

ServeRAID-4x Ultra160 and ServeRAID-5i Ultra320
SCSI Controllers



Hardware Maintenance Manual

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SCSI Controllers



Hardware Maintenance Manual

Note

Before using this information and the product it supports, be sure to read "Notices" on page 160.

Third Edition (July 2002)

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About this manual

This manual contains diagnostic information, a Symptom-to-FRU index, service information, error codes, error messages, and configuration information for the IBM ServeRAID™ -4x Ultra160 and ServeRAID-5i Ultra320 controllers.

Note: The IBM ServeRAID product can be either a controller on an adapter or a controller on the system board of the server. For consistency in this manual, the ServeRAID product is referred to as a ServeRAID controller, unless it is specifically noted otherwise.

To install device drivers and utility programs for an IBM ServeRAID controller that comes as a standard feature on an IBM system board, see the installation instructions and CDs provided with the server for instructions.

Important: This manual is intended for trained servicers who are familiar with IBM server products.

Important safety information

Be sure to read all caution and danger statements in this book before performing any of the instructions. See “Safety information” on page 127.

Leia todas as instruções de cuidado e perigo antes de executar qualquer operação.

注意和危险声明 (简体中文)

重要事项:

本书中的所有注意和危险声明之前都有编号。该编号用于英语的注意或危险声明与 *Safety Information* 一书中可以找到的翻译版本的注意或危险声明进行交叉引用。

例如，如果一个注意声明以编号 1 开始，那么对该注意声明的翻译出现在 *Safety Information* 一书中的声明 1 中。

在按说明执行任何操作前，请务必阅读所有注意和危险声明。

注意及危險聲明 (中文)

重要資訊：

本書中所有「注意」及「危險」的聲明均以數字開始。此一數字是用來作為交互參考之用，英文「注意」或「危險」聲明可在「安全資訊」(Safety Information)一書中找到相同內容的「注意」或「危險」聲明的譯文。

例如，有一「危險」聲明以數字 1 開始，則該「危險」聲明的譯文將出現在「安全資訊」(Safety Information)一書的「聲明」1 中。

執行任何指示之前，請詳讀所有「注意」及「危險」的聲明。

Prenez connaissance de toutes les consignes de type Attention et Danger avant de procéder aux opérations décrites par les instructions.

Lesen Sie alle Sicherheitshinweise, bevor Sie eine Anweisung ausführen.

Accertarsi di leggere tutti gli avvisi di attenzione e di pericolo prima di effettuare qualsiasi operazione.

중요:

본 Server Library에 있는 모든 주의 및 위험 경고문은 번호로 시작합니다. 이 번호는 영문 주의 혹은 위험 경고문과 이 절에 나오는 번역된 버전의 주의 혹은 위험 경고문을 상호 참조하는 데 사용됩니다.

예를 들어, 주의 경고문이 번호 1로 시작하면, 번역된 해당 주의 경고문을 본 절의 경고문 1에서 찾아볼 수 있습니다.

모든 지시사항을 수행하기 전에 반드시 모든 주의 및 위험 경고문을 읽으십시오.

Lea atentamente todas las declaraciones de precaución y peligro ante de llevar a cabo cualquier operación.

Online support

You can download the most current diagnostic, BIOS flash, and device driver files from <http://www.ibm.com/pc/support> on the World Wide Web.

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General checkout

The following general checkout procedures are for the system boards containing integrated ServeRAID controllers.

Attention: The drives in the system you are servicing might have been rearranged or the drive startup sequence changed. Be extremely careful during write operations such as copying, saving, or formatting. Data or programs can be overwritten if you choose an incorrect drive.

Diagnostic error messages appear when a test program finds a problem with a hardware option. For the test programs to determine if a test *Passed*, *Failed*, or *Aborted* properly, the test programs check the error-return code at test completion.

General error messages appear if a problem or conflict is found by an application program, the operating system, or both. For an explanation of these messages, refer to the information supplied with that software package.

For systems that are part of a shared DASD cluster, run one test at a time in looped mode. Do not run all tests in looped mode, as this could enable the DASD diagnostic tests.

Note: A failed system might be part of a shared DASD cluster (two or more systems sharing the same external storage device(s)). Prior to running diagnostics, verify that the failing system is not part of a shared DASD cluster.

A system might be part of a cluster if:

- The customer identifies the system as part of a cluster.
- One or more external storage units are attached to the system and at least one of the attached storage units is additionally attached to another system or unidentifiable source.
- One or more systems are located near the failing system.

If the failing system is suspected to be part of a shared DASD cluster, all diagnostic tests can be run except diagnostic tests that test either the storage unit (DASD residing in the storage unit), or the storage controller attached to the storage unit.

Notes:

1. Before replacing any FRUs, ensure the latest level of system BIOS is installed on the system. Also, ensure that the latest level or customer-approved level of the ServeRAID controller BIOS and firmware are installed. Down-level BIOS or firmware might cause false errors and unnecessary replacement of the controller.
2. If multiple error codes are displayed, diagnose the first error code displayed.
3. If an installed device is not recognized by the diagnostics program, that device might be defective.

The following steps list the general checkout procedures.

001

IS THE SYSTEM PART OF A CLUSTER?

YES: Schedule maintenance with the customer. Shut down all systems related to the cluster. Run the hard disk test of the server diagnostics on the shared storage.

NO: Go to step 2.

002

DO THE FOLLOWING:

- Power-off the server and all external enclosures.
- Check all cables and power cords.
- Set all display controls to the middle position.
- Power-on all external enclosures.
- Boot the machine and watch for the ServeRAID controller BIOS screen.

003

DID THE BIOS SCREEN APPEAR?

YES: Go to Step 4.

NO: Try to download the ServeRAID Firmware and BIOS to the controller and reboot. If unsuccessful, replace the ServeRAID controller. To download relevant files, see “Obtaining ServeRAID updates” on page 61.

004

NOTE THE STATUS OF THE SERVERAID POWER-ON SELF-TEST (POST). DID THE POST INDICATE A PASSED STATUS?

YES: Go to Step 5.

NO: Refer to the “Symptom-to-FRU index” on page 65.

005

NOTE THE DRIVE CONFIGURATION STATUS. DID THE DRIVE CONFIGURATION STATUS INDICATE A PASSED STATUS?

YES: Controller is OK.

NO: Refer to the drive configuration conflict resolution procedures for the controller in “BCS and ECS register codes” on page 95.

General information

This *Hardware Maintenance Manual* provides information for configuring an IBM ServeRAID controller and using the ServeRAID utility programs and the IBM ServeRAID Cluster Solution, and troubleshooting errors.

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

Notices that are used in this book

This book contains the following notices designed to highlight key information:

- **Notes:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or difficult situations.
- **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.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

IBM ServeRAID Support CD

The *IBM ServeRAID Support CD* is shipped with the controller and contains the following:

- ServeRAID ROM Update Wizard
- Device drivers
- ServeRAID Manager program
- IPSSSEND command-line program
- Diskette images
- ServeRAID files needed to install Microsoft® Cluster Server (MSCS)
- ServeRAID publications

ServeRAID support information is also available at <http://www.ibm.com/pc/support/>.

ServeRAID ROM Update Wizard

The IBM ServeRAID ROM (read-only memory) Update Wizard is a program designed to automatically identify and scan each ServeRAID controller installed in your server. If the BIOS and firmware code need updating, the wizard will give you the opportunity to do so.

Device drivers

The device drivers are located in the following directory on the *IBM ServeRAID Support CD*:

e:/operatingsystem/DRIVER

where *e* is the CD-ROM drive and *operatingsystem* is the specific operating system used in the ServeRAID installation.

The device drivers are also located on the operating-system-specific *IBM ServeRAID Support* diskettes.

ServeRAID Manager program

Use this program to configure arrays and logical drives using ServeRAID controllers. ServeRAID Manager operates in two ways: in startable-CD mode and as an installed program. In startable-CD mode, you can configure your ServeRAID adapter *before* you install an operating system.

This program is available in the following directory:

e:/operatingsystem/MANAGER

where *e* is the CD-ROM drive and *operatingsystem* is the specific operating system used in the ServeRAID installation.

IPSSEND command-line program

Use this program to configure and manage your ServeRAID controllers. This program is available on both the *IBM ServeRAID Support CD* and the operating-system-specific *IBM ServeRAID Support* diskettes.

Diskette images

Use these images to create the ServeRAID diskettes. These diskettes include the following:

- *IBM ServeRAID BIOS and Firmware Update (1 of 3)* diskette
- *IBM ServeRAID BIOS and Firmware Update (2 of 3)* diskette
- *IBM ServeRAID BIOS and Firmware Update (3 of 3)* diskette
- *IBM ServeRAID Failover Support for Windows NT® 4.0 and Windows® 2000* diskette
- *IBM ServeRAID Cluster Solution for Windows NT 4.0 and Windows 2000* diskette
- *IBM ServeRAID Support for Windows 2000 Server* diskette
- *IBM ServeRAID Support for Windows (Professional Editions)* diskette
- *IBM ServeRAID Support for Windows NT 4.0* diskette
- *IBM ServeRAID Support for IBM OS/2®* diskette
- *IBM ServeRAID Support for Novell NetWare* diskette
- *IBM ServeRAID Support for Caldera UnixWare and Open UNIX®* diskette
- *IBM ServeRAID Support for SCO OpenServer* diskette
- *IBM ServeRAID Support for Red Hat Linux (1 of 2)* diskette
- *IBM ServeRAID Support for Red Hat Linux (2 of 2)* diskette
- *IBM ServeRAID Support for Caldera OpenLinux (1 of 2)* diskette
- *IBM ServeRAID Support for Caldera OpenLinux (2 of 2)* diskette

- *IBM ServeRAID Support for SuSE Linux* diskette
- *IBM ServeRAID Support for Turbolinux* diskette
- *IBM ServeRAID Support for DOS* diskette

These files are available in the *e:/DISKETTE* directory, where *e* is the CD-ROM drive.

For instructions on creating the diskettes, see “Creating ServeRAID diskettes” on page 89.

ServeRAID files needed to install Microsoft Cluster Server (MSCS)

Note: The IBM ServeRAID Cluster Solution requires either Windows 2000 or Windows NT 4.0.

These files are available in the following directory:

e:/operatingsystem/CLUSTER

where *e* is the CD-ROM drive and *operatingsystem* is the specific operating system used in the ServeRAID installation.

ServeRAID publications

The following books are available in Portable Document Format (PDF) on the *IBM ServeRAID Support* CD in the */BOOKS* directory:

- *IBM ServeRAID User's Reference, Version 5.10* (SRAID51.PDF)
- *IBM ServeRAID Device Driver Installation Instructions* (DEVDRV51.PDF)

The following booklets are extracted from the *IBM ServeRAID User's Reference, Version 5.10* and are available on the *IBM ServeRAID Support* CD in the */BOOKS* directory:

- *IBM ServeRAID-4 Ultra160 and ServeRAID-5i Ultra320 SCSI Controllers Installation Guide* (INSTAL51.PDF)
- *Configuring IBM ServeRAID Controllers for Failover* (FAILOV51.PDF)
- *Installing the IBM ServeRAID Cluster Solution* (CLUSTE51.PDF)
- *Understanding IBM ServeRAID Technology* (TECHNO51.PDF)

Note: Use Adobe Acrobat Reader to view these files. The *IBM ServeRAID Support* CD contains the Acrobat Readers for Microsoft Windows, IBM OS/2, and Linux® in the */BOOKS/READERS* directory.

If you are installing the IBM ServeRAID Cluster Solution, you might need to refer to the *IBM Shared Disk Clustering Hardware Reference*. This book provides general information about planning and configuring a shared-disk cluster using IBM server products. It contains illustrations, descriptions, and parts listings for various high-availability, shared-disk cluster examples.

Note: You can obtain this publication from the IBM Support Web site. See “Obtaining ServeRAID updates” on page 61 for additional information.

In addition, the following IBM Redbooks™ might be of interest:

- *Implementing Netfinity® Disk Subsystems: ServeRAID SCSI, Fibre Channel, and SSA*

- *Tuning Netfinity Servers for Performance: Getting the most out of Windows 2000 and Windows NT 4.0*
- *Netfinity Director: Integration and Tools*
- *Netfinity Clustering Planning Guide*

You can download these books from the IBM Web site at <http://www.ibm.com/redbooks/>.

Supported operating systems

The following operating systems are supported with ServeRAID-4 and ServeRAID-5i controllers:

- Microsoft XP Professional (ServeRAID-4Lx controller only)
- Microsoft Windows 2000 Advanced Server, Datacenter, and Server
- Microsoft Windows 2000 Professional (ServeRAID-4Lx controller only)
- Microsoft Windows NT 4.0 Enterprise Edition and Server
- Novell NetWare (versions 5.x and 6.0)
- IBM OS/2 WARP[®] Server for e-business
- Red Hat Linux (versions 6.2, 7.0, 7.1, 7.2, and 7.3)
- SuSE Linux (versions 7.1, 7.2, 7.3, and 8.0)
- Caldera OpenLinux (versions 3.1 and 3.1.1)
- Turbolinux (versions 6.5 and 7.0)
- SCO OpenServer 5.0.6a
- Caldera UnixWare 7.1.1
- Caldera Open UNIX 8.0

Controller features

The standard features of the ServeRAID controllers are listed in the section for the individual controllers.

The features of ServeRAID software and utility programs supported by ServeRAID controllers are listed in the following table.

| ServeRAID features | ServeRAID controller | | | | | |
|---|----------------------|------|-----|------|-----|-----|
| | -5i | -4Mx | -4M | -4Lx | -4L | -4H |
| ServeRAID ROM Update Wizard | Yes | Yes | Yes | Yes | Yes | Yes |
| ServeRAID Manager | Yes | Yes | Yes | Yes | Yes | Yes |
| ServeRAID Mini-Configuration program | Yes | Yes | Yes | Yes | Yes | Yes |
| IPSEND | Yes | Yes | Yes | Yes | Yes | Yes |
| IPSEND FlashCopy [™] function (Windows XP Professional, Windows 2000, and Windows NT only) | No | Yes | Yes | Yes | Yes | Yes |
| IPSMON (NetWare only) | Yes | Yes | Yes | Yes | Yes | Yes |
| Clustering (Windows NT and Windows 2000 only) | No | Yes | Yes | Yes | Yes | Yes |
| Failover (Windows NT and Windows 2000 only) | No | Yes | Yes | Yes | Yes | Yes |

Connector locations

This section provides illustrations of the SCSI channel connectors and cable connectors for the ServeRAID-4H, ServeRAID-4L, ServeRAID-4Lx, ServeRAID-4M, ServeRAID-4Mx, and ServeRAID-5i controllers.

Note: You cannot attach internal *and* external SCSI devices to the same channel. For example, you cannot attach devices to both external Channel 1 and internal Channel 1. The ServeRAID-4 controllers do not support configurations that use both the internal and external connectors on the same channel *concurrently*.

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

ServeRAID-4H controller

Standard features of the ServeRAID-4H controller are as follows.

| Feature | ServeRAID-4H |
|----------------------------|--|
| Arrays (max.) | 8 |
| Battery-backup cache | Yes |
| Cache memory | 128 MB |
| Hard disk drives (max.) | 60 |
| Logical drives (max.) | 8 |
| Microprocessor | 266 MHz |
| SCSI channels | 4 |
| SCSI transfer speed (max.) | 160 MB per sec. |
| Supported RAID levels | 0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E), 00, 10, 1E0, 50 |
| System PCI data bus | 64 bit at 33 MHz |

The ServeRAID-4H controller has four independent SCSI channel connectors: Channel 1, Channel 2, Channel 3, and Channel 4. Each of these SCSI channels supports up to 15 physical devices.

Note: In the event of a power outage or failure, the battery-backup cache protects the data stored in the ServeRAID cache memory when using the write-back setting of the write-cache mode.

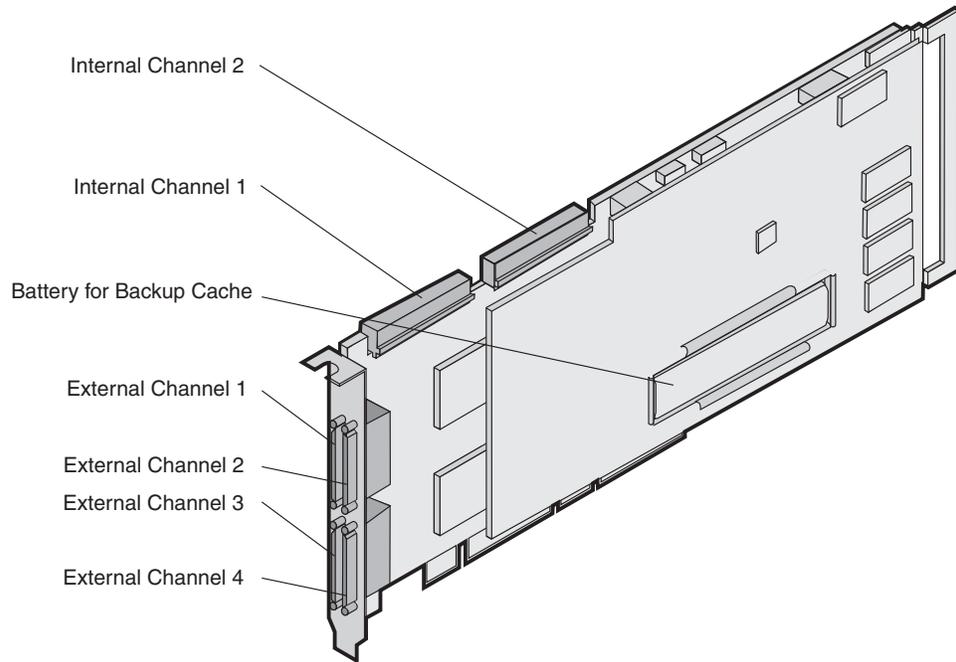


Figure 1. ServeRAID-4H controller

You can attach internal SCSI devices to the internal Channel 1 and Channel 2 connectors. You can attach external SCSI devices to the external Channel 1, Channel 2, Channel 3, and Channel 4 connectors.

Note: The ServeRAID-4H controller uses the module (P/N 38L3386) containing a lithium battery.

Statement 2

CAUTION:



When replacing the lithium battery, use only IBM Part Number 38L3386 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water.**
- **Heat to more than 100° C (212° F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

ServeRAID-4L controller

Standard features of the ServeRAID-4L controller are as follows.

| Feature | ServeRAID-4L |
|----------------------------|--|
| Arrays (max.) | 8 |
| Battery-backup cache | No |
| Cache memory | 16 MB |
| Hard disk drives (max.) | 15 |
| Logical drives (max.) | 8 |
| Microprocessor | 100 MHz |
| SCSI channels | 1 |
| SCSI transfer speed (max.) | 160 MB per sec. |
| Supported RAID levels | 0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E), 00, 10, 1E0, 50 |
| System PCI data bus | 64 bit at 33 MHz |

The ServeRAID-4L controller has one independent SCSI channel connector: Channel 1. This SCSI channel supports up to 15 physical devices.

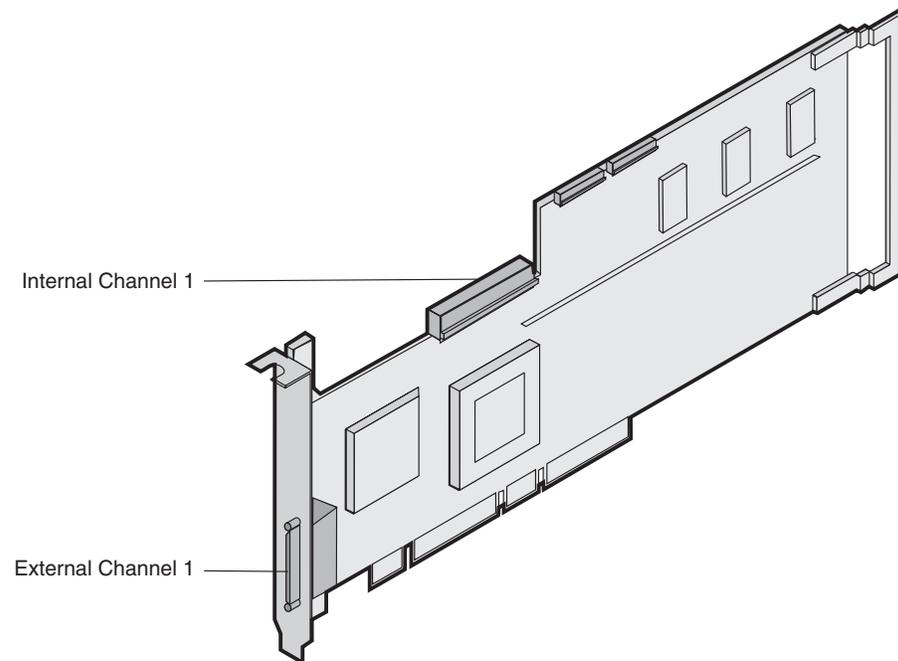


Figure 2. ServeRAID-4L controller

You can attach internal SCSI devices to the internal Channel 1 connector. You can attach external SCSI devices to the external Channel 1 connector.

Note: The ServeRAID-4L controller uses the module (P/N 38L3386) containing a lithium battery.

Statement 2

CAUTION:



When replacing the lithium battery, use only IBM Part Number 38L3386 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water.
- Heat to more than 100° C (212° F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

ServeRAID-4Lx controller

Standard features of the ServeRAID-4Lx controller are as follows.

| Feature | ServeRAID-4Lx |
|----------------------------|--|
| Arrays (max.) | 8 |
| Battery-backup cache | No |
| Cache memory | 32 MB |
| Hard disk drives (max.) | 15 |
| Logical drives (max.) | 8 |
| Microprocessor | 100 MHz |
| SCSI channels | 1 |
| SCSI transfer speed (max.) | 160 MB per sec. |
| Supported RAID levels | 0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E), 00, 10, 1E0, 50 |
| System PCI data bus | 64 bit at 33-66 MHz |

The ServeRAID-4Lx controller has one independent SCSI channel connector, Channel 1. This SCSI channel supports up to 15 physical devices.

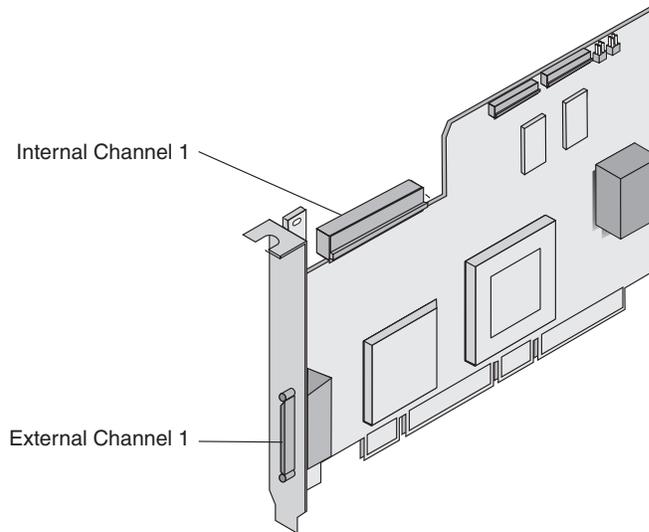


Figure 3. ServeRAID-4Lx controller

You can attach internal SCSI devices to the internal Channel 1 connector. You can attach external SCSI devices to the external Channel 1 connector.

Note: The ServeRAID-4Lx controller uses the module (P/N 38L3386) containing a lithium battery.

Statement 2

CAUTION:



When replacing the lithium battery, use only IBM Part Number 38L3386 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water.
- Heat to more than 100° C (212° F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

ServeRAID-4M controller

Standard features of the ServeRAID-4M controller are as follows.

| Feature | ServeRAID-4M |
|-------------------------|--------------|
| Arrays (max.) | 8 |
| Battery-backup cache | Yes |
| Cache memory | 64 MB |
| Hard disk drives (max.) | 30 |

| Feature | ServeRAID-4M |
|----------------------------|--|
| Logical drives (max.) | 8 |
| Microprocessor | 100 MHz |
| SCSI channels | 2 |
| SCSI transfer speed (max.) | 160 MB per sec. |
| Supported RAID levels | 0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E), 00, 10, 1E0, 50 |
| System PCI data bus | 64 bit at 33 MHz |

The ServeRAID-4M controller has two independent SCSI channel connectors: Channel 1 and Channel 2. Each of these SCSI channels supports up to 15 physical devices.

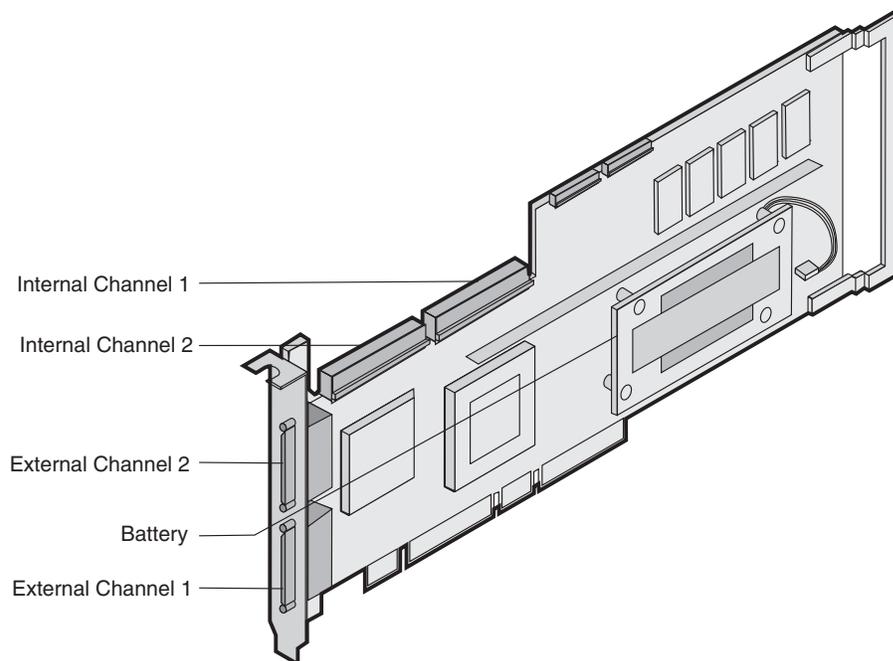


Figure 4. ServeRAID-4M controller

You can attach internal SCSI devices to the internal Channel 1 and Channel 2 connectors. You can attach external SCSI devices to the external Channel 1 and Channel 2 connectors.

Note: The ServeRAID-4M controller uses the module (P/N 38L3386) containing a lithium battery.

Statement 2

CAUTION:



When replacing the lithium battery, use only IBM Part Number 38L3386 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water.
- Heat to more than 100° C (212° F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

ServeRAID-4Mx controller

Standard features of the ServeRAID-4Mx controller are as follows.

| Feature | ServeRAID-4Mx |
|----------------------------|--|
| Arrays (max.) | 8 |
| Battery-backup cache | Yes |
| Cache memory | 64 MB |
| Hard disk drives (max.) | 30 |
| Logical drives (max.) | 8 |
| Microprocessor | 100 MHz |
| SCSI channels | 2 |
| SCSI transfer speed (max.) | 160 MB per sec. |
| Supported RAID levels | 0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E), 00, 10, 1E0, 50 |
| System PCI data bus | 64 bit at 33-66 MHz |

The ServeRAID-4Mx controller has two independent SCSI channel connectors: Channel 1 and Channel 2. Each of these SCSI channels supports up to 15 physical devices.

Note: In the event of a power outage or failure, the battery-backup cache protects the data stored in the ServeRAID cache memory when using the write-back setting of the write-cache mode.

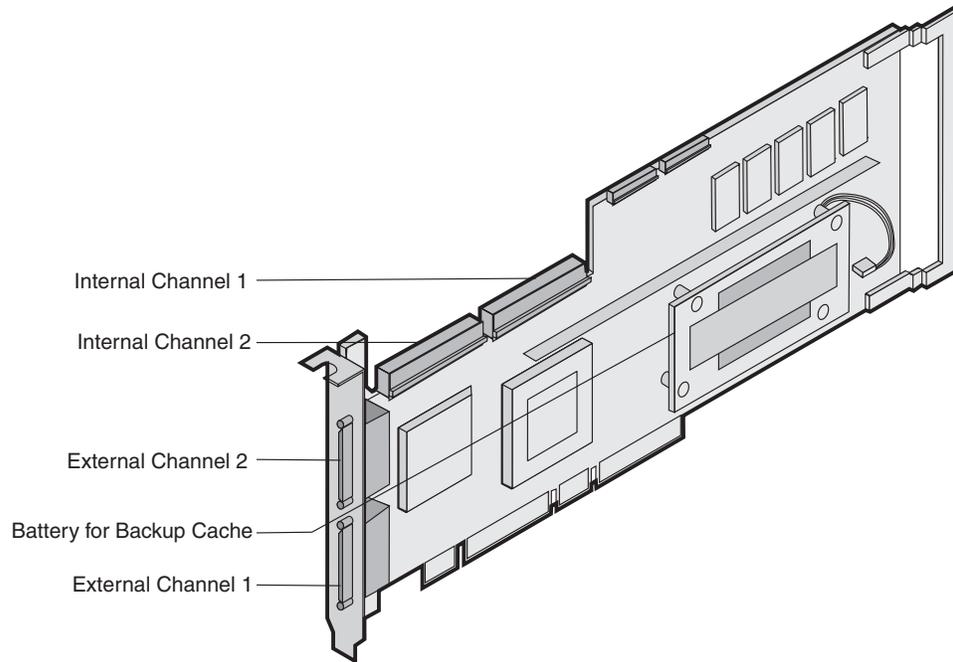


Figure 5. ServeRAID-4Mx controller

You can attach internal SCSI devices to the internal Channel 1 and Channel 2 connectors. You can attach external SCSI devices to the external Channel 1 and Channel 2 connectors..

Note: The ServeRAID-4Mx controller uses the module (P/N 38L3386) containing a lithium battery.

Statement 2

CAUTION:



When replacing the lithium battery, use only IBM Part Number 38L3386 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water.
- Heat to more than 100° C (212° F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

ServeRAID-5i controller

Standard features of the ServeRAID-5i controller are as follows.

| Feature | ServeRAID-5i |
|----------------------------|---|
| Arrays (max.) | 8 |
| Battery-backup cache | Yes |
| Cache memory | 128 MB |
| Hard disk drives (max.) | 30 |
| Logical drives (max.) | 8 |
| Microprocessor | 100 MHz |
| SCSI channels | 0 |
| SCSI transfer speed (max.) | 320 MB per sec. |
| Supported RAID levels | 0, 1, 5, Enhanced-1 (1E), and 00, 10, 1E0, 50 |
| System PCI data bus | 64 bit at 66 MHz |

The ServeRAID-5i controller has no independent SCSI channel connectors. It must be used with an IBM xSeries™ server that contains an integrated RAID controller. It comes with both a 2-U and 3-U I/O bracket; the 3-U bracket is mounted on the controller. You can connect devices to this controller using the integrated RAID controller's connectors.

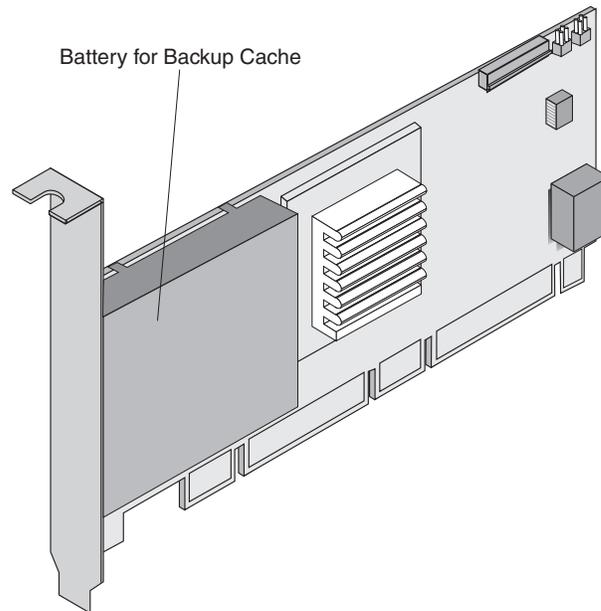


Figure 6. ServeRAID-5i controller

Note: The ServeRAID-5i controller uses the module (P/N 38L3386) containing a lithium battery.

Statement 2

CAUTION:



When replacing the lithium battery, use only IBM Part Number 38L3386 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water.**
- **Heat to more than 100° C (212° F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

Installing and configuring ServeRAID controllers

This section provides installation, cabling and configuration information for the ServeRAID-4H, -4L, -4Lx, -4M, -4Mx Ultra160 SCSI controllers and ServeRAID-5i Ultra320 SCSI controller (hereafter sometimes referred to as IBM ServeRAID-4x controllers and the IBM ServeRAID-5i Ultra320 SCSI controller).

For information on ServeRAID updates, see “Obtaining ServeRAID updates” on page 61. For information on BIOS code, see “Updating BIOS and firmware code” on page 61.

Using a ServeRAID-4x controller in a server with Active PCI features

Note: The ServeRAID-5i controller does not support (Active) hot-plug features.

Some IBM servers support Active PCI (also called hot-plug PCI) features. The ServeRAID-3 and ServeRAID-4 controllers support Active PCI features on Windows NT 4.0, Windows 2000, and Novell NetWare. The following table summarizes which operating systems support specific Active PCI functions:

| Feature | Windows NT 4.0 | Windows 2000 | NetWare 5.x | NetWare 6.0 |
|-------------|----------------|--------------|-------------|-------------|
| Hot add | Yes | Yes | Yes | Yes |
| Hot remove | No | Yes | Yes | Yes |
| Hot replace | Yes | No | No | No |

You can use the Active PCI features to install, remove, or replace PCI controllers without turning off the server.

- Use the hot-add feature to add a controller to a running server, thus expanding its capacity.
- Use the hot-remove feature to remove a controller from a running server.
- Use the hot-replace feature to replace a controller with an identical controller.

Note: When you use the hot-replace feature, some parameters (such as rebuild rate) are not restored. If you have previously saved the controller configuration, refer to it for information.

Attention: Do *not* attempt a hot-replace operation on Windows 2000 or NetWare by hot-removing a failed controller and then hot-adding a new controller. Loss of data can occur. If a controller fails on these operating systems, you *must* shut down the server to replace the controller.

Using Windows NT 4.0 with Active PCI features

To use Active PCI with Windows NT 4.0 and a ServeRAID controller, you must install the following software components in this order:

1. DMI Service provider. A free version is included on the *IBM ServeRAID Support CD* in the following directory:
e:\WINNT\DMISP\setup.exe
where e is the CD-ROM drive.

Note: This version is sufficient for most users' needs, but a Y2K compliant version is available at <http://www.enablers.com/>.

2. IBM Hot Plug for Windows NT 4.0 Package, version 4.2 or later. This package is available from the IBM Support Web site. See "Obtaining ServeRAID updates" on page 61 for additional information.

Note: Be sure to read the instructions and restrictions for this software program.

3. ServeRAID Active PCI DMI component. This is an optional component that you can install during the ServeRAID Manager installation.

To perform a hot-replace operation, start the IBM ServeRAID Hot Replace Wizard. You can start this program from within either the IBM Hot Plug for Windows NT 4.0 program or the ServeRAID Manager program. You can use the ServeRAID Manager program to start the wizard either on the server with the failed controller, or across the network from a remote installation of the ServeRAID Manager.

Note: It is useful to start the IBM ServeRAID Hot Replace Wizard from a remote installation when the server with the failed controller does not have a monitor.

Using Windows 2000 with Active PCI features

To use Active PCI with Windows 2000, you must install the IBM Active PCI Software for Windows 2000. This software is available from the IBM Support Web site. See "Obtaining ServeRAID updates" on page 61 for additional information.

Note: Be sure to read the instructions and restrictions for this software program.

Using NetWare with Active PCI features

To use Active PCI with NetWare, you must install the IBM PCI Hot-Plug Controller Driver for NetWare. This software is available from the IBM Support Web site. See "Obtaining ServeRAID updates" on page 61 for additional information.

Note: Be sure to read the instructions and restrictions for this software program.

Installing the ServeRAID-4x controller

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

Complete the following steps to install the ServeRAID-4 controller:

1. Review "Safety information" on page 127 and the Safety Information book provided with your server.

Note: Some IBM servers support Active PCI features, which enable you to install or remove PCI controllers without turning off the server. If your server model provides Active PCI support and you are using Windows 2000, Windows NT 4.0, NetWare 5.0, or NetWare 6.0, you do not need to turn off your server to install this controller. This operation is referred to as a hot-add operation. Before performing this operation, complete the following tasks:

- Review the information provided with your server to determine whether your model supports these features.

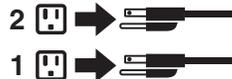
- Review the documentation provided with your operating system for information concerning using these features.
 - See “Using a ServeRAID-4x controller in a server with Active PCI features” on page 17.
2. If your server model does *not* support Active PCI, turn off the server and disconnect all power cords and cables from the server.

Statement 5



CAUTION:

The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



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

Note: Some server models require that you install the ServeRAID controller in a specific PCI slot. See the documentation that came with your server for more information.

4. Remove the expansion-slot cover, if applicable.
5. Touch the static-protective package containing the controller to an unpainted metal expansion-slot cover on the server. This discharges any static electricity from the package and your body.
6. Holding the controller by the edges, remove it from the static-protective package. Do not touch any exposed components on the controller.
7. Insert the controller into the PCI expansion slot. Press the controller firmly into the slot so that it is fully seated.

