is interrupted, you must restart the server to unblock the blocked RAID level 0 logical drive.
- If you use the Administration and Monitoring utility to initiate the rebuild process, you can unblock the blocked RAID level 0 drive when the rebuild process completes. Refer to “Unblocking a Logical Drive” on page 133 for more information.

Data in a logical drive with RAID level 0 is lost during the rebuild process. If you backed up your data before the drive failed, you can restore the data to the new drive.

Rebuilding a Drive

To rebuild a physical drive, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
 2. Select **Rebuild/Device Management** from the Main Menu; then, press **Enter**.
 3. Select **Rebuild Drive** from the Rebuild/Device Management menu. The cursor is active in the Array/Bay selection list.
 4. A pop-up window appears. Select one of the following.
 - Select **Same Location** if you physically replaced a hard disk drive in the same bay; then, press **Enter**. A Confirm pop-up window appears. Select **Yes** and continue with step 5.
 - Select **New Location** to assign a hard disk drive in a new location. Use the Up Arrow (↑) or Down Arrow (↓) keys to select the replacement drive that you want to use for the rebuild operation; then, press **Enter**.
- Information and status messages about each stage of the rebuild process appear on the screen. Continue with step 5.
5. When the rebuild process completes, press **Esc** to return to the Main Menu. The new configuration is saved.

6. **Backup** the new configuration to a diskette (refer to “Backup Up Your Disk-Array Configuration” on page 76).
7. Select **Exit** to leave the ServeRAID configuration program.
8. Remove the diskette and press **Ctrl+Alt+Del** to restart the server.

Initialize, View, or Synchronize the ServeRAID Configuration

The ServeRAID configuration information is critical to the operation of the disk array. To protect the integrity of the configuration information, the configuration information is also stored in the adapter NVRAM and EEPROM, and on each RBL and ONL hard disk drive. Each time you change configuration information, all corresponding copies are updated automatically.

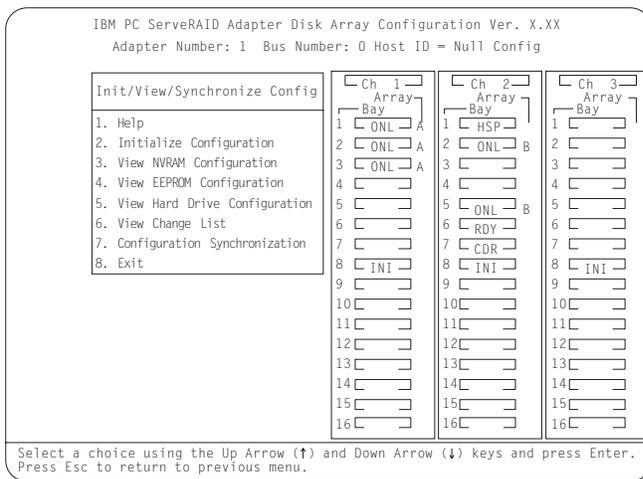
During POST, if the NVRAM configuration information does not match the configuration information stored in the EEPROM or on the hard disk drives, an error message appears.

You can use the Init/View Synchronize Configuration menu to view or reset configuration information.

To initialize, view, or synchronize the adapter configuration, do the following:

1. Start the ServeRAID configuration program (refer to “Starting the Configuration Program” on page 25).
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **Init/View/Synchronize Config** from the next menu.

A screen similar to the following appears:



Descriptions of the choices available from this menu are as follows:

Help provides information about the choices on the menu. You also can press F1 from any screen to obtain online help.

Initialize Configuration lets you set the configuration of the ServeRAID adapter to its default settings. This choice sets the states for all powered-on hard disk drives to RDY, all CD-ROM drives to CDR, and all tape drives to TAP. This choice also deletes all previously defined arrays and logical drives. This choice writes a “Null Configuration” for the ServeRAID adapter.

You must select this choice if a message appears stating that you have an unrecoverable configuration event, because valid configuration information does not exist.

View NVRAM Configuration displays the current configuration settings stored in the adapter's NVRAM.

View EEPROM Configuration displays the current configuration settings stored in the adapter's EEPROM.

View Hard Drive Configuration displays the configuration settings for the selected ONL or RBL hard disk drive.

View Change List lets you view the device state configuration changes that the ServeRAID adapter reported since you restarted or turned on the server.

- **View Power-on Change List** displays the hard disk drive device state changes that occurred when you restarted or turned on the server.
- **View Wrong SCSI ID List** provides a list of hard disk drives that were found at a different SCSI ID location when you restarted or turned on the server.
- **View Unidentified Drive List** provides a list of hard disk drives that have identifiers that do not match the stored configuration information.

The identifier consists of both the configuration host ID and a time stamp. You can define the host ID (for example, a host ID can be the serial number of the server) with any string, up to 12 characters. (Refer to “Viewing or Changing the ServeRAID Adapter Parameters” on page 54 for more information.)

Configuration Synchronization See “Configuration Synchronization” for a description of this choice.

4. Use the Up Arrow (↑) or Down Arrow (↓) to highlight your choice from the menu; then, press **Enter**.
5. Follow the instructions on the screen.

Configuration Synchronization

When the configuration information stored in the NVRAM, in the EEPROM, and on the hard disk drives does not match, you can select one source; then, copy the selected configuration information to the other locations.

You can view the individual configurations to determine if they are valid, and then select the configuration that you want to use.

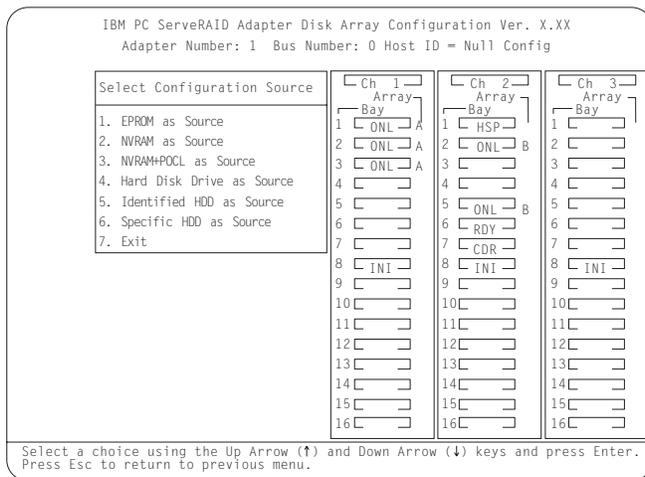
If a message appears stating that you have a recoverable configuration error, one of the following conditions exists:

The configuration information in NVRAM is valid, but the configuration information in the EEPROM (Flash) is invalid.

The configuration information in the EEPROM is valid, but the configuration information in NVRAM is invalid.

The configuration information in NVRAM is valid and the configuration information in the EEPROM is valid, but they do not match.

If a message appears stating that you have an unrecoverable configuration error, valid configuration information does not exist. If this occurs, you must initialize the configuration immediately.



Descriptions of the choices available from the Configuration Synchronization menu are as follows:

EEPROM as Source copies configuration information from the adapter's EEPROM to NVRAM and to all configured RBL and ONL hard disk drives defined in the adapter EEPROM configuration.

NVRAM as Source copies configuration information from NVRAM to the adapter's EEPROM and to all configured RBL and ONL hard disk drives defined in the NVRAM configuration.

NVRAM and POCL as Source updates information from the power-on change list (drive state changes at power-on time) with the information in NVRAM, then copies this updated configuration information to the adapter's EEPROM and to all configured RBL and ONL hard disk drives defined in the NVRAM configuration.

Hard Disk Drive as Source retrieves configuration information from the most common hard disk drive configuration, then copies the configuration information to the adapter's NVRAM and EEPROM.

Identified HDD as Source updates the adapter's configuration information with the configuration information on a hard disk drive that matches the identifiers stored in the NVRAM. The updated configuration information is then copied to NVRAM, the adapter's EEPROM, and the configured hard disk drives in the array.

Specific HDD as Source retrieves the configuration information from the hard disk drive that you select. The updated configuration information is then copied to NVRAM, to the adapter's EEPROM, and to the configured hard disk drives.

Using the ServeRAID Adapter Mini-Configuration Program

The Mini-Configuration program is a quick way to display the adapter settings and to perform a limited set of the configuration functions without using the ServeRAID Adapter Configuration diskette.

To access the ServeRAID Adapter Mini-Configuration program, do the following:

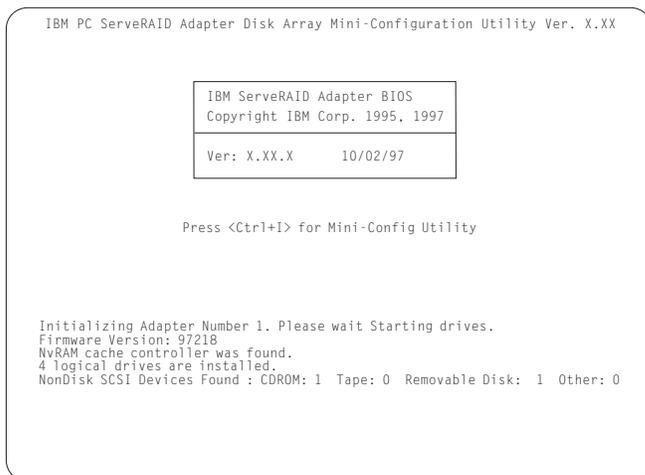
1. Start the server; if the system is already started, restart the system.

Each time your system starts, the ServeRAID adapter performs a power-on self-test (POST). The POST checks the adapter hardware and the configuration for any changes that have occurred.

If POST does not detect changes in the adapter configuration or any adapter hardware problems, continue with step 2.

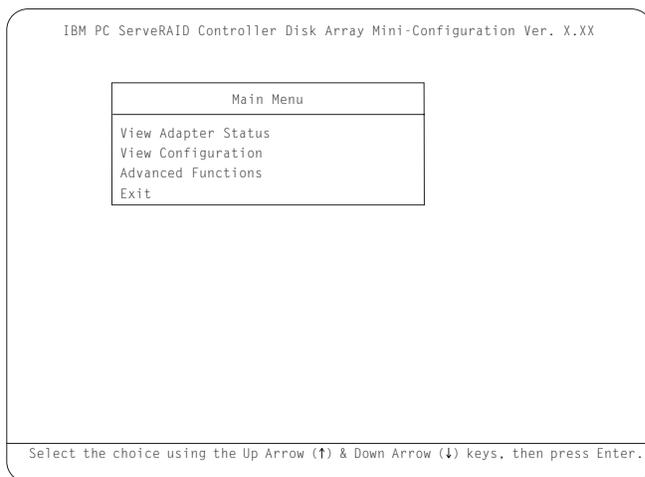
If POST detects changes in the adapter configuration or detects an adapter hardware problem, messages appear on the screen. Refer to "IBM PC ServeRAID Adapter POST and Setup Messages" on page 161 and correct the problem. Then, return here and continue with step 2.

