IBM ServeRAID

**Adapters and Controllers
Hardware Maintenance Manual
December 1999**

**Use this manual with the
PC Server and Netfinity Server
Hardware Maintenance Manuals**

**We Want Your Comments!
(Please see page 307)**

This Manual Supports:

PC ServeRAID
ServeRAID II
ServeRAID 3H
ServeRAID 3L

IBM ServeRAID   S10L-9938-01

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IBM

About this manual

This manual contains diagnostic information, Symptom-to-FRU Indexes, service information, error codes, error messages, and configuration information for the following IBM ServeRAID adapters and ServeRAID controllers integrated on IBM system boards.

- IBM PC ServeRAID Adapter
- IBM ServeRAID II Ultra SCSI Adapter
- IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter
- IBM Netfinity ServeRAID 3HB Ultra2 SCSI Adapter
- IBM Netfinity ServeRAID 3L Ultra2 SCSI Adapter

References to ServeRAID adapter/controller refer to the entire Family of IBM ServeRAID Adapters/Controllers.

References to PC ServeRAID Adapter, ServeRAID II Adapter/Controller, ServeRAID 3H Adapter/Controller, ServeRAID 3HB Adapter/Controller, and ServeRAID 3L Adapter/Controller refer to the specific type of adapter/controller within a given section of this manual.

> **Note**
>
> When servicing an integrated RAID controller on a PC Server 330, refer to "IBM ServeRAID II Ultra SCSI Adapter/Controller" on page 33 for service information about the controller.

For an explanation of the terminology used with these adapters or controllers, see "Acronyms, terms, and definitions" on page 265.

> **Important**
>
> This manual is intended for trained servicers who are familiar with IBM Netfinity server products.
>
> Before servicing an IBM product, be sure to review "Safety information" on page 278.

Important safety information

Be sure to read all caution and danger statements in this
book before performing any of the instructions.

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。

注意及危险聲明 （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.

주의 및 위험 경고문(한글)

중요:

> 이 책에 나오는 모든 주의 및 위험 경고문은 번호로 시작됩니다.
> 이 번호는 *Safety Information* 책에 나오는 영문판 주의 및 위험
> 경고문과 한글판 주의 및 위험 경고문을 상호 참조하는데 사용됩
> 니다.
>
> 예를 들어 주의 경고문이 번호 1로 시작되면 *Safety Information*
> 책에서 이 주의 경고문은 경고문 1번 아래에 나옵니다.
>
> 지시를 따라 수행하기 전에 먼저 모든 주의 및 위험 경고문을 읽
> 도록 하십시오.

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

Online support

Use the World Wide Web (WWW) to download Diagnostic, BIOS Flash, and Device Driver files.

File download address is:

http://www.pc.ibm.com/files.html

IBM online addresses:

The HMM online address is:

http://www.pc.ibm.com/us/cdt/hmm.html

The IBM Support Page is:

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

The IBM PC Home Page is:

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

Contents

General Checkout

The following general checkout procedures are for the ServeRAID adapters and 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 adapter attached to the storage unit.

(CONTINUED)

> **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 adapter/controller BIOS and firmware are installed. Down-level BIOS or firmware might cause false errors and unnecessary replacement of the adapter or system board.
> 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.

001

IS THE SYSTEM PART OF A CLUSTER?

Yes No

> **002**
>
> Go to Step 004.

003

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.

004

– Power-off the server and all external devices.
– Check all cables and power cords.
– Set all display controls to the middle position.
– Boot the machine and watch for the ServeRAID adapter BIOS screen. An example of a BIOS screen appears below.

```
                  IBM ServeRaid BIOS
              Copyright IBM Corp. 1995, 1998
              Version 3.00.12      08/14/98

        ** Press Ctrl+I to access the Mini-Configuration Program **

  ** Press Ctrl + I to access the Mini-Configuration Program **
  Initializing ServeRAID Controller 1 in Slot 1.
  Power-on self-test can take up to 59 Seconds(s) -- test Passed
  Drive Configuration can take up to 6 Minute(s) O Second(s) -- test Passed
  ServeRAID Firmware Version: 2.82.00
  No logical drives found; none are installed.
  Non-Disk SCSI Devices Found: CD-ROM O, Tape O, Removable-media O, Other 1.

  BIOS not loaded no devices found - Installation stopped
```

(Step **004** continues)

004 (continued)
DID THE BIOS SCREEN APPEAR?
Yes No

> **005**
>
> Try to download the ServeRAID BIOS to the adapter
> and reboot. If unsuccessful, replace the ServeRAID
> adapter. To download relevant files, see :hdref,
> refid=online..

006
– Note the status of the Power-On Self-Test.
DID THE POST INDICATE A PASSED STATUS?
Yes No

> **007**
>
> Refer to the Symptom-to-FRU Index for the following
> adapters:
>
> - IBM PC ServeRAID Adapter (see
>   "Symptom-to-FRU index" on page 31)
> - IBM ServeRAID II Ultra SCSI Adapter (see
>   "Symptom-to-FRU index" on page 61)
> - IBM Netfinity ServeRAID Adapter 3H Ultra2
>   SCSI Adapter (see "Symptom-to-FRU index" on
>   page 197)
> - IBM Netfinity ServeRAID Adapter 3HB Ultra2
>   SCSI Adapter (see "Symptom-to-FRU index" on
>   page 203)
> - IBM Netfinity ServeRAID Adapter 3L Ultra2
>   SCSI Adapter (see "Symptom-to-FRU index" on
>   page 209)

008
– Note the Drive Configuration Status.
**DID THE DRIVE CONFIGURATION STATUS INDICATE
A PASSED STATUS?**
Yes No

> **009**
>
> Refer to the Drive Configuration Conflict Resolution
> procedures for the following Adapters:
>
> - IBM PC ServeRAID Adapter (see
>   "Symptom-to-FRU index" on page 31)
> - IBM ServeRAID II Ultra SCSI Adapter (see
>   "Symptom-to-FRU index" on page 61)
> - IBM Netfinity ServeRAID Adapter 3H Ultra2
>   SCSI Adapter (see "Symptom-to-FRU index" on
>   page 197)
> - IBM Netfinity ServeRAID Adapter 3HB Ultra2
>   SCSI Adapter (see "Symptom-to-FRU index" on
>   page 203)

(CONTINUED)

- IBM Netfinity ServeRAID Adapter 3L Ultra2 SCSI Adapter (see "Symptom-to-FRU index" on page 209)

010

Replace the adapter. If the new adapter is installed and you still suspect a problem, go to "General Checkout" in the Hardware Maintenance Manual for the server that the adapter/controller is installed in.

IBM PC ServeRAID Adapter

The following information applies to the IBM PC ServeRAID Adapter.

Diagnostics

All diagnostic operations for the ServeRAID adapters can be performed through the IBM ServeRAID Configuration software in the **Advanced Functions** option. Subsystem diagnostics may be run through the system diagnostics.

Prior to performing any test whatsoever, back up the current disk array configuration using the ServeRAID diagnostics test program.

ServeRAID Diagnostics Test program

The IBM PC ServeRAID Adapter diagnostics test program runs independently of the operating system and *is run from diskette.* You can obtain a copy from the ServerGuide Diskette Factory or download it from IBM's web site.

To back up the ServeRAID configuration:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Backup IPS ServeRaid Config**.

Testing the ServeRAID Subsystem

You can use the ServeRAID Subsystem Diagnostic program to test the PC ServeRAID Adapter and the devices connected to it.

To test the ServeRAID subsystem:

1. Start the ServeRAID Configuration Utility program.
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **IBM ServeRAID Subsystem Diagnostic** from the next menu; then, press **Enter**.
4. Select the diagnostic test that you want to run; then, press **Enter**. Descriptions of the diagnostic tests available include:
   - **Run Adapter Self-tests** tests the PC ServeRAID Adapter. Restart the server after the self-test completes.
   - **SCSI Device Self-test** runs diagnostic tests on the SCSI devices attached to the PC ServeRAID Adapter.

Additional checkout procedures

If you determine you have a DDD drive, follow the additional checkout procedures in "Recovery procedures for DDD drives" on page 211.

Predictive Failure Analysis (PFA)

Determine if an HSP drive is present and follow the relevant recovery procedures as listed in "Recovery procedures for DDD drives" on page 211. Replace the drive physically; **do not** software-replace the drive.

View the ServeRAID Device Event Table by clicking on a specific ServeRAID adapter in the Administration and Monitoring Utility and choosing **Device Event Log**. You may also view the error counters for each drive with ServeRAID Netfinity Manager. If the operating system is not functional, you can boot the ServeRAID Configuration Diskette and view the device errors by choosing **Display Drive Information** for each drive under **Rebuild/Device Management**.

For additional checkout information, see the "Symptom-to-FRU index" on page 31.

Features

The IBM PC ServeRAID Adapter has the following features:

- Maximum 8 arrays
- 4 MB Cache memory
- Supports up to 45 SCSI hard disks with 15 SCSI hard disk drives on each bus
- Supports 8 maximum Logical Drives
- 25 MHz Microprocessor
- 3 SCSI Channels
- Maximum 20 MB/sec SCSI Transfer Speed
- Supports RAID levels 0, 1, 5, and Enhanced-1
- 32-bit System PCI Data Bus
- Allows RAID-5 and RAID-1 logical drives to be data scrubbed via synchronization utilities.
- Supports hot-spare drives

Additional service information

The following additional service information supports IBM PC ServeRAID Adapters.

Configuration overview

The IBM ServeRAID Configuration Utility programs enable viewing of the current disk array configuration, the changing or deletion of existing arrays, the creation and initialization of new disk arrays, and the performance of many other configuration and maintenance tasks.

It is necessary to use a ServeRAID Configuration Utility program to configure the disk array *before* partitioning hard disk drives and installing an operating system. You can use the DOS Configuration Program, the GUI-Based Configuration Program, and the ServeRAID Administration and Monitoring Utility. After configuring the disk arrays and installing the operating system, return to this manual for information about installing and using the ServeRAID Administration and Monitoring Utility programs.

Using the ServeRAID DOS Configuration program

To start the ServeRAID Configuration Utility program:

1. Insert the IBM ServeRAID Configuration Diskette into the primary diskette drive and turn on the system. If the system is already turned on, shut down and restart the system.

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

   a. If POST does not detect changes in the adapter configuration or any adapter hardware problems, continue with step b.
   b. If you have multiple ServeRAID adapters installed in the system, you will see a screen with multiple adapters. The screen may not look exactly like this one.

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


                        ┌─────────────────────────┐
                        │      Select Adapter     │
                        ├─────────────────────────┤
                        │ 1. Help                 │
                        │ 2. ServeRAID Adapter 1  │
                        │ 3. ServeRAID Adapter 2  │
                        │ 4. Exit                 │
                        └─────────────────────────┘







        Multiple IBM ServeRAID Adapter found in the system. Select a choice using the Up
        Arrow (↑) and Down Arrow (↓) keys and press Enter.
```

Note

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

---

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

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

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

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


                        ┌─────────────────────────────┐
                        │          Main Menu          │
                        ├─────────────────────────────┤
                        │ 1. Help                     │
                        │ 2. View Configuration       │
                        │ 3. EZ-RAID Configuration    │
                        │ 4. Create/Delete/Copy Log Drive │
                        │ 5. Initialize/Synchronize Log Drive │
                        │ 6. Rebuild/Device Management │
                        │ 7. Advanced Functions       │
                        │ 8. Exit                     │
                        └─────────────────────────────┘




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

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

PC ServeRAID Adapter   **9**

To restore or convert disk array information when you upgrade from an IBM PCI ServeRAID Adapter or an IBM Streaming Adapter to an IBM PC ServeRAID Adapter:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Restore/Convert Saved Config**.

Note

You cannot convert all ServeRAID configurations created for an IBM PCI ServeRAID or an IBM Streaming RAID Adapter for use with the IBM PC ServeRAID Adapter. Since the IBM PC ServeRAID adapter/controller only supports data arrangement using the right asymmetric method, a configuration using the left symmetric arrangement is not supported. **Restore/Convert Saved Configuration** displays a message in the status area whenever it detects a left symmetric data arrangement configuration. If this message appears, follow the instructions on the screen to continue. Be sure that all cable connections from the drives to the IBM PC ServeRAID Adapter are the same as they were when using the IBM PCI ServeRAID Adapter or IBM Streaming RAID Adapter.

To "fine tune" the ServeRAID subsystem for optimal performance:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Change ServeRAID Parameters**.

You can control the following parameters:

- **Stripe unit size** - defines the stripe unit size of the data close to the size of the system I/O requirements. The default setting is 8K bytes.

  Note

  Once a stripe unit is chosen and data is stored on the logical drives, the stripe unit cannot be changed without destroying data on the logical drives.

- **Rebuild priority** - sets the priority of the execution order of the rebuild I/O requests with respect to system I/O requests. You can change the Rebuild Priority without affecting data in the logical drives. The default setting is *High*.
- **Unattended mode** - enables/disables the PC ServeRAID Adapter or Controller to resolve configuration-related conflicts without user intervention. The default setting is *Off*.
- **Read ahead** - enables/disables the cache read ahead up to the end of the stripe unit. You can change the Read Ahead without destroying data in the logical drives. The default setting is *On*.

To set a basic configuration:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Init/View/Synchronize Config**.

When you choose **Initialize Configuration**:

- all defined logical drives and arrays are deleted
- all attached drives are reset to *Ready*
- the configuration Host ID changes to "Null Configuration."
- "Start Device" is issued to all drives.

The PC ServeRAID Adapter stores its ServeRAID configuration in its NVRAM (Battery-Backup Cache), FLASH (EEPROM), and on all physical hard disk drives that are part of a logical drive. An option is provided to view the configuration from all of these sources.

You may also choose a source (hard disk drive, FLASH, NVRAM (Battery-Backup Cache)) from which to synchronize the ServeRAID configuration. For example, you may do this when a new ServeRAID adapter/controller is used to replace a defective one. We recommend using the hard drive, since it refreshes information in the buffers about the drive firmware levels.

The PC ServeRAID Adapter also maintains a list of all changes to its ServeRAID configuration. A power-on change list, wrong SCSI ID list, and an unidentified drive list are updated when devices are added or moved. Changes to the states of the devices also change this list. An option is provided to view all of this information.

To display the PC ServeRAID Adapter status or to write a new adapter configuration Host ID:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Display/Change Adapter Params**.

You can also change the PC ServeRAID Adapter SCSI channel ID and speed.

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**.

001

DOES THIS SERVERAID ADAPTER/CONTROLLER HAVE MORE THAN ONE CHANNEL?

Yes No

> **002**
>
> ServeRAID adapter/controller has only one channel and it is failing.
> – Follow the channel trouble shooting procedure. See "Channel troubleshooting procedure" on page 15.
> – Move adapter to a different PCI slot.
> If problem persists, replace the adapter/controller.

003

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

Yes No

> **004**
>
> **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 adapter/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 adapter/controller that prevents the adapter/controller from communicating with the devices attached to that channel. Go to "Channel troubleshooting procedure" on page 15 to resolve the problem.

– or –
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 adapter/controller is defective. Replace adapter/controller.

005

DOES THE STATUS FOR THESE DRIVES APPEAR CORRECT?
Yes No

    006

    Status is incorrect for multiple channels.
    – Verify that devices on channel are powered up and properly connected.
    – Move adapter to a different PCI slot.
    If problem persists, replace the adapter/controller.

007

Do not press F5, since this changes the customer's configuration.
– Disconnect one of the correctly-operating channel connectors at the adapter/controller and connect it to the failing adapter/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 "...not responding...", referring to original and moved channels, and do not get the "Following drives found in new location..." message, then this channel on the adapter/controller is defective. Replace adapter/controller.
– or –
If you get "...new location...", this channel on the adapter/controller is working correctly. Continue at Step 008.

008

– 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 adapter/controller that prevents the adapter/controller from communicating with the devices attached to that channel.
Go to "Channel troubleshooting procedure" on page 15 to resolve the problem.
(Step **008** continues)

(CONTINUED)

008 (continued)
– or –
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 adapter/controller connectors.

Channel troubleshooting procedure

This procedure should be used when there is a problem on the SCSI channel outboard of the adapter/controller that prevents the adapter/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.

PC ServeRAID Adapter error codes/messages

The error codes/messages are displayed on the screen in a line of text immediately after the adapter BIOS version.

If POST detects changes in the adapter configuration or detects an adapter hardware problem, messages appear on the screen. Refer to "POST (ISPR) error procedures" on page 16 and correct the problem.

If there is no POST Error or Configuration Error message, the BIOS screen resembles the sample shown below. Please note that your version may be different from the one shown.

```
                 _____
                      IBM ServeRAID BIOS
                   Copyright IBM Corp. 1995,1998
                      Ver: 3.00.12        08/14/1998

      «« Press Ctrl+I to access the Mini-Configuration Program. »»

  Initializing ServeRAID Controller 1 in Slot 1.
  Power-on self-test can take up to 59 Second(s) -- test Passed.
  Drive configuration can take up to 6 Minute(s) 0  Second(s) -- test Passed.
  ServeRAID Firmware Version:2.82.00
  No logical drives found; none are installed.
  Non-Disk SCSI Devices Found: CD-ROM 0, Tape 0, Removable-media 0, Other 1.

  BIOS not loaded no devices found - Installation stopped.
```

If there is a POST Error message, the BIOS screen resembles the sample shown below. Refer to "POST (ISPR) error codes" on page 16 and correct the problem. The characters *XXXX* indicate the POST (ISPR) error.

PC ServeRAID Adapter **15**

```
                   IBM ServeRAID BIOS
              Copyright IBM Corp. 1995,1998
                Ver: 3.00.12        08/14/1998

   «« Press Ctrl+I to access the Mini-Configuration Program. »»
Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Failed.
Controller is not responding properly - Run Diagnostics.
      Error Code: XXXX-YY

BIOS not loaded no devices found - Installation stopped.
```

The BIOS screen below shows Configuration Status and/or
Error information. Refer to "Drive configuration conflict
resolution" on page 26.

```
                   IBM ServeRAID BIOS
              Copyright IBM Corp. 1995,1998
                Ver: 3.00.12        08/14/1998

   «« Press Ctrl+I to access the Mini-Configuration Program. »»
Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Passed.
Drive configuration-can take up to 6 Minute(s) 0  Second(s) -- test Failed.
Controller POST and Config Error Codes: ISPR = EF10 BCS = 09 ECS = 20.
Following drives not responding(old state: new state: ch SID)
(RDY:EMP: 2:0)
The system has a configuration error due to above condition(s).

Press: F4 - Retry the command
       F5 - Update Controller configuration to exclude NON-RESPONDING drives
            Warning:NON-RESPONDING drives will be set to DDD, DHS, or EMP state
       F10 - Exit without change
```

> **Note**
>
> **Do not** replace a PC ServeRAID Adapter or a system
> board containing an imbedded ServeRAID controller
> for ServeRAID problems unless replacing the
> adapter/controller is listed in the Symptom-to-FRU
> Index.

POST (ISPR) error codes

The ISPR (Interrupt Status Port Register), BCS (Basic
Configuration Status), and ECS (Extended Configuration
Status) codes identify the adapter/controller state.

> **Note**
>
> **Do not** replace the PC ServeRAID Adapter or an
> imbedded controller on a system board unless such a
> replacement is indicated in the recommended Actions
> in an error code list that appears in "Symptom-to-FRU
> index" on page 31.

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.

> **Note**
>
> Where the ISPR Error Procedures refer to a SCSI backplane, see the Hardware Maintenance Manual for the system you are servicing.
>
> See "ServeRAID Diagnostics Test program" on page 5 for a description of the diagnostic programs that come with the server.

EF10 (Default ISPR)

1. No ISPR Error Present.

1XXX (Microcode Checksum Error)

1. Replace the PC ServeRAID Adapter.

2XXX thru 8XXX (RAID Controller Hardware or Firmware Error)

1. Install download jumpers. For jumper locations, see "Locations (IBM PC ServeRAID Adapter)" on page 32.
2. Flash the adapter/controller with the latest IBM PC ServeRAID BIOS/Firmware from the IBM Website.
3. Remove the jumpers.
4. If the error persists, replace PC ServeRAID Adapter.

9XXX thru BXXX (SCSI bus error caused either by defective drives, termination, etc.)

1. Isolate between SCSI subsystem and adapter 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 adapter
   b. Replace the adapter

   > **Note**
   >
   > 1. Refer to the HMM (Hardware Maintenance Manual) specific to the system comprising the SCSI channel for SCSI cable details.
   > 2. 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 of the original ISPR code:
      - ISPR = B1xx = Channel 1
      - ISPR = B2xx = Channel 2
      - ISPR = B3xx = Channel 1 and 2

- ISPR = B4xx = Channel 3
- ISPR = B5xx = Channel 1 and 3
- ISPR = B6xx = Channel 2 and 3
- ISPR = B7xx = Channel 1, 2 and 3
- ISPR = BFxx = Channel not identified

b. Confirm that the channel(s) identified from the error in step 2a 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 above.

f. Disconnect one drive at a time attached to the channel identified in step 2a, then reboot to determine which drive is causing the error.

g. Replace SCSI cable.

h. Replace SCSI backplane.

EF10 (Default ISPR)

1. Adapter/controller is probably functioning properly. ***Do not*** replace adapter/system board unless you have run the adapter's diagnostics and you get an error message. If you do not get an error message, assume it is functioning properly.

2. Refer to "Drive configuration conflict resolution" on page 26. Note the resulting BCS and or ECS Error codes, and see the FRU actions respective to those codes. (EF10 is a default code for ISPR indicating that there is no ISPR error present.)

EFFE (Firmware code corrupted or download jumpers are in place.)

1. Verify download jumpers are in their default locations. See "Locations (IBM PC ServeRAID Adapter)" on page 32 for jumper locations.

2. If download jumpers are **not** in place and error persists, then flash the adapter/controller firmware **with** the jumpers in place; then remove the download jumpers.

3. If error persists after step 2, replace the adapter or the system board with integrated controller.

FFFF or other code not listed

1. Isolate between SCSI subsystem and adapter/controller by disconnecting all SCSI cables attached to the suspect adapter and reboot. 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 1a.

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

   c. Replace SCSI Cable attached to channel identified in step 1a.
   d. Replace Backplane attached to channel identified in step 1a.
   e. Disconnect one drive at a time attached to channel identified in step 1a and reboot each time to determine which drive is causing the problem.
2. 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 adapter
   - Replace the adapter/controller

PC ServeRAID startup messages

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

> **Notes**
>
> 1. When the ServeRAID controller requires your input, a list of function keys will appear below the message.
> 2. Where the *Action* information tells you to start the IBM ServeRAID configuration program, insert the IBM ServeRAID Configuration Diskette or CD into the appropriate drive; then, restart the server. The *Action* information also provides general information about the message.
> 3. Where *SID* and *ch* appear in these messages, *SID* shows the SCSI ID for the device and *ch* shows the channel to which the device is attached.
> 4. Where *m* or *n* appears in these messages, a number will appear in the actual message.

The following is a list of messages associated with the ServeRAID subsystem.

Auto rearrange

Explanation: Auto rearrange is enabled or disabled.

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

Following drives not responding (`old state:  new state:  ch: SID`)

Explanation: One or more drives did not respond to the PC ServeRAID Adapter. This may occur if configured drives are missing or are not ready.

Where: `old state` is the configured state of the drive.

   `new state` is the state that the ServeRAID controller will assign to the drive.

   `ch` is the channel where the drive was located previously.

   `SID` is the SCSI ID for where the drive was located previously.

Examples of the possible state changes include:

```
Online to Defunct            (ONL: DDD: x:  y)
Ready to Empty               (RDY: EMP: x:  y)
Standby to Empty             (SBY: EMP: x:  y)
Rebuild to Defunct           (RBL: DDD: x:  y)
Hot-Spare to Defunct         (HSP: DHS: x:  y)
Standby Hot-Spare to Defunct (SHS: DHS: x:  y)
```

Action: Press one of the following keys:

F4   Retry. Press this key after correcting a problem. For example, press F4 after you turn on the external storage enclosure that contains the hard disk drive.

F5   Accept. Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct (DDD) or empty (EMP).

You can also press F5 when you must remove a drive, RAID level-1 and RAID level-5 logical drives are present, and performance in a degraded mode is acceptable. The ServeRAID controller will assign the drive a state of defunct (DDD), but the server can complete startup. However, the array will remain in *Critical* mode and the potential for data loss will exist until you replace and rebuild the defunct drive. To prevent the loss of data, replace and rebuild the defunct drive in a timely manner.

> **Note**
>
> A hard disk drive in the DDD state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:
>
> 1. All cables are connected properly to the backplane and to the hard disk drive. Also, ensure that all cables inside the server are connected properly.
> 2. The hot-swap drive trays are seated properly in the drive bay.
> 3. If you have not already attempted to rebuild the drive, try rebuilding it.
>
> After you perform these steps, if the hard disk drive does not function properly, replace the drive.

F10   Continue. Press this key to continue without change to the configuration.

Following new drives found (`old state:  new state:  ch:  SID`)

Explanation: The ServeRAID adapter/controller detects a new drive that is not part of the current configuration.

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

— or —

Following new drives found: (`host id:  old ch:  old SID > new ch:  new SID`)

Explanation: New adapter installed in a configured server or drives are imported. This message might be preceded by the previous two messages and the **F5** and **F6** key choices because the drives were not found in the configured location. Appears when the ServeRAID controller detects that the identifiers of the drives do not match the adapter configuration information.

Where: `host id` identifies the System Name where the ServeRAID controller resides.

        `old ch` is the channel that matches the drive configuration information.

        `old SID` is the SCSI ID that matches the drive configuration information.

        `new ch` is the channel where the drive is now located.

        `new SID` is the SCSI ID where the drive is now located.

For example, when drives are imported from a server with the System Name of *My Machine*: (My Machine: 1:6 > 1:10)

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

Action: Press one of the following keys:

F4 Retry. Press this key after correcting the problem.
For example, press F4 after you move the physical drive to its previously assigned location, or after you install the original physical drives back in the server.

F5 Accept. Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct (DDD) or empty (EMP).

> ─── **Note** ───
>
> A hard disk drive in the defunct state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:
>
> 1. All cables are connected properly to the backplane or system board, and to the hard disk drive. Also, ensure that all cables inside the server are connected properly.
> 2. The hot-swap drive trays are seated properly in the drive bay.
> 3. If you have not already attempted to rebuild the drive, try rebuilding it.
>
> After you perform these steps, if the hard disk drive does not function properly, replace the drive.

F6 Modify. This choice is not always active. Press this key to modify the configuration to match the current drive location.

You might remove the hot-swap drives from the server for security or maintenance reasons. If you replace the drives but install them in different drive bays, you can press **F6** to accept the new locations, and the ServeRAID controller will update the configuration.

F7 Import. Press this key to import the configuration information from the drive and to update the configuration information for the ServeRAID controller. This choice is useful when you replace the ServeRAID controller in an existing ServeRAID subsystem.

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

> **Note**
>
> When you install drives in a server that has no
> logical drives defined, the F7 choice will not
> appear. The ServeRAID controller does not
> contain any logical drives in its factory
> configuration. Therefore, F7 will not appear. In
> this case, do the following:
>
> 1. Restart the server and press **Ctrl+I** to enter
>   the Mini-Configuration program.
> 2. Select **Advanced Functions**.
> 3. Select **Import Configuration from Drives
>   to Adapter** and follow the instructions on
>   the screen.

**Controller is not responding to commands. No logical drives
are installed.**

Explanation: The ServeRAID controller is not operational.

Action: Reseat the adapter. If problem persists, replace the PC
ServeRAID Adapter.

Error: Cannot disable this adapter BIOS.

Explanation: The ServeRAID controller was unable to prevent an
extra copy of its BIOS code from being stored on the server. This
condition occurs when the server contains multiple ServeRAID
adapters or controllers.

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

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

Explanation: Configured drives are not in the configured location.
This message will be preceded by the previous messages and the
F5 key choice because configured drives were not found in the
configured location. Appears when the ServeRAID controller
detects that a previously configured drive is present, but the drive
is in a new location.

Where: `old ch` is the channel that matches the existing drive
configuration information.

`old SID` is the SCSI ID that matches the existing drive
configuration information.

`new ch` is the channel where the drive is now located.

`new SID` is the SCSI ID where the drive is now located.

For example:

`(1:5 > 1:14)`

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

Action: Press one of the following keys:

F4　　　　Retry. Press this key after correcting a problem. For
example, press F4 after you move the physical drive to
its previously assigned location.

F5　　　　Accept. Press this key to accept the new state that the
ServeRAID controller will assign to the drive. For
example, the ServeRAID controller will assign the drive
a state of defunct (DDD) or empty (EMP).

> **Note**
>
> A hard disk drive in the DDD state does not
> necessarily mean that you need to replace the
> drive. Before you replace the drive, ensure that:
>
> 1. All cables are connected properly to the
>   backplane and to the hard disk drive. Also,
>   ensure that all cables inside the server are
>   connected properly.
> 2. The hot-swap drive trays are seated properly
>   in the drive bay.
> 3. If you have not already attempted to rebuild
>   the drive, try rebuilding it.
>
> After you perform these steps, if the hard disk
> drive does not function properly, replace the drive.

F6   Modify. Press this key to modify the configuration to
match the current drive location.

You might remove the hot-swap drives from the server
for security or maintenance reasons. If you replace the
drives but install them in different drive bays, you can
press **F6** to accept the new locations, and the
ServeRAID controller will update the configuration.

Installation stopped.

Explanation: The server cannot access the ServeRAID controller.

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

---

n logical drives are installed.

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

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

NVRAM Cache Controller Not Responding

Explanation: BIOS code detected a bad or failed Battery-Backup.

Action: Press **F9** to remove the Battery-Backup Cache controller
from the configuration, or press **F10** to exit without change.

NVRAM Cache Controller Replacement

Explanation: The ServeRAID controller detects that the
Battery-Backup Cache controller is defective.

Action: Press **F8** if you replaced the Battery-Backup Cache
controller, or press **F10** if you have not replaced the
Battery-Backup Cache controller.

Recoverable configuration error

Explanation: The configuration data stored in NVRAM
(Battery-Backup Cache) does not match the configuration data
stored in the EEPROM.

Action:

1. Press **Ctrl**+**Alt**+**Del** to restart the system.
2. Press **Ctrl**+**I** during POST to enter the Mini-Configuration
   program.
3. Select **Advanced Functions** from the Main Menu; then, select
   Import Configuration from Drive(s).

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

Explanation: One or more hard disk drives have failed.

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

The server has an error due to a Blocked Logical Drive.

Explanation: One or more logical drives are in a blocked state. A blocked logical drive cannot be accessed.

Action: Press **F4** to unblock the logical drive, or press **F5** to continue without unblocking.

Unable to communicate with the Controller

Explanation: The adapter/controller is not responding to commands.

Action: Reseat the adapter. If the problem persists, replace the PC ServeRAID Adapter.

Controller Reg. <x> test failed. Test Number: <y>

Explanation: The adapter or embedded controller failed the register test, where <x> is the register number and <y> is the test number.

Action: Reseat the adapter. If the problem persists, replace the PC ServeRAID Adapter.

Controller hardware error

Explanation: The adapter/controller is not responding to commands.

Action: Reseat the adapter. If the problem persists, replace the PC ServeRAID Adapter.

BIOS not loaded no devices found - Installation stopped.

Explanation: The BIOS is unable to find any logical drives attached to any ServeRAID controllers. Therefore the ServeRAID BIOS is not loaded.

Action: Reconnect the cable(s) attaching the hard drives to the adapter and restart the system. If performing a service procedure, reconnect them when told to do so.

Controller Ok; Devices not responding check cables or enclosures.

Explanation: A SCSI connection problem has been detected.

Action: Check all cables and devices attached to the PC ServeRAID Adapter. Look for bent or missing pins on all cables and devices.

Unable to communicate with the following devices. (`Channel : SID`)

Explanation: Devices at the channel and SCSI ID specified in the message are not responding. The devices may have been removed.

Action: Check that the device(s) are at the location specified. If they are located in an external enclosure, make sure that the external enclosure is powered on.

Download codeblk (via bootblk) is ready.

Explanation: Preparations for the download of the firmware to the adapter/controller are complete.

Action: Insert the BIOS/Firmware Diskette and download the firmware. Restart the system.

Controller is not responding properly - Run Diagnostics.

Explanation: The adapter/controller is not responding appropriately to commands.

Action: Use the ServeRAID DOS Configuration Utility and run the diagnostics.

System PCI BIOS does not respond to commands; no logical drives are installed.

Explanation: The system's PCI BIOS is returning error status in response to calls to it.

Action: Refer to the system's HMM and diagnostics.

Drive configuration conflict resolution

> **Note**
>
> 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, then refer to "Dead Channel Service Procedure" on page 12.

Once the ServeRAID POST completes, register information appears on the screen in hexadecimal format, as follows:

```
Hardware: ISPR=aaaa  BCS=bb  ECS=cc
```

ISPR displays the four digit Interrupt Status Port Register code, BCS displays the Basic Configuration Status register code, and ECS displays the Extended Configuration Status register code.

If no errors occur:

```
ISPR (aaaa)     = EF10
BCS (bb)        = 0F or 09
ECS (cc)        = 00
```

Basic and extended configuration status codes

BCS	ECS	Explanation and Possible Recovery Action
Code not in table	Code not in table	**Explanation:** The ServeRAID controller is not functioning properly. **Action:** Replace the adapter or embedded controller on the system board.
00	01	**Explanation:** Invalid flash configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.

BCS	ECS	Explanation and Possible Recovery Action
00	02	**Explanation:** Invalid NVRAM configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.
00	03	**Explanation:** Invalid flash and NVRAM configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.
01	08	**Explanation:** No configuration was found in drives; or, Online/Rebuild drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	18	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	28	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	38	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	48	**Explanation:** No configuration was found in drives; or, Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	58	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	68	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	78	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
03	88	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding.
		Action: Press F4, F5, F7, or F10.
03	98	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding.
		Action: Press F4, F5, F7, or F10.
03	A8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding.
		Action: Press F4, F5, F7, or F10.
03	B8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding.
		Action: Press F4, F5, F7, or F10.
03	C8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
03	D8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
03	E8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
03	F8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
07	08	**Explanation:** Online/Rebuild drives are not responding.
		Action: Press F4, F5, or F10.

BCS	ECS	Explanation and Possible Recovery Action
07	0C	**Explanation:** Online/Rebuild drives are not responding and a drive was found at the incorrect SCSI ID.
		Action: Press F4, F5, F6, or F10.
07	18	**Explanation:** Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding.
		Action: Press F4, F5, or F10.
07	1C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding and a drive was found at the incorrect SCSI ID.
		Action: Press F4, F5, F6, or F10.
07	28	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding.
		Action: Press F4, F5, or F10.
07	2C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, a drive was found at the incorrect SCSI ID.
		Action: Press F4, F5, F6, or F10.
07	38	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding.
		Action: Press F4, F5, or F10.
07	3C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, a drive was found at the incorrect SCSI ID.
		Action: Press F4, F5, F6, or F10.
07	48	**Explanation:** Online/Rebuild drives are not responding and unidentified drives were found.
		Action: Press F4, F5, or F10.
07	4C	**Explanation:** Online/Rebuild drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found.
		Action: Press F4, F5, F6, or F10.
07	58	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found.
		Action: Press F4, F5, or F10.
07	5C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found.
		Action: Press F4, F5, F6, or F10.

BCS	ECS	Explanation and Possible Recovery Action
07	68	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	6C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	78	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	7C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
09	00	**Explanation:** No error occurred. **Action:** No action is required.
09	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
09	20	**Explanation:** Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
09	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
0F	00	**Explanation:** No error occurred. **Action:** No action is required.
0F	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
0F	20	**Explanation:** Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
0F	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.

Symptom-to-FRU index

This index supports PC ServeRAID Adapters and 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 16). Only replace a PC ServeRAID Adapter or Controller if indicated to do so in the POST (ISPR) Error Procedures.

Problem	FRU/Action
1XXX (Microcode Checksum Error)	1. PC ServeRAID Adapter
2XXX thru 8XXX (RAID Controller Hardware or Firmware error)	1. Install download jumpers, flash latest level BIOS and firmware for adapter, then remove jumpers. 2. PC ServeRAID Adapter
9XXX thru BXXX SCSI Bus error caused by cables, termination, defective drives, etc.)	1. Refer to "POST (ISPR) error procedures" on page 16 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. PC ServeRAID Adapter
EF10 (default ISPR)	1. Run diagnostics on DOS configuration program.
EFFE (Firmware code corrupt or download jumpers are in place)	1. Refer to "POST (ISPR) error procedures" on page 16.
FFFF or other code not listed	1. Refer to "POST (ISPR) error procedures" on page 16 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. PC ServeRAID Adapter

Locations (IBM PC ServeRAID Adapter)

(FRU no. 06H9334)
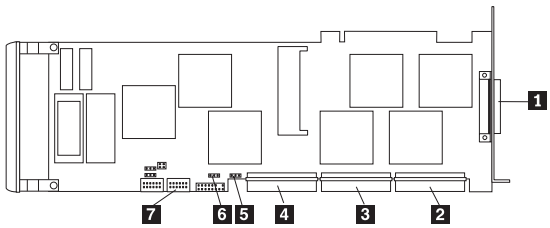
1 External Channel 1
2 Internal Channel 1
3 Internal Channel 2
4 Internal Channel 3
5 J4
6 J1
7 DASD Status Connector
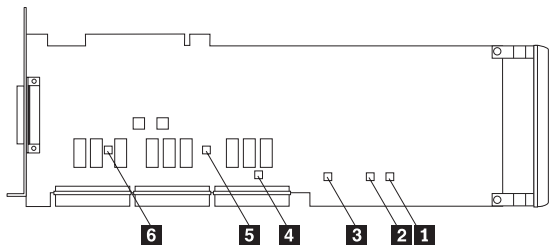
1 , 2 and 3 Check Engine LEDs
4 , 5 and 6 SCSI Activity LEDs

Download Jumper Locations:

- J13 consists of 4 pins that accept 2 jumper blocks.
- Install jumper blocks as follows (with respect to the card layout above) to enable Download via Bootlock.

  - **Note** -

  This procedure is only needed if a download by code block does not work.

- The Default position is to have no jumper blocks installed.

IBM ServeRAID II Ultra SCSI Adapter/Controller

The following information applies to the IBM ServeRAID II Ultra SCSI Adapter. It also applies to specific imbedded ServeRAID controllers which are integrated into system boards designed to function in the same manner that the IBM ServeRAID II Ultra SCSI Adapter does. For additional information on integrated ServeRAID controllers, refer to the documentation that comes with that system board.

Diagnostics

All diagnostic operations for the ServeRAID II Adapters can be performed through the IBM ServeRAID Configuration Utility in the **Advanced Functions** option. Subsystem diagnostics may be run through the system diagnostics.

Prior to performing any test whatsoever, back up the current disk array configuration using the ServeRAID diagnostics test program.

ServeRAID Diagnostics Test program

The ServeRAID adapter diagnostics test program runs independently of the operating system and *is run from diskette.* You can obtain a copy from the ServerGuide Diskette Factory or download it from IBM's web site.

To back up the ServeRAID configuration:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Backup IPS ServeRaid Config**.

Testing the ServeRAID Subsystem

You can use the ServeRAID Subsystem Diagnostic program to test the ServeRAID adapter/controller and the devices connected to it.

To test the ServeRAID subsystem:

1. Start the ServeRAID Configuration Utility program.
2. Select **Advanced Functions** from the Main Menu; then, press **Enter**.
3. Select **IBM ServeRAID Subsystem Diagnostic** from the next menu; then, press **Enter**.
4. Select the diagnostic test that you want to run; then, press **Enter**. Descriptions of the diagnostic tests available include:
   - **Run adapter Self-tests** tests the ServeRAID II Adapter/Controller. Restart the server after the self-test completes.
   - **SCSI Device Self-test** runs diagnostic tests on the SCSI devices attached to the ServeRAID II Adapter/Controller.

Additional checkout procedures

If you determine you have a DDD drive, follow the additional checkout procedures in "Recovery procedures for DDD drives" on page 211.

Predictive Failure Analysis (PFA)

Determine if an HSP drive is present and follow the relevant recovery procedures as listed in "Recovery procedures for DDD drives" on page 211. Replace the drive physically; **do not** software-replace the drive.

View the ServeRAID Device Event Table by clicking on a specific ServeRAID adapter in the Administration and Monitoring Utility and choosing **Device Event Log**. You may also view the error counters for each drive with ServeRAID Manager. If the operating system is not functional, you can boot the ServeRAID Configuration Diskette and view the device errors by choosing **Display Drive Information** for each drive under **Rebuild/Device Management**.

For additional checkout information, see the "Symptom-to-FRU index" on page 61.

Features

The IBM ServeRAID II Ultra SCSI adapter has the following features:

- Supports up to 45 SCSI hard disks with 15 SCSI hard disk drives on each bus.
- Supports 40 MB per second per SCSI bus
- Maximum 8 arrays
- 4 MB Cache memory
- Supports up to 45 SCSI hard drives
- Supports hot-spare drives
- Supports 8 maximum Logical Drives
- 25 MHz Microprocessor
- 3 SCSI Channels
- Supports RAID levels 0, 1, 5, and Enhanced-1
- 32-bit System PCI Data Bus
- Automatic data scrubbing in background
- Auto-synchronization
- Battery-Backup Option support

Additional service information

The following additional service information supports IBM ServeRAID II Adapters.

Configuration overview

The IBM ServeRAID Configuration Utility programs enable viewing of the current disk array configuration, the changing or deletion of existing arrays, the creation and initialization of new disk arrays, and the performance of many other configuration and maintenance tasks.

It is necessary to use a ServeRAID Configuration Utility program to configure the disk array *before* partitioning hard disk drives and installing an operating system. You can use the DOS Configuration Program, the GUI-Based Configuration Program, and the ServeRAID Administration and Monitoring Utility. After configuring the disk arrays and installing the operating system, return to this manual for information about installing and using the ServeRAID Administration and Monitoring Utility programs.

Using the ServeRAID DOS Configuration program

To start the ServeRAID Configuration Utility program:

1. Insert the IBM ServeRAID Configuration Utility Diskette into the primary diskette drive and turn on the system. If the system is already turned on, shut down and restart the system.

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

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

   b. If you have multiple ServeRAID adapters installed in the system, you will see a screen with multiple adapters. The screen may not look exactly like this one.

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


                         Select Adapter

               1. Help
               2. ServeRAID Adapter 1
               3. ServeRAID Adapter 2
               4. Exit








      Multiple IBM ServeRAID Adapter found in the system. Select a choice using the Up
      Arrow (↑) and Down Arrow (↓) keys and press Enter.
```

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

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

    Use the Up Arrow (↑) or Down Arrow (↓) key to
    highlight your choice; then, press **Enter**. The Main
    Menu appears.
3. If you have only **one** ServeRAID adapter installed in
    the server, the Main Menu appears, as shown in the
    following figure.

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


                         Main Menu

               1. Help
               2. View Configuration
               3. EZ-RAID Configuration
               4. Create/Delete/Copy Log Drive
               5. Initialize/Synchronize Log Drive
               6. Rebuild/Device Management
               7. Advanced Functions
               8. Exit






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

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

To change write policies of logical drives:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Logical Drive Params Management**.

This option lets you enable the NVRAM (Battery-Backup Cache) write cache feature if the Non-Volatile Write Cache Feature Card is installed on the IBM ServeRAID II Adapter.

The **Change Write Policy** command configures a local drive in an array to work in either write-through mode or write-back mode. In write-through mode, completion status is sent after the data is written to the drives. In write-back mode, completion status is sent before the data is actually written to the drives. The write-back mode usually provides higher performance, but with increased risk of data loss in the event of a power failure.

When you enable write-back mode, you enable the NVRAM (Battery-Backup Cache) write cache feature for a logical drive, which provides a backup of the data being written to a logical drive in the NVRAM (Battery-Backup Cache) cache on the Non-Volatile Write Cache Feature card.

To "fine tune" the ServeRAID II subsystem for optimal performance:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Change ServeRAID Parameters**.

You can control the following parameters:

- **Stripe unit size** - defines the stripe unit size of the data close to the size of the system I/O requirements. The default setting is 8K bytes.

  > **Note**
  >
  > Once a stripe unit is chosen and data is stored on the logical drives, the stripe unit cannot be changed without destroying data on the logical drives.

- **Rebuild priority** - sets the priority of the execution order of the rebuild I/O requests with respect to system I/O requests. You can change the Rebuild Priority without affecting data in the logical drives. The default setting is *High*.
- **Unattended mode** - enables/disables the ServeRAID II Adapter or controller to resolve configuration-related conflicts without user intervention. The default setting is *Off*.
- **Read ahead** - enables/disables the cache read ahead up to the end of the stripe unit. You can change the Read Ahead without destroying data in the logical drives. The default setting is *On*.

To set a basic configuration:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Init/View/Synchronize Config**.

When you choose **Initialize Configuration**:

- All defined logical drives and arrays are deleted
- Configuration is reset to factory parameters
- All attached drives are reset to *Ready*
- The configuration Host ID changes to "Null Configuration."
- "Start Device" is issued to all drives.

The ServeRAID II Adapter/Controller stores its ServeRAID configuration in its NVRAM (Battery-Backup Cache), FLASH (EEPROM), and on all physical hard disk drives that are part of a logical drive. An option is provided to view the configuration from all of these sources. You must import the configuration from the hard drive.

To display the ServeRAID II Adapter/Controller status or to write a new adapter configuration Host ID:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Display/Change Adapter Params**.

You can also change the ServeRAID II Adapter/Controller SCSI channel ID and speed.

To define or delete a merge group ID for a shared or non-shared logical drive:

1. From the Main Menu, select **Advanced Functions**.
2. Select **Merge Group Management**.

    Merge group IDs are valid only in a High Availability environment. A High Availability environment is a setup in which two servers have access to the same physical disk drives via a shared SCSI bus. The ServeRAID configuration is set up in such a way as to allow the operational server to assume the logical drives of the failing server. This minimizes the downtime to clients of the failed server.

    Create Shared Logical Drive ID enables you to define a merge group ID for a logical drive. The logical drive's physical disk(s) are assumed to be shared by another server via the SCSI bus. The merge group ID must be in the range of 1-8. Merge group IDs 1-4 are allocated for use on one of the servers in the cluster and IDs 5-8 are to be allocated for the other partner server.

    Create Non-Shared Logical Drive ID enables you to create a merge group ID for non-shared logical drives. The merge group ID must be in the range of 200-215.

    Delete Logical Drive Merge ID enables you to delete shared and non-shared merge group IDs.

Merge/Unmerge Logical Drive enables you to merge/unmerge partner logical drives. It also lets you merge/unmerge a host system's own shared logical drives. You may also merge/unmerge a host system's own non-shared logical drives.

Note

The High Availability feature is supported only for the IBM ServeRAID II, IBM ServeRAID 3H, and ServeRAID 3HB Adapters/Controllers.

Battery-backup cache

The Battery-Backup Cache can be installed on IBM
ServeRAID II Adapters. The Battery-Backup Cache does
not disable the cache memory SIMM already attached to
the IBM ServeRAID II Adapter, nor is the memory capacity
increased by its installation. The Battery-Backup Cache
mirrors only the dirty data in the SIMM. Dirty data is data
that is stored in the memory SIMM that has not been
written to the hard drives. In write-back mode the
ServeRAID II Adapter notifies the host that it has
completed the write operation even though the data hasn't
yet been written to the hard drive.

The ServeRaid II Adapter can use either an 8 MB or a 32
MB Battery-Backup Cache.

While write-back mode improves performance, dirty data is
in jeopardy of being lost in the event of a system
malfunction or power loss.

If a ServeRAID adapter/controller equipped with a
Battery-Backup Cache fails, it can be removed and
installed on a working adapter. The data on that
Battery-Backup Cache can then be flushed into the
memory SIMM located on the new adapter and written to
the disk.

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**.

001

DOES THIS SERVERAID ADAPTER/CONTROLLER HAVE MORE THAN ONE CHANNEL?

Yes No

> **002**
>
> ServeRAID adapter/controller has only one channel and it is failing.
> – Follow the channel trouble shooting procedure. See "Channel troubleshooting procedure" on page 44.
> – Move adapter to a different PCI slot.
> If problem persists, replace the adapter/controller.

003

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

Yes No

> **004**
>
> – **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 adapter/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 adapter/controller that prevents the adapter/controller from communicating with the devices attached to that channel. Go to "Channel troubleshooting procedure" on page 44 to resolve the problem.

– or –
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 adapter/controller is defective. Replace adapter/controller.

005

DOES THE STATUS FOR THESE DRIVES APPEAR CORRECT?
Yes No

> **006**
>
> Status is incorrect for multiple channels.
> – Verify that devices on channel are powered up and properly connected.
> – Move adapter to a different PCI slot.
> If problem persists, replace the adapter/controller.

007

Do not press F5, since this changes the customer's configuration.
– Disconnect one of the correctly-operating channel connectors at the adapter/controller and connect it to the failing adapter/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 "...not responding...", referring to original and moved channels, and do not get the "Following drives found in new location..." message, this channel on the adapter/controller is defective. Replace adapter/controller.
– or –
If you get "...new location...", this channel on the adapter/controller is working correctly. Continue at Step 008.

008

– 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 adapter/controller that prevents the adapter/controller from communicating with the devices attached to that channel.
Go to "Channel troubleshooting procedure" on page 44 to resolve the problem.
(Step **008** continues)

ServeRAID II Adapter   **43**

(CONTINUED)

008 (continued)

– or –

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 adapter/controller connectors.

Channel troubleshooting procedure

This procedure should be used when there is a problem on the SCSI channel outboard of the adapter/controller that prevents the adapter/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.

ServeRAID II Ultra SCSI Adapter/Controller error codes/messages

The error codes/messages are displayed on the screen in a line of text immediately after the adapter BIOS version.

If POST detects changes in the adapter configuration or detects an adapter hardware problem, messages appear on the screen. Refer to "POST (ISPR) error procedures" on page 46 and correct the problem.

If there is no POST Error or Configuration Error message, the BIOS screen resembles the sample shown below. Please note that your version may be different from the one shown.

```
                    IBM ServeRAID BIOS
                Copyright IBM Corp. 1995,1998
                Ver: 3.00.12        08/14/1998

     «« Press Ctrl+I to access the Mini-Configuration Program. »»

Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Passed.
Drive configuration can take up to 6 Minute(s) 0  Second(s) -- test Passed.
ServeRAID Firmware Version:2.82.00
No logical drives found; none are installed.
Non-Disk SCSI Devices Found: CD-ROM 0, Tape 0, Removable-media 0, Other 1.

BIOS not loaded no devices found - Installation stopped.
```

If there is a POST Error message, the BIOS screen resembles the sample shown below. Refer to "POST (ISPR) error codes" on page 46 and correct the problem. The characters *XXXX* indicate the POST (ISPR) error.

```
                    IBM ServeRAID BIOS
                Copyright IBM Corp. 1995,1998
                Ver: 3.00.12        08/14/1998

     «« Press Ctrl+I to access the Mini-Configuration Program. »»
Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Failed.
Controller is not responding properly - Run Diagnostics.
     Error Code: XXXX-YY

BIOS not loaded no devices found - Installation stopped.
```

The BIOS screen below shows Configuration Status and/or Error information. Refer to "Drive configuration conflict resolution" on page 56.

```
                 ────────────────────
                    IBM ServeRAID BIOS
                  Copyright IBM Corp. 1995,1998
                  Ver: 3.00.12          08/14/1998

    «« Press Ctrl+I to access the Mini-Configuration Program. »»
 Initializing ServeRAID Controller 1 in Slot 1.
 Power-on self-test can take up to 59 Second(s) -- test Passed.
 Drive configuration-can take up to 6 Minute(s) 0  Second(s) -- test Failed.
 Controller POST and Config Error Codes: ISPR = EF10 BCS = 09 ECS = 20.
 Following drives not responding(old state: new state: ch SID)
 (RDY:EMP: 2:0)
 The system has a configuration error due to above condition(s).

 Press: F4  - Retry the command
        F5  - Update Controller configuration to exclude NON-RESPONDING drives
              Warning:NON-RESPONDING drives will be set to DDD, DHS, or EMP state
        F10 - Exit without change
```

Note

Do not replace a ServeRAID adapter or a system
board containing an imbedded ServeRAID controller
for ServeRAID problems unless replacing the
adapter/controller is listed in the Symptom-to-FRU
Index.

POST (ISPR) error codes

The ISPR (Interrupt Status Port Register), BCS (Basic
Configuration Status), and ECS (Extended Configuration
Status) codes identify the adapter/controller state.

Note

Do not replace the ServeRAID II Adapter or an
imbedded controller on a system board unless such a
replacement is indicated in the recommended Actions
in an error code list that appears in "Symptom-to-FRU
index" on page 61.

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.

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.

1XXX (Microcode Checksum Error)

 1. Replace the ServeRAID II Adapter/Controller.

2XXX thru 5XXX (Code DRAM Error)

1. Install download jumpers. For jumper locations, see "Locations (IBM ServeRAID II Ultra SCSI Adapter)" on page 63.
2. Flash the adapter/controller with the latest IBM ServeRAID II BIOS/Firmware from the IBM Website.
3. Remove the jumpers.
4. If the error persists, replace ServeRAID II Adapter/Controller.

6*XXX* (Cache DRAM Error)

1. Reseat Cache Memory SIMM
2. Install download jumpers. For jumper locations, see "Locations (IBM ServeRAID II Ultra SCSI Adapter)" on page 63.
3. Flash the adapter/controller with the latest IBM ServeRAID II BIOS/Firmware from the IBM Website.
4. Remove the jumpers.
5. If the error persists, replace ServeRAID II Adapter/Controller.

7*XXX* thru 8*XXX* (Host/Local PCI Bus Interface Error)

1. Install download jumpers. For jumper locations, see "Locations (IBM ServeRAID II Ultra SCSI Adapter)" on page 63.
2. Flash the adapter/controller with the latest IBM ServeRAID II BIOS/Firmware from the IBM Website.
3. Remove the jumpers.
4. If the error persists, replace ServeRAID II Adapter/Controller.

9*XXX* thru B*XXX* (SCSI bus error caused either by defective drives, termination, etc.)

1. Isolate between SCSI subsystem and adapter 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 adapter
   b. Replace the adapter/controller

   ┌─ **Note** ──────────────────────────┐
   │ 1. Refer to the HMM (Hardware Maintenance │
   │   Manual) specific to the system comprising │
   │   the SCSI channel for SCSI cable details. │
   │ 2. 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 of the original ISPR code:
   - ISPR = B1xx = Channel 1
   - ISPR = B2xx = Channel 2
   - ISPR = B3xx = Channel 1 and 2
   - ISPR = B4xx = Channel 3
   - ISPR = B5xx = Channel 1 and 3
   - ISPR = B6xx = Channel 2 and 3
   - ISPR = B7xx = Channel 1, 2 and 3
   - ISPR = BFxx = Channel not identified
b. Confirm that the channel(s) identified from the error in step 2a 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 above.
f. Disconnect one drive at a time attached to the channel identified in step 2a, then reboot to determine which drive is causing the error.
g. Replace SCSI cable.
h. Replace SCSI backplane.

EF10 (Default ISPR)

1. Adapter/controller is probably functioning properly. ***Do not*** replace adapter/system board unless you have run the adapter's diagnostics and you get an error message. If you do not get an error message, assume it is functioning properly.
2. Refer to "Drive configuration conflict resolution" on page 56. Note the resulting BCS and or ECS Error codes, and see the FRU actions respective to those codes. (EF10 is a default code for ISPR indicating that there is no ISPR error present.)

EFFE (Firmware code corrupted or download jumpers are in place.)

1. Verify download jumpers are in their default locations. See "Locations (IBM ServeRAID II Ultra SCSI Adapter)" on page 63 for jumper locations.

2. If download jumpers are **not** in place and error still persists, then flash the adapter/controller firmware **with** the jumpers in place; then remove the jumpers.
3. If error persists after step 2, replace the adapter or the system board with integrated controller.

FFFF or other code not listed

1. Isolate between SCSI subsystem and adapter/controller by disconnecting all SCSI cables attached to the suspect adapter and reboot. 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 1a.

> --- **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 1a and reboot each time to determine which drive is causing the problem.
   d. Replace SCSI Cable attached to channel identified in step 1a.
   e. Replace Backplane attached to channel identified in step 1a.
2. 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 adapter
   - Replace the adapter/controller

ServeRAID II startup messages

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

> ─── **Notes** ───────────────────────
>
> 1. When the ServeRAID controller requires your
>   input, a list of function keys will appear below the
>   message.
> 2. Where the *Action* information tells you to start the
>   IBM ServeRAID configuration program, insert the
>   IBM ServeRAID Configuration Utility Diskette or
>   CD into the appropriate drive; then, restart the
>   server. The *Action* information also provides
>   general information about the message.
> 3. Where *SID* and *ch* appear in these messages,
>   *SID* shows the SCSI ID for the device and *ch*
>   shows the channel to which the device is
>   attached.
> 4. Where *m* or *n* appears in these messages, a
>   number will appear in the actual message.

The following is a list of messages associated with the
ServeRAID subsystem.

Auto rearrange

Explanation: Auto rearrange is enabled or disabled.

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

Following drives not responding (old state: new state: ch:
SID)

Explanation: One or more drives did not respond to the
ServeRAID II Adapter/Controller. This may occur if configured
drives are missing or are not ready.

Where: old state is the configured state of the drive.

new state is the state that the ServeRAID controller will
assign to the drive.

ch is the channel where the drive was located
previously.

SID is the SCSI ID for where the drive was located
previously.

Examples of the possible state changes include:

```
Online to Defunct           (ONL: DDD: x:  y)
Ready to Empty              (RDY: EMP: x:  y)
Standby to Empty            (SBY: EMP: x:  y)
Rebuild to Defunct          (RBL: DDD: x:  y)
Hot-Spare to Defunct        (HSP: DHS: x:  y)
Standby Hot-Spare to Defunct (SHS: DHS: x:  y)
```

Action: Press one of the following keys:

F4　　　Retry. Press this key after correcting a problem. For
example, press F4 after you turn on the external
storage enclosure that contains the hard disk drive.

F5　　　Accept. Press this key to accept the new state that the
ServeRAID controller will assign to the drive. For
example, the ServeRAID controller will assign the drive
a state of defunct (DDD) or empty (EMP).

You can also press F5 when you must remove a drive,
RAID level-1 and RAID level-5 logical drives are
present, and performance in a degraded mode is

acceptable. The ServeRAID controller will assign the drive a state of defunct (DDD), but the server can complete startup. However, the array will remain in *Critical* mode and the potential for data loss will exist until you replace and rebuild the defunct drive. To prevent the loss of data, replace and rebuild the defunct drive in a timely manner.

> **Note**
>
> A hard disk drive in the DDD state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:
>
> 1. All cables are connected properly to the backplane and to the hard disk drive. Also, ensure that all cables inside the server are connected properly.
> 2. The hot-swap drive trays are seated properly in the drive bay.
> 3. If you have not already attempted to rebuild the drive, try rebuilding it.
>
> After you perform these steps, if the hard disk drive does not function properly, replace the drive.

F10   Continue. Press this key to continue without change to the configuration.

Following new drives found (old state: new state: ch: SID)

Explanation: The ServeRAID controller detects a new drive that is not part of the current configuration.

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

— or —

Following new drives found: (host id: old ch: old SID > new ch: new SID)

Explanation: New adapter installed in a configured server, or drives are imported. This message might be preceded by the previous two messages and the **F5** and **F6** key choices because the drives were not found in the configured location. Appears when the ServeRAID controller detects that the identifiers of the drives do not match the adapter configuration information.

Where: host id identifies the System Name where the ServeRAID controller resides.

old ch is the channel that matches the drive configuration information.

old SID is the SCSI ID that matches the drive configuration information.

new ch is the channel where the drive is now located.

new SID is the SCSI ID where the drive is now located.

For example, when drives are imported from a server with the System Name of *My Machine*: (My Machine: 1:6 > 1:10)

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

Action: Press one of the following keys:

F4   Retry. Press this key after correcting the problem. For example, press F4 after you move the physical drive to its previously assigned location, or after you install the original physical drives back in the server.

F5   Accept. Press this key to accept the new state that the ServeRAID controller will assign to the drive. For example, the ServeRAID controller will assign the drive a state of defunct (DDD) or empty (EMP).

> **Note**
>
> A hard disk drive in the defunct state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:
>
> 1. All cables are connected properly to the backplane or system board, and to the hard disk drive. Also, ensure that all cables inside the server are connected properly.
> 2. The hot-swap drive trays are seated properly in the drive bay.
> 3. If you have not already attempted to rebuild the drive, try rebuilding it.
>
> After you perform these steps, if the hard disk drive does not function properly, replace the drive.

F6   Modify. This choice is not always active. Press this key to modify the configuration to match the current drive location.

You might remove the hot-swap drives from the server for security or maintenance reasons. If you replace the drives but install them in different drive bays, you can press **F6** to accept the new locations, and the ServeRAID controller will update the configuration.

F7   Import. Press this key to import the configuration information from the drive and to update the configuration information for the ServeRAID controller. This choice is useful when you replace the ServeRAID controller in an existing ServeRAID subsystem.

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

> **Note**
>
> When you install drives in a server that has no logical drives defined, the F7 choice will not appear. The ServeRAID controller does not contain any logical drives in its factory configuration. Therefore, F7 will not appear. In this case, do the following:
>
> 1. Restart the server and press **Ctrl**+**I** to enter the Mini-Configuration program.
> 2. Select **Advanced Functions**.
> 3. Select **Import Configuration from Drives to Adapter** and follow the instructions on the screen.

**Controller is not responding to commands. No logical drives
are installed.**

Explanation: The ServeRAID controller is not operational.

Action: Reseat the adapter. If problem persists, replace the
ServeRAID II Adapter/Controller.

Error: Cannot disable this adapter BIOS.

Explanation: The ServeRAID controller was unable to prevent an
extra copy of its BIOS code from being stored on the server. This
condition occurs when the server contains multiple ServeRAID
adapters or controllers.

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

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

Explanation: Configured drives are not in the configured location.
This message will be preceded by the previous messages and the
F5 key choice because configured drives were not found in the
configured location. Appears when the ServeRAID controller
detects that a previously configured drive is present, but the drive
is in a new location.

Where: old ch is the channel that matches the existing drive
configuration information.

old SID is the SCSI ID that matches the existing drive
configuration information.

new ch is the channel where the drive is now located.

new SID is the SCSI ID where the drive is now located.

For example:

     (1:5 > 1:14)

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

Action: Press one of the following keys:

F4   Retry. Press this key after correcting a problem. For
example, press F4 after you move the physical drive to
its previously assigned location.

F5   Accept. Press this key to accept the new state that the
ServeRAID controller will assign to the drive. For
example, the ServeRAID controller will assign the drive
a state of defunct (DDD) or empty (EMP).

> **Note**
>
> A hard disk drive in the DDD state does not
> necessarily mean that you need to replace the
> drive. Before you replace the drive, ensure that:
>
> 1. All cables are connected properly to the
>   backplane and to the hard disk drive. Also,
>   ensure that all cables inside the server are
>   connected properly.
> 2. The hot-swap drive trays are seated properly
>   in the drive bay.
> 3. If you have not already attempted to rebuild
>   the drive, try rebuilding it.
>
> After you perform these steps, if the hard disk
> drive does not function properly, replace the drive.

F6   Modify. Press this key to modify the configuration to
           match the current drive location.

           You might remove the hot-swap drives from the server
           for security or maintenance reasons. If you replace the
           drives but install them in different drive bays, you can
           press **F6** to accept the new locations, and the
           ServeRAID controller will update the configuration.

Installation stopped.

Explanation: The server cannot access the ServeRAID controller.

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

---

n logical drives are installed.

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

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

NVRAM Cache Controller Not Responding

Explanation: BIOS code detected a bad or failed Battery-Backup.

Action: Press **F9** to remove the Battery-Backup Cache controller
from the configuration, or press **F10** to exit without change.

NVRAM Cache Controller Replacement

Explanation: The ServeRAID controller detects that the
Battery-Backup Cache controller is defective.

Action: Press **F8** if you replaced the Battery-Backup Cache
controller, or press **F10** if you have not replaced the
Battery-Backup Cache controller.

Recoverable configuration error

Explanation: The configuration data stored in NVRAM
(Battery-Backup Cache) does not match the configuration data
stored in the EEPROM.

Action:

1. Press **Ctrl**+**Alt**+**Del** to restart the system.
2. Press **CTRL+I** during POST to enter the Mini-Configuration
   program.
3. Select **Advanced Functions** from the Main Menu; then, select
   Import Configuration from Drive(s).

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

Explanation: One or more hard disk drives have failed.

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

The server has an error due to a Blocked Logical Drive.

Explanation: One or more logical drives are in a blocked state. A
blocked logical drive cannot be accessed.

Action: Press **F4** to unblock the logical drive, or press **F5** to
continue without unblocking.

Unable to communicate with the controller

Explanation: The adapter/controller is not responding to commands.

Action: Reseat the adapter. If the problem persists, replace the ServeRAID II Adapter/Controller.

Controller Reg. <x> test failed. Test Number: <y>

Explanation: The adapter or embedded controller failed the register test, where <x> is the register number and <y> is the test number.

Action: Reseat the adapter. If the problem persists, replace the ServeRAID II Adapter/Controller.

Controller hardware error

Explanation: The adapter/controller is not responding to commands.

Action: Reseat the adapter. If the problem persists, replace the ServeRAID II Adapter/Controller.

BIOS not loaded no devices found - Installation stopped.

Explanation: The BIOS is unable to find any logical drives attached to any ServeRAID II controllers. Therefore the ServeRAID II BIOS is not loaded.

Action: Reconnect the cable(s) attaching the hard drives to the adapter and restart the system. If performing a service procedure, reconnect them when told to do so.

Controller Ok; Devices not responding check cables or enclosures.

Explanation: A SCSI connection problem has been detected.

Action: Check all cables and devices attached to the ServeRAID II Adapter. Look for bent or missing pins on all cables and devices.

Unable to communicate with the following devices. (Channel : SID)

Explanation: Devices at the channel and SCSI ID specified in the message are not responding. The devices may have been removed.

Action: Check that the device(s) are at the location specified. If they are located in an external enclosure, make sure that the external enclosure is powered on.

Download codeblk (via bootblk) is ready.

Explanation: Preparations for the download of the firmware to the adapter/controller are complete.

Action: Insert the BIOS/Firmware Diskette and download the firmware. Restart the system.

Controller is not responding properly - Run Diagnostics.

Explanation: The adapter/controller is not responding appropriately to commands.

Action: Use the ServeRAID DOS Configuration Utility and run the diagnostics.

System PCI BIOS does not respond to commands; no logical drives are installed.

Explanation: The system's PCI BIOS is returning error status in response to calls to it.

Action: Refer to the system's HMM and diagnostics.

Drive configuration conflict resolution

> **Note**
>
> 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, then refer to "Dead Channel Service Procedure" on page 42.

Once the ServeRAID POST completes, register information appears on the screen in hexadecimal format, as follows:

```
Hardware: ISPR=aaaa  BCS=bb  ECS=cc
```

ISPR displays the four digit Interrupt Status Port Register code, BCS displays the Basic Configuration Status register code, and ECS displays the Extended Configuration Status register code.

If no errors occur:

```
ISPR (aaaa)    = EF10
BCS (bb)       = 0F or 09
ECS (cc)       = 00
```

Basic and extended configuration status codes

BCS	ECS	Explanation and Possible Recovery Action
Code not in table	Code not in table	**Explanation:** The ServeRAID controller is not functioning properly. **Action:** Replace the adapter or the system board with integrated controller.
00	01	**Explanation:** Invalid flash configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.
00	02	**Explanation:** Invalid NVRAM configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.
00	03	**Explanation:** Invalid flash and NVRAM configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.

BCS	ECS	Explanation and Possible Recovery Action
01	08	**Explanation:** No configuration was found in drives; or, Online/Rebuild drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	18	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	28	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	38	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	48	**Explanation:** No configuration was found in drives; or, Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	58	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	68	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	78	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	88	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	98	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
03	A8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding.
		Action: Press F4, F5, F7, or F10.
03	B8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding.
		Action: Press F4, F5, F7, or F10.
03	C8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
03	D8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
03	E8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
03	F8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found.
		Action: Press F4, F5, F7, or F10.
07	08	**Explanation:** Online/Rebuild drives are not responding.
		Action: Press F4, F5, or F10.
07	0C	**Explanation:** Online/Rebuild drives are not responding and a drive was found at the incorrect SCSI ID.
		Action: Press F4, F5, F6, or F10.
07	18	**Explanation:** Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding.
		Action: Press F4, F5, or F10.

BCS	ECS	Explanation and Possible Recovery Action
07	1C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding and a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	28	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
07	2C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	38	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
07	3C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	48	**Explanation:** Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, or F10.
07	4C	**Explanation:** Online/Rebuild drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	58	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	5C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	68	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.

BCS	ECS	Explanation and Possible Recovery Action
07	6C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found.
		Action: Press F4, F5, F6, or F10.
07	78	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found.
		Action: Press F4, F5, or F10.
07	7C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found.
		Action: Press F4, F5, F6, or F10.
09	00	**Explanation:** No error occurred.
		Action: No action is required.
09	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding.
		Action: Press F4, F5, or F10.
09	20	**Explanation:** Ready/Standby drives are not responding.
		Action: Press F4, F5, or F10.
09	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding.
		Action: Press F4, F5, or F10.
0F	00	**Explanation:** No error occurred.
		Action: No action is required.
0F	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding.
		Action: Press F4, F5, or F10.
0F	20	**Explanation:** Ready/Standby drives are not responding.
		Action: Press F4, F5, or F10.
0F	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding.
		Action: Press F4, F5, or F10.

Symptom-to-FRU index

This index supports ServeRAID II Adapters and 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 46). Only replace a ServeRAID II Adapter or controller if indicated to do so in the POST (ISPR) Error Procedures.