Note: The illustrations in this section depict the ServeRAID-4H controller. Other IBM ServeRAID controllers will have a slightly different appearance.

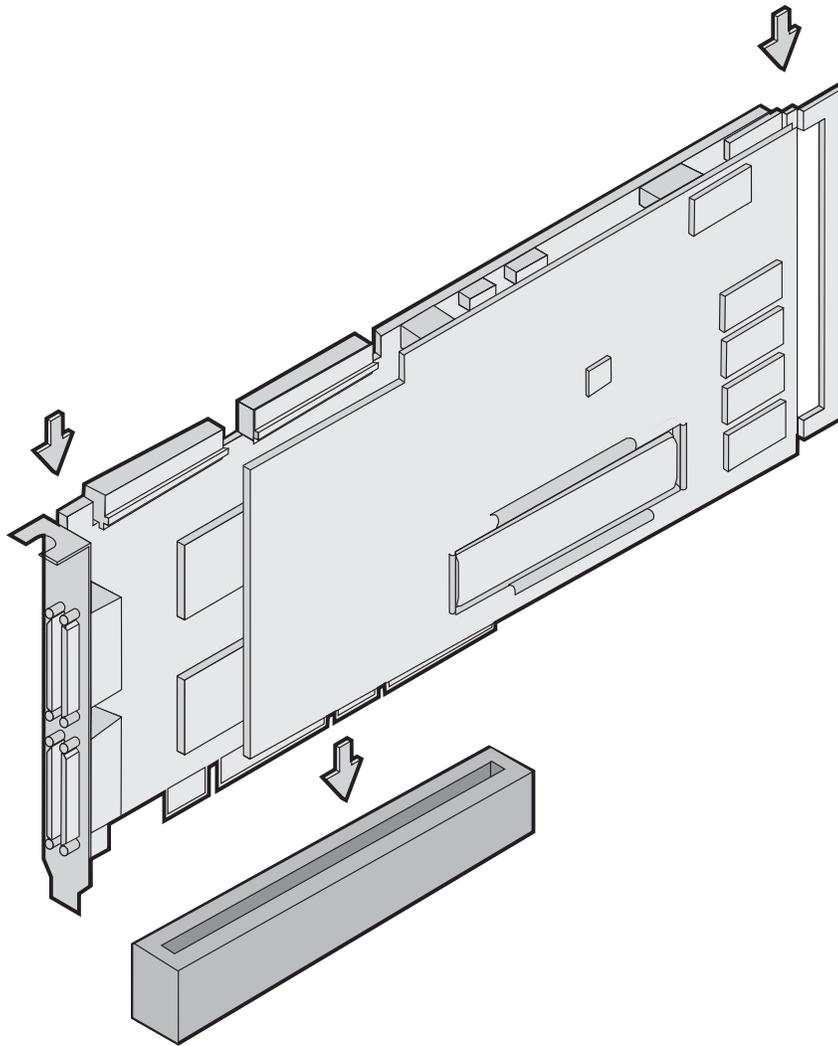


Figure 7. Inserting a ServeRAID-4H controller into the PCI expansion slot

8. Secure the controller by either tightening the expansion-slot screw on the top of the controller or closing the latch, depending on your server.
9. Connect the SCSI cables to the controller. If you intend to attach external devices only, go to step 13 on page 21. Otherwise, go to step 10.
10. Connect one end of a 68-pin standard cable (separately purchased or already in your server) to the internal channel connector on the ServeRAID controller.

Note: For the channel connector locations, refer to the controller locations for the specific ServeRAID model, earlier in this chapter.

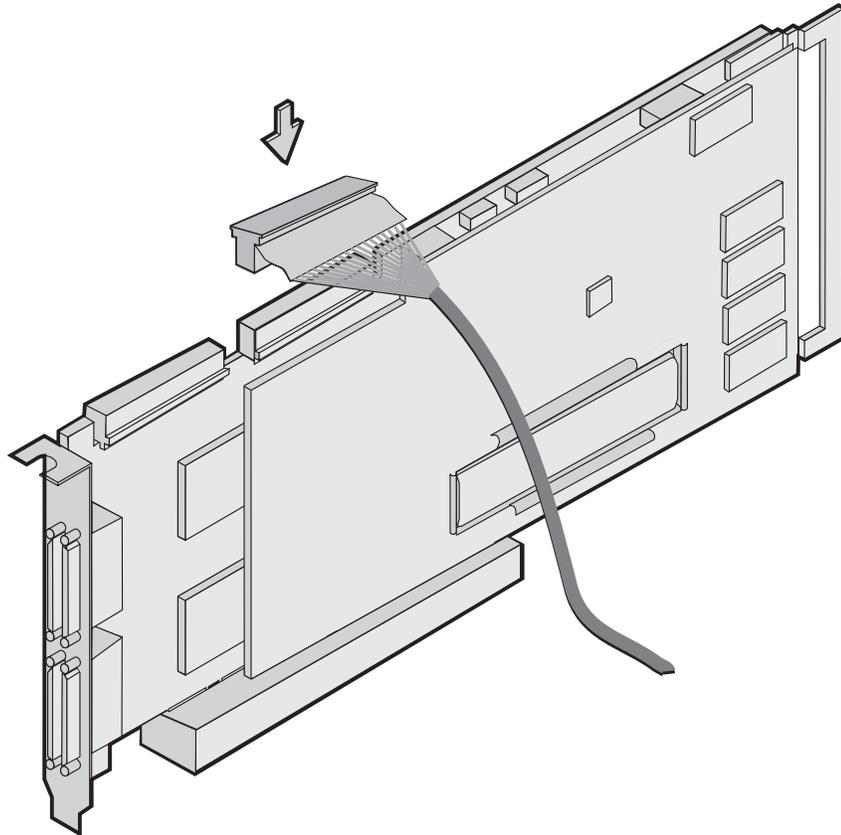


Figure 8. Connecting a ServeRAID-4H controller internal channel connector

11. Connect the other end of the SCSI cable to the SCSI backplane or to a SCSI device in the server. (See your server documentation or the system label inside the server cover for the location of the SCSI connector on the backplane.)
12. If you have physical drives to install, install them now. See your server documentation for drive installation instructions.
13. Install the server cover.
14. If you disconnected the cables and power cords in step 2 on page 19, reconnect the cables and cords. See your server documentation if you need detailed instructions.
15. If you want to attach an external SCSI device to the ServeRAID controller, go to “Connecting external devices to a ServeRAID-4 controller” on page 27. Otherwise, go to “Understanding RAID technology” on page 103.

Installing the ServeRAID-5i controller

Attention: If you plan to install a ServeRAID-5i controller into a server that contains data, back up the data first. When the ServeRAID-5i controller is installed, you will lose access to any data or applications on physical drives connected to the integrated RAID controller.

Preparing for installation

Before you begin the installation procedure, see the documentation that comes with your server. You need to determine the following:

- The PCI expansion slot into which you will install the controller

- Whether you need to install the low-profile 2-U bracket

Complete the following steps to install the 2-U bracket. You will need a small, flat-blade screwdriver.

1. Holding the controller by the edges, remove it from the static-protective package. Do not touch any exposed components on the controller.
2. Set the controller battery-side down on a nonconductive, static-protected surface. Do not place the controller on your server cover or on a metal table.
3. Using a small, flat-blade screwdriver, remove the screw from the battery pack.
4. To remove the battery, gently press the tab up and lift the battery away from the controller.

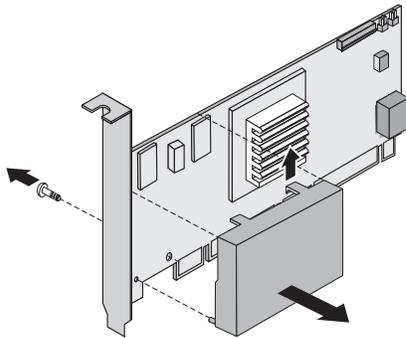


Figure 9. Removing the battery from a ServeRAID-5i controller

5. Remove the two bracket screws. Set them aside.
6. Remove the 3-U bracket.
7. Align the two screw holes in the 2-U bracket with the two screw holes on the controller. Using the two screws you removed in step 5, secure the bracket to the controller.
8. Gently snap the battery back into place.
9. Using the screw you removed in step 3, secure the battery to the controller.
10. Return the controller to the static-protective package.

Installing the ServeRAID-5i controller

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

Complete the following steps to install the ServeRAID-5i controller:

1. Review “Safety information” on page 127 and the Safety Information book provided with your server.
2. Turn off the server and disconnect all power cords and cables from the server.

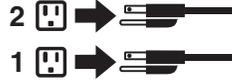
Statement 5



CAUTION:

The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

Statement 5



3. Remove the server cover and locate the PCI expansion slot.

Notes:

- a. The ServeRAID-5i controller *must* be installed in an extended PCI expansion slot. If you have not already done so, see the documentation that comes with your server to determine the correct PCI expansion slot for the ServeRAID-5i controller.
 - b. If another controller is already installed in the extended PCI expansion slot designed for the ServeRAID-5i controller, you must remove the controller before installing the ServeRAID-5i controller.
4. Remove the expansion-slot cover, if applicable.
 5. Touch the static-protective package containing the controller to an unpainted metal expansion-slot cover on the server. This discharges any static electricity from the package and your body.
 6. Holding the controller by the edges, remove it from the static-protective package. Do not touch any exposed components on the controller.
 7. Insert the controller into the PCI expansion slot. Press the controller firmly into the slot so that it is fully seated.

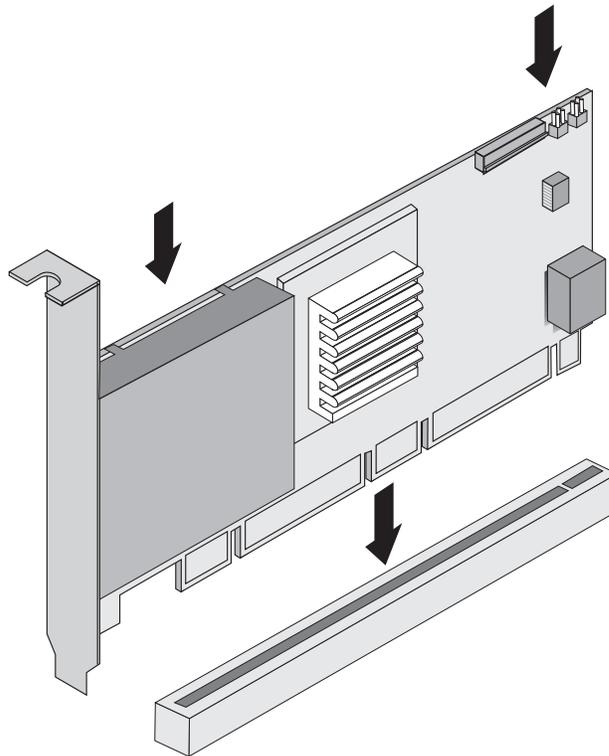


Figure 10. Inserting a ServeRAID-5i controller into the PCI expansion slot

8. Secure the controller by either tightening the expansion-slot screw on the top of the controller or closing the latch, depending on your server.
9. If you have physical drives to install, install them now. See your server documentation for drive installation instructions.
10. Install the server cover.
11. Reconnect the cables and cords. See your server documentation if you need detailed instructions.

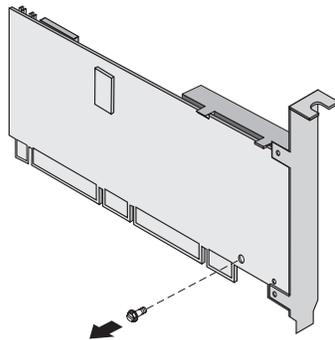
Replacing the battery pack on the ServeRAID-5i Ultra320 controller

The IBM ServeRAID-5i Ultra320 SCSI controller has a replaceable battery pack for the backup cache. If your controller requires a new battery pack, you *must* use the following instructions to replace the battery pack.

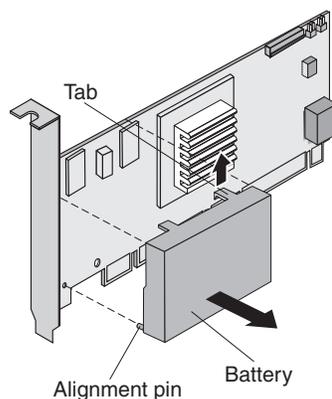
Attention: Failure to follow these instructions might damage the ServeRAID-5i controller.

Complete the following steps to replace the battery pack. You will need a small, flat-blade screwdriver.

1. Review “Safety information” on page 127, “Handling electrostatic discharge-sensitive devices” on page 130, and the Safety Information book provided with your server.
2. Set the controller battery-side down on a nonconductive, static-protected surface. Do not place the controller on your server cover or on a metal table.
3. Using a small, flat-blade screwdriver, remove the screw from the battery pack.



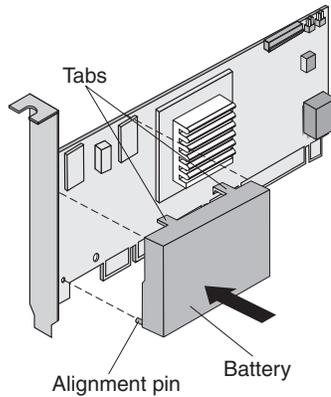
4. To remove the battery, gently press the tab up and lift the battery away from the controller.



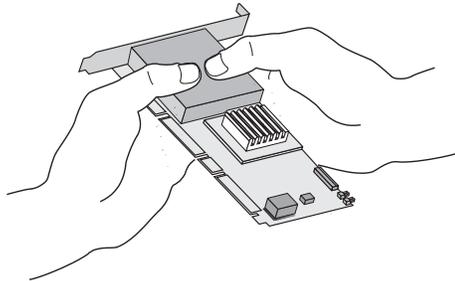
5. Remove the new battery pack from its packaging.

Attention: Attention Follow steps 6 and 7 carefully. Failure to do so might damage the controller.

6. Carefully position the new battery pack on the controller. Be sure that the alignment pin and the two tabs are properly aligned.



7. Press gently on the center of the battery pack to snap the battery pack into place. Be sure to apply pressure evenly with both hands and to hold the controller as shown in the figure below. Also, make sure that the tab is properly latched on the controller.



8. Using the screw you removed in step 3 on page 24, secure the battery to the controller.
9. The battery pack contains a nickel metal hydride battery. Be sure to recycle or dispose of the discarded battery pack properly. Recycling facilities might not be available in your area.

Installing the ServeRAID-5i controller 2-U bracket

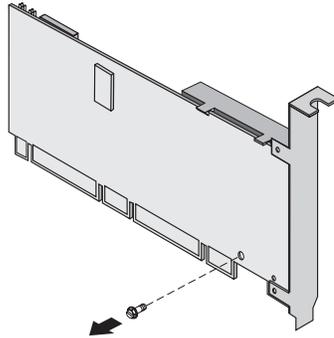
The IBM ServeRAID.-5i Ultra320 SCSI controller has a 3-U bracket. If your server requires a low-profile 2-U bracket, you *must* use the following instructions to install the 2-U bracket.

Attention: Failure to follow these instructions might damage the ServeRAID-5i controller.

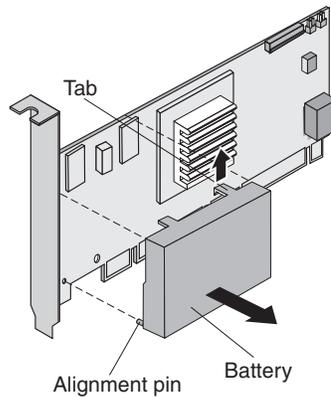
Complete the following steps to install the 2-U bracket. You will need a small, flat-blade screwdriver.

1. Review “Safety information” on page 127, “Handling electrostatic discharge-sensitive devices” on page 130, and the Safety Information book provided with your server.
2. Holding the controller by the edges, remove it from the static-protective package.

3. Set the controller battery-side down on a nonconductive, static-protected surface. Do not place the controller on your server cover or on a metal table.
4. Using a small, flat-blade screwdriver, remove the screw from the battery pack.



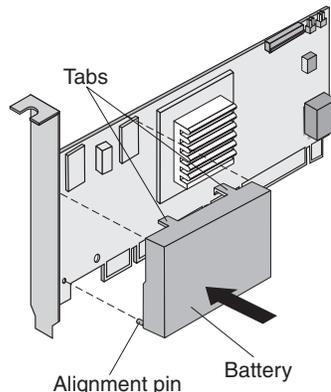
5. To remove the battery, gently press the tab up and lift the battery away from the controller.



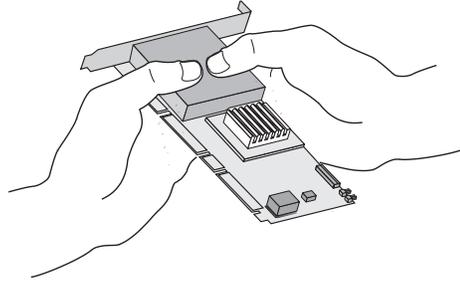
6. Remove the two bracket screws. Set them aside.
7. Remove the 3-U bracket.
8. Align the two screw holes in the 2-U bracket with the two screw holes on the controller. Using the two screws you removed in step 6, secure the bracket to the controller. The screws enter the screw holes on the battery side of the controller and then go through the bracket screw holes.

Attention: Follow steps 9 and 10 on page 27. carefully. Failure to do so might damage the controller.

9. Carefully reposition the battery pack on the controller. Be sure that the alignment pin and the two tabs are properly aligned.



10. Press gently on the center of the battery pack to snap the battery pack into place. Be sure to apply pressure evenly with both hands and to hold the controller as shown in the figure below. Also, make sure that the tab is properly latched on the controller.



11. Using the screw you removed in step 4 on page 26, secure the battery to the controller.

IBM Director support for the ServeRAID-5i controller

If you want to use IBM Director to monitor and manage the IBM ServeRAID-5i Ultra320 SCSI controller, you must use IBM Director Version 3.1 with Service Pack 1, or later.

Notes:

1. IBM plans to release IBM Director 3.1 with Service Pack 1 by the beginning of August, 2002.
2. If you do not use IBM Director, you can use the ServeRAID Manager program to configure, manage, and monitor your ServeRAID-5i controller. This program is on the IBM *ServeRAID Support* CD that came with your ServeRAID-5i controller.

Complete the following steps to download IBM Director 3.1 with Service Pack 1:

1. Go to the IBM Systems Management - Director Version 3.1 Package page at www.pc.ibm.com/qtechinfo/MIGR-40738.html
2. Scroll down the page to the File Details section.
3. For each file that you want to download, right-mouse click the file and click your browser action to save the file to your hard disk drive (for example, click **Save Target As**).
4. Install the IBM Director Service Pack according to the instructions in the IBM Director Version 3.1 with Service Pack 1 README file.

Connecting external devices to a ServeRAID-4 controller

Note: You cannot attach internal *and* external SCSI devices to the same channel. For example, you cannot attach devices to both external Channel 1 and internal Channel 1. The ServeRAID-4 controllers do not support configurations that use both the internal and external connectors on the same channel *concurrently*.

Complete the following steps to attach SCSI devices to an external channel connector on the ServeRAID-4 controller:

1. Connect one end of a 68-pin very-high-density connector interface (VHDCI) SCSI cable to an external channel connector on the ServeRAID controller.

Note: For connector locations, refer to the controller locations for the specific ServeRAID model, earlier in this chapter.

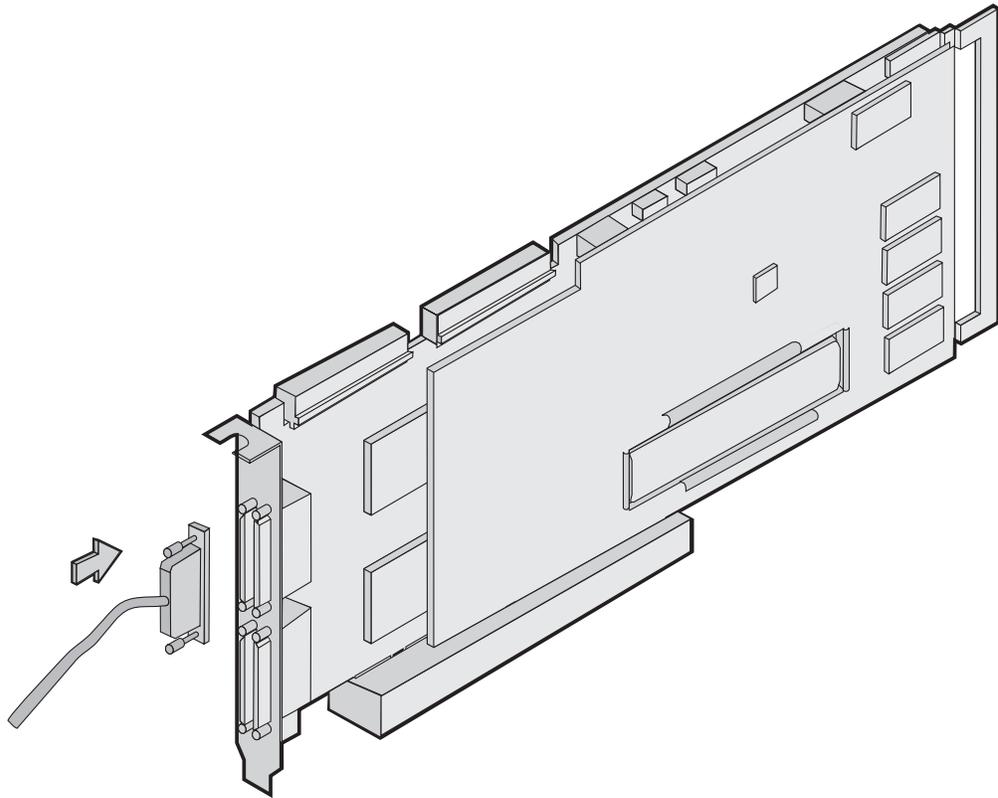


Figure 11. Connecting a ServeRAID-4H controller external channel connector

2. Connect the other end of the SCSI cable to the external SCSI device.
3. Go to “Updating BIOS and firmware code” on page 61.

Configuring the ServeRAID controller

This section provides information about starting and using the ServeRAID Manager program. You can use the ServeRAID Manager program to configure your ServeRAID controllers, view the ServeRAID configurations and associated devices, change controller settings, monitor your controllers, and more.

The information in this section is an overview of the ServeRAID Manager program and its capabilities. For instructions on specific processes using the ServeRAID Manager program, refer to the ServeRAID Manager online help.

If you are configuring an integrated RAID controller, see the instructions in the *Installation Guide* provided with your server.

Important: If you intend to use your ServeRAID-4 controllers in a Microsoft Windows failover or clustering environment, do the following:

- For failover, see the *IBM ServeRAID User's Reference* .
- For clustering, go to “IBM ServeRAID cluster solution” on page 53.

Using ServeRAID Manager

The ServeRAID Manager program operates in two ways:

- Startable-CD mode
- As an installed software program

When you run the ServeRAID Manager program from the startable *IBM ServeRAID Support* CD, you are using startable-CD mode. Startable-CD mode lets you to configure your controller *before* you install your operating system. After you have configured the controller and installed the operating system, you also can use startable-CD mode to change specific controller settings. For additional information, see “Viewing your configuration” on page 36.

To run the ServeRAID Manager program in startable-CD mode, turn on the server; then, insert the *IBM ServeRAID Support* CD (or the CD that contains the ServeRAID Manager program that came with your server) into the CD-ROM drive.

If the ServeRAID Manager program detects unconfigured controllers and ready drives, the program automatically starts the Configuration wizard, and a window similar to that shown in Figure 12 opens.

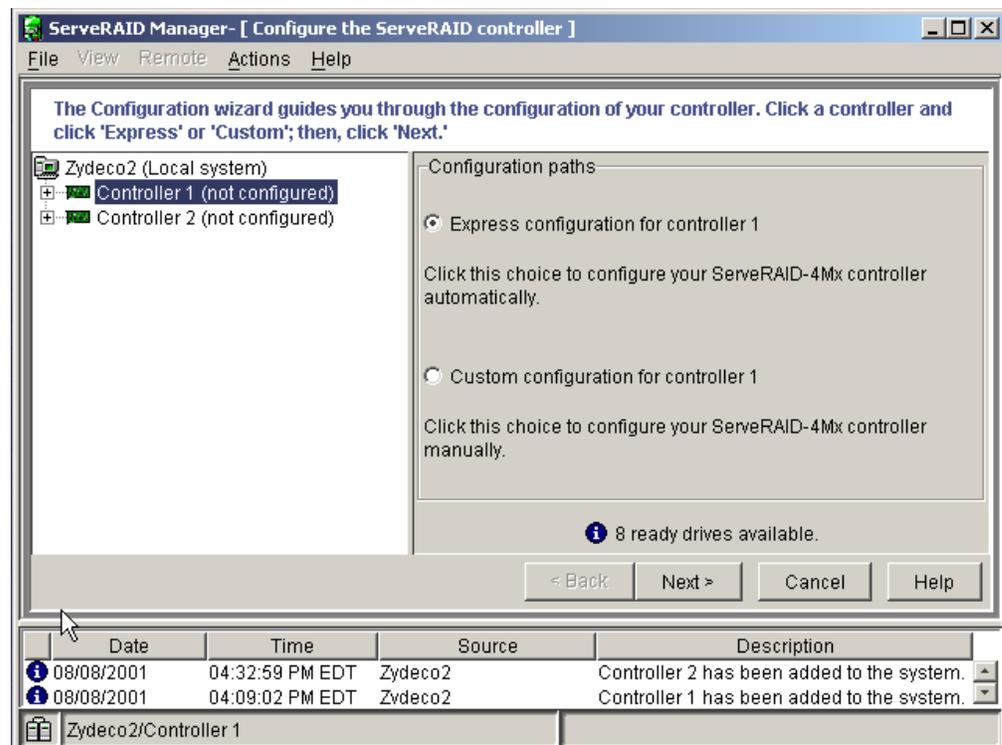


Figure 12. “Configuration wizard” window

You can use the Configuration wizard to create up to eight arrays and up to eight logical drives for each ServeRAID controller. The Configuration wizard provides two configuration options: Express and Custom. Express configuration automatically configures your ServeRAID controller, and you can use Custom configuration to configure your controller manually. If you want to use RAID level-1E, RAID-level-5E, or RAID level-x0, you must use Custom configuration. For more information about RAID levels, see “Understanding RAID technology” on page 103.

Using Express configuration

Express configuration automatically configures your ServeRAID controller. This feature does the following:

- Creates arrays by grouping together same-sized physical drives.
- Creates one logical drive per array.
- Assigns a RAID level based on the number of physical drives in an array:
 - An array with a single physical drive is assigned RAID level-0.
 - An array with two physical drives is assigned RAID level-1.
 - An array with three or more physical drives is assigned RAID level-5.
- Designates a hot-spare drive for the controller. If one or more arrays has four or more physical drives, the largest-sized drive from those arrays is designated the hot-spare drive.

Complete the following steps to use Express configuration:

1. In the ServeRAID Manager tree, click the ServeRAID controller that you want to configure.
2. Click **Express configuration**.
3. Click **Next**. The “Configuration summary” window opens.
4. Review the information that is displayed in the “Configuration summary” window. To change the configuration, click **Modify arrays** or **Modify logical drives**.

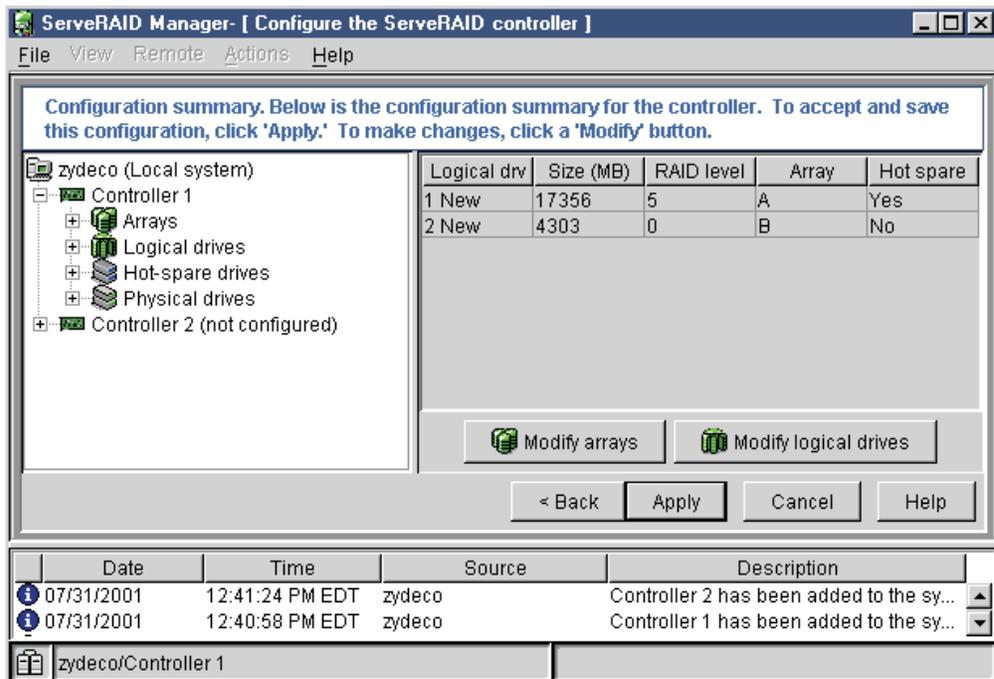


Figure 13. “Configuration summary” window (Express Configuration)

Note: Some operating systems have size limitations for logical drives. Before you save the configuration, verify that the size of the logical drive is appropriate for your operating system.

5. Click **Apply**; then, click **Yes** when asked if you want to apply the new configuration. The configuration is saved in the ServeRAID controller and in the physical drives.
6. If you have multiple controllers, do the following:

a. Click the ServeRAID controller that you want to configure.



b. From the toolbar, click  (Configure RAID).

c. Repeat steps 2 on page 30 through 6 on page 30 for each controller.

7. When you have completed configuring your controllers, you can change certain controller settings. See “Fine-tuning your configuration” on page 36 for more information. If you do not want to change any settings, exit from the ServeRAID Manager program, and remove the CD from the CD-ROM drive.
8. Restart the server.
9. Continue by installing ServeRAID device drivers (see the IBM ServeRAID *User’s Reference* for more information).

Note: If you are configuring your startup (boot) ServeRAID controller, you *must* install the device driver while installing the operating system.

Using Custom configuration

Select Custom configuration to configure your controller manually. Complete the following steps to use Custom configuration:

1. In the ServeRAID Manager tree, click the ServeRAID controller that you want to configure.
2. Click **Custom configuration**.
3. Click **Next**. The “Create arrays” window opens. If you want to create spanned arrays, go to step 2 of “Creating spanned arrays” on page 34.

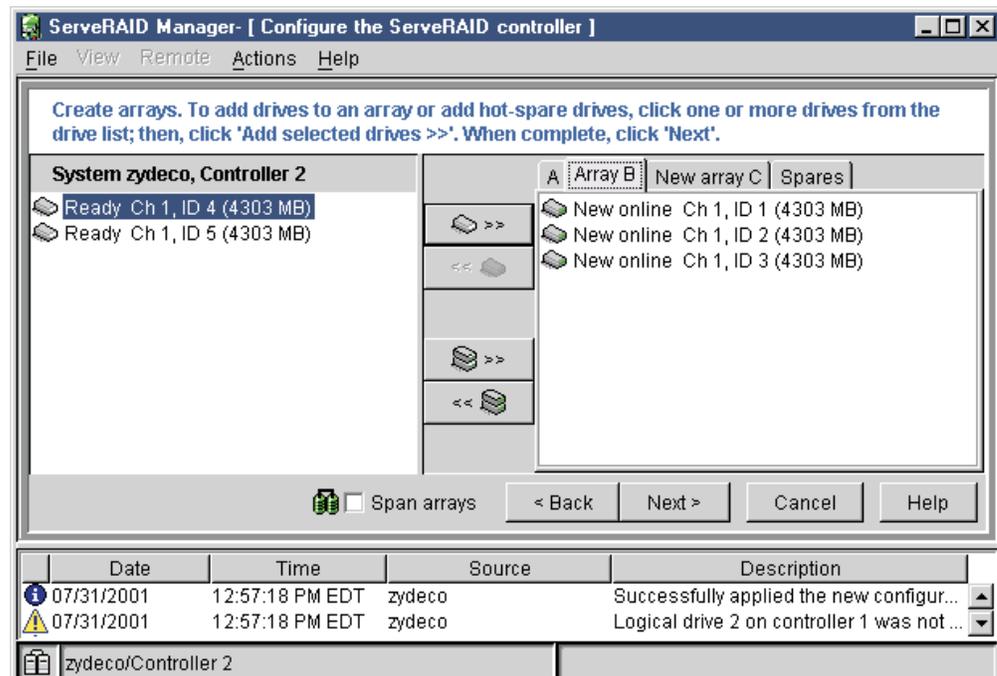


Figure 14. “Create arrays” window

4. Click the appropriate tab in the right pane; then, from the list of ready drives, select the drives you want to move to the array.
5. Click **Add selected drives** to add the drives to the array. Click **Add all drives** to move *all* ready drives to an array.

6. Repeat steps 4 on page 31 and 5 on page 31 for each additional array or hot-spare drive that you want to configure.
7. After you select the ready drives for your arrays and hot-spare drive, click **Next**. The “Create logical drives” window opens.

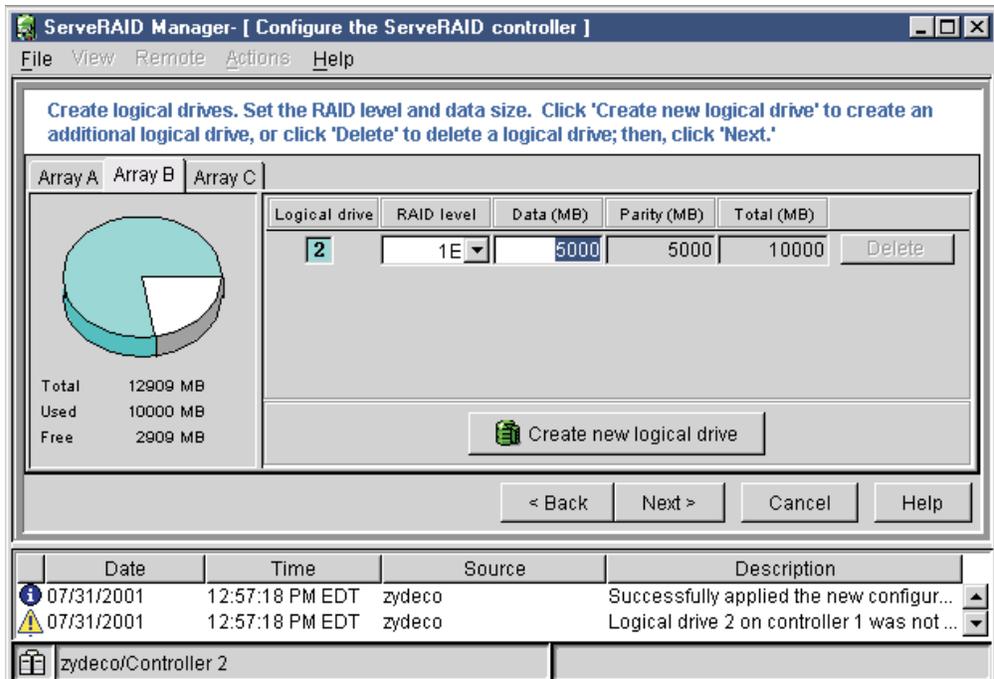


Figure 15. “Create logical drives” window

8. Click the appropriate **Array** tab.
 9. Select a RAID level from the drop-down list. (For more information, see “Supported RAID levels” on page 104.)
- Notes:**
- a. RAID level-5E allows only one logical drive per array.
 - b. If you are configuring a spanned array, you can set the RAID level only for the first logical drive you create.
10. If you do not want to use the maximum size for the logical drive, type the size in the **Data (MB)** field.

Notes:

- a. You can define up to eight logical drives per controller. There are two exceptions:
 - If an array contains a logical drive assigned RAID level-5E
 - If you want to use the logical-drive migration feature

In these cases, one logical drive slot must be left free; therefore, you cannot define more than seven logical drives.

- b. Some operating systems have size limitations for logical drives. Before you save the configuration, verify that the size of the logical drive is appropriate for your operating system.
- c. A logical drive cannot exceed 2048 GB.
- d. Typically, the first logical drive defined on the first ServeRAID controller found by system BIOS during startup will be your startup (boot) drive.

- If you have free space available and want to create additional logical drives, click **Create new logical drive**.