2. Press **Ctrl+I** immediately when a screen similar to the following Mini-Configuration screen appears.



Note: In the figure above, the Ver. x.xx and x.xx.x will be replaced by the version number of the Mini-Configuration program, the example date of 10/02/97 will be replaced by the date of the version of your Mini-Configuration program, and the example firmware version number of 97218 will be replaced with the version number of your firmware.

3. If you have more than one ServeRAID adapter installed, you will get an adapter selection screen. Use the Up Arrow (↑) and Down Arrow (↓) keys to select the desired adapter; then, press **Enter**. Otherwise, the Main Menu of the Mini-Configuration program appears, similar to the following screen.



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

View Adapter Status displays the current status of the ServeRAID adapter. (Refer to “Viewing the Adapter Status” on page 95.)

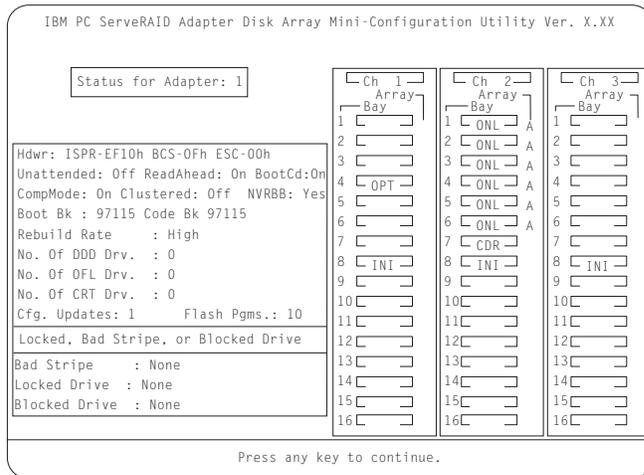
View Configuration displays the current configuration information for the ServeRAID adapter. (Refer to “Viewing the Configuration” on page 97.)

Advanced Functions lets you initialize the configuration, import configuration from drives, enable and disable the Boot CD-ROM and INT13 extensions, and view the adapter and PCI information. (Refer to “Using the Advanced Configuration Functions” on page 98.)

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. Select **Exit** to leave the Main Menu.

Viewing the Adapter Status

When you select View Adapter Status from the Main Menu, a screen similar to the following appears.



The screen contains the following fields:

Unattended displays the current on/off state of Unattended Mode. (Refer to “Changing the RAID Parameters” on page 62.)

Read Ahead displays the current on/off state of the Read Ahead Cache Mode. (Refer to “Changing the RAID Parameters” on page 62.)

BootCd displays the current on/off state of the BootCd function. (Refer to “Setting the BootCD Feature” on page 100.)

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

NVRBB displays the current state of the battery-backup cache option. The default value is enabled.

Boot Bk displays the current version number of the bootable microcode loaded in the ServeRAID adapter.

Code Bk displays the current version number of the firmware microcode loaded on the adapter.

Rebuild Rate displays the current speed of the rebuild: high, medium, or low. (Refer to “Changing the RAID Parameters” on page 62.)

No. of DDD Drv. displays the current number of defunct drives.

No. of OFL Drv. displays the current number of offline logical drives.

No. of CRT Drv. displays the current number of critical logical drives.

Cfg. Updates displays the current number of times that the configuration has been changed. When you initialize the configuration, the Cfg. Update is reset to zero.

Flash Pgms displays the current number of times that the Flash EEPROM has been written.

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

- **Bad Stripe** indicates the area of a logical drive that is inaccessible.
- **Locked Stripe** is a reserved field.
- **Blocked Drive** indicates the logical drives that are blocked. The drives that are blocked cannot be used until they are unblocked. (Refer to “Unblocking a Logical Drive” on page 133.)

Viewing the Configuration

When you select View Configuration from the Main Menu, a screen similar to the following appears. You can view the number and size of logical drives installed, RAID level, current state, stripe unit size, write policy, read-ahead status, and the date the logical drive was created.

IBM PC ServeRAID Adapter Disk Array Mini-Configuration Ver. X.XX

Adapter 1 Logical Drive Configuration

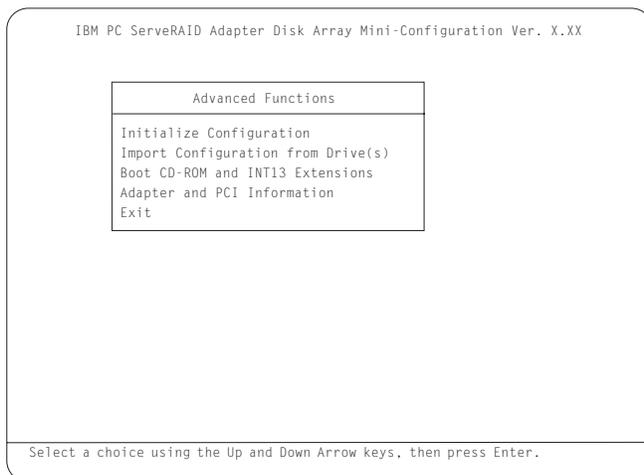
Logical Drive	Size (MB)	RAID Level	Current State	Stripe Size	Wrt Pol	Read Ahead	Date Created mm/dd/xx
0	100	5	OKY	8K	WT	NO	01/18/96
1	100	5	OKY	8K	WT	NO	01/18/96
2	100	5	OKY	8K	WT	NO	01/18/96
3	100	5	OKY	8K	WB	NO	01/18/96
4	100	5	OKY	8K	WB	NO	01/18/96
5	99	1	OKY	8K	WT	NO	01/18/96
6	200	5	OKY	8K	WT	NO	01/18/96
7	300	1	OKY	8K	WT	NO	01/18/96

Press any key to continue

Using the Advanced Configuration Functions

The Advanced Functions choice allows you to reset the ServeRAID adapter, initialize the configuration, import the configuration information from the drives, enable and disable the CD-ROM boot and INT13 extensions, and view the adapter and PCI information.

When you select Advanced Functions from the Main Menu, the following screen appears.



Attention: The following choices may result in loss of data due to changes in the configuration.

Initialize Configuration resets the adapter configuration values to the factory defaults and sets all functional hard disk drive states to RDY.

Import Configuration from Drive(s) reads the most common configuration from the drives in the system and copies it to the adapter's NVRAM and EEPROM module.

Boot CD-ROM and INT13 Extensions is used to configure the boot CD option. When BootCd is enabled, the adapter attempts to start a CD-ROM that has a bootable startup partition if no other adapter installed in the system is currently using INT13.

Attention: Only one adapter in the system can support INT13 extensions.

Adapter and PCI Information displays the adapter's hardware and PCI register information as shown in the example screen below.

```

IBM PC ServeRAID Adapter Disk Array Mini-Configuration Utility Ver. X.XX

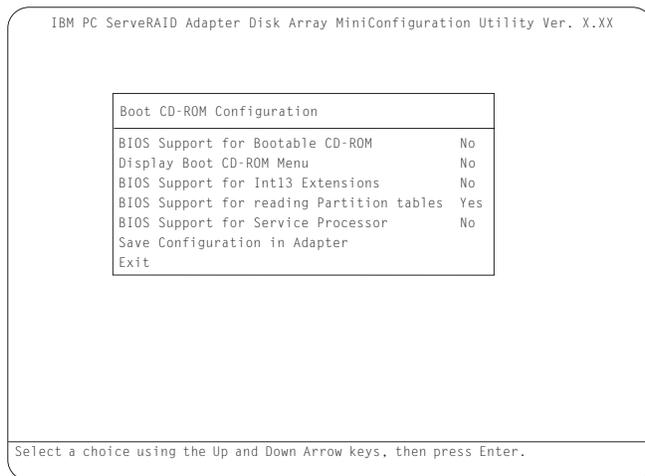
Adapter Information          PCI Reg Information
Code Seg.(Cs): CB80h        Dev. Ven Id (00h): 002Eh 1014h
Data Seg.(Ds): 9A00h        Status, Cmd(04h): 0200h 0107h
Adapter No: 1               Class, Rev Id(08h): 010000h 04h
  Intr No: 0009h            Bist,Hdr,Lat,Cach (0Ch): 00h 00h 40h 08h
  I/O Adr: F400h            Base Adr Reg0(10h): 0000F401h
  Mem Adr: FDFFE000h        Base Adr Reg1(14h): FDFFE000h
  Bus No: 00h               Base Adr Reg2(18h): 000000000h
  Device No: 0Eh            Base Adr Reg3(1Ch): 000000000h
Status0 Start: 0009E814h    Base Adr Reg4(20h): 000000000h
Status0 End: 0009E82Ch      Base Adr Reg5(24h): 000000000h
Status0 Head: 0009E818h     Reserved(28h): 000000000h
Status0 Tail: 0009E814h     Reserved(2Ch): 000000000h
OS/2 Table: 4800h          Exp ROM Adr(30h): 000000000h
Part Number: 01K8562        Reserved(34h): 000000000h
                             Reserved(38h): 000000000h
                             MaxLat,MinG,IntP,Int1(3Ch): 00h 00h 00h 00h

Press any key to continue.

```

Setting the BootCD Feature

When you select **BootCD-ROM and INT13 Extensions**, a screen similar to the following appears.



To enable the BootCD feature, do the following:

1. Use the Up Arrow (↑) and Down Arrow (↓) keys to highlight **BIOS Support for Bootable CD-ROM**; then, press **Enter** to change No to Yes. (This also changes No to Yes next to **Display Boot CD-ROM Menu** and **BIOS Support for INT13 Extensions**.)
2. 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 changes you just set.

3. Highlight **Save Configuration for Adapter** and press **Enter**. A message appears saying Configuration Saved and then returns you to the Main Menu of the Mini-Configuration program.
4. Press **Ctrl+Alt+Del** to restart the system.

Chapter 4. Administration and Monitoring Utilities

The IBM ServeRAID Administration and Monitoring Utilities monitor your ServeRAID adapter while your network operating system is up and running.

The Administration and Monitoring Utilities come in three versions:

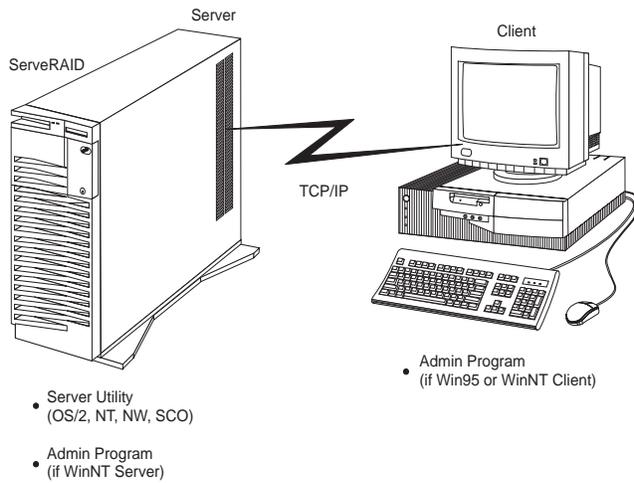
- IBM OS/2
- Novell NetWare
- Microsoft Windows NT and Windows 95

The OS/2 and NetWare utilities run only on the system containing a ServeRAID adapter (stand-alone mode). For installation instructions for these utilities, refer to the README file on the *IBM ServeRAID Device Driver* diskette that comes with the adapter.