Problem	FRU/Action
1XXX (Microcode Checksum Error)	1. ServeRAID II Adapter/Controller
2XXX thru 5XXX (Code DRAM Error)	1. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 2. ServeRAID II Adapter/Controller
6XXX (Cache DRAM Error)	1. Reseat Cache memory SIMM 2. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 3. ServeRAID II Adapter/Controller
7XXX thru 8XXX (Host/Local PCI Bus Interface Error)	1. Install download jumpers, flash latest level of BIOS and firmware for adapter. Remove jumpers. 2. ServeRAID II Adapter/Controller
9XXX thru BXXX SCSI Bus error caused by cables, termination, defective drives, etc.)	1. Refer to "POST (ISPR) error procedures" on page 46 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. ServeRAID II Adapter/Controller
EF10 (default ISPR)	a. Run diagnostics on DOS configuration program.

Problem	FRU/Action
EFFE (Firmware code corrupt or download jumpers are in place)	a. Refer to "POST (ISPR) error procedures" on page 46.
FFFF or other code not listed	a. Refer to "POST (ISPR) error procedures" on page 46 b. SCSI cable c. SCSI backplane d. Hard drive e. ServeRAID II Adapter/Controller

Locations (IBM ServeRAID II Ultra SCSI Adapter)

(FRU no. 76H3587)
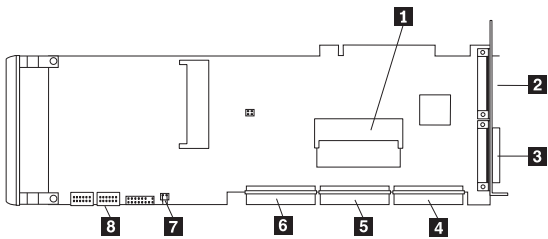
1 4 MB EDO Cache
2 External Channel 1
3 External Channel 2
4 Internal Channel 1
5 Internal Channel 2
6 Internal Channel 3
7 LED Connector
8 DASD Status Connector
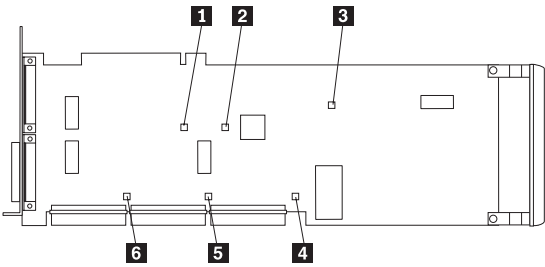
1 , 2 and 3 Check Engine LEDs
4 , 5 and 6 SCSI Activity LEDs

If you want to attach external SCSI devices to the Channel 3 connector, use the following illustration to help you install the ServeRAID Channel 3 Cable kit.
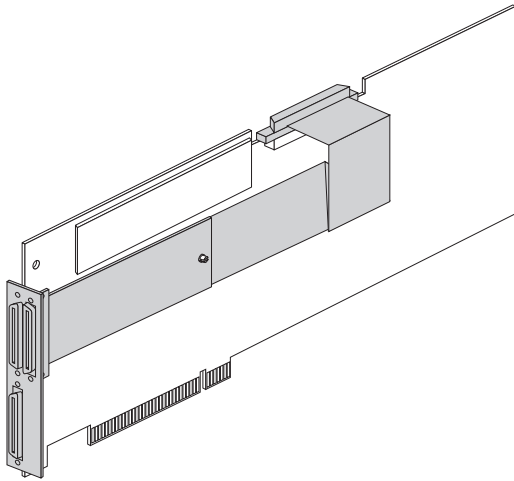
To protect your data when using the write-back mode, the ServeRAID-3HB controller comes with battery-backup write cache standard (it is an option for the other ServeRAID controllers). This device protects the data being stored in the ServeRAID cache memory during a power outage or failure.

Download Jumper Locations:

- J11 consists of 4 pins that accept 2 jumper blocks.
- Install jumper blocks as follows (with respect to the card layout above) to enable Download via Bootblock.

  --- **Note** ---

  This procedure is only needed if a download by code block does not work.

- The Default position is to have no jumper blocks installed. for each jumper block is on one of each pair of pins.

IBM Netfinity ServeRAID 3H, 3HB, 3L Adapters/Controllers

The following information applies to the IBM PC ServeRAID 3H, 3HB and 3L Adapters/Controllers. It also applies to specific imbedded ServeRAID controllers which are integrated into system boards designed to function in the same manner that the IBM Netfinity ServeRAID 3 Adapter does. For additional information on integrated ServeRAID controllers, refer to the documentation that comes with that system board.

References to ServeRaid 3 adapters refer to the 3H, 3HB, and 3L adapters for procedures common to these controllers.

Using IPSSEND and IPSMON

IPSSEND and IPSMON are advanced command-line programs that you can use to manage your ServeRAID controllers. These utility programs are provided on the *IBM ServeRAID Command Line Programs Diskette* and the *IBM ServeRAID Support CD*. See "IBM ServeRAID Support CD and diskettes" on page 112.

You can use the IPSSEND program to view the configuration of a ServeRAID controller, initialize logical drives, synchronize logical drives, and perform other functions.

You can use the IPSMON program to monitor a ServeRAID controller for defunct drives, Predictive Failure Analysis® (PFA) warnings, rebuild operations, FlashCopy operations, synchronizations, and logical-drive migrations. This program can log a message to the monitor, to a file, or to both the monitor and a file whenever activities occur.

You can use the IPSSEND and IPSMON programs with the following operating systems:

- Microsoft Windows NT
- Novell NetWare 4.x and 5.0
- IBM OS/2 Warp Server
- Linux 2.2.x or later
- SCO OpenServer 5.0.x
- SCO UnixWare 7.0

You also can use the IPSSEND program with DOS, but DOS requires the ServeRAID ASPI Manager. If you boot the *IBM ServeRAID Command Line Programs Diskette*, the ASPI Manager is automatically started.

Prior to performing any test whatsoever, back up the current disk array configuration.

This section contains:

Running the IPSSEND program

You can run the IPSSEND program from the operating system command line. When you run the IPSSEND program with no parameters, a list of available functions and their specific parameters appears. The following instructions are for running the IPSSEND program with no parameters. The available functions and their parameters are described in the sections that follow:

To run the IPSSEND program:

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

       c:\ipsadm\ipssend

       where c is the drive letter of the drive where OS/2 or Windows NT is installed.

    2. Press **Enter**.
- If you are using NetWare:
    1. From the console, type:

       load ipssend

    2. Press **Enter**.
- If you are using DOS:
    1. Insert the startable IPSSEND diskette into diskette drive A; then, type:

       a:\ipssend

       where a is the drive letter of the diskette drive.
    2. Press **Enter**.
- If you are using Linux, SCO OpenServer, or UnixWare:
    1. Type:

       /usr/bin/ipssend

    2. Press **Enter**.

Using the IPSSEND program: There are five types of IPSSEND functions:

- FlashCopy
- Server roll-out
- Error-recovery
- Problem-isolation and debug
- RAID configuration

FlashCopy function (for Windows NT only):

FlashCopy creates a quick backup copy of data from a source drive to a target drive at the instant you issue the command. Any changes made to the source drive after you issue the command are not reflected on the target drive.

You can use the backup copy for tasks such as tape backup and multiserver rollout (for example, drive cloning). The **flashcopy** function sets up a link between the source and target partitions, and then creates a snapshot-like backup of the source data on the target partition. The target partition is available instantly for read access.

Notes

To create the backup copy, the following must be true:

- The size of the target partition must be equal to or larger than that of the source partition.
- The partition type must be the same on the source and target partitions.

When issuing the FlashCopy function, you must specify either the **flashcopy backup** or **flashcopy nobackup** functions to create a backup.

The **flashcopy backup** function sets up a link between the source and target drives. This link creates a backup of the source data on the target drive. After the link is set up, a background copy operation is immediately initiated to copy all the data from the source drive to the target drive. After the background copy operation completes, the link between the source and target drives is dissolved.

The **flashcopy nobackup** function also sets up a link between the source and target drives. Unlike the **flashcopy backup** function, after the **flashcopy nobackup** link is set up, *no* background copy operation immediately takes place. The background copy operation waits until the data on the source logical drive changes. When a change to the data on the source drive occurs, the backup of the source logical drive data gets copied to the target logical drive. Then, the new data gets written to the source logical drive. This **flashcopy nobackup** link exists until you dissolve the link by issuing a **flashcopy stop**.

Note

You have instant read access to the target partition after a **flashcopy backup** or **flashcopy nobackup** is issued.

Important

Before using **flashcopy**, consider the following:

- Normal I/O functions can be performed on the source partition while the **flashcopy** operation is in progress. If you are performing a **flashcopy backup**, do not write to the target partition until the **flashcopy backup** process is complete.

  If you are performing a **flashcopy nobackup**, do not write to the target partition **at all**.
- You can have up to four **flashcopy** relationships active at a time.
- The source and target drives must be on the same ServeRAID controller.
- There is no limit on source and target partition size.
- When the **flashcopy** function completes, the data on the target partition will be an exact image of the data on the source partition at the time the **flashcopy** function was issued.
- The target partition must be at least the same size as the source partition. For optimal space usage, the **flashcopy** target partition should be the same size as the source partition.
- You can use the **noprompt** option to run some of the **flashcopy** functions without receiving any interactive prompts.

The following information shows you how to use the **flashcopy** function.

Flashcopy Map

Use the **flashcopy map** function to correlate how the ServeRAID logical drives map to the operating-system drive partitions.

Supported operating systems: Windows NT

Command: **ipssend flashcopy** *controller* **map**

where:

- *controller* is the ServeRAID controller number (1–12)

Partition Number	Partition Letter	Partition Size	Logical Drive	Array Letter	Available for FlashCopy
1	H:	100	1	A	No (note 1)
2	I:	100	2	A	No (note 1)
3	J:	50	2	A	Yes
None	None	-	3	B	No (note 5)
None	None	-	4	B	No (note 5)

For example, if you type `ipssend flashcopy 2 map`, the
following results appear on the screen:

```
Found 2 IBM ServeRAID Controller(s).
Note 1:
This partition is currently in an active
FlashCopy link.  See the table below for details.
Use the STOP command to break this link.  Once
the link is broken, you can reissue the
FLASHCOPY BACKUP or FLASHCOPY NOBACKUP command.

Note 5:
There is no partition defined on this logical drive.
```

If a partition is available for FlashCopy, the report states
Yes and there are no notes for that partition. If a partition
is *not* available for FlashCopy, the report states **No** with
one of the following explanatory notes:

Note 1

This partition is currently in an active **FlashCopy** link. See
the table below for details. Use the **stop** function to break
this link. After the link is broken, you can reissue the
FlashCopy backup or **FlashCopy nobackup** functions.

Note 2

One or more of the following is true for this partition:

- The partition is the boot partition.
- The partition has open files.
- The partition has a memory-paging file.

You can override these requirements by using the **force**
option. See the **flashcopy backup** and **flashcopy
nobackup** functions for more details.

Note 3

One or more of the following is true for this partition:

- The partition is in the blocked state.
- The partition is not in the okay or critical state.
- The partition is currently synchronizing, rebuilding, or
  migrating.

Note 4

FlashCopy can support up to four active links only.

Note 5

There is no partition defined on this logical drive.

Flashcopy Backup

Use the **flashcopy backup** function to create a quick
snapshot impression of source partitions on corresponding
target partitions. Once the snapshot is created, the source
partitions are ready for immediate use. When the process
completes, each target partition will contain a copy of its

source partition's data that existed at the exact time you issued the **flashcopy backup** function. A link between each source partition and target partition will exist until all the data is copied. Once all the source data is copied to the target partition (determined by the **ipssend getstatus** function), the link is automatically broken, and you can use the **flashcopy delete** and **flashcopy import** functions to move a logical drive to another system.

You can use the **flashcopy map** function to determine the partition numbers and if they are available for the **flashcopy backup** process.

```
┌─ Notes ──────────────────────────────────────┐
│                                              │
│  1. Only one flashcopy backup (involving     │
│     up to four source and target            │
│     partitions) can be active on a          │
│     controller at a time. If a flashcopy    │
│     backup is in progress, you cannot       │
│     issue another flashcopy backup or       │
│     flashcopy nobackup until the            │
│     previous flashcopy backup process is    │
│     completed or until the backup links are │
│     broken. You can use the flashcopy       │
│     stop function to break the links        │
│     between the source and target           │
│     partitions.                             │
│  2. For flashcopy backup to function        │
│     properly, each target partition must    │
│     have the same partition type as its     │
│     source partition.                       │
│  3. Do not attempt to write to the target   │
│     partitions until the backup process is  │
│     completed.                              │
└──────────────────────────────────────────────┘
```

Supported operating systems: Windows NT

Command: **ipssend flashcopy** *controller* **backup** *[source target] options*

```
┌─ Note ───────────────────────────────────────┐
│                                              │
│  The symbols [ ] above mean that the         │
│  parameters are repeatable. The maximum      │
│  number of repetitions is 4.                 │
└──────────────────────────────────────────────┘
```

where:

- *controller* is the ServeRAID controller number (1–12)
- *source* is the source partition number

```
  ┌─ Note ─────────────────────────────────────┐
  │                                            │
  │  Use the flashcopy map function to         │
  │  correlate the ServeRAID logical drive     │
  │  number to the operating system drive      │
  │  partition number.                         │
  └────────────────────────────────────────────┘
```

- *target* is the target partition number

```
  ┌─ Note ─────────────────────────────────────┐
  │                                            │
  │  Use the flashcopy map function to         │
  │  correlate the ServeRAID logical drive     │
  │  number to the operating system drive      │
  │  partition number.                         │
  └────────────────────────────────────────────┘
```

- *options* is an optional parameter that includes the following:
  - POLL displays the progress of the **backup** function.
  - FORCE creates a **flashcopy** of a source partition that is the boot partition, contains open files, or contains a memory paging file.

    > **Note**
    >
    > Using the FORCE option will not guarantee file consistency between the source and target partitions.

  - NOPROMPT overrides the user prompt.

Flashcopy Nobackup

Use the **flashcopy nobackup** function to create a quick snapshot impression of the source partition data on its target partition. Once the snapshot is created, the source partitions are ready for immediate use. Each target partition will contain a snapshot of its source partition data that existed at the exact time you issued the command. A link between each source partition and its target partition will exist until you issue the **flashcopy stop** function. Once you issue the **flashcopy stop** function, each target partition's contents are no longer valid. The **flashcopy nobackup** function is useful if you want a snapshot of your data to perform a tape backup.

You can use the **flashcopy map** function to determine the partition numbers and if they are available for the **flashcopy nobackup** function process.

> **Notes**
>
> 1. Only one **flashcopy nobackup** link (involving up to four source and target partitions) can exist on a ServeRAID controller. If a **flashcopy nobackup** function is invoked, you cannot issue another **flashcopy backup** or **flashcopy nobackup** function until existing nobackup links are broken. You can use the **flashcopy stop** function to break the links between the source and target partitions.
> 2. For the **flashcopy nobackup** function to operate properly, each target partition must have the same partition type as its source partition.
> 3. Do not attempt to write to the target partition until the nobackup link is broken.

Supported operating systems: Windows NT

Command: **ipssend flashcopy** *controller* **nobackup** [*source target*] *options*

> **─ Note ─**
>
> The symbols [ ] above mean that the parameters are repeatable. The maximum number of repetitions is 4.

where:
- *controller* is the ServeRAID controller number (1–12)
- *source* is the source partition number

> **─ Note ─**
>
> Use the **flashcopy map** function to correlate the ServeRAID logical drive number to the operating system drive partition number.

- *target* is the target partition number

> **─ Note ─**
>
> Use the **flashcopy map** function to correlate the ServeRAID logical drive number to the operating system drive partition number.

- *options* is an optional parameter that includes the following:
  - FORCE creates a **flashcopy** of a source partition that is the boot partition, contains open files, or contains a memory paging file.

    > **─ Note ─**
    >
    > Using the FORCE option will not guarantee file consistency between the source and target partitions.

  - NOPROMPT overrides the user prompt.

Flashcopy Stop All

Use the **flashcopy stop** function to break the link between the source partitions and target partitions. Once you issue the **flashcopy stop** function, the target partition contents are no longer valid. After you issue the **flashcopy stop** function, reformat your target partition.

Supported operating systems: Windows NT

Command: **ipssend flashcopy** *controller* **stop all** [**noprompt**]

where:
- *controller* is the ServeRAID controller number (1–12)
- **noprompt** is an optional parameter to override the user-prompt.

Flashcopy Delete

Use the **flashcopy delete** function to delete an array. This is useful when you have used the **flashcopy backup** function and you want to move the target array to another

system. After you delete the array, you can move the drives to the other system; then, you can issue the **flashcopy import** function to add the array to the existing configuration of the other system.

You can use the ServeRAID Manager Program to identify the array you want to delete. This program can blink the LEDs for the drives that belong to the specific array.

Important

If your target logical drive is configured with write-back cache enabled, wait 10 minutes after the **flashcopy backup** completes before issuing a **flashcopy delete** command. This ensures that all data has been moved from the controller cache to the logical drive.

Supported operating systems: Windows NT

Note

The **flashcopy delete** function is not available in a cluster configuration.

Command: **ipssend flashcopy** *controller* **delete** *arrayID* [**noprompt**]

where:

- *controller* is the ServeRAID controller number (1–12)
- *arrayID* is the Array ID (A–H)
- **noprompt** is an optional parameter to override the user-prompt.

Flashcopy Import

Use the **flashcopy import** function to merge logical drive information from new physical drives when they are added to the system. You can use this function to incorporate a target array after a **flashcopy backup** function is completed.

> **Notes**
>
> 1. The stripe-unit size of the logical drives being imported must be the same as the stripe-unit size of the logical drives on the new controller.
> 2. The number of physical drives you add must be equal to the number of physical drives that were in the original defined logical drive.
> 3. The physical drives must be added while the system is powered on.
> 4. When a logical drive is imported, all partitions from that logical drive are also imported automatically. You cannot import a single partition selectively.
> 5. You must manually assign drive letters after the import completes.

Supported operating systems: Windows NT

> **Note**
>
> The **flashcopy import** function is not available in a cluster configuration.

Command: **ipssend flashcopy** *controller* **import** *options*

where:

- *controller* is the ServeRAID controller number (1–12)
- *options* is one of the following:
  - ALL to specify all logical drives
  - *n* to specify a valid logical drive number (1–8)

Server roll-out functions: The IPSSEND server roll-out functions include the following:

backup　　　　　Use the **backup** function to save a ServeRAID controller configuration and BIOS settings to a diskette or to a physical drive. The ServeRAID adapter/controller configuration must be valid.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare and DOS

Command:
ipssend backup *controller filename* [**noprompt**]

where:

- *controller* is the ServeRAID controller number (1–12)
- *filename* is the path and file name where the configuration is to be written

copyld   - **noprompt** is an optional parameter that overrides the user prompt

copyld   Use the **copyld** function to copy a source logical drive to a target logical drive. The size of the target logical drive must be greater than or equal to the size of the source logical drive.

Supported operating system: DOS

Command:
ipssend copyld *controller source target* [**noprompt**]

where:

- *controller* is the ServeRAID controller number (1–12)
- *source* is the source logical drive number
- *target* is the target logical drive number
- **noprompt** is an optional parameter that overrides the user prompt.

restore   Use the **restore** function to load a configuration from a file stored on a diskette or a hard disk. The configuration must be a valid configuration file from the backup option in IPSSEND. This operation overwrites the existing configuration information and BIOS settings stored for the ServeRAID controller.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend restore *controller filename* [**noprompt**]

where:

- *controller* is the ServeRAID controller number (1–12)
- *filename* is the path and file name where the configuration is to be written
- **noprompt** is an optional parameter that overrides the user prompt

init Use the **init** function to initialize the first 0.5 MB of a logical drive. This process will erase the partition tables and all data on the disk.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend init *controller drivenum* [**noprompt**]

where:

- *controller* is the ServeRAID controller number (1–12)
- *drivenum* is the logical drive number (1–8)
- **noprompt** is an optional parameter that overrides the user prompt

initsync Use the **initsync** function to initialize and synchronize a logical drive at the same time. This command works only on RAID level-1 and level-5 logical drives. The command will erase all data on the entire logical drive.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend initsync *controller drivenum* [**noprompt**]

where:

- *controller* is the ServeRAID controller number (1–12)
- *drivenum* is the logical drive number (1–8)
- **noprompt** is an optional parameter that overrides the user prompt

synch Use the **synch** function to synchronize the parity information on redundant logical drives. If the parity information is inconsistent, the IPSSEND program will repair it automatically.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:

ipssend synch *controller drive drivenum*

where:

- *controller* is the ServeRAID controller number (1–12)
- *scope* indicates the number of logical drives:
    - DRIVE is a single logical drive
    - GROUP is a Merge Group
- *scopeID* specifies the *scope* item:
    - If DRIVE, specifies the logical drive number (1–8)
    - If GROUP, specifies the Merge Group number

Error-recovery functions: The IPSSEND error-recovery functions include the following:

getstatus Use the **getstatus** function to display the current logical-drive status for the most recent rebuild, synchronization, or logical-drive migration. The status includes such information as the remaining size of the logical drive, the percentage completed for the function in process, and information about the most recently completed logical-drive function.

 Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

 Command:
 ipssend getstatus *controller*

 where:

  controller is the ServeRAID controller number (1–12)

rebuild Use the **rebuild** function to rebuild a designated disk drive. This command is valid for disk arrays that contain one or more logical drives that are in the critical state. Progress is indicated during the rebuild operation, but you can also use the **getstatus** command to obtain progress information about the rebuild.

 Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

 Command:

ipssend rebuild *controller dch dsid nch nsid*

where:

- *controller* is the ServeRAID controller number (1–12)
- *dch* is the channel number for the defunct drive (1–3)
- *dsid* is the SCSI ID for the defunct drive (0–15)
- *nch* is the channel number for the new drive (1–3)
- *nsid* is the SCSI ID for the new drive (0–15)

setstate

Use the **setstate** function to change the state of a physical device from its current state to a new state.

Attention:
You must be very careful when you use this command. For example, you might lose data if you reset a defunct device to online without first performing a rebuild operation.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend setstate *controller channel sid nstate*

where:

- *controller* is the ServeRAID controller number (1–12)
- *channel* is the channel number for the drive (1–3)
- *sid* is the SCSI ID for the drive (0–15)
- *nstate* is the new state for the drive. Valid states are: EMP for Empty, RDY for Ready, HSP for Hot spare, SHS for Standby hot spare, DDD for Defunct disk drive, DHS for Defunct hot spare, RBL for Rebuild, SBY for Standby, and ONL for Online.

unblock

Use the **unblock** function to gain access to a blocked logical drive. RAID level-0 logical drives become blocked if they are in an array that contains RAID level-1 or level-5 logical drives and the array is being

rebuilt. Because the RAID level-0 logical drives cannot be rebuilt, the data stored on the RAID level-0 logical drives is damaged and should not be accessed. After you issue the **unblock** command, you must re-create or restore the data previously stored on the RAID level-0 logical drives.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend unblock *controller drivenum*

where:

- *controller* is the ServeRAID controller number (1–12)
- *drivenum* is the logical drive number (1–8)

Problem-isolation and debug commands: The
IPSSEND problem-isolation and debug commands include
the following:

certify   Use the **certify** function to verify the
media of a physical drive. When the
program finds a media error, it
reassigns the sectors. A summary of
reassignments and PFA errors
appears upon completion of the
verification.

Supported operating system: DOS

Command:
ipssend certify *controller channel sid*

where:

- *controller* is the ServeRAID
controller number (1–12)
- *channel* is the channel number
for the device (1, 2, or 3)
- *sid* is the SCSI ID for the device
(0–15)

eraseevent   Use the **eraseevent** function to clear
all logged entries in the designated
event log. See GETEVENT help for
information about the contents of the
device event log and the controller
soft and hard event logs.

Supported operating systems:
Windows NT, OS/2, NetWare, Linux,
OpenServer, UnixWare, and DOS

Command:
ipssend eraseevent *controller
options*

where:

- *controller* is the ServeRAID
controller number (1–12)
- *options* is the designated event
log:
  - DEVICE for the device
event log
  - SOFT for the ServeRAID
adapter/controller soft event
log
  - HARD for the ServeRAID
adapter/controller hard
event log

getbst   Use the **getbst** function to display the
number of bad stripes in the bad
stripe table for each logical drive.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, Unixware, and DOS

Command:
ipssend getbst *controller*

where:

controller is the ServeRAID controller number (1–12)

fmstatus   Use the **fmstatus** function to display the progress of a format operation currently processing.

Supported operating system: DOS

Command:
ipssend fmstatus *controller channel sid*

where:

- *controller* is the ServeRAID controller number (1–12)
- *channel* is the channel number for the device (1, 2, or 3)
- *sid* is the SCSI ID for the device (0–15)

format   Use the **format** function to perform a low-level format of a physical drive.

Attention:

1. When you issue this command, all data on the disk will be lost.
2. After a **format** command is issued, do not stop it. If a format process is stopped for any reason, the hard disk that was being formatted will not respond to any commands except the format command. Thus, the ServeRAID controller will not be able to recognize commands anymore. To recover the drive, refer to "Recovering from an incomplete format of a physical drive" on page 213.

Supported operating system: DOS

Command:
ipssend format *controller channel sid*

where:

- *controller* is the ServeRAID controller number (1–12)
- *channel* is the channel number for the device (1, 2, or 3)

| **getevent** | Use the **getevent** function to display information about various unexpected events. IBM uses the soft and hard event logs for development and debugging purposes only. The device event log contains event counters for each attached physical device. These counters include: |

* *sid* is the SCSI ID for the device (0–15)

getevent
Use the **getevent** function to display information about various unexpected events. IBM uses the soft and hard event logs for development and debugging purposes only. The device event log contains event counters for each attached physical device. These counters include:

* Parity: An unexpected event occurred while data was being transferred on the SCSI bus. This usually indicates a problem with the SCSI cable, connectors, or terminators.
* Soft: A SCSI device detected a check-condition event.
* Hard: The SCSI controller detected an unexpected event. The controller is the most likely cause.
* Misc: The ServeRAID adapter/controller detected an event that was most likely caused by the device.

The device event log also provides Predictive Failure Analysis (PFA) alerts, which indicate that the device has signaled the ServeRAID adapter/controller that it might fail in the near future.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend getevent *controller options*

where:

* *controller* is the ServeRAID controller number (1–12)
* *options* is the designated event log:
    – DEVICE for the device event log
    – SOFT for the ServeRAID adapter/controller soft event log
    – HARD for the ServeRAID adapter/controller hard event log

selftest The **selftest** function is used to direct a controller or a device to perform its self-test.

Supported operating systems: DOS

Command:
ipssend selftest *controller options*

where:

- *controller* is the ServeRAID controller number (1–12)
- *options* is the designated self-test:
  – AD for the ServeRAID adapter/controller self-test
  – PD *channel sid* for the device self-test

> **Note**
>
> *channel* represents the drive channel, and *sid* is the SCSI ID for the device.

startdely Use the **startdely** function to set the number of drives in a group to start up simultaneously and to set the delay in seconds between the startup of these groups of drives.

Supported operating systems: DOS

Command:
ipssend startdely *controller options*

where:

- *controller* is the ServeRAID controller number (1–12)
- *options* is one of the following:
  – ? displays the concurrent drive startup count and the delay time.
  – A number (1–16) that specifies the new concurrent drive startup count
  – A number (1–16) that specifies the new concurrent drive startup count and a number (3–15) that specifies the startup delay time, in seconds.

RAID Configuration commands: The IPSSEND RAID configuration commands include the following:

drivever

Use the **drivever** function to display the vendor ID, microcode version, and serial number of a SCSI device. The IPSSEND program retrieves this information directly from the device.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend drivever *controller channel sid*

where:

- *controller* is the ServeRAID controller number (1–12)
- *channel* is the channel number for the device (1, 2, or 3)
- *sid* is the SCSI ID for the device (0–15)

getconfig

Use the **getconfig** function to display the ServeRAID controller configuration information. This includes information about the firmware version; initiator ID and rebuild rate; logical-drive status, RAID level, and size; and physical device type, SCSI ID, and PFA error.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:
ipssend getconfig *controller options*

where:

- *controller* is the ServeRAID controller number (1–12)
- *options* is one of the following:
  - AD for the controller information
  - LD for the logical drive information
  - PD for the physical device information
  - AL for all information. This is the default option.

hsrebuild

Use the **hsrebuild** function to turn on the ServeRAID controller hot-swap rebuild feature or display the current status of the hot-swap rebuild feature.

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare, and DOS

Command:

ipssend hsrebuild *controller options*

where:

- *controller* is the ServeRAID controller number (1–12)
- *options* is one of the following:
  - ON enables the hot-swap feature
  - ? displays the status of the hot-swap rebuild feature.

readahead   Use the **readahead** function to enable, disable, or set the adaptive mode for the read-ahead feature of the ServeRAID controller.

Supported operating systems: Windows NT and DOS

Command:
ipssend readahead *controller options*

where:

- *controller* is the ServeRAID controller number (1–12)
- *options* is one of the following:
  - ON enables the read-ahead feature
  - OFF disables the read-ahead feature
  - ADAPTIVE indicates that the controller will determine the best mode to use at any given time.
  - ? displays the current read-ahead feature mode being used.

stripesize   Use the **stripesize** function to set the size of the ServeRAID controller's stripe to 8 KB, 16 KB, 32 KB, or 64 KB.

Supported operating systems: DOS

Command:
ipssend stripesize *controller options*

where:

- *controller* is the ServeRAID controller number (1–12)
- *options* is one of the following:
  - 8 to set the stripe-unit size to 8 KB
  - 16 to set the stripe-unit size to 16 KB
  - 32 to set the stripe-unit size to 32 KB

	– 64 to set the stripe-unit size to 64 KB
	– ? to display the current stripe-unit size being used
unattended	Use the **unattended** command to enable or disable the unattended feature of the ServeRAID controllers.
	Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, Unixware, and DOS
	Command: **ipssend unattended** *controller options*
	where:
	• *controller* is the ServeRAID controller number (1–12)
	• *options* is one of the following: – ON to enable the feature – OFF to disable the feature – ? to display the current setting of this feature

Starting the IPSMON program

You can run the IPSMON program from the operating system command line.

To start the IPSMON program:

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

        c:\ipsadm\ipsmon

        where c is the drive letter of the drive where OS/2 or Windows NT is installed.
    2. Press **Enter**.
- If you are using Novell NetWare:
    1. From the console, type:

        load ipsmon

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

        /usr/bin/ipsmon

    2. Press **Enter**.

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

Supported operating systems: Windows NT, OS/2, NetWare, Linux, OpenServer, UnixWare

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 monitor)
    - -? 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 appear on the screen.

After you start the IPSMON program, the program will continuously poll the ServeRAID controllers until you take one of the following actions:

- If you are using Windows NT or OS/2, press **Ctrl**+**C**.
- If you are using NetWare, type `unload ipsmon` at the system console.
- If you are using OpenServer or UnixWare, press the **Del** key to cancel the program.

During operation, the program will log various messages. Each message will contain an alert code and a location specifier.

- The alert code begins with the message type and number; for example, INF, WRN, or CRT (followed by the message number).
- The location specifier comes after the alert code:
    A followed by the controller number
    SID followed by the SCSI ID (if required)
    C followed by the channel number (if required)

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

The IPSMON program can log the following messages, based on the required condition.

Information Messages:
  <Date and Time> INF000:A1C-SID--
  no errors detected

  <Date and Time> INF001:A1C-SID--
  rebuild started

  <Date and Time> INF002:A1C-SID--
  rebuild completed

  <Date and Time> INF003:A1C-SID--
  synchronization started

  <Date and Time> INF004:A1C-SID--
  synchronization completed

  <Date and Time> INF005:A1C-SID--
  migration started

  <Date and Time> INF006:A1C-SID--
  migration completed

Warning Messages:
  <Date and Time>
  WRN001:A2C3SID12 PFA Error detected

Critical Messages:
  <Date and Time>
  CRT001:A3C2SID04 dead drive detected

  <Date and Time>

CRT002:A1C-SID-- not responding to commands

Features

Standard features of the ServeRAID 3 controllers are as follows in the table on the next page:

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

Additional service information

The following additional service information supports IBM PC ServeRAID 3 Adapters.

Configuring controllers using the ServeRAID Manager Program

This section provides the information needed to start and use the ServeRAID Manager Program. You can use the ServeRAID Manager Program to easily configure and monitor your ServeRAID controllers. You can also use the ServeRAID Manager Program to configure two ServeRAID controllers in a failover environment.

For instructions on specific processes using the ServeRAID Manager Program, refer to the ServeRAID Manager online help.

Note

The ServeRAID Manager Program works with systems using Microsoft Windows NT, Windows 95, Windows 98, Novell NetWare, IBM OS/2, and SCO UnixWare.

Using the ServeRAID Manager Program

interface: The graphical interface in the ServeRAID Manager Program makes it easy for you to create, delete, change, view and monitor your ServeRAID configuration.

Before you begin, review the following illustration to become familiar with the layout of the ServeRAID Manager Program screens.

Figure 1. ServeRAID Manager Program screen layout

Descriptions of the numbered areas are as follows:

1. Menu bar	Provides File, View, Remote, Actions, and Help pull-down menus.
2. Tool bar	Provides quick-path icons for common tasks. The icons from left to right are **Add remote system**, **Create arrays**, **Configure for clustering**, **Scan for new or removed ready drives**, **Silence repeating alarm**, and **Help**.
3. Main Tree	Provides an expandable tree view of your ServeRAID subsystem. You will perform most of your ServeRAID configuration and maintenance tasks by first selecting the ServeRAID controller, array, logical drive, hot-spare drive, or physical drive objects from this Main Tree.
4. Main Panel	Provides specific device information or configuration instructions. When the ServeRAID Manager Program is in the Information mode and you select an object from the Main Tree, detailed information about the object appears in this panel. When the ServeRAID Manager Program is in the Configuration mode, the instructions needed to configure your ServeRAID subsystem appear in this panel.
5. Event viewer	Provides advisory and progressive-status information and messages during the ServeRAID configuration process and while monitoring systems with ServeRAID controllers. Each message appears with a host name from where the event originated, a time stamp, a date stamp, and an icon that classifies the severity of the event. The event icons are:

- Information: An "i" inside a blue circle
- Warning: A "!" inside a yellow triangle
- Fatal: An "x" inside a red circle

Warning messages identify potential data-loss situations, and Fatal messages inform you when a failure has occurred. All Fatal

	messages will launch an audible alarm.
6. Status bar	Provides three types of information in a resizable panel. The panels contain the following information:

- The left panel displays the managed system status, which is either **No problems detected on any system** or **Problems detected on one or more systems**.
- The center panel displays the current tree path.
- The right panel displays a progress meter with the label of the currently selected system and the process that is taking place at the current time.

Using the ServeRAID Manager Program in bootable-CD mode:

When you start the ServeRAID Manager Program from the bootable *IBM ServeRAID Support CD*, you can configure your ServeRAID controller configuration *before* you install your operating system.

You can use the ServeRAID Manager Program to configure your ServeRAID controllers, view the ServeRAID configuration and associated devices, create arrays and logical drives, delete an array, dynamically increase the logical-drive size, change RAID levels, and much more.

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

In the Configuration mode, you can create disk arrays, create logical drives, and define your hot-spare drives. When this mode is active, only a limited set of functions is available from the menu and tool bars. See "Using the Configuration mode" on page 97 for more information.