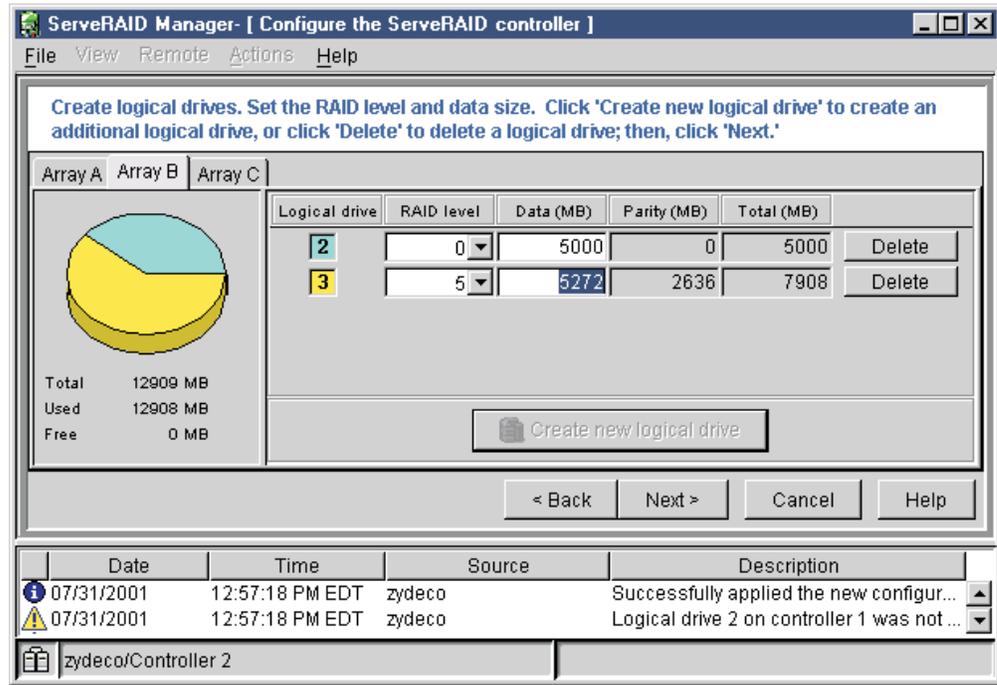


Figure 16. “Adding another logical drive” window

- Repeat steps 9 through 11 for each logical drive that you want to define in this array.
- Repeat steps 8 on page 32 through 12 for each additional array you want to configure.
- Click **Next**. The “Configuration summary” window opens.

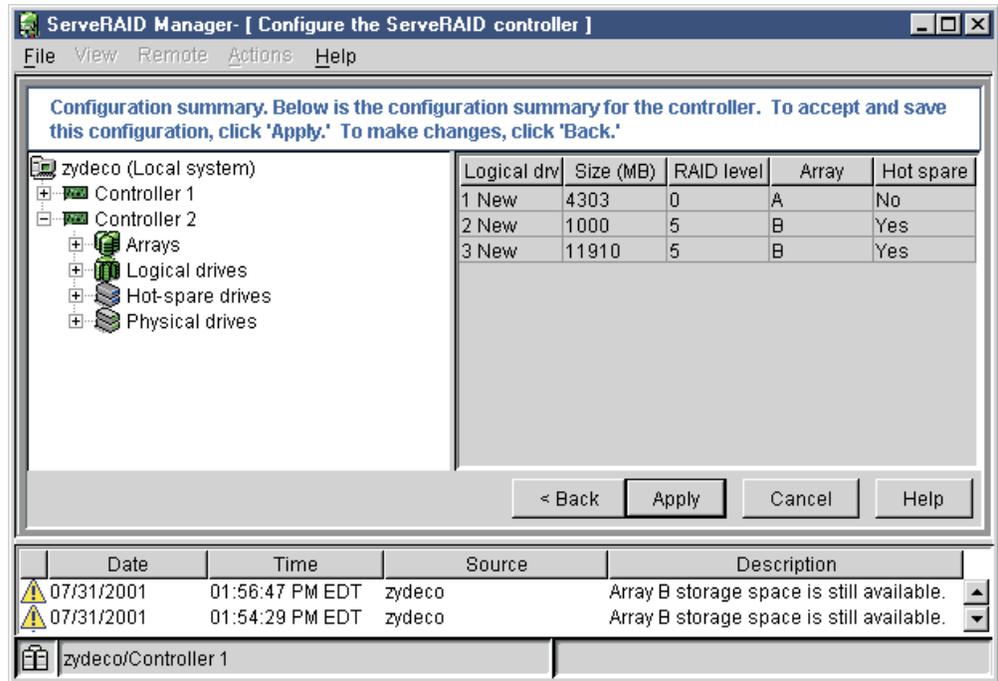


Figure 17. “Configuration summary” window (Custom Configuration)

15. Review the information that is displayed in the “Configuration summary” window. To change the configuration, click **Back**.
16. Click **Apply**; then, click **Yes** when asked if you want to apply the new configuration. The configuration is saved in the ServeRAID controller and in the physical drives.
17. If you have multiple controllers, do the following:
 - a. Click the ServeRAID controller that you want to configure.
 - b. From the toolbar, click  (Configure RAID).
 - c. Repeat steps 2 on page 31 through 17b for each controller.
18. When you have completed configuring your controllers, you can change certain controller settings. See “Fine-tuning your configuration” on page 36 for more information. If you do not want to change any settings, exit from the ServeRAID Manager program, and remove the CD from the CD-ROM drive.
19. Restart the server.
20. Continue by installing ServeRAID device drivers (see the IBM ServeRAID *User’s Reference* for more information).

Note: If you are configuring your startup (boot) ServeRAID controller, you *must* install the device driver while installing the operating system.

Creating spanned arrays: If you want to assign RAID level-x0 to an array, you must create a spanned array. For more information about spanned arrays, see “Understanding RAID level-x0” on page 112.

Notes:

1. Spanned arrays are supported only by ServeRAID-4 and ServeRAID-5i controllers.

2. A logical drive cannot exceed 2048 GB.

Complete the following steps to create one or more spanned arrays:

1. If you have not completed steps 1 to 3 in “Using Custom configuration” on page 31, do so now.
2. Create identical arrays by doing the following:
 - a. Click the **Array** tab in the right panel; then, from the list of ready drives, select the drives you want to move to the array.
 - b. Click **Add selected drives** to add the drives to the array.
 - c. Repeat steps 2a and 2b for each additional array that you want to configure.

Note: To create a spanned array, the arrays to be spanned must be identical (that is, they must have the same number of physical drives).

- d. Select the **Span arrays** check box; then, click **Next**. The “Create spanned arrays” window opens.

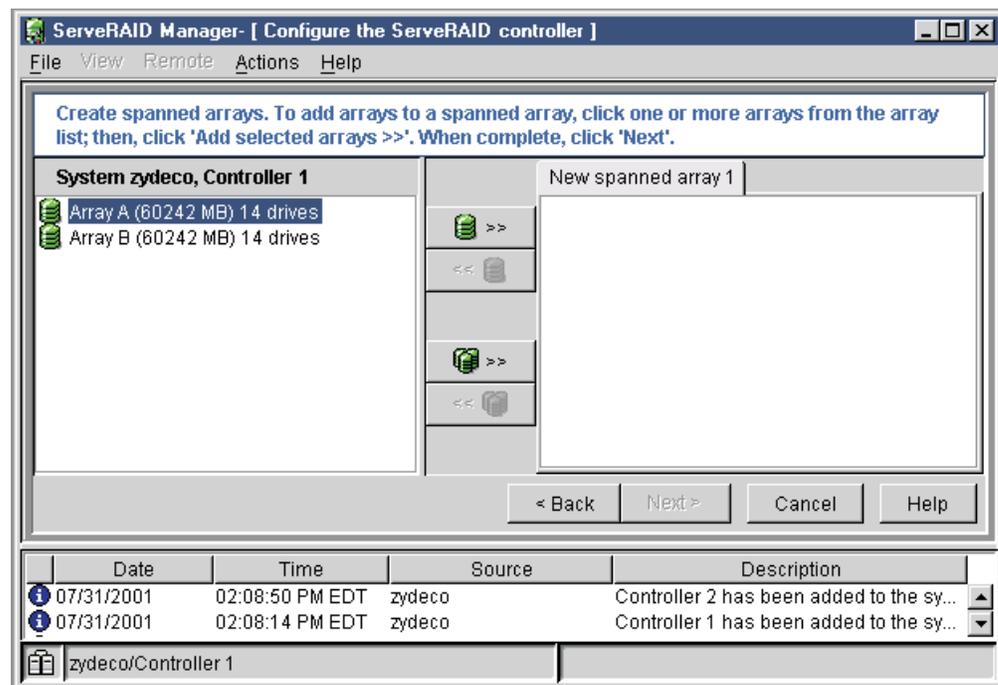


Figure 18. “Create spanned arrays” window

3. Create spanned arrays by doing the following:
 - a. In the list of arrays, click the arrays that you want to add to your spanned array.
 - b. Click  (Add selected arrays) to add the arrays to the spanned array. You can click  (Add all arrays) to move *all* arrays to the spanned array.
 - c. To create additional spanned arrays, click the **New spanned array** tab in the right pane; then, repeat steps 3a and 3b.
4. Click **Next**; the “Create logical drives” window opens. Continue with step 8 of “Using Custom configuration” on page 31.

Fine-tuning your configuration

Before you store data on the controller, you will need to determine the correct stripe-unit size for your configuration and set the write-cache mode, if necessary.

Changing the stripe-unit size

The new controller stripe-unit size is set at the factory to 8 KB. If you need to change this setting, you *must* change the stripe-unit size before you store data in the logical drives. After you store data in the logical drives, you cannot change the stripe-unit size without destroying data in the logical drives.

Complete the following steps to change the stripe-unit size:

1. In the ServeRAID Manager tree, click the new controller to select it.
2. Click **Actions** → **Change stripe-unit size**.
3. Select the new stripe-unit size for your installation.

Note: Consider your server application environment when you select the controller stripe-unit size setting.

| Environment | Stripe-unit size |
|--|------------------|
| Groupware (such as Lotus Notes [®] or Exchange) | 16 KB |
| Transaction processing database | 16 KB |
| Decision support database | 16 KB |
| Thin client environments | 8 KB |
| File server (Windows 2000, Windows NT 4.0, Novell NetWare) | 16 KB |
| File server (other) | 8 KB |
| Web server | 8 KB |
| Other | 8 KB |

Write-cache mode

If you are preparing to install Novell NetWare 5.x from the startable *Novell NetWare 5.x* CD, set the write-cache mode to write through for the logical drive to which you will install the operating system. To accomplish this, complete the following steps:

1. In the ServeRAID Manager tree, click the logical drive.
2. Click **Actions** → **Change write-cache mode to write through**.

Viewing your configuration

You can use ServeRAID Manager to view information about RAID controllers and the RAID subsystem (such as arrays, logical drives, hot-spare drives, and physical drives).

To view information, expand the ServeRAID Manager tree; then, click the relevant tree object. Detailed information about the selected device appears in the right pane.

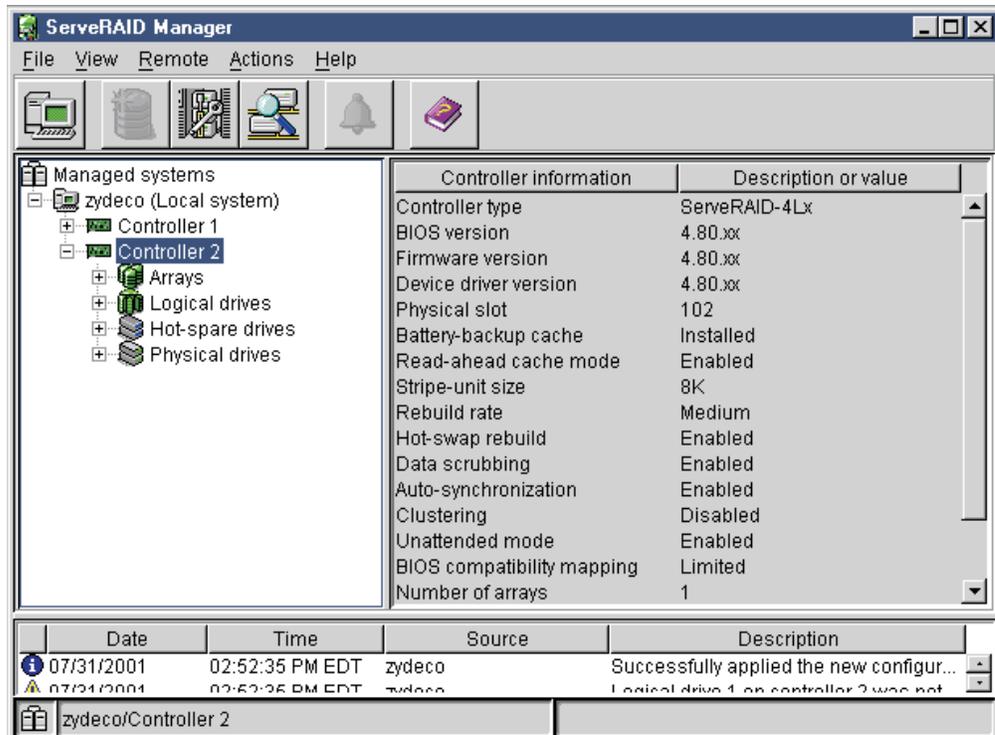


Figure 19. ServeRAID Manager window

To display available actions for an item, click the item in the ServeRAID Manager tree and click **Actions**.

Getting assistance

For more information about ServeRAID Manager, see the online help system. To start the help system, select an item from the **Help** menu.

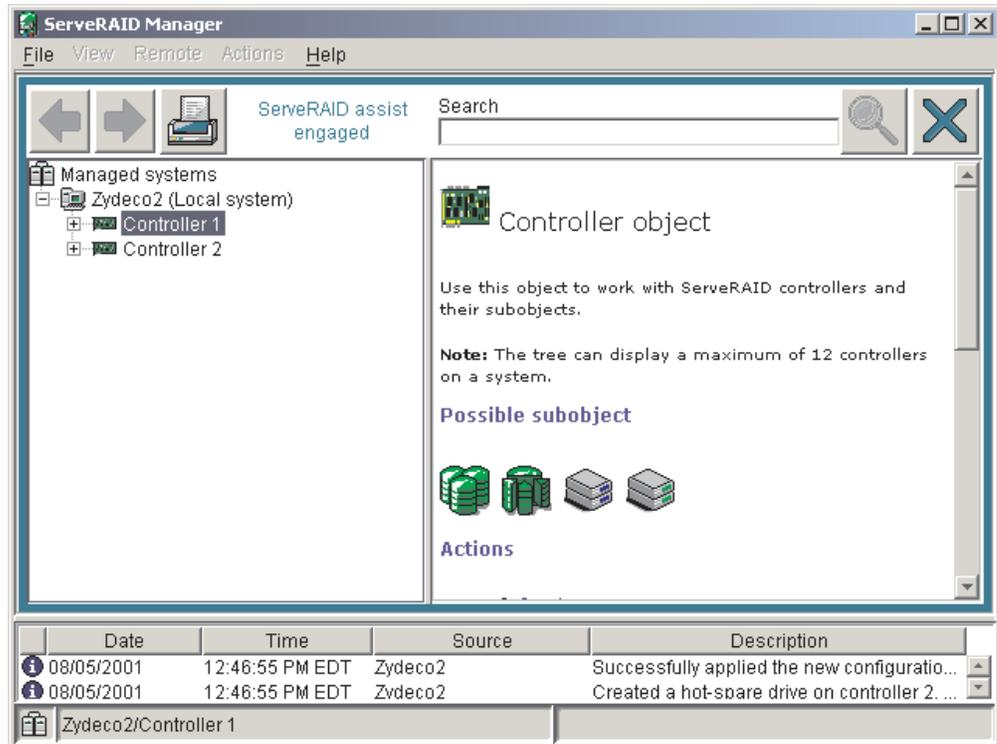


Figure 21. Hints and tips feature

Using utility programs

This section provides the information that is needed to start and use the ServeRAID Mini-Configuration program, and the IPSSEND and IPSMON command-line programs.

Using the ServeRAID Mini-Configuration program

This chapter provides the information needed to start and use the ServeRAID Mini-Configuration program.

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

Accessing the Mini-Configuration program

Complete the following steps to access the Mini-Configuration program:

1. Turn on the server. If the server already is running, shut down the operating system; then, restart the server.
2. When the following message appears, promptly press Ctrl+I:
Press Ctrl+I to access the Mini-Configuration Program
3. If your server contains more than one ServeRAID controller, a selection screen appears. To continue, do the following:
 - a. Use the Up Arrow (↑) or Down Arrow (↓) key to select a controller.
 - b. Press Enter.

If your server contains only one ServeRAID controller, or after you select a ServeRAID controller, the main menu appears.

The following choices are available from the main menu:

- **View Controller Status** shows the current status of the ServeRAID controller. (See “Viewing the controller status” for more information.)
 - **View Configuration** shows the current configuration information for the ServeRAID controller. (See “Viewing the configuration” on page 42 for more information.)
 - **Advanced Functions** is used to restore the controller to the factory-default settings, import configuration from drives, configure BIOS settings, and view the controller and PCI information. (See “Viewing the configuration” on page 42 for more information.)
4. Use the Up Arrow (↑) or Down Arrow (↓) key to highlight your choice; then, press Enter.
 5. Follow the instructions that appear on the screen.
 6. Click **Exit**. If your server contains more than one ServeRAID controller, the controller selection screen appears. Otherwise, the Mini-Configuration program closes.

Viewing the controller status

When you select **View Controller Status** from the main menu, the following information appears on the screen:

- All physical drives and their states

- **Unattend** shows the current state of the unattended mode.
 - When this option is set to **Off** and a startup error occurs, the system stops at the recovery option screen and waits for you to choose the recovery method.
 - When this option is set to **On** and a startup error occurs, the system stops at the recovery option screen and waits 30 seconds for you to respond. Then, the BIOS automatically selects an appropriate option and continues the system startup process.
- **ReadAhead** shows the current state of the read-ahead cache mode.
- **CompMode** shows the current state of BIOS-compatibility mapping. **Off** indicates 8 GB (Extended); **On** indicates 2 GB (Limited).
- **Clustered** shows the current state for clustering.
- **BBC** shows the cache size of the battery-backup cache, if it is installed (8 = 8 MB or 32 = 32 MB) or **No** if there is no battery-backup cache installed.
- **Boot Blk** shows the version number of the startable microcode (or firmware) loaded for the ServeRAID controller.
- **Code Blk** shows the current version number of the microcode (or firmware) loaded for the ServeRAID controller.
- **Rebuild Rate** shows the current speed setting for rebuilds: High, Medium, or Low.
- **Number of Defunct drives** shows the current number of defunct physical drives.
- **Number of Offline drives** shows the current number of offline logical drives.
- **Number of Critical drives** shows the current number of critical logical drives.
- **Config Updates** shows the number of times that the configuration has been changed since it was initialized. When you initialize the configuration, the Config Updates resets to 0.
- **Bad Stripe, Locked Stripe, or Blocked Drive** identifies the logical drives that are affected.
 - **Bad Stripe Drives** indicates logical drives that have inaccessible areas.
 - **Locked Stripe Drives** is a reserved field.
 - **Blocked Drives** indicates the logical drives that are blocked. You must unblock a blocked drive before you can use it. See “Logical drive state descriptions” on page 114 for more information.

Viewing the configuration

You can select **View Configuration** from the main menu to display the number, size, RAID level, state, stripe-unit size, write-cache mode, read-ahead cache mode, and creation date for each logical drive.

Using the advanced configuration functions

You can select the **Advanced Functions** to restore the controller configuration to factory-default settings, copy the configuration to the controller from the connected physical drives, configure BIOS settings, and view the controller and PCI information.

When you select the **Advanced Functions** from the main menu, the following choices are displayed.

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

- **Restore to Factory Default Settings** restores all parameters in the configuration to the factory-default settings. When you reset the configuration, any data or programs stored on the logical drives attached to the selected ServeRAID controller will become inaccessible.
This choice deletes the existing configuration information; that is, it deletes all logical drives defined for the controller and sets all functional physical drives attached to the controller to the ready state.
- **Copy the Configuration from Drives to Controller** reads the most common configuration from the drives in the server and copies it to the ServeRAID controller.
- **Configure BIOS Settings** is used to modify the following BIOS settings for the ServeRAID controller:
 - BIOS support for startable CDROM
 - BIOS support for INT13 extensions
 - BIOS support for reading partition tables
 - Bypass read/verify operations
 - BIOS compatibility mapping
 - Override temporary write through
 - Load ServeRAID BIOS default settings
 - Save configuration to the ServeRAID controller
- **View Controller and PCI Information** shows the ServeRAID controller hardware and PCI register information.
- **Exit** is used to exit from the current menu to the previous menu.

Using the IPSSSEND command-line program

This chapter provides the information needed to start and use the IPSSSEND command-line program.

IPSSSEND is an advanced command-line program that you can use to configure and manage your ServeRAID controllers. This utility program is provided on the *IBM ServeRAID Support* diskettes and the *IBM ServeRAID Support CD*.

Starting the IPSSSEND command-line program

The IPSSSEND command-line program provides a number of functions. Some of these functions are useful as diagnostic or error-recovery tools. This manual addresses only these diagnostic and error-recovery functions. Descriptions of the other functions of the IPSSSEND command-line program can be found in the documentation that shipped with the controller.

When you run IPSSSEND with no parameters, a list of available functions and their specific parameters appears. The available functions and their parameters are described in the sections that follow.

To run the IPSSSEND program with no parameters:

- If you are using Windows NT 4.0, Windows 2000, or OS/2:
 1. Type:


```
c:\ipsadm\ipssend
```

 where c is the drive letter of the drive where Windows NT 4.0, Windows 2000, or OS/2 is installed.
 2. Press Enter.

- If you are using NetWare:
 1. From the console, type:


```
load ipssend
```
 2. Press **Enter**.
- If you are using Linux, OpenServer, or UnixWare:
 1. Type:


```
/usr/bin/ipssend
```
 2. Press **Enter**.
- If you are using DOS:
 1. Insert the startable IPSSSEND diskette into diskette drive A; then type:


```
a:\ipssend
```

where *a* is the drive letter of the diskette drive.
 2. Press **Enter**.

You can run IPSSSEND either from your operating system or by using the startable (bootable) *IBM ServeRAID Support for DOS* diskette. When you run IPSSSEND without parameters, a list of available functions and their specific parameters is displayed.

Starting IPSSSEND from Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, or Open UNIX

To start and run IPSSSEND without parameters, type one of the following and press Enter:

| | |
|---|--------------------------------|
| For Windows and OS/2 | <code>c:\ipsadm\ipssend</code> |
| For NetWare | <code>load ipssend</code> |
| For Linux, OpenServer, UnixWare, and Open UNIX | <code>/usr/bin/ipssend</code> |

where *c* is the drive letter of the drive where the operating system is installed.

Starting IPSSSEND from DOS

Complete the following steps to start IPSSSEND:

1. Insert the *IBM ServeRAID Support for DOS* diskette into the diskette drive.
2. Restart the server.
3. Type the following and press Enter:


```
a:\ipssend
```

where *a* is the diskette drive letter.

Using the IPSSSEND command-line program

The syntax conventions are as follows:

- Commands are shown in uppercase letters.
- Variables are shown in italics and explained immediately afterward.
- Optional commands or variables are enclosed in brackets.
- Where you must type one of several commands, the values are separated by slashes.
- Default values are underlined.

- Repeatable parameters are enclosed in braces, and the maximum number of repetitions is specified.

Server roll-out functions

Server roll-out functions are for server roll-out and building systems only; these functions are not for restoring systems. Do not use these commands for servicing systems.

The following lists the IPSSSEND server roll-out functions:

- autosync
- backup
- copyld
- init
- restore
- synch

Error-recovery functions

The following table describes the IPSSSEND error-recovery functions.

| Function | What it does | Command and supported operating systems |
|------------------|--|---|
| getstatus | This function displays information about the most recent rebuild, synchronization, logical drive migration, or FlashCopy. The information includes the type of operation, status, logical drive number, logical drive size, and percentage of the operation completed. | IPSSSEND GETSTATUS <i>controller</i> where <i>controller</i> is the ServeRAID controller number (1–12). Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS |
| rebuild | This function rebuilds a defunct physical drive. You can use this function for arrays that contain one or more logical drives in the critical state. | IPSSSEND REBUILD <i>controller dch dsid nch nsid</i> where: <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>dch</i> is the channel number for the defunct drive (1–4) • <i>dsid</i> is the SCSI ID for the defunct drive (0–15) • <i>nch</i> is the channel number for the new drive (1–4) • <i>nsid</i> is the SCSI ID for the new drive (0–15) Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS |

| Function | What it does | Command and supported operating systems |
|-----------------|---|---|
| setstate | <p>This function changes the state of a physical drive.</p> <p>Attention: Be very careful when using this function. For example, you might lose data if you change a physical drive from the defunct to online state without first performing a rebuild operation.</p> | <p>IPSSSEND SETSTATE <i>controller channel sid newstate</i></p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>channel</i> is the channel number for the drive (1–4) • <i>sid</i> is the SCSI ID for the drive (0–15) • <i>newstate</i> is the new state for the drive. Valid states are: <ul style="list-style-type: none"> – EMP for Empty – RDY for Ready – HSP for Hot spare – SHS for Standby hot spare – DDD for Defunct disk drive – DHS for Defunct hot spare – RBL for Rebuild – SBY for Standby – ONL for Online <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |
| unblock | <p>This function provides access to a blocked RAID level-0 logical drive.</p> <p>Important: The logical drive might contain damaged data. You must recreate or restore the data.</p> | <p>IPSSSEND UNBLOCK <i>controller logicaldrive</i></p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>logicaldrive</i> is the logical drive number (1–8) <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |

Problem-isolation and debug functions

The following table describes the IPSSSEND problem-isolation and debug functions.

| Function | What it does | Command and supported operating systems |
|-------------------|---|--|
| certify | <p>This function verifies the media of a physical drive. If IPSSSEND finds errors, it reassigns the sectors. Once the procedure is complete, IPSSSEND summarizes the reassignments and Predictive Failure Analysis® (PFA) errors.</p> | <p>IPSSSEND CERTIFY <i>controller channel sid</i></p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>channel</i> is the channel number for the device (1–4) • <i>sid</i> is the SCSI ID for the device (0–15) <p>Supported operating system: DOS</p> |
| eraseevent | <p>This function clears all entries in the designated event logs. (See <code>getevent</code> for descriptions of the ServeRAID controller device event, soft event, and hard event logs).</p> | <p>IPSSSEND ERASEEVENT <i>controller</i> DEVICE/SOFT/HARD/ALL</p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • DEVICE is the device event log • SOFT is the ServeRAID controller soft event log • HARD is the ServeRAID controller hard event log • ALL is the ServeRAID controller device event, soft event, and hard event logs <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |

| Function | What it does | Command and supported operating systems |
|-------------------|--|---|
| format | <p>This function performs a low-level format of a physical drive, erasing all data.</p> <p>Attention: After issuing the format command, do not stop the formatting process. If you stop the process, the physical drive will not respond to anything except the format function. To recover the drive, see “Recovering from an incomplete format of a physical drive” on page 70.</p> | <p>IPSSSEND FORMAT <i>controller options</i> NOPROMPT</p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1 to 12) • <i>options</i> is composed of one of three choices: <ul style="list-style-type: none"> – [<i><Channel> <SCSI ID></i>] <p>When this option is selected:</p> <ul style="list-style-type: none"> - <i>Channel</i> is the channel number for the device (1 to 4) - <i>SCSI ID</i> is the SCSI ID of the device (0 to 15) – ALL <ul style="list-style-type: none"> - When <i>ALL</i> is selected, all hard disk drives in the READY state will be formatted. – CHANNEL <i><Channel></i> <ul style="list-style-type: none"> - When <i>CHANNEL</i> is selected, all READY drives for the specified channel will be formatted. <p>Format command errors indicate that the specified hard disk drive is not present or there is some other hard disk drive problem.</p> <p>If a previous format command to a hard disk drive was interrupted, this drive may respond only to a format command. In this situation, the hard disk drive will not appear in the controller’s configuration. The user can attempt to format the drive using the FORMAT command to make it available for use.</p> |
| getevent | <p>This function displays the contents of the designated event logs.</p> | <p>IPSSSEND GETEVENT <i>controller</i> DEVICE/SOFT/HARD/ALL</p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>DEVICE</i> is the device event log • <i>SOFT</i> is the ServeRAID controller soft event log • <i>HARD</i> is the ServeRAID controller hard event log • <i>ALL</i> is the ServeRAID controller device event, soft event, and hard event logs <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |
| getversion | <p>This function lists the versions of BIOS, cluster DLL, device driver, and firmware for every ServeRAID controller in the server.</p> | <p>IPSSSEND GETVERSION</p> <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |
| identify | <p>This function flashes the LEDs on a designated physical or logical drive. To stop the LEDs from flashing, press any key.</p> | <p>IPSSSEND IDENTIFY <i>controller</i> PHYSICALDRIVE/LOGICALDRIVE <i>options</i></p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>PHYSICALDRIVE</i> is the designated physical drive • <i>LOGICALDRIVE</i> is the designated logical drive • <i>options</i> is one of the following: <ul style="list-style-type: none"> – If <i>PHYSICAL DRIVE</i>, the channel ID and SCSI ID – If <i>LOGICALDRIVE</i>, the logical drive number (1-8) <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |

| Function | What it does | Command and supported operating systems |
|-----------------|--|--|
| selftest | This function directs a controller or physical drive to perform its self-test. You must restart the server after the self-test is completed. | <p>IPSSSEND SELFTEST <i>controller options AD/PD channel sid</i></p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • AD is the ServeRAID controller self-test • PD is the physical drive self-test • (If PD) <i>channel</i> is the drive channel (1–4), and <i>sid</i> is the SCSI ID for the device (0–15). <p>Supported operating system: DOS</p> |

RAID configuration functions

The following table describes the IPSSSEND RAID configuration functions.

| Function | What it does | Command and supported operating systems |
|---------------|--|--|
| create | <p>This function create logical drives on either an existing or a new array. To define a new array, you must type the channel and SCSI ID of the physical drives.</p> <p>Note: You cannot create RAID level-x0 logical drives with this function.</p> <p>After the logical drive is created, a quick initialization is done. The quick initialization process initializes the first 1024 sectors of the logical drive.</p> <p>If you assign the logical drive RAID level-5 or RAID level-5E and the ServeRAID controller supports auto-synchronization, the logical drive automatically synchronizes in the background. If the controller does not support the auto-synchronization feature, you can use the IPSSSEND synch function to synchronize the RAID level-5 or RAID level-5E logical drives. After synchronization, the logical drives are available for storing data.</p> | <p>IPSSSEND CREATE <i>controller LOGICALDRIVE NEWARRAY/ARRAYID size raidlevel {channel sid}</i> [NOPROMPT]</p> <p>where:</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • NEWARRAY indicates that you are creating a new array and logical drive • ARRAYID is the Array ID (A–H) of the existing array on which you want to create a logical drive • <i>size</i> is one of the following: <ul style="list-style-type: none"> – The size in MB of the logical drive – MAX indicates that you want to use all available space in the array. • <i>raidlevel</i> is the RAID level for the logical drive (0, 1, 1E, 5, or 5E) • If NEWARRAY, <i>channel</i> is the channel number for the device (1– 4), and <i>sid</i> is the SCSI ID for the device (0–15). The maximum number of repetitions of <i>{channel sid}</i> is 16. • NOPROMPT is an optional parameter that overrides the user prompt. <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |
| delete | <p>This function deletes an array. You will lose all the data contained in logical drives defined in the array.</p> <p>Note: You cannot delete spanned arrays (RAID level-x0 logical drives) with this function.</p> | <p>IPSSSEND DELETE <i>controller ARRAY arrayID</i></p> <p>where</p> <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>arrayID</i> is the array identifier (A-H) of an existing array <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |

| Function | What it does | Command and supported operating systems |
|-------------------|---|---|
| devinfo | This function lists the state and size of a physical drive. | IPSSSEND DEVINFO <i>controller channel sid</i> where: <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>channel</i> is the channel number for the device (1– 4) • <i>sid</i> is the SCSI ID for the device (0–15) Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS |
| drivever | This function lists the vendor ID, firmware version, and serial number of a designated physical drive. IPPSEND retrieves this information directly from the physical drive. | IPSSSEND DRIVEVER <i>controller channel sid</i> where: <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • <i>channel</i> is the channel number for the device (1– 4) • <i>sid</i> is the SCSI ID for the device (0–15) Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS |
| getconfig | This function lists information about a controller, logical drive, or physical drive. This information potentially includes (but is not limited to) the following: <ul style="list-style-type: none"> • Controller type • BIOS, boot block, device driver, and firmware versions • Logical drive status, RAID level, and size • Physical drive type, SCSI ID, presence of PFA • Physical drive state | IPSSSEND GETCONFIG <i>controller AD/LD/PD/AL</i> where: <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • AD specifies the controller information. • LD specifies the logical drive information. • PD specifies the physical device information. • AL specifies all information. Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS |
| hsrebuild | This function enables the hot-swap rebuild feature. | IPSSSEND HSREBUILD <i>controller ON</i> where <i>controller</i> is the ServeRAID controller number (1–12) Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS |
| readahead | This function enables, disables, or sets the read-ahead cache mode to “Adaptive.” | IPSSSEND READAHEAD <i>controller ON/OFF/ADAPTIVE</i> where: <ul style="list-style-type: none"> • <i>controller</i> is the ServeRAID controller number (1–12) • ON enables the read-ahead cache mode • OFF disables the read-ahead cache mode • ADAPTIVE indicates that the controller will determine the best mode to use at any given time. Supported operating system: DOS |
| scandrives | This function scans all SCSI channel on a controller for the following: <ul style="list-style-type: none"> • Physical drives that have been added • Ready drives that have been removed | IPSSSEND SCANDRIVES <i>controller</i> where <i>controller</i> is the ServeRAID controller number (1–12) Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS |

| Function | What it does | Command and supported operating systems |
|-------------------|--|--|
| setconfig | This function modifies the controller configuration. You can either restore the controller to the factory-default settings, or you can copy the configuration from physical drives attached to a controller. | <p>IPSSEND SETCONFIG <i>controller</i> DEFAULT/IMPORTDRIVE [NOPROMPT]</p> <p>where:</p> <ul style="list-style-type: none"> <i>controller</i> is the ServeRAID controller number (1–12) DEFAULT restores the controller to the factory-default settings. All logical drives that are currently defined will be deleted. IMPORTDRIVE copies the configuration from the drives attached to the controller. To import from a specific physical drive, type the channel number and the SCSI ID; otherwise, the controller selects the drive from which to import the configuration. This option is useful when you are replacing a controller and reestablishing the original configuration on the new controller. NOPROMPT is an optional parameter that overrides the user prompt. <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |
| unattended | This function enables or disables unattended mode. This controller setting determines how the BIOS handles failures during system startup. | <p>IPSSEND UNATTENDED <i>controller</i> ON/OFF</p> <p>where:</p> <ul style="list-style-type: none"> <i>controller</i> is the ServeRAID controller number (1–12) ON enables the feature OFF disables the feature <p>Supported operating systems: Windows, NetWare, OS/2, Linux, OpenServer, UnixWare, Open UNIX, and DOS</p> |

Using the IPSMON command-line program (NetWare only)

This chapter provides the information about starting and using the IPSMON command-line program.

You can use the IPSMON program to monitor a ServeRAID controller for defunct drives, Predictive Failure Analysis (PFA) warnings, rebuild operations, FlashCopy operations, synchronizations, logical-drive migrations, and RAID level-5E compressions. Whenever activities occur, this program can log a message to the screen, to a file, or to both the screen and a file.

You can use the IPSMON program with Novell NetWare 5.x only.

This utility program is provided on the *IBM ServeRAID Support for Novell NetWare* diskette.

Complete the following steps to run the IPSMON program:

- From the console, type the following:

```
load ipsmon
```
- Press Enter.

When you start IPSMON, it immediately begins polling all ServeRAID controllers for specific conditions. If a condition is found, this program logs a message to the screen, to a file, or to both the screen and a file.

Note: IPSMON continuously polls the ServeRAID controllers until you type `unload ipsmon` at the system console.

Command: **ipsmon options**

where *options* is one of the following optional parameters:

- `-F:filename` to specify the name of the file in which to record messages. The default file name is `IPSMON.LOG`.
- `-S` to display messages on the standard output (usually the screen).
- `-?` to obtain a current list of valid parameters.

Note: If you start this program without any command-line parameters, the IPSMON program will log the messages to the `IPSMON.LOG` file, and the messages will not be displayed on the screen.

During operation, IPSMON logs various messages. Each message contains an alert code and a location specifier.

- The alert code begins with the message type and number:
 - **INF** (information) followed by the message number
 - **WRN** (warning) followed by the message number
 - **CRT** (critical) followed by the message number
- The location specifier comes after the alert code:
 - **A** followed by the controller number
 - **C** followed by the channel number (if required)
 - **SID** followed by the SCSI ID (if required)

For example, a message of `CRTxxx:A2C3SID04` signifies that a Critical condition (`CRTxxx`) was found on Controller 2 (`A2`), Channel 3 (`C3`), SCSI ID 4 (`SID04`).

The IPSMON program can log the following messages, based on the condition being monitored and errors detected.

Information Messages:

```
<Date and Time> INF000:A1C-SID-- (no errors detected)
<Date and Time> INF001:A1C-SID-- (rebuild started)
<Date and Time> INF002:A1C-SID-- (rebuild completed)
<Date and Time> INF003:A1C-SID-- (synchronization started)
<Date and Time> INF004:A1C-SID-- (synchronization completed)
<Date and Time> INF005:A1C-SID-- (migration started)
<Date and Time> INF006:A1C-SID-- (migration completed)
```

Warning Messages:

```
<Date and Time> WRN001:A2C3SID12 (PFA error detected)
```

Critical Messages:

```
<Date and Time> CRT001:A3C2SID04 (dead drive detected)
<Date and Time> CRT002:A1C-SID-- (controller is not responding to
commands)
```

IBM ServeRAID cluster solution

A *cluster* is a group of independent computer systems that work together as a single logical system. A client interacts with a cluster as though it is a single server. In other words, a cluster is a group of computers linked together in such a way that they share and manage a set of resources that can support a number of users at the same time.