The Windows NT and Windows 95 utilities run on the system containing a ServeRAID adapter (standalone mode) or in a client/server environment (client/server mode). You can use the stand-alone mode to administer and configure ServeRAID adapters within the system.

You can use the client/server mode to administer and configure ServeRAID adapters that are in systems anywhere on your network. This environment is supported under the TCP/IP networking protocol and allows connections to IBM OS/2, Microsoft Windows NT, Novell NetWare, and SCO OpenServer operating systems.

Note: The Windows NT and Windows 95 utilities are required to use the logical drive migration feature. Refer to “Logical Drive Migration Administration” on page 134.



Installing the Administration and Monitoring Utilities

This section guides you through the installation of the following utilities that are supported with the ServeRAID adapter.

The Administration and Monitoring Utilities runs on a Windows-based system (Windows 95 workstation, Windows NT workstation, or Windows NT server).

Server Utilities

- IBM OS/2 Server
- Microsoft Windows NT Server
- Novell NetWare Server
- SCO OpenServer

Updates to the installation instructions for the server utilities can be accessed from the World Wide Web. Refer to “Using the World Wide Web” on page 172 for detailed information.

Before you begin the installation:

Be sure that your ServeRAID adapter 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 Administration and Monitoring Utilities in client/server mode (across the network) or stand-alone mode (at the system).

- Refer to “Installing and Using the Server Utilities” on page 105 for client/server mode instructions.
- Refer to “Installing the Administration and Monitoring Utility for Windows NT and Windows 95” on page 114 for stand-alone mode instructions.

If your network operating system is OS/2, NetWare, or OpenServer you must use the Administration and Monitoring Utilities program in client/server mode. Requirements for this environment include:

- A Windows NT or Windows 95 client running the IBM ServeRAID Administration and Monitoring Utilities
- A network card with proper cabling for access to the remote systems
- The TCP/IP networking protocol installed on both the local and remote systems
- The IBM ServeRAID Administration and Monitoring Server Utilities installed on the remote system
 - Refer to “Installing and Using the Server Utilities” on page 105 to install your server utilities.
 - Refer to “Installing the Administration and Monitoring Utility for Windows NT and Windows 95” on page 114 to install the Administration and Monitoring Utilities on a Windows 95 or Windows NT system.

Installing and Using the Server Utilities

This section contains installation instructions and information for using the IBM OS/2 server utility, Microsoft Windows NT server utility, Novell NetWare server utility, and SCO OpenServer utility.

Installing the IBM OS/2 Server Utility

To install the IBM OS/2 server utility, do the following:

1. Insert the *IBM ServeRAID Device Driver Diskette* into a diskette drive, such as drive a:

2. Create an IPSRAID directory on the hard disk; type:

```
md d:\ipsraid
```

(where d: is the drive letter)

3. Copy the following file to the target directory; type:

```
copy a:\remote\servers\os2\ipsadm.exe d:\ipsraid\ipsadm.exe
```

(where a: is the diskette drive and d: is the drive letter)

4. Copy the icon file to the target directory; type:

```
copy a:\remote\servers\os2\ipsadm.ico d:\ipsraid\ipsadm.ico
```

(where a: is the diskette drive and d: is the drive letter)

5. Create an icon for the application:

- a. Open the template folder.
- b. Drag a **Program Template** onto the Desktop.
- c. At the Program Tab, type the following path and file name:

```
d:\ipsraid\ipsadm.exe
```

(where d: is the drive letter)

d. At the General Tab, type the following:

```
ipsraid admin/monitor
```

e. Find the current icon: d:\ipsraid\ipsadm.ico.

6. Double-click on the new icon to access the server utility.

Continue with “Using the Server Utility” on page 111.

Installing Microsoft Windows NT 4.X Server Utility

To install the Microsoft Windows NT server utility, do the following:

1. Insert the *IBM ServeRAID Device Driver Diskette* into a diskette drive, such as drive a:.

2. Create an IPSRAID directory on the hard disk; type:

```
md d:\ipsraid
```

(where d: is the drive letter)

3. Copy the following file to the target directory; type:

```
copy a:\remote\servers\nt\ipsadm.exe d:\ipsraid\ipsadm.exe
```

(where a: is the diskette drive and d: is the drive letter)

4. Copy the icon file to the target directory; type:

```
copy a:\remote\servers\nt\ipsadm.ico d:\ipsraid\ipsadm.ico
```

(where a: is the diskette drive and d: is the drive letter)

5. To create a new shortcut for the utility, do the following:

- a. Using the right mouse button, click on the Desktop and select **New**; then, select **Shortcut**.

- b. In the **Create Shortcut** window, type:

```
d:\ipsraid\ipsadm.exe
```

(where d: is the drive letter)

or, if you are not sure of the path and filename,

Click on the **Browse** button, find and select the file:

```
d:\ipsraid\ipsadm.exe
```

(where d: is the drive letter)

- c. Click on **Next**.

- d. In the Select a Title for the Program window, type:

```
ipsraid admin/monitor server
```

- e. Click on **Finish** and an icon appears on your desktop.

6. To get a customized icon for the shortcut you just created, do the following:
 - a. Using the right mouse button, click on the icon that was created for your shortcut and select **Properties**
 - b. Click on the **Shortcut** notetab.
 - c. Click on **Change Icon**.
 - d. Click on **OK** in the information window.
 - e. In the **Change Icon window**, type:
`d:\ipsadm\ipsadm.ico`
(where d: is the drive letter)
or,
Click on the **Browse** button, find and select the file:
`d:\ipsraid\ipsadm.ico`
(where d: is the drive letter)
 - f. Click on **OK** for the icon.
 - g. Click on **OK** for the program properties.
7. Double-click on the new icon to access the server utility.

Continue with "Using the Server Utility" on page 111.

Installing the Novell NetWare 3.12/4.X Server Utility

To install the Novell NetWare 3.12/4.X server utility, do **one** of the following:

From a DOS prompt:

1. Insert the *IBM ServeRAID Device Driver Diskette* into a diskette drive, such as drive a:.

2. Type:

```
copy a:\remote\servers\netware\ipsadm.nlm d:\nwserver\ipsadm.nlm
```

(where *a:* is the diskette drive and *d:nwserver* is the drive and the directory where NetWare is installed)

3. Load the NLM from the system console, type:

```
load d:\nwserver\ipsadm.nlm
```

(where *d:nwserver* is the drive and the directory where NetWare is installed)

From a client on the network:

1. Insert the *IBM ServeRAID Device Driver Diskette* into a diskette drive, such as drive a:.

2. Type:

```
copy a:\remote\servers\netware\ipsadm.nlm f:\system\ipsadm.nlm
```

(where *a:* is the diskette drive and *f:* is the SYS volume)

3. Load the NLM from the system console, type:

```
load ipsadm.nlm
```

Continue with "Using the Server Utility" on page 111.

Installing the SCO OpenServer 5.X Server Utility

The SCO OpenServer Server utility is installed from the SCO OpenServer Boot-Time Loadable Diskette (BTLT) during the installation of the IBM ServeRAID adapter device driver. The file is installed in the **/usr/bin** directory.

To run the program, enter **ipsadm &** at the command prompt.

If, for any reason, the program does not run, use the following instructions to manually install the SCO OpenServer 5.X server utility.

1. Insert the *IBM ServeRAID SCO OpenServer Boot-Time Loadable Diskette (BTLT)* into a diskette drive.
2. Create a directory for the server utility; type:

```
mkdir /ipsraid
```
3. Mount the diskette drive; type:

```
mount /dev/fd /mnt
```
4. Copy the following file; type:

```
cp /mnt/ipsraid/new/usr/bin/ipsadm /ipsraid/ipsadm
```
5. Unmount the diskette drive; type:

```
umount /mnt
```
6. Start the server utility to run in the background; type:

```
./ipsadm &
```

Continue with "Using the Server Utility" on page 111.

Using the Server Utility

The server utility accepts the following optional command-line parameters to “fine tune” your system.

To use command-line parameters, issue the IPSADM command in the following format:

```
IPSADM <parameter 1> <parameter 2> and so on...
```

Valid parameters are as follows:

- ?** The `-?` command displays the help for the valid parameters.
- p:number** The `-p:number` command specifies the port number on which the server will check for client connections.

The port number is a parameter used in TCP/IP to distinguish between different services on a single server. The default for the server utility is port number 1087. The port number can be changed with this parameter if another service on the system occupies 1087.
- s:filename** The `-s:filename` command specifies the name of the file that contains security information. For more information on security information, see “Server Utility Security” on page 112.
- f** The `-f` command specifies to log messages to the default filename, 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 adapter 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. Messages can be logged to the standard output, usually the screen, but can be defined as a printer or other output device. Messages also can be logged to a text file on the system at the same time. (The default is to log messages to the standard output.)

The following information shows you some 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 filename: IPSADM.LOG.
IPSADM -f:NEWFILE.LOG	Logs messages to the standard output and to the filename that you defined: NEWFILE.LOG.
IPSADM -d	This disables the logging of messages.
IPSADM -f -d	Messages are logged to filename: IPSADM.LOG; however, messages are not logged to the standard output.

Server Utility Security

Security information is maintained in an optional text file on the server. The file stores unencrypted usernames and unencrypted passwords; therefore, the file must be kept in a secure directory.

When usernames and passwords are entered on the Administration and Monitoring Utilities (the client), they are encrypted for delivery to

the server. The server decrypts the usernames and passwords to verify proper access to the ServeRAID adapter. If the verification is successful, the adapter 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 utility then accepts commands from any client connection.

The security file contains one username and password combination per line. The strings are separated by a colon (:) and each string has a maximum of eight characters.

Server Utility Name Resolution

The server utility 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.

Installing the Administration and Monitoring Utility for Windows NT and Windows 95

To install the Administration and Monitoring utility for Windows NT and Windows 95:

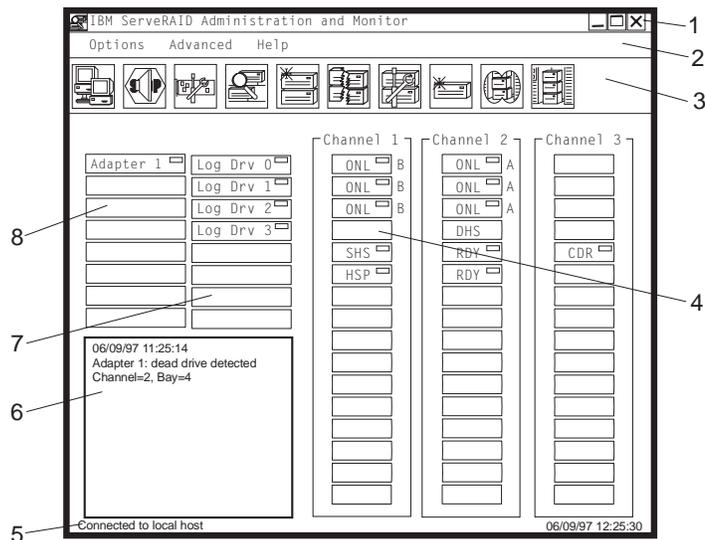
1. Insert the Administration and Monitoring utility diskette that comes with your adapter into a diskette drive, such as drive a:
2. At the **Run** prompt, type:
`a:setup`
3. Press **Enter**, then, follow the instructions that appear on the screen.