In the Information mode, you can view and modify the existing device and configuration information for your ServeRAID subsystem. When this mode is active, you can use the functions available from the menu and tool bars to customize settings for your ServeRAID controllers. See "Using the Information mode" on page 105 for more information.

To start the ServeRAID Manager Program, use the following procedure:

1. Insert the *IBM ServeRAID Support CD* (or the CD that contains the ServeRAID Manager Program that came

with your system) into the CD-ROM drive; then, turn
on the system.

One of the following screens will appear:

- If the configuration program detects unconfigured
  ServeRAID controllers, the program starts in the
  Configuration mode and a screen similar to the
  following appears.
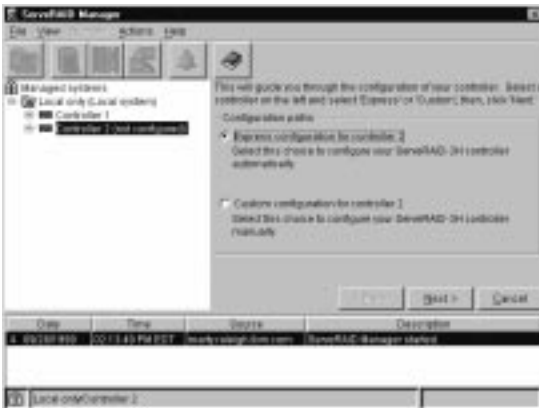
Figure 2. Configuration mode screen

> Follow the instructions on the right screen to
> create logical drives on your ServeRAID
> controller. Click **Cancel** if you do not wish to
> configure your ServeRAID controller. This will
> switch the program from the Configuration mode
> to the Information mode.

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

Figure 3. Information mode screen

Click on the tool bar to switch from the
Information mode to the Configuration mode.

2. Continue with one of the following:

   - "Using the Configuration mode."
   - "Using the Information mode" on page 105.

Using the Configuration mode: You can use the
Configuration mode to create up to eight independent disk
arrays for each ServeRAID controller. The Configuration
mode provides two configuration paths: *Express
configuration* and *Custom configuration* (see Figure 2 on
page 96).

Important

The new controller stripe-unit size setting defaults to 8
KB[1]. 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. To change the
stripe-unit size, do the following:

1. Click the new controller in the Main Tree.
2. Select **Change stripe-unit size** on the Actions
   menu.
3. Select the new stripe-unit size for your installation
   on the menu.

(See "Stripe-unit size" on page 231 for more
information about stripe-unit size.)

---

[1] KB equals approximately 1000 bytes.

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

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

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

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

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

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

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

Notes

1. When there are four or more Ready drives of the same capacity, Express configuration groups defines one drive as a hot spare and the remaining drives into one array (as in Array C).

2. A hot-spare drive must be of equal or greater capacity than the drive that it is intended to replace. In this configuration, the 4300 MB drive can replace any failed drives in Array B or Array C. The drive in Array A cannot be replaced because it is RAID level-0.

Using Express configuration: To use the Express configuration path:

Note

If the Express configuration mode/Custom configuration mode radio buttons do not appear on the right screen, click on the tool bar.

---

1. Click the ServeRAID controller that you want to configure in the Main Tree.
2. If it is not already selected, click the **Express configuration** radio button.
3. Click **Next**.
4. Review the information that appears on the Configuration summary screen.

Figure 4. Configuration summary screen

Notes

1. Some operating systems have size limitations for logical drives. Before you save the configuration, you might want to verify that the size of the logical drive is appropriate for your operating system. See your operating-system documentation for more detailed information.
2. To change the configuration, click **Modify arrays** or **Modify logical drives**.

---

5. Click **Apply** to accept and save the configuration. The configuration is saved in the ServeRAID controller and in the physical drives.
6. If you have multiple controllers repeat steps 1 to 5 for each controller.

7. When you have completed configuration, close the ServeRAID Manager Program and remove the CD from the CD-ROM drive when prompted.
8. Restart the system.
9. If you have not already done so, install your operating system. See the server documentation or the documentation provided with your operating system for more information.

After you install your operating system, see "Installing the ServeRaid Manager Program" on page 112 (or see the installation instructions provided with your server) for information about installing the ServeRAID device drivers and utility programs.

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

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

- If you are not familiar with the IBM implementation of RAID technology, you might want to review the information provided in "ServeRAID reference information" on page 231 before you begin.
- Each ServeRAID controller supports a maximum of eight arrays.
- Each ServeRAID controller supports a maximum of eight logical drives.

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

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

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

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

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

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

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

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

- If you are using the ServeRAID-3L:
  - Eight physical drives are supported in an array if the stripe-unit size is set to 32 KB or 64 KB.
  - Sixteen physical drives are supported in an array if the stripe-unit size is set to 8 KB or 16 KB.

  If you are using the ServeRAID-3H or ServeRAID-3HB, sixteen physical drives are supported in an array if the stripe-unit size is set to 32 KB or 64 KB. (See "Stripe-unit size" on page 231 for more information.)

Using Custom configuration: To use the Custom configuration path:

> **Note**
>
> If the Express configuration mode/Custom configuration mode radio buttons do not appear on the
>
> right screen, click on the tool bar.

---

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

ServeRAID 3H, 3HB, 3L Adapters/Controllers **101**

1. Click the ServeRAID controller that you want to configure in the Main Tree.
2. Click the **Custom configuration** radio button.
3. Click **Next**. The screen similar to the following appears:

Figure 5. Create arrays screen

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

   or

   Drag the drive or SCSI channel icon from the Main Tree and drop it on the Array or Hot-spare drive icon in the Main Panel on the right. If you change your mind, you can drag the icons back to the Main Tree to remove them from the configuration.
5. After you select the physical drives for your arrays and define your hot-spare drives, click **Next**.

Figure 6. Create logical drives screen

If you change your mind, you can:
- Remove a specific drive from a newly defined array or delete an entire newly defined array. To do this, click **Back**, use the right mouse button to click on the specific drive or Array icon in the Main Panel on the right, and then select **Remove from new array** or **Delete new array**.
- Remove a specific hot-spare drive or all newly defined hot-spare drives. To do this, click **Back**, use the right mouse button to click on the Hot-spare drive icon in the Main Panel on the right, and then select **Remove new hot-spare drive** or **Remove all new hot-spare drives**.

6. Select a RAID level for the logical drive from the RAID pull-down menu in the Main Panel. (See "Supported RAID levels" on page 232 for descriptions of the supported levels.)

7. If you do not want to use the maximum size for the logic l drive, move the sliding bar in the Main Panel from right to left to allot data and parity space for the logical drive, or type in the size in the data field.

> **Notes**
>
> 1. You can define from one to eight logical drives.
> 2. Some operating systems have size limitations for logical drives. Before you save the configuration, you might want to verify that the size of the logical drive is appropriate for your operating system. See your operating-system documentation for more detailed information.
> 3. Typically, the first logical drive defined on the first ServeRAID adapter/controller found by system BIOS during startup will be your startup (boot) drive.

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

Figure 7. Adding another logical drive

9. Repeat steps 6, 7, and 8 for each logical drive that you want to define in this array; then, continue with step 10.
10. If you are defining multiple arrays, click on the next New array tree node; then, repeat steps 6, 7, 8 and 9. When you are finished, go to step 11.
11. Click **Next**.
12. Review the information that appears on the Configuration summary screen.

Figure 8. Configuration summary screen

> ┌─── **Note** ────────────────────────────┐
> │ To change the configuration, click **Modify arrays** │
> │ or **Modify logical drives**.   │
> └──┘

13. Click **Apply** to accept and save the configuration.
    The configuration is saved in the ServeRAID
    controller and on the physical drives.
14. If you have multiple controllers, repeat steps 1 to 13
    for each controller.
15. When you have completed configuration, close the
    ServeRAID Manager Program and remove the
    CD-ROM from the CD-ROM drive.
16. Restart the system.
17. If you have not already done so, install your operating
    system. See the server documentation or the
    documentation provided with your operating system
    for more information.

After you install your operating system, see "Installing the
ServeRaid Manager Program" on page 112 (or the
installation instructions provided with your server) for
information about installing the ServeRAID device drivers
and utility programs.

Using the Information mode: You can use the
Information mode to view the configuration information of
ServeRAID controllers, arrays, logical drives, hot-spare
drives, and physical drives that make up your ServeRAID
subsystem (see Figure 3 on page 97). You also can use
this mode to change some of the ServeRAID controller
settings. Click an item in the Main Tree and select the
Actions menu to display available actions on that item.

***Viewing the device and configuration
information:*** To view the current settings:

1. Click the plus (+) box next to the object in the Main
   Tree to expand that portion of the tree.
2. Click the icon for the server, ServeRAID controller,
   array, logical drive, hot-spare drive, or physical drive
   to view its current settings.

Detailed information about the selected device will appear
in the Main Panel on the right.

Battery-backup cache

The Battery-Backup Cache can be installed on IBM ServeRaid 3H Adapters. The ServeRAID 3HB Adapter/Controller comes with a Battery-Backup Cache installed. The Battery-Backup Cache does not disable the cache memory SIMM already attached to the IBM ServeRAID 3 Adapter, nor is the memory capacity increased by its installation. The Battery-Backup Cache mirrors only the dirty data in the SIMM. Dirty data is data that is stored in the memory SIMM that has not been written to the hard drives. In write-back mode the ServeRAID 3 Adapter notifies the host that it has completed the write operation even though the data hasn't yet been written to the hard drive.

While write-back mode improves performance, dirty data is in jeopardy of being lost in the event of a system malfunction or power loss.

If a ServeRAID adapter/controller equipped with a Battery-Backup Cache fails, it can be removed and installed on a working adapter. The data on that Battery-Backup Cache can then be flushed into the memory SIMM located on the new adapter and written to the disk.

Channel troubleshooting procedure

This procedure should be used when there is a problem on the SCSI channel outboard of the adapter/controller that prevents the adapter/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.

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**.

001

DOES THIS SERVERAID ADAPTER/CONTROLLER HAVE MORE THAN ONE CHANNEL?

Yes   No

> **002**
>
> – Follow the channel trouble shooting procedure. See "Channel troubleshooting procedure" on page 108.
> ServeRAID adapter/controller has only one channel and it is failing.
> – Move adapter to a different PCI slot.
> If problem persists, replace the adapter/controller.

003

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

Yes   No

> **004**
>
> – **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 adapter/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 adapter/controller that prevents the adapter/controller from communicating with the devices attached to that channel. Go to "Channel troubleshooting procedure" on page 108 to resolve the problem.

(CONTINUED)

– or –
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
adapter/controller is defective. Replace
adapter/controller.

| 005 |

**DOES THE STATUS FOR THESE DRIVES APPEAR
CORRECT?**
Yes No

> | 006 |
>
> Status is incorrect for multiple channels.
> – Verify that devices on channel are powered up
>   and properly connected.
> – Move adapter to a different PCI slot.
> If problem persists, replace the adapter/controller.

| 007 |

Do not press F5, since this changes the customer's
configuration.
– Disconnect one of the correctly-operating channel
   connectors at the adapter/controller and connect it to the
   failing adapter/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 "...not responding...", referring to original and
moved channels, and do not get the "Following drives
found in new location..." message, this channel on the
adapter/controller is defective. Replace adapter/controller.
– or –
If you get "...new location...", this channel on the
adapter/controller is working correctly. Continue at Step
008.

| 008 |

– 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
adapter/controller that prevents the adapter/controller from
communicating with the devices attached to that channel.
Go to "Channel troubleshooting procedure" on page 108 to
resolve the problem.
(Step **008** continues)

008 (continued)

– or –

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 adapter/controller connectors.

Installing the ServeRaid Manager Program

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

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

The ServeRAID Manager Program for Microsoft Windows NT, 95, and 98, Novell NetWare, IBM OS/2 and SCO UnixWare provides a graphical interface that you can use to monitor ServeRAID configuration changes being performed on your server while your server is fully operational. You can create an array, delete an array, create a logical drive, change the RAID level, dynamically increase the logical drive size, rebuild an array, configure your ServeRAID controllers in a failover environment, configure a cluster, and perform other ServeRAID configuration functions.

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

When using:	Go to:
Windows NT, 98, 95	"Installing on Windows NT, Windows 98, or Windows 95" on page 115.
NetWare	"Installing on NetWare" on page 115.
OS/2	"Installing on OS/2" on page 117.
UnixWare	"Installing on UnixWare" on page 118.

IBM ServeRAID Support CD and diskettes

IBM periodically makes updated versions of the ServeRAID device drivers and utility programs available from the IBM Support page on the World Wide Web. In addition to the updated device drivers and utility programs, there are also two ServeRAID command-line programs, IPSSEND and IPSMON, available from the World Wide Web. These programs are both on the *IBM ServeRAID Command Line Programs Diskette.*

> **Note**
>
> If you need to update any RAID software, you must
> update all RAID software at the same time to ensure
> compatibility with all of the levels of the software. This
> includes:
>
> - BIOS/Firmware
> - Device Drivers
> - ServeRAID Manager
> - Command-Line Programs
>
> You can download the most current versions of the
> ServeRAID device drivers and utility programs or a
> copy of the *IBM ServeRAID Command Line Programs
> Diskette* from the following address on the World Wide
> Web:
>
> `http://www.pc.ibm.com/support`

The *IBM ServeRAID Support CD* contains the following:

- ServeRAID Manager Program. You can run this
  program before installing your operating system when
  you start (boot) the CD. You can also use this
  program after you have installed your operating
  system. This program is available in the
  PROGRAMS/OPERATING SYSTEM/MANAGER
  directory. See "Configuring controllers using the
  ServeRAID Manager Program" on page 93 for more
  information.
- Device drivers. These files are available in the
  PROGRAMS/OPERATING SYSTEM/DRIVER
  directory.
- Command-Line Programs. These command-line
  programs are in the appropriate operating system
  subdirectory of the /PROGRAMS/CMDLINE directory.
  See "Installing the IPSSEND and IPSMON
  command-line programs" on page 139 for more
  information.
- ServeRAID files needed to install Microsoft Cluster
  Server (MSCS) when using Windows NT and an IBM
  ServeRAID-3H Ultra2 SCSI Adapter. These files are
  in the /PROGRAMS/CLUSTER directory on the *IBM
  ServeRAID Support CD*. Detailed instructions for
  installing and using these files are provided in the
  *IBM Netfinity High-Availability Cluster Solution
  Installation and User's Guide*.

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

- DOS CD-ROM drive device drivers
- Device Drivers and the background-server component
  for Microsoft Windows NT
- Device Drivers, Administration and Monitoring
  Program, and the background-server components for

OS/2® Warp Server, OS/2 LAN Server, Novell NetWare 3.12, and Novell NetWare 4.1X

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

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

Installing on Windows NT, Windows 98, or Windows 95

> **Note**
>
> This version of the ServeRAID Manager Program supports up to eight ServeRAID controllers when using Microsoft NT 3.5 and 12 ServeRAID controllers when using Microsoft NT 4.0.

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

1. Configure your controllers and arrays. See "Configuring controllers using the ServeRAID Manager Program" on page 93 for information.
2. Install your operating system. See the instructions that came with your server and your operating system for information.
3. Insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
4. The installation program starts. Follow the instructions on the screen to install the program.

To use the ServeRAID Manager Program, see "Configuring controllers using the ServeRAID Manager Program" on page 93.

Installing on NetWare

> **Notes**
>
> - To install the NetWare version of the ServeRAID Manager Program, you must install from a Microsoft Windows client connected to the NetWare system.
> - ServeRAID does not support NetWare versions older than 4.11.
> - This version of the ServeRAID Manager Program supports up to eight ServeRAID controllers when using NetWare.

> **Important**
>
> To install the ServeRAID Manager Program, you must
> have a network drive mapped to the root directory of
> the SYS partition.
>
> Before you install the ServeRAID Manager Program,
> be sure you have the following installed on your
> NetWare system:
>
> - If you are using NetWare 5.0:
>
>   Install Support Pack 2 before installing the Novell
>   JVM for NetWare. Download the latest Support
>   Pack from the following address:
>
>   ```
>   http://support.novell.com/misc
>   /patlst.htm#nw
>   ```
>
> - If you are using NetWare 4.2:
>
>   No Support Packs are required for NetWare 4.2,
>   although it is recommended you install the latest
>   Support Pack available from Novell. Download
>   the latest Support Pack from the following
>   address:
>
>   ```
>   http://support.novell.com/misc
>   /patlst.htm#nw
>   ```
>
> - If you are using NetWare 4.11:
>   - Install *at least* Support Pack 5, however,
>   more recent Support Packs are available
>   and recommended. Download the latest
>   Support Pack from the following address:
>
>     ```
>     http://support.novell.com/misc
>     /patlst.htm#nw
>     ```
>
>   - You must activate long file names on the
>   NetWare server. To activate long file name
>   support, type at the NetWare command line:
>
>     ```
>     load long
>     add name space long to sys
>     ```
>
>   After executing these commands, restart the
>   server.
> - For NetWare 4.x, 4.2, and 5.0:
>
>   Use the Novell Java Virtual Machine version
>   1.1.7 or later. Versions older than 1.1.7 are not
>   compatible with the ServeRAID Manager
>   Program. To check your JVM version, load Java
>   and type at the NetWare command prompt:
>
>   ```
>   JAVA -VERSION
>   ```
>
>   Download the latest JVM from the following
>   address:
>
>   ```
>   http://developer.novell.com/ndk
>   /download.htm
>   ```

To install the ServeRAID Manager Program for Novell
NetWare, do the following:

1. Configure your controllers and arrays. See
   "Configuring controllers using the ServeRAID
   Manager Program" on page 93 for information.
2. Install your operating system. See the instructions
   that came with your server and your operating system
   for information.
3. On a Microsoft Windows client that is connected to
   the NetWare system, map a network drive to the root
   directory of your NetWare SYS partition.
4. Insert the *IBM ServeRAID Support CD* into the
   CD-ROM drive of the Windows client. The installation
   program starts.
5. When prompted, choose the NetWare 4.x/5.x
   operating system.
6. When prompted for the installation directory, provide
   only the drive letter to the NetWare SYS partition that
   you mapped in step 3.
7. Follow the instructions on the screen to install the
   program.

To use the ServeRAID Manager Program, see "Configuring
controllers using the ServeRAID Manager Program" on
page 93.

Installing on OS/2

> **Note**
>
> This version of the ServeRAID Manager Program
> supports up to eight ServeRAID controllers when
> using OS/2.

To install the ServeRAID Manager Program for OS/2, do
the following:

1. Configure your controllers and arrays. See
   "Configuring controllers using the ServeRAID
   Manager Program" on page 93 for information.
2. Install your operating system. See the instructions
   that came with your server and your operating system
   for information.
3. Insert the *IBM ServeRAID Support CD* into the
   CD-ROM drive.
4. Open an OS/2 command window.
5. Type the following:

   `d:`

   where `d` is the CD-ROM drive letter.
6. Press Enter; then, type:

   `cd \programs\os2\manager`
7. Press Enter; then, type:

   `install`
8. Press Enter.

9. The installation program starts. Follow the instructions on the screen to install the program. On the final installation panel, be sure to specify the location where you want to install the ServeRAID Manager Program.

To use the ServeRAID Manager Program, see "Configuring controllers using the ServeRAID Manager Program" on page 93.

Installing on UnixWare

<blockquote>
Note

- To use the ServeRAID Manager Program with UnixWare, you must have either the Java Runtime Environment (JRE) or the Java Development Kit (JDK) installed on your server.
- To install or remove the ServeRAID Manager package you must have "root" privileges.
- This version of the ServeRAID Manager Program supports up to eight ServeRAID controllers when using UnixWare.
</blockquote>

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

1. Configure your controllers and arrays. See "Configuring controllers using the ServeRAID Manager Program" on page 93 for information.
2. Install your operating system. See the instructions that came with your server and your operating system for information.
3. Insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
4. Type the following:

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

   where cdromdevicefile is the specific device file for the CD-ROM block device. Look in the /dev/cdrom directory to determine what *cdromdevicefile* is on your server, for example, c0b0t010.
5. Press Enter; then type:

   ```
   pkgadd -d /mnt/programs/unixware/manager/RaidMan.ds
   ```

6. Press Enter.
7. When the installation is complete, type:

   ```
   umount /mnt
   ```

8. Press Enter. You can now remove the CD from the drive.

To use the ServeRAID Manager Program, see "Configuring controllers using the ServeRAID Manager Program" on page 93.

Installing ServeRAID device drivers

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

When using:	Go to:
Windows NT	"Installing device drivers for Windows NT."
NetWare	"Installing device drivers for NetWare" on page 121.
Linux	"Installing device drivers for Linux 2.2.x (or later)" on page 124.
OS/2	"Installing device drivers for OS/2" on page 126.
OpenServer	"Installing device drivers for OpenServer" on page 130.
UnixWare	"Installing device drivers for UnixWare" on page 133.

Installing device drivers for Windows NT

This section provides instructions for installing the device drivers for Windows NT 3.5 and Windows NT 4.0.

- If you are installing the files for Windows NT 3.5, go to "Installing the files for Windows NT 3.5."
- If you are installing the files for Windows NT 4.0, go to "Installing the files for Windows NT 4.0" on page 120.

Installing the files for Windows NT 3.5: This section provides instructions for installing the device drivers for Windows NT 3.5.

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

- If you are installing the files *while* you are installing Windows NT 3.5, go to "Installing the files while installing Windows NT 3.5."
- If you are installing the files *after* you have installed Windows NT 3.5, go to "Installing the files after installing Windows NT 3.5" on page 120.

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

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

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

appears, press **F6**.

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

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

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

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

7. When prompted, press Enter to continue.

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

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

Installing the files after installing Windows

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

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

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

3. Click **Configuration** from the menu; then, click **Add/Remove SCSI Adapter**.

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

5. Click **OK**.

6. Click **OK**.

7. Click **Add**.

8. Click **OK**.

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

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

    `a:\nt3_5`

11. Click **OK**.

Installing the files for Windows NT 4.0

This section provides the instructions for installing the device drivers for Windows NT 4.0.

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

- If you are installing the files *while* you are installing Windows NT 4.0, go to "Installing the device drivers while installing Windows NT 4.0" on page 121.
- If you are installing the files *after* you have installed Windows NT 4.0, go to "Installing the device driver after installing Windows NT 4.0" on page 121.

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

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

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

   appears, press the **F6** key.
3. After loading some files, Windows NT displays a screen where you can manually specify a controller. When this screen appears, press S to specify additional devices.
4. When prompted in the next window, select **Other** from the list.
5. When prompted to insert the

   `Manufacturer-supplied-hardware support disk,`

   insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive; then, press Enter.
6. Select **IBM ServeRAID Controller (NT 4.0)**; then, press Enter. A message similar to the following will appear: `Setup is loading files (IBM ServeRAID Controller (NT 4.0))...`
7. When prompted, press Enter to continue.
8. Use the instructions provided in the Windows NT manual to complete the normal installation process.
9. After you complete the installation, be sure to apply the latest Service Pack.

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

1. Insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
2. From the Start Menu, select Settings; then, select Control Panel.
3. Select SCSI Adapter; then, click on the Drivers tab.
4. Click on Add; then, click on Have Disk.
5. In the Copy manufacturer's files from field, type:

   `z:\programs\winnt\driver\nt4_0`

   where *z* is the drive letter for the CD-ROM.
6. Click **OK**; then in the next dialog box, click **OK** again.
7. After the device driver installs, restart the system.

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

Installing the files while installing NetWare 4.x or 5.0:

1. Use the instructions provided in the NetWare manual to begin the installation.
2. When the `Choose the Server Drivers - Disk Driver` prompt appears during the install process, insert the *IBM ServeRAID Device Driver Diskette*.
3. Click **Select additional or modify selected Disk/LAN drivers**.
4. If IPSRAID appears, select **Deselect a selected driver**.
5. Click **Select an additional driver**; then, press the **Ins** (Insert) key to add an unlisted new device driver.
6. Press **F3** to specify a path; then,

   For NetWare 4.x, type:

   `a:\netware4`

   where *a* is the diskette drive letter

   For NetWare 5.0, type:

   `a:\netware5`

   where a is the diskette drive letter

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

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

8. Click **OK** to overwrite the existing files.
9. Follow the instructions in the NetWare manual to complete the installation.

Installing the files after installing NetWare 4.x or 5.0

> **Note**
>
> If the device driver is already installed and the operating system is installed on the ServeRAID controller, do the following before starting this procedure:
>
> 1. Type:
>
>   `Unload IPSRAID`
>
> 2. Press Enter; then, go to step 1 in the following instructions.

To install the files after installing NetWare 4.x or 5.0, do the following:

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

   `load install`

2. Press Enter.

3. Insert the *IBM ServeRAID Device Driver Diskette* into the diskette drive or insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
4. Click **Driver options** from the Installation Options list.
5. Click **Configure disk and storage** from the Driver Options pop-up window.
6. Select **Select an additional driver** from the Additional Drivers Actions pop-up window.
7. When the next screen appears, press the **Ins** key to install an unlisted driver.
8. When the next screen appears, press the **F3** key to specify a different path.
9. In the **Specify a directory path** field:
   - For NetWare 4.x: If you are installing from diskette, type:

     `a:\netware4`

     where *a* is the diskette drive letter.
   - For NetWare 4.x: If you are installing from CD-ROM, type:

     `d:\programs\netware\driver\netware4`

     where *d* is the CD-ROM drive letter.
   - For NetWare 5.0: If you are installing from diskette, type:

     `a:\netware5`

     where *a* is the diskette drive letter.
   - For NetWare 5.0: If you are installing from CD-ROM, type:

     `d:\programs\netware\driver\netware5`

     where *d* is the CD-ROM drive letter.
10. When prompted to select a device driver to install, select **IPSRAID.HAM**.
11. Select **Yes** when prompted to copy the IPSRAID.HAM driver.
12. When the prompt appears to specify the server boot path, type:

    `c:\nwserver`

    > **Notes**
    >
    > - This instruction assumes that you installed NetWare in its default directory. If you did not install NetWare in the NWSERVER directory on drive C, modify step 12 accordingly.
    > - If any of the files you are installing already exist on the server, NetWare will prompt you to save the older files. Although it is not necessary to save the older files, it might be useful to do so.

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

ServeRAID 3H, 3HB, 3L Adapters/Controllers   **123**

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

> **Note**
>
> If the device driver is not installed already and the operating system is installed on the ServeRAID controller, an error message stating that the device driver failed to load should appear after you did the previous step. If that happens, do the following:
>
> 1. Do step 15.
> 2. Shut down the server.
> 3. Restart the server by typing the following at the system prompt:
>
>    ```
>    server
>    ```
>
> 4. The device driver loads.

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

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

Installing device drivers for Linux 2.2.x (or later)

This section provides instructions for installing the ServeRAID device driver from CD-ROM and diskette. You can install the device driver if Linux is already installed or when updating a previous device driver.

Installing the files from CD-ROM after installing Linux:

Before proceeding, you must have already installed a Linux distribution onto your system. This set of instructions assumes you already have a Linux system installed and want to add a ServeRAID to your system.

1. Insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
2. Type:

   ```
   mount -t iso9660 /dev/cdromdevicefile /mnt
   ```

   where *cdromdevicefile* is the specific device file for the CD-ROM block device. Typically this is /dev/cdrom.
3. Press Enter; then, type:

   ```
   cd /usr/src
   patch -p0 < /mnt/programs/linux/driver/ips-patch
   ```

4. Unmount the CD-ROM:

```
umount /mnt
```

5. Reconfigure and recompile your kernel.

> **Note**
>
> See the Linux Kernel-HOWTO for more
> information on configuring and recompiling your
> kernel.

Updating the files from the CD-ROM after

installing Linux: Before proceeding, you must have
already installed a Linux distribution onto your system and
have previously patched the ServeRAID driver into your
kernel.

1. Insert the *IBM ServeRAID Support CD* into the
   CD-ROM drive.
2. Type:

   ```
   mount -t iso9660 /dev/cdromdevicefile /mnt
   ```

   where *cdromdevicefile* is the specific device file for
   the CD-ROM block device. Typically this is
   /dev/cdrom.
3. Press Enter; then, type:

   ```
   cd /usr/src/linux
   cp /mnt/programs/linux/driver/ips.c drivers/scsi
   cp /mnt/programs/linux/driver/ips.h drivers/scsi
   ```

4. Unmount the CD-ROM:

   ```
   umount /mnt
   ```

5. Reconfigure and recompile your kernel.

> **Note**
>
> See the Linux Kernel-HOWTO for more
> information on configuring and recompiling your
> kernel.

Installing the files from diskette after

installing Linux: Before proceeding, you must have
already installed a Linux distribution onto your system.
This set of instructions assumes you already have a Linux
system installed and want to add a ServeRAID to your
system.

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

   ```
   mount -t msdos -o conv=auto
   /dev/diskettedevicefile /mnt
   ```

   where *diskettedevicefile* is the specific device file for
   the diskette block device. Typically this is /dev/fd0.
3. Press Enter; then, type:

   ```
   cd /usr/src
   patch -p0 < /mnt/linux/ips-patch
   ```

4. Unmount the diskette drive:

   umount /mnt

5. Reconfigure and recompile your kernel.

   > **— Note —**
   >
   > See the Linux Kernel-HOWTO for more
   > information on configuring and recompiling your
   > kernel.

Updating the files from diskette after

installing Linux: Before proceeding, you must have
already installed a Linux distribution onto your system.
This set of instructions assumes you already have a Linux
system installed and want to add a ServeRAID to your
system.

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

   mount -t msdos -o conv=auto
   /dev/diskettedevicefile /mnt

   where *diskettedevicefile* is the specific device file for
   the diskette block device. Typically this is /dev/fd0.
3. Press Enter; then, type:

   cd /usr/src/linux
   cp /mnt/linux/ips.c drivers/scsi
   cp /mnt/linux/driver/ips.h drivers/scsi

4. Unmount the diskette drive:

   umount /mnt

5. Reconfigure and recompile your kernel.

   > **— Note —**
   >
   > See the Linux Kernel-HOWTO for more
   > information on configuring and recompiling your
   > kernel.

Installing device drivers for OS/2

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

Installing the files while installing OS/2:   You can
use the following instructions to install the ServeRAID
device driver files while installing OS/2 Warp Server.

> **Note**
>
> - If the battery-backup option is not installed and any logical drives are set to write-back mode, the logical drives must be changed to write-through mode during the OS/2 installation. After the installation is complete, the logical drives can be changed to write-back mode.
> - When booting the OS/2 Diskette 1 in Drive A after the Logo Screen appears and the "Please Wait" messages, you might receive the following message:
>
>   ```
>   * Initializing Raid SCSI Subsystem.
>   * Unable to allocate IRQ resources.
>   * RMCreate Device Adapter failure.
>   * RMCreate Device (disk) failure.
>   * RMCreate Device (disk) failure.
>   * RMCreate Device (disk) failure.
>   * RMCreate Device (disk) failure.
>   ```
>
> If you receive these messages, disregard them during installation. The installation will complete successfully. After the installation completes, install an updated RESOURCE.SYS file that is available from the OS/2 Device Driver Pak *On-Line* Web site at the following address:
>
> `http://service.software.ibm.com/os2ddpak/index.htm`
>
> At this Web site, follow these steps to obtain the updated RESOURCE.SYS file:
>
> - Scroll down to the bottom and click **Yes, I agree. Show the Device Category list**.
> - Scroll down and select **OS/2 Component Updates** from the list.
> - Select **OS/2 Base Device Driver Updates**.
> - Select **RESOURCE.SYS update; pre-requisite for updated IBM RAID Driver**.
> - Follow the instructions at the Web site for installing the RESOURCE.SYS update after you have installed OS/2.

To install the ServeRAID files while installing OS/2:

1. Make a copy of the *OS/2 Warp Diskette 1* and label it *Copy of OS/2 Diskette 1*.
2. Copy the IPSRAID.ADD file from the OS2 directory on the *IBM ServeRAID Device Driver Diskette* to the *Copy of OS/2 Diskette 1*.

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

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

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

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

4. Install OS/2, but when you are prompted to insert
   diskette 1, use the updated *Copy of OS/2 Diskette 1*.
5. After you complete the OS/2 installation, insert the
   IBM ServeRAID Device Driver Diskette.
6. From an OS/2 window, type:

   ```
   a:
   ```

   where *a* is the drive letter for the diskette drive that
   contains the ServeRAID diskette.

7. Press Enter; then, type:

   ```
   ddinstal
   ```

8. Press Enter. The OS/2 Device Driver Installation
   window opens.
9. In the **Source** field type a: (a: is the letter of the
   diskette drive where the *IBM ServeRAID Device
   Driver Diskette* is located). In the **Destination** field,
   type the full path where you want the device driver
   files to be copied.
10. Click **Install**. The program copies the IPSRAID.ADD
    ServeRAID device driver to the OS/2 subdirectory on
    your hard disk.
11. Edit the CONFIG.SYS file and verify that there is only
    one copy of the line BASEDEV=IPSRAID.ADD.

    > **Note**
    >
    > • If you have more than one ServeRAID or
    >   SCSI adapter in your system, make sure
    >   that the BASEDEV statement for the adapter
    >   or controller controlling the startup (boot)
    >   device appears first in the CONFIG.SYS file
    >   before the BASEDEV statements for other
    >   ServeRAID or SCSI adapters.
    > • After you install any service packs, check
    >   the path for the IPSRAID.ADD device driver
    >   and verify that the correct device driver is
    >   installed.

12. Restart the server.

Installing the files after installing OS/2: You
can use the following instructions to install the ServeRAID
device driver files after installing OS/2 Warp Server.

To install the ServeRAID files after installing OS/2:

1. After you complete the OS/2 installation, insert the
   IBM ServeRAID Device Driver Diskette.
2. From an OS/2 window, type:

   `a:`

   where *a* is the letter for the diskette drive that
   contains the ServeRAID diskette.
3. Press Enter; then, type:

   `ddinstal`

4. Press Enter. The OS/2 Device Driver Installation
   window will appear and prompt you for the source
   and destination drives. The source directory shows
   where to insert the *IBM ServeRAID Device Driver
   Diskette*. The destination directory shows where the
   program will copy the device driver files.
5. Click **Install**.
   - The program copies the following ServeRAID
     device driver statement to your CONFIG.SYS
     file: BASEDEV=IPSRAID.ADD
   - The program copies the IPSRAID.ADD
     ServeRAID device driver to the OS/2
     subdirectory on your hard disk.
6. Edit the CONFIG.SYS file and verify that there is only
   one copy of the line BASEDEV=IPSRAID.ADD.