This *high-availability clustering solution* is based on a two-server cluster, where both servers can access the same storage devices, but only one server at a time controls the storage devices shared by both servers. If one of the two running servers fails, the remaining server automatically assumes control of the shared resources managed by the failed server while still controlling its own resources at the same time. Then, the failed server can be repaired offline without the loss of time or work efficiency, because the shared data and applications earlier managed by the failed server are still online to the clients.

When the failed server is operational again, it can be placed back into the cluster; the resources are reallocated between the two servers and the cluster resumes normal operation.

A *controller* is a device that coordinates and controls the operation of one or more input and output devices, such as workstations, and synchronizes the operation of such devices with the operation of a system as a whole.

The IBM ServeRAID Cluster Solution, as discussed in this book, uses one of the following controllers:

- IBM ServeRAID-4H Ultra160 SCSI controller
- IBM ServeRAID-4M Ultra160 SCSI controller
- IBM ServeRAID-4Mx Ultra160 SCSI controller
- IBM ServeRAID-4L Ultra160 SCSI controller
- IBM ServeRAID-4Lx Ultra160 SCSI controller

The IBM ServeRAID Cluster Solution also uses IBM expansion enclosures, such as the following:

- IBM Netfinity EXP15 Rack Storage Enclosure
- IBM Netfinity EXP200 Rack Storage Enclosure
- IBM Netfinity EXP300 Rack Storage Enclosure

Note: You can configure only 13 physical drives in an EXP300 enclosure.

You can install the IBM ServeRAID Cluster Solution by using one of the following software applications:

- Microsoft Cluster Server, which is part of Windows NT Server Enterprise Edition
- Microsoft Cluster Server, which is part of Windows 2000 Advanced Server Edition.

The following figures show an example of a simple high-availability clustering solution. The first figure shows a high-level view of a cluster; the second figure shows a more detailed view of a cluster.

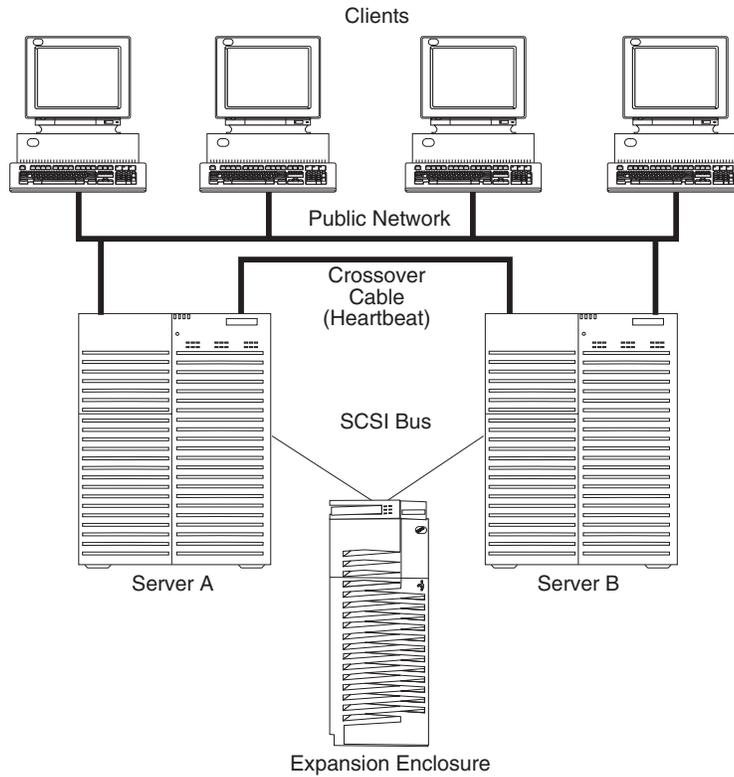


Figure 22. A high-level view of a cluster

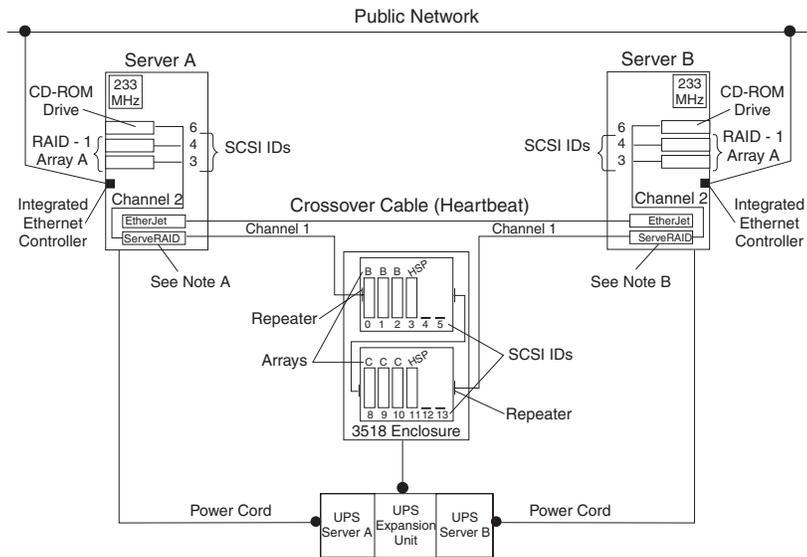


Figure 23. A detailed view of a cluster

Note A: Server A

- Shared Channel 1 - SCSI ID 6
- Non-shared Channel 2 - SCSI ID 7

Note B: Server B

- Shared Channel 1 - SCSI ID 7
- Non-shared Channel 2 - SCSI ID 7

The solution you use for your installation depends on your specific requirements. For more information about requirements and types of installations, see the *IBM Shared Disk Clustering Hardware Reference*. You can obtain this publication from the IBM Support Web site. See “Obtaining ServeRAID updates” on page 61 for additional information.

ServeRAID considerations

It is important to understand the following ServeRAID considerations before you set up your high-availability cluster solution.

Hardware considerations

- You must cable the SCSI channels in a controller pair so that the controllers share the same channels.
- You must connect all disks that will be shared to the shared channels. This includes hot-spare drives, as well as data drives.
- Each shared physical drive must be part of a logical drive or defined as a hot spare to one or the other servers. You must remove all other physical drives from the shared disk enclosure to ensure proper operation.
- Do not connect nondisk devices, such as CD-ROM or tape drives, to shared channels. These devices will be accessible to both servers, and conflicts might arise.

Controller considerations

- *Controller pair* is a term that refers to two controllers, one in each system, that are connected to each other through the same SCSI bus.
- Each ServeRAID controller must have a different SCSI initiator ID assigned to the shared channels. For example, set one server, Server A, to ID 6, and set the other server, Server B, to ID 7. The setup instructions describe this in more detail.
- You must set the stripe-unit size of each ServeRAID controller in a pair to the same value (8 KB, 16 KB, 32 KB, or 64 KB).
- Each ServeRAID controller must have a unique controller name assigned.
- Do not change the controller name on both ServeRAID controllers in a pair at the same time. Doing so can cause problems and might require that you restart the server.
- You *cannot* share hot-spare drives between controllers in a cluster pairing. If you want hot-spare protection, *each* ServeRAID controller must have a hot-spare drive defined. You *must* connect hot-spare drives *only* to shared channels. Both servers must be able to access their uniquely-defined hot-spare drives in case a failover occurs *after* a hot-spare drive replaces a failed shared drive.
- Physical drives that are configured by one controller in the pair must appear as ready drives to the other controller in the pair. Be sure to verify this criterion when you add drives. Restart both servers, or scan for new devices using the ServeRAID Manager program on both servers, to make sure the added physical drives appear as ready drives on both servers before creating logical drives.

Array or logical drive considerations

- Create only *one* logical drive for each array.
- Every logical drive that is shared by the two servers *must* have its write-cache mode set to write through; this will help ensure that data integrity is maintained.

For logical drives that are not shared between the two servers, set the write-cache mode to write back; this will improve performance.

- You must assign merge-group numbers in the range 1–8 to each logical drive that will be shared. Merge-group numbers must be unique for each shared logical drive in the cluster. You must assign merge-group numbers 206 or 207 to the non-shared logical drives.
- If you are starting (booting) the operating system from a shared controller, define the first logical drive as the startup drive and assign a merge-group number for a non-shared drive, for example, 206 for Server A.
- The total number of logical drives per controller must be eight or less before or after a failover. If you exceed this number, a failover will not be completed.
- The following logical drives will not failover:
 - Logical drives currently undergoing Logical Drive Migration (LDM) operations
 - RAID level-5E logical drives undergoing compression or decompression
 - RAID level-5 or level-5E logical drives in a critical state

However, all other logical drives will failover if necessary.

- The ServeRAID controller does not permit the failover of RAID level-5 or level-5E logical drives that are in a critical state. For this reason, do not use RAID level-5 or level-5E for the quorum drive. You must configure the quorum drive as a RAID level-1 logical drive.

Note: Define hot-spare drives in your array to minimize the time that logical drives remain in critical state.

- If a failover occurs while a critical RAID level-1, level-1E, level-10 or level-1E0 logical drive is rebuilding to a spare disk, the rebuild operation automatically restarts.
- The cluster support software will initiate a synchronization of all RAID level logical drives except for the following:
 - RAID level-0 logical drives
 - Any critical or offline logical drives.

If a drive fails before this synchronization is complete, logical drive access is blocked and is no longer accessible.

- When a logical drive spans multiple SCSI channels and a failure within the drive subsystem occurs that is unique to a channel (for example, a disconnected cable), the entire physical array will be identified as failed even though access from the surviving server can occur. Therefore, if you have small arrays, consider not spanning multiple channels.

Monitoring and updating an IBM ServeRAID cluster solution

You can use the ServeRAID Manager program to check the ownership of a physical drive on another server or to add or remove a logical drive in the cluster. The ServeRAID Manager program supports three features for cluster functions:

- View shared drives
- Validate cluster
- Configure for clustering

Note: Make sure that you installed the ServeRAID Manager program on your server. For instructions, see the IBM ServeRAID *User's Guide*.

Checking the ownership of a physical drive

A physical drive that is owned (and configured) on Server B will appear in the ready or defunct state on Server A. Complete the following steps to determine whether a ready drive is owned by the other server:

1. In the ServeRAID Manager tree, click the controller that contains the ready drives. A window similar to the following opens.

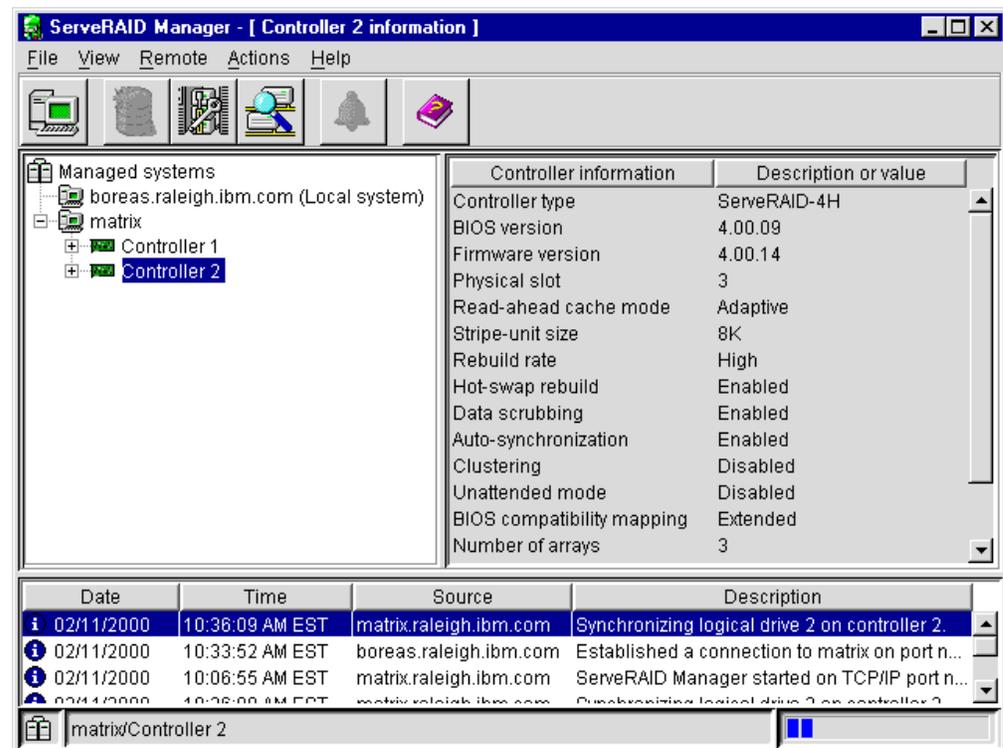


Figure 24. ServeRAID Manager window

2. Click **Actions** → **Clustering actions** → **View shared drives**. The "View shared drives" window opens.
3. Click **Enable view shared drives**.
4. Select the SCSI channel and SCSI ID of a physical drive on a shared channel.

5. Click **OK**. Physical drives that are available for use are labeled **Ready** in the tree. If the physical drive is not available for use (that is, it is owned by the other server), the drive is labeled **Reserved** in the tree.

Important: Hot-spare drives owned by the other server are not labeled Reserved. Be sure you do not inadvertently use a hot-spare drive in both servers.

Adding logical drives to a cluster

Complete the following steps to add logical drives to a cluster:

1. Install the hard disk drives in the server or shared expansion enclosure. For installation information, see the documentation that is included with the hard disk drive and the server.

Important: Physical drives that are configured by one controller in the pair must appear as ready drives to the other controller in the pair. Be sure to verify this status when you add drives *after* the servers are started. Before creating logical drives, restart both servers, or scan for new drives using the ServeRAID Manager program on both servers, to make sure the added physical drives appear as ready drives on both servers. For more information, see “ServeRAID considerations” on page 55.

2. Using the ServeRAID Manager program, configure the physical drives for the ServeRAID controller. For instructions, see “Configuring the ServeRAID controller” on page 28.

Note: If the drives will be shared, define only one logical drive per array.

3. In the ServeRAID Manager tree, click the controller for the cluster.
4. Click **Configure for clustering** on the toolbar. A window similar to the following opens.

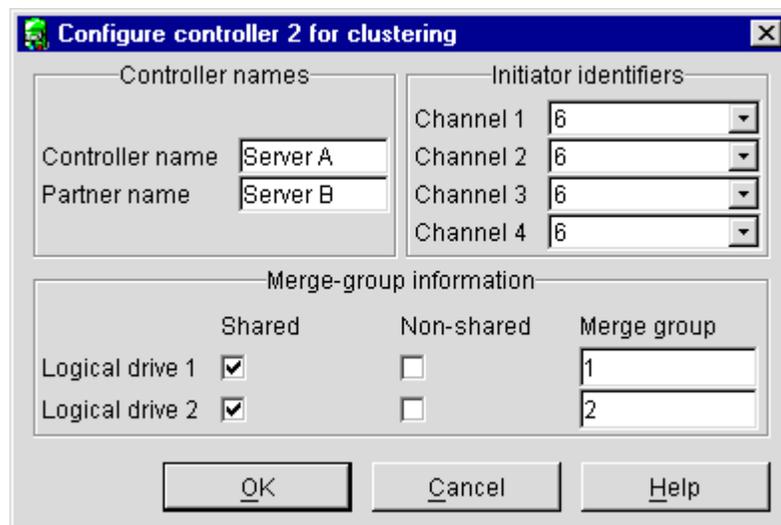


Figure 25. “Configure for clustering” window

5. Click **Shared** or **Non-shared** for the logical drive you have just defined.
6. Select the merge-group number that you want to use for the logical drive you just defined.

7. Click **OK**.
8. If you are using Windows NT 4.0, continue by creating additional ServeRAID disk resources on a Windows NT 4.0 ServeRAID cluster (see the IBM *ServeRAID User's Guide* for more information).

If you are using Windows 2000, continue by creating additional ServeRAID disk resources on a Windows 2000 ServeRAID cluster (see the IBM *ServeRAID User's Guide* for more information).

Validating a cluster

Use the Validate cluster feature to determine whether your cluster is configured correctly.

Note: You must have the ServeRAID Manager program installed and running on all servers in the cluster for this feature to work.

Complete the following steps to validate a cluster:

1. In the ServeRAID Manager tree, click a server in the cluster.
2. Click **Actions** → **Validate cluster**. A window similar to the following opens.

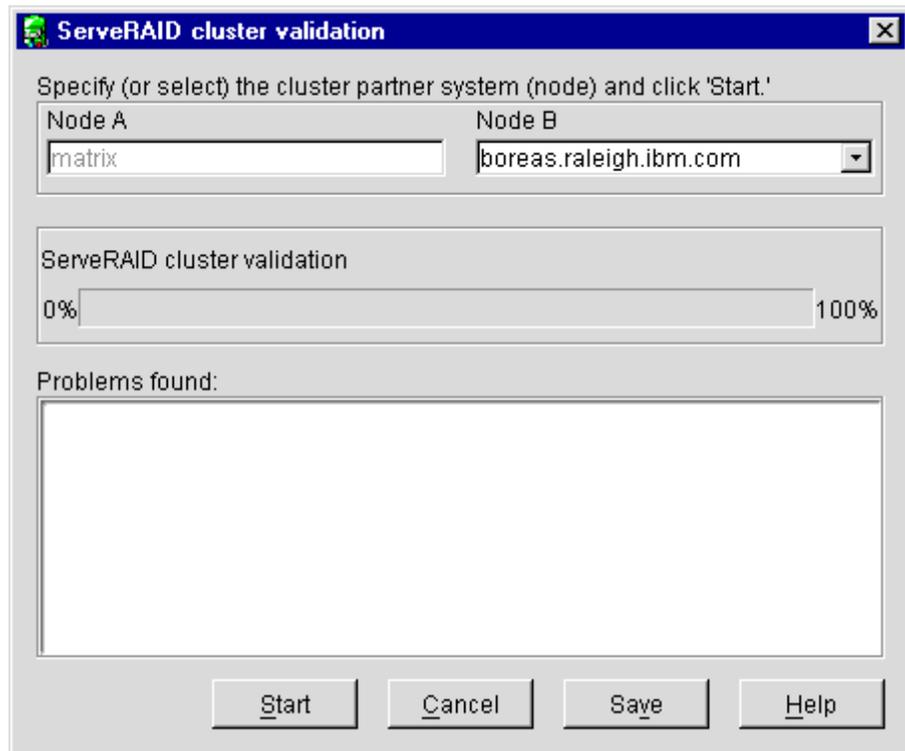


Figure 26. “ServeRAID cluster validation” window

The server you selected in step 1 is listed in the Node A field.

Note: You cannot change the Node A system in the “ServeRAID cluster validation” window. To select a different system, click **Cancel** to return to the ServeRAID Manager tree.

3. From the **Node B** menu, select your second server.

Note: The Node B system defaults to the first system in the tree other than the Node A system. If there are no remote systems in the tree, click **Cancel** to return to the tree and add a remote system. You can also type the Node B name.

4. Click **Start**. The ServeRAID Manager program scans both systems to verify the ServeRAID cluster configuration. The progress indicator reports the progress of the validation.
5. If you want to stop the validation before it is completed, click **Cancel**. Otherwise, if the ServeRAID Manager program finds problems with the ServeRAID cluster configuration, it reports the problems in the **Problems found** message field. If there are no problems with the ServeRAID cluster configuration, the message field reports only the cluster pairings found.
6. To view the problem report events in an easy-to-read window, double-click an event in the **Problems found** message field.
7. To save the contents of the **Problems found** message field, click **Save**. A “Save as” window opens. Specify the file name for the message field log and click **OK**.
8. Click **Done** to exit the “ServeRAID cluster validation” window. If the ServeRAID cluster configuration has problems, fix the problems; then, use **Validate cluster** again.

Viewing merge-group numbers and other cluster information

Complete the following steps to view the merge-group numbers and other cluster information:

1. In the ServeRAID Manager tree, click the controller you are using for the cluster.
2. Click **Configure for clustering** on the toolbar. A window similar to the following opens.

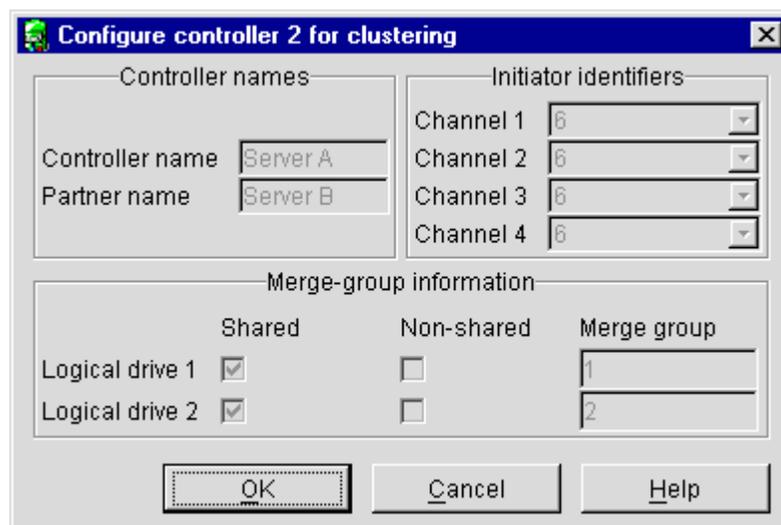


Figure 27. “Configure controller for clustering” window

Note: In this case, you can view this information only. You cannot change the information.

Maintenance and troubleshooting

Obtaining ServeRAID updates

IBM periodically makes updated versions of the ServeRAID software available from the IBM Support page on the World Wide Web.

Complete the following steps to locate files:

1. Go to <http://www.ibm.com/pc/support/>.
2. In the **Search** field at the top of the page, type ServeRAID; then, press Enter.

Note: If you download ServeRAID software, you must download and install *all* ServeRAID software at the same time. This will ensure that all levels of the software are compatible. The ServeRAID software includes the following:

- BIOS and firmware code
- Device drivers
- ServeRAID Manager program
- Command-line programs

If you do not have access to the World Wide Web, contact your place of purchase, your IBM reseller, or your IBM marketing representative for replacement CDs.

Updating BIOS and firmware code

Before configuring the ServeRAID controller, you must have the latest BIOS and firmware code installed on your server. Complete the following steps to update the levels of BIOS and firmware code:

1. Insert the *IBM ServeRAID Support* CD into the server CD-ROM drive, and turn on the server.

The IBM ServeRAID ROM Update Wizard automatically starts. The IBM ServeRAID ROM (read-only memory) Update Wizard is a program that updates the BIOS and firmware code on ServeRAID controllers. The wizard automatically identifies and scans each ServeRAID controller.

If the BIOS and firmware code do not require updating, the wizard automatically stops and the ServeRAID Manager program starts. Continue with “Configuring the ServeRAID controller” on page 28.

If the BIOS and firmware code require updating, a report screen opens with the following information:

- Controller types found.
- Controller slot number, if known.
- Firmware version.
- BIOS version.
- Update status. If a controller has outdated BIOS or firmware code, the IBM ServeRAID ROM Update Wizard marks the controller as a candidate for update.

The IBM ServeRAID ROM Update Wizard asks if you want to update. You decide whether to update, but you must update all or none of the controllers in your server; you cannot selectively update.

2. If you want to update your ServeRAID controllers, click **Update**. If the wizard detects an error, an error message appears and you are prompted to insert a diskette into your diskette drive. The wizard saves details about the error to a file on the diskette.

If you do not want to update your ServeRAID controllers, click **Cancel**.

3. When all updates are completed, scroll through the Features window. This window reports the changes that the IBM ServeRAID ROM Update Wizard applied to your ServeRAID controllers.
4. Leave the *IBM ServeRAID Support* CD in the CD-ROM drive; shut down and restart the server.

Upgrading a ServeRAID controller

This section contains instructions for upgrading a ServeRAID controller. The following table displays possible upgrade scenarios.

| Existing controller | Upgrade to ServeRAID-II | Upgrade to ServeRAID-3 | Upgrade to ServeRAID-4 |
|---------------------|-------------------------|------------------------|------------------------|
| ServeRAID-II | Yes | Yes | Yes |
| ServeRAID-3 | No | Yes | Yes |
| ServeRAID-4 | No | No | Yes |
| ServeRAID-5i | No | No | No |

Backward compatibility is not supported. In addition, you must usually upgrade to a controller with the same or greater number of channels; upgrading to a controller with fewer number of channels is possible only if the new controller contains as many or more channels than those actually used on the original controller.

You must select a ServeRAID controller that meets the conditions outlined above. After updating the device driver, BIOS and firmware code, and utility programs, you can replace the older controller with the new controller and copy the configuration from the physical drives.

Notes:

1. When upgrading an existing system, you *must* update the device driver before flashing the controller with the new BIOS and firmware code.
2. This procedure assumes that you are replacing an existing ServeRAID controller in a fully functioning system.

Updating device drivers, BIOS and firmware code, and utility programs

Complete the following steps to upgrade the device driver, BIOS and firmware code, and utility programs:

1. Install the device driver for the new ServeRAID controller. For more information, see the *IBM ServeRAID Device Driver Installation Instructions* (DEVDRV51.PDF) on the *IBM ServeRAID Support* CD.
2. Update the BIOS and firmware code for your existing ServeRAID controller, using the *IBM ServeRAID Support* CD that came with the new controller. For more information, see “Updating BIOS and firmware code” on page 61.
3. If the IPSEND command-line program is currently installed on the server, upgrade to the latest version. For more information, see the *IBM ServeRAID User’s Guide*.
4. Upgrade or install the ServeRAID Manager program. For more information, see the *IBM ServeRAID User’s Guide*.
5. Ensure that the server is functioning properly before continuing to “Replacing the old controller” on page 63.

Replacing the old controller

Complete the following steps to replace the old controller:

1. Shut down the server.
2. If the controller is a ServeRAID-4x:
 - a. Make note of which SCSI cables were attached to specific channels.
 - b. Remove any cables from the old controller; remove the controller.
 - c. Insert the new controller into a PCI slot. If possible, use the PCI slot in which the old controller was inserted.
 - d. Attach the SCSI cables to the new controller.

Note: If the new controller has the same number of channels as the old controller, attach storage devices to the same channels as used previously.

3. If the controller is a ServeRAID-5i:
 - a. Remove the ServeRAID-5i controller.
 - b. Insert the new ServeRAID-5i controller in the same extended PCI slot as the one that was just removed.
4. Insert the *IBM ServeRAID Support* CD into the server CD-ROM drive, and turn on the server. The IBM ServeRAID ROM Update Wizard automatically starts. If the BIOS and firmware code do not require updating, the wizard automatically stops, and the ServeRAID Manager starts. Go to step 5. If necessary, update the BIOS and firmware code for the new controller. Leave the *IBM ServeRAID Support* CD in the CD-ROM drive; shut down and start the server.
5. After the ServeRAID Manager program starts, click the new controller in the left pane.
6. Click **Actions** → **Restore to factory-default settings**.
7. Click **Actions** → **Copy configuration from drives**.
8. Shut down the server, and remove the *IBM ServeRAID Support* CD from the CD-ROM drive.
9. Restart the server.

Symptom-to-FRU index

This index supports ServeRAID-4H, -4L, -4Lx, -4M and -4Mx Ultra 160 SCSI controllers, and ServeRAID-5i Ultra 320SCSI controllers.

The Symptom-to-FRU index lists symptoms, errors, and the possible causes.

The purpose of this index is to allow the servicer to determine which FRUs may need to be replaced at the conclusion of troubleshooting procedures.

Note: Do not replace any FRU until you have followed the POST (ISPR) Error Procedures (see “POST (ISPR) error procedures” on page 93). Only replace a ServeRAID-4H, -4L, -4Lx, -4M, -4Mx or -5i controller if indicated to do so in the POST (ISPR) Error Procedures.

xxx in the following table is used as a placeholder and may be any letter or number in an actual error message.

| Error | FRU/action |
|----------------------------------|---|
| 1xxx (Microcode checksum error) | 1. ServeRAID controller |
| 2xxx (Code DRAM error) | 1. Install download jumpers, flash latest level BIOS and firmware for controller. Remove jumpers. 2. ServeRAID controller. |
| 3000-31XX (Code DRAM error) | 1. Install download jumpers, flash latest level BIOS and firmware for controller. Remove jumpers. 2. ServeRAID controller. |
| 3200 (Code DRAM error) | 1. Install download jumpers, flash latest level BIOS code and firmware for controller. Remove jumpers. 2. ServeRAID controller. |
| 3300 (ServeRAID-5i only) | 1. Install ServeRAID-5i controller in an extended PCI expansion slot. See the documentation that came with the server for more information. |
| 3E20 (ServeRAID-5i only) | 1. Remove the ServeRAID-5i controller from its slot and install it in the proper PCI option slot. 2. Verify that the ServeRAID-5i controller is supported in this server. 3. ServeRAID-5i controller. 4. System board (refer to the <i>Hardware Maintenance Manual</i> for your system). |
| 3E2x | 1. Reseat the ServeRAID controller. 2. Flash latest level of BIOS code and firmware for controller. 3. ServeRAID-5i controller. 4. Integrated RAID controller on server (refer to the <i>Hardware Maintenance Manual</i> for your system). |
| 4xxx thru 5xxx (Code DRAM error) | 1. Install download jumpers, flash latest level BIOS code and firmware for controller. Remove jumpers. 2. ServeRAID controller. |

| Error | FRU/action |
|---|---|
| 6xxx (Cache DRAM error) (ServeRAID-4H only) | <ol style="list-style-type: none"> 1. Reseat daughter card. 2. Install download jumpers, flash latest level BIOS code and firmware for controller. Remove jumpers. 3. ServeRAID controller. |
| 7xxx thru 8xxx (Host/local PCI bus interface error) | <ol style="list-style-type: none"> 1. Flash latest level of BIOS code and firmware for controller. 2. If ServeRAID-4x controller, replace controller. 3. If ServeRAID-5i controller, integrated RAID controller on the server (refer to the <i>Hardware Maintenance Manual</i> for your system). |
| 9003 | <ol style="list-style-type: none"> 1. Flash latest level of BIOS code and firmware for controller. 2. Confirm that this controller is a supported option for this system. 3. ServeRAID controller. 4. Integrated RAID controller on the server (refer to the <i>Hardware Maintenance Manual</i> for your system). |
| 9xxx thru BZxx (SCSI bus error caused by cables, termination, defective drives, etc.). Z refers to the specific channel or channels that cause the error. See "Drive state descriptions" on page 113. | <ol style="list-style-type: none"> 1. Follow indications at "POST (ISPR) error procedures" on page 93. Follow those instructions before continuing with the next steps listed in this index. 2. SCSI cable. 3. SCSI backplane. 4. Hard drive. 5. ServeRAID controller. |
| EFFE (Firmware code corrupt or download jumpers are in place) | <ol style="list-style-type: none"> 1. Flash latest level BIOS and firmware for controller. Remove jumpers. 2. ServeRAID controller. |
| FFFF or other code not listed | <ol style="list-style-type: none"> 1. Follow indications at "POST (ISPR) error procedures" on page 93. 2. SCSI cable. 3. SCSI backplane. 4. Hard disk drive. 5. ServeRAID controller. |

Parts listing

The following table lists the ServeRAID-4x and 5i controller parts and provides the FRU number.

Table 1. Part name and FRU for ServeRAID-4H

| Part name | FRU P/N |
|-------------------------------------|---------|
| Base card assembly | 37L6892 |
| Daughter card assembly (Japan only) | 19K0561 |
| Daughter card assembly | 37L6902 |
| Battery (Japan only) | 00N9561 |
| Battery | 37L6903 |
| ServeRAID Support CD | 19K0577 |
| ServeRAID Support CD (Japan) | 19K0578 |

Table 2. Part name and FRU for ServeRAID-4L

| Part name | FRU P/N |
|------------------------------|---------|
| Card assembly | 09N9540 |
| ServeRAID Support CD | 19K0579 |
| ServeRAID Support CD (Japan) | 19K0580 |

Table 3. Part name and FRU for ServeRAID-4Lx

| Part name | FRU P/N |
|------------------------------|---------|
| Card assembly | 06P5741 |
| ServeRAID Support CD | 19K6131 |
| ServeRAID Support CD (Japan) | 24P2925 |

Table 4. Part name and FRU for ServeRAID-4M

| Part name | FRU P/N |
|------------------------------|---------|
| Card assembly | 37L7258 |
| Card assembly (Japan only) | 00N9543 |
| Battery | 37L6903 |
| Battery (Japan only) | 00N9561 |
| ServeRAID Support CD | 19K0579 |
| ServeRAID Support CD (Japan) | 19K0580 |

Table 5. Part name and FRU for ServeRAID-4Mx

| Part name | FRU P/N |
|----------------------------|---------|
| Card assembly | 06P5737 |
| Card assembly (Japan only) | 06P5739 |
| Battery | 37L6903 |
| Battery (Japan only) | 00N9561 |
| ServeRAID Support CD | 19K6131 |

Table 5. Part name and FRU for ServeRAID-4Mx (continued)

| Part name | FRU P/N |
|------------------------------|----------------|
| ServeRAID Support CD (Japan) | 24P2925 |

Table 6. Part name and FRU for ServeRAID-5i

| Part name | FRU P/N |
|----------------------|----------------|
| Card assembly | 32P0016 |
| Battery | 25P3482 |
| ServeRAID Support CD | 33P2640 |

Recovery procedures

This section includes information on the recovering from certain problems.

IBM ServeRAID Support CD warning message while starting

If you start a server with the *IBM ServeRAID Support* CD in the CD-ROM drive, the following warning message might be displayed:

```
You passed an undefined mode number.  
Press <RETURN> to see video modes available,  
<SPACE> to continue or wait 30 secs
```

Press the Spacebar to continue starting the *IBM ServeRAID Support* CD. The following message appears, and the CD starts:

```
Uncompressing Linux... Ok, booting the kernel.
```

Recovering from problems starting the ServeRAID Manager

| Problem | Explanation | Action |
|---|--|---|
| The ServeRAID Manager program hangs on the splash screen. | You might be using an old version of the ServeRAID device driver. | Upgrade the ServeRAID device driver to the latest version. More information about installing ServeRAID device drivers is available in the <i>IBM ServeRAID User's Guide</i> . |
| When starting the ServeRAID Manager, the following error message is displayed: Unable to find load file RAIDMAN | The ServeRAID Manager program was not installed to the root directory of the SYS volume. | Reinstall the ServeRAID Manager. If the installation is completed properly, there will be a directory called RAIDMAN under the root directory of the SYS volume. |
| When starting the ServeRAID Manager, the following error message is displayed: -autounload is an invalid parameter | You are using an old version of the Novell Java™ Virtual machine (JVM). | Download and install the latest JVM from the Novell Web site: http://developer.novell.com/ndk/download.htm |
| When starting the ServeRAID Manager, the following error message is displayed: ERROR: Unable to find Java | The Novell Java Virtual machine (JVM) is not installed on your server. | Download and install the latest JVM from the Novell Web site: http://developer.novell.com/ndk/download.htm |

| Problem | Explanation | Action |
|---|--|--|
| <p>The ServeRAID Manager program fails to start, and the following error message is displayed:</p> <pre>Can't find class com.ibm.sysmgmt.raidmgr.mgtGUI. Launch</pre> | <p>Your TCP/IP hosts file is not configured for the local server hostname.</p> | <p>Configure your TCP/IP hosts file for the local server hostname.</p> <ol style="list-style-type: none"> 1. Open the <code>/etc/hosts</code> file. 2. If TCP/IP networking is configured, complete the following steps: <ol style="list-style-type: none"> a. If the hostname of the server is identified on the line starting with <code>127.0.0.1</code>, remove the hostname from this line. b. On a new line, type the IP address of the server. c. Press the Tab key to the second column and type the fully qualified hostname. d. Press the Tab key to the third column and type the nickname for the server. <p>Note: The following is an example of a completed line:</p> <pre>1.1.1.1 matrix.localdomain matrix</pre> <p>where <code>1.1.1.1</code> is the IP address of the server and <code>matrix</code> is the hostname of the server.</p> 3. If TCP/IP networking is not configured, type the server name in the third column of the line that starts with <code>127.0.0.1</code>. <p>Note: The following is an example of a completed line:</p> <pre>127.0.0.1 localhost matrix</pre> <p>where <code>matrix</code> is the server name.</p> 4. Restart the server for these changes to take effect. |

Recovering from an incomplete format of a physical drive

During formatting of a physical drive, if the format process is stopped by a system reset, system shutdown, power outage, or by some other means, the physical drive becomes inoperable.

Complete the following steps to enable the physical drive to communicate with the ServeRAID controller again:

1. Note the channel of the ServeRAID controller to which the physical drive is connected.
2. Note the SCSI ID of the physical drive.
3. Use the **ipssend format** function to restart the format of the physical drive. The syntax is: **ipssend format** *controller channel sid*
where:
 - *controller* is the ServeRAID controller number (1–12)
 - *channel* is the channel number for the device (1–4)
 - *sid* is the SCSI ID for the device (0–15)

After the format process is complete, the ServeRAID controller will be able to recognize the drive again.

Channel troubleshooting procedures

Note: The ServeRAID-5i controller does not have any physical channel connectors; it uses the system's onboard integrated controller's channel connectors. All references to channels in these troubleshooting procedures are in regard to the integrated controller physical connectors for the ServeRAID-5i only. Logically, these channels are the same as the other ServeRAID controllers.