For instructions on how to use the Administration and Monitoring program, refer to Chapter 5, "Using the Administration and Monitoring Utility" on page 115.

Chapter 5. Using the Administration and Monitoring Utility

You can use the Administration and Monitoring Utility to monitor your ServeRAID adapters, 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.

Before starting the Administration and Monitoring Utility, it is a good idea to become familiar with the Main Screen. The following figure is an example of the Main Screen for the Administration and Monitoring Utility. The list that follows the figure gives an explanation of the areas.



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 adapter and its array identifier, if applicable.
- 5. Status Bar** Displays help for the area where the cursor is currently pointing. The date and time also are displayed.
- 6. Status Window** Displays messages regarding the operational status of each adapter.
- 7. Logical Drive Area** Displays the number of logical drives created and the status of the logical drive.
- 8. Adapter Area** Displays the number of adapters installed and the adapter status.

Starting the Administration and Monitoring Utility

To start the Administration and Monitoring Utility, do one of the following:

Double-click on the IBM ServeRAID Administration icon

or

Select **IBM ServeRAID Administration** from the start menu.



Note: The Administration and Monitoring Utility starts in stand-alone mode. If no ServeRAID adapters are installed in your system, you first need to initiate the client/server mode. To initiate client/server mode, refer to *Network Settings* under “Options Pull-Down Menu” on page 118.

Options Pull-Down Menu

There are three selections under the Options pull-down menu on the Main Screen of the Administration and Monitoring utility:

- Network Settings
- General Options
- Alert Options

The information on the following pages describes each of these selections.

Network Settings

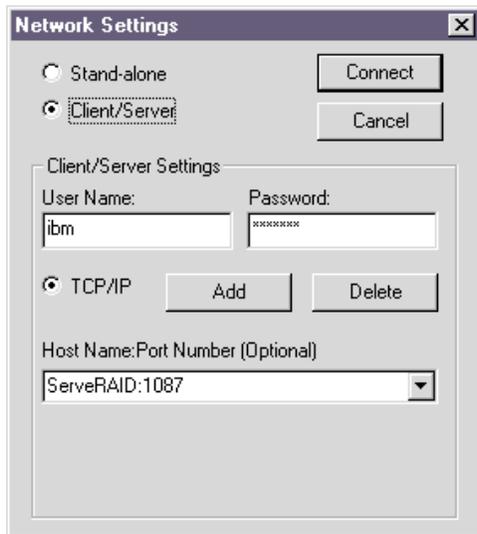
If you want to monitor the ServeRAID adapters across a network, you must switch to client/server mode.



You can use the Network Settings dialog box to select and connect to servers in your network that have IBM ServeRAID adapters installed.

To select and connect to a server, do the following:

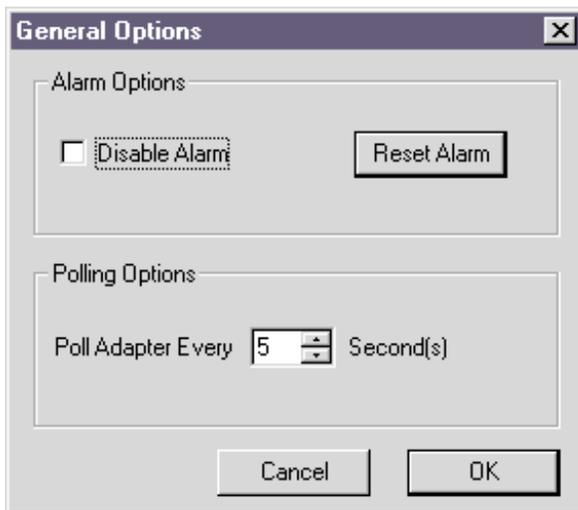
1. Click on the  icon on the tool bar or select **Network Settings** from the **Options** pull-down menu. A screen similar to the following appears.



2. Select 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 “Server Utility Security” on page 112 for information on the security file).
4. Type in either the **Hostname** 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 Hostname 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:



Use this screen to do one of the following:

- Enable/Disable the alarm
- Reset the alarm
- Set the polling options

Enabling or Disabling the Alarm

The alarm alerts the user to a failure in the system. It will activate if any of the following conditions occur:

- A DDD hard disk drive has been detected.
- A Predictive Failure Analysis (PFA) error has occurred.
- A ServeRAID adapter 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 checkbox 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 adapter 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 adapter 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 events that are polled for are:

- Rebuild started
- Rebuild completed
- Synchronization started
- Synchronization completed
- Migration started
- Migration completed
- PFA error detected
- Dead drive detected
- Adapter not responding to commands

Alert Options

The NetFinity alerts allow system administrators who are using the IBM NetFinity Program to configure the ServeRAID Administration and Monitoring Utility to notify the NetFinity alert manager of various activities occurring on the server.

To configure the settings for the NetFinity alerts, do the following:

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 alerts is disabled.

4. To enable all of the NetFinity alerts, click on the check box next to Enable NetFinity Alerts.
5. To disable any of the NetFinity 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 integration, click on the **Send Test Alert** button. This will send a NetFinity alert to the Alert Manager with a test message.

If NetFinity Alerts are enabled, the ServeRAID adapter relays 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
 - Adapter not responding to commands

By knowing what these types of messages are, the system administrator can then configure NetFinity with instructions for monitoring the server configuration and the appropriate action to take if an alert is given. For example, the network administrator could program NetFinity to dial out through a modem to a specified phone number should a defunct drive be detected on any server across the network.

Using the ServeRAID Administration Functions

This section describes how to administer your ServeRAID adapter using the following functions:

- Array administration
- Logical drive administration
- Logical drive migration administration
- Physical drive administration
- Adapter administration

Array Administration

The Array Administration contains procedures for creating a disk array and deleting a disk array.

Creating a Disk Array



Disk arrays are created to allow access to hard disk drives in a logical manner. Hard disk drives are grouped in a disk array, and divided into logical drives for access by the operating system.

To create a disk array, do the following:

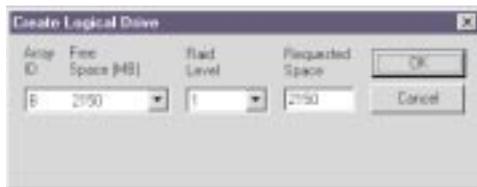
1. Click on the  icon on the tool bar or select **Manage Disk Arrays** from the **Advanced** pull-down menu; then, select **Create Disk Array**. A screen similar to the following appears.



2. Select one or more Ready (RDY) drives for the new disk array from the Main Screen of the Administration and Monitoring Utility. 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.



4. Select the appropriate RAID level from the pull-down list.

Note: RAID levels are determined according to the number of hard disk drives that you select for the disk array.

If you have one hard disk drive in the array, the logical drive can be only RAID level 0

If you have two hard disk drives in the array, the logical drive can be RAID level 0 or 1.

If you have three or more hard disk drives in the array, the logical drive can be RAID level 0, 1, or 5.

5. Enter the **Requested Space** in the entry field.

The default value assigned is calculated as the maximum available space for the RAID level assigned.

Note: The actual logical drive size may be slightly different from what you type in the **Requested Space** field. The size of a logical drive is determined by the RAID level and the number of hard disk drives. For example, a disk array consisting of three, 1 GB hard disk drives with a requested RAID level 0 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.

If your firmware version of your ServeRAID adapter is 2.40.xx or later, your RAID Level 5 logical drives are synchronized automatically in the background. A progress meter appears and reports the percentage complete. Refer to “ServeRAID Adapters and Firmware Versions” on page 154 for an explanation of the firmware version.

7. Initialize all new logical drives before using them. See “Initializing Logical Drives” on page 130.
8. If your firmware version is not 2.40.xx or later, synchronize all new RAID Level 5 logical drives before using them. See “Synchronizing Logical Drives” on page 131.

You have now completed the required steps for creating a ServeRAID configuration.

Deleting a Disk Array

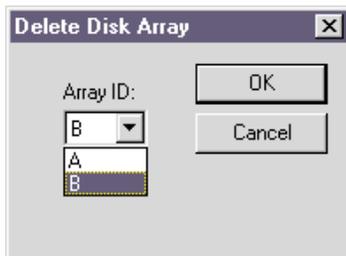


Deleting a disk array deletes all logical drives that are defined in that disk array. All data and programs on the logical drives in this disk array will be lost during this procedure.

Attention: Before proceeding, ensure that you have backed up any data and programs that you want to save.

To delete a disk array, do the following:

1. Click on the  on the tool bar or select **Manage Disk Arrays** from the **Advanced** pull-down menu; then, select **Delete Disk Array**. The following screen appears.



2. Select the desired disk array ID from the pull-down list.
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 letters that are assigned to the remaining drives when you restart the system.

Logical Drive Administration

Logical drive administration contains procedures for creating a logical drive, initializing and synchronizing a logical drive, and accessing blocked logical drives.

Creating a Logical Drive



Logical drives are required for an operating system to access data on the hard disk drives. You can create up to eight logical drives on each ServeRAID adapter.

To create a logical drive, do the following:

1. Click on the  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: RAID levels are determined according to the number of hard disk drives that you select for the disk array.

If you have one hard disk drive in the array, the logical drive can be only RAID level 0.

If you have two hard disk drives in the array, the logical drive can be RAID level 0 or 1.

If you have three or more hard disk drives in the array, the logical drive can be RAID level 0, 1, or 5.

4. Enter the amount of **Requested Space** in the entry field. The default value assigned is calculated as the maximum available

space for the RAID level assigned. The requested space must be between 2 MB and the maximum available.

Note: The actual logical drive size may be slightly different from what you type in the **Requested Space** field. The size of a logical drive is determined by the RAID level and the number of hard disk drives. For example, a disk array consisting of three, 1 GB hard disk drives with a requested RAID level 0 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.

If your firmware version of your ServeRAID adapter is 2.40.xx or later, your RAID Level 5 logical drives are synchronized automatically in the background. A progress meter appears and reports the percentage complete.

6. Initialize all new logical drives before using them. See “Initializing Logical Drives” on page 130.
7. If your firmware version is not 2.40.xx or later, synchronize all new RAID Level 5 logical drives before using them. See “Synchronizing Logical Drives” on page 131.

You have now completed the required steps for creating a ServeRAID configuration.