   ┌─ **Notes** ──────────────────────────────┐
   │   │
   │ - If you have more than one ServeRAID or │
   │   SCSI adapter in your system, make sure │
   │   that the BASEDEV statement for the adapter │
   │   or controller controlling the startup (boot) │
   │   device appears first in the CONFIG.SYS file │
   │   before the BASEDEV statements for other │
   │   ServeRAID or SCSI adapters.   │
   │ - After you install any service packs, check │
   │   the path for the IPSRAID.ADD device driver │
   │   and verify that the correct device driver is │
   │   installed.   │
   └──┘

7. Restart the server.

```
┌─── Notes ──────────────────────────┐
│                                    │
│  When booting OS/2 after installing the new │
│  ServeRAID device driver, you might receive the │
│  following messages:               │
│                                    │
│  * Initializing Raid SCSI Subsystem. │
│  * Unable to allocate IRQ resources. │
│  * RMCreate Device Adapter failure. │
│  * RMCreate Device (disk) failure. │
│  * RMCreate Device (disk) failure. │
│  * RMCreate Device (disk) failure. │
│  * RMCreate Device (disk) failure. │
│                                    │
│  If you receive these messages, install an updated │
│  RESOURCE.SYS file that is available from the │
│  OS/2 Device Driver Pak On-Line Web site at the │
│  following address:                │
│                                    │
│  http://service.software.ibm.com   │
│  /os2ddpak/index.htm               │
│                                    │
│  At this Web site,  follow these steps to obtain the │
│  updated RESOURCE.SYS file:        │
│                                    │
│   •  Scroll down to the bottom and click Yes, I │
│      agree. Show the Device Category list. │
│   •  Scroll down and select OS/2 Component │
│      Updates from the list.        │
│   •  Select OS/2 Base Device Driver Updates. │
│   •  Select RESOURCE.SYS update;   │
│      pre-requisite for updated IBM RAID │
│      Driver.                       │
│   •  Follow the instructions at the Web site for │
│      installing the RESOURCE.SYS update after │
│      you have installed OS/2.      │
│                                    │
└────────────────────────────────────┘
```

Installing device drivers for OpenServer

Before you begin the installation, review the following
information:

- You must install logical drives as Bus Number 0 when
  using the MKDEV program, regardless of the channel
  that the physical drives are on.
- You must install a nondisk device, such as a
  CD-ROM or tape drive, as Bus Number 1, 2, or 3
  relative to the channel to which it is attached.
  External Channel 1 connector is Bus Number 1,
  external Channel 2 connector is Bus Number 2, and
  internal Channel 3 connector is Bus Number 3.

To configure the default nondisk devices during the initial
installation:

1. Redefine the default tape drive in the initial boot
   string. For example, to install the boot-time loadable
   driver IPSRAID BTLD and redefine the tape drive, go
   to the BOOT prompt and type:

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

The numbers in parentheses represent the host adapter number, the bus number, the SCSI ID, and the LUN respectively.

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

Adding IPSRAID BTLD at startup time: To install the ServeRAID device driver for OpenServer 5.0.x

1. At the BOOT prompt, type:

   `link`

2. Press Enter; then, when prompted for the name of the package, type:

   `ipsraid`

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

   While the installation program copies the files, one or both of the following messages might appear:
   - `Extracting BTLD distribution for ipsraid...` `/etc/uadmin getdev b ips: No such device (error 19)`
   - `dynamic linker: dlvr_audit: Cannot open /dev/zero for file /lib/libprot.so.1`

   You can ignore the first message, no action is required. But if the second message appears, you must press Enter when prompted to continue the installation.
5. Keep the *IBM ServeRAID Device Drivers for SCO Operating Systems Diskette* available. You will need it to configure the device driver into the link kit.

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

Adding IPSRAID BTLD after the initial installation

1. Start the server in system maintenance mode, and log in as ROOT.
2. Type:

   `installpkg`

3. Press Enter; then, select the diskette drive in which you will insert your installation diskette.
4. When prompted, insert the *IBM ServeRAID Device Drivers for SCO Operating Systems Diskette*.
5. When prompted for the name of the package, type:

   `ipsraid`

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

```
cd /etc/conf/cf.d
```

7. Press Enter; then type:

```
./link_unix
```

8. Press Enter.
9. After the kernel rebuilds, the following message appears:

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

   To continue, type y

   The system backs up the old kernel by moving /unix to /unix.old.
10. When the system asks for the kernel environment to be rebuilt, type y

    The system will respond with a message.
11. *Shut down* the system; then, *Restart* the system.

Using an IDE CD-ROM drive to install

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

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

1. Type the following at the BOOT prompt:

   ```
   restart ahslink="ATAPI ipsraid" Srom=wd(0,0,0,0)
   ```

2. Insert the ATAPI BTLD diskette when prompted; then, press R to replace the WD driver.

   The fields for the ATAPI CDROM are:

   Srom=wd(*c,d,l,b*) where:
   > c = primary (0) or secondary (1) IDE/EIDE controller
   > d = master (0) or slave (1) device
   > l = LUN of device (always 0 with ATAPI or wd driver)
   > b = BUS of device (always 0 with ATAPI or wd driver)

Installing the files for OpenServer 5.0.2 and

5.0.4: To install files for OpenServer 5.0.2 or 5.0.4 using an IDE CD-ROM drive:

1. Type the following at the BOOT prompt:

   ```
   restart link=ipsraid Srom=wd(0,0,0,0)
   ```

   Note

   The ATAPI BTLD (which includes the WD driver) is included in OpenServer 5.0.2 and 5.0.4.

   The fields for the ATAPI CDROM are:

   Srom=wd(*c,d,l,b*) where:

    c = primary (0) or secondary (1) IDE/EIDE
    controller
    d = master (0) or slave (1) device
    l = LUN of device (always 0 with ATAPI or WD
    driver)
    b = BUS of device (always 0 with ATAPI or WD
    driver)

2. Let the system start normally until it comes to the
   select Media options.
   - If you are using OpenServer 5.0.2, go to step 3.
   - If you are using OpenServer 5.0.4, go to step 4.
3. To install with OpenServer 5.0.2:
   a. Click Adapter type as **WD**.
   b. Click Media Type as **SCSI CDROM**.
   c. Click ID, BUS and LUN as **0**.
4. To install with OpenServer 5.0.4:
   a. Select Media Type as **IDE CDROM Drive**.
   b. Select **Primary Adapter** and **Master Device**.

Installing device drivers for UnixWare

The instructions that you use for installing the ServeRAID
files when using UnixWare depend on the number of IDE
and SCSI disk-storage adapters and controllers installed in
the system. If all of the direct-access-storage devices
(DASD) in the system are attached to a single disk-storage
adapter or controller (such as the ServeRAID
adapter/controller), you can skip the instructions in this
section and go directly to "Installing the files while installing
UnixWare" on page 137 or "Installing the files after
installing UnixWare" on page 137.

If you are attaching devices to multiple disk-storage
adapters or controllers (including IDE and SCSI controllers
integrated on the system board), use the following
instructions. If you are not using multiple disk-storage
adapters and controllers go to "Installing the files while
installing UnixWare" on page 137.

- If you are installing UnixWare on a drive attached to a
  ServeRAID adapter/controller, follow the instructions
  in "Installing UnixWare on a ServeRAID drive."
- If you are installing UnixWare on a drive attached to a
  non-ServeRAID adapter or controller and you intend
  to store only data on the drives attached to your
  ServeRAID controllers, follow the instructions in
  "Installing UnixWare on a non-ServeRAID drive" on
  page 135.

Installing UnixWare on a ServeRAID drive:

Use the following instructions if you are using multiple
disk-storage adapters or controllers and you are installing
UnixWare on a drive attached to a ServeRAID
adapter/controller. If you not using multiple disk-storage
adapters and controllers, go to "Installing the files while
installing UnixWare" on page 137.

1. Install all ServeRAID controllers that you intend to use in your system.
2. Using the ServeRAID Manager Program, create all of your arrays and define all of your logical drives.
3. Make a list of all of the ServeRAID controllers, including the order and slot number, installed in the system. To do this:
   a. Turn on the server.
   b. If the ServeRAID Mini-Configuration prompt appears, press **Ctrl+I**. When a system contains more than one ServeRAID controller, a selection window appears.
   c. The menu lists the ServeRAID controllers in order. Select the first ServeRAID adapter/controller from the menu.
   d. Select **Advanced Functions** from the Main Menu.
   e. Select **View Controller and PCI Information** from the Advanced Functions menu.
   f. Record the slot number for the ServeRAID adapter/controller; then, press **Esc** three times to return to the controller-selection window.
   g. Repeat step 3c through step 3f until you record the slot number for each ServeRAID adapter/controller that appears on the selection screen.
4. Turn off the system; then, remove all ServeRAID controllers except the first one on your list.

> **Note**
>
> If one of the ServeRAID controllers that you need to remove is on the system board, you must do one of the following:
>
> - If the CD-ROM drive that you are using to install your operating system is attached to the integrated ServeRAID controller, disconnect or remove all disk drives attached to the integrated controller.
> - If only disk drives are attached to the integrated controller, disconnect the SCSI cable from the ServeRAID connector on the system board. See the label inside the server cover for the location of the ServeRAID connector.

5. Remove all other non-ServeRAID IDE and SCSI disk-storage adapters or controllers.

> **Note**
>
> If one of the disk-storage controllers that you
> need to remove is on the system board, you
> must do one of the following:
>
> - If the CD-ROM drive that you are using to
>   install your operating system is attached to
>   the integrated disk-storage controller,
>   disconnect or remove all disk drives
>   attached to the integrated controller.
> - If only disk drives are attached to the
>   integrated controller, disconnect the cable
>   for the integrated controller from the IDE or
>   SCSI connector on the system board. See
>   the label inside the server cover for the
>   location of the IDE or SCSI controller
>   connector.

6. Follow the instructions in "Installing the files while
   installing UnixWare" on page 137; then, return here
   and continue with step 7.
7. Turn off the system.
8. Install any non-ServeRAID disk-storage adapters or
   controllers in the server; then, attach the drives to the
   disk-storage adapters and controllers.
9. Install the second ServeRAID adapter/controller from
   the list you created in step 3f on page 134; then,
   attach the drives to the ServeRAID adapter/controller.
10. Turn on the system and allow UnixWare to discover
    the new disk-storage adapters and controllers.
11. Turn off the system.
12. Repeat steps 9, 10, and 11 until all ServeRAID
    adapters, ServeRAID controllers, and drives are
    installed.
13. You can now partition and format the logical drives
    attached to the additional ServeRAID adapters and
    controllers. See the information provided with
    UnixWare for more instructions.

Installing UnixWare on a non-ServeRAID

drive: Use the instructions in this section if you are
using multiple disk-storage adapters or controllers, you are
installing UnixWare on a drive attached to a
non-ServeRAID adapter or controller, and you intend to
store only data on the drives attached to your ServeRAID
adapters and controllers.

1. Install all ServeRAID controllers that you intend to use
   in your system.
2. Using the ServeRAID Manager Program, create all of
   your arrays and define all of your logical drives.
3. Make a list of all of the ServeRAID controllers,
   including the order and slot numbers, installed in the
   system. To do this:
   a. Turn on the server.

b. When the ServeRAID Mini-Configuration prompt appears, press **Ctrl+I**. When a system contains more than one ServeRAID controller, a selection screen appears.

c. The menu lists the ServeRAID controllers in order. Select the first ServeRAID adapter/controller from the menu.

d. Select **Advanced Functions** from the Main Menu.

e. Select **View Controller and PCI Information** from the Advanced Functions menu.

f. Record the slot number for the ServeRAID adapter/controller; then, press **Esc** three times to return to the controller-selection screen.

g. Repeat step 3c through step 3f until you record the slot number for each ServeRAID adapter/controller that appears on the selection screen.

4. Turn off the system; then, remove all ServeRAID, IDE, and SCSI disk-storage adapters and controllers except the one attached to the drive where you intend to install UnixWare.

> **Note**
>
> If one of the disk-storage or ServeRAID controllers that you need to remove is on the system board, do one of the following:
>
> - If the CD-ROM drive that you are using to install your operating system is attached to the integrated controller, disconnect or remove all disk drives attached to the integrated controller.
> - If only disk drives are attached to the integrated controller, disconnect the SCSI or IDE cable for the integrated controller from the connector on the system board. See the label inside the server cover for the location of the SCSI and IDE cable connectors.

5. Follow the instructions in "Installing the files while installing UnixWare" on page 137; then, return here and continue with step 6.

6. Turn off the system.

7. Install any non-ServeRAID disk-storage adapters or controllers in the server; then, attach the drives to the disk-storage adapters and controllers.

8. Install the first ServeRAID adapter/controller from the list you created in step 3f; then, attach the drives to the ServeRAID adapter/controller.

9. Turn on the system and allow UnixWare to discover the new disk-storage adapters and controllers.

10. Turn off the system.

11. Repeat steps 8, 9, and 10 until all ServeRAID adapters, ServeRAID controllers, and drives are installed.
12. You can now partition and format the logical drives attached to the ServeRAID adapters and controllers. See the information provided with UnixWare for more instructions.

Installing the files while installing

UnixWare: To install the ServeRAID files while installing UnixWare 7.x:

1. Use the instructions provided with UnixWare to begin the installation.
2. When a message appears asking if you want to install any HBA diskettes, insert the *IBM ServeRAID Device Drivers for SCO Operating Systems Diskette*; then, select **Install HBA diskette**.
3. Use the instructions provided in the UnixWare manual to complete the normal installation process.

Installing the files after installing

UnixWare: Use the following instructions to install the ServeRAID files after you install UnixWare, or use these instructions to update a previously installed ServeRAID file with a newer version. You can use the UnixWare Pkgadd or the UnixWare SCOAdmin utility program to install the files.

Installing an HBA diskette file using Pkgadd

1. Insert the *IBM ServeRAID Device Drivers for SCO Operating Systems Diskette* into the diskette drive.
2. Type:

   `pkgadd –d /dev/dsk/f0t`

3. Press Enter.
4. When the message `Insert diskette into Floppy Drive 1` appears, press Enter.
5. When the message `Installation of IBM ServeRAID SCSI IHV HBA (ips) was successful` appears, type:

   `q`

6. Press Enter; then after the device driver is installed, restart the system.

Installing an HBA diskette file using SCOAdmin

1. Insert the *IBM ServeRAID Device Drivers for SCO Operating Systems Diskette* into the diskette drive.
2. Start the SCOAdmin utility program by typing `SCOADMIN` at the system prompt.
3. Select **Software_Management**.
4. Select **Application Installer**.
5. Click the **Install From** tab.
6. Select **Disk_A**.

7. Click **Update View** button if nothing appears in the window.
8. When the icon labeled **ips** appears in the window, click **Install**.
9. After the device driver is installed, restart the system.

Installing the IPSSEND and IPSMON command-line programs

IPSSEND and IPSMON are advanced command-line programs that you can use to manage your ServeRAID controllers. These utility programs are provided on the *IBM ServeRAID Command Line Programs Diskette* and the *IBM ServeRAID Support CD*. See "IBM ServeRAID Support CD and diskettes" on page 112.

You can use the IPSSEND program to view the configuration of a ServeRAID controller, initialize logical drives, synchronize logical drives, and perform other functions.

You can use the IPSMON program to monitor a ServeRAID controller for defunct drives, Predictive Failure Analysis® (PFA) warnings, rebuild operations, FlashCopy operations, synchronizations, and logical-drive migrations. This program can log a message to the monitor, to a file, or to both the monitor and a file whenever activities occur.

You can use the IPSSEND and IPSMON programs with the following operating systems:

- Microsoft Windows NT
- Novell NetWare 4.x and 5.0
- IBM OS/2 Warp Server
- Linux 2.2.x or later
- SCO OpenServer 5.0.x
- SCO UnixWare 7.0

You also can use the IPSSEND program with DOS, but DOS requires the ServeRAID ASPI Manager. If you boot the *IBM ServeRAID Command Line Programs Diskette*, the ASPI Manager is automatically started.

Installing IPSSEND and IPSMON for Windows NT, NetWare, or OS/2

To install these programs for Windows NT, NetWare, or OS/2:

1. Start the server.
2. After the operating system starts, insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
3. If you are using NetWare, go to step 5. If you are using Windows NT or OS/2, create an IPSADM directory on your hard disk. To do this, go to the operating system command prompt and type:

   ```
   md c:\ipsadm
   ```

   where *c* is the drive letter of the drive where OS/2 or Windows NT is installed.
4. Press Enter.
5. Copy the IPSSEND.EXE file to your hard disk drive by typing one of the following at the command prompt:

- For Windows NT, type on one line:

  ```
  copy z:\programs\winnt\cmdline
  \ipssend.exe c:\ipsadm
  ```

- For NetWare, from a DOS prompt type on one line:

  ```
  copy z:\programs\netware\cmdline
  \ipssend.nlm c:\nwserver
  ```

- For OS/2, type on one line:

  ```
  copy z:\programs\os2\cmdline\
  ipssend.exe c:\ipsadm
  ```

  > **Note**
  >
  > - Where *z* is the drive letter for the CD-ROM drive that contains the *IBM ServeRAID Support CD* and *c* is the drive letter where Windows NT, NetWare, or OS/2 is installed.
  > - These instructions assume that you installed NetWare in the NWSERVER directory.

6. Press Enter; then, copy the IPSMON.EXE file to your hard disk drive by typing one of the following at the command prompt:

   - For Windows NT, type on one line:

     ```
     copy z:\programs\winnt\cmdline\
     ipsmon.exe c:\ipsadm
     ```

   - For NetWare, from a DOS prompt type on one line:

     ```
     copy z:\programs\netware\cmdline
     \ipsmon.nlm c:\nwserver
     ```

   - For OS/2, type on one line:

     ```
     copy z:\programs\os2\cmdline
     \ipsmon.exe c:\ipsadm
     ```

     > **Note**
     >
     > - Where *z* is the drive letter for the CD-ROM drive that contains the *IBM ServeRAID Support CD* and *c* is the drive letter of the drive where Windows NT, NetWare, or OS/2 is installed.
     > - These instructions assume that you installed NetWare in the NWSERVER directory.

7. Press Enter; then, refer to "Running the IPSSEND program" on page 66 for information to start and use the IPSSEND and IPSMON programs.

Installing IPSSEND and IPSMON for Linux

To install these programs for Linux 2.2.x (and later):

1. Start the server.

2. After the operating system starts, insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
3. Mount the CD by typing the following at the console:

   ```
   mount -t iso9660 -o ro /dev/cd0 /mnt
   ```

   > **Note**
   >
   > - where /dev/cd0 is the specific device file for the CD-ROM block device. If you have more than one CD-ROM, you must replace /dev/cd0 with the specific name of the CD-ROM you want to use.
   > - If you currently have another device mounted on /mnt, you must create a new directory and substitute its name for /mnt in these instructions.

4. Press Enter; then, type:

   ```
   cp /mnt/programs/linux/cmdline
   /ipssend /usr/bin

   cp /mnt/programs/linux/cmdline
   /ipsmon /usr/bin
   ```

5. Press Enter; then, type:

   ```
   chmod 700 /usr/bin/ipssend
   chmod 700 /usr/bin/ipsmon
   ```

6. Press Enter; then, unmount the CD-ROM by typing the following:

   ```
   umount /mnt
   ```

7. Press Enter. You can now remove the CD from the CD-ROM drive.
8. Refer to "Running the IPSSEND program" on page 66 for information to start and use the IPSSEND and IPSMON programs.

Installing IPSSEND and IPSMON for OpenServer

To install these programs for OpenServer 5.0.x:

1. Start the server.
2. After the operating system starts, insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
3. Mount the CD by typing the following at the console:

   ```
   mount -f ISO9660 -o ro,lower /dev/cd0 /mnt
   ```

> **Note**
> - where /dev/cd0 is the specific device file for the CD-ROM block device. If you have more than one CD-ROM, you must replace /dev/cd0 with the specific name of the CD-ROM you want to use.
> - If you currently have another device mounted on /mnt, you must create a new directory and substitute its name for /mnt in these instructions.

4. Press Enter; then, type:

   ```
   cp /mnt/programs/openserv/cmdline/ipssend /usr/bin
   cp /mnt/programs/openserv/cmdline/ipsmon /usr/bin
   ```

5. Press Enter; then, type:

   ```
   chmod 700 /usr/bin/ipssend
   chmod 700 /usr/bin/ipsmon
   ```

6. Press Enter; then, unmount the CD-ROM by typing the following:

   ```
   umount /mnt
   ```

7. Press Enter. You can now remove the CD from the CD-ROM drive.
8. Refer to "Running the IPSSEND program" on page 66 for information to start and use the IPSSEND and IPSMON programs.

Installing IPSSEND and IPSMON for UnixWare

To install these programs for UnixWare 7.0:

1. Start the server.
2. After the operating system starts, insert the *IBM ServeRAID Support CD* into the CD-ROM drive.
3. Mount the CD by typing the following at the console:

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

   > **Note**
   > - where *cdromdevicefile* is the specific device file for the CD-ROM block device. Look in the /dev/cdrom directory to determine what *cdromdevicefile* is on your server, for example, c0b0t010.
   > - If you currently have another device mounted on /mnt, you must create a new directory and substitute its name for /mnt in these instructions.

4. Press Enter; then, type:

   ```
   cp /mnt/programs/unixware/cmdline/ipssend /usr/bin
   cp /mnt/programs/unixware/cmdline/ipsmon /usr/bin
   ```

5. Press Enter; then, type:

```
chmod 700 /usr/bin/ipssend
chmod 700 /usr/bin/ipsmon
```

6. Press Enter; then, unmount the CD-ROM by typing
   the following:

   ```
   umount /mnt
   ```

7. Press Enter. You can now remove the CD from the
   CD-ROM drive.
8. Refer to "Running the IPSSEND program" on
   page 66 for information to start and use the
   IPSSEND and IPSMON programs.

Installing IPSSEND for IBM DOS

To install IPSSEND for DOS you must download the
diskette image from the World Wide Web:

1. Go to the IBM Support Web site at the following
   address:

   ```
   www.ibm.com/pc/support/
   ```

2. Select **Server** from the **Select a Brand** list box. The
   IBM Netfinity and PC Server Support page appears.
3. Select **ServeRAID** from the **Select a Family** list box.
   The ServeRAID Support page appears.
4. Click **Downloadable Files**. The list of downloadable
   files appears.
5. Click **ServeRAID - version 3.60 [operating system
   of your choice] Updates**. The ServeRAID Update
   page for your chosen operating system appears.
6. Download the *IBM ServeRAID Command Line
   Programs Diskette version 3.60* and *IBM ServeRAID
   Command Line Programs Readme version 3.60* files.
7. Follow the directions in the Readme file for creating
   the diskette and installing the IPSSEND for IBM DOS
   command line program.

Installing the ServeRAID 3 controller

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

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

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

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

2. If your server model does not support hot-swap PCI, turn off the server; then, disconnect all power cords and cables from the server.
3. Remove the server cover and locate an empty PCI expansion slot for the controller. Choose a slot with the most clearance from any other installed components, such as the microprocessor. If necessary, see your server documentation for more detailed information about the expansion slots.

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

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

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

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

10. Connect one end of a 68-pin ANSI2[00] standard cable (separately purchased or already in your server) to the internal channel connector on the ServeRAID controller.

> **Note**
>
> See "Connector locations" on page 146 for the channel connector locations.

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

> **Note**
>
> When the ServeRAID controller and a SCSI CD-ROM drive are connected to the same SCSI bus (cable), you must enable the ServeRAID bootable (startable) CD-ROM feature before the controller can start a bootable CD-ROM. See "Setting the Bootable CD-ROM feature" on page 194 for more information.

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

> **Note**
>
> * The ServeRAID controllers use SCSI ID 7.
> * Removable-media devices (such as a CD-ROM) connected to the same ServeRAID controller must all have unique SCSI IDs, even when they are connected to different channels. For example, if you have a CD-ROM drive on Channel 1 set to SCSI ID 6, you must not have a tape drive on Channel 2 or Channel 3 of the same ServeRAID controller set to SCSI ID 6.

13. Install the server cover.

14. If you disconnected the cables and power cords in step 2 on page 144, reconnect the cables and cords. See your server documentation if you need detailed instructions.

15. If you want to attach an external SCSI device to the ServeRAID controller, continue with "Connecting external devices" on page 146. Otherwise, go to

"Configuring controllers using the ServeRAID
Manager Program" on page 93.

Connecting external devices

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

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

   > **Note**
   >
   > See "Connector locations" for the channel
   > connector locations.

2. Connect the other end of the SCSI cable to the
   external SCSI device.
3. Go to "Additional service information" on page 93.

Connector locations

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

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

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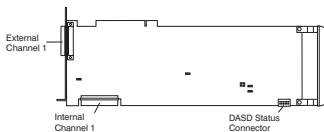attach devices to both connectors simultaneously.

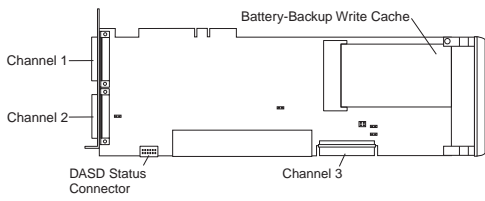*Figure 9. ServeRAID-3L Controller*

ServeRAID-3H and ServeRAID-3HB

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

> **Note**
>
> Only the ServeRAID-3HB controller comes with the
> battery-backup cache standard. It is an option for the
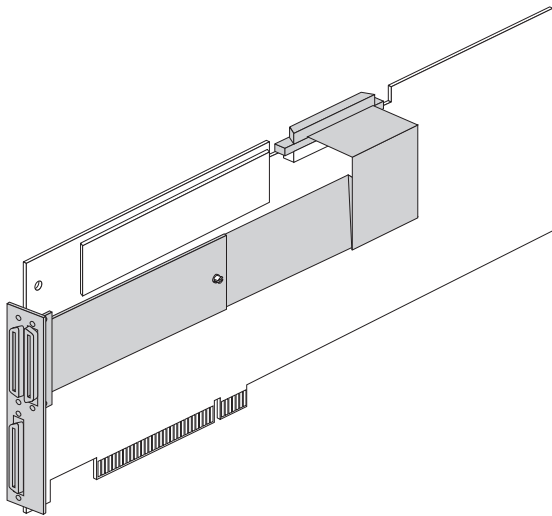> ServeRAID-3H.

Figure 10. ServeRAID-3H Controller

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

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

Figure 11. ServeRAID Controller with the Channel 3 Cable Installed

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

ServeRAID 3 Ultra2 SCSI Adapter/Controller error codes/messages

The error codes/messages are displayed on the screen in a line of text immediately after the adapter BIOS version.

If POST detects changes in the adapter configuration or detects an adapter hardware problem, messages appear on the screen. Refer to "POST (ISPR) error procedures" on page 150 and correct the problem.

If there is no POST Error or Configuration Error message, the BIOS screen resembles the sample shown below. Please note that your version may be different from the one shown.

```
                    ─────────────────
                       IBM ServeRAID BIOS
                     Copyright IBM Corp. 1995,1998
                       Ver: 3.00.12         08/14/1998

      «« Press Ctrl+I to access the Mini-Configuration Program. »»

  Initializing ServeRAID Controller 1 in Slot 1.
  Power-on self-test can take up to 59 Second(s) -- test Passed.
  Drive configuration can take up to 6 Minute(s) 0  Second(s) -- test Passed.
  ServeRAID Firmware Version:2.82.00
  No logical drives found; none are installed.
  Non-Disk SCSI Devices Found: CD-ROM 0, Tape 0, Removable-media 0, Other 1.

  BIOS not loaded no devices found - Installation stopped.

```

If there is a POST Error message, the BIOS screen resembles the sample shown below. Refer to "POST (ISPR) error codes" on page 150 and correct the problem. The characters *XXXX* indicate the POST (ISPR) error.

```
                    ─────────────────
                       IBM ServeRAID BIOS
                     Copyright IBM Corp. 1995,1998
                       Ver: 3.00.12         08/14/1998

     «« Press Ctrl+I to access the Mini-Configuration Program. »»
  Initializing ServeRAID Controller 1 in Slot 1.
  Power-on self-test can take up to 59 Second(s) -- test Failed.
  Controller is not responding properly - Run Diagnostics.
        Error Code: XXXX-YY

  BIOS not loaded no devices found - Installation stopped.

```

The BIOS screen below shows Configuration Status and/or Error information.

```
                     IBM ServeRAID BIOS
                 Copyright IBM Corp. 1995,1998
                 Ver: 3.00.12       08/14/1998

    «« Press Ctrl+I to access the Mini-Configuration Program. »»
Initializing ServeRAID Controller 1 in Slot 1.
Power-on self-test can take up to 59 Second(s) -- test Passed.
Drive configuration-can take up to 6 Minute(s) 0  Second(s) -- test Failed.
Controller POST and Config Error Codes: ISPR = EF10 BCS = 09 ECS = 20.
Following drives not responding(old state: new state: ch SID)
(RDY:EMP: 2:0)
The system has a configuration error due to above condition(s).

Press: F4  - Retry the command
       F5  - Update Controller configuration to exclude NON-RESPONDING drives
             Warning:NON-RESPONDING drives will be set to DDD, DHS, or EMP state
       F10 - Exit without change
```

> **Note**
>
> **Do not** replace a ServeRAID 3 Adapter or a system
> board containing an imbedded ServeRAID 3 controller
> for ServeRAID problems unless replacing the
> adapter/controller is listed in the Symptom-to-FRU
> Index.

POST (ISPR) error codes

The ISPR (Interrupt Status Port Register), BCS (Basic
Configuration Status), and ECS (Extended Configuration
Status) codes identify the adapter/controller state.

> **Note**
>
> **Do not** replace the ServeRAID 3 Adapter or an
> imbedded controller on a system board unless such a
> replacement is indicated in the recommended Actions
> in an error code list that appears in "Symptom-to-FRU
> index" on page 203.

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.

> **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.

1XXX (Microcode Checksum Error)

1. Replace the ServeRAID 3 Adapter/Controller.

2XXX thru 8XXX (RAID Controller Hardware or Firmware
Error)

1. Install download jumpers.
2. Flash the adapter/controller with the latest IBM ServeRAID 3 BIOS/Firmware from the IBM Website.
3. Remove the jumpers.
4. If the error persists, replace ServeRAID 3 Adapter/Controller.

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

1. Isolate between SCSI subsystem and adapter 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 adapter
   b. Replace the adapter/controller

   ---- **Note** -----------------------------------
   | 1. Refer to the HMM (Hardware Maintenance |
   | Manual) specific to the system comprising |
   | the SCSI channel for SCSI cable details. |
   | 2. 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 of the original ISPR code:
      - ISPR = B1xx = Channel 1
      - ISPR = B2xx = Channel 2
      - ISPR = B3xx = Channel 1 and 2
      - ISPR = B4xx = Channel 3
      - ISPR = B5xx = Channel 1 and 3
      - ISPR = B6xx = Channel 2 and 3
      - ISPR = B7xx = Channel 1, 2 and 3
      - ISPR = BFxx = Channel not identified
   b. Confirm that the channel(s) identified from the error in step 2a 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 above.

   f. Disconnect one drive at a time attached to the
      channel identified in step 2a then reboot to
      determine which drive is causing the error.

   g. Replace SCSI cable.

   h. Replace SCSI backplane.

EF10 (Default ISPR)

1. Adapter/controller is probably functioning properly.
   Do not replace adapter/system board unless you
   have run the adapter's diagnostics and you get an
   error message. If you do not get an error message,
   assume it is functioning properly.

2. Refer to "Basic and extended configuration status
   codes" on page 161. Note the resulting BCS and or
   ECS Error codes, and see the FRU actions respective
   to those codes. (EF10 is a default code for ISPR
   indicating that there is no ISPR error present.)

EFFE (Firmware code corrupted or download jumpers are
in place.)

1. Verify download jumpers are in their default locations.

2. If download jumpers are **not** in place and error still
   persists, then flash the adapter/controller firmware
   with the jumpers in place; then remove the jumpers.

3. If error persists after step 2, replace the adapter or
   the system board with integrated controller.

FFFF or other code not listed

1. Isolate between SCSI Subsystem and
   adapter/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
      1a.

> **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 1a and reboot each
      time to determine which drive is causing the
      problem.
   d. Replace SCSI Cable attached to channel
      identified in step 1a.
   e. Replace Backplane attached to channel
      identified in step 1a.
2. 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 adapter
- Replace the adapter/controller

ServeRAID 3 controller messages

This section lists the ServeRAID messages that might appear during system startup.

The ServeRAID controllers provide a Device Event Log that collects statistics on the number and types of events that occur on a selected hard disk drive. After correcting a problem with the disk array, clear the log so that you can identify any subsequent errors quickly. For information about clearing the event log, see "**eraseevent**" on page 81.

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

This section contains the following:

- "ServeRAID startup messages."
- "ServeRAID 3 ISPR error codes" on page 160.
- "Basic and extended configuration status codes" on page 161.

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

Notes

1. When the ServeRAID adapter/controller requires your input, a list of function keys will appear below the message.
2. Where the Action information tells you to start the IBM ServeRAID Configuration program, insert the *IBM ServeRAID Support CD* into the CD-ROM drive; then, restart the server. The Action column also provides general information about the message.
3. Where *SID* or *ch* appears in these messages, *sid* is the SCSI ID for the device, and *ch* is the channel to which the device is attached.
4. Where *m* or *n* appears in these messages, a number will appear in the actual message.

Following are messages associated with the ServeRAID subsystem.

A new drive was installed.

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

x new Ready drives found
where *x* is the number of Ready drives found.

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

Auto rearrange.

Explanation: Auto rearrange is enabled or disabled.

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

Configured drives are missing.

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

x Online drives not responding
where *x* is the number of drives not responding.

Example of a possible message:

```
Online Drive on Channel 3 SCSI ID 3 is not responding.
```

Action: Press one of the following keys:

F2 Detailed description. Press this key for a detailed description of the problem, such as the example message message above.

F4 Retry. Press this key after correcting a problem. For example, press F4 after you turn on the external storage enclosure that contains the physical drive.

F5 Change the configuration and set the drives to Defunct. Press this key to accept the new state that the ServeRAID adapter/controller will assign to the drive. For example, the ServeRAID adapter/controller will assign the drive a state of Defunct (DDD) or Empty (EMP).

You can also press F5 when you must remove a drive. RAID level-1 and RAID level-5 logical drives are present, and performance in a degraded mode is acceptable. The ServeRAID adapter/controller will assign the drive a state of defunct (DDD), but the server can complete startup. However, the array will remain in Critical mode and the potential for data loss will exist until you replace and rebuild the defunct drive. To prevent the loss of data, replace and rebuild the defunct drive in a timely manner.

Note: A physical drive in the DDD state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:

1. All cables are connected properly to the backplane and to the physical drive. Also, ensure that all cables inside the server are connected properly.
2. The hot-swap drive trays are seated properly in the drive bay.
3. Try rebuilding the drive if you have not already done so. See "Drive replacement (rebuilding a defunct drive)" on page 211 for more information.

After you perform these steps, if the physical drive does not function properly, replace the drive.

F10	Continue booting without changing the configuration. Press this key to continue without change to the configuration.

Configured drives are not in the configured location.

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

x Online drive has been rearranged
where *x* is the number of drives that have been rearranged.

For example:

Examples of possible messages are:

```
Online Drive on Channel 3 SCSI ID 4
moved to Channel 3 SCSI ID 3

Online Drive on Channel 3 SCSI ID 3
moved to Channel 3 SCSI ID 4
```

Action: Press one of the following keys:

F2	Detailed description. Press this key for a detailed description of the problem, such as the example messages above.
F4	Retry. Press this key after correcting a problem. For example, press F4 after you move the hard disk drive to its previously assigned location.
F5	Change the configuration and set the drive to defunct. Press this key to accept the new state that the ServeRAID adapter/controller will assign to the drive. For example, the ServeRAID adapter/controller will assign the drive a state of Defunct (DDD) or Empty.