This procedure should be used when there is a problem on the SCSI channel outboard of the controller that prevents the controller from communicating with the devices attached to that channel.

1. For non-hot-swap systems, check termination of identified channel.
2. Check for proper cabling configuration in systems that use DASD status cables.
3. To determine if a single drive is causing the failure, disconnect one drive at a time and reboot the system each time. Continue until you have disconnected all the drives, or the failure has disappeared.
4. Replace SCSI cable.
5. Replace SCSI backplane.
6. If the controller is a ServeRAID-4x, replace the controller.
7. If the controller is a ServeRAID-5i, refer to your system's *Hardware Maintenance Manual* or *User's Guide*.

Dead channel service procedure

Use this procedure when, on one or more channels, all configured (ONL/HSP) drives are shown as DDD, and all RDY/SBY/DHS devices are shown as EMP.

Before continuing, verify that the hard drive enclosure is powered on. If the drives in the enclosure have been marked DDD because the enclosure was powered off, power-on the enclosure, then import the configuration from the drives by performing the following actions:

1. Press **CTRL+I** during POST to enter the Mini-Configuration program.
2. Choose **Advanced Functions**.
3. Choose **Import Configuration**.

The dead channel service procedure is listed in the following steps:

001

IS THIS A SERVERAID-5i CONTROLLER?

YES: Follow "Channel troubleshooting procedures".

NO: Go to step **002**

002

DOES THIS SERVERAID CONTROLLER HAVE MORE THAN ONE CHANNEL?

YES: Go to step **003**.

NO:

- Follow the channel trouble shooting procedure. See "Channel record table" on page 101.

- If serveRAID controller has only one channel and it is failing, move controller to a different PCI slot. If problem persists, replace the controller.

003

DO THE OTHER CHANNELS ON THE SERVERAID CONTROLLER HAVE ANY DEVICES CONNECTED?

YES: Go to step **004** .

NO:

- **Do not** press F5, since this changes the customer's configuration.
- Connect the failing channel cable to one of the other channel connectors on the controller and reboot.

You should get new error messages now for the moved channel in the form of "Following drives not responding...", and "Following drives found in new location..." If you get "...drives not responding..." and do not get the "...drives in new location...", there is a problem on the SCSI channel outboard of the controller that prevents the controller from communicating with the devices attached to that channel. Go to "Channel record table" on page 101 to resolve the problem. If you get "...drives not responding..." and "...drives in new location...", reconnect the cable to the original channel connector and reboot. If original message appears, the original channel on the controller is defective. Replace controller.

004

DOES THE STATUS FOR THESE DRIVES APPEAR CORRECT?

YES: **Do not** press F5, since this changes the customer's configuration.

- Disconnect one of the correctly-operating channel connectors at the controller and connect it to the failing controller channel.
- Reboot the system.

You should get new error messages now for the moved channel in the form of "Following drives not responding...", referring to original and moved channels, and "Following drives found in new location..."

If you get the message "...not responding...", referring to original and moved channels, and do not get the "Following drives found in new location..." message, this channel on the controller is defective. Replace controller. If you get "...new location...", this channel on the controller is working correctly.

- Connect the original failing channel cable to the connector from which the working channel was removed and reboot.

If you get the "...drives not responding" message, and do not get the "Following drives found in new location...", there is a problem on the SCSI channel outboard of the controller that prevents the controller from communicating with the devices attached to that channel. Go to "Channel record table" on page 101 to resolve the problem. If you get the "...drives in new location..." message, the problem has apparently resolved itself. Restore the channel

connections to original locations and reboot. If the original problem persists, suspect a problem in the mating of the cable and controller connectors.

NO: Status is incorrect for multiple channels.

- Verify that devices on channel are powered up and properly connected.
- Move controller to a different PCI slot.

If problem persists, replace the controller.

Drive replacement (rebuilding a defunct drive)

A physical drive is marked defunct when there is a loss of communication between the controller and the physical drive. This can be caused by any of the following:

- An improperly connected cable, physical drive, or controller
- Loss of power to a drive
- An improperly assembled SCSI channel in an unsupported configuration
- A defective cable, backplane, physical drive, or controller
- Connecting unsupported SCSI devices (such as tape drives or CD-ROM drives) to the same SCSI channel used for an array

In each case, after the communication problem is resolved, a rebuild operation is required to reconstruct the data for the device in its disk array. The ServeRAID controllers can reconstruct RAID level-1, level-1E, level-5, level-5E, level-10, level-1E0, and level-50 logical drives. They cannot, however, reconstruct data stored in RAID level-0 logical drives because RAID level-0 is not redundant. If an array contains only RAID level-0 logical drives, the logical drives in the array are marked offline and the logical drives contain damaged data. You cannot rebuild the logical drives. You must correct the cause of the failure or replace the physical drives; then, you must restore your data.

To prevent data-integrity problems, the ServeRAID controllers set the RAID level-0 logical drives in the affected array to blocked status during the rebuild operation for RAID level-1 or RAID level-5. After the rebuild operation is completed, you can unblock the RAID level-0 logical drives and access them once again. Remember, however, that the RAID level-0 logical drives contain damaged data.

Note: For logical drives in an IBM ServeRAID Cluster Solution:

- Because shared logical drives can have *only* one logical drive for each array, blocking a RAID level-0 logical drive during a rebuild operation does *not* apply to shared logical drives.
- Because non-shared logical drives can have *more* than one logical drive for each array, blocking a RAID level-0 logical drive during a rebuild operation *does* apply to non-shared logical drives.

Recovering from defunct drives

When a physical drive is marked as *defunct* and *it is not part of an array*, it has been replaced in the array that it had formerly belonged to with a new physical drive. Run the ServeRAID diagnostics that can be started from the server's diagnostics by starting the server and pressing the F2 key when prompted. If the diagnostics do not log an error for the physical drive, set the drive to the "ready" state using the IPSSSEND programs SETSTATE command (see "Error-recovery

functions” on page 45). If successful, it can now be made part of a new array or set up as a hot spare drive using that same command.

If a physical drive fails in an array or multiple physical drives fail in separate arrays (one physical drive per array), complete the following steps:

1. Replace each defunct physical drive. The ServeRAID controller starts the rebuild operation when it detects the removal and reinsertion of a drive that is part of an array.

Note: (For a configuration that contains a hot-spare drive) If you replace a failed physical drive, it is not necessary to position the new physical drive on the same SCSI channel and SCSI ID as the original hot-spare drive. The replacement physical drive is automatically incorporated into the configuration as a hot-spare drive. Here is an example of how this works:

- a. The original configuration consists of a RAID level-5 logical drive composed of four physical drives. The physical drives are connected to SCSI channel 1; they are assigned SCSI IDs 0, 1, 2, and 3. SCSI ID 3 is a hot-spare drive.
 - b. The physical drive at Channel 1, SCSI ID 2, fails; the logical drive enters the critical state.
 - c. The hot-spare drive at Channel 1, SCSI ID 3, is rebuilt into the array.
 - d. You remove the failed physical drive at Channel 1, SCSI ID 2, and replace it with a new physical drive. The new physical drive at Channel 1, SCSI ID 2, is automatically assigned to be a hot-spare drive.
2. If a rebuild operation is in progress, wait until the rebuild is complete. Otherwise, go to step 3.

Note: If you are replacing multiple defunct drives, you must wait for each rebuild operation to complete before starting subsequent rebuild operations.

3. Verify the cables, physical drives, and controllers are installed properly.
4. Attempt to rebuild the defunct physical drive by performing a hot-swap rebuild. See “Rebuilding a hot-swap drive” for instructions.
5. If the hot-swap rebuild fails, use the system diagnostics to test the ServeRAID subsystem. Press F2 to start diagnostics. If the diagnostics fail, refer to the *Hardware Maintenance Manual* for the server and find the error codes to determine which component is to be replaced.

Note: Be sure to use the most recent diagnostic tests available for the server.

Rebuilding a hot-swap drive

A hot-swap rebuild refers to a rebuild operation that is started by the ServeRAID controller when it detects that a drive that is part of an array and in the defunct state has been removed and reinserted on the SCSI cable or backplane. The reinsertion of the physical drive, whether it is the same drive or a new drive, will trigger the ServeRAID controller to start the rebuild operation. During the rebuild operation, the drive being rebuilt is in the rebuild state, and the logical drive remains critical until the rebuild operation has been successfully completed.

On IBM servers, when a hot-spare drive is available, the rebuild operation begins automatically without the need to replace the failed drive. If more than one drive fails within the same array, no rebuild takes place. If multiple drives fail in separate

arrays (one physical drive per array), the controller initiates a rebuild operation for the logical drives within the array containing the first failed physical drive. This rebuild operation is performed on the *first* hot-spare drive of sufficient size to become a valid member of the array.

Complete the following steps to start a hot-swap rebuild:

1. Without removing the drive completely, gently remove the physical drive from the server, using the handle of the hot-swap tray. If necessary, see the documentation that comes with your server for information about removing a physical drive.

Attention: When power is removed from a hot-swap drive, the drive immediately parks the heads, locks the actuator in the “landing zone,” and begins spinning down. However, the spinning down of the disk might require up to 20 seconds after power is removed. Do not move the drive while it is spinning down. Moving the drive while it is spinning down might damage the drive.

2. Wait 20 seconds to allow the physical drive to completely stop spinning.
3. If you are certain there is nothing wrong with the physical drive you removed, gently reinstall the drive into the server. Make sure the drive is completely installed in the backplane connector.

Otherwise, replace the physical drive with a new drive that is the same size (or larger) and continue with the rebuild operation.

Notes:

- a. If multiple drives fail in separate arrays (one physical drive per array), replace each defunct physical drive. If multiple physical drives fail at the same time within the *same* array, see “Recovering from multiple physical drive failures (Windows only)”.
- b. Although it is possible to rebuild a defunct physical drive to an online physical drive that is defective, avoid doing so.

Recovering from multiple physical drive failures (Windows only)

Important:

- There is no guarantee that this procedure will recover data.
- This procedure requires a ServeRAID-3 or ServeRAID-4 controller with BIOS and firmware at version 4.x or later installed prior to the physical drive failures.
- Repeat this procedure for *each* array that contains multiple physical drives marked defunct.

The ServeRAID controller is designed to tolerate a *single* physical drive failure in an array. Although there is no guarantee that intact data can be recovered after a *multiple* physical drive failure in an array, the following procedure offers the possibility of a successful recovery in the event that multiple physical drives are marked defunct within the same array.

You will need the following:

- An *IBM ServeRAID Support* CD, version 4.80 or later.
- A diskette containing the IPSEND command-line program. This can be either downloaded from the IBM Web site or created using the *IBM ServeRAID Support* CD.

- A version of DUMPLOG and CLEARLOG appropriate for your operating system. You can download both programs from the IBM Support Web site at <http://www.ibm.com/pc/support>

Notes:

1. If you have downloaded a newer version of the *IBM ServeRAID Support CD*, do *not* upgrade the BIOS and firmware until you have completed this procedure.
2. The following procedures rely upon logging functions introduced in version 4.0 of the *IBM ServeRAID Support CD*. The ServeRAID controller must have had BIOS and firmware version 4.x or later installed *prior* to the multiple physical drive failure.

This procedure involves the following steps:

1. Capturing the ServeRAID logs
2. Isolating and removing the failed physical drive
3. Checking the hardware connections
4. Setting defunct drives to the online state
5. Accessing the critical logical drives
6. Finishing the procedure

Capturing the ServeRAID logs

Complete the following steps to capture the ServeRAID logs:

1. Run DUMPLOG.BAT to capture the ServeRAID logs. Do one of the following:
 - If the operating system is located on the failed logical drive, complete the following steps:
 - a. Copy the DUMPLOG.BAT and CLEARLOG.BAT files to the root of the ServeRAID diskette.
 - b. Start the server from the ServeRAID command-line diskette.
 - c. At the prompt, type the following:
`DUMPLOG filename controller`

 where *filename* is the name of the text file and *controller* is the ServeRAID controller number (1-12)
 - If the operating system is accessible, complete the following tasks:
 - a. Copy or extract the DUMPLOG utility appropriate for your operating system to a local directory or folder.
 - b. Run the DUMPLOG command appropriate for the operating system and save the output to a text file.
2. Trained service technicians can refer to the logs for root-cause analysis. The logs provide the best evidence for determining the cause of the failure.

Isolating and removing the failed physical drive

To use ServeRAID Manager to determine the order in which drives were marked defunct, complete the following steps:

1. Start ServeRAID Manager in startable-CD mode.
2. In the ServeRAID Manager tree, right-click **Local system**.
3. Click **Save printable configuration and event logs**; then, press Enter. A window opens, listing the name and location of the log file.
4. Click **OK**.

5. Open the log file in a text editor. The ServeRAID defunct drive event log lists all physical drives marked defunct; the most recent failure is shown at the bottom of the list.
6. Review the list to determine which physical drive failed first. If you cannot determine which drive failed first, go to step 7 on page 78 of “Accessing the critical logical drives.”

Notes:

- a. The ServeRAID defunct drive event log *might* contain entries from earlier incidents of defunct drives. Review the list of defunct drives carefully, and use the date and time stamps to identify the first drives associated with *this* incident.
 - b. In certain circumstances, the ServeRAID defunct drive event log does not list the drives in the exact order that the drives failed. For example, when an array spans multiple ServeRAID channels, the ServeRAID controller issues parallel I/O requests to devices on each channel. In the event of a catastrophic failure, physical drives might be marked defunct at the same time.
7. Remove the first physical drive marked defunct from the backplane or disconnect the SCSI cable from the drive.
 8. Exit ServeRAID Manager; then, shut down the server.

Checking the hardware connections

While the server is turned off, complete the following tasks:

1. Reseat the ServeRAID controllers.
2. Reseat the SCSI cables and the disks against the backplanes.
3. Reseat the power cables to the backplane and SCSI backplane repeater options, if they are present.

As you are reseating the components, visually inspect each piece for bent pins, nicks, crimps, pinches, or other signs of damage. Take extra time to ensure that each component snaps or clicks into place properly.

Setting defunct drives to the online state

Complete the following steps to set the defunct drives to the online state:

1. Start the server.
2. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
3. Use ServeRAID Manager to delete all hot-spare and standby-hot-spare drives. This will prevent a rebuild operation from starting.
4. Set each defunct physical drive in the failed array to the online state. The failed logical drives should change to a critical state. If there are problems bringing physical drives online, or if a physical drive initially goes online and then fails to a defunct state soon after, see “Troubleshooting” on page 78. The logical drives must be in a critical state before you proceed.

Accessing the critical logical drives

Complete the following steps to attempt to access the critical logical drives:

1. If you are still in ServeRAID Manager, exit and restart the server.
2. Attempt to start the operating system. If you are prompted to perform any file-system integrity tests, skip the tests.

3. If the operating system starts, run the IPSSSEND getbst command on each logical drive. This will determine if the bad stripe table has incremented on a logical drive. If there are one or more bad stripes, data is lost or damaged.
4. Run a read-only, file-system integrity check on each logical drive.
5. Using application-specific tools, run more intensive integrity tests on each logical drive.
6. If all tests pass, you can assume that the data is good. Go to “Finishing the procedure”. Otherwise, weigh the results of the file-integrity tests and determine how best to proceed. Your options include the following:
 - Use a recent backup to restore damaged files.
 - Use a recent backup to restore damaged files; schedule a planned outage to rebuild the data at a later date.
 - Restore or rebuild the data.
7. Restore or rebuild the missing data on each critical logical drive if any of the following problems persists:
 - The critical logical drive remains inaccessible.
 - Data errors are found on the critical logical drives.
 - The operating system continuously fails to start properly.
 - Partition information on the critical logical drives is unknown.

Finishing the procedure

Complete the following steps:

1. Initiate a backup of the data.
2. After the backup is completed, replace the physical drive that was removed in step 7 on page 77. The new physical drive must be equal to or greater in size than the original drive. An auto-rebuild operation will start.
3. If necessary, redefine the hot-spare drives.
4. Using DUMPLOG, capture another set of ServeRAID logs.
5. Clear the ServeRAID logs using the following CLEARLOG.BAT command available on the DUMPLOG Web site:

```
CLEARLOG controller
```

where *controller* is the ServeRAID controller number (1-12).

6. Using DUMPLOG, capture the ServeRAID logs after two to three days of normal activity. Trained service technicians can refer to the logs to determine whether the ServeRAID controller and SCSI bus activities are operating properly.

Troubleshooting

If you continue to experience problems, review the following information. It might help you identify the configuration or hardware problem.

Poor signal quality across the SCSI bus

The most common cause of multiple physical drive failures is poor signal quality across the SCSI bus. As the SCSI protocol tries to recover, the overhead increases. As the system becomes busier and demand for data increases, the corrective actions of the SCSI protocol increase, and the SCSI bus moves toward saturation. This overhead will eventually limit the normal device communication bandwidth. If left unchecked, one or more SCSI physical drives might not respond to the ServeRAID controller in a timely way, which will result in the ServeRAID controller marking the physical drives defunct.

Poor signal quality problems can be caused by any of the following:

- Improper installation of the ServeRAID controller in a PCI slot
- Poor cable connections
- Poor seating of hot-swap drives against the SCSI backplane
- Improper installation or seating of backplane repeaters
- Improper SCSI bus termination

Isolating hardware problems

You can use the following techniques to isolate most hardware problems:

- Check error codes within the ServeRAID Manager when a physical drive fails to respond to a command. Research these codes in the *Hardware Maintenance Manual and Troubleshooting Guide* for your server.
- In non-hot swap systems, make sure the physical drives are properly attached to the cable connectors. Start with the connector closest to the SCSI terminator and work your way forward to the connector closest to the controller. Examine each SCSI device and ensure that it has the proper jumper settings.
- While the server is turned off, reseal the ServeRAID controller in its PCI slot and all cables and disk devices on the SCSI bus.
- Examine the cables for bent or missing pins, nicks, crimps, pinches, or over-stretching.
- Temporarily attach the physical drives to an integrated SCSI controller, if available. Start the BIOS. As the BIOS POST runs, review the status of the physical drives and the negotiated data rates. Determine if it is correct.

From the BIOS, choose an option which will list all the devices attached to the controller. Select one of the physical drives and initiate a media test. This will test the device and the entire SCSI bus. If you see errors on the integrated SCSI controller, try to determine if it is the physical drive or the cable by initiating a media test on other physical drives. Test both online and defunct physical drives to determine if the test results are consistent with the drive states on the ServeRAID controller. You can also move hot-swap physical drives to a different position on the backplane and retest to see if the results change.

If the problem persists, swap out the SCSI cable and run a media test again on the physical drives. If the physical drives pass the test, the previous cable is bad. This is a valuable technique for isolating a failing component in the SCSI path.

Note: Depending on the rate at which it negotiates data with low-voltage differential (LVD) SCSI devices, an integrated controller might produce different results than the ServeRAID controller.

- Use the system diagnostics to test the ServeRAID subsystem. Press F2 to start diagnostics. If the subsystem fails the test, disconnect the physical drives from the ServeRAID controller; then, reset the controller to the factory-default settings. Run the diagnostic tests again. If the subsystem passes the diagnostics test, then attach the disks to the ServeRAID controller, one channel at a time, and run the tests again to isolate the channel of the failing component. If the controller continues to fail diagnostic tests, refer to the *Hardware Maintenance Manual* for the server and find the error codes that determine which component is to be replaced.

Note: Be sure to use the most recent diagnostic tests available for the server.

- Disconnect the first physical drive marked defunct from the cable or backplane. Restore the ServeRAID controller to the factory-default setting. Attempt to import the RAID configuration from the physical drives. Depending on how the failure

occurred, this technique might have mixed results. There is a reasonable chance that all physical drives will return to an online state, except for the physical drive that is disconnected.

- Move the ServeRAID controller into a different PCI slot or PCI bus and retest.

Notes:

1. When attaching an LVD ServeRAID controller to storage enclosures, set the data rate for the channel to the data rate supported by the enclosure.
 2. Mixing LVD SCSI devices with single-ended SCSI devices on the same SCSI bus will switch all devices on the channel to single-ended mode and data rates.
- Trained service technicians can refer to the ServeRAID logs captured on the system for interpretation to isolate a failing component.

Locating the startup device (SCO OpenServer only)

After installing a ServeRAID controller, SCO OpenServer might fail to find the startup (boot) device.

This problem occurs when your server locates a startup device before coming to the ServeRAID controller on which OpenServer is installed. To solve this problem, consult the documentation that came with your server to determine the PCI slot scan order; then, specify the startup device.

Complete the following steps to specify the startup device:

1. Restart the server.
2. From the prompt, type the following and press Enter:

```
boot: defbootstr Sdsk=ips(x,0,0,0)
```

where *x* is the number of startup devices installed before the ServeRAID controller on which OpenServer is installed.

Solving problems in a failover environment

Use these procedures to recover from problems in a failover environment. Also, you can find hints and tips to help you solve problems on the IBM Support Web site. See “Obtaining ServeRAID updates” on page 61 for additional information.

Recovering from a failure in a failover environment

In a failover environment, when the ServeRAID device driver is unable to send a command to the active controller and the active controller does not respond to a reset command, the device driver attempts to failover to the passive controller.

Note: Loose cables or defective physical drives will not cause a failover to occur.

Replacing a controller of a failover pair in a non-hot-plug PCI slot

Important: Before replacing the failed controller, ensure that you have the latest device drivers, BIOS, and firmware code installed in your server. Follow the instructions in “Updating device drivers, BIOS and firmware code, and utility programs” on page 62

If a failed controller is not in a hot-plug PCI slot, complete the following steps:

1. Shut down the server.
2. Replace the failed controller.

Note: Do not attach the SCSI cables to the new controller.

3. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive; then, turn on the server. The ServeRAID Manager program starts.
4. Select the controller that you just inserted, and click **Actions** → **Restore to factory-default settings**.
5. If a confirmation window opens, click **Yes**. When the operation is complete, a message appears at the bottom of the window indicating that the ServeRAID Manager has successfully restored the configuration to the factory-default settings.
6. Configure the new controller for failover. Click **Configure for clustering** on the toolbar. The “Configure controller for clustering” window opens.

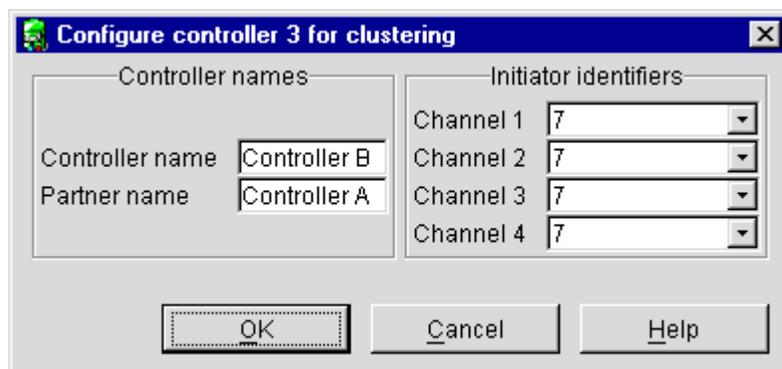


Figure 28. “Configure controller for clustering” window

7. Type the controller name, partner name, and SCSI initiator IDs that you used for the controller you are replacing.
8. Click **OK**.
9. Shut down the server.

Important:

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

10. Connect the enclosure to the new ServeRAID controller.
11. Remove the *IBM ServeRAID Support* CD from the CD-ROM drive; then, turn on the server.
12. Start the ServeRAID Manager program that is installed on the server; then, confirm that the ServeRAID controllers are correctly configured for failover.

Replacing a controller of a failover pair in a hot-plug PCI slot

If the failed controller is in a hot-plug slot, see the documentation that comes with the server for instructions for replacing the controller.

Note: Windows 2000 does not support the hot-replace feature. For more information, see “Replacing a controller of a failover pair in a non-hot-plug PCI slot” on page 80.

For Windows NT 4.0, use the following software to replace the controller. Follow the on-screen directions:

- IBM Netfinity PCI Hot Plug for Windows NT 4.0 Package, version 4.1 or later
- (For the ServeRAID-4M, ServeRAID-4Mx, ServeRAID-4L, and ServeRAID-4Lx controllers only) IBM PCI Hot Plug Adapter Update, version 1.0, for the IBM Netfinity PCI Hot Plug for Windows NT 4.0
- IBM ServeRAID Manager program
- IBM ServeRAID Hot Replace Wizard

Recovering from a failed physical drive in a RAID level-5E environment

If a RAID level-5E logical drive undergoes compression as the result of a failed physical drive, the failed drive will be marked defunct hot spare (DHS). Replace the defunct physical drive or remove the defunct drive from the enclosure as soon as possible. If a DHS drive is present, the RAID level-5E logical drive might not failover.

Recovering from a power failure during a failover

If a power failure occurs during a failover, the two controllers in the active-passive pair might have the following problems:

- Some logical drives are configured on one controller and some logical drives are configured on the other controller.
- A logical drive does not appear on either controller.

Complete the following steps to recover from a power failure:

1. Run **ipssend merge** for every merge-group number configured on the active controller.

Note: If **ipssend merge** fails, run **ipssend merge partner** for every merge-group number configured on the active controller.

2. Run **ipssend unmerge** for every merge-group number configured on the passive controller.
3. Shut down and restart the server. Windows 2000 and Windows NT 4.0 pairs the controllers again.

Troubleshooting an IBM ServeRAID Cluster Solution

There is the possibility that one of the servers, one of the ServeRAID controllers, or one of the hard disk drives in a cluster might fail. This section presents procedures you can take to recover from these potential problems. If you still have problems after following these procedures, see “Symptom-to-FRU index” on page 65. Also, you can find hints and tips to help you solve problems on the IBM Support Web site. See “Obtaining ServeRAID updates” on page 61 for additional information.

Recovering from a failed ServeRAID server

When replacing a failed server in a high-availability configuration, you might not need to replace the ServeRAID controller. However, if you replace your ServeRAID controller, you must reconfigure the controller after installing your new server.

Important: The following procedure requires specific configuration settings for the ServeRAID controller. If the server and controller that are being replaced are functional, you can obtain these settings from the controller. However, if the controller or the server is not functional, you will need a record of the settings, such as one created when the

controller was previously configured. If you are replacing your ServeRAID controller at the same time as your server, you *must* have correct configuration information to complete this procedure.

Complete the following steps to recover from a failed server:

1. Shut down the failed server.
2. Remove all local physical drives from the failed server.

As you remove your physical drives, be sure to note the bay in which each drive was installed. If you are replacing your failed server with an identical server, you can reinstall the drives in an identical configuration and get your server up and running quickly.
3. If the ServeRAID controller is functional, remove it from the failed server. As you remove the controller from the failed server, be sure to note the following:
 - Which SCSI cables are connected to the SCSI channel connectors on the controller
 - Which PCI slot has the controller installed
4. Install all the local physical drives into the new server, using the location information you recorded in step 2.

For information on how to install a physical drive, see the documentation that comes with your server. If you are replacing the failed server with an identical server, install each physical drive in the same bay as the one it was removed from in the failed server.
5. If the ServeRAID controller in the failed server is *not functional*, or if you are not sure, continue with “Recovering from a failed ServeRAID controller”. Otherwise, perform the following steps with the functional ServeRAID controller:
 - a. Install the controller in the new server.
 - b. Reinstall the cables as they were in the failed server.
 - c. Start the server.

Recovering from a failed ServeRAID controller

You must have the following configuration information to configure your new ServeRAID controller:

- **SCSI initiator IDs**

The SCSI initiator IDs for a non-shared SCSI channel are set to 7. For shared SCSI channels, the SCSI initiator IDs must be 7 or 6; they must be different from the SCSI initiator IDs for the corresponding SCSI channels of the cluster partner controller. Therefore, if you can obtain the SCSI initiator IDs for the corresponding cluster partner system, you know the correct SCSI initiator IDs for this system. For example, if the cluster partner system-shared SCSI initiator IDs were set to 7, the controller you are replacing would need to have its SCSI initiator IDs set to 6 for the shared channels.

- **Controller and partner name**

You can also determine the names for the controller being replaced by reading the settings from the cluster partner system.

- **Stripe-unit size**

The stripe-unit size *must* be the same on both controllers in a high-availability cluster.

- **Unattended mode setting**

This setting is configured automatically as Enabled when a controller is set up for clustering.

If the ServeRAID controller you are replacing *is* functional, you can obtain the above configuration information by starting your server with the *IBM ServeRAID Support CD* in the CD-ROM drive and using the ServeRAID Manager program.

Note: The configuration information is also available in the printable configuration file you might have saved when configuring the ServeRAID controllers for clustering.

If the ServeRAID controller is *not* functional, you will need to refer to a record of the settings that was made when the controller was previously configured. If you do not have a record of the configuration information, see “Obtaining the current configuration information” for information that might help you to assign the proper values.

Obtaining the current configuration information

To obtain the SCSI initiator IDs, controller name, partner name, and stripe-unit size from the corresponding cluster partner controller, complete the following steps:

1. Click **Start** → **ServeRAID Manager**.

or

Start the cluster partner system with the *IBM ServeRAID Support CD* in the CD-ROM drive. The ServeRAID Manager program starts.

2. In the ServeRAID Manager tree, click the cluster partner controller.
3. Click **Configure for clustering** on the toolbar. The “Configure controller for clustering” window opens.

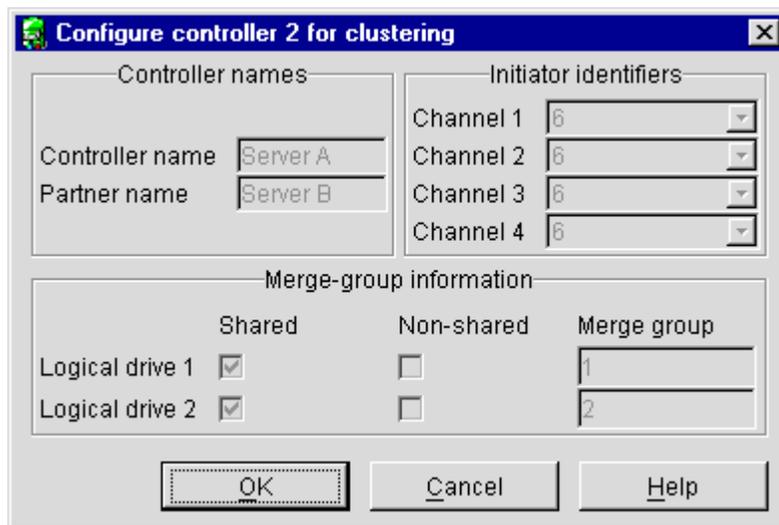


Figure 29. “Configure controller for clustering” window

4. Note the settings in the fields.
5. To determine stripe-unit size, refer to the information displayed in the right pane of ServeRAID Manager.

Replacing a ServeRAID controller

Complete the following steps to replace a failed ServeRAID controller in your high-availability configuration:

1. Shut down the server.
2. Note which SCSI cables are connected to which SCSI channel connectors on the controller.

3. Note which PCI slot has the controller installed.
4. Remove the failed ServeRAID controller.
For instructions on how to remove and install the ServeRAID controller, see the installation guide that came with your ServeRAID controller.
5. Install the new ServeRAID controller. Be sure to install the controller in the same PCI slot from which you removed the failed ServeRAID controller.

Important: Observe the following precautions:

- Do *not* reconnect the SCSI channel cables to the controller at this time.
- You must ensure that you have the same level of ServeRAID BIOS and firmware on both controllers in the cluster.
The software is available on the IBM Support Web site. See “Obtaining ServeRAID updates” on page 61 for additional information.

6. Start the system with the *IBM ServeRAID Support CD* (version 4.0, or later) in the CD-ROM drive. The ServeRAID Manager program starts.
7. In the ServeRAID Manager tree, click the new controller.
8. Click **Actions** → **Restore to factory-default settings**. The ServeRAID Manager program initializes the controller configuration.
9. With the new controller still selected in the tree, click **Configure for clustering** on the toolbar. The “Configure controller for clustering” window opens.

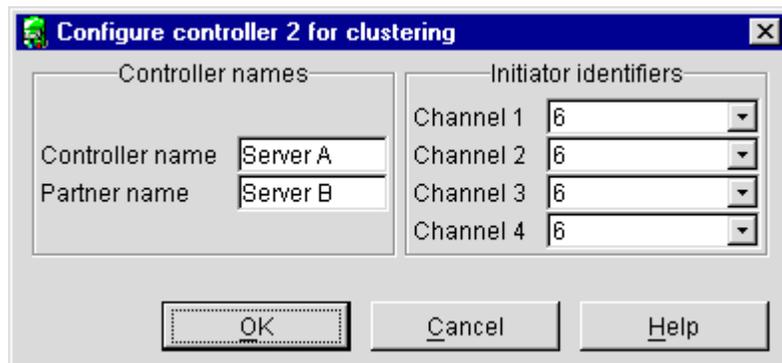


Figure 30. “Configure controller for clustering” window

10. Using the settings that were assigned to the previous ServeRAID controller (that is, the controller you are replacing), complete each of the following fields:
 - SCSI initiator IDs
 - Controller name
 - Partner name
11. Click **OK**. The new controller stripe-unit size setting defaults to 8 KB. If you need to change this setting to match the partner controller, go to step 12. Otherwise, go to step 15.
12. In the ServeRAID Manager tree, click the new controller.
13. Click **Actions** → **Change stripe-unit size**.
14. Click the new stripe-unit size for your installation.
15. Shut down and turn off the server.
16. Reconnect the SCSI channel cables to the controller.

Note: Be sure to connect the cables to the correct SCSI channels as noted in step 2 on page 84.

17. If the ServeRAID controller being replaced is attached to the server startup disk array or other non-shared disk arrays, start the system with the *IBM ServeRAID Support* CD (version 4.0, or later) in the CD-ROM drive. The ServeRAID Manager program starts.

If the ServeRAID controller being replaced is not attached to any of these items, go to step 21.

18. In the ServeRAID Manager tree, click the new controller.
19. Click **Actions** → **Copy configuration from drives**.
20. Click the merge-group number for the non-shared logical drives (that is, 206 or 207).

Note: The last number in the merge-group number is the shared SCSI initiator ID. That is, if the merge-group number is 206, the SCSI initiator ID is 6.

21. Remove the *IBM ServeRAID Support* CD from the CD-ROM drive.
22. Restart your server.

Note: If the controller you replaced is the startup controller, the system will now start the operating system properly.

Recovering from a failover in a Microsoft Cluster Server server

After a failover occurs in a Microsoft Cluster Server server, the red drive lights in external expansion enclosures might turn on for physical drives that are online. There is no hardware problem; the lights turn off within an hour.

Recovering from a failed physical drive in a RAID level-5E environment

If a RAID level-5E logical drive undergoes compression as the result of a failed physical drive, the failed drive will be marked defunct hot spare (DHS). Replace the defunct physical drive or remove the defunct drive from the enclosure as soon as possible. If a DHS drive is present, the RAID level-5E logical drive might not failover.

Recovering from a failed server in a ServeRAID cluster

Contact IBM technical support for assistance.