Notes:

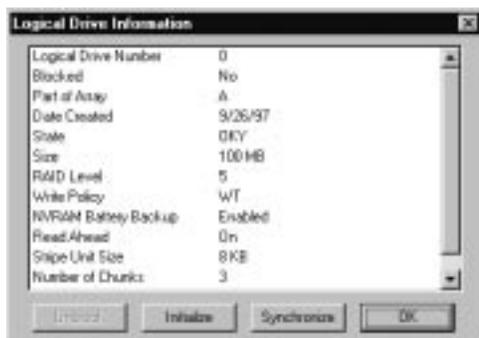
1. If you plan to use Logical Drive Migration (LDM), the maximum number of logical drives you can define is seven. Logical drive migration requires one free logical drive to perform the migration. Refer to “Logical Drive Migration Administration” on page 134 for more information.
2. If you plan to use the Change RAID Level feature of logical drive migration, all logical drives within a single disk array must be the same RAID level. Refer to “Change RAID Levels” on page 134 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, do the following:

1. Select the desired logical drive from the Main Screen of the Administration and Monitoring Utility. A screen similar to the following appears.



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" on page 131.

Synchronizing Logical Drives

The purpose of synchronizing logical drives is to compute and write the parity data on the selected drives.

It is good practice to synchronize 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.

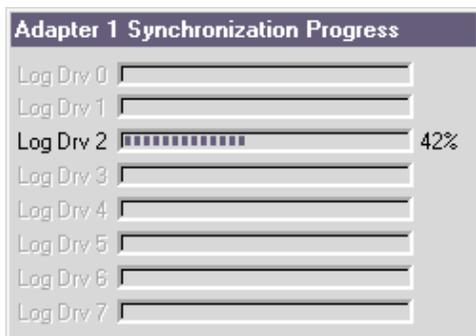
To synchronize a logical drive, do the following:

1. Select the desired logical drive from the Main Screen of the Administration and Monitoring Utility. A screen similar to the following appears.



2. Click on **Synchronize** to synchronize the drive.

- The synchronization begins automatically and reports progress information on the screen.



Note: Only one synchronization command can be active at a time.

Unblocking a Logical Drive

When the ServeRAID adapter performs a rebuild operation on an array, the data in RAID level 1 and RAID level 5 logical drives within the array is reconstructed. However, the data stored in any RAID level 0 logical drives in that array cannot be reconstructed. The data in the RAID level 0 logical drives is blocked when the ServeRAID adapter detects that the array is valid, but the data might be corrupt.

After the rebuild is complete, 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, do the following:

1. Select the logical drive that is blocked from the Main Menu of the Administration and Monitoring Utility. A screen similar to the following appears.



2. Click on **Unblock** to unblock the drive.
3. Initialize all unblocked logical drives before using them. See "Initializing Logical Drives" on page 130.
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 adapter 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 adapter 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 adapter supports changing RAID levels as follows:

- Change RAID level 0 to RAID level 5 by adding one hard disk drive

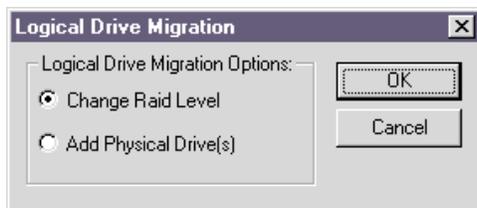
- Change two-drive RAID level 1 to RAID level 5 by adding one hard disk drive

- Change from RAID level 5 to RAID level 0 by removing one hard disk drive

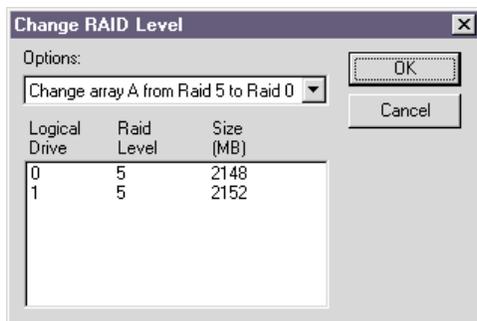
To change the RAID level of an existing disk array, do the following:

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 selected
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.

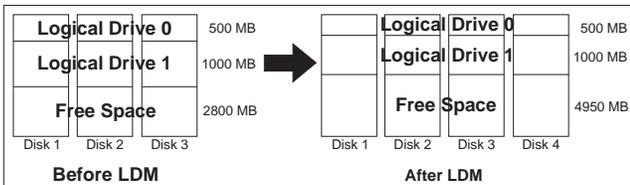
Adding a Physical Drive



You can expand currently defined arrays by adding one to three new hard disk drives.

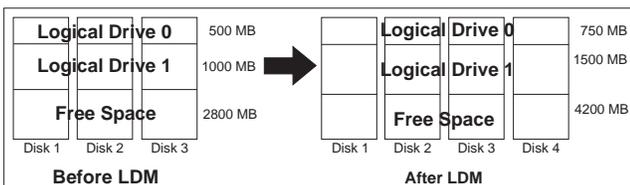
The ServeRAID adapter supports adding new space to a disk array in the following scenarios:

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.

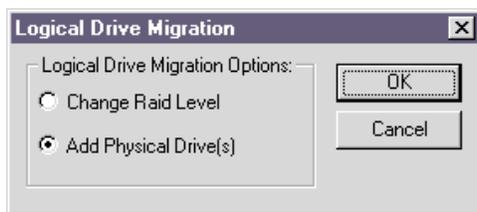


For example, an array uses three 2150 MB hard disk drives that are configured as two RAID level 5 logical drives (one 500 MB

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 5 logical drives (one 750 MB and 1500 MB) and 4200 MB of free space.

To add a physical device, do the following:

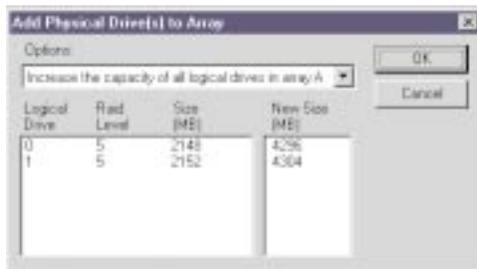
1. Click on the  icon on the tool bar or select **Manage Disk Arrays** from the **Advanced** pull-down menu; then, select **Logical Drive Migration**. A screen similar to the following appears:



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. Click on **OK** when you are finished selecting the drives.



5. Select one of the available options for expansion from the pull-down list.

The screen shows a list of the affected logical drives with their new sizes.

6. Click on **OK**.

Physical Device Administration

Physical device administration contains procedures for setting device states and rebuilding devices.

Setting Physical Device States

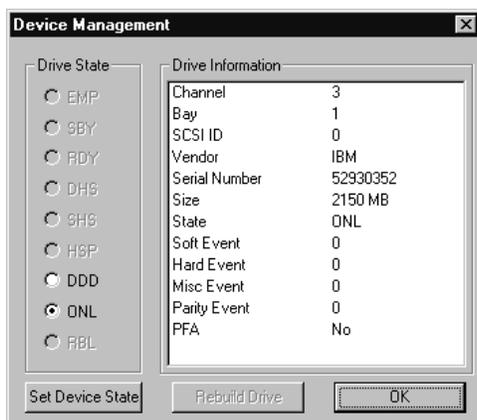
Physical devices are always in one of the following defined states, but can be redefined easily into another state.

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 change the physical device state, do the following:

1. Select the device from the Main Screen of the Administration and Monitoring Utility.



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.

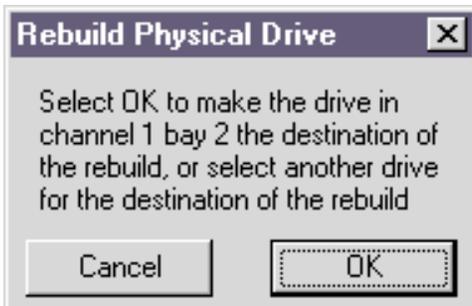
3. Click on **Set Device State**.

Rebuilding a Device

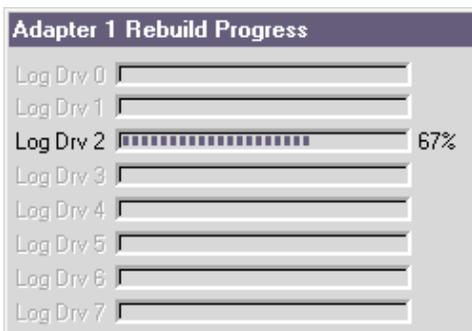
When a hard disk drive goes defunct (DDD), a Rebuild operation is required to reconstruct the data for the device in its respective disk array. Only RAID level 1 and RAID level 5 logical drives are reconstructed. RAID level 0 logical drives containing data cannot be reconstructed and therefore will be marked blocked. (Refer to “Unblocking a Logical Drive” on page 133 for more information.)

To perform a Rebuild operation, do the following:

1. Click on the DDD device on the Main Screen of the Administration and Monitoring Utility.
2. Click on **Rebuild Device**.



3. Select a RDY drive for the reconstructed data, or click on **OK** to use the same bay if you have replaced the device.
4. The reconstruction automatically begins and reports progress information on the screen.



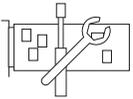
Notes:

1. Only one Rebuild operation can be performed at a time.
2. The Rebuild operation changes the hard disk drive state from DDD to RBL if the array contains a CRT logical drive. After the Rebuild operation completes, the hard disk drive state changes from RBL to ONL. (If you have rebuilt 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 adapter searches all the bays 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 adapter, copying the ServeRAID adapter configuration to the drives, initializing the adapter configuration and scanning for new drives.

Copying the Drive Configuration to the Adapter

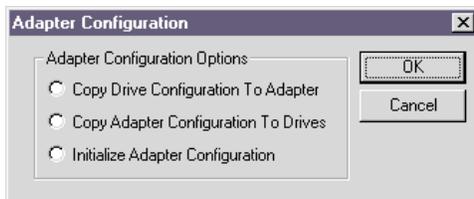


You can copy the configuration stored in the hard disk drives to the adapter. During this operation, any necessary rearrangement of the configuration is automatically performed and then written back to the configured hard disk drive reserve area.

This operation is useful when drives are imported from other systems.

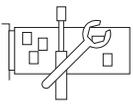
To perform this operation, do the following:

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**.

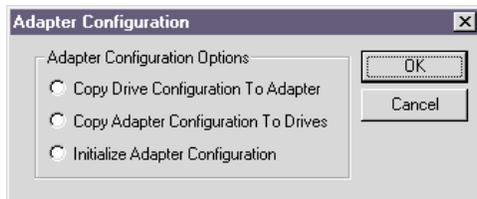
Copying the Adapter Configuration to the Drives



You can copy the configuration stored in the adapter to all configured hard disk drives.

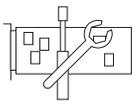
To perform this operation, do the following:

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 Adapter



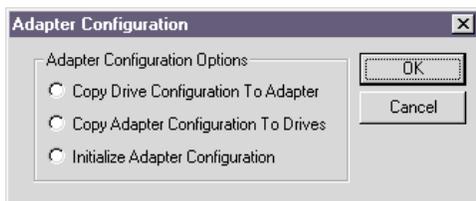
This operation initializes the adapter configuration by clearing all the logical drives and resetting all functional hard disk drives to RDY.

Attention: All the data and programs in the array are lost during this procedure.

This operation is useful when you want to start over and create a new configuration.

To perform this operation, do the following:

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 **Initialize Adapter Configuration**.
3. Click on **OK**.

Scanning for New Drives

You can scan for new devices attached to the ServeRAID adapter.