Note: A physical drive in the DDD state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:

1. All cables are connected properly to the backplane and to the physical drive. Also, ensure that all cables inside the server are connected properly.
2. The hot-swap drive trays are seated properly in the drive bay.
3. If you have not already attempted to rebuild the drive, try rebuilding it. See "Drive replacement (rebuilding a defunct drive)" on page 211 for more information.

After you perform these steps, if the physical drive does not function properly, replace the drive.

F6	Change the configuration and accept the rearrangement. Press this key to modify the configuration to match the current drive location.

You might remove the hot-swap drives from the server for security or maintenance reasons. If you replace the drives but install them in different drive bays, you can press **F6** to accept the new locations, and the ServeRAID adapter/controller will update the configuration.

F10	Continue startup without changing the configuration. Press this key to continue without change to the configuration.

Controller is not responding to commands. No logical drives are installed.

Explanation: The ServeRAID adapter/controller is not operational.

Action: See "Channel troubleshooting procedure" on page 108 and "Dead Channel Service Procedure" on page 109.

Error: Cannot disable this controller BIOS.

Explanation: The ServeRAID adapter/controller was unable to prevent an extra copy of its BIOS code from being stored on the server. This condition occurs when the server contains multiple ServeRAID controllers.

Action: See "Channel troubleshooting procedure" on page 108 and "Dead Channel Service Procedure" on page 109.

Installation stopped.

Explanation: The server cannot access the ServeRAID adapter/controller.

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

New controller installed in a configured server or drives are imported.

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

x Online drive(s) found with mismatch configuration

Examples of possible messages:

```
Configuration mismatch Channel 1 SCSI ID 0 with Host ID
Configuration mismatch Channel 2 SCSI ID 0 with Host ID
```

Action: Press one of the following keys:

F2   Detailed description. Press this key for a detailed description of the problem, such as the example messages above.

F4   Retry. Press this key after correcting the problem. For example, press F4 after you move the hard disk drive to its previously assigned location, or after you install the original hard disk drives back in the server.

F5   Change the configuration and set the drive to Defunct. Press this key to accept the new state that the ServeRAID adapter/controller will assign to the drive. For example, the ServeRAID adapter/controller will assign the drive a state of Defunct (DDD) or Empty (EMP).

   Note: A physical drive in the defunct state does not necessarily mean that you need to replace the drive. Before you replace the drive, ensure that:

   1. All cables are connected properly to the backplane or system board, and to the physical drive. Also, ensure that all cables inside the server are connected properly.
   2. The hot-swap drive trays are seated properly in the drive bay.
   3. If you have not already attempted to rebuild the drive, try rebuilding it. See "Drive replacement

	(rebuilding a defunct drive)" on page 211 for more information.
	After you perform these steps, if the physical drive does not function properly, replace the drive.
F7	Import configuration information from drive. Press this key to restart the server. Press this key to import the configuration information from the drive and to update the configuration information for the ServeRAID adapter/controller. This choice is useful when you replace the ServeRAID adapter/controller in an existing ServeRAID subsystem.
	You also might press F7 if you replace a whole set of drives with drives that were configured in another server with a ServeRAID adapter/controller.
	Note: When you install drives in a server that has no logical drives defined, the F7 choice will not appear. The ServeRAID adapter/controller does not contain any logical drives in its factory configuration. Therefore, F7 will not appear. In this case, do the following:

1. Restart the server and press **Ctrl**+**I** to enter the Mini-Configuration program (see "Using the ServeRAID Mini-Configuration program" on page 191).
2. Select **Advanced Functions**.
3. Select **Copy the Configuration from Drives to the Controller** and follow the instructions on the screen.

Battery-Backup Write Cache Not Responding

Explanation: BIOS code detected a bad or failed battery-backup write cache.

Action: Press **F9** to remove the battery-backup write cache from the configuration, or press **F10** to exit without change.

Battery-Backup Write Cache Replacement

Explanation: The ServeRAID controller detects that the battery-backup write cache is defective.

Action: Press **F8** if you replaced the battery-backup write cache, or press **F10** if you have not replaced the battery-backup write cache.

Recoverable configuration error

Explanation: The configuration data stored in NVRAM does not match the configuration data stored in the EEPROM.

Action:

1. Press **Ctrl**+**I** to access the ServeRAID Mini-Configuration menu. (See "Using the ServeRAID Mini-Configuration program" on page 191 for instructions.)
2. Select **Advanced Functions** from the Main Menu.
3. Then, select **Copy the Configuration from Drives to the Controller**. (See "Using the advanced configuration functions" on page 193 for more information.)

Unrecoverable configuration error

Explanation: The configuration data stored in NVRAM does not match the configuration data stored in the EEPROM.

Action:

1. Press **Ctrl**+**I** to access the ServeRAID Mini-Configuration menu. (See "Using the ServeRAID Mini-Configuration program" on page 191 for instructions.)
2. Select **Advanced Functions** from the Main Menu.
3. Then, select **Select Restore to Factory Default Settings**. (See "Using the advanced configuration functions" on page 193 for more information.)

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

Explanation: One or more physical drives have failed.

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

Your server has an error due to a Blocked Logical Drive.

Explanation: One or more logical drives are blocked. A blocked logical drive cannot be accessed. See "Logical drive state descriptions" on page 178 for additional information.

Action: Press **F4** to unblock the logical drive, or press **F5** to continue without unblocking.

ServeRAID 3 ISPR error codes

After the ServeRAID POST completes, register information
appears on the screen in hexadecimal format, as follows:

```
Hardware:  ISPR=aaaa  BCS=bb  ECS=cc
```

ISPR displays the four-digit Interrupt Status Report
Register code, BCS displays the Basic Configuration
Status Register code, and ECS displays the Extended
Configuration Status Register code.

For example:

```
Controller 1 Slot 5,
Status:Not responding properly - Error Code=0B0

Controller 2 Slot 4,
Logical Drive=0, Other=0, Firmware=2.88.10,
Status=Ok

Controller 3 Slot 3,
Logical Drive=0, Other=0, Firmware=3.60.13,
Status=Ok

Controller 4 Slot 2,
Logical Drive=1, Other=1, Firmware=1.00.09,
Status=Ok
```

If no errors occur:

ISPR (*aaaa*) = EF10

BCS (*bb*) = 0F or 09

ECS (*cc*) = 00

If an error occurs, refer to: "Basic and extended
configuration status codes" on page 161 for the BCS and
ECS error codes.

Basic and extended configuration status codes

BCS	ECS	Explanation and Possible Recovery Action
Code not in table	Code not in table	**Explanation:** The ServeRAID adapter/controller is not functioning properly. **Action:** Replace the adapter or the system board with integrated controller.
00	01	**Explanation:** Invalid flash configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.
00	02	**Explanation:** Invalid NVRAM configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.
00	03	**Explanation:** Invalid flash and NVRAM configuration. **Action:** Start the IBM ServeRAID Support CD and follow the instructions that appear on the screen.
01	08	**Explanation:** No configuration was found in drives; or, Online/Rebuild drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	18	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	28	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	38	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
01	48	**Explanation:** No configuration was found in drives; or, Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	58	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
01	68	**Explanation:** No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
01	78	**Explanation:** No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	88	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	98	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	A8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	B8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. **Action:** Press F4, F5, F7, or F10.
03	C8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	D8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
03	E8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
03	F8	**Explanation:** A drive was imported from another system and it has valid configuration; and, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding and unidentified drives were found. **Action:** Press F4, F5, F7, or F10.
07	08	**Explanation:** Online/Rebuild drives are not responding. **Action:** Press F4, F5, or F10.
07	0C	**Explanation:** Online/Rebuild drives are not responding and a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	18	**Explanation:** Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
07	1C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding and a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	28	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
07	2C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	38	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
07	3C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, a drive was found at the incorrect SCSI ID. **Action:** Press F4, F5, F6, or F10.
07	48	**Explanation:** Online/Rebuild drives are not responding and unidentified drives were found. **Action:** Press F4, F5, or F10.
07	4C	**Explanation:** Online/Rebuild drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.

BCS	ECS	Explanation and Possible Recovery Action
07	58	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	5C	**Explanation:** Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	68	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	6C	**Explanation:** Online/Rebuild and Ready/Standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
07	78	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. **Action:** Press F4, F5, or F10.
07	7C	**Explanation:** Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. **Action:** Press F4, F5, F6, or F10.
09	00	**Explanation:** No error occurred. **Action:** No action is required.
09	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.
09	20	**Explanation:** Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
09	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
0F	00	**Explanation:** No error occurred. **Action:** No action is required.
0F	10	**Explanation:** Hot-Spare/Standby Hot-Spare drives are not responding. **Action:** Press F4, F5, or F10.

BCS	ECS	Explanation and Possible Recovery Action
0F	20	**Explanation:** Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.
0F	30	**Explanation:** Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. **Action:** Press F4, F5, or F10.

Using the ServeRAID Manager Program installed on your system

When you install the ServeRAID Manager Program on your system, you can administer and monitor other systems with ServeRAID controllers as well as configure ServeRAID controllers in your system. For further information about installing the ServeRAID Manager Program, see "Installing the ServeRaid Manager Program" on page 112. To start the ServeRAID Manager Program after installing it on your system, see "Starting the ServeRAID Manager Program after installing your operating system." For information about administering and monitoring other systems, see "Using the Notification Manager" on page 172 and "Using the Security Manager" on page 174.

Starting the ServeRAID Manager Program after installing your operating system

After you have configured your ServeRAID controller, installed the device drivers, and installed the operating system, you can install the ServeRAID Manager Program on your system to administer and monitor your ServeRAID controllers, as well as modify the ServeRAID controller configuration.

Starting in Windows NT: To start the ServeRAID Manager Program in Windows NT:

1. Click **Start** in the lower-left corner of the screen.
2. Select **Programs** → **ServeRAID Manager** → **ServeRAID Manager**. The Windows NT control panel window appears. The program starts in the Information mode and a screen similar to the following appears.

Figure 12. Information mode screen

3. See "Local-only mode and network mode" on page 168.

Starting in NetWare: To start the ServeRAID Manager Program in NetWare:

1. From the NetWare console, type:

   LOAD RAIDMAN

   The program starts in the Information mode and a screen similar to the previous screen appears.

2. See "Local-only mode and network mode" on page 168.

Starting in OS/2: To start the ServeRAID Manager Program in OS/2:

1. Change to the directory where you installed the ServeRAID Manager program by typing the following:

   cd \RaidMan

2. Type the following; then, press **Enter** to start the program:

   RaidMan

   The program starts in the Information mode and a screen similar to the previous screen appears.

3. See "Local-only mode and network mode" on page 168.

Starting in UnixWare: To start the ServeRAID Manager Program in UnixWare:

> **Note**
>
> Ensure you have superuser privileges before starting this procedure.

1. Get to the directory where you installed the ServeRAID Manager program by typing:

ServeRAID 3H, 3HB, 3L Adapters/Controllers   **167**

```
cd /opt/Netfinity/RaidMan
```

2. Type the following; then, press **Enter** to start the program:

```
sh RaidMan.sh
```

The program starts in the Information mode and a screen similar to the previous screen appears.

3. See "Local-only mode and network mode."

Local-only mode and network mode: The ServeRAID Manager Program starts in local-only mode if TCP/IP is not installed on your system. After the program loads, you can access the ServeRAID controllers.

When the Main window appears:

- If you are running the program in the local-only mode and you have ServeRAID controllers installed in your system, the current settings of the installed controllers appears on the screen.
- If you are running the program from a client with no ServeRAID controllers, a message appears stating that no ServeRAID controllers are installed in your system.

For information on using network mode and viewing other servers with ServeRAID controllers, see "Using the Notification Manager" on page 172.

Configuring the ServeRAID controller

When the ServeRAID Manager Program is installed on your system, you can use the program to configure and modify ServeRAID controllers as you did in bootable-CD mode (see "Using the Configuration mode" on page 97 and "Using the Information mode" on page 105). This section provides information about the following ServeRAID actions:

- Change RAID levels
- Increase free space
- Increase logical drive space

Modifying a configuration: You can modify a configuration to change RAID levels, increase free space, or increase logical drive space. When you use these actions, you dynamically change the current logical drive structure.

To modify a configuration, you must have at least two logical drives available: one free logical drive and one source logical drive that is in the okay state. During the procedure, the ServeRAID controller changes the state of the free logical drive to system; then, temporarily uses the system drive to perform the migration. When the migration procedure completes, the ServeRAID controller changes the state of the system drive back to free.

Considerations while modifying a logical drive

- The Main Tree displays only physical drives that are **at least** the size of the smallest physical drive in the selected array. When adding to an existing array, you cannot add physical drives that are smaller than the smallest drive currently in the array.
- When adding to an existing array, if you add physical drives that are larger than the physical drives currently in the array, you will not be able to use all the space on the new physical drives.
- Existing physical drives in the selected array are labeled **Online**. Newly added physical drives are labeled **New online**. You cannot remove online drives from an existing array.
- If you want to remove a new online drive from the array, drag it back to the Main Tree.

Changing RAID levels: You can change the RAID levels of currently defined logical drives. To use **Change RAID level**, all of the logical drives within the array *must* be the same RAID level.

The ServeRAID controllers support changing RAID levels as follows:

- Change two or more drives from RAID level-0 to RAID level-5 by adding one physical drive
- Change two drives from RAID level-1 to RAID level-5 by adding one physical drive
- Change from RAID level-5 to RAID level-0 by removing one physical drive
- Change from RAID level-5E to RAID level-5.

To change the RAID level of an existing array:

1. Click an array from the Main Tree (that is, the left tree).
2. Select **Logical drive migration** from the Actions menu.
3. Select from the available **Change RAID levels** on the menu.

   If you select one of the following, another tree appears on the right. Go to step 4 on page 170.
   - **Change RAID level from RAID 0 to RAID 5**
   - **Change RAID level from RAID 1 to RAID 5**

   ┌─ **Note** ─────────────────────────────
   │
   │ If the array already contains the maximum
   │ number of physical drives (based on the firmware
   │ level and the stripe-unit size), the two previous
   │ **Change RAID level** actions are not available.
   │
   └──

   If you select one of the following, go to step 6 on page 170.
   - **Change RAID level from RAID 5 to RAID 0**
   - **Change RAID level from RAID 5E to RAID 5**

4. Add to the selected array by dragging one ready drive from the Main Tree to the array in the right tree.
5. After you add the physical drives to your arrays, click **Next** to review your new logical drive configuration.

> ─ **Note** ─────────────────────────────
>
> If you change your mind and want to modify your configuration, you can click **Back** to return to this array tree window.

6. Review the configuration in the right panel. It describes how the configuration will affect the logical drives and free space when you click **Apply**.

   Tip: You can expand the tree for another view of the configuration.
7. Click **Apply** to approve the new configuration. The ServeRAID Manager Program automatically changes the RAID levels of the logical drives in the array.

   If you do not want to approve the logical drive configuration, click **Cancel** and return to the system management information window.

> ─ **Notes** ─────────────────────────────
>
> Change RAID levels is a lengthy process. You cannot perform any other actions on the affected controller until the migration is complete. The ServeRAID Manager Program displays a progress indicator in the status bar. You can use the logical drive during the change RAID levels process. You can also remove the system power. When you restore the power, the change RAID levels process restarts where it left off.

8. Click **Yes** when the confirm pop-up window opens.

Increasing free space: Using this feature you can add one, two, or three physical drives to an existing array so you can create another logical drive in the array.

When you create an array, logical drives are striped across all physical drives in that array. To create more free space in an existing array, define additional physical drives to add to the array. Then, the ServeRAID Manager Program migrates the logical drives such that the data is spread across the existing and new physical drives.

To increase free space:
1. Click an array from the Main Tree (that is, the left tree).
2. Select **Logical drive migration** from the Actions menu.
3. Select **Increase free space** from the menu.
4. Add to the selected array by dragging ready drives from the Main Tree to the array in the right tree.

> **Note**
>
> You can add up to three physical drives.

5. After you add the physical drives to your arrays, click **Next** to review your new logical drive configuration.
6. Review the configuration in the right panel. It describes how the configuration will affect the logical drives and free space when you click **Apply**. If you want to modify the configuration, click **Back** to return to the array tree window.

   Tip: You can expand the tree for another view of the configuration.
7. Click **Apply** to approve the new configuration. The ServeRAID Manager Program automatically increases the free space.

   If you do not want to approve the logical drive configuration, click **Cancel** and return to the system management information window.
8. Click **Yes** when the confirm pop-up window opens.

> **Notes**
>
> Increasing free space is a lengthy process. You cannot perform any other actions on the affected controller until the process is complete. The ServeRAID Manager displays a progress indicator in the status bar. You can use the logical drive during the increase free space process. You can also remove the system power. When you restore the power, the increase free space process restarts where it left off.

9. When the increase free space process completes, you can create new logical drives in this array. See "Using Custom configuration" on page 101 to review this process.

Increasing logical drive space: Using this feature you can add one, two, or three physical drives to an existing array so you can expand the size of the logical drives in the array. When increasing logical drive space, the ServeRAID Manager Program migrates the logical drives such that the logical drives gain additional space, much like adding paper to a notebook.

When you create an array, logical drives are striped across all of the physical drives in that array. To increase the size of the logical drives in an existing array, define additional physical drives to add to the array. Then, the ServeRAID Manager Program migrates the logical drives such that the data is spread across the existing and new physical drives.

To increase logical drive space:

1. Click an array from the Main Tree (that is, the left tree).
2. Select **Logical drive migration** from the Actions menu.
3. Select **Increase logical drive space** from the menu.
4. Add to the selected array by dragging ready drives from the Main Tree to the array in the right tree.

   > --- **Note** ---
   >
   > You can add up to three physical drives.

5. After you add the physical drives to your arrays, click **Next** to review your new logical drive configuration.
6. Review the configuration in the right panel. It describes how the configuration will affect the logical drives and free space when you click **Apply**. If you want to modify the configuration, click **Back** to return to the array tree window.

   Tip: You can expand the tree for another view of the configuration.
7. Click **Apply** to approve the new configuration. The ServeRAID Manager Program automatically increases the logical drive space.

   If you do not want to approve the logical drive configuration, click **Cancel** and return to the system management information window.
8. Click **Yes** when the confirm pop-up window opens.

   > --- **Notes** ---
   >
   > Increasing logical drive space is a lengthy process. You cannot perform any other actions on the affected controller until the process is complete. The ServeRAID Manager displays a progress indicator in the status bar. You can use the logical drive during the increase logical drive space process. You can also remove the system power. When you restore the power, the increase logical drive space process restarts where it left off.

Using the Notification Manager

The Notification Manager is a tool used to notify other systems running the ServeRAID Manager Program of all events that occur on this (that is, the local) system. The user of the system types system names in the notification list. Each system in the list is notified of all events that occur on the local system.

To start the Notification Manager, select **Open Notification Manager** from the Actions menu. You can use the Notification Manager to do the following:

- Add a system to the Notification List
- Delete a system from the Notification List

- Modify system properties in the Notification List
- Send a test event to a system in the Notification List
- Monitor events sent from the Notification Manager

> **Note**
>
> You cannot use the Notification Manager in Bootable-CD mode.

An example: You install SystemA in a lab with a ServeRAID subsystem. You run the ServeRAID Manager Program on SystemA to monitor for events and problems, but you want to monitor from your workstation and not from SystemA. You open the SystemA Notification Manager from the ServeRAID Manager Program and define your workstation in the notification list. When running the ServeRAID Manager Program from your workstation, you are notified of all problems and events that occur on SystemA.

Adding a system: Use this action to add a new system to the Notification List. Every new system you add to the list is notified of all events that occur on this system.

1. Click **Add system** .
2. Type the host name or TCP/IP address of the system you want to add.
3. Type the TCP/IP port for the remote system Startup Port number. The default port is 34571. If you changed the system Startup port number in User preferences on the remote system, type that number here.
4. Click **Add**.
5. Continue to add systems, or click **Cancel** to close the window.

After you add the system to the Notification List, the ServeRAID Manager will attempt to connect to the remote system and send an initial set of events. The Manager uses these events to update the ServeRAID Manager user interface running on the remote system.

Deleting a system: Use this action to delete a remote system from the Notification List.

1. Click the system you want to delete from the Notification List.
2. Click **Delete system** .

The ServeRAID Manager deletes the system from the Notification List.

After deleting the remote system, the Manager no longer notifies the remote system of events occurring on the local system.

Modifying a system: Use this action to modify a remote system host name, TCP/IP address, or port number.

1. Click the system you want to modify from the Notification List.

2. Click **Modify system** . The System properties window opens.

3. Change the host properties in the appropriate entry fields.

4. Click **OK**.

Sending a test event: Use this action to send a test event to a remote system.

1. Click the system you want from the Notification List to which you want to send a test event.

> **Note**
>
> If you select no system or more than one system, this action is disabled.

2. Select **Send test event** from the Actions menu. A window opens to report success or failure.

> **Notes**
>
> If the test fails, verify the following and try the test send again:
>
> 1. You typed the correct TCP/IP information.
> 2. The ServeRAID Manager is running on the remote system.

3. Click **OK**.

Clearing the event log: Use this action to clear the current contents of the Notification Manager event viewer. This action does not clear or delete the event logging file.

1. Select **Clear the event log** from the File menu.
2. Select **Notification Manager** from the menu.

Using the Security Manager

You can use the Security Manager to give users the ability to configure and view controller information from remote systems.

Security is enabled by default. You must configure at least one user name and password before any user can connect to the local system. You can disable security by selecting Disable security from the Actions menu. If you disable security, any user can establish a connection with the local system and modify the RAID subsystem. This might create security concerns in a working environment.

The first time you open the Security Manager, it prompts you to type an Admin (administrator) password. Either

type a password or click **Cancel** to not have an Admin user.

To start the Security Manager, select **Open Security Manager** from the Actions menu. You can use the Security Manager to do the following:

- Add a user
- Delete a user
- Modify a user

Note

You cannot use the Security Manager in Bootable-CD mode.

Adding a user: Use this action to permit a new user access to the local system (that is, this system).

1. Click **Add user** . The Add user window appears.
2. Fill in all the entry fields appropriately for the user you want to add. **User name**, **Password**, and **Confirm password** are required fields.

   Note

   The password is case sensitive.

   ---

3. Click **Add**.
4. You can continue adding more users or click **Cancel** to close the window.

Deleting a user: Use this action to revoke access to the local system for a selected user.

1. Click the user you want to delete from the Security List.

2. Click **Delete user** .
3. The ServeRAID Manager deletes the user from the Security List.

Modifying a user: Use this action to modify a selected user's user name or password.

1. Click the user you want to modify from the Security List.

2. Click **Modify user** . The User properties window appears.
3. Change the parameters in the appropriate entry fields.
4. Click **OK**.

Clearing the event log: Use this action to clear the current contents of the Security Manager event viewer. This action does not clear or delete the event logging file.

1. Select **Clear event log** from the File menu.

2. Select **Security Manager** from the menu.

Disabling and enabling security: Use this action to disable and enable the security. If security is enabled, all commands from remote ServeRAID Managers are verified as having access to your system before any command is executed. If security is disabled, all commands from remote ServeRAID Managers are accepted and fulfilled.

Note

The default is security enabled.

Setting user preferences

Select **User preferences** from the File menu. A window appears that you can use to specify the following settings:

- Initialization settings
- Remote access settings
- Alarm settings

Initialization settings: Initializing a logical drive erases the first 1024 sectors on the drive and prevents access to any data previously stored on the drive. The default setting is checked. When this mode is enabled, the ServeRAID Manager Program automatically initializes each new logical drive and prevents access to the manual initialization function.

1. Click the **Initialization settings** tab.
2. Click the check box to enable or disable automatic initialization of logical drives.
3. Click **OK**.

   Attention: If you uncheck (that is, disable) automatic initialization, the Manager will not initialize each logical drive (by writing zeros to the first 1024 sectors of the logical drive) when it is created. You must still initialize all newly defined logical drives before storing data.

Remote access settings: If you want to run the ServeRAID Manager Program in local-only mode:

1. Click the **Remote access settings** tab.
2. Check the **Local only** box. If you select this option, the port number entry field will gray out.
3. Click **OK**.

The next time you start the Manager, TCP/IP networking will be disabled. In local-only mode, you cannot monitor any remote systems and no remote systems can monitor your system.

If you want to run the ServeRAID Manager Program in Networking mode:

1. Click the **Remote access settings** tab.
2. If the the **Local only** box is checked, uncheck it.

3. If you have a conflict with the default port number,
   type a new port number in the entry field. The default
   port number is 34571.
4. Click **OK**.
5. Restart the Manager for this setting to take effect.

Alarm settings: All Warning and Error events cause
an audible alarm to sound every five minutes, notifying you
of the event. You can adjust the alarm interval in the Alarm
settings window.

1. Click the **Alarm settings** tab.
2. Click the check box to enable or disable the repeating
   alarm.

   > **Note**
   >
   > If you disable the alarm, you will not hear an
   > audible alarm when you receive problem events.

3. If you have enabled the alarm, you can adjust the
   time interval (in seconds) you want between each
   alarm. The default is 300 seconds (that is, 5
   minutes).
4. If you have enabled the alarm, you can adjust the
   length of time (in beeps) you want the alarm to
   continue. The default is 3 beeps.
5. Click **OK**.
6. Restart the Manager for these settings to take effect.

Silencing the repeating alarm: Silence the
repeating alarm turns off the alarm for the current failure
without disabling the feature. To silence the alarm, click

 on the tool bar.

Understanding drive states

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	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. If a physical drive has become defunct, refer to "Drive replacement (rebuilding a defunct drive)" on page 211.
Hot Spare	A Hot-Spare drive is a hard disk drive that is defined for automatic use when a similar drive fails.
Online	The drive is Online. It is functioning properly and is part of an array.
Rebuilding	The drive is being rebuilt. For more information on rebuilding a drive, refer to "Drive replacement (rebuilding a defunct drive)" on page 211.
Ready	The ServeRAID controller recognizes a Ready drive as being available for definition.
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	During a rebuild operation, the ServeRAID controller sets the state of any RAID level-0 logical drives associated with a failed array to the Blocked state; then, it reconstructs the data that was stored in RAID level-1, RAID level-1E, Raid level-5 and RAID level-5E logical drives. After the Rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. However, the logical drive might contain damaged data. You must either re-create, reinstall, or restore the data from the most recent backup disk or tape to the RAID level-0 logical drive.
Critical Migrating	A logical drive in the critical state that is undergoing a logical drive migration (LDM).
Critical System	The ServeRAID controller uses this reserved state during a logical drive migration (LDM) when the logical drive is in the critical state.
Critical	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. **Attention:** If the state of the logical drive is critical, refer to "Drive replacement (rebuilding a defunct drive)" on page 211.
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.

Drive State	Meaning
Offline	The logical drive is offline and not accessible. This state occurs when one of the following is true. • One or more physical drives in a RAID level-0 logical drive is defunct. • Two or more physical drives in a RAID level-1, RAID level-1E, or level-5 logical drive are defunct. • Three or more drives in a RAID level-5E logical drive are defunct. If any of these are true, refer to "Drive replacement (rebuilding a defunct drive)" on page 211.
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).

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

You can now configure two ServeRAID-3 controllers in a failover environment when using Windows NT 4.0. The latest version of the ServeRAID-3 device drivers includes *fault tolerant* technology. With fault tolerance, you can pair two controllers and connect them to the same enclosure in order to provide access to the disk, even after a controller fails.

Hardware requirements

> **Important**
>
> To perform fault tolerance, you must use only matched pairs of ServeRAID controllers. The controllers must be identical, including the level of BIOS and firmware on the controllers.

You can use the following pairs for fault tolerance:

- Two ServeRAID-3H
- Two ServeRAID-3HB
- Two ServeRAID-3L

> **Note**
>
> If your system has a ServeRAID controller built-in on the system board, you cannot use the built-in controller in the fault-tolerant pair.

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

- IBM PC Server Enterprise Expansion Enclosure (3518), using IBM SCSI-2 Fast/Wide Enhanced Repeater Adapter
- IBM Netfinity Rack Drawer Enclosure (3519), using IBM SCSI-2 Fast/ Wide Enhanced Repeater Adapter
- IBM Netfinity EXP10 Rack Storage Enclosure, using Netfinity EXP10 3m External Auto-Sensing Cable
- IBM Netfinity EXP15 Rack Enclosure.
- IBM Netfinity EXP200 Rack Enclosure.

Installation guidelines, considerations, and restrictions:

In order to perform fault tolerance with ServeRAID, you must adhere to the following guidelines and restrictions.

- The stripe-unit size and firmware level must be the same on both controllers.
- A fault-tolerant pair cannot be part of a Microsoft Cluster Server shared cluster.
- The controller must be configured as write-through.

Note: If you have the battery backup option, it will be disabled when you create a fault-tolerant pair. The write-cache mode will automatically be changed from write-back mode to write-through mode.

- The controllers must be configured in an active-passive mode, where all logical drives are defined on only one controller of the pair.

  Note: If both controllers have logical drives configured, the controllers will not be configured as a fault-tolerant pair.

- Do not create hot-spare drives when creating a fault-tolerant pair. Hot-spare drives are not supported in a failover environment except within a logical drive with a RAID level-5E.
- A fault-tolerant pair must not contain any Ready physical drives. All physical drives must be configured in arrays.
- All logical drives must have unique shared merge-group numbers.
- When using multiple fault-tolerant pairs in a system, each set of controllers must have a unique set of controller host IDs, cluster partner IDs, and SCSI initiator IDs.
- You cannot hot-add a backup controller to a system.
- You cannot disable an on-board ServeRAID controller, even if the controller is not used.

Preparing the controllers for failover configuration:
To configure the controllers, do the following:

> **Note**
>
> Do not connect the controllers to the external enclosures. You will connect the controllers later in the process.

1. Insert the *IBM ServeRAID Support CD* (or the configuration CD that came with your system) into the CD-ROM drive; then, turn on the system.

   The ServeRAID Manager Program opens in either the Configuration mode or the Information mode. If the program opens in the Information mode, a screen similar to the following appears. Continue to step 2 on page 184.

Figure 13. Information mode screen

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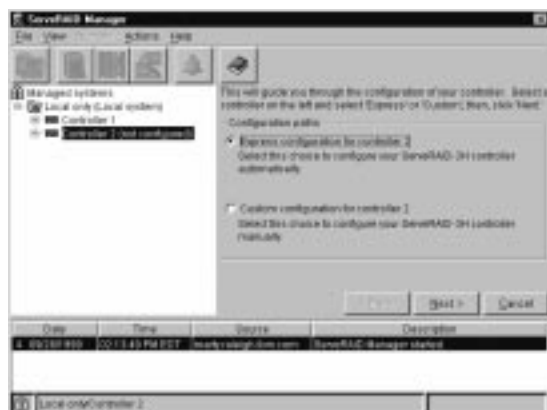screen similar to the following appears.

Figure 14. Configuration mode screen

Click **Cancel** to go to the Information mode screen
and then continue to step 2 on page 184.

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

2. Click the first ServeRAID controller that you are configuring in the Main Tree.
3. Select **Restore to factory default settings** from the Actions menu.
4. When the initialization is complete, a message appears at the bottom of the screen saying that the initialization was successful.
5. Click the second ServeRAID controller that you are configuring in the Main Tree.
6. Select **Restore to factory default settings** from the Actions menu.
7. When complete, a message appears at the bottom of the screen saying that the initialization was successful.

Configuring the controllers for failover: To configure the controllers for failover, do the following:

1. Click the first ServeRAID controller that you are configuring in the Main Tree.

2. Click on the tool bar. The Configure for clustering window appears.

Figure 15. Configure for clustering window

3. Fill in the following information:

> **Note**
>
> The Controller Name and Partner Name are case sensitive.

- Controller Name - Enter a name to identify the first controller, for example, Name_1.
- Partner Name - Enter a name that you will use to identify the second controller, for example, Name_2.
- Initiator identifiers (Channels) - The system presets these to seven (7). Change them to 6.

4. Click **OK**.
5. Click the second ServeRAID controller that you are configuring in the Main Tree.
6. Click on the tool bar. The Configure for clustering appears.
7. Fill in the following information:
   - Controller Name - This is the same name as the Partner Name you set up for the first controller, in this case, Name_2.
   - Partner Name - This is the same name as the Controller Name you set up for the first controller, in this case, Name_1.
   - Initiator identifiers (Channels) - The system presets these to seven (7). Do **not** change this value.
   - Record all Controller Names and Partner Names that you have chosen in a safe place for future reference. You will need this information to recover the configuration if the ServeRAID 3 controller should fail.

   > **Notes**
   >
   > You can save this information to a file by using the ServeRAID Manager Program:
   >
   > 1. Click the system from the Main Tree.
   > 2. Select **Save printable configuration** from the Actions menu.

8. Click **OK**.

   > **Note**
   >
   > Disregard the instructions to remove the *IBM ServeRAID Support CD* (or the configuration CD that came with your system) from the CD-ROM drive; do not remove the CD.

9. Select **Exit** from the File menu to exit the ServeRAID Manager Program.
10. Shut down the system.

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

1. Connect the expansion enclosure to each of the
    ServeRAID controllers.

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

2. Restart the system with the *IBM ServeRAID Support
    CD* still in the CD-ROM drive.

Configuring logical drives

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

To configure a logical drive, do the following:

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

    Click on the tool bar.
2. Click the **Custom configuration** radio button.
3. Click **Next**.
4. Define your logical drives by doing one of the
    following:
    *   Using the right mouse button, click on the drive
        or SCSI channel icons in the Main Tree to select
        the drives that you want to add to your arrays or
        delete from your arrays; then, select a choice
        from the pop-up list.

            or

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

        ---- **Note** ------------------------------------
        You must use all the Ready drives when creating
        your arrays (that is, all Ready drives in the Main
        Tree must be Online).
        ----

5. After you select the Ready drives for your arrays, click **Next**.

   If you change your mind, you can remove a specific drive from a newly defined array or delete an entire newly defined array. To do this:
   a. Click **Back**.
   b. Using the right mouse button, click on the specific drive or Array icon in the Main Panel on the right.
   c. Select **Remove from new array** or **Delete new array**.

   ┌─ **Note** ─────────────────────────────┐
   │   │
   │ Hot-spare drives are not supported in a failover │
   │ environment except within a logical drive with a │
   │ RAID level-5E.   │
   │   │
   └───┘

6. Select a RAID level for each of the logical drives from the RAID pull-down menu in the Main Panel.

   ┌─ **Note** ─────────────────────────────┐
   │   │
   │ If you have four or more Ready drives in an │
   │ array, the recommended RAID level is RAID │
   │ level-5E.   │
   │   │
   └───┘

7. Create only one logical drive for each array.

   ┌─ **Notes** ────────────────────────────┐
   │   │
   │ • Typically, the first logical drive defined on │
   │   the first ServeRAID adapter/controller found │
   │   by system BIOS during startup will be your │
   │   startup (boot) drive.   │
   │ • You cannot increase the free space in │
   │   arrays or expand the size of a logical drive │
   │   in a fault-tolerant pair.   │
   │   │
   └───┘

8. If you have created multiple arrays in step 4 on page 186, click on another array in the Main Tree and go back to step 6 to configure it. After configuring all of your arrays, continue with step 9.
9. Click **Next**.
10. Review the information that appears on the Configuration summary screen.