Troubleshooting ServeRAID subsystems in a cluster environment

Following is a series of common problems and solutions that can help you troubleshoot your IBM ServeRAID Cluster Solution.

| Problem | Action |
|--|---|
| <p>The ServeRAID Manager program shows physical drives in defunct state.</p> | <ol style="list-style-type: none"> 1. Enable the View shared drives feature in the ServeRAID Manager program. Doing so will display a drive as reserved, instead of defunct, in the following situations: <ul style="list-style-type: none"> • A drive has been moved. • A drive has failed-over to the other server in the cluster. <p>Note: It is normal for drives in the above situations to be displayed as defunct if you have not enabled the View shared drives feature. In this case, the drives shown in the defunct state are not really defective.</p> 2. Check RAID level-1 and RAID level-5 arrays to make sure they are not in critical state. If they are in critical state, replace the failed drive and perform a rebuild operation. |
| <p>ServeRAID shared logical drives do not failover properly.</p> | <ol style="list-style-type: none"> 1. Ensure that the resource type of each ServeRAID controller shared disk resource is <i>IBM ServeRAID logical disk</i>. If the resource type is shown as “physical drive,” the localquorum option was not specified properly when MSCS under Windows NT 4.0 was installed. To correct this problem, you must reinstall the high-availability cluster solution using Microsoft Windows NT. 2. Ensure that shared SCSI buses on the ServeRAID controller pair are connected in the same way that corresponding SCSI channels are connected. For example, SCSI channel 1 on the controller in the first cluster server is connected to SCSI channel 1 on the controller in the second cluster server, channel 2 is connected to channel 2, and so forth. 3. Ensure that the physical SCSI drives that contain logical drives are all connected to shared SCSI channels. 4. Ensure that there are no more than eight shared logical drives defined per pair of ServeRAID controllers. 5. Make sure each shared logical drive has a unique merge-group number assigned. Shared merge-group numbers <i>must</i> be in the range 1–8. 6. Make sure each ServeRAID controller has been assigned a unique controller name and that each ServeRAID controller has its partner name assigned properly to correspond to the ServeRAID controller in the other cluster server that is attached to the shared SCSI buses. 7. Check for loose shared SCSI bus cables. 8. Ensure that the physical drives that are expected to be moved or to failover show up in a ready or reserved state on the server that is attempting to take control of these drives. |

| Problem | Action |
|---|---|
| <p>RAID level-5 logical drives cannot be accessed by the operating system after a failover.</p> | <p>Use the ServeRAID Manager program to check the state of the logical drive to ensure that it is not blocked. Using this program, select the logical drive and look for Blocked state Yes. If the logical drive is blocked, make sure all physical drives that are part of the logical drive are in the online state. If all physical drives are <i>not</i> in the online state, a drive might have failed during one of the following situations:</p> <ul style="list-style-type: none"> • A failover • A resynchronization process after a failover <p>Data integrity cannot be guaranteed in this case and the logical drive has been blocked to prevent the possibility of incorrect data being read from the logical drive.</p> <p>Unblock, reinitialize, and synchronize the logical drive and restore the data from a backup source. Depending on the type of data contained on the logical drive and the availability of a recent backup copy, you can do one of the following:</p> <ul style="list-style-type: none"> • Unblock the drive and continue normal operation. • Replace and rebuild one or more defunct drives. <p>However, if you do not reinitialize, synchronize, and restore the drive, be aware that some data could be lost or damaged.</p> |
| <p>If one of the cluster servers fails and the surviving server takes over the cluster resources, occasionally one or more of the IP address resources will stay in the online pending state for several minutes after they are moved over to the surviving server. After this, the resource will go to the failed state, and the following error message will be displayed in the surviving server system log (as viewed with the Event viewer).</p> <p>For example, the Windows NT Event Log Message:</p> <pre>Date: ??? Event ID: 1069 Time: ??? Source: ClusSvc User: N/A Type: Error Computer: ??? Category: (4)</pre> <p>Description: Cluster resource 'ip address resource name' failed</p> | <p>Complete the following steps:</p> <ol style="list-style-type: none"> 1. Right-click the IP resource in the Cluster Administrator. 2. From the General page, click Properties. 3. Select Run this resource in a separate Resource Monitor check box. A message appears stating that the resource must be restarted for the change to take effect. <p>Note: Placing IPSHA disk resources into their own Resource Monitor can decrease failover time.</p> |

| Problem | Action |
|---|--|
| <p>After one of the cluster servers has been shut down normally and the surviving server takes over the cluster resources, occasionally one or more of the IBM ServeRAID logical drive resources will stay in the online-pending state for several minutes, after they are moved over to the surviving server (when viewed with the Cluster Administrator). After this, the resource will go to the Failed state and the following error message will be displayed in the surviving server system log (as viewed with the Event viewer).</p> <p>For example, the Windows NT Event Log Message:</p> <pre>Date: ??? Event ID: 1069 Time: ??? Source: ClusSvc User: N/A Type: Error Computer: ??? Category: (4)</pre> <p>Description: Cluster resource 'IBM ServeRAID Logical Disk name' failed.</p> | <p>No action is necessary to bring the resource online after the failover. MSCS will bring this resource online on the surviving server within approximately 4 minutes.</p> |
| <p>If a previous version of IBM ServeRAID Cluster Solution has been uninstalled, a message is incorrectly displayed prompting you to perform an upgrade when you attempt to reinstall the ServeRAID Windows NT Cluster Solution.</p> | <p>You must delete the <i>C3E76E53-F841-11D0-BFA1-08005AB8ED05</i> registry key. Complete the following steps to delete the registry key:</p> <ol style="list-style-type: none"> 1. From the Start menu, click Run. 2. Type: REGEDIT and click OK. The Registry Editor window opens. 3. Select HKEY_CLASSES_ROOT\CLSID and delete <i>C3E76E53-F841-11D0-BFA1-08005AB8ED05</i>. 4. Reinstall the ServeRAID Windows NT Cluster Solution. For more information about configuring ServeRAID controllers for clustering, see the IBM ServeRAID <i>User's Guide</i>. |
| <p>Array identifiers and logical drive numbers might change during a failover condition.</p> | <p>By design, the array identifiers and logical drive numbers might change during a failover condition. Consistency between the merge-group numbers and Windows NT or Windows 2000 permanent (sticky) drive letters is maintained, while the ordering process during a failover condition is controlled by the Microsoft Cluster Server software and the available array identifiers on the surviving server.</p> |

Creating ServeRAID diskettes

Images for the following diskettes are in the \DISKETTE directory of the *IBM ServeRAID Support* CD. Each of the operating-system specific diskettes contains device drivers and the IPSEND utility.

Note: The IPSPMON utility is available only on the *IBM ServeRAID Support for Novell NetWare* diskette.

| Diskette image | Diskette |
|----------------|--|
| biosfw1.img | <i>IBM BIOS and Firmware Update (1 of 3)</i> for the ServeRAID-5i controller |
| biosfw2.img | <i>IBM BIOS and Firmware Update (2 of 3)</i> for the ServeRAID-4H, ServeRAID-II, ServeRAID on-board, and the ServeRAID controllers |

| Diskette image | Diskette |
|----------------|---|
| biosfw3.img | <i>IBM BIOS and Firmware Update (3 of 3) for the ServeRAID-4M, ServeRAID-4Mx, ServeRAID-4L, ServeRAID-4Lx, ServeRAID-3H, and ServeRAID-3L controllers</i> |
| failover.img | <i>IBM ServeRAID Failover Support for Windows NT and Windows 2000</i> |
| clusnt.img | <i>IBM ServeRAID Cluster Solution for Windows NT and Windows 2000</i> |
| winsrv.img | <i>IBM ServeRAID Support for Windows 2000 Server</i> |
| winpro.img | <i>IBM ServeRAID Support for Windows (Professional Editions) for Microsoft Windows XP Professional and Microsoft Windows 2000 Professional</i> |
| os2.img | <i>IBM ServeRAID Support for OS/2</i> |
| winnt.img | <i>IBM ServeRAID Support for Windows NT 4.0</i> |
| netware.img | <i>IBM ServeRAID Support for Novell NetWare</i> |
| openunix.img | <i>IBM ServeRAID Support for Caldera UnixWare and Open UNIX</i> |
| openserv.img | <i>IBM ServeRAID Support for SCO OpenServer</i> |
| redhat1.img | <i>IBM ServeRAID Support for Red Hat Linux (1 of 2) for Red Hat Linux, versions 6.2 and 7.0</i> |
| redhat2.img | <i>IBM ServeRAID Support for Red Hat Linux (2 of 2) for Red Hat Linux, versions 7.1, 7.2, and 7.3</i> |
| caldera1.img | <i>IBM ServeRAID Support for Caldera OpenLinux (1 of 2) for Caldera OpenLinux, version 3.1</i> |
| caldera2.img | <i>IBM ServeRAID Support for Caldera OpenLinux (2 of 2) for Caldera OpenLinux, version 3.1.1</i> |
| suse.img | <i>IBM ServeRAID Support for SuSE Linux</i> |
| turbo.img | <i>IBM ServeRAID Support for Turbolinux</i> |
| dos.img | <i>IBM ServeRAID Support for DOS</i> |

Creating diskettes on Windows

Complete the following steps to create a diskette:

1. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
2. Insert a blank diskette into the diskette drive.
3. At the DOS or command prompt, type the following and press Enter:

```
e:\diskette\tools\dsk4w32 e:\diskette\disketteimage a:
```

where

- *e* is the drive letter for the CD-ROM drive.
 - *disketteimage* is the name of the diskette image.
 - *a* is the drive letter for the diskette drive.
4. Remove the *IBM ServeRAID Support* CD from the CD-ROM drive.
 5. Remove the diskette from the diskette drive and label the diskette appropriately.

Creating diskettes on IBM OS/2

Complete the following steps to create a diskette:

1. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
2. Insert a blank diskette into the diskette drive.
3. At the OS/2 command prompt, type the following and Press Enter:

```
e:\diskette\tools\dsk4wrp e:\diskette\disketteimage a:
```

where

- *e* is the drive letter for the CD-ROM drive.
 - *disketteimage* is the name of the diskette image.
 - *a* is the drive letter for the diskette drive.
4. Remove the *IBM ServeRAID Support* CD from the CD-ROM drive.
 5. Remove the diskette from the diskette drive and label the diskette appropriately.

Creating diskettes on Linux or UNIX

Complete the following steps to create a diskette:

1. Insert the *IBM ServeRAID Support* CD into the CD-ROM drive.
2. Insert a blank diskette into the diskette drive.
3. At a command prompt, mount the CD-ROM drive by typing one of the following:

| | |
|------------------|--|
| For Linux | <code>mount -t iso9660 /dev/cdromdevicefile /mountpoint</code> |
|------------------|--|

| | |
|-----------------------|---|
| For OpenServer | <code>mount -r -f ISO9660 /dev/cdromdevicefile /mountpoint</code> |
|-----------------------|---|

| | |
|-----------------------------------|---|
| For UnixWare and Open UNIX | <code>mount -f cdfs /dev/cdromdevicefile /mountpoint</code> |
|-----------------------------------|---|

where *cdromdevicefile* is the specific device file for the CD-ROM block device, and *mountpoint* is the mountpoint of the CD-ROM drive.

4. Press Enter.
5. At the command prompt, type the following:

```
dd if=/mnt/diskette/disketteimage of=/dev/diskettedevicefile bs=32k
```

where

- *disketteimage* is the name of the diskette image.
 - *diskettedevicefile* is the specific device file for the diskette block device.
6. Press Enter.
 7. Unmount the CD-ROM drive. Type the following and press Enter:

```
umount /mountpoint
```

where *mountpoint* is the mountpoint of the device file used in step 3.

8. Remove the *IBM ServeRAID Support* CD from the CD-ROM drive.
9. Remove the diskette from the diskette drive and label the diskette appropriately.

Error codes and procedures

This section lists the ServeRAID-4x and ServeRAID-5i controller error codes/messages, and the error procedures.

ServeRAID startup (POST) messages

During power-on self-test (POST), the ServeRAID controller compares the stored configuration information to the configuration that is actually present. If a discrepancy exists, one or more status messages appear after POST is completed, but before the operating system starts.

```
IBM ServeRAID BIOS
Copyright IBM Corp. 1995, 2001
BIOS Version: 4.10.05

Controller 1 Slot 4, Logical Drive=1, Firmware=4.00.20, Status=Fail
2 Drives(s) not responding or found at new location(s)

Press: F2 - Detailed information
       F4 - Retry
       F5 - Change the configuration and set drive(s) defunct
       F10 - Continue booting without changing the configuration
```

When you press F2 for detailed information, the following register information appears on the screen.

```
Detailed information
-----
Online Drive on Channel 2 SCSI ID 0 is not responding
Online Drive on Channel 2 SCSI ID 1 is not responding
-----
Controller Status Codes: ISPR = EF10  BCS = 07  ECS = 08

Press PgUp = Page Up    PgDn = Page Down    Esc = Exit panel
```

The controller status codes include the interrupt status port register (ISPR) code, the basic configuration status (BCS) register code, and the extended configuration status (ECS) register code.

If no errors occur during POST, the following register information is displayed: ISPR = EF10, BCS = 0F or 09, and ECS = 00

If an error occurs, see “POST (ISPR) error procedures” for the ISPR error codes and “BCS and ECS register codes” on page 95.

POST (ISPR) error procedures

The ISPR Error Procedures list errors, symptoms, and the possible causes. The most probable cause is listed first. Use these procedures to help you solve ServeRAID problems when servicing the computer. A complete list of error codes is in the “Symptom-to-FRU index” on page 65.

Note: Where the ISPR Error Procedures refer to a SCSI backplane, see the Hardware Maintenance Manual for the system you are servicing.

EF10 (Default ISPR)

1. No ISPR Error Present.

9ZXX thru BZXX (SCSI bus error caused either by cables, termination, defective drives, etc.)

1. Isolate between SCSI subsystem and controller by disconnecting all SCSI cables from suspect card, and reboot.

CAUTION:

Do not press F5. Doing so changes the customer's configuration.

If an ISPR error is still present, perform the following actions until the error is no longer present:

- a. Reseat the controller
- b. Replace the controller

Notes:

- a. Refer to the Hardware Maintenance Manual specific to the system comprising the SCSI channel for SCSI cable details.
 - b. The adapter/controller detects a configuration change. **Do not choose Save Changes.** Instead, press **F10** to bypass any options to this effect.
2. If ISPR error is **EF10** after disconnecting cables:
 - a. Identify which channel is causing the error by the second digit (Z) of the original ISPR code as indicated in the following table:

Note: ServeRAID-4H controllers have 4 channels; ServeRAID-4L and -4Lx controllers have only one channel; and ServeRAID-4M and -4Mx controllers have 2 channels. ServeRAID-5i controllers have no channels. The ServeRAID-5i controller uses the server's onboard integrated SCSI controller's channel connectors.

Table 7. SCSI identifier

| SCSI Channel Code (z) | Descriptions |
|-----------------------|----------------------|
| 1 | Channel 1 |
| 2 | Channel 2 |
| 3 | Channel 1 & 2 |
| 4 | Channel 3 |
| 5 | Channel 1 & 3 |
| 6 | Channel 2 & 3 |
| 7 | Channel 1, 2, & 3 |
| 8 | Channel 4 |
| 9 | Channel 1 & 4 |
| A | Channel 2 & 4 |
| B | Channel 1, 2, & 4 |
| C | Channel 3 & 4 |
| D | Channel 1, 3, & 4 |
| E | Channel 2, 3, & 4 |
| F | Channel 1, 2, 3, & 4 |

- b. Confirm that the channel(s) identified from the error in step 2a on page 94 is (are) the cause of the error by verifying that the error presents itself ONLY when the offending channel is reconnected.
- c. Check termination of identified channel.

Note: Refer to the HMM (Hardware Maintenance Manual) specific to the system comprising the SCSI channel for termination details.

- d. Check for proper backplane jumper configuration.

Note: Refer to the HMM (Hardware Maintenance Manual) specific to the system comprising the SCSI channel for jumper details.

- e. Check for proper cabling configuration in systems that use DASD status cables. Reconnect all cables removed in step 1 on page 94.
- f. Disconnect one drive at a time attached to the channel identified in step 2a on page 94; then, reboot to determine which drive is causing the error.
- g. Replace SCSI cable.
- h. Replace SCSI backplane.

FFFF or other code not listed

1. Place download jumpers on the controller and try to flash the Firmware code to the card.
2. Isolate between SCSI Subsystem and controller by disconnecting all SCSI cables attached to the suspect card, and reboot.

CAUTION:

Do not press F5. Doing so will change the customer's configuration.

If ISPR code is **EF10** after disconnecting cables, follow the steps below until the error is eliminated:

- a. Identify which channel is causing the error by reconnecting cables one at a time and rebooting until the error returns.
- b. Check termination of identified channel in step 2a.

Note: Refer to the HMM (Hardware Maintenance Manual) specific to the system comprising the SCSI channel for termination details.

- c. Disconnect one drive at a time attached to channel identified in step 2a and reboot each time to determine which drive is causing the problem.
- d. Replace SCSI Cable attached to channel identified in step 2a.
- e. Replace Backplane attached to channel identified in step 2a.
3. If original ISPR code is still present after disconnecting all SCSI cables and rebooting, perform the following actions until the error is no longer present:
 - Reseat the controller
 - Replace the controller

BCS and ECS register codes

Notes:

1. When the ServeRAID controller requires your input, a list of function keys will be displayed below the message.
2. Where the Action information tells you to start the IBM ServeRAID configuration program, insert the *IBM ServeRAID Support CD* into the CD-ROM drive; then, restart the server. The Action column also provides general information about the message.

| BCS | ECS | Explanation | Action |
|-----|-----|---|--|
| 00 | 01 | Invalid flash configuration. | <ul style="list-style-type: none"> Copy the configuration from the drives using the mini-configuration (see “Using the ServeRAID Mini-Configuration program” on page 41), IPPSEND (see “Using the IPPSEND command-line program” on page 43), or ServeRAID Manager (see “Using ServeRAID Manager” on page 29) utility. <p>If no instructions appear or if the problem persists, run diagnostics.</p> |
| 00 | 02 | Invalid NVRAM configuration. | |
| 00 | 03 | Invalid flash and NVRAM configuration. | |
| 01 | 08 | No configuration was found in drives, or the online/rebuild drives are not responding. | <p>To correct the problem:</p> <ol style="list-style-type: none"> If the controller is connected to an enclosure, verify that the enclosure is on. If the enclosure is off, turn on the power and press F4 to retry. Verify that all the physical drives are present. If any drives are missing, replace the drives and press F4 to retry. Verify that all the physical drives are connected to the controller correctly. If any drives are unconnected, connect the drives and press F4 to retry. If all the physical drives are present and connected correctly, one or more of the drives might be defective. Identify and replace the defective drives; then, press F5 to accept the changes. If you have intentionally switched physical drives that are connected to this controller, press F7 to import the configuration from the drives and account for the drive rearrangement. <p>To exit without making changes, press F10.</p> |
| 01 | 18 | No configuration was found in drives, or the online/rebuild and hot spare/standby hot-spare drives are not responding. | |
| 01 | 28 | No configuration was found in drives, or the online/rebuild and ready/standby drives are not responding. | |
| 01 | 38 | No configuration was found in drives, or the online/rebuild, hot spare/standby hot-spare, and ready/standby drives are not responding. | |
| 01 | 48 | No configuration was found in drives, or the online/rebuild drives are not responding and unidentified drives were found. | |
| 01 | 58 | No configuration was found in drives, or the online/rebuild and hot spare/standby hot-spare drives are not responding and unidentified drives were found. | |
| 01 | 68 | No configuration was found in drives, or the online/rebuild and ready/standby drives are not responding and unidentified drives were found. | |
| 01 | 78 | No configuration was found in drives, or the online/rebuild, hot spare/standby hot-spare, and ready/standby drives are not responding and unidentified drives were found. | |

| BCS | ECS | Explanation | Action |
|-----|-----|---|--|
| 03 | 88 | A drive was imported from another server and it has a valid configuration, and the online/rebuild drives are not responding. | <p>To correct the problem:</p> <ol style="list-style-type: none"> To keep the previous configuration in the controller, replace the physical drives that were switched and press F4 to retry. Attention: Completing step 2 might result in a loss of the original configuration and data on the drives. To accept the new configuration from the physical drives, press F7. If all the physical drives are present and connected correctly, one or more of the drives might be defective. Identify and replace the defective drives; then, press F5 to accept the changes. <p>To exit without making changes, press F10.</p> |
| 03 | 98 | A drive was imported from another server and it has a valid configuration, and the online/rebuild and hot spare/standby hot-spare drives are not responding. | |
| 03 | A8 | A drive was imported from another server and it has a valid configuration, and the online/rebuild and ready/standby drives are not responding. | |
| 03 | B8 | A drive was imported from another server and it has a valid configuration, and the online/rebuild, hot spare/standby hot-spare, and ready/standby drives are not responding. | |
| 03 | C8 | A drive was imported from another server and it has a valid configuration, and the online/rebuild drives are not responding and unidentified drives were found. | |
| 03 | D8 | A drive was imported from another server and it has a valid configuration, and the online/rebuild and hot spare/standby hot-spare drives are not responding and unidentified drives were found. | |
| 03 | E8 | A drive was imported from another server and it has a valid configuration, and the online/rebuild and ready/standby drives are not responding and unidentified drives were found. | |
| 03 | F8 | A drive was imported from another server and it has a valid configuration, and the online/rebuild, hot spare/standby hot-spare, and ready/standby drives are not responding and unidentified drives were found. | |
| 07 | 00 | The specified drive is not responding. | <p>To correct the problem:</p> <ol style="list-style-type: none"> If the specified physical drive or drives are in an external enclosure, verify that the enclosure is turned on. If the enclosure is turned off, turn on the power and press F4 to retry. Download and install the latest version of IBM ServeRAID software. See "Obtaining ServeRAID updates" on page 61 for more information. Replace the failed physical drive or drives. |
| 07 | 08 | The specified drives are not responding. | |

| BCS | ECS | Explanation | Action |
|-----|-----|---|--|
| 07 | 0C | Online/rebuild drives are not responding, and a drive was found at the incorrect SCSI ID. | <p>To correct the problem:</p> <ol style="list-style-type: none"> To keep the previous configuration in the controller, replace the physical drives and cable connections that were switched or moved; then, press F4 to retry. Note: Pressing F4 might not correct the problem. If you do not return the drives and cables to the previous configuration, the message might return. If all the physical drives are present and connected correctly, one or more of the drives might be defective. Identify and replace the defective drives; then, press F5 to accept the changes. To modify the configuration and accept the rearrangement of the physical drives, press F6. <p>To exit without making changes, press F10.</p> |
| 07 | 1C | Online/rebuild and hot spare/standby hot-spare drives are not responding, and a drive was found at the incorrect SCSI ID. | |
| 07 | 2C | Online/rebuild and ready/standby drives are not responding, and a drive was found at the incorrect SCSI ID. | |
| 07 | 3C | Online/rebuild, ready/standby, and hot spare/standby hot-spare drives are not responding, and a drive was found at the incorrect SCSI ID. | |
| 07 | 4C | Online/rebuild drives are not responding, and a drive was found at the incorrect SCSI ID, and unidentified drives were found. | |
| 07 | 5C | Online/rebuild and hot spare/standby hot-spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. | |
| 07 | 6C | Online/rebuild and ready/standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. | |
| 07 | 7C | Online/rebuild, ready/standby, and hot spare/standby hot-spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. | <p>To correct the problem:</p> <ol style="list-style-type: none"> To keep the previous configuration in the controller, replace the physical drives and cable connections that were switched or moved; then, press F4 to retry. If all the physical drives are present and connected correctly, one or more of the drives might be defective. Identify and replace the defective drives; then, press F5 to accept the changes. <p>To exit without making changes, press F10.</p> |
| 07 | 18 | Online/rebuild and hot spare/standby hot-spare drives are not responding. | |
| 07 | 28 | Online/rebuild and ready/standby drives are not responding. | |
| 07 | 38 | Online/rebuild, ready/standby, and hot spare/standby hot-spare drives are not responding. | |
| 07 | 48 | Online/rebuild drives are not responding, and unidentified drives were found. | |
| 07 | 58 | Online/rebuild and hot spare/standby hot-spare drives are not responding, and unidentified drives were found. | |
| 07 | 68 | Online/rebuild and ready/standby drives are not responding, and unidentified drives were found. | |
| 07 | 78 | Online/rebuild, ready/standby, and hot spare/standby hot-spare drives are not responding, and unidentified drives were found. | <p>No action is required. Press F10 to exit without making any changes.</p> |
| 09 | 00 | No error occurred. | |

| BCS | ECS | Explanation | Action |
|------------|------------|--|--|
| 09 | 10 | Hot spare/standby hot-spare drives are not responding. | <p>To correct the problem:</p> <ol style="list-style-type: none"> 1. To keep the previous configuration in the controller, replace the physical drives and cable connections that were switched or moved; then, press F4 to retry. 2. If all the physical drives are present and connected correctly, one or more of the drives might be defective. Identify and replace the defective drives; then, press F5 to accept the changes. <p>To exit without making changes, press F10.</p> |
| 09 | 20 | Ready/standby drives are not responding. | |
| 09 | 30 | Hot spare/standby hot-spare and ready/standby drives are not responding. | |
| 0F | 00 | No error occurred. | No action is required. Press F10 to exit without making any changes. |
| 0F | 10 | Hot spare/standby hot-spare drives are not responding. | <p>To correct the problem:</p> <ol style="list-style-type: none"> 1. To keep the previous configuration in the controller, replace the physical drives and cable connections that were switched or moved; then, press F4 to retry. 2. If all the physical drives are present and connected correctly, one or more of the drives might be defective. Identify and replace the defective drives; then, press F5 to accept the changes. <p>To exit without making changes, press F10.</p> |
| 0F | 20 | Ready/standby drives are not responding. | |
| 0F | 30 | Hot spare/standby hot-spare and ready/standby drives are not responding. | |
| 1X | XX | The controller detected an unsupported mix of tape and disk devices on the same channel. | To correct the problem, power-down and reconfigure to put tape and disk devices on different channels. |

Reference information

This section contains information to help you understand the principles and uses of high-performance, redundant array of independent disk (RAID) controllers. This section describes the different ways that drives can be grouped together to create data-storage environments that require superior performance, flexibility, and reliable data storage. A listing of important acronyms, terms, and definitions is also included at the end of this section.

Understanding RAID technology

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

When you group multiple physical drives into a logical drive, the ServeRAID controller can transfer data in parallel from the multiple drives in the array. This parallel transfer yields data-transfer rates that are many times higher than with nonarrayed drives. This increased speed makes the system better able to meet the *throughput* (the amount of data processed 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 increase in throughput, but also a decrease in response time. The combination of parallel transfers and simultaneous responses to multiple requests enables disk arrays to provide a high level of performance in network environments.

Stripe-unit size

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

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

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

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

Selecting a RAID level and tuning performance

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

Each RAID level provides different levels of fault-tolerance (data redundancy), utilization of physical drive capacity, and read and write performance. In addition, the RAID levels differ in regard to the minimum and maximum number of physical drives that are supported.

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

| RAID level | Data redundancy | Physical drive capacity utilization | Read performance | Write performance | Built-in spare drive | Min. number of drives | Max. number of drives |
|----------------|-----------------|-------------------------------------|------------------|-------------------|----------------------|-----------------------|-----------------------|
| RAID level-0 | No | 100% | Superior | Superior | No | 1 | 16 |
| RAID level-1 | Yes | 50% | Very high | Very high | No | 2 | 2 |
| RAID level-1E | Yes | 50% | Very high | Very high | No | 3 | 16 |
| RAID level-5 | Yes | 67% to 94% | Superior | High | No | 3 | 16 |
| RAID level-5E | Yes | 50% to 88% | Superior | High | Yes | 4 | 16 |
| RAID level-00 | No | 100% | Superior | Superior | No | 2 | 60 |
| RAID level-10 | Yes | 50% | Very high | Very high | No | 4 | 60 |
| RAID level-1E0 | Yes | 50% | Very high | Very high | No | 6 | 60 |
| RAID level-50 | Yes | 67% to 94% | Superior | High | No | 6 | 60 |

Physical drive utilization, read performance, and write performance depend on the number of drives in the array. Generally, the more drives in the array, the better the performance.

Supported RAID levels

The ServeRAID controllers support RAID level-0, level-1, level-1E, level-5, level-5E, level-00, level-10, level-1E0, and level-50.

The integrated RAID controllers support RAID level-1 only. The ServeRAID-5i controller does not support RAID level-5E.

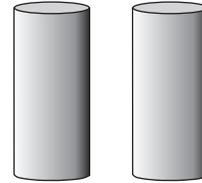
Understanding RAID level-0

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

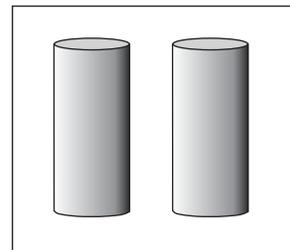
RAID level-0 requires a minimum of one drive and, depending upon the level of firmware and the stripe-unit size, supports a maximum of 8 or 16 drives.

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

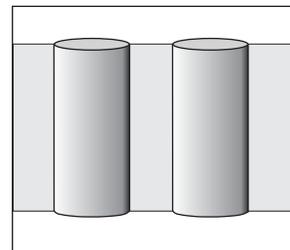
Start with two physical drives.



Create an array using the two physical drives.

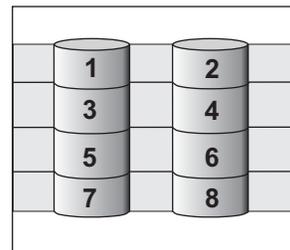


Then create a logical drive within that array.



The data is striped across the drives, creating blocks.

Notice that the data is striped across all the drives in the array, but no redundant data is stored.



A physical drive failure within the array results in loss of data in the logical drive assigned RAID level-0, but only in that logical drive. If you have logical drives assigned RAID level-1, level-1E, level-5, or level-5E in the same array, they will not lose data.

Note: If you have an array that contains only one physical drive, you can assign only RAID level-0 to the logical drive in that array.

When you replace a failed drive, the ServeRAID controller can rebuild all the RAID level-1, level-1E, level-5, and level-5E logical drives automatically onto the replacement physical drive. However, any data stored in a failed RAID level-0 logical drive is lost.

Although the risk of data loss is present, you might want to assign RAID level-0 to a logical drive to take advantage of the speed this RAID level offers. You can use this logical drive to store data that you back up each day and can re-create easily. You also might want to use a RAID level-0 logical drive when you require maximum capacity.

RAID level-0 offers the following advantages and disadvantages.

| Advantages | Disadvantages |
|---|--|
| <ul style="list-style-type: none"> • Substantial speed enhancement • Maximum utilization of physical drive storage capacity, because no room is taken for redundant data or data-parity storage | <p>No data redundancy, resulting in data loss in the event that a physical drive fails</p> |

Understanding RAID level-1

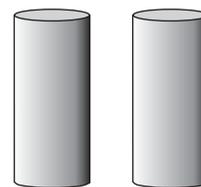
RAID level-1 uses data mirroring. Two physical drives are combined into an array, and data is striped across the array. The first half of a stripe is the original data; the second half of a stripe is a *mirror* (that is, a copy) of the data, but it is written to the other drive in the RAID level-1 array.

RAID level-1 provides data redundancy and high levels of performance, but the storage capacity is diminished. Because the data is mirrored, the capacity of the logical drive when assigned RAID level-1 is 50% of the array capacity.

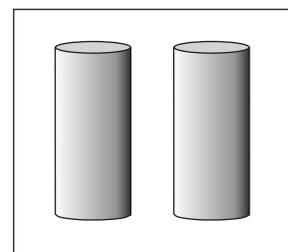
RAID level-1 requires two physical drives.

The following illustration shows an example of a RAID level-1 logical drive.

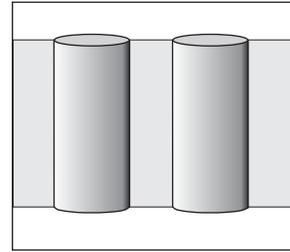
Start with two physical drives.



Create an array using the two physical drives.

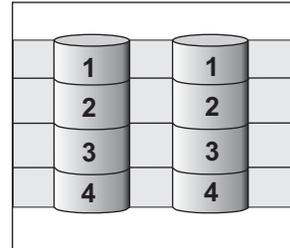


Then create a logical drive within that array.



The data is striped across the drives, creating blocks.

Notice that the data on the drive on the right is a copy of the data on the drive on the left.



With RAID level-1, if one of the physical drives fails, the ServeRAID controller switches read and write requests to the remaining functional drive in the RAID level-1 array.

RAID level-1 offers the following advantages and disadvantages.

| Advantages | Disadvantages |
|--|---|
| <ul style="list-style-type: none"> • 100% data redundancy • High performance | Allows only 50% of the physical drive storage capacity to be used |

Understanding RAID level-1 Enhanced

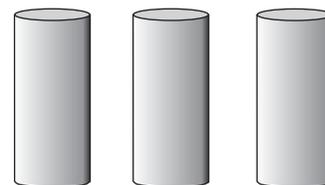
RAID level-1 Enhanced (RAID level-1E) combines mirroring and data striping. This RAID level stripes data and copies of the data across all of the drives in the array. As with the standard RAID level-1, the data is mirrored, and the capacity of the logical drive is 50% of the array capacity.

RAID level-1E has a similar profile to RAID level-1; it provides data redundancy and high levels of performance, but the storage capacity is diminished. However, RAID level-1E allows a larger number of physical drives to be used.

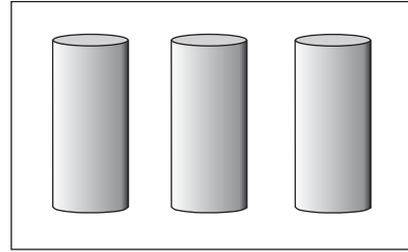
RAID level-1E requires a minimum of three drives and, depending upon the level of firmware and the stripe-unit size, supports a maximum of 8 or 16 drives.

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

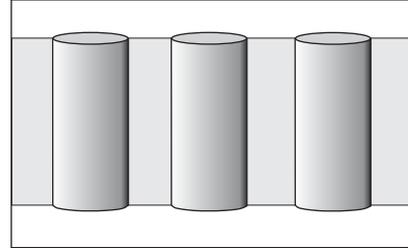
Start with three physical drives.



Create an array using the physical drives.

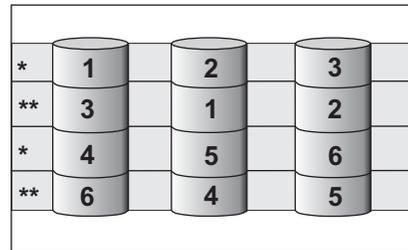


Then create a logical drive within that array.



The data is striped across the drives, creating blocks.

Notice that the stripe labeled * is the data stripe and the stripe labeled ** is the copy of the preceding data stripe. Also, notice that each block on the mirror stripe is shifted one drive.



With RAID level-1E, if one of the physical drives fails, the ServeRAID controller switches read and write requests to the remaining functional drives in the RAID level-1E array.

RAID level-1E offers the following advantages and disadvantages:

| Advantages | Disadvantages |
|--|---|
| <ul style="list-style-type: none"> • 100% data redundancy • High performance | Allows only 50% of the physical drive storage capacity to be used |

Understanding RAID level-5

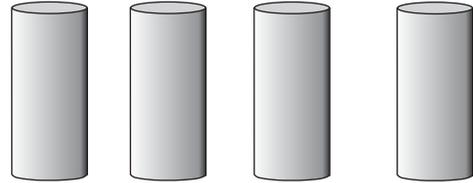
RAID level-5 stripes data and parity across all drives in the array.

RAID level-5 offers both data protection and increased throughput. When you assign RAID level-5 to an array, the capacity of the array is reduced by the capacity of one drive (for data-parity storage). RAID level-5 gives you higher capacity than RAID level-1, but RAID level-1 offers better performance.

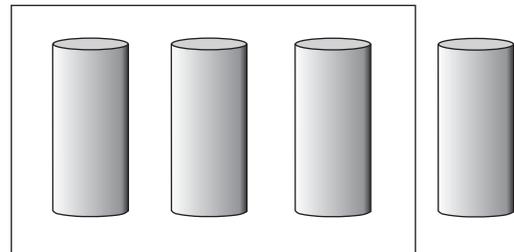
RAID level-5 requires a minimum of three drives and, depending upon the level of firmware and the stripe-unit size, supports a maximum of 8 or 16 drives.

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

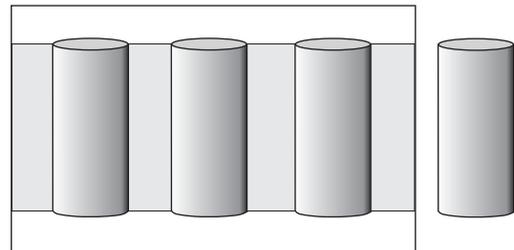
Start with four physical drives.



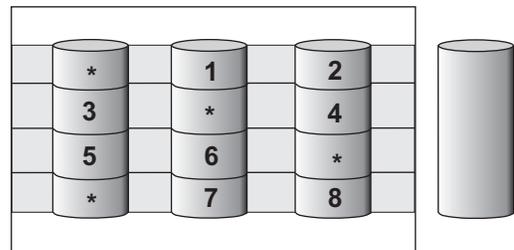
Create an array using three of the physical drives, leaving the fourth as a hot-spare drive.



Then create a logical drive within that array.



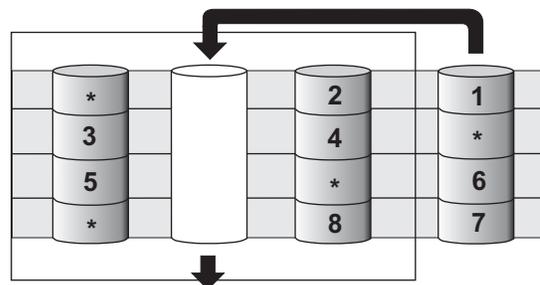
The data is striped across the drives, creating blocks.



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

A parity block (*) contains a representation of the data from the other blocks in the same stripe. For example, the parity block in the first stripe contains data representation of blocks 1 and 2.

If a physical drive fails in the array, the data from the failed physical drive is reconstructed onto the hot-spare drive.



RAID level-5 offers the following advantages and disadvantages.

| Advantages | Disadvantages |
|--|--|
| <ul style="list-style-type: none">• 100% data protection• Offers more physical drive storage capacity than RAID level-1 or level-1E | Lower performance than RAID level-1 and level-1E |

Understanding RAID level-5 Enhanced

RAID level-5E is the same as RAID level-5 with a built-in spare drive. Like RAID level-5, this RAID level stripes data and parity across all of the drives in the array.

RAID level-5E offers both data protection and increased throughput. When an array is assigned RAID level-5E, the capacity of the logical drive is reduced by the capacity of two physical drives in the array (one for parity and one for the spare).

Reading from and writing to four physical drives is more efficient than reading from and writing to three physical drives and an idle hot spare. Therefore, RAID level-5E provides a higher level of performance than RAID level-5.

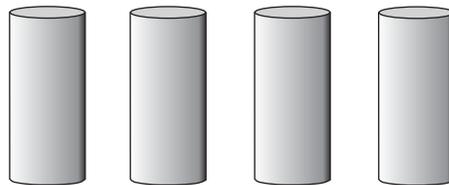
The spare drive is actually part of the RAID level-5E array, as shown in the following example. With such a configuration, you cannot share the spare drive with other arrays. If you want a spare drive for any other array, you must have another spare drive for those arrays.

RAID level-5E requires a minimum of four drives and, depending upon the level of firmware and the stripe-unit size, supports a maximum of 8 or 16 drives. RAID level-5E is also firmware-specific.