To scan for new drives, click on the  icon on the tool bar or select **Scan For New Drives** from the **Advanced** pull-down menu.

Using the ServeRAID Monitoring Functions

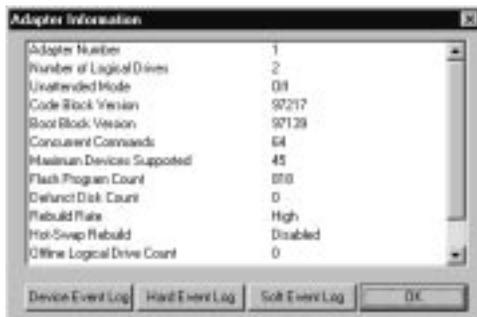
This section contains instructions for using the Administration and Monitoring Utility to monitor the ServeRAID adapter status information, event logs, logical drive information, and physical device information.

Monitoring the Adapter Status Information

The currently active adapter button is indicated by a green or red light. (Green indicates that the adapter is responding; red indicates that the adapter is not responding.) If there is more than one ServeRAID adapter in the system, click once on the appropriate adapter to make it active.

You can then monitor the adapter status by clicking on the active adapter button on the Main Screen of the Administration and Monitoring Utility.

A screen similar to the following appears.



Descriptions of the information that appears on the screen are as follows.

Note: You might have to scroll down, using the scroll bar, to see all of the items that appear on this screen.

Adapter Number	The active adapter (1 to 8).
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 an adapter startup error. On - The adapter chooses the recovery method when there is an adapter startup error.
Code Block Version	The current version number of the firmware microcode loaded on the adapter.
Boot Block Version	The current version number of the bootable microcode loaded on the adapter.
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	If your adapter supports hot-swap rebuild, this field displays the current state (Enabled or Disabled) of this feature.

- Offline Logical Drive Count** The current number of offline logical drives.
- Configuration Update Count** The number of times that the adapter configuration has been updated.
- NVRAM Battery Backup Device** The current state of the battery-backup cache (installed, not installed or defective)

Monitoring the Adapter Event Logs

The ServeRAID adapter stores, in the event logs, information concerning various unexpected events. There are three types of event logs: a device event table, a hard event log, and a soft event log.

To view the adapter event logs, do the following:

1. Click on the **adapter** on the Main Screen of the Administration and Monitoring Utility. A screen similar to the following appears.



2. Select the appropriate button at the bottom of the screen for the event log you want to view.

The Device Event Table contains event counters for each attached physical device.

The screenshot shows a window titled "View ServeRAID Device Event Log" with a table of event counters for "Adapter 1". The table has columns for "Chk", "Day", "Parity", "Soft", "PFA", "Hard", and "Misc" events. The data shows various counts for each event type over a period of 13 days.

Chk	Day	Parity	Soft	PFA	Hard	Misc
1	0	0	1	No	0	0
2	0	0	0	No	0	1
3	0	0	0	No	0	1
4	0	0	0	No	0	0
5	0	0	0	No	0	1
6	0	0	1	No	0	0
7	0	0	0	No	0	0
8	0	0	0	No	0	0
9	0	0	0	No	0	0
10	0	0	0	No	0	0
11	0	0	0	No	0	0
12	0	0	0	No	0	0
13	0	0	0	No	0	0

The device event table contains counters for the following:

Parity Event - The adapter 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 attached to the device.

Soft Event - These events are detected by the SCSI device and reported to the adapter through Check Condition status.

Predictive Failure Analysis (PFA) - The device has signaled the adapter that it might fail in the near future.

Hard Event - These events are detected by the ServeRAID adapter; most likely an event caused by the adapter.

Misc Event - These events are detected by the SCSI adapter; most likely an event caused by the device, such as selection timeout, unexpected bus free, or unexpected SCSI phase event.

The Hard Event Log might be used by your IBM service representative.



The Soft Event Log might be used by your IBM service representative.



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 Utility. A screen similar to the following appears.



The following explains the information that appears on the Logical Drive Information screen.

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's disk array (A, B, C, D, E, F, G, H).
Part of Merge Group	The identifier of the logical drive's merge group (1 through 254).
Date Created	The date the logical drive was created.
State	The current state (see "Logical Drive States" on page 24 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 bay number 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 Utility. A screen similar to the following appears.

Note: The number of fields shown on the following screen are dependent on whether they are relevant to your physical device.



The following explains the information on the Device Management screen.

Channel	The channel to which the device is connected (1, 2, or 3).
Bay	The bay number of the device on the channel (1 to 16).
SCSI ID	The SCSI ID (0 to 15).
Vendor	The manufacturer of the physical device.
Serial Number	The manufacturer's identifier.
Size	The size in megabytes.
State	The current state (see "Physical Device States" on page 22 and "Logical Drive States" on page 24 more information).
Soft Event	The number of soft events reported from the device event table
Hard Event	The number of hard events reported from the device event table.
Misc Event	The number of miscellaneous events reported from the device event table.
Parity Event	The number of parity events reported from the device event table.
PFA Event	Yes - device indicates predictive failure analysis event. No - device does not indicate predictive failure analysis error.

Appendix A. IBM PC Server POST/BIOS Update Information

If you are installing the ServeRAID adapter in an IBM PC Server, you might need to update the POST/BIOS code in the server.

Note: The version level of the POST/BIOS code installed in an IBM PC Server appears on the screen when you restart (boot) the system.

To obtain the latest POST/BIOS code for your server, do the following:

Download the current POST/BIOS version for your server from the IBM PC Company Bulletin Board System by calling 1-919-517-0001.

Obtain a POST/BIOS update from the IBM Help Center. In the United States call 1-800-772-2227. In Canada call 1-800-565-3344. Outside the United States and Canada, contact your IBM reseller, IBM marketing representative, or your place of purchase.

IBM PC Server PCI/Micro Channel Models

If you are installing the ServeRAID adapter in an IBM PC Server 720, you might need to update the system's POST/BIOS code. To function properly with the ServeRAID adapter, the PC Server 720 requires POST/BIOS Revision Level 14 (or higher).

IBM PC Server PCI/EISA Models

If you are installing the ServeRAID adapter in an IBM PC Server 320, 325, 330, 520, or 704, ensure that your server has an appropriate level of POST/BIOS code installed.

The appropriate POST/BIOS revision levels for the PCI/EISA models are as follows:

Server Models	POST/BIOS Levels
Model 320	Revision Level M54PE-16T3C (or higher)
Model 325	All Revision Levels
Model 330	All Revision Levels
Model 520	Revision Level M54PE-16T3C (or higher)
Model 704	Revision Level 8 (or higher)

IBM Netfinity Servers

If you are installing the ServeRAID adapter in an IBM Netfinity Server, ensure that your server has an appropriate level of POST/BIOS code installed. The appropriate POST/BIOS levels are as follows:

Server Models	POST/BIOS Levels
Netfinity 7000	All Revision Levels

ServeRAID Adapters and Firmware Versions

Following is a listing of the ServeRAID Adapters and the firmware version you need to run to take advantage of all of the latest features.

Note: Firmware (Codeblock) versions written in the format of 96XXX or 97XXX are superseded by versions written in the format of 2.xx.xx.

ServeRAID Adapter	Firmware (Codeblock)	BIOS
ServeRAID	2.23S	2.30
ServeRAID II	2.30	2.30
ServeRAID II	2.40	2.40

Appendix B. 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 *physical* drive. This grouping technique greatly enhances logical-drive capacity and performance.

In addition, if one of the hard disk drives fails (becomes defunct) in a RAID level 1 or 5 array, the system continues to run, with no operator intervention required, at reduced performance until the defunct drive is replaced and its contents rebuilt. This rebuilding process takes place in the background with the system online.

Once the drive contents are rebuilt, full performance and fault-tolerance functions are restored. You can replace the defunct drive without turning off the system (*hot-swap*). For more information about hot-swappable hard disk drives, refer to the documentation that comes with your computer.

Improved System Performance

When you group multiple physical hard disk drives into a logical drive, the ServeRAID adapter can transfer in parallel from the multiple drives in the array. This parallel transfer yields data-transfer rates that are many times higher than with non-arrayed 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 the highest level of performance in network environments.

IBM RAID Adapter Features

With RAID technology, data is *striped* across an array of hard disk drives. *Striping* is the process of storing data across all the disk drives that are grouped in an array. This data-distribution scheme complements the way the operating system requests data.

Overlapped Input/Output Operation

Because the ServeRAID adapter provides multiple data paths to and from arrayed drives, your system can respond to requests from several users simultaneously. Because the adapter can overlap input and output operations, if one user requests data that resides on the first drive of the array, and a second user requests data that resides on the second drive, the adapter can simultaneously deliver both pieces of information.

Interleave Depth/Stripe Unit

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 *interleave depth*. The interleave depth can be set for optimum system performance to a stripe unit size of 8 K, 16 K, 32 K, and 64 K bytes of data.

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*.

Cache

The ServeRAID adapter has 4 MB of memory. This cache memory comes configured to operate in a write-back mode, but can be changed to write-through.

Hot-Spare Drive Replacement

A *hot-spare drive* is a hard 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 drives in the array that it is intended to replace. You can define as many hot-spare drives as you want.

If a drive fails and it is part of a RAID level 1 or RAID level 5 logical drive, the system automatically switches to the hot-spare drive. The data from the defunct drive is automatically re-created in the hot-spare drive and the state of the defunct drive becomes defunct hot-spare (DHS). When you replace the defunct drive using the operating system-specific utility program or the ServeRAID Configuration program, the replacement drive becomes a hot-spare drive (HSP) drive.

Data Protection

For logical drive RAID levels 1 and 5, the ServeRAID adapter provides the system with a data redundancy technique that distributes data across all the drives in the array. In the event of a single drive failure, read and write requests are serviced by the remaining disks in the array, without loss of data. The defunct hard disk drive *appears* to be operating correctly, if at reduced performance, despite its total failure.

When you replace the defunct drive, the data in logical drives assigned RAID levels 1 and 5 is rebuilt on the new hard disk drive using the parity information stored on the other hard disk drives of the array. It is important that the defunct drive be replaced and rebuilt in a timely manner so that you avoid multiple-drive failure and reduced performance. After the drive contents are rebuilt, full performance and fault-tolerance functions are restored.

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. The RAID adapter automatically assigns RAID level 0 to all logical drives in an array containing only one hard disk drive.

A hard disk 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 assigned RAID level 1 or 5 in the same array, they will not lose data.

When you replace the failed drive, the RAID adapter automatically rebuilds all the logical drives assigned RAID levels 5 and 1 onto the replacement hard disk drive. However, the data that was in the 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, that is, data that you can re-create easily. You also might want to use a RAID level-0 logical drive when the work you are doing requires maximum capacity. RAID level 0 provides the largest capacity of the three RAID levels offered, because no room is taken up for redundant data or data parity storage.

RAID Level 1

RAID level 1 provides 100% data redundancy and requires at least two hard disk drives. With RAID level 1, the first stripe is the data stripe; the second stripe is the *mirror* (copy) of the first stripe, but written to another drive. If one of the hard disk drives fails, the RAID adapter switches read and write requests to the remaining functional drive in the array.