    ┌─ **Note** ────────────────────────────┐
    │   │
    │ To change the configuration, click **Modify arrays** │
    │ or **Modify logical drives**.   │
    │   │
    └───┘

11. Click **Apply** to accept and save the configuration.

Setting merge group numbers

After creating the logical drives, you must assign merge
group numbers to the shared drives. To set the merge
group numbers, do the following:

1. Click the ServeRAID controller in the Main Tree that
   contains the logical drives.

2. Click [icon] on the tool bar. The Configure
   controller for clustering window appears.

3. Click on the **Shared** check boxes for all logical drives.

4. Click **OK**.

5. Select **Exit** from the File menu to exit the ServeRAID
   Manager Program.

6. Shut down the system and remove the *IBM
   ServeRAID Support CD* (or the configuration CD that
   came with your system) from the CD-ROM drive.

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

Completing the failover environment

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

1. Install the ServeRAID device drivers for Windows NT.
   Refer to "Installing the ServeRaid Manager Program"
   on page 112.

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

Figure 16. Information mode screen showing a failover controller pairing

For troubleshooting in a failover-environment, refer to "Recovering from a failure in a failover-environment" on page 213.

Using FlashMan, the IBM ServeRAID ROM Update program

FlashMan is an easy to use program that simplifies the updating of BIOS and firmware on ServeRAID controllers. FlashMan reports the current BIOS version, firmware version, and update status for each controller found. FlashMan also reports if a controller needs updating. You decide whether or not to update your controllers, but you must update all the controllers or none (that is, you cannot selectively update).

FlashMan is provided on the *IBM ServeRAID Support CD* packaged with the ServeRAID controller, and it also is provided on the configuration CD packaged with some IBM server models.

To access FlashMan:

1. Insert the *IBM ServeRAID Support CD* into the system CD-ROM drive.
2. Turn on the system.
3. The FlashMan splash screen appears. FlashMan automatically scans and identifies each ServeRAID controller in your system. After scanning completes and if an update is required, a report screen appears with the following information:
    - Controller types found
    - Controller slot number, if known
    - Firmware version
    - BIOS version
    - Update status. If a controller has down-level BIOS or firmware, the controller is marked as a candidate for update.
4. If any of your ServeRAID controller require updating, click **Update** to update *all marked* ServeRAID controllers. The controller BIOS or firmware is updated from the *IBM ServeRAID Support CD* or *IBM ServeRAID Device Driver Diskette*. FlashMan displays a progress indicator as it updates the controllers. If FlashMan detects an error, it displays the error message and saves the error message to a file on the disk.

    If you do not want to update your ServeRAID controllers, click **Cancel**.
5. When all updates are complete, scroll through the New Feature window. This window reports the changes that FlashMan applied to your ServeRAID controllers.

Notes

When the splash screen appears, you can use **Ctrl**+**L** to copy **all** updated files to the RAMDISK. **Use this keystroke only when instructed by IBM Support.**

Using the ServeRAID Mini-Configuration program

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

To access the Mini-Configuration program:

1. Turn on the server. If the server already is turned on, press **Ctrl+Alt+Del**.
2. When the ServeRAID Mini-Configuration prompt appears, press **Ctrl+I**.
3. If your system contains more than one ServeRAID controller, a selection screen will appear. To continue:
   a. Use the Up Arrow (↑) or Down Arrow (↓) key to select a controller.
   b. Press **Enter**.

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

   Descriptions of the choices available from the Main Menu of the Mini-Configuration program are as follows:
   - **View Controller Status** shows the current status of the ServeRAID controller. (See "Viewing the controller status" for more information.)
   - **View Configuration** shows the current configuration information for the ServeRAID controller. (See "Viewing the configuration" on page 192 for more information.)
   - **Advanced Functions** is used to initialize the configuration, import configuration from drives, configure BIOS settings, and view the controller and PCI information. (See "Using the advanced configuration functions" on page 193 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**; then, press **Enter**.

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
- **Unattended** shows the current state of the Unattended mode.
  - When this option is set to Off, you can choose the recovery method when a ServeRAID adapter/controller startup error occurs.

- When this option is set to On, the ServeRAID adapter/controller chooses the recovery method when a startup error occurs.
- **Read Ahead** shows the current state of the read-ahead cache mode.
- **BootCD** shows the current state of the Bootable CD-ROM function. (Refer to "Setting the Bootable CD-ROM feature" on page 194.)
- **CompMode** shows the current BIOS compatibility mode. **On** indicates 8 gigabyte (GB) Extended; **Off** indicated 2 gigabyte (GB) Limited.
- **Clustered** shows the current state for clustering.
- **BBWC** shows the cache size of the battery-backup write cache, if it is installed (8 = 8 MB or 32 = 32 MB) or **No** if there is a no battery-backup write 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 has been initialized. When you initialize the configuration, the Config. Update resets to zero.
- **Bad Stripe, Locked Stripe, or Blocked Drive** identifies the logical drives that are affected.
  - **Bad Stripe Drives** indicates logical drives that has 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 178 for more information.

Viewing the configuration

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

Using the advanced configuration functions

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

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

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

- **Restore to Factory Default Settings** is used to reset the configuration. When you reset the configuration, you will not have access to any data stored on the logical drives attached to the selected ServeRAID adapter/controller.

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

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

- **Copy the Configuration from Drives to Controller** reads the most common configuration from the drives in the system and copies it to the ServeRAID controller.

- **Configure BIOS Settings** is used to modify the BIOS settings, such as the Bootable CD-ROM setting, for the ServeRAID adapter/controller. (See "Setting the Bootable CD-ROM feature" on page 194 for more information.)

Notes

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

- **View Controller and PCI Information** shows the ServeRAID controller hardware and PCI register information.
- **Exit** is used to exit from the Mini-Configuration program.

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

To enable the Bootable CD-ROM feature:

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

   > ── **Note** ───────────────────
   >
   > You must perform this next step to save the new settings.

5. Highlight **Save Configuration to the ServeRAID Controller** then, press Enter. The program displays an 0kay message and then returns you to the Main Menu of the Mini-Configuration program.
6. Press **Ctrl+Alt+Del** to restart the system.

IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter/Controller

The following information applies to the IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter/Controller. It also applies to specific imbedded ServeRAID controllers which are integrated into system boards designed to function in the same manner that the IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter does. For additional information on integrated ServeRAID controllers, refer to the documentation that comes with that system board.

For common service information for ServeRaid 3H adapter, see "IBM Netfinity ServeRAID 3H, 3HB, 3L Adapters/Controllers" on page 65.

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Features

The IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter has the following features:

- Maximum 8 arrays
- Supports up to 45 SCSI hard disks with 15 SCSI hard disk drives on each bus
- Optional Battery-Backup Write Cache support
- 32 MB Cache memory
- Supports hot-spare drives
- Supports 8 maximum Logical Drives
- 40 MHz Microprocessor
- 3 SCSI Channels
- Maximum 80 MB /sec. SCSI Transfer Speed
- 64-bit System PCI Data Bus
- Supports RAID levels 0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E)
- Automatic data scrubbing in background
- Auto-synchronization

Symptom-to-FRU index

This index supports ServeRAID 3H Adapters and 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 150). Only replace a ServeRAID 3H Adapter or controller if indicated to do so in the POST (ISPR) Error Procedures.

Problem	FRU/Action
1XXX (Microcode Checksum Error)	1. ServeRAID 3H Adapter/Controller
2XXX thru 5XXX (Code DRAM Error)	1. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 2. ServeRAID 3H Adapter/Controller
6XXX (Cache DRAM Error)	1. Reseat Cache Memory SIMM 2. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 3. ServeRAID 3H Adapter/Controller
7XXX thru 8XXX (Host/Local PCI Bus Interface Error)	1. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 2. ServeRAID 3H Adapter/Controller
9XXX thru BXXX SCSI Bus error caused by cables, termination, defective drives, etc.)	1. Refer to "POST (ISPR) error procedures" on page 150 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. ServeRAID 3H Adapter/Controller
EF10 (default ISPR)	a. Run diagnostics on DOS configuration program.

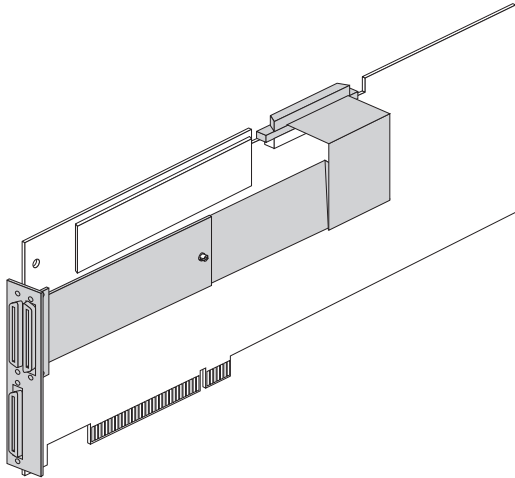| Problem	FRU/Action
EFFE (Firmware code corrupt or download jumpers are in place)	a. Refer to "POST (ISPR) error procedures" on page 150.
FFFF or other code not listed	a. Refer to "POST (ISPR) error procedures" on page 150 b. SCSI cable c. SCSI backplane d. Hard drive e. ServeRAID 3H Adapter/Controller

Locations (IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter)

(FRU no. 01K7396)

.1. Battery-Backup Cache Slot
.2. 64/32-bit PCI Connector
.3. External Channel 1
.4. External Channel 2
.5. DASD Status Connector
.6. LED Connector
.7. 32 MB EDO Cache
.8. Internal Channel 3

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

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

Download Jumper Locations:

- J6 consists of 4 pins that accept 2 jumper blocks.

- Install jumper blocks in either of the positions shown below (with respect to the card layout above) to enable Download via Bootblock.

  > **Note**
  >
  > This procedure is only needed if a download by code block does not work.

- The Default position is to have no jumper blocks installed.

IBM Netfinity ServeRAID 3HB Ultra2 SCSI Adapter/Controller

The following information applies to the IBM Netfinity ServeRAID 3HB Ultra2 SCSI Adapter/Controller. It also applies to specific imbedded ServeRAID controllers which are integrated into system boards designed to function in the same manner that the IBM Netfinity ServeRAID 3HB Ultra2 SCSI Adapter does. For additional information on integrated ServeRAID controllers, refer to the documentation that comes with that system board.

For common service information for ServeRaid 3HB adapter, see "IBM Netfinity ServeRAID 3H, 3HB, 3L Adapters/Controllers" on page 65.

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Features

The IBM Netfinity ServeRAID 3HB Ultra2 SCSI Adapter
has the following features:

- Maximum 8 arrays
- Supports up to 45 SCSI hard disks with 15 SCSI hard
  disk drives on each bus
- Battery-Backup Write Cache
- 32 MB Cache memory
- Supports hot-spare drives
- Supports 8 maximum Logical Drives
- 40 MHz Microprocessor
- 3 SCSI Channels
- Maximum 80 MB /sec. SCSI Transfer Speed
- 64-bit System PCI Data Bus
- Supports RAID levels 0, 1, 5, Enhanced-1 (1E), and
  Enhanced-5 (5E)
- Automatic data scrubbing in background
- Auto-synchronization

Symptom-to-FRU index

This index supports ServeRAID 3HB Adapters and 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.
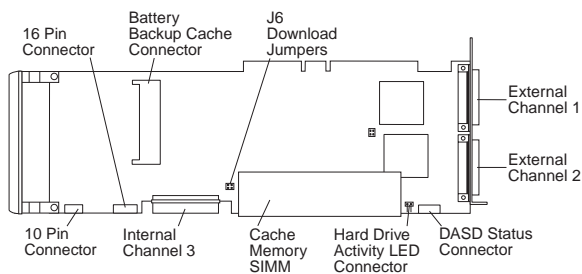
> **Note**
>
> **Do not** replace any FRU until you have followed the POST (ISPR) Error Procedures (see "POST (ISPR) error procedures" on page 150). Only replace a ServeRAID 3HB Adapter or controller if indicated to do so in the POST (ISPR) Error Procedures.

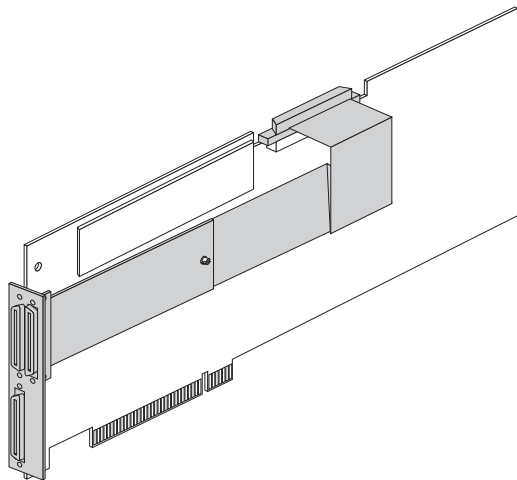| Problem	FRU/Action
1XXX (Microcode Checksum Error)	1. ServeRAID 3HB Adapter/Controller
2XXX thru 5XXX (Code DRAM Error)	1. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 2. ServeRAID 3HB Adapter/Controller
6XXX (Cache DRAM Error)	1. Reseat Cache Memory SIMM 2. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 3. ServeRAID 3HB Adapter/Controller
7XXX thru 8XXX (Host/Local PCI Bus Interface Error)	1. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 2. ServeRAID 3HB Adapter/Controller
9XXX thru BXXX SCSI Bus error caused by cables, termination, defective drives, etc.)	1. Refer to "POST (ISPR) error procedures" on page 150 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. ServeRAID 3HB Adapter/Controller
EF10 (default ISPR)	a. Run diagnostics on DOS configuration program.

Problem	FRU/Action
EFFE (Firmware code corrupt or download jumpers are in place)	a. Refer to "POST (ISPR) error procedures" on page 150.
FFFF or other code not listed	a. Refer to "POST (ISPR) error procedures" on page 150 b. SCSI cable c. SCSI backplane d. Hard drive e. ServeRAID 3HB Adapter/Controller

Locations (IBM Netfinity ServeRAID 3HB Ultra2 SCSI Adapter)

(FRU no. 01K7396)

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

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

Download Jumper Locations:

- J6 consists of 4 pins that accept 2 jumper blocks.
- Install jumper blocks in either of the positions shown below (with respect to the card layout above) to enable Download via Bootblock.

> **Note**
>
> This procedure is only needed if a download by code block does not work.

- The Default position is to have no jumper blocks installed.

IBM Netfinity ServeRAID 3L Ultra2 SCSI Adapter/Controller

The following information applies to the IBM Netfinity ServeRAID 3L Ultra2 SCSI Adapter. It also applies to specific imbedded ServeRAID controllers which are integrated into system boards designed to function in the same manner that the IBM Netfinity ServeRAID 3L Ultra2 SCSI Adapter does. For additional information on integrated ServeRAID controllers, refer to the documentation that comes with that system board.

For common service information for ServeRaid 3L adapter, see "IBM Netfinity ServeRAID 3H, 3HB, 3L Adapters/Controllers" on page 65.

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Features

The IBM Netfinity ServeRAID 3L Ultra2 SCSI adapter has the following features:

- Maximum 8 arrays
- Host PCI interface
- Contains an array accelerator
- 4 MB Cache memory
- 25 MHz Microprocessor
- 1 SCSI Channel
- Maximum 80 MB /sec. SCSI Transfer Speed
- Supports RAID Levels 0, 1, 5, Enhanced-1 (1E), and Enhanced-5 (5E)
- 32-bit System PCI Data Bus
- Supports up to 15 SCSI hard drives
- Supports up to 15 hot-spare drives
- Supports 8 maximum Logical Drives
- Data Scrubbing
- Auto-synchronization
- Allows RAID-5 and RAID-1 logical drives to be data scrubbed via synchronization utilities

Symptom-to-FRU index

This index supports ServeRAID 3L Adapters and 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 150) Only replace a ServeRAID 3L Adapter or controller if indicated to do so in the POST (ISPR) Error Procedures.

Problem	FRU/Action
1XXX (Microcode Checksum Error)	1. ServeRAID 3L Adapter/Controller
2XXX thru 8XXX (RAID Controller Hardware or Firmware Error)	1. Install download jumpers, flash latest level BIOS and firmware for adapter. Remove jumpers. 2. ServeRAID 3L Adapter/Controller
9XXX thru BXXX SCSI Bus error caused by cables, termination, defective drives, etc.)	1. Refer to "POST (ISPR) error procedures" on page 150 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. ServeRAID 3L Adapter/Controller
EF10 (default ISPR)	a. Run diagnostics on DOS configuration program.
EFFE (Firmware code corrupt or download jumpers are in place)	a. Refer to "POST (ISPR) error procedures" on page 150.
FFFF or other code not listed	a. Refer to "POST (ISPR) error procedures" on page 150 b. SCSI cable c. SCSI backplane d. Hard drive e. ServeRAID 3L Adapter/Controller

Locations (IBM Netfinity ServeRAID 3L Ultra2 SCSI Adapter)

(FRU no. 01K7207)
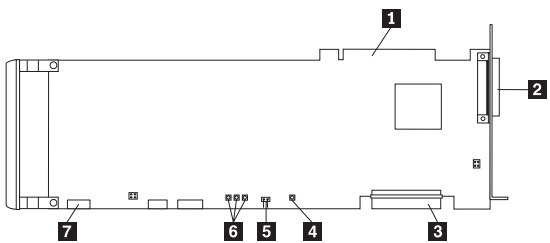
1 32-bit PCI Connector
2 External Channel 1
3 Internal Channel 1
4 SCSI Activity LED
5 LED Connector
6 Check Engine LEDs
7 DASD Status Connector

Download Jumper Locations:

- J6 consists of 4 pins that accept 2 jumper blocks.
- Install jumper blocks in either of the positions shown below (with respect to the card layout above) to enable Download via Bootblock.

> **Note**
>
> This procedure is only needed if a download by code block does not work.

- The Default position is to have no jumper blocks installed.

Recovery procedures for DDD drives

Procedures for recovering from DDD scenarios
include:

- Drive replacement (rebuilding a defunct drive)
- Software and physical replacement
- Using and understanding the ServeRAID
  Administration Log
- Recovery from ServeRAID Adapter failure
- When HSP is present at time of failure
- When HSP is not present at time of failure

Note

The following information applies only to drives
that are part of the same array

Drive replacement (rebuilding a defunct drive)

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

- An improperly connected cable, hard disk drive,
  or controller
- A loss of power to a drive
- A defective cable, backplane, hard disk drive or
  controller

In each case, the communication problem needs to
be resolved, and then a Rebuild operation is
required to reconstruct the data for the device in its
disk array. The ServeRAID controllers can
reconstruct RAID level-1 and RAID level-5 logical
drives, but they cannot reconstruct data stored in
RAID level-0 logical drives.

To prevent data-integrity problems, the ServeRAID
controllers set the RAID level-0 logical drives to
Blocked during a Rebuild operation. After the
Rebuild operation completes, you can unblock the
RAID level-0 logical drives, and access them once
again. Remember, however, that the logical drive
might contain damaged data.

Steps for recovering from defunct drives

If the defunct drives are not part of an array, contact your IBM service representative.

If the defunct drives are part of an array, do the following:

- If more than one hard disk drive in an array is defunct, contact your IBM service representative.
- If a Rebuild operation is in progress, wait until the Rebuild is complete.
- If a Rebuild is not in progress and only one hard disk drive in the array is defunct, do the following:
    1. Verify the cables, hard disk drives, and controllers are installed properly.
    2. Attempt to rebuild the defunct hard disk drive by performing a hot-swap rebuild. Refer to "Rebuilding a hot-swap drive" for instructions.
    3. If the hot-swap rebuild fails, contact your IBM service representative.

Rebuilding a hot-swap drive

A hot-swap rebuild refers to a rebuild operation that is started by the ServeRAID controller when it detects that a drive 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 hard disk 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 will begin automatically without the requirement to replace the failed drive.

To start a hot-swap rebuild, do the following:

1. Without removing the drive completely, gently remove the hard disk drive from the server, using the handle of the hot-swap tray. If necessary, refer to the documentation that comes with your server on removing a hard disk drive.

2. Wait 20 seconds to allow the disk drive to completely spin down.

> **Note**
>
> When power is removed from a hot-swap drive, the drive immediately parks the heads, locks the actuator in the "landing zone," and begins spinning down. However, the spinning down of the disk 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 may damage the drive.

3. Gently reinstall into the server the hard disk drive that you removed. Make sure the drive is completely installed in the backplane connector.

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 shut down, power outage, or by some other means, the physical drive becomes inoperable.

To enable the physical drive to communicate with the ServeRAID controller again, do the following:

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, 2, or 3)
   - *sid* is the SCSI ID for the device (0–15)

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

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

primary controller and the primary controller does not respond to a reset command, the device driver attempts to failover to the secondary controller.

> ┌─ **Note** ─────────────────────────────┐
> Loose cables or defective physical drives will not cause a failover to occur.

Replacing a non-hot-plug controller in a failover pair

If a failed controller is not in a hot-plug PCI slot, do the following to replace it:

1. Shut down the server.
2. Replace the failed controller.
3. Follow the steps to reconfigure the new controller.

    - To initialize the controller, do steps 5 through 7 on page 184.
    - To configure the controller for failover, do steps 5 through 10 on page 185.

    > ┌─ **Important** ─────────────────────┐
    > Be sure the firmware level of the new controller is the same as the controller you are replacing.
    >
    > Be sure to use the same Controller Name, Partner Name, and SCSI Initiator ID for the controller you are replacing.

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

Guidelines for the rebuild operation

- The replacement hard disk drive must have a capacity equal to or greater than the failed drive.
- If the hard disk drive being rebuilt is part of a RAID level-0 logical drive, the RAID level-0 logical drive is blocked.
    - You must unblock any RAID level-0 logical drives at the end of the rebuild operation.
    - If you use the Administration and Monitoring Utility to initiate the rebuild operation, you can unblock the blocked

RAID level-0 drive when the rebuild operation completes.

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

General information about the rebuild operation

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

- You physically replace a defunct drive that is part of the critical logical drive.

  When you physically replace a defunct drive in a critical logical drive, the ServeRAID adapter/controller rebuilds the data on the new physical drive *before* it changes the logical drive state back to *Okay*.
- The ServeRAID adapter/controller adds a hot-spare or a standby hot-spare drive to the array and changes its state from *Hot-Spare* or *Standby Hot-Spare* to *Rebuilding*.

Automatically rebuilding the defunct drive

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

- The physical drive that failed is part of a RAID level-1 or RAID level-5 logical drive.
- A hot-spare or standby hot-spare drive with a capacity equal to or greater than the capacity of the defunct drive is available the moment the drive fails.
  - When multiple hot-spare drives are available, the ServeRAID adapter/controller searches for a hot-spare drive of the appropriate size. The smallest drive that meets this requirement enters the Rebuild state.
  - If no hot-spare or standby hot-spare drives are available, the rebuild operation will start the moment you replace the defective drive.

> **Note**
>
> If you physically replace the drive and the new drive does not appear in the Physical Drives branch of the Main Tree, you must scan for new or removed Ready drives.

- No rebuild, synchronization, or logical-drive migration operation is in process.

Software and physical replacement: When the ServeRAID adapter communicates with the hardfile and receives an unexpected response, the adapter will mark the drive defunct in order to avoid any potential data loss. For example, this could occur in the event of a power loss to any of the components in the SCSI ServeRAID subsystem. In this case, the ServeRAID adapter will err on the side of safety and will no longer write to that drive, although the drive may not be defective in any way.

It is recommended to use a software replace to recover data when multiple DDD drives occur. In this situation, you may lose data on drives that are not actually defective if you run a normal rebuild process.

Perform a software replace or a physical replace according to the following criteria:

- A software replace is recommended when trying to recover data when multiple DDD drives occur. In this situation, you may lose data on drives that are not actually defective if you run a normal rebuild process.

  > **Warning**
  >
  > If you use the wrong order when you attempt a software replace, data corruption results.

- Perform a software replace also for a single DDD drive when a hot-spare (HSP) is not present in the system and the drive has been marked DDD for the first time. In such a situation, the software replace requires a rebuild of the drive. During the rebuild, all sectors of the drive are rebuilt. Therefore, the drive is well tested. If a rebuild of the drive

completes successfully, the drive need not be physically replaced.

- Replace the DHS drive physically if a DDD drive has been replaced by an HSP. Under these circumstances, a software replace sends only a start unit command to the drive. If the unit starts successfully, the drive is seen as good by the ServeRAID adapter. Restarting a drive does not test the drive sufficiently. Therefore, the drive must be replaced physically to ensure that a good HSP drive is present in the system.

Using and understanding the ServeRAID Administration Log: The ability to read the ServeRAID log, generated by the IPSMON or Netfinity ServeRAID Manager, is a most important part of recovering an array when one or more drives are marked DDD. From the ServeRAID log, you can determine in what order drives went DDD, and, if multiple drives are DDD, which one is the "inconsistent" or "out-of-synch" drive. The ServeRAID log is created by running either IPSMON.EXE or Netfinity Manager. IPSMON.EXE is available on the IBM ServeRAID Command Line Programs Diskette from the IBM web site:

http://www.ibm.com/pc/files.html

Search on "ServeRAID."

Netfinity Manager is part of ServerGuide, which is shipped with every IBM PC Server and Netfinity Server.

The following is an excerpt from a ServeRAID log created by the IPSMON utility:

RAID log
09/12/97 09:33:36 INF003:A1C-B -- synchronization started
09/12/97 09:40:22 INF004:A1C-B -- synchronization completed
09/12/97 09:41:43 CRT001:A1C3B03 -- dead drive detected
09/12/97 09:42:13 INF001:A1C-B -- rebuild started
09/12/97 09:52:11 INF002:A1C-B -- rebuild completed
09/12/97 09:55:24 CRT001:A1C3B04 -- dead drive detected

The original configuration was:

- SID 1: HSP
- SID 2: ONL
- SID 3: ONL
- SID 4: ONL

The format is as follows:

  date time error type:A*x* C*x* B*xx* message

The *x* following A is the adapter number; the *x* following C is the channel, and the *xx* following B is the SID number. An error type can be either *informational* or *critical*. The message gives a brief description of the RAID event that has occurred.

The first two lines of the ServeRAID log show that a synchronization was started and proceeded to complete successfully. At a later point in time, on line 3 of the ServeRAID log, a dead drive is detected on adapter 1, channel 3, SID 3. In this case, since an HSP drive is defined, the rebuild starts automatically. Both the start and finish of the rebuild is logged by the IPSMON monitoring utility. Later on, the drive in SID 4 is marked dead, but no rebuild is started because the HSP drive has already been used.

In the current ServeRAID log, the drive in SID 4 is the "inconsistent" drive, and must be physically replaced. If more drives are DDD but are not listed in the ServeRAID log because the server has trapped (OS/2 or Windows NT) or the volume was dismounted (NetWare), you must software-replace those drives before replacing the drive in SID 2,

because the other drives contain the correct information to rebuild the "inconsistent" drive.

If this is the case, you should mark other drives ONL and then rebuild drive SID 4.

Before you perform any actions on the hardware, make a photocopy of the Channel Record table on "Channel Record Table" on page 263. Use Netfinity Manager, the ServeRAID administration program, or the ServeRAID configuration program to fill in the copy of the Channel Record table at the end of this manual with the current status of all the drives, both internal and external. This table provides a three-channel diagram to accommodate all types of ServeRAID adapters.

For the ServeRAID adapters, if power is lost or another drive is marked DDD during a rebuild operation, the rebuild fails and the drive being rebuilt remains in the RBL state. Consequently, the "inconsistent" drive remains recognizable.

Recovery from ServeRAID Adapter failure

When a ServeRAID adapter fails, you must replace the ServeRAID adapter and then restore the ServeRAID configuration to the new ServeRAID adapter. There are three ways to restore the ServeRAID configuration:

Method 1 (preferred method)

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

Recovery procedures

There are two groupings of recovery procedures:

- "When HSP is present at time of failure"
- "When HSP is not present at time of failure" on page 224

When HSP is present at time of failure: Use the following recovery procedures when an HSP state is present at the time of a disk failure:

- "One DHS drive, no RBL" on page 220
- "One DDD drive, one DHS drive, no RBL" on page 221

- "More than one DDD drive, one DHS, no RBL" on page 222
- "One DHS drive, one or more DDD drives, and one RBL drive" on page 223

One DHS drive, no RBL: Follow the steps below to bring the DHS drive back to an HSP state if the following items are true:

- Only one drive is marked DHS and the rest are ONL.
- The ServeRAID logical drive status is OKY because an HSP is present in the system. Either the HSP drive is the hard drive that went DHS or the HSP drive has already taken over for the DHS drive automatically and has been rebuilt successfully.
- There are no drives with a RBL status.

Once you verify the conditions above through either the ServeRAID Administration log or the ServeRAID Administration Utility, perform the following steps to bring the DHS drive back to HSP status:

1. Physically replace the DHS hard drive with a new one of the same capacity or greater in the same location. If Hot-Swap Rebuild is Enabled, the state of the new drive will automatically be set to HSP. If this occurs, skip to step 5. If the new drive is not automatically set to HSP, then this must be done manually. Instructions for manually setting the drive state continue with step 2.
2. With a RAID-1 or RAID-5 logical drive, the operating system is still functional at this point. Use either Netfinity Manager 5.0 (or later) or the ServeRAID Administration Utility to bring the drive back to HSP status. Using the ServeRAID Manager, select the DHS drive.
3. A window named Device Management appears, listing all the possible drive states. Select Hot-Spare (HSP), or Standby Hot-Spare (SHS) if necessary, then select **Set Device State**.
4. The adapter issues a start unit command to the drive. Once the drive successfully spins up, the adapter changes the drive's state to HSP (or SHS) and saves the new configuration. A message appears that reads, "Device state changed from DHS to HSP (or SHS)". Select

OK on this message and then on the Device Management window.

5. If you see a message that says:

   Error in starting drive

   Reinsert the cables and hard drive to verify that they are connected properly, then go to step 2. If the error persists, go to step 1.

6. If the error still occurs with a hard drive that is known to be good, troubleshoot to determine the defective part. The defective part can be a cable, a back plane, a ServeRAID adapter, or some other component. Once you have replaced the defective part so that there is a good connection between the adapter and the hard drive, go to step 2.

One DDD drive, one DHS drive, no RBL: If the system has a DDD drive and a DHS drive and a hot-spare (HSP) existed prior to the drive failures, the system should still run as long as the logical drives are configured as RAID-5 or RAID-1. The logical drives in the array will be in the CRT state due to one drive in the array being defunct.

Note

Because the operating system is functional, this procedure assumes you are using the ServeRAID Administration Utility within the operating system to recover.

Perform the following steps to bring the logical drive from CRT to OKY status:

1. Physically replace the drives that are marked DDD and DHS.

   Important

   Before you proceed, verify whether it is in a rebuild state. Do not attempt to start another rebuild.

   If the customer has enabled the HOT SWAP rebuild option, the new adapter automatically starts a rebuild. If this is the case, the following step occurs automatically.

   ---

2. Select the DDD drive from within the ServeRAID Administration Utility and then

select **Rebuild Drive**. You see a message confirming that the drive is starting. The drive then starts the rebuild process. When this process is complete, the drive is marked ONL.
3. After the rebuild is complete, select the DHS drive from within the ServeRAID administration utility. You then see several options. Choose **HSP** (or **SHS** if necessary) and choose **Set Device State**. The adapter issues a start unit command to the drive. Once the drive spins up and the adapter saves the drive's configuration, the drive is marked HSP, or SHS, as is applicable.

More than one DDD drive, one DHS, no RBL

> **Note**
>
> The following procedure for multiple DDD drives assumes that the operating system is installed on one of the DDD drives.

In this scenario, the operating system is no longer functional. Therefore, you must boot to the ServeRAID DOS Configuration Diskette to recover the logical drive. It is extremely important to confirm that either the ServeRAID Administration Utility or Netfinity Manager 5.0 has been running prior to the drives being marked defunct. If so, the utility or Netfinity Manager has logged the sequence of DDD events to a log file, either on a diskette or on a local or network drive. With this file, you can view the log file on another machine to determine the "inconsistent" drive. When you know which drive is "inconsistent", you can attempt to recover data.

> **Note**
>
> Once you lose more than one drive in a set of RAID-5 or RAID-1 logical drives, loss of data is definitely a possibility. The steps below guide you through a recovery. However, a recovery may not be possible in every case.

1. View the ServeRAID log on another machine and write down the order in which the drives went defunct.
2. Boot to the ServeRAID DOS Configuration Diskette and choose **View Configuration**. Make sure that the Channel Record Table

contains the correct information for the status of all drives, not just those listed in the RAID log.

3. Using the ServeRAID Configuration Utility program, choose **Set Device State** and choose a DDD drive that is not listed in the ServeRAID log. Set that drive to an ONL state. Repeat this step until the only DDD drives remaining are those indicated in the ServeRAID log file.

> **Important**
>
> The drives marked DDD that are not listed in the ServeRAID log are the last ones to go defunct. You must recover those drives first so that the information from them can be used to rebuild the original drive that failed —that is, the "inconsistent" drive. If you do not replace the "inconsistent" drive last, the system uses it to rebuild the last drive that went defunct, and data can be corrupted as a result. Therefore, it is **extremely important** to perform the above step 3 carefully!

4. Choose **Set Device State** and then choose the last drive to go defunct according to the log file. Set that device to the ONL state. Repeat until there is only one DDD drive remaining.
5. Choose **Set Device State** and choose the DHS drive. Change its state from DHS to HSP.
6. Choose **Rebuild** and highlight the DDD drive.

One DHS drive, one or more DDD drives, and one RBL drive

> **Note**
>
> The following procedure for multiple DDD drives assumes that the operating system is installed on one of the DDD drives.

> **Important**
>
> The ServeRAID adapter **must** be using firmware level 2.87 or later for the following procedure to have a chance at success.

Usually when you have a RBL drive after bringing up a system, it is because the data on the drive was being rebuilt when the system went down. If there

are DDD drives as well, those drives are more than likely the cause of the system crash. The following steps allow you to attempt to recover the logical drive:

1. Boot to the ServeRAID DOS Configuration Diskette for the ServeRAID adapter.
2. Choose **View Configuration**.
3. Write down the current status of each drive.
4. Physically replace the DHS drive.
5. Return to the utility's Main Menu and choose **Device Management**.
6. Choose **Set Device State**.

   If you see any DDD drives, highlight them and change their status to ONL.

   If you do not see any DDD drives, highlight the DHS drive and change its state to HSP, or SHS, as appropriate. Repeat this step until there are no more drives marked DDD or DHS.
7. Choose **Rebuild** and highlight the RBL drive. The rebuild process begins, and all data will be rebuilt to the drive.

When HSP is not present at time of failure:
Use the following recovery procedures when HSP is not present at the time of a disk failure:

- "One DDD drive, no RBL"
- "Two DDD drives, no RBL" on page 226
- "More than two DDD drives, no RBL" on page 228

One DDD drive, no RBL: Follow these steps to bring the DDD drive back to the ONL state if the following items are true:

- Only one drive is marked DDD and the rest are ONL.
- There are no drives with an RBL status.

Once the conditions above are verified through either the RAID administration log or the ServeRAID Administration Utility, perform the following steps to bring the DDD drive back to ONL status.