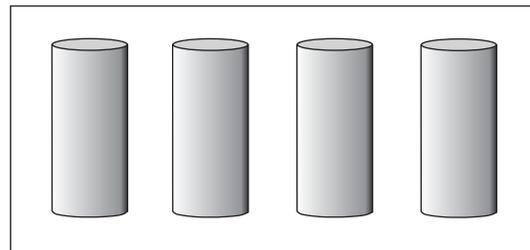
Note: For RAID level-5E, you can have only one logical drive in an array. When using RAID level-5E, you can have a maximum of seven logical drives on the controller.

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

Start with four physical drives.

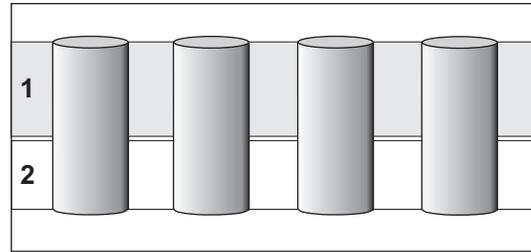


Create an array using all four physical drives.



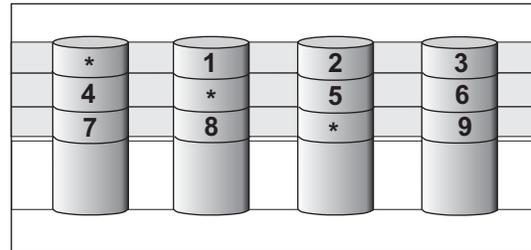
Then create a logical drive (labeled as 1) within the array.

Notice that the distributed spare drive is the free space (labeled as 2) shown below the logical drive.



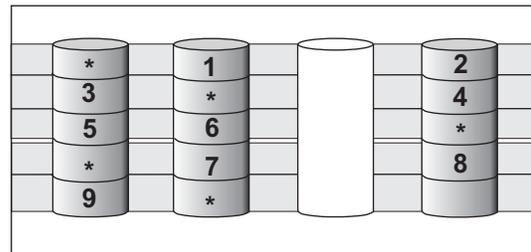
The data is striped across the drives, creating blocks in the logical drive.

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



Notice that the spare drive is *not* striped.

If a physical drive fails in the array, the data from the failed drive is reconstructed. The array undergoes compression, and the distributed spare drive becomes part of the array. The logical drive remains RAID level-5E.



When you replace the failed drive, the data for the logical drive decompresses and returns to the original striping scheme.

If you use a RAID level-5E logical drive in a failover or cluster configuration, the RAID level-5E logical drive will not failover while undergoing compression or decompression.

RAID level-5E offers the following advantages and disadvantages.

| Advantages | Disadvantages |
|---|---|
| <ul style="list-style-type: none"> • 100% data protection • Offers more physical drive storage capacity than RAID level-1 or level-1E • Higher performance than RAID level-5 | <ul style="list-style-type: none"> • Lower performance than RAID level-1 and level-1E • Supports only one logical drive per array • Cannot share a hot-spare drive with other arrays |

Note: The ServeRAID Manager program Configuration wizard does not default to RAID level-5E. If you have four physical drives, Express configuration defaults to RAID level-5 with a hot-spare drive.

Understanding RAID level-x0

Note: RAID level-x0 is available only on the ServeRAID-4 and ServeRAID-5i controllers.

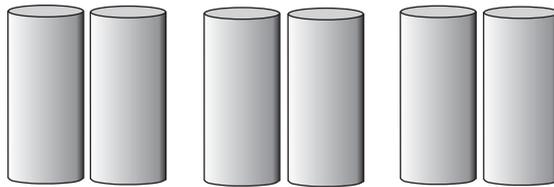
RAID level-x0 refers to RAID level-00, level-10, level-1E0, and level-50. RAID level-x0 uses an array of arrays, or a *spanned array*. The operating system uses the spanned array logical drive in the same way as a regular array logical drive.

RAID level-x0 allows more physical drives in an array. The benefits of doing so are larger logical drives, increased performance, and increased reliability. RAID level-0, level-1E, level-5, and level-5E cannot use more than 16 physical drives in an array; however, RAID level-1E0 and level-50 support 60 drives.

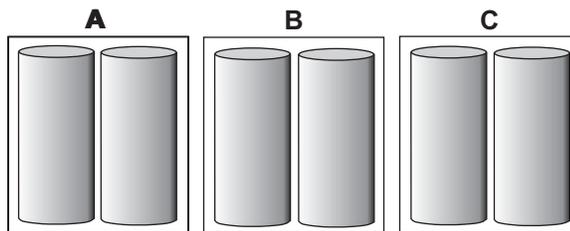
RAID level-x0 requires a minimum of two drives and supports a maximum of 60 drives.

The following illustration is an example of a RAID level-10 logical drive.

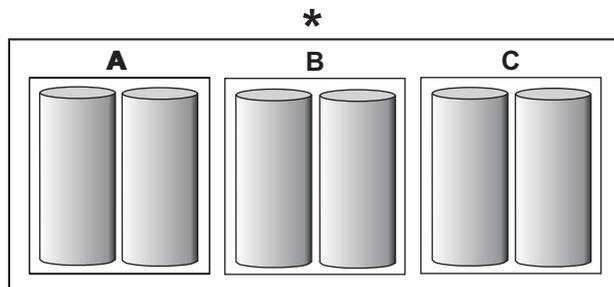
Start with six physical drives.



Create three arrays (labeled A, B, and C), each array using two physical drives.

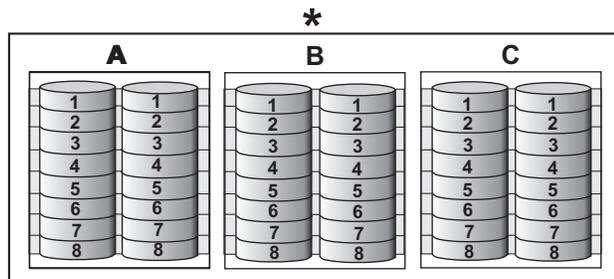


Then create a *spanned array* (labeled as *) that spans the three arrays.

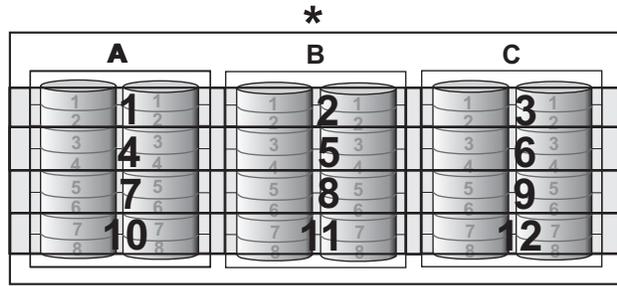


A sub-logical drive is created within *each* array (A, B, and C). Then, the data is striped across the physical drives in the array, creating blocks.

Notice that, in each array, the data on the drive on the right is a copy of the data on the drive on the left because the sub-logical drives (A, B, and C) are RAID level-1 in a RAID level-10 implementation (see the following table).



Then, create a logical drive within the spanned array (*). The data is striped across this logical drive, creating blocks (1-12). Notice that none of these blocks are redundant. This is because the logical drive is RAID level-0 in a RAID level-x0 implementation (see the following table).



| RAID level | Sub-logical drive | Spanned array logical drive |
|------------|-------------------|-----------------------------|
| 00 | RAID level-0 | RAID level-0 |
| 10 | RAID level-1 | RAID level-0 |
| 1E0 | RAID level-1E | RAID level-0 |
| 50 | RAID level-5 | RAID level-0 |

With RAID level-10, level-1E0, and level-50, if one of the physical drives fails in a sub-logical drive, the ServeRAID controller switches read and write requests to the remaining functional drives in the sub-logical drive. With RAID level-00, a physical drive failure within the sub-logical drive results in loss of data.

RAID level-x0 offers the following advantages and disadvantages.

| Advantages | Disadvantages |
|--|--|
| <ul style="list-style-type: none"> • Supports up to 60 physical drives • 100% data redundancy (except for RAID level-00) | <ul style="list-style-type: none"> • Available only on the ServeRAID-4 and ServeRAID-5i controllers • No data redundancy for RAID level-00 |

Drive state descriptions

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

Physical drive state descriptions

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

| Drive state | Meaning |
|-------------|--|
| Defunct | <p>A physical drive in the online, hot-spare, or rebuild state has become defunct. It does not respond to commands, which means that the ServeRAID controller cannot communicate properly with the drive.</p> <p>If a physical drive has become defunct, refer to “Drive replacement (rebuilding a defunct drive)” on page 73.</p> |
| Hot spare | A hot-spare drive is a physical drive that is defined for automatic use when a similar drive fails. |
| Online | The drive is online. It is functioning properly and is part of an array. |
| Rebuilding | <p>The drive is being rebuilt.</p> <p>For more information on rebuilding a drive, refer to “Drive replacement (rebuilding a defunct drive)” on page 73.</p> |
| Ready | The ServeRAID controller recognizes a ready drive as being available for definition. |

| Drive state | Meaning |
|-------------------|--|
| Standby Hot Spare | A standby hot spare is a hot-spare drive that the ServeRAID controller has spun down. If an online drive becomes defunct and no suitable hot-spare drive is available, a standby hot-spare drive of the appropriate size automatically spins up, and enters the rebuild state. |

Logical drive state descriptions

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

| Drive State | Meaning |
|--------------------|--|
| Blocked | <p>During a rebuild operation, the ServeRAID controller sets the state of any RAID level-0 logical drives associated with a failed array to the blocked state; then, it reconstructs the data that was stored in RAID level-1, RAID level-1E, RAID level-5 and RAID level-5E logical drives.</p> <p>After the rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. However, the logical drive might contain damaged data. You must either re-create, reinstall, or restore the data from the most recent backup disk or tape to the RAID level-0 logical drive.</p> |
| Critical Migrating | A logical drive in the critical state that is undergoing a logical drive migration (LDM). |
| Critical System | The ServeRAID controller uses this reserved state during a logical drive migration (LDM) when the logical drive is in the critical state. |
| Critical | <p>A RAID level-1, RAID level-1E, RAID level-5, or RAID level-5E logical drive that contains a defunct physical drive is in the critical state. A critical logical drive is accessible, despite a physical drive failure.</p> <p>Attention: If the state of the logical drive is critical, refer to “Drive replacement (rebuilding a defunct drive)” on page 73.</p> |
| Migrating | The logical drive is undergoing a logical drive migration; that is, a change in RAID levels, a change in logical drive size, an increase in free space, or a RAID level-5E compression or decompression. |
| Offline | <p>The logical drive is offline and not accessible. This state occurs when one of the following is true.</p> <ul style="list-style-type: none"> • One or more physical drives in a RAID level-0 logical drive are defunct. • Two or more physical drives in a RAID level-1, RAID level-1E, or RAID level-5 logical drive are defunct. • Three or more drives in a RAID level-5E logical drive are defunct. <p>If any of these are true, refer to “Drive replacement (rebuilding a defunct drive)” on page 73.</p> |
| Okay | The logical drive is okay. It is in a good, functional state. |
| System | The ServeRAID controller uses this reserved state during logical drive migration (LDM). |

Device drivers

The ServeRAID controller requires the installation of device drivers. See the README file on the Device Driver Diskette and Device Drivers for SCO Operating Systems for detailed instructions.

If the operating system is installed from the ServerGuide™ CD, the device drivers are installed automatically. However, if the operating system is installed from another source, the device drivers must be installed. See the README file on the Device Driver diskette for installation instructions.

Miscellaneous programs

The IPSSSEND and IPSPMON programs are advanced command-line programs that can be used to manage the ServeRAID controllers. You can use the IPSSSEND program to view the configuration of a ServeRAID controller, rebuild a defunct drive, and perform other functions. You can use the IPSPMON program to monitor a ServeRAID controller for defunct drives, predictive failure analysis (PFA) warnings, rebuild operations synchronizations, and logical drive migration. See the README files for installation instructions.

Using ServeRAID Controllers to avoid data loss

RAID-5 and RAID-1 technology provides the ability to continue operation after the failure of a hard drive and the ability to rebuild the lost data onto a replacement drive. In conjunction with the bad sector remapping capabilities of the hard drives, RAID-5 and RAID-1 can also help recreate data lost due to sector media corruption.

Defective sectors on hard drives are not uncommon. Data scrubbing helps you detect and correct these errors before they become a problem. If the ServeRAID Array is not properly set up and/or maintained, a significant risk of data loss grows with the passage of time. This manual examines how to avoid data loss wherever possible.

Drive failures

Three types of drive failures can typically occur in a RAID-5 or RAID-1 subsystem that may endanger the protection of stored data:

- “Catastrophic drive failures”
- “Grown sector media errors”
- “Combination failures” on page 116

Catastrophic drive failures: How They Occur

Catastrophic drive failures occur when all data on a drive, including the ECC data written on the drive to protect information, is completely inaccessible due to mechanical or electrical problems.

Grown sector media errors: How They Occur

Grown sector media errors occur due to the following:

- Latent imperfections on the disk
- Media damage due to mishandling of the disk
- Harsh environments

The drive itself can often repair these errors by recalculating lost data from Error Correction Code (ECC) information stored within each data sector on the drive. The drive then remaps this damaged sector to an unused area of the drive to prevent data loss.

Note: Sector media errors, which affect only a small area of the surface of the drive, may not be detected in seldom used files or in non-data areas of the disk. These errors are only identified and corrected if a read or write request is made to data stored within that location.

Data scrubbing forces all sectors in the logical drive to be accessed so that sector media errors are detected by the drive. Once detected, the drive’s error recovery procedures are launched to repair these errors by recalculating the lost data from the ECC information described above. If the ECC information is not sufficient to

recalculate the lost data, the information may still be recovered if the drive is part of a RAID-5 or RAID-1 array. RAID-5 and RAID-1 arrays can provide their own redundant information (similar to the ECC data written on the drive itself), which is stored on other drives in the array. The ServeRAID controller can recalculate the lost data and remap the bad sector.

Note:

The act of synchronization executes data scrubbing.

Data scrubbing can be performed in the background while allowing concurrent user disk activity on RAID-5 and RAID-1 logical drives.

Combination failures: How They Occur

Combination failures occur when a catastrophic drive failure occurs while there are still undetected, uncorrected sector media errors on the remaining drives in the array; the controller cannot rebuild all the data. In such cases, a double failure exists; files must be restored from backup media.

See “Combination failure protection” on page 120 for information about protection provided at the ServeRAID controller level.

Note: IBM provides management software, IBM Director, with IBM servers that ship with ServerGuide. The software monitors the status of the hardware and provides alerts when conditions are not optimal. IBM Director enables customers to obtain all of the information necessary for data protection. Installation of IBM Director or similar tools to monitor and track disk subsystem integrity is critical for the protection of stored data. If you are planning to use IBM Director in conjunction with the ServeRAID-5i controller, see “IBM Director support for the ServeRAID-5i controller” on page 27.

Drive protection features

Note: This section explains the Drive Protection Features in greater detail. You may wish to skip this section and proceed to the procedures for synchronization and data scrubbing in the next section.

The following sections describe the drive protection features of the ServeRAID controllers:

- “Remapping bad sectors”
- “Error Correction Code (ECC)”
- “Predictive Failure Analysis (PFA)” on page 117

Remapping bad sectors: *Sector media errors* that show up over time usually only affect a single 512 byte block of data on the disk. This sector can be marked as “bad”; the location can then be reassigned, or “remapped,” to a spare sector of the drive.

Most drives reserve one spare sector per track of data and can perform this operation automatically.

Error Correction Code (ECC): The drive avoids potential problems by using only “reliable” sections of the disk when remapping bad sectors.

For example, if a media problem develops after the data has been written, during a disk read, most drives can correct minor sector media errors automatically by using error correction code (ECC) information stored along with the data and then used in rewriting the data on the disk. If the sector is badly damaged and the data cannot be reliably rewritten to the same spot, the drive remaps the data to a spare sector on the disk. If the sector is very badly damaged, the drive may not be able to recreate the data automatically with the ECC. If no other protection (such as RAID) is in place, the system reports a read failure and the data is lost. These lost data areas are typically reported to the user via operating system messages.

Predictive Failure Analysis (PFA):

Note: Replace all PFA drives as soon as possible.

As with any electrical/mechanical device, there are two basic failure types:

1. *Gradual performance degradation* of components can create a catastrophic drive failure (see “Catastrophic drive failures” on page 115).

Predictive Failure Analysis performs the following remedial operations:

- Monitors performance of drives
- Analyzes data from periodic internal measurements
- Recommends replacement when specific thresholds are exceeded

The data from periodic internal measurements is collected when data sectors are accessed.

Data scrubbing performs the following operations:

- Forces all data sectors to be read
- Provides more data to improve the accuracy of PFA

The thresholds have been determined by examining the history logs of drives that have failed in actual customer operation. When PFA detects a threshold exceeded failure, the system administrator can be notified through IBM Director. The design goal of PFA is to provide a minimum of 24 hours warning before a drive experiences “catastrophic” failure.

2. A cable breaking, a component burning out, a solder connection failing, are all examples of “on/off” *unpredictable catastrophic failures*. As assembly and component processes have improved, these types of defects have been reduced but not eliminated. PFA cannot always provide warning for on/off unpredictable failures.

Device Event Table

This table contains counters indicating the number of times unexpected events were reported through the storage subsystem. These events may be caused by several sources, including:

ServeRAID controller, Cables (external and internal), Connectors, Hot-Swap Backplane(s), Hot-Swap Drive Trays, Target Devices (Disk Drives, CD-ROMs, etc.), and SCSI Terminators.

The Device Event Table can be displayed using the IPSSSEND program.

Using the IPSSSEND program

Note: In the following command, replace <controller> with the ServeRAID controller number.

At a command prompt, type the following:

```
ipssend getevent <controller> device
```

Frequently asked questions regarding the Device Event Table:

In the Device Event Table, what are hard events?: The hard event count entry in the device event table is a count of events detected by the SCSI I/O processor since the Device Event Table was last cleared. These events are usually not caused by the target device. The controller processor can detect many types of events. Usually these events are related to SCSI cabling, back planes or internal problems in the ServeRAID controller. Hard events are usually not related to the hard drives or other SCSI devices that are on the bus.

How should hard events be handled?: If you find a hard event entered into the Event log, first check to see if there is a discernible pattern to the events in the device error table. For example a large number of events on a particular drive or channel may indicate a problem with the cabling or back plane for that particular drive, channel, etc. Always check for cables being properly seated, bent pins, pushed pins, damaged cables and proper termination. Before replacing the ServeRAID controller, replace the SCSI cables followed by the back plane. If you have exhausted all other possibilities, then replace the ServeRAID controller. Remember that the ServeRAID card is the least likely item in the subsystem to cause hard events and the most expensive to replace.

In the Device Event Table what is the meaning of soft events?: The soft event entry in the device error table is a count of the SCSI check conditions (other than unit attention) received from the target device (hard disk drive, CD ROM, tape drive, etc.) since the Device Error Table was last cleared. There are many types of SCSI check conditions that can be received by the ServeRAID controller. Some of the check conditions indicate errors while others indicate unexpected (but not error) conditions such as the command queue on a drive being temporarily full.

How should soft events be handled?: An occasional soft event in the absence of PFA, parity and hard event entries is usually not a problem. Check for cables being properly seated, bent pins, pushed pins, damaged cables and proper termination of the SCSI bus. No further action is necessary if there are only a small number of random events.

Is there a threshold guide line to follow before replacing the drive?: As with hard errors, a pattern of entries for a particular drive or channel may indicate a problem. There is not an absolute threshold for soft errors and when drives should be replaced. The ServeRAID controller internally filters the types of soft errors and will mark a disk drive defunct when appropriate.

In the Device Error Table what is the meaning of parity events?: The parity event entry in the device event table is the number of parity or ECC errors on the SCSI bus found by the ServeRAID controller since the last time the Device Event Table was cleared. Parity errors found by the targets (hard disk drive, tape drive, etc.) are reported as soft events.

How should parity events be handled?: Check for cables being properly seated, bent pins, pushed pins, damaged cables and proper termination of the SCSI bus. If some or all of the devices are operating at Fast or Ultra speeds, then ensure that the maximum cable lengths for the SCSI interface are not exceeded. No further action is necessary if there are only a small number of random events. A large number of events on a particular channel or to a particular target may require

replacement of the backplane or SCSI cabling. It is possible but unlikely that the ServeRAID controller has caused the parity errors.

In the Device Event Table what is the meaning of miscellaneous events?:

Miscellaneous events are all entries that are not parity, soft, hard or PFA entries. Miscellaneous events are very often target (hard drive, tape drive, etc.) problems.

How should miscellaneous events be handled?: Some common events that cause miscellaneous errors are selection time-out when accessing the drive, unexpected SCSI bus free detected by the SCSI I/O processor or SCSI phase error. Check for cables being properly seated, bent pins, pushed pins, damaged cables and proper termination of the SCSI bus. If all the preceding items are correct, then suspect the target indicated in the log. The least likely cause would be a problem in the ServeRAID controller.

What is PFA and do all drives have this capability?: PFA stands for Predictive Failure Analysis. Most server class hard disk drives have the capability of monitoring internal parameters in the drive that could predict a future failure in the drive. The algorithms and data monitored are very complex and in most cases proprietary.

If a drive determines that a failure is likely, then it notifies the ServeRAID controller of a possible future failure. This notification is included as a Device Event Table entry. Any drive with a PFA entry in the Device Event Table should be replaced as soon as possible.

How should PFA events be handled?: For RAID-1 or RAID-5, replace the drive immediately and rebuild the array. For RAID-0 back up all data to tape immediately, replace the drive and then restore the data to the RAID-0 array.

RAID-5 controller level protection: At the controller level, RAID-5 has become an industry standard method to provide increased availability for servers. RAID-5 and RAID-1 implementations allow servers to continue operation even if there is a “catastrophic” failure of a hard drive.

During normal operations in a RAID-5 environment, redundant information is calculated and written out to the drives. In a n disk environment, $n-1$ disks of data are provided with one disk of space dedicated to redundant “check sum” or “parity” information. For example, three 2GB drives provide 4GB of data space and 2GB of redundancy.

Note: The redundant data is actually spread out over all the disks for performance reasons.

Catastrophic disk failure protection: If a drive that is a member of a RAID-5 array fails, the remaining members of the array can use their redundant information to recalculate the lost data, either to respond to user requests for data or to rebuild the data stored on the lost drive when it is replaced with a new one.

For example, information in Record 1 from Drive 1 is combined with the check sum information on Drive 3 to recreate information that is not available from Drive 2.

As long as the array controller can access the remaining $n-1$ drives, the rebuild will be successful. Naturally, if a second disk failure were to suddenly occur, the array and its data would be lost. RAID-5 can only protect against the loss of a single drive.

Grown sector media error protection: In this scenario, as the drive attempts to read data in a read request, it determines that Record 1 of Disk 1 has a bad sector. If the media error is minor, the drive corrects or remaps the information using the drive ECC information, which is transparent to the RAID array.

If the disk cannot recreate the information from the ECC information on the drive, the controller determines if the data is still lost, as it was without RAID support. In such a case, ServeRAID controllers can recognize the fault and re-create the data from redundant information stored on other drives.

For example:

1. Record 1 is corrected from data stored in Record 2 on Drive 2 and check sum information on Drive 3.

The ServeRAID controller requests that Record 1 be rewritten.

2. The drive remaps the bad sector elsewhere on the drive. Record 1 now has good data.

In this example, RAID-5 has increased the availability of the information by re-creating data that otherwise would have been lost. It is initially assumed that this process was initiated by accessing this data on the drive. Were this data not accessed, this error would not be detected. This problem can be significant if a catastrophic failure occurs before the data is corrected.

Combination failure protection: In this example, an undetected sector media error exists within Record 1 of Disk 1.

This error occurred within an archived section of the user's database that is seldom accessed. Before this error is recognized and corrected, a "catastrophic" failure of Drive 2 is sustained. So far, no data problems are noticed.

User requests for information other than Record 1 can still be serviced with RAID protection and data recalculation. When Drive 2 is replaced and a rebuild is initiated, the ServeRAID controller attempts to recalculate Record 2 from the failed Drive 2 by combining Record 1 with the check sum data on Drive 3. At this point, the media sector error is discovered.

- If the error is minor, the disk can re-create the missing information from its ECC data (as before) and potentially remap the bad sector.
- If the error is too severe, the disk cannot recover the data. The rebuild process cannot complete successfully because it does not have a complete Record 1 to combine with the check sum data to rebuild the lost data on Drive 2. The Rebuild, therefore, skips that stripe and continues rebuilding the rest of the logical drive. Once the rebuild has completed, a "rebuild failed" message is displayed.

The ServeRAID controller brings the rebuilt drive online and takes the array out of "critical" mode. To protect data integrity, it also blocks access to the damaged stripes of the array. Data files covered by these damaged stripes still report data errors and must be restored from a previous backup. The necessity for a full restore due to a "rebuild failed" message caused by one or two bad stripes is thereby prevented.

Configuration procedures required to provide RAID-5 protection: Synchronization and initialization are required before installing an operating system or storing any customer data on a RAID-5 array for data integrity and to provide data protection. The RAID-5 arrays write data out to drives in stripe units.

The size of the stripe unit can be configured to:

- 8KB
- 16KB
- 32KB
- 64KB

Synchronization performs the following operations:

- Reads all the data bits in each stripe unit
- Calculates the parity for that data
- Compares the calculated parity with the existing parity for all stripe units in the array
- Updates the existing parity, if inconsistent

Initialization writes zeroes out to the logical drive.

Operating systems may not install properly if the first few sectors are not set to zero (approximately the first 32 sectors).

After creating an array, the user must create a logical drive. *Physical drives* are the individual disk drives that are inside the machine. A *logical drive* is the drive that the array controller shows the operating system. A logical drive spans across multiple physical drives.

All redundant RAID logical drives are automatically synchronized by the ServeRAID-4 controller in the background when the logical drive is defined. No other user action is required.

Providing additional protection for redundant RAID logical drives: Full tape backups and automatic data scrubbing provide protection against multiple drive failure and unprotected grown media defects.

Full tape backups: Periodic full tape backups force all data files to be read and copied to tape. This procedure provides two advantages:

- It provides an archive of all data in case it is needed to restore from a multiple drive failure or user error that could cause data loss/corruption.
- By reading every file on the disk, the backup process forces the disk and the controller to discover any sector media errors and to correct them, greatly decreasing the likelihood of the rebuild failures described in the previous section. If weekly tape backups are performed, data scrubbing is still recommended to detect and correct sector media errors in non-data areas of the drives.

If a sector media error has not been discovered and an array rebuild fails as described previously, a full tape backup can then be performed to minimize data loss. The tape backup saves all files except for the one containing the damaged sector. The drives can then be restored from the configuration disk and synchronized, forcing the remapping of bad sectors. The data can then be restored. The files that were contained on the damaged sector would then have to be restored from a prior backup.

Automatic Data scrubbing: Automatic data scrubbing continuously reads all sectors of all logical drives in the background while the system is running. If a defective sector is found, it is automatically repaired. The advantage to this procedure, when used in addition to tape backups, is that data scrubbing examines unallocated sectors of the drive, in addition to those that have been allocated, that

is, data areas protected by a tape backup. If any sector media errors are found during this process, they are corrected at the disk level using disk ECC information, if possible, or at the array level using RAID parity information, if necessary. Automatic data scrubbing is enabled by defaults.

Note: You do not need to synchronize RAID level-0 or 1 logical drives before storing data.

Data scrubbing continuously reads all sectors of RAID-1 and RAID-5 logical drives in the background while the system is running. If a defective sector is found, it is automatically repaired. As a result of this feature, you no longer have to synchronize logical drives on a weekly basis.

Acronyms, terms, and definitions

Acronyms and terms are listed in alphabetical order in the following table.

array An arrangement of data in one or more dimensions: a list, a table, or a multidimensional arrangement of items. In the ServeRAID environment, data is striped across multiple physical hard drives. The array is defined as the set of hard drives included in the data striping.

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.

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

DASD

Direct access storage device.

Data Scrubbing

The process that forces all data sectors in a logical drive to be accessed so that sector media errors are identified and corrected at the disk level using disk ECC information, if possible, or at the array level using ServeRAID parity information, if necessary. For a high level of data protection, perform data scrubbing weekly.

DDD Defunct disk drive.

defunct

Unrecoverable; failed; not responding.

DHS Defunct hot-spare. A hot-spare or standby hot-spare drive enters the defunct hot-spare (DHS) state if it fails to respond to the adapter commands. Once a Defunct (DHS) drive is replaced, its state changes from DHS to HSP. Only the IBM ServeRAID adapter has the DHS state.

disk array

A grouping of hard disks that can be logically considered one drive.

A grouping of hard disks over which a data file is spread.

electronically erasable programmable read-only memory (EEPROM)
A PROM that can be erased by a special process and reused.

EMP Empty. No device is present in the SID or the adapter cannot communicate with the drive. This state is represented with dashes (- - -) on the IBM ServeRAID configuration screen, or a blank space on the Administration and Monitor screen. Only the IBM ServeRAID adapter has this state.

GB Gigabyte; equal to approximately one billion bytes.

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. In the ServeRAID family of controllers, a hot-spare (HSP) drive is a drive designated to be a replacement for the first Defunct (DDD) drive that occurs. The state of the drive appears as HSP. When a Defunct (DDD) drive occurs and a HSP is defined, the hot-spare drive takes over for the drive that appears as Defunct (DDD). The HSP drive is rebuilt to be identical to the Defunct (DDD) drive. During the rebuilding of the HSP drive, this drive changes to the Rebuild (RBL) state. The RBL state will turn to ONL once the drive is completely rebuilt and fully operating for the Defunct (DDD) drive.

initialize
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.

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.

ISPR Interrupt Status Port register.

KB Kilobyte; equal to approximately 1000 bytes.

LDM Logical drive migration.

logical drive
Part of an array.

The array specifies which drives to include in the striping of data. Each array is subdivided into one or more logical drives. The logical drives specify the following:

- The number and size of the physical drives as seen by the operating system. The operating system sees each defined logical drive as a physical drive.

- The RAID level. When a logical drive is defined, its ServeRAID level (0, 1, or 5) is also defined.

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.

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.

non-volatile random access memory (NVRAM)

Random access memory that retains its contents after electrical power is shut off.

NVRAM

Non-volatile random access memory.

OFL Offline, a good drive that replaces a defunct drive in a RAID level-1 or level-5 array. This drive is associated with the array but does not contain any data. Drive status remains OFL during the rebuild phase.

OKY Good functional state. The ServeRAID adapter's logical drive state in which all drives in the array are online and fully operational.

ONL Online, a drive that ServeRAID adapter detects as installed, operational, and configured into an array appear as this state.

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.

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 pre-established.

PFA The firmware of a hard drive uses algorithms to track the error rates on the drive. The drive alerts the user with a Predictive Failure Analysis (PFA) alert via IBM Director when degradation of drive performance (read/write errors) is detected. When a PFA alert occurs, physical replacement of the drive is recommended.

pop-up window

A box on the display screen that displays information or asks the user to make choices.

- POST** Power-on self-test.
- RAID** Redundant array of independent disks.
- RBL** Rebuild. A drive in this state is being rebuilt. Only the IBM ServeRAID adapter has this state.
- RDY** Ready. RDY appears as the status of a drive that the ServeRAID adapter detects as installed, spun up, but not configured in an array.
- redundancy**
In a functional unit, the existence of more than one means for performing a required function.
- RAID-0**
RAID level-0 stripes the data across all of the drives of the array. RAID-0 offers substantial speed enhancement, but provides for no data redundancy. Therefore, a defective hard disk within the array results in loss of data in the logical drive assigned level-0, but only in that logical drive.
- RAID-1**
RAID level-1 provides an enhanced feature for disk mirroring that stripes data as well as copies of the data across all the drives of the array. The first stripe is the data stripe, and the second stripe is the mirror (copy) of the first data stripe. The data in the mirror stripe is written on another drive. Because data is mirrored, the capacity of the logical drive when assigned level-1 is 50% of the physical capacity of the grouping of hard disk drives in the array.
- RAID-5**
RAID level-5 stripes data and parity across all drives of the array. When a disk array is assigned RAID-5, the capacity of the logical drive is reduced by one physical drive size because of parity storage. The parity is spread across all drives in the array. If one drive fails, the data can be rebuilt. If more than one drive fails but one or none of the drives are actually defective, then data may not be lost. You can use a process called software replacement on the non-defective hard drives.
- SID** SCSI ID. A zero based counting scheme (0, 1, ... 15) for the SCSI devices on a channel.
- SBY** Standby. A standby drive is a hard disk drive that the ServeRAID adapter has spun down. Devices such as tape drives and CD-ROM drives are also considered to be in a standby state. Only the IBM ServeRAID adapter has the state.
- 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.
- 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.
- software replace**
Refers to when the hard disk drive is not physically replaced in the system.

A drive may have been marked defunct but brought back online. The drive is rebuilt without having been physically replaced. This could occur because, when the ServeRAID adapter communicates with the hard file and receives an unexpected response, the adapter marks the drive defunct to avoid any potential data loss.

synchronization

The process that reads all the data bits of the entire logical drive, calculates the parity bit for the data, compares the calculated parity with the existing parity, and updates the existing parity if inconsistent.

SYS System.

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.

WB Write-back.

write-back

WB.

The write policy mode that sends a completion status to the system when the data is entered into memory.

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

WT.

The write policy mode that sends a completion status to the system when the data is written to the device.

Compare with *write-back*.

Related service information

Note: The service procedures are designed to help you isolate problems. They are written with the assumption that you have model-specific training on all computers, or that are familiar with the computers, functions, terminology, and service information provided in this manual.

Safety information

The following section contains the safety information that you need to be familiar with before servicing an IBM computer.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
 1. Ensure you can stand safely without slipping.
 2. Distribute the weight of the object equally between your feet.
 3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
 4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*
- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your tool case away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, approximately 8 centimeters (3 inches) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

Remember: Metal objects are good electrical conductors.
- Wear safety glasses when you are: hammering, drilling soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

Electrical safety



CAUTION:

Electrical current from power, telephone, and communication cables can be hazardous. To avoid personal injury or equipment damage, disconnect the attached power cords, telecommunication systems, networks, and modems before you open the server covers, unless instructed otherwise in the installation and configuration procedures.

Observe the following rules when working on electrical equipment.

Important: Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents.

Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
 - Performing a mechanical inspection
 - Working near power supplies
 - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has exposed electrical circuits, observe the following precautions:
 - Ensure that another person, familiar with the power-off controls, is near you.
Remember: Another person must be there to switch off the power, if necessary.
 - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.
Remember: There must be a complete circuit to cause electrical shock. By observing the above rule, you may prevent a current from passing through your body.
 - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
 - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.
 - Do not use worn or broken tools and testers.
 - *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered-off.
 - Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.
 - Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
 - Do not service the following parts with the power on when they are removed from their normal operating places in a machine:
 - Power supply units
 - Pumps
 - Blowers and fans
 - Motor generators
- and similar units. (This practice ensures correct grounding of the units.)
- If an electrical accident occurs:
 - Use caution; do not become a victim yourself.
 - Switch off power.
 - Send another person to get medical aid.

Safety inspection guide

The intent of this inspection guide is to assist you in identifying potentially unsafe conditions on these products. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This guide addresses only those items. However, good judgment should be used to identify potential safety hazards due to attachment of non-IBM features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock).
- Explosive hazards, such as a damaged CRT face or bulging capacitor
- Mechanical hazards, such as loose or missing hardware

The guide consists of a series of steps presented in a checklist. Begin the checks with the power off, and the power cord disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Turn off the computer. Disconnect the power cord.
3. Check the power cord for:

- a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
 - b. The power cord should be the appropriate type as specified in the parts listings.
 - c. Insulation must not be frayed or worn.
4. Remove the cover.
 5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
 6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
 7. Check for worn, frayed, or pinched cables.
 8. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Handling electrostatic discharge-sensitive devices

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the server, the part, the work mat, and the person handling the part are all at the same charge.

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD-protective devices you use have been certified (ISO 9000) as fully effective.

When handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those in the following list, to provide protection that meets the specific service requirement.

Note: The use of a grounding system is desirable but not required to protect against ESD damage.

- Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
- Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
- Use the round ground-prong of the ac plug on ac-operated computers.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Safety notices (multi-lingual translations)

The caution and danger safety notices in this section are provided in the following languages:

- English
- Brazilian/Portuguese
- Chinese
- French
- German
- Italian
- Korean
- Spanish

Important: All caution and danger statements in this IBM documentation begin with a number. This number is used to cross reference an English caution or danger statement with translated versions of the caution or danger statement in this section.

For example, if a caution statement begins with a number 1, translations for that caution statement appear in this section under statement 1.

Be sure to read all caution and danger statements before performing any of the instructions.

- Statement 1



DANGER

Electrical current from power, telephone and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**

- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

| To Connect | To Disconnect |
|--|--|
| 1. Turn everything OFF. 2. First, attach all cables to devices. 3. Attach signal cables to connectors. 4. Attach power cords to outlet. 5. Turn device ON. | 1. Turn everything OFF. 2. First, remove power cords from outlet. 3. Remove signal cables from connectors. 4. Remove all cables from devices. |

- Statement 2



CAUTION:

When replacing the lithium battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.

- Statement 3



CAUTION:

When laser products (such as CD-ROMs, DVD-ROM drives, fiber optic devices, or transmitters) are installed, note the following:

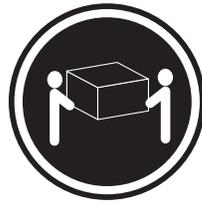
- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.