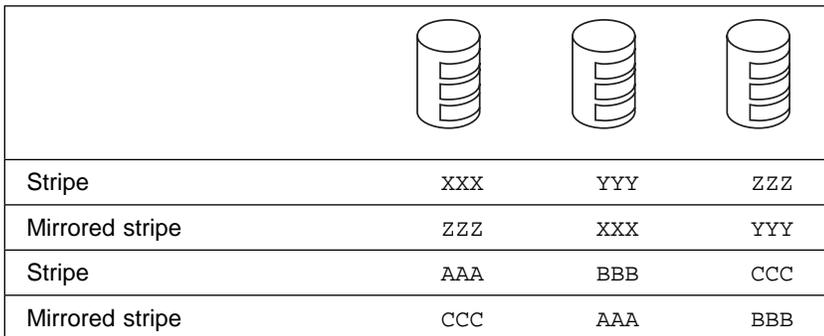
Because the data is mirrored, the capacity of the logical drive when assigned RAID level 1 is 50% of the physical capacity of the grouping of hard disk drives in the array.

RAID level 1 requires two drives. When you group more than two drives into a RAID level-1 array, the RAID adapter automatically assigns the Enhanced RAID level 1 to the array.

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

The Enhanced RAID level 1 stripes data and copies of the data across all 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 physical capacity of the grouping of hard disk drives in the array.

The following illustration shows data arranged in an array with three hard disk drives. The logical drive is assigned the Enhanced RAID level 1. Notice that the mirror of the first data stripe (XXX YYY ZZZ) is shifted one drive. The other data stripes follow the same pattern.



If you have only two drives available, the second drive is a mirror copy of the first drive.

RAID Level 5

RAID level 5 stripes data and parity across all drives in the array. When an array is assigned RAID level 5, the capacity of the logical drive 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.

If you want to have a hot-spare drive and also assign RAID level 5, you must have at least four hard disk drives.

Appendix C. IBM PC ServeRAID Adapter Startup Messages

This section lists the ServeRAID diagnostic and run-time error messages that might appear during startup.

The ServeRAID adapter contains a device-error table that collects statistics on the number and type of errors that occur on a selected hard disk drive. After correcting a problem with the disk array, clear the table so that you can identify any subsequent errors quickly. For more information, refer to “Viewing the Drive Information” on page 52.

All hard disk drives contain unique identifiers, such as the drive serial number and manufacturer. During configuration, the ServeRAID adapter stores this information.

The ServeRAID adapter also adds an additional unique identifier, called the host ID, to each hard disk drive that is part of a logical drive. The host ID is a user-defined, 12-character string. (Refer to “Viewing or Changing the ServeRAID Adapter Parameters” on page 54 for information on assigning a host ID.)

IBM PC ServeRAID Adapter POST and Setup Messages

During power-on self-test (POST), the ServeRAID adapter 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. When the ServeRAID adapter requires your input, a list of function keys will appear below the message.

New Drive Installed

When the ServeRAID adapter detects a new drive that is not part of the current configuration, the following message appears:

Following new drives found

```
(old state: new state: ch: bay)
```

This is an information message. No action is required.

Configured Drives are Missing

When the ServeRAID adapter detects that a previously configured drive is missing, the following message appears:

Following drives not responding

```
(old state: new state: ch: bay)
```

where *old state* is the configured state of the drive, *new state* is the state that the ServeRAID adapter will assign to the drive, *ch* and *bay* are the channel and bay where the drive was located previously.

Examples of the possible state changes include:

```
(ONL: DDD x: Y)
```

```
(RDY: EMP x: Y)
```

```
(SBY: EMP x: Y)
```

```
(RBL: DDD x: Y)
```

```
(HSP: DHS x: Y)
```

```
(SHS: DHS x: Y)
```

Two choices will follow this message:

- F4 Retry. Press this key after correcting a problem. For example, select retry after you turn on the external storage enclosure that contains the hard disk drive.
- F5 Press this key to accept the new state that the ServeRAID adapter will assign to the drive. For example, the adapter will assign the drive a state of defunct or empty.
- Note:** When F5 is selected, non-responding ONL and RBL drives will become DDD, RDY and SBY drives will become EMP, and HSP drives will become DHS.
- You can also select 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 adapter will assign the drive a state of defunct, 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.

Configured Drives Are Not in the Configured Location

When the ServeRAID adapter detects that a previously configured drive is present, but the drive is in a new location, the following message appears:

Following drives found in new location

```
(old ch: old bay: > new ch: new bay)
```

where *old ch* is the channel that matches the existing drive configuration information, *old bay* is the bay that matches the existing drive configuration information, *new ch* is the channel where the drive is now located, and *new bay* is the bay where the drive is now located. This message will be preceded by the previous messages and the **F5** function key choice because the drive is not found in its configured location.

For example, when the configured drives are not in the configured bay:

```
(1 :6 > 2:14)
(2 :5 > 2: 6)
```

In this example, the message indicates that the drive from Channel 1, Bay 6 is now located at Channel 2, Bay 14, and the drive from Channel 2, Bay 5 is now located at Channel 2, Bay 6. The drive might have been physically moved to the new bay.

Three choices will follow this message:

- F4 Retry. Press this key after correcting a problem. For example, select retry after you move the hard disk drive to its previously assigned location.
- F5 Press this key to accept the new state that the ServeRAID adapter will assign to the drive. For example, the adapter will assign the drive a state of defunct or empty.
- Note:** When F5 is selected, non-responding ONL and RBL drives will become DDD, RDY and SBY drives will become EMP, and HSP drives will become DHS.
- F6 Press this key to modify the configuration to match the current drive location.
- You might remove the hot-swap drives from the server while the server is powered down for maintenance. If you replace the drives but install them in different bays, you can press F6 to accept the new locations and the ServeRAID adapter will update the configuration.

New Adapter Installed in a Configured Server or Drives are Imported from a Different Server

When the ServeRAID adapter detects that the identifiers of the drives do not match the adapter configuration information, the following message appears:

Following new drive found

```
(host id: old ch: old bay: new ch:new bay)
```

where *host id* is the adapter identification, *old ch* is the channel that matches the drive configuration information, and *old bay* is the bay that matches the drive configuration information. *New ch* is the channel where the drive is now located, and *new bay* is the bay where the drive is now located. This message may be preceded by the previous two messages and the **F5** and **F6** function key choice because the drives are not found in the configured location.

For example, when drives are imported from a server with the host ID of *My Machine*:

```
(My Machine : 1:6 > 2:1 )
```

In this example, the message indicates that the drive from Channel 1, Bay 6 is now located at Channel 2, Bay 10. The drive might have been physically moved to the new bay.

Three-to-Four choices will follow this message:

F4 Retry. Press this key after correcting the problem. For example, select retry 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 Press this key to accept the new state that the ServeRAID adapter will assign to the drive. For example, the adapter will assign the drive a state of defunct or empty.

Note: When F5 is selected, non-responding ONL and RBL drives will become DDD, RDY and SBY drives will become EMP, and HSP drives will become DHS.

F6 This choice is not always active. If it is, you can press this key to modify the configuration to match the current drive location.

You might remove the hot-swap drives from the server while the server is powered down for maintenance. If you replace the drives but install them in different bays, you can press F6 to accept the new locations and the ServeRAID adapter will update the configuration.

F7 Press this key to import the configuration information from the drive and to update the configuration information on the ServeRAID adapter. This choice is useful when you replace the ServeRAID adapter in an existing disk-array model.

You also might press F7 if you replace a whole set of drives with drives that were configured in another server with a ServeRAID adapter.

Note:

When you install drives in a server and the adapter does not have a configured logical drive, the **F7** function key will not appear. For example, this can occur when you replace the ServeRAID adapter itself. The adapter 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 (refer to “Using the ServeRAID Adapter Mini-Configuration Program” on page 92).
2. Select **Advanced Functions**.
3. Select **Import Configuration from Drives to Adapter** and following the instructions on the screen.

IBM PC ServeRAID Adapter Status and Error Messages

This table lists, in alphabetic order, messages associated with the IBM ServeRAID II Ultra SCSI Adapter.

Where the “Action” information tells you to start the IBM ServeRAID configuration program, insert the IBM ServeRAID Configuration diskette in the primary diskette drive (usually drive A); then, press **Ctrl+Alt+Del**.

Where *m* or *n* appears in these messages, a number will appear in the actual message.

***n* logical drives are installed.**

Cause: *n* represents the number of defined logical drives.

Action: This is an information message. No action is required.

Cannot disable this adapter BIOS.

Cause: The adapter was unable to prevent an extra copy of the adapter BIOS from being stored on the server. This condition occurs when the server contains multiple ServeRAID adapters.

Action: Follow the instructions on the screen.

Following drives not responding. (old state: new state ch: bay)

Cause: One or more drives did not respond to the adapter. This message will occur if the adapter detected that a configured drive is missing.

Action: Refer to “Configured Drives are Missing” on page 162.

Following new drives found. (old state: new state ch: bay)

Cause: One or more drives were found in an unconfigured bay. For each drive listed, a new state of Ready (RDY) appears. If non hard disk drives are found, they are shown in the Standby (SBY) state.

Action: This is an information message. No action is required.

Following drives found in new location (old ch: old bay > new ch: new bay)

Cause: POST found that the location of one or more drives does not match the stored configuration information.

Action: Refer to "Configured Drives Are Not in the Configured Location" on page 163.

Installation stopped.

Cause: The server cannot access the ServeRAID adapter.

Action: This is a follow-on message to a preceding message. Follow the "Action" instructions for the preceding message to resolve the problem.

Recoverable configuration error; run Configuration program.

Cause: The configuration data stored in the ServeRAID adapter's NVRAM does not match the configuration information stored in the adapter's EEPROM.

Action: Insert the IBM ServeRAID Adapter Configuration Diskette; then, press **Ctrl+Alt+Del** to restart the system. Select **Advanced Functions** on the Main Menu and synchronize the adapter's configuration. Refer to "Configuration Synchronization" on page 89.

WARNING: n logical drives are critical; n logical drives are offline.

Cause: One or more hard disk drives have failed.

Action: Replace the defunct drives as soon as possible to prevent data loss.

NVRAM cache controller is not responding - error code : 01H

F9: Remove NVRAM cache controller from configuration

F10: Exit without any change

Cause: The ServeRAID 8MB/Battery-Backup Cache is not installed or has been removed but not disabled

Action: Press F9 to remove the NVRAM cache controller from the ServeRAID configuration or Press F10 to exit without changing the configuration.

Interrupt Status Port Register (ISPR) Error Codes

The following information describes the interrupt status port register error codes and, if required, the actions you should take to correct the error.

Description: No Adapter Hardware Error

Status Code: EF10

Action: None

Description: Flash Checksum Error

Status Code: 1XXX

Action: Call for service.

Description: Code DRAM Error

Status Code: 2XXX

Action: Call for service.

Description: NVRAM Error

Status Code: 3XXX

Action: Call for service.

Description: Timer/Cache Memory Control Error

Status Code: 4XXX

Action: Call for service.