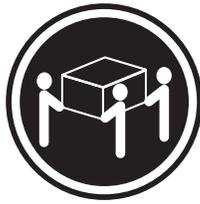
DANGER: Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following:

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

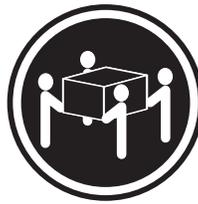
- Statement 4



≥18 kg (37 lbs)



≥32 kg (70.5 lbs)



≥55 kg (121.2 lbs)

CAUTION:
Use safe practices when lifting.

- Statement 5



CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



- Statement 10

CAUTION:

Do not place any object weighing more than 82 kg (180 lbs.) on top of rack-mounted devices.



Importante:

Todas as instruções de cuidado e perigo da IBM documentation começam com um número. Este número é utilizado para fazer referência cruzada de uma instrução de cuidado ou perigo no idioma inglês com as versões traduzidas das instruções de cuidado ou perigo encontradas nesta seção.

Por exemplo, se uma instrução de cuidado é iniciada com o número 1, as traduções para aquela instrução de cuidado aparecem nesta seção sob a instrução 1.

Certifique-se de ler todas as instruções de cuidado e perigo antes de executar qualquer operação.

Instrução 1



PERIGO

A corrente elétrica proveniente de cabos de alimentação, de telefone e de comunicações é perigosa.

Para evitar risco de choque:

- Não conecte ou desconecte cabos e não realize instalação, manutenção ou reconfiguração deste produto durante uma tempestade com raios.
- Conecte todos os cabos de alimentação a tomadas elétricas corretamente instaladas e aterradas.
- Conecte todos os equipamentos ao qual esse produto será conectado a tomadas corretamente instaladas.
- Sempre que possível, utilize apenas uma das mãos para conectar ou desconectar cabos de sinal.
- Nunca ligue qualquer equipamento quando existir evidência de danos por fogo, água ou na estrutura.
- Desconecte cabos de alimentação, sistemas de telecomunicação, redes e modems antes de abrir as tampas dos dispositivos, a menos que especificado de maneira diferente nos procedimentos de instalação e configuração.
- Conecte e desconecte cabos conforme descrito na seguinte tabela, ao instalar ou movimentar este produto ou os dispositivos conectados, ou ao abrir suas tampas.

| Para Conectar: | Para Desconectar: |
|--|--|
| <ol style="list-style-type: none">1. DESLIGUE Tudo.2. Primeiramente, conecte todos os cabos aos dispositivos.3. Conecte os cabos de sinal aos conectores.4. Conecte os cabos de alimentação às tomadas.5. LIGUE os dispositivos. | <ol style="list-style-type: none">1. DESLIGUE Tudo.2. Primeiramente, remova os cabos de alimentação das tomadas.3. Remova os cabos de sinal dos conectores.4. Remova todos os cabos dos dispositivos. |

Instrução 2



CUIDADO:

Ao substituir a bateria de lítio, utilize apenas uma bateria IBM, Número de Peça 33F8354 ou uma bateria de tipo equivalente, recomendada pelo fabricante. Se o seu sistema possui um módulo com uma bateria de lítio, substitua-o apenas pelo mesmo tipo de módulo, do mesmo fabricante. A bateria contém lítio e pode explodir se não for utilizada, manuseada e descartada de maneira correta.

Não:

- Jogue ou coloque na água
- Aqueça a mais de 100°C (212°F)
- Conserte nem desmonte

Para descartar a bateria, entre em contato com a área de atendimento a clientes IBM, pelo telefone (011) 889-8986, para obter informações sobre como enviar a bateria pelo correio para a IBM.

Instrução 3



PRECAUCIÓN:

Quando produtos a laser (unidades de CD-ROM, unidades de DVD, dispositivos de fibra ótica, transmissores, etc.) estiverem instalados, observe o seguinte:

- Não remova as tampas. A remoção das tampas de um produto a laser pode resultar em exposição prejudicial à radiação de laser. Nenhuma peça localizada no interior do dispositivo pode ser consertada.
- A utilização de controles ou ajustes ou a execução de procedimentos diferentes dos especificados aqui pode resultar em exposição prejudicial à radiação.

PERIGO

Alguns produtos a laser contêm um diodo laser da Classe 3A ou Classe 3B embutido. Observe o seguinte:

Radiação de laser quando aberto. Não olhe diretamente para o raio a olho nu ou com instrumentos óticos, e evite exposição direta ao raio.

Instrução 4





≥18 kg (37 lbs)



≥32 kg (70.5 lbs)



≥55 kg (121.2 lbs)

CUIDADO:

Ao levantar a máquina, faça-o com segurança.

Instrução 5



CUIDADO:

Os botões Liga/Desliga localizados no dispositivo e na fonte de alimentação não desligam a corrente elétrica fornecida ao dispositivo. O dispositivo também pode ter mais de um cabo de alimentação. Para remover toda a corrente elétrica do dispositivo, assegure que todos os cabos de alimentação estejam desconectados da fonte de energia elétrica.



CUIDADO:

Instrução 10



CUIDADO:



Não coloque nenhum objeto com peso superior a 82 kg (180 lbs.) sobre dispositivos montados em rack.

重要:

Server Library 中的所有提醒和危险条款前都有一个数字标识。该数字是用来交叉引用一个英文的提醒和危险条款及本部分中的与之对应的已翻译成其它文字的提醒和危险条款。

例如, 如果一个提醒条款前的数字为 1, 则本部分中相应的译文也带有标号 1。

在执行任何指示的操作之前, 请确保您已经阅读了全部提醒和危险条款。

声明 1



危险

电源、电话和通信电缆中带有危险电流。
为避免电击:
雷电期间不要拆接电缆或安装、维修及重新配置本产品。
将所有电源线连接至正确布线并已安全接地的电源插座上。
将与本产品连接的所有设备连接至正确布线的插座上。
尽量只使用单手拆接信号电缆。
有水、火及结构损坏迹象时, 请勿打开任何设备。
除非在安装配置过程中有明确指示, 否则, 打开设备机盖前应先断开与电源线、远程通信系统、网络和调制解调器的所有连接。
安装、移动或打开本产品及其附带设备的机盖时, 应按下表所述连接和断开电缆。

连接时:

1. 关闭所有设备。
2. 首先将所有电缆连接至设备。
3. 将信号电缆连接至接口。
4. 将电源线连接至插座。

断开连接时:

1. 关闭所有设备。
2. 首先从插座中拔出电源线。
3. 从接口上拔下信号电缆。

声明 2



警告:

更换锂电池时，只能使用 IBM 产品号 33F8354 或者是厂商推荐的等同类型的电池。

如果系统模块中含有锂电池，则只能使用同一厂商制造的同一类型的模块进行更换。电池中含有锂，如果使用、拿放或处理不当，可能会发生爆炸。

请勿对电池进行下列操作：
扔入或浸入水电
加热超过 100 (212 F)
进行修理或分解
请按本地法规要求处理电池。

声明 3



警告:

安装激光产品（如 CD-ROM、DVD 驱动器、光纤设备或送话器）时，应注意以下事项：

不要拆除外盖。拆除激光产品的外盖可能会导致激光辐射的危险，本设备中没有用户可维修的部件。

非此处指定的其它控制、调整或与性能有关的操作都有可能导致激光辐射的危险。



危险

某些激光产品中包含内嵌的 3A 级或 3B 级激光二极管。请注意以下事项。

打开时会产生激光辐射。不要直视光束，不要使用光学仪器直接观看光束，避免直接暴露于光束之下。

声明 4



≥18 kg (37 磅)



≥32 kg (70.5 磅)



≥55 kg (121.2 磅)

警告：
抬起时请采用安全操作方法。

声明 5



警告：

使用设备上的电源控制按钮和电源上的开关都不能断开本设备上的电流。
另外，本设备可能带有多条电源线。如要断开设备上的所有电流，请确保所有电源线均已与电源断开连接。



声明 6



警告：

如果在电源线连接设备的一端安装了固定松紧夹，则必须将电源线的另一端连接至使用方便的电源。

声明 7



警告:

如果设备带有外门，则在移动或抬起设备前应将其拆除或固定以避免造成人员伤害。外门支撑不了设备的重量。

声明 8



警告:

不要拆除电源外盖或贴有下列标签的任何部件。



贴有此标签的组件内部存在高电压、高电流的危险。这些组件中没有用户可维修的部件。如果怀疑其中的部件存在问题，应与服务技术人员联系。

声明 9



警告:

为避免人员伤害，拆除设备上的风扇前应拨下热插拔风扇电缆。

声明 10



警告:

机柜安装的设备上面不能放置重于 82kg (180 磅) 的物品。



> 82 kg (180 磅)

声明 11



警告:

下面的标签表明附近有锋利的边、角或接头。



声明 12



警告:

下面的标签表明附近有高热表面。



重要資訊：

Server Library 中所有「注意」及「危險」的聲明均以數字開始。此一數字是用來作為交互參考之用，英文「注意」或「危險」聲明可在本節中找到相同內容的「注意」或「危險」聲明的譯文。

例如，有一「危險」聲明以數字 1 開始，則該「危險」聲明的譯文將出現在本節的「聲明」1 中。

執行任何指示之前，請詳讀所有「注意」及「危險」的聲明。

聲明 1



危險

電源、電話及通信電纜上所產生的電流均有危險性。

欲避免電擊危險：

- 在雷雨期間，請勿連接或切斷本產品上的任何電纜線，或安裝、維修及重新架構本產品。
- 請將電源線接至接線及接地正確的電源插座。
- 請將本產品隨附的設備連接至接線正確的插座。
- 儘可能使用單手來連接或切斷信號電纜線。
- 當設備有火燒或泡水的痕跡，或有結構性損害時，請勿開啓該設備的電源。
- 在安裝及架構之時，若非非常熟悉，在開啓裝置蓋子之前，請切斷電源線、電信系統、網路及數據機。
- 在安裝、移動本產品或附加裝置，或開啓其蓋子時，請依照下表中「連接」及「切斷」電纜線的步驟執行。

連接：

1. 關閉所有開關。
2. 先將所有電纜線接上裝置。
3. 將信號電纜接上接頭。
4. 再將電源線接上電源插座。
5. 開啓裝置的電源。

切斷：

1. 關閉所有開關。
2. 先自電源插座拔掉電源線。
3. 拔掉接頭上的所有信號電纜。
4. 再拔掉裝置上的所有電纜線。

聲明 2



注意：

更換鋰電池時，只可使用 IBM 零件編號 33F8354 的電池，或製造商建議之相當類型的電池。若系統中具有包含鋰電池的模組，在更換此模組時，請使用相同廠商製造的相同模組類型。如未正確使用、處理或丟棄含有鋰的電池時，可能會引發爆炸。

請勿將電池：

- 丟入或浸入水中
- 加熱超過 100 °C (212 °F)
- 修理或拆開

請遵照當地法令規章處理廢棄電池。

聲明 3



注意：

安裝雷射產品(如 CD-ROM、DVD 光碟機、光纖裝置或發射器)時，請注意下列事項：

- 請勿移開蓋子。移開雷射產品的蓋子，您可能會暴露於危險的雷射輻射之下。裝置中沒有需要維修的組件。
- 不依此處所指示的控制、調整或處理步驟，您可能會暴露於危險的輻射之下。



危險

有些雷射產品含有內嵌式 Class 3A 或 Class 3B 雷射二極體。請注意下列事項：

開啓時會產生雷射輻射。請勿凝視光束，不要使用光學儀器直接觀察，且應避免直接暴露在光束下。

聲明 4



≥ 18 公斤 (37 磅) ≥ 32 公斤 (70.5 磅) ≥ 55 公斤 (121.2 磅)

注意：

抬起裝置時，請注意安全措施。

聲明 5



注意：

裝置上的電源控制按鈕及電源供應器上的電源開關均無法關閉裝置上的電流。

本裝置可能有一條以上的電源線。如要移除裝置上的所有電流，請確認所有電源線已與電源分離。



聲明 10



注意：

請勿將任何重量超過 82 公斤 (180 磅) 的物品置於已安裝機架的裝置上方。



>82 公斤 (180 磅)

Important:

Toutes les consignes Attention et Danger indiquées dans la bibliothèque IBM documentation sont précédées d'un numéro. Ce dernier permet de mettre en correspondance la consigne en anglais avec ses versions traduites dans la présente section.

Par exemple, si une consigne de type Attention est précédée du chiffre 1, ses traductions sont également précédées du chiffre 1 dans la présente section.

Prenez connaissance de toutes les consignes de type Attention et Danger avant de procéder aux opérations décrites par les instructions.

Notice n° 1



DANGER

Le courant électrique passant dans les câbles de communication, ou les cordons téléphoniques et d'alimentation peut être dangereux.

Pour éviter tout risque de choc électrique:

- Ne manipulez aucun câble et n'effectuez aucune opération d'installation, d'entretien ou de reconfiguration de ce produit au cours d'un orage.
- Branchez tous les cordons d'alimentation sur un socle de prise de courant correctement câblé et mis à la terre.
- Branchez sur des socles de prise de courant correctement câblés tout équipement connecté à ce produit.
- Lorsque cela est possible, n'utilisez qu'une seule main pour connecter ou déconnecter les câbles d'interface.
- Ne mettez jamais un équipement sous tension en cas d'incendie ou d'inondation, ou en présence de dommages matériels.
- Avant de retirer les carters de l'unité, mettez celle-ci hors tension et déconnectez ses cordons d'alimentation, ainsi que les câbles qui la relient aux réseaux, aux systèmes de télécommunication et aux modems (sauf instruction contraire mentionnée dans les procédures d'installation et de configuration).
- Lorsque vous installez ou que vous déplacez le présent produit ou des périphériques qui lui sont raccordés, reportez-vous aux instructions ci-dessous pour connecter et déconnecter les différents cordons.

| Connexion | Déconnexion |
|---|---|
| <ol style="list-style-type: none">1. Mettez les unités hors tension.2. Commencez par brancher tous les cordons sur les unités.3. Branchez les câbles d'interface sur des connecteurs.4. Branchez les cordons d'alimentation sur des prises.5. Mettez les unités sous tension. | <ol style="list-style-type: none">1. Mettez les unités hors tension.2. Débranchez les cordons d'alimentation des prises.3. Débranchez les câbles d'interface des connecteurs.4. Débranchez tous les câbles des unités. |



Notice n° 2

ATTENTION:

Remplacez la pile au lithium usagée par une pile de référence identique exclusivement - voir la référence IBM - ou par une pile équivalente recommandée par le fabricant. Si votre système est doté d'un module contenant une pile au lithium, vous devez le remplacer uniquement par un module identique, produit par le même fabricant. La pile contient du lithium et présente donc un risque d'explosion en cas de mauvaise manipulation ou utilisation.

- Ne la jetez pas à l'eau.
- Ne l'exposez pas à une température supérieure à 100 °C.
- Ne cherchez pas à la réparer ou à la démonter.

Pour la mise au rebut, reportez-vous à la réglementation en vigueur.



Notice n° 3

ATTENTION:

Si des produits laser sont installés (tels que des unités de CD-ROM ou de DVD, des périphériques contenant des fibres optiques ou des émetteurs-récepteurs), prenez connaissance des informations suivantes:

- N'ouvrez pas ces produits pour éviter une exposition directe au rayon laser. Vous ne pouvez effectuer aucune opération de maintenance à l'intérieur.
- Pour éviter tout risque d'exposition au rayon laser, respectez les consignes de réglage et d'utilisation des commandes, ainsi que les procédures décrites dans le présent document.



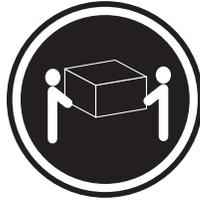
DANGER

Certains produits laser contiennent une diode laser de classe 3A ou 3B. Prenez connaissance des informations suivantes:

Rayonnement laser lorsque le carter est ouvert. évitez de regarder fixement le faisceau ou de l'observer à l'aide d'instruments optiques. évitez une exposition directe au rayon.

Notice n° 4





≥18 kg (37 lbs)



≥32 kg (70.5 lbs)



≥55 kg (121.2 lbs)

ATTENTION:

Faites-vous aider pour soulever ce produit.

Notice n° 5



ATTENTION:

Le bouton de mise sous tension/hors tension de l'unité et l'interrupteur d'alimentation du bloc d'alimentation ne coupent pas l'arrivée de courant électrique à l'intérieur de la machine. Il se peut que votre unité dispose de plusieurs cordons d'alimentation. Pour isoler totalement l'unité du réseau électrique, débranchez tous les cordons d'alimentation des socles de prise de courant.



Notice n° 10



ATTENTION:

Ne posez pas d'objet dont le poids dépasse 82 kg sur les unités montées en armoire.

Wichtig:

Alle Sicherheitshinweise in dieser IBM documentation beginnen mit einer Nummer. Diese Nummer verweist auf einen englischen Sicherheitshinweis mit den übersetzten Versionen dieses Hinweises in diesem Abschnitt.

Wenn z. B. ein Sicherheitshinweis mit der Nummer 1 beginnt, so erscheint die Übersetzung für diesen Sicherheitshinweis in diesem Abschnitt unter dem Hinweis 1.

Lesen Sie alle Sicherheitshinweise, bevor Sie eine Anweisung ausführen.

Hinweis 1



VORSICHT

Elektrische Spannungen von Netz-, Telefon- und Datenübertragungsleitungen sind gefährlich.

Aus Sicherheitsgründen:

- Bei Gewitter an diesem Gerät keine Kabel anschließen oder lösen. Ferner keine Installations-, Wartungs- oder Rekonfigurationsarbeiten durchführen.
- Gerät nur an eine Schutzkontaktsteckdose mit ordnungsgemäß geerdetem Schutzkontakt anschließen.
- Alle angeschlossenen Geräte ebenfalls an Schutzkontaktsteckdosen mit ordnungsgemäß geerdetem Schutzkontakt anschließen.
- Signalkabel möglichst einhändig anschließen oder lösen.
- Keine Geräte einschalten, wenn die Gefahr einer Beschädigung durch Feuer, Wasser oder andere Einflüsse besteht.
- Die Verbindung zu den angeschlossenen Netzkabeln, Telekommunikationssystemen, Netzwerken und Modems ist vor dem Öffnen des Gehäuses zu unterbrechen. Es sei denn, dies ist in den zugehörigen Installations- und Konfigurationsprozeduren anders angegeben.
- Nur nach den nachfolgend aufgeführten Anweisungen arbeiten, die für Installation, Transport oder Öffnen von Gehäusen von Personal Computern oder angeschlossenen Einheiten gelten.

| Kabel anschließen: | Kabel lösen: |
|---|---|
| <ol style="list-style-type: none">1. Alle Geräte ausschalten und Netzstecker ziehen.2. Zuerst alle Kabel an Einheiten anschließen.3. Signalkabel an Anschlußbuchsen anschließen.4. Netzstecker an Steckdose anschließen.5. Gerät einschalten. | <ol style="list-style-type: none">1. Alle Geräte ausschalten.2. Zuerst Netzstecker von Steckdose lösen.3. Signalkabel von Anschlußbuchsen lösen.4. Alle Kabel von Einheiten lösen. |

Hinweis 2



ACHTUNG:

Eine verbrauchte Batterie nur durch eine Batterie mit der IBM Teilenummer 33F8354 oder durch eine vom Hersteller empfohlene Batterie ersetzen. Wenn Ihr System ein Modul mit einer Lithium-Batterie enthält, ersetzen Sie es immer mit dem selben Modultyp vom selben Hersteller. Die Batterie enthält Lithium und kann bei unsachgemäßer Verwendung, Handhabung oder Entsorgung explodieren.

Die Batterie nicht:

- mit Wasser in Berührung bringen.
- über 100 C erhitzen.
- reparieren oder zerlegen.

Die örtlichen Bestimmungen für die Entsorgung von Sondermüll beachten.

Hinweis 3



ACHTUNG:

Wenn ein Laserprodukt (z. B. CD-ROM-Laufwerke, DVD-Laufwerke, Einheiten mit Glasfaserkabeln oder Transmitter) installiert ist, beachten Sie folgendes.

- Das Entfernen der Abdeckungen des CD-ROM-Laufwerks kann zu gefährlicher Laserstrahlung führen. Es befinden sich keine Teile innerhalb des CD-ROM-Laufwerks, die vom Benutzer gewartet werden müssen. Die Verkleidung des CD-ROM-Laufwerks nicht öffnen.
- Steuer- und Einstellelemente sowie Verfahren nur entsprechend den Anweisungen im vorliegenden Handbuch einsetzen. Andernfalls kann gefährliche Laserstrahlung auftreten.



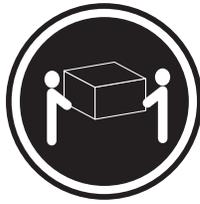
VORSICHT

Manche CD-ROM-Laufwerke enthalten eine eingebaute Laserdiode der Klasse 3A oder 3B. Die nachfolgend aufgeführten Punkte beachten.

Laserstrahlung bei geöffneter Tür. Niemals direkt in den Laserstrahl sehen, nicht direkt mit optischen Instrumenten betrachten und den Strahlungsbereich meiden.

Hinweis 4

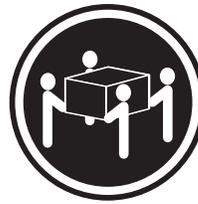




≥18 kg



≥32 kg



≥55 kg

ACHTUNG:

Beim Anheben der Maschine die vorgeschriebenen Sicherheitsbestimmungen beachten.

Hinweis 5



ACHTUNG:

Mit dem Betriebsspannungsschalter an der Vorderseite des Servers und dem Betriebsspannungsschalter am Netzteil wird die Stromversorgung für den Server nicht unterbrochen. Der Server könnte auch mehr als ein Netzkabel aufweisen. Um die gesamte Stromversorgung des Servers auszuschalten, muß sichergestellt werden, daß alle Netzkabel aus den Netzsteckdosen herausgezogen wurden.



Hinweis 10



ACHTUNG:



Keine Gegenstände, die mehr als 82 kg wiegen, auf Rack-Einheiten ablegen.

Importante:

Tutti gli avvisi di attenzione e di pericolo riportati nella pubblicazione IBM documentation iniziano con un numero. Questo numero viene utilizzato per confrontare avvisi di attenzione o di pericolo in inglese con le versioni tradotte riportate in questa sezione.

Ad esempio, se un avviso di attenzione inizia con il numero 1, la relativa versione tradotta è presente in questa sezione con la stessa numerazione.

Prima di eseguire una qualsiasi istruzione, accertarsi di leggere tutti gli avvisi di attenzione e di pericolo.

Avviso 1



PERICOLO

La corrente elettrica circolante nei cavi di alimentazione, del telefono e di segnale è pericolosa.

Per evitare il pericolo di scosse elettriche:

- Non collegare o scollegare i cavi, non effettuare l'installazione, la manutenzione o la riconfigurazione di questo prodotto durante i temporali.
- Collegare tutti i cavi di alimentazione ad una presa elettrica correttamente cablata e munita di terra di sicurezza.
- Collegare qualsiasi apparecchiatura collegata a questo prodotto ad una presa elettrica correttamente cablata e munita di terra di sicurezza.
- Quando possibile, collegare o scollegare i cavi di segnale con una sola mano.
- Non accendere qualsiasi apparecchiatura in presenza di fuoco, acqua o se sono presenti danni all'apparecchiatura stessa.
- Scollegare i cavi di alimentazione, i sistemi di telecomunicazioni, le reti e i modem prima di aprire i coperchi delle unità, se non diversamente indicato nelle procedure di installazione e configurazione.
- Collegare e scollegare i cavi come descritto nella seguente tabella quando si effettuano l'installazione, la rimozione o l'apertura dei coperchi di questo prodotto o delle unità collegate.

| Per collegare: | Per scollegare: |
|---|---|
| <ol style="list-style-type: none">1. SPEGNERE tutti i dispositivi.2. Collegare prima tutti i cavi alle unità.3. Collegare i cavi di segnale ai connettori.4. Collegare i cavi di alimentazione alle prese elettriche.5. ACCENDERE le unità. | <ol style="list-style-type: none">1. SPEGNERE tutti i dispositivi.2. Rimuovere prima i cavi di alimentazione dalle prese elettriche.3. Rimuovere i cavi di segnale dai connettori.4. Rimuovere tutti i cavi dalle unità. |

Avviso 2



ATTENZIONE:

Quando si sostituisce la batteria al litio, utilizzare solo una batteria IBM con numero parte 33F8354 o batterie dello stesso tipo o di tipo equivalente consigliate dal produttore. Se il sistema di cui si dispone è provvisto di un modulo contenente una batteria al litio, sostituire tale batteria solo con un tipo di modulo uguale a quello fornito dal produttore. La batteria contiene litio e può esplodere se utilizzata, maneggiata o smaltita impropriamente.

Evitare di:

- Gettarla o immergerla in acqua
- Riscaldarla ad una temperatura superiore ai 100°C
- Cercare di ripararla o smontarla

Smaltire secondo la normativa in vigore (D.Lgs 22 del 5/2/9) e successive disposizioni nazionali e locali.

Avviso 3



ATTENZIONE:

Quando si installano prodotti laser come, ad esempio, le unità DVD, CD-ROM, a fibre ottiche o trasmettitori, prestare attenzione a quanto segue:

- Non rimuovere i coperchi. L'apertura dei coperchi di prodotti laser può determinare l'esposizione a radiazioni laser pericolose. All'interno delle unità non vi sono parti su cui effettuare l'assistenza tecnica.
- L'utilizzo di controlli, regolazioni o l'esecuzione di procedure non descritti nel presente manuale possono provocare l'esposizione a radiazioni pericolose.



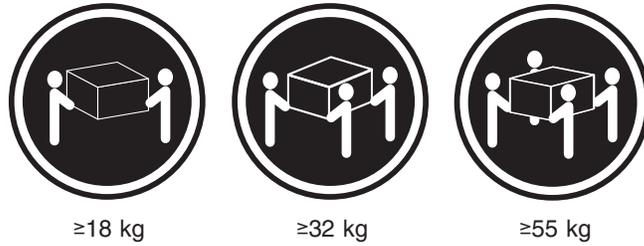
PERICOLO

Alcuni prodotti laser contengono all'interno un diodo laser di Classe 3A o Classe 3B. Prestare attenzione a quanto segue:

Aperto l'unità vengono emesse radiazioni laser. Non fissare il fascio, non guardarlo direttamente con strumenti ottici ed evitare l'esposizione diretta al fascio.

Avviso 4





ATTENZIONE:

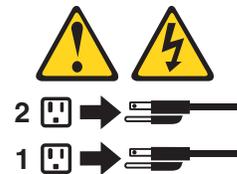
Durante il sollevamento della macchina seguire delle norme di sicurezza.

Avviso 5



ATTENZIONE:

Il pulsante del controllo dell'alimentazione situato sull'unità e l'interruttore di alimentazione posto sull'alimentatore non disattiva la corrente elettrica fornita all'unità. L'unità potrebbe disporre di più di un cavo di alimentazione. Per disattivare la corrente elettrica dall'unità, accertarsi che tutti i cavi di alimentazione siano scollegati dalla sorgente di alimentazione.



Avviso 10



ATTENZIONE:



Non poggiare oggetti che pesano più di 82 kg sulla parte superiore delle unità montate in rack.

중요:

본 *Server Library*에 있는 모든 주의 및 위험 경고문은 번호로 시작합니다. 이 번호는 영문 주의 혹은 위험 경고문과 이 절에 나오는 번역된 버전의 주의 혹은 위험 경고문을 상호 참조하는 데 사용됩니다.

예를 들어, 주의 경고문이 번호 1로 시작하면, 번역된 해당 주의 경고문을 본 절의 경고문 1에서 찾아볼 수 있습니다.

모든 지시사항을 수행하기 전에 반드시 모든 주의 및 위험 경고문을 읽으십시오.

경고문 1



위험

전원, 전화 및 통신 케이블로부터 흘러 나오는 전류는 위험합니다.

전기 충격을 피하려면:

- 뇌우를 동반할 때는 케이블의 연결이나 철수, 이 제품의 설치, 유지보수 또는 재구성을 하지 마십시오.
- 모든 전원 코드를 적절히 배선 및 접지해야 합니다.
- 이 제품에 연결될 모든 장비를 적절하게 배선된 콘센트에 연결하십시오.
- 가능한한 신호 케이블을 한 손으로 연결하거나 끊으십시오.
- 화재, 수해 또는 구조상의 손상이 있을 경우 장비를 켜지 마십시오.
- 설치 및 구성 프로시저에 다른 설명이 없는 한, 장치 덮개를 열기 전에 연결된 전원 코드, 원거리 통신 시스템, 네트워크 및 모뎀을 끊어 주십시오.
- 제품 또는 접속된 장치를 설치, 이동 및 덮개를 열 때 다음 설명에 따라 케이블을 연결하거나 끊도록 하십시오.

연결하려면:

1. 모든 스위치를 끕니다.
2. 먼저 모든 케이블을 장치에 연결합니다.
3. 신호 케이블을 커넥터에 연결합니다.
4. 콘센트에 전원 코드를 연결합니다.
5. 장치 스위치를 켭니다.

연결을 끊으려면:

1. 모든 스위치를 끕니다.
2. 먼저 콘센트에서 전원 코드를 뽑습니다.
3. 신호 케이블을 커넥터에서 제거합니다.
4. 장치에서 모든 케이블을 제거합니다.

경고문 2



주의:

리튬 배터리를 교체할 때는 IBM 부품 번호 33F8354 또는 제조업체에서 권장하는 동등한 유형의 배터리를 사용하십시오. 시스템에 리튬 배터리를 갖고 있는 모듈이 있으면 동일한 제조업체에서 생산된 동일한 모듈 유형으로 교체하십시오. 배터리에 리튬이 있을 경우 제대로 사용, 처리 또는 처분하지 않으면 폭발할 수 있습니다.

다음은 주의하십시오.

- 던지거나 물에 담그지 않도록 하십시오.
- 100°C(212°F) 이상으로 가열하지 마십시오.
- 수리하거나 분해하지 마십시오.

지역 법령이나 규정의 요구에 따라 배터리를 처분하십시오.

경고문 3



주의:

레이저 제품(CD-ROMs, DVD 드라이브, 광 장치 또는 트랜스미터 등과 같은)이 설치되어 있을 경우 다음을 유의하십시오.

- 덮개를 제거하지 마십시오. 레이저 제품의 덮개를 제거했을 경우 위험한 레이저 광선에 노출될 수 있습니다. 이 장치 안에는 서비스를 받을 수 있는 부품이 없습니다.

- 여기에서 지정하지 않은 방식의 제어, 조절 또는 실행으로 인해 위험한 레이저 광선에 노출될 수 있습니다.



위험

일부 레이저 제품에는 클래스 3A 또는 클래스 3B 레이저 다이오드가 들어 있습니다. 다음을 주의하십시오.

열면 레이저 광선에 노출됩니다. 광선을 주시하거나 광학 기계를 직접 쳐다보지 않도록 하고 광선에 노출되지 않도록 하십시오.

경고문 4



≥18 kg (37 lbs)



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

주의:

기계를 들 때는 안전하게 들어 올리십시오.

경고문 5



주의:

장치의 전원 제어 버튼 및 전원 공급기의 전원 스위치는 장치에 공급되는 전류를 차단하지 않습니다. 장치에 둘 이상의 전원 코드가 연결되어 있을 수도 있습니다. 장치에서 모든 전류를 차단하려면 모든 전원 코드가 전원으로부터 차단되어 있는지 확인하십시오.



경고문 10



주의:

서랍형 모델의 장치 상단에 82 kg(180 lbs.)이 넘는 물체를 올려 놓지 마십시오.



> 82 kg (180 lbs)

Importante:

Todas las declaraciones de precaución de esta IBM documentation empiezan con un número. Dicho número se emplea para establecer una referencia cruzada de una declaración de precaución o peligro en inglés con las versiones traducidas que de dichas declaraciones pueden encontrarse en esta sección.

Por ejemplo, si una declaración de peligro empieza con el número 1, las traducciones de esta declaración de precaución aparecen en esta sección bajo Declaración 1.

Lea atentamente todas las declaraciones de precaución y peligro antes de llevar a cabo cualquier operación.

Declaración 1



PELIGRO

La corriente eléctrica de los cables telefónicos, de alimentación y de comunicaciones es perjudicial.

Para evitar una descarga eléctrica:

- No conecte ni desconecte ningún cable ni realice las operaciones de instalación, mantenimiento o reconfiguración de este producto durante una tormenta.
- Conecte cada cable de alimentación a una toma de alimentación eléctrica con conexión a tierra y cableado correctos.
- Conecte a tomas de alimentación con un cableado correcto cualquier equipo que vaya a estar conectado a este producto.
- Si es posible, utilice una sola mano cuando conecte o desconecte los cables de señal.
- No encienda nunca un equipo cuando haya riesgos de incendio, de inundación o de daños estructurales.
- Desconecte los cables de alimentación, sistemas de telecomunicaciones, redes y módems conectados antes de abrir las cubiertas del dispositivo a menos que se indique lo contrario en los procedimientos de instalación y configuración.
- Conecte y desconecte los cables tal como se describe en la tabla siguiente cuando desee realizar una operación de instalación, de traslado o de apertura de las cubiertas para este producto o para los dispositivos conectados.

| Para la conexión | Para la desconexión |
|--|--|
| <ol style="list-style-type: none">1. APÁGUELO todo.2. En primer lugar, conecte los cables a los dispositivos.3. Conecte los cables de señal a los conectores.4. Conecte cada cable de alimentación a la toma de alimentación.5. ENCIENDA el dispositivo. | <ol style="list-style-type: none">1. APÁGUELO todo.2. En primer lugar, retire cada cable de alimentación de la toma de alimentación.3. Retire los cables de señal de los conectores.4. Retire los cables de los dispositivos. |

Declaración 2



PRECAUCIÓN:

Cuando desee sustituir la batería de litio, utilice únicamente el número de pieza 33F8354 de IBM o cualquier tipo de batería equivalente que recomiende el fabricante. Si el sistema tiene un módulo que contiene una batería de litio, sustitúyalo únicamente por el mismo tipo de módulo, que ha de estar creado por el mismo fabricante. La batería contiene litio y puede explotar si el usuario no la utiliza ni la maneja de forma adecuada o si no se desprende de la misma como corresponde.

No realice las acciones siguientes:

- Arrojarla al agua o sumergirla
- Calentarla a una temperatura que supere los 100°C (212°F)
- Repararla o desmontarla

Despréndase de la batería siguiendo los requisitos que exija el reglamento o la legislación local.

Declaración 3



PRECAUCIÓN:

Cuando instale productos láser (como, por ejemplo, CD-ROM, unidades DVD, dispositivos de fibra óptica o transmisores), tenga en cuenta las advertencias siguientes:

- No retire las cubiertas. Si retira las cubiertas del producto láser, puede quedar expuesto a radiación láser perjudicial. Dentro del dispositivo no existe ninguna pieza que requiera mantenimiento.
- El uso de controles o ajustes o la realización de procedimientos que no sean los que se han especificado aquí pueden dar como resultado una exposición perjudicial a las radiaciones.

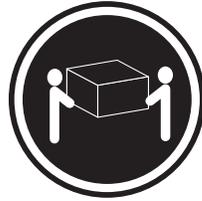


PELIGRO

Algunos productos láser contienen un diodo de láser incorporado de Clase 3A o de Clase 3B. Tenga en cuenta la advertencia siguiente.

Cuando se abre, hay radiación láser. No mire fijamente el rayo ni lleve a cabo ningún examen directamente con instrumentos ópticos; evite la exposición directa al rayo.

Declaración 4



≥18 kg



≥32 kg



≥55 kg

PRECAUCIÓN:

Tome medidas de seguridad al levantar el producto.

Declaración 5



PRECAUCIÓN:

El botón de control de alimentación del dispositivo y el interruptor de alimentación de la fuente de alimentación no apagan la corriente eléctrica suministrada al dispositivo. Es posible también que el dispositivo tenga más de un cable de alimentación. Para eliminar la corriente eléctrica del dispositivo, asegúrese de desconectar todos los cables de alimentación de la fuente de alimentación.



Declaración 10



PRECAUCIÓN:



No coloque ningún objeto que pese más de 82 kg (180 libras) encima de los dispositivos montados en bastidor.

Problem determination tips

Due to the variety of hardware and software combinations that can be encountered, use the following information to assist you in problem determination. If possible, have this information available when requesting assistance from Service Support and Engineering functions.

- Machine type and model
- Processor or hard disk upgrades
- Failure symptom
 - Do diagnostics fail?
 - What, when, where, single, or multiple systems?
 - Is the failure repeatable?
 - Has this configuration ever worked?
 - If it has been working, what changes were made prior to it failing?
 - Is this the original reported failure?
- Reference/Diagnostics version
 - Type and version level
- Hardware configuration
 - Print (print screen) configuration currently in use
 - BIOS level
- Operating system software
 - Type and version level

Note: To eliminate confusion, identical systems are considered identical only if they:

1. Are the exact machine type and models
2. Have the same BIOS level
3. Have the same adapters/attachments in the same locations
4. Have the same address jumpers/terminators/cabling
5. Have the same software versions and levels
6. Have the same Reference/Diagnostics Diskette (version)
7. Have the same configuration options set in the system
8. Have the same setup for the operation system control files

Comparing the configuration and software set-up between "working and non-working" systems will often lead to problem resolution.

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