Description: Cache Mem Ctl Error

Status Code: 5XXX

Action: Call for service.

Description: Cache DRAM Error

Status Code: 6XXX

Action: Call for service.

Description: Host/Local PCI Bus Interface Error

Status Code: 7XXX

Action: Call for service.

Description: SCSI IOP Error

Status Code: 8XXX

Action: Call for service.

Description: SCSI Termination Error

Status Code: 9XXX

Action: Call for service.

Description: SCSI IOP Error

Status Code: AXXX

Action: Call for service.

Description: SCSI Bus Interface Error

Status Code: BXXX

Action: Call for service.

Appendix D. 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. This section provides information about those sources.

Services available and telephone numbers listed are subject to change without notice.

Before You Call for Service

Many 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 option or software.

Getting Customer Support and Service

Purchasing an IBM PC 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, such as:

- Hardware setup and configuration
- Preinstalled software
- OS/2, DOS, and Windows
- Networking
- Communications

In addition, the latest device driver updates are available.

The IBM PC Company 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 PC Company BBS:

In the U.S., call 1-919-517-0001.

In Canada:

- In Halifax, call 902-420-0300.
- In Montreal, call 514-938-3022.
- In Toronto, call 905-316-4255 or 416-956-7877.
- In Vancouver, call 604-664-6461 or 604-664-6464.
- In Winnipeg, call 204-934-2735.

Commercial online services that contain information about IBM products include:

CompuServe

Use the following GO words: APTIVA, IBMPS2, ThinkPad, PowerPC, ValuePoint, IBMSVR, or IBMObI.

PRODIGY

Use the Jump command; type **IBM** and select **PC Product Support**.

America Online

Use the "Go to" keyword **IBM Connect**.

Using the World Wide Web

On the World Wide Web, the IBM Personal Computers home page has information about IBM Personal Computer products and support. The address for the IBM Personal Computer home page is:

<http://www.us.pc.ibm.com>

Also available to you is the latest information about product compatibility and configuration. This information is updated as new PC Server products are announced. For a product to be included in the PC Server compatibility list, it must pass a strict set of hardware and operating system compatibility tests. The following is a sample

of the information available at <http://www.us.pc.ibm.com>, under the PC Server information on the World Wide Web.

- A listing of products that have been tested for compatibility with IBM PC Servers.

- Certification and compatibility information about Network Operating Systems (NOS) and Operating Systems (OS)²

- Direct access to device drivers, flash BIOS updates, and other code

- Descriptions of PC Server compatibility and certification tests

Getting Help by Telephone

During the warranty period, you can get help and information by telephone through the IBM HelpWare PC Support Line. Expert technical-support representatives are available to assist you with questions you might have on the following:

- Installing and setting up IBM options purchased from IBM or an IBM reseller
- 30-day, preinstalled-operating-system support
- Arranging for service (on-site or carry-in)
- Arranging for overnight shipment of customer-replaceable parts

Please have the following information ready when you call:

- Serial numbers of your server, 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 server when you call.

² IBM makes no guarantee regarding the compatibility of specific products.

These services are available 24 hours a day, 7 days a week.³

In the U.S. and Puerto Rico, 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 Around the World

If you need to move your server 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.

For more information or to register for International Warranty Service in the U.S. or Canada, call 1-800-497-7426.

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.

³ Response time will vary depending on the number and complexity of incoming calls.

Appendix E. Product Warranties and Notices

The following is the statement of limited warranty for the United States, Canada, and Puerto Rico.

International Business Machines Corporation

Armonk, New York, 10504

Statement of Limited Warranty

The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you originally 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. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. If you have any questions, contact IBM or your reseller.

Machine: IBM ServeRAID II Ultra SCSI Adapter

Warranty Period*: Three Years

**Contact your place of purchase for warranty service information.*

Production Status

Each 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 warranty terms apply.

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 receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period IBM or your reseller, if authorized by IBM, will provide warranty service under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

For IBM or your reseller to provide warranty service for a feature, conversion, or upgrade, IBM or your reseller may require that the Machine on which it is installed be 1) for certain Machines, the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Many of these transactions involve the removal of parts and their return to IBM. You represent that all removed parts are genuine and unaltered. A part that replaces a removed part will assume the warranty service status of the replaced part.

If a Machine does not function as warranted during the warranty period, IBM or your reseller will repair it or replace it with one that is at least functionally equivalent, without charge. The replacement may not be new, but will be in good working order. If IBM or your reseller is unable to repair or replace the Machine, you may return it to your place of purchase and your money will be refunded.

If you transfer a Machine to another user, warranty service is available to that user for the remainder of the warranty period. You should give your proof of purchase and this Statement to that user. However, for Machines which have a life-time warranty, this warranty is not transferable.

Warranty Service

To obtain warranty service for the Machine, you should contact your reseller or call 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 will provide certain types of repair and exchange service, either at your location or at IBM's or your reseller's service center, to restore a Machine to good working order.

When a type of 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. 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 ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange.

You agree to:

1. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
2. where applicable, before service is provided —
 - a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provide,
 - b. secure all programs, data, and funds contained in a Machine, and
 - c. 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.

Extent of Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

The warranties may be voided by misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, removal or alteration of Machine or parts identification labels, or failure caused by a product for which IBM is not responsible.

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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 or loss, up to the greater of U.S. \$100,000 or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR LOSSES OR 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 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 EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

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IBM	PowerPC
Micro Channel	ValuePoint
OS/2	Predictive Failure Analysis
HelpWare	

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Phoenix	Phoenix Technologies, Ltd.
Prodigy	Prodigy Services Company
OpenServer	The Santa Cruz Operation, Inc.
SCO	The Santa Cruz Operation, Inc.

Microsoft, Windows, and Windows NT are trademarks or registered trademarks of the Microsoft Corporation.

Other company, product, and service names may be trademarks or service marks of others.

Federal Communications Commission (FCC) Statement

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM authorized dealers. 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.

Responsible Party:

International Business Machines Corporation
Old Orchard Road

Armonk, NY 10504
Telephone: 1-919-543-2193

Industry Canada Class B Emission Compliance Statement

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Community Directive Conformance Statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

Glossary

This glossary includes terms and definitions from the following publications.

The American National Dictionary for Information Systems, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies may be purchased from the American National Standards Institute, 11 West 42 Street, New York, NY 10036. Definitions are identified by the symbol (A).

The ANSI/EIA Standard 440-A: *Fiber Optic Terminology*. Copies may be purchased from the Electronic Industries Association, 2001 Pennsylvania Avenue, N.W., Washington DC 20006. Definitions are identified by the symbol (E).

The Information Technology Vocabulary, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). These definitions are identified by the symbol (I). Definitions from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1 are identified by the symbol (T), indicating that final agreement has

not yet been reached among the participating National Bodies of SC1.

A

array. An arrangement of data in one or more dimensions: a list, a table, or a multidimensional arrangement of items.

B

block. A string of data elements recorded or transmitted in a unit. The elements may be characters, words, or physical records.

byte. A string of eight bits that is treated as a unit, and that represents a character.

C

cache memory. A special buffer storage, smaller and faster than main storage, that is used to hold a copy of instructions and data in main storage that are likely to be needed next by the processor, and that have been obtained automatically from main storage.

CDR. CD-ROM

CRT. Critical

D

DDD. Defunct drive.

defunct. Irrecoverable; failed; not responding.

DHS. Defunct hot-spare.

disk array. (1) A grouping of hard disks that can be logically considered one drive. (2) A grouping of hard disks over which a data file is spread.

E

electronically erasable programmable read-only memory (EEPROM). A PROM that can be erased by a special process and reused.

EMP. Empty.

F

FRE. Free logical drive. (Logical drives are not defined.)

G

GB. Gigabyte; equal to approximately 1 000 000 000 bytes.

H

hard disk drive. A stand-alone disk drive that reads and writes data on rigid disks.

hot-spare drive. A hard disk drive that is installed in a computer and configured by the system for use in the event of a drive failure.

HSP. Hot spare.

I

initialize. (1) To set counters, switches, addresses, or contents of storage to zero or other starting values at the beginning of, or at prescribed points in, the operating of a computer routine. (2) To prepare for use; for example, to initialize a hard disk or diskette.

interleave. To arrange parts of one sequence of things or events so that they alternate with parts of one or more other sequences of the same nature and so that each sequence retains its identity.

interleave depth. 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 in the array.

interleaving. The simultaneous accessing of two or more bytes or streams of data from distinct storage units.

K

KB. Kilobyte; equal to approximately 1000 bytes.

L

LDM. Logical drive migration.

logical drive. Part of an array.

low-level format. The writing of track and sector control information on the disk so that a computer system can store data in and subsequently retrieve data from the disk.

M

mapping. The establishing of correspondences between a given logical structure and a given physical structure.

MB. Megabyte; equal to approximately 1 000 000 bytes.

menu-driven. Concerning application software allowing user to select operations from one or more menus without entering keyboard commands.

mirroring. The process of writing the same data to two disk units within the same auxiliary storage pool (disk array) at the same time. The two disk units become a mirrored pair, allowing the system to continue when one of the mirrored units fails.

nonvolatile random access memory (NVRAM). Random access memory that retains its contents after electrical power is shut off.

N

NVRAM. Nonvolatile random access memory.

O

OFL. Offline.

OKY. Good functional state.

ONL. Online.

overlap. To perform an operation at the same time another operation is being performed; for example, to perform input/output operations while instructions are being executed by the processing unit.

P

parity. The state of being odd or even used as the basis of a method of detecting errors in binary-coded data.

parity bit. A binary digit appended to a group of binary digits to make the sum of all the digits, including the appended binary digit, either odd or even as preestablished.

pop-up window. A box on the display screen that displays information or asks the user to make choices.

R

RAID. Redundant array of independent disks.

RBL. Rebuild.

RDY. Ready.

redundancy. In a functional unit, the existence of more than one means for performing a required function.

S

SBY. Standby.

sector. A predetermined angular part of a track or band on a magnetic disk that can be addressed.

server. In a network, a data station that provides facilities to other stations; for example, a file server, a print server, a mail server.

SHS. Standby hot-spare.

stripe. The collection of sectors, in logical order, from the first to the last drive of the disk array, over which data is stored.

striping. The process of storing data across all the drives grouped in an array.

synchronize. In a disk array, to compute and store the parity of all the data in the array.

SYS. System.

T

TAP. Tape.

throughput. A measure of the amount of work performed by a computer system over a period of time, for example, number of jobs per day.

toggle. To switch between two modes.

W

WB. Write-back.

write-back. (1) WB. (2) The write policy mode that sends a completion status to the system when the data is entered into memory. (3) Compare with *write-through*.

write operation. An output operation that sends a processed record to an output device or an output file.

write policy. The mode set by the system controller that determines when the completion status is sent to the system; it can be either when the data is written to the hard disk (write-through mode) or when the data is entered into memory (write-back mode).

WT. Write-through.

write-through. (1) WT. (2) The write policy mode that sends a completion status to the system when the data is written to the

device. (3) Compare with *write-back*.

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