1. If drive has never been marked DDD, proceed to step 3 to software-replace the drive using the ServeRAID Administration and Monitoring Utility or Netfinity ServeRAID Manager.

> **Note**
>
> Refer to "Software and physical replacement" on page 216 to understand differences between software and physical replacement.

2. If the drive has been marked DDD before, physically replace the hard drive in the DDD SID with a new one of the same capacity or greater.
3. With a RAID-1 or RAID-5 logical drive, the operating system will be functional. Use either Netfinity Manager or the ServeRAID Administration Utility within the operating system to start the Rebuild process. With the ServeRAID Administration Utility, select the drive marked DDD, and choose **Rebuild** from the menu that appears.
4. The adapter issues a start unit command to the drive. The drive then begins the rebuild process. Once the drive completes this process, the drive's status changes to ONL.
5. If you see the message:

   Error in starting drive

   Reinsert the cables, hard drive, etc., to verify there is a good connection. Go to step 3. If the error persists, go to step 6.
6. Physically replace the hard drive in the DDD SID with a new one of the same capacity or greater and go to step 3.
7. If the error still occurs with a known good hard file, troubleshoot to determine if the cable, back plane, ServeRAID adapter, or other component is defective.

> **Note**
>
> You can view the ServeRAID Device Event Table by clicking on the logical drive from the ServeRAID Administration and Monitoring Utility. If Hard Events are reported in the ServeRAID Device Event Table, refer to "Device Event Table" on page 250 for information. The ServeRAID adapter should not be replaced, in many cases.

8. Once you have replaced the defective part so that there is a good connection between the adapter and the hard drive, go to step 3.

Two DDD drives, no RBL

> **Note**
>
> The following procedure for multiple DDD drives assumes that the operating system is installed on one of the DDD drives.

In this case, with no defined hot-spare drive, the server more than likely trapped (under OS/2 and Windows NT) or the volume was dismounted (under NetWare). To resolve this scenario, examine the ServeRAID log generated by the ServeRAID Administration Utility and follow the steps below:

1. Boot to the ServeRAID DOS Configuration Diskette for the ServeRAID adapter.
2. Choose **Set Device State** and highlight the drive marked DDD last by the ServeRAID adapter. Set this drive's state to ONL. The drive spins up and changes from DDD to ONL status.

> **Warning**
>
> If you use the wrong order when you set the drive's state to ONL, data corruption results. See the following note to determine the last drive marked DDD by the ServeRAID adapter.

> **Note**
>
> Refer to "Using and understanding the
> ServeRAID Administration Log" on
> page 217 for details on obtaining and
> interpreting the ServeRAID log.
>
> - If only one drive is recorded in the
>   ServeRAID log because the
>   ServeRAID adapter was not able to
>   log the defunct drive before the
>   operating system went down, the last
>   drive that went defunct is the drive
>   that is not recorded in the ServeRAID
>   log.
> - If two drives are recorded in the
>   ServeRAID log, then the last drive to
>   go defunct is the second drive listed in
>   the log —that is, the drive with the
>   most recent time stamp.

3. If the drive has been marked DDD before,
   physically replace the hard drive with a new
   one of the same capacity or greater. Proceed
   to step 5.
4. Proceed to step 5 to software-replace the
   remaining DDD drive using the ServeRAID
   Administration and Monitoring Utility or Netfinity
   ServeRAID Manager.

   > **Note**
   >
   > Refer to "Software and physical
   > replacement" on page 216 to understand
   > the differences between software and
   > physical replacement.

5. With a RAID-1 or RAID-5 logical drive, the
   operating system will be functional. Use either
   Netfinity Manager or the ServeRAID
   Administration and Monitoring Utility within the
   operating system to start the Rebuild process.
   With the ServeRAID Administration and
   Monitoring Utility, select the drive marked DDD
   and choose **Rebuild** from the menu that
   appears.
6. The adapter issues a start unit command to the
   drive. The drive then begins the Rebuild
   process. Once the drive completes this
   process, the drive's status changes to ONL.

7. If you see the message:

   `Error in starting drive`

   Re-insert the cables, hard drive, and all other components to verify that there is a good connection. Go to step 5. If the error persists, go to step 8
8. Physically replace the hard drive in the DDD SID with a new one of the same capacity or greater and go to step 5
9. If the error still occurs with a known good hard drive, troubleshoot to determine if the cable, back plane, ServeRAID adapter, or other component is defective.

   ---- **Note** ----

   You can view the ServeRAID Device Event Table by selecting the logical drive from the ServeRAID Administration and Monitoring Utility. If Hard Events are reported in the ServeRAID Device Event Table, refer to "Device Event Table" on page 250 for more information. The ServeRAID adapter, in many cases, should not be replaced.

10. Once you have replaced the defective part so that there is a good connection between the adapter and the hard drive, go to step 5.
11. If software replacement brings all the drives back ONL and makes the system operational, carefully inspect all cables, etc., to ensure that the cables or backplane are not defective. Make sure that the card is seated properly. When multiple drives are marked defunct, it is often the communication channel (cable or backplane) that is the cause of the failure. If the backplane is bowed, drives and backplane connectors may not seat properly, causing it to have a bad connection. Also, with hot-swap drives that are removed frequently, connectors could become damaged if too much force is exerted.

More than two DDD drives, no RBL

Note

The following procedure for multiple DDD drives
assumes that the operating system is installed
on one of the DDD drives.

---

1. View the ServeRAID log on another machine
   and write down the order in which drives went
   defunct.
2. Boot to the ServeRAID DOS Configuration
   Diskette and choose **View Configuration**.
   Make sure that the Channel Record Table
   contains the correct information for the status
   of all drives, not just those listed in the
   ServeRAID log.
3. Using the ServeRAID Configuration Utility
   program, choose **Set Device State**, then
   choose a DDD drive not listed in the
   ServeRAID log to software-replace the drives.
   Change the state of this drive to ONL.
4. Perform the previous step until only two DDD
   drives are remaining. One or both of these
   drives should be listed as the first drive(s) to go
   defunct as indicated in the ServeRAID log.

   Note

   If you choose the wrong order when you
   choose **Set Device State** to change the
   drives' states to ONL, data corruption
   results. Be sure that you only change
   device states to ONL for drives not listed
   as DDD in the ServeRAID log. The first
   defunct drive requires rebuilding, so it must
   be replaced last.

ServeRAID reference information

Understanding RAID technology

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 work in a given amount of time) or productivity needs of the multiple-user network environment.

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

Stripe-unit size

With RAID technology, data is *striped* across an array of 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 control the stripe-unit size and maximize the performance of your ServeRAID controller by setting a stripe-unit size to a value that is close to the size of the system I/O requests. You can set the stripe-unit size to 8 KB, 16 KB, 32 KB, or 64 KB. For example, performance in transaction-based environments, which typically involve large blocks of data, might be optimal when

the stripe-unit size is set to 32 KB or 64 KB; however, performance in file and print environments, which typically involve multiple small blocks of data, might be optimal when the stripe-unit size is set to 8 KB or 16 KB.

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

> **Note**
>
> If you are using the ServeRAID-3L:
>
> - Eight physical drives are supported in an array if the stripe-unit size is set to 32 KB or 64 KB.
> - Sixteen physical drives are supported in an array if the stripe-unit size is set to 8 KB or 16 KB.
>
> If you are using the ServeRAID-3H or ServeRAID-3HB, sixteen physical drives are supported in an array if the stripe-unit size is set to 32 KB or 64 KB.

Supported RAID levels

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

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

Understanding RAID level-0: RAID level-0 stripes the data across all the drives in the array. This offers substantial speed enhancement, but provides for no data redundancy. RAID level-0 provides the largest capacity of the RAID levels offered, because no room is taken up for redundant data or data-parity storage.
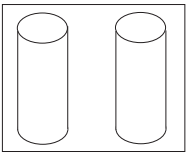
RAID level-0 requires a minimum of one drive and, depending upon the level of firmware and the stripe-unit size, supports a maximum of eight or 16 drives.

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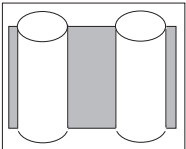RAID level-0 logical drive.

You start with two physical drives.
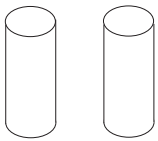
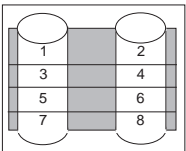Create an array using the two physical drives.

Then, create a logical drive within that array.

The 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, 1E, 5, or 5E in
the same array, they will not lose data.

Note

You can assign RAID level-0 only to logical
drives in an array that contains only one
physical drive.

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

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

Understanding RAID Level-1: RAID level-1 provides 100% data redundancy and requires only two physical drives. With RAID level-1, 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 written to the other drive in the RAID level-1 array.
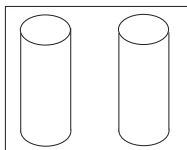
Because the data is mirrored, the capacity of the logical drive when assigned RAID level-1 is 50% of the array capacity.

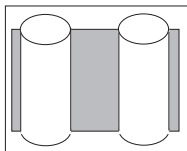The following illustration shows an example of a RAID level-1 logical drive.
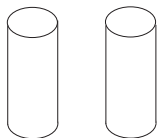
You start with two physical drives.

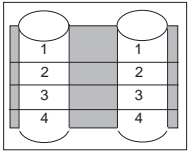Create an array using the two physical drives.

Then, create a logical drive within that array.

The data is striped across the drives, creating blocks.

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

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.

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

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

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 eight or 16
drives.

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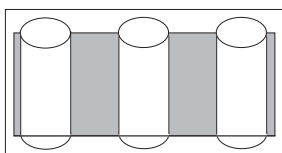Enhanced RAID level-1 logical drive.

You start with three physical drives.
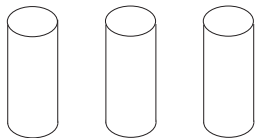
Create an array using the physical drives.
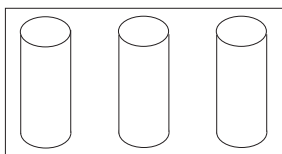
Then, create a logical drive within that array.

The data is striped across the drives, creating
blocks.

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

*	1	2	3
**	3	1	2
*	4	5	6
**	6	4	5
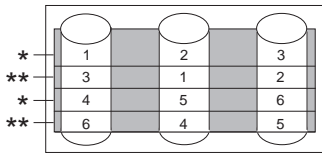
With RAID level-1E, if one of the physical drives fails, the ServeRAID controller switches read and write requests to the remaining functional drives in the RAID level-1E array.

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

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

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

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

You start with four physical drives.

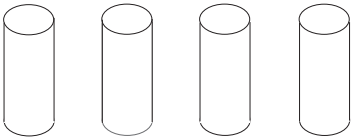Create an array using three of the physical drives, leaving the fourth as a hot-spare drive.
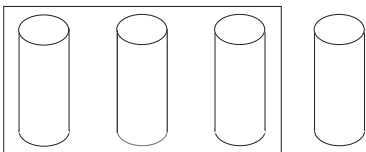
Then, create a logical drive within that array.

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.

✱	1	2
3	✱	4
5	6	✱
✱	7	8

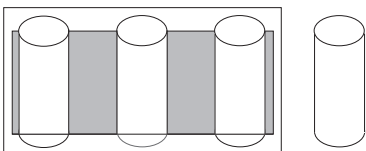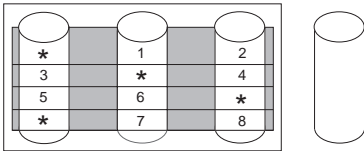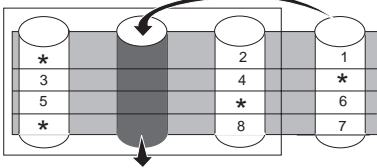If a physical drive fails in the array, the ServeRAID controller switches read and write requests to the remaining functional drive in the RAID level-5 array, which is a hot-spare drive.

✱		2	1
3		4	✱
5		✱	6
✱		8	7

Understanding RAID Level-5 Enhanced:

RAID level-5 Enhanced (also called RAID level-5E) requires a minimum of four physical drives. RAID level-5E is also firmware-specific. You can think of RAID level-5E as "RAID level-5 with a built-in spare drive."

Reading from and writing to four disk drives is more efficient than three disk drives and an idle hot spare and therefore improves performance. Additionally, 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.

Like RAID level-5, this RAID level stripes data and parity across all of the drives in the array. When an array is assigned RAID level-5E, the capacity of the logical drive is reduced by the capacity of two

physical drives in the array (that is, one for parity and one for the spare).

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

Note

For RAID level-5E, you 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.

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 eight or 16 drives.

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

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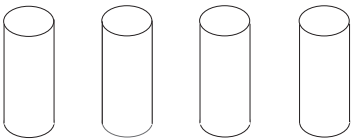
Create an array using all four physical drives.
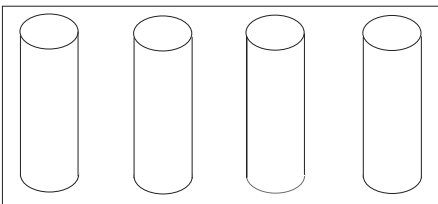
Then, create a logical drive (labeled as 1) within the array.

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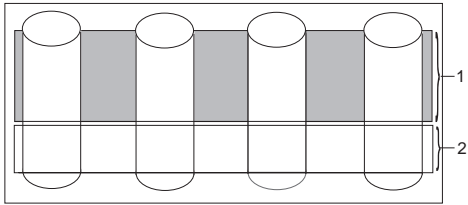
The data is striped across the drives, creating blocks in the logical drive.

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.
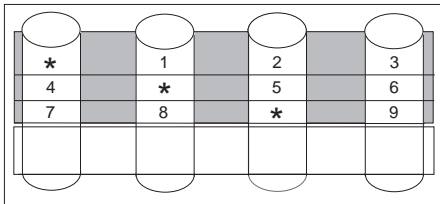
If a physical drive fails in the array, the data from the failed drive is compressed into the distributed spare drive. The logical drive remains RAID level-5E.

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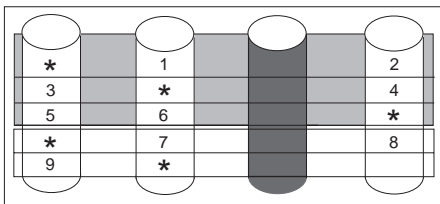
Note

The ServeRAID Manager Program Express configuration 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.

Selecting a RAID level and performance tuning: When selecting a RAID level for your system, consider the following:

---

3 Depending on the number of physical drives in the array.
4 Performance depends on the number of drives in the array. Generally, the more drives in the array, the better your performance.

RAID level	Data Redundancy	Hard Disk Drive Capacity Utilization	Read Performance	Write Performance	Built-in Spare Drive
RAID level-0	No	100%	Excellent	Excellent	No
RAID level-1	Yes	50%	Very Good	Very Good	No
RAID level-1E	Yes	50%	Very Good	Very Good	No
RAID level-5	Yes	67% to 94%[3]	Excellent[4]	Good[4]	No
RAID level-5E	Yes	50% to 88%[3]	Excellent[4]	Good[4]	Yes

Device drivers

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

Using ServeRAID Adapters 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.

> **Note**
>
> The RAID-5 logical drive must be synchronized initially to ensure that the RAID-5 parity used to reconstruct data in the event of an unreadable sector is correct.

Perform data scrubbing weekly on the RAID-5 and RAID-1 logical drives to minimize the risk of undetected and, therefore, uncorrected sector media errors on the remaining drives in the array.

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 248

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.

See "Grown sector media error protection" on page 254 for information about protection provided at the ServeRAID adapter level.

> **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 adapter 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.

Netfinity Manager 5.0 allows you to schedule synchronization automatically from either the server or the remote manager. Netfinity Manager 5.0 can be obtained at no additional charge by customers who have ServerGuide, which is shipped with every IBM server. If the customer has another type of scheduler, such as the AT scheduler, built into Windows NT, or REXXWARE by Simware Corporation, the IBM PC ServeRAID and ServeRAID II Adapter IPSSEND utility may be used to allow the customer to schedule data scrubbing without Netfinity Manager installed. Refer to "Automatic data scrubbing and data scrubbing utilities" on page 259 for the adapter and operating

system compatibility matrix for these data scrubbing utilities.

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 adapter cannot rebuild all the data. In such cases, a double failure exists; files must be restored from backup media.

See "Combination failure" on page 255 for information about protection provided at the ServeRAID adapter level.

IBM recommends data scrubbing **all** RAID-5 and RAID-1 logical drives weekly, or updating firmware to a level which provides automatic data scrubbing, to minimize the risk of having any undetected sector media errors on the remaining drives of the array when a drive failure occurs.

Note

IBM provides management software, Netfinity Manager, with IBM servers that ship with ServerGuide. The software monitors the status of the hardware and provides alerts when conditions are not optimal. Netfinity Manager enables customers to obtain all of the information necessary for data protection. Installation of Netfinity Manager or similar tools to monitor and track disk subsystem integrity is critical for the protection of stored data.

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 adapters:

- "Remapping bad sectors" on page 249

- "Error Correction Code (ECC)" on page 249
- "Predictive Failure Analysis (PFA)"

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): 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 246).

   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 Netfinity Manager 5.0. 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 adapter, 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 IPSSEND program or the IBM ServeRAID Administration and Monitoring Utility.

Using the IPSSEND program

```
  ┌─ Note ──────────────────────────────────┐
  │                                          │
  │ In the following command, replace <controller> │
  │ with the ServeRAID adapter or 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 adapter processor can detect many types of events. Usually these events are related to SCSI cabling, back planes or internal problems in the ServeRAID adapter. 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 adapter, replace the SCSI cables followed by the back plane. If you have exhausted all other possibilities, then replace the ServeRAID adapter. 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 adapter. 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 adapter internally filters the types of soft errors and will mark a disk drive defunct (DDD) 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 single bit errors on the SCSI bus found by the ServeRAID adapter 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 adapter 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 adapter.

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 adapter 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 adapter level protection

At the adapter 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 as shown below. 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. The following illustration shows that three 2GB drives provide 4GB of data space and 2GB of redundancy.
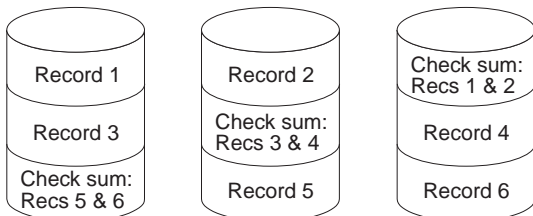
Note

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.

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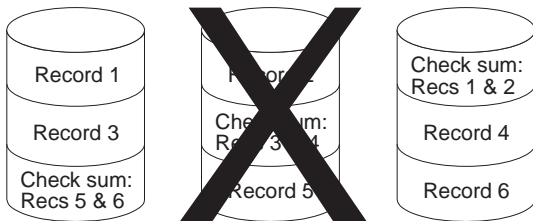
As long as the array controller can access the remaining *n*-1 drives, the rebuild will be successful. Naturally, if a second disk failure were to suddenly occur, the array and its data would be lost. RAID-5 can only protect against the loss of a single drive.

Grown sector media error protection: As the drive attempts to read data in a read request, it determines that Record 1 of Disk 1 has a bad sector, as pictured below. 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 adapter determines if the data is still lost, as it was without RAID support. In such a case, ServeRAID adapters can recognize the fault and re-create the data from redundant information stored on other drives.

For example:

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

   The ServeRAID adapter 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.
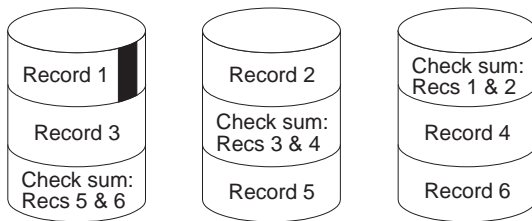
Combination failure: In the example below, an undetected sector media error exists within Record 1 of Disk 1.
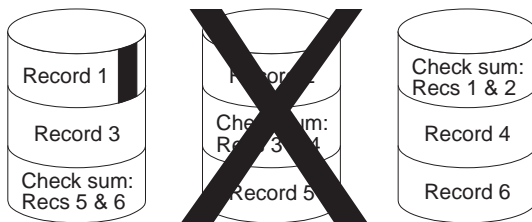
This error occurred within an archived section of the user's database that is seldom accessed. Before this error is recognized and corrected, a "catastrophic" failure of Drive 2 is sustained. So far, no data problems are noticed.

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 adapter 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 RAID-5 logical drives must be synchronized after their definition before data may be stored. The IBM ServeRAID Configuration Utility program does not force the user to synchronize the logical drive when defined to provide the customer the flexibility to define multiple logical drives and then to synchronize them in one step. Once the array has been synchronized, the RAID-5 parity remains synchronized until the logical drive is redefined.

Data stored before synchronizing a RAID-5 array is **not** protected. The corresponding parity for this data may not be correct. If you do not know whether the RAID-5 logical drives have been synchronized, you can use the IBM ServeRAID Synch/Verify/Update Diskette to determine if the RAID-5 logical drives are synchronized.

The Synch/Verify/Update Diskette consists of the following two tools:

1. SYNCV1 - Synchronization Verification Utility
2. SYNCV2 - Synchronization Tool

The *Synchronization Verification Utility* is run during off-peak hours to determine whether the logical drives are synchronized. If the RAID-5 logical drives are synchronized, no further action is necessary. If the Synchronization Verification utility identifies that one or more RAID-5 logical drives may not be synchronized, a full tape backup should be performed. Then, downtime must be scheduled to run the SYNCV2 tool to synchronize all the RAID-5 logical drives. Once the Synch/Verify/Update Diskette has been run completely, the RAID-5 logical drives remain synchronized until it is redefined.

The IBM ServeRAID Synch/Verify/Update Diskette is available at:

http://www.ibm.com/pc/files.html

Search for the file name with "ServeRAID." If the RAID-5 logical drives have been synchronized, you **do not** need to run the IBM ServeRAID Synch/Verify/Update Diskette.

Providing additional protection for RAID-5 and RAID-1 logical drives

For protection against multiple drive failures and undetected grown defects, force the detection of any sector media errors through periodic data scrubbing. This operation can be done in the following ways:

- "Full tape backups"
- "Data scrubbing"

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 adapter 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.

Data scrubbing: Another way to force discovery and correction of sector media errors is "Automatic data scrubbing and data scrubbing utilities" on page 259.

Array *synchronization* reads the data and parity blocks from all the disks and checks that the parity correctly matches the data block information. If the logical drive was synchronized upon configuration, the parity information matches the data. The synchronization procedure is, therefore, used for data scrubbing. 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 and data scrubbing utilities: ServeRAID II, 3H, 3HB, and 3L Adapters allow RAID-5 and RAID-1 logical drives to be data scrubbed in the background via firmware. This feature is available using the following firmware levels available from:

http://www.ibm.com/pc/files.html

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 RAID level-1 and RAID level-5 logical drives on a weekly basis.

You must synchronize all RAID level-5 logical drives before storing data.

The IBM PC ServeRAID Adapter allows RAID-5 and RAID-1 logical drives to be data scrubbed via the synchronization utility by taking the server offline and running the IBM ServeRAID Configuration Diskette. Array synchronization may take several hours, depending on the size of the logical drive. The ServeRAID adapter provides various utilities to provide the customer with data scrubbing flexibility.

Netfinity Manager 5.0 and above: Through
Netfinity Manager 5.0 and above, data scrubbing
can be performed via synchronization as a
background task while users access the data.
Netfinity Manager supports either local or remote
access on the server console under OS/2 or
Windows NT. Synchronization can be scheduled to
run at off-peak hours without requiring user
intervention by using Netfinity's event scheduler. To
use Netfinity 5.0 to schedule data scrubbing,
download NF50RAID.EXE from:

http://www.ibm.com/pc/files.html

This file contains updated Netfinity program files that
are required for scheduling data scrubbing on
adapters or controllers with the write policy set to
write-back cache.

When the Netfinity Manager code is installed, the
following operating systems are affected:

- OS/2
- WINNT
- WIN95.

System administrators can also use Netfinity
Manager's out of band, or serial connection,
capabilities to dial into a machine that has Netfinity
Manager installed, and access the entire network.
This "out of band" support is particularly important
since this allows LAN administrators to "dial in" from
remote locations to initiate an array synchronization.
All these features, plus many more, are discussed in
the Netfinity Manager Users Guide.

Netfinity Manager 5.0 and above is included in
ServerGuide version 3.1 and above, which is
shipped with every IBM server.

If you have ServerGuide version 3.0 or older, you
can obtain an upgrade at no additional cost to the
latest release.

Instructions for configuring ServeRAID Adapter
under Netfinity Manager 5.0

- Run ServeRAID Manager service
- Choose **Options** from the menu bar.
- Choose **Configure Enclosure**.

- Configure the adapter number and channel for each bank using the IBM ServeRAID Administration and Monitoring Utility.
- Choose **Options / Save Configuration**.

Instructions for scheduling data scrubbing

1. Start the Netfinity Service Manager.
2. Select **Event Scheduler**.
3. Choose **New**.
4. Type in DATA SCRUB for the new event name or any specific name you choose.
5. Highlight **Synchronize All ServeRAID Drives** under Tasks.
6. Select **Systems** or **Groups** under **Scheduled By** to choose the systems for data scrubbing.

> ── **Note** ──────────────
>
> Ensure that all systems selected have an ServeRAID adapter installed that supports the Netfinity Manager 5.0 data scrubbing utility. See the above compatibility matrix for supported adapters.

7. Once all systems have been selected, select **Schedule** to choose the time and date along with the frequency desired. IBM recommends weekly data scrubbing for a high level of data protection.
8. Select **Save** to save the event and exit.

> ── **Note** ──────────────
>
> The status of the DATA SCRUB event can be viewed by clicking on **View Logs** within the Event Scheduler. If the log displays that the DATA SCRUB event has started but has not yet been completed, the percentage complete can be viewed in the ServeRAID Monitor portion of Netfinity Manager.

In addition, the ServeRAID adapters provide two other methods for initiating data scrubbing. The TCP/IP based client/server administration utility allows online synchronization of arrays initiated from a Windows 95 or Windows NT client station.

IPSSEND.EXE for ServeRAID Adapters

Note

You must know the adapter number and logical drive number of the drive you want to data scrub. To determine the adapter number and logical drive number, use the IBM ServeRAID Administration and Monitoring Utility. Refer to the Hardware Maintenance Manual for the system you are servicing.

Instructions for using the IPSSEND utility: The IBM PC ServeRAID and ServeRAID II Adapters provide the IPSSEND utility as a means for data scrubbing under all supported operating systems. The IPSSEND utility is available on the IBM ServeRAID Supplemental Diskette at:

http://www.ibm.com/pc/files.html

Search on "ServeRAID."

The IPSSEND utility may be coupled with a third party event scheduler, such as REXXWARE by Simware Corporation, available at:

http://www.simware.com

or the AT Scheduler that is built into Windows NT. The syntax of IPSSEND is described below.

Note

In the following command, replace `<adapter number>` with the adapter number and replace `<logical drive number>` with the logical drive number.

At a command prompt, type the following:

```
ipssend synch <adapter number> drive <logical drive number>
```

where the adapter number starts at 1 and logical drive number starts at 0.

The IBM ServeRAID Administration and Monitoring Utility displays the logical drive numbers and their corresponding adapter numbers.

Channel Record Table

Make photocopies of this table and fill out a copy for each system you service. Provide it to the customer to keep with the records of the system configuration.

Channel 1	Channel 2	Channel 3

Acronyms, terms, and definitions

A

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.

B

BAY.   Refers to a one-based counting scheme for the SCSI devices on a channel. A device's bay value is equal to its "SCSI ID" plus one (BAY = SCSI ID + 1).

block.   A string of data elements recorded or transmitted in a unit. The elements may be characters, words, or physical records.

byte.   A string of eight bits that is treated as a unit, and that represents a character.

C

cache memory.   A special buffer storage, smaller and faster than main storage, that is used to hold a copy of instructions and data in main storage that are likely to be needed next by the processor, and that have been obtained automatically from main storage.

CDR.   CD-ROM

CRT.   Critical

D

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

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parity information, if necessary. For a high level of data protection, perform data scrubbing weekly.

DDD.   Defunct drive.

The ServeRAID adapter marks an ONL or OFL (RBL if ServeRAID) drive defunct, changing its status to DDD and removing power from the drive when one of the following conditions occur:

- The drive does not respond to commands by a certain timeout value.
- The drive exceeds the number of allowed busy status responses as specified by the ServeRAID adapter firmware.
- A reassign failure or two successive failures in verification occur when the ServeRAID adapter tries to recover from a media error reported from the drive.

Note

Media error recovery and conditions under which a drive is marked defunct in the recovery process vary slightly depending upon the specific ServeRAID adapter.

---

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 DHS drive is replaced, its state changes from DHS to HSP. Only the IBM ServeRAID adapter has the DHS state.

disk array.   (1) A grouping of hard disks that can be logically considered one drive. (2) A grouping of hard disks over which a data file is spread.

E

electronically erasable programmable read-only memory (EEPROM).   A PROM that can be erased by a special process and reused.

EMP.   Empty. 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.

F

FRE. Free logical drive. (Logical drives are not defined.)

G

GB. Gigabyte; equal to approximately one billion bytes.

H

hard disk drive. A stand-alone disk drive that reads and writes data on rigid disks.

hot-spare drive. A hard disk drive that is installed in a computer and configured by the system for use in the event of a drive failure.

HSP. Hot-Spare. In IBM PC ServeRAID and ServeRAID II adapters or controllers, a hot-spare (HSP) drive is a drive designated to be a replacement for the first DDD drive that occurs. The state of the drive appears as HSP. When a DDD drive occurs and a HSP is defined, the hot-spare drive takes over for the drive that appears as DDD. The HSP drive is rebuilt to be identical to the DDD drive. During the rebuilding of the HSP drive, this drive changes to the RBL state. The RBL state will turn to ONL once the drive is completely rebuilt and fully operating for the DDD drive.

In other other adapters or controllers, a drive designated to be a replacement for the first DDD drive that occurs. The state of the drive appears as HSP. When a DDD drive occurs and a HSP is defined, the hot-spare drive takes over for the drive that appears as DDD. The HSP drive is rebuilt to be identical to the DDD drive. During the rebuilding of the HSP drive, this drive changes to the OFL state. The OFL state turns to ONL once the drive is completely rebuilt and fully operating for the DDD drive.

I

initialize.   (1) To set counters, switches, addresses, or contents of storage to zero or other starting values at the beginning of, or at prescribed points in, the operating of a computer routine. (2) To prepare for use; for example, to initialize a hard disk or diskette.

interleave.   To arrange parts of one sequence of things or events so that they alternate with parts of one or more other sequences of the same nature and so that each sequence retains its identity.

interleave depth.   The granularity at which data from one file is stored on one drive of the array before subsequent data is stored on the next drive in the array.

interleaving.   The simultaneous accessing of two or more bytes or streams of data from distinct storage units.

ISPR.   Interrupt Status Port register.

K

KB.   Kilobyte; equal to approximately 1000 bytes.

L

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.

M

mapping.   The establishing of correspondences between a given logical structure and a given physical structure.

MB.   Megabyte; equal to approximately 1 000 000 bytes.

menu-driven.   Concerning application software allowing user to select operations from one or more menus without entering keyboard commands.

mirroring.   The process of writing the same data to two disk units within the same auxiliary storage pool (disk array) at the same time.   The two disk units become a mirrored pair, allowing the system to continue when one of the mirrored units fails.

non-volatile random access memory (NVRAM). Random access memory that retains its contents after electrical power is shut off.

N

NVRAM.   Non-volatile random access memory.

O

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.

P

parity.   The state of being odd or even used as the basis of a method of detecting errors in binary-coded data.

parity bit.   A binary digit appended to a group of binary digits to make the sum of all the digits, including the appended binary digit, either odd or even as 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 the ServeRAID administration utility and Netfinity 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.

R

RAID.   Redundant array of independent disks.

RBL.   Rebuild. A drive in this state is being rebuilt. Only the IBM ServeRAID adapter has this state. A physical hard drive can enter the RBL state if one of the following conditions occurs:

- A good working drive replaces a DDD drive that is part of the critical logical drive. At the end of a successful rebuild, the state of the physical drive changes to ONL, and the state of the corresponding logical drives changes to OKY.
- The HSP or standby hot-spare (SHS) drive is added to the array and the state changes from HSP or SHS to RBL. At the same time, the DDD drive is removed from the array and its state changes to DHS from DDD. The adapter then automatically reconstructs data in the RBL drive. The state of the corresponding logical drive CRT (if the RAID level is 1 or 5) or OFL during the rebuild process. When the rebuild

completes successfully, the device state changes from RBL to ONL and the logical drive state changes from CRT to OKY.

- A ready (RDY) or standby (SBY) drive replaces a DDD drive that is part of the critical logical drive. The state of the RDY or SBY drive becomes RBL. When the rebuild completes successfully, the state changes to ONL. The DDD drive is removed from the logical drive and becomes DHS

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.

S

SID. SCSI ID. A zero based counting scheme (0, 1, ... 15) for the SCSI devices on a channel.

SBY. Standby.

sector. A predetermined angular part of a track or band on a magnetic disk that can be addressed. 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

server. In a network, a data station that provides facilities to other stations; for example, a file server, a print server, a mail server.

SHS. Standby hot-spare. A standby hot-spare is a hot-spare drive that the adapter has spun down. If a drive becomes defunct and no suitable hot-spare drive is available, a standby hot-spare of the appropriate size spins up and enters the RBL state. You must have at least four hard disk drives if you want a standby hot-spare with RAID-5. Only the IBM ServeRAID adapter has this state.

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 hardfile is not physically replaced in the system (see "Software and physical replacement" on page 216). A drive may have been marked defunct but brought back online using the ServeRAID Administration program. 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.

T

TAP. Tape.

throughput. A measure of the amount of work performed by a computer system over a period of time, for example, number of jobs per day.

toggle. To switch between two modes.

U

UFM. Unformatted; a drive that requires a low-level formatting before it can be used in an array. You can start the low-level format by choosing **Format Drive** from the ServeRAID Configuration Main Menu.

W

WB. Write-back.

write-back. (1) WB. (2) The write policy mode that sends a completion status to the system when the data is entered into memory. (3) Compare with *write-through*.

write operation. An output operation that sends a processed record to an output device or an output file.

write policy. The mode set by the system controller that determines when the completion status is sent to the system; it can be either when the data is written to the hard disk (write-through mode) or when the data is entered into memory (write-back mode).

WT. Write-through.

write-through. (1) WT. (2) The write policy mode that sends a completion status to the system when

the data is written to the device. (3) Compare with
write-back.

Parts listing

Part Name	FRU No.
IBM PC ServeRAID Adapter	06H9334
IBM ServeRAID II Ultra SCSI Adapter	76H3587
IBM ServeRAID II Internal 3rd Channel Cable	01K6501
IBM ServeRAID II DASD Status Cable	01K6496
IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter	01K7396
IBM Netfinity ServeRAID 3HB Ultra2 SCSI Adapter	01K7396
IBM Netfinity ServeRAID 3H/3HB 3rd Channel Cable	01K7249
IBM Netfinity ServeRAID 3H/3HB/3L DASD Status Cable	03K9356
IBM Netfinity ServeRAID 3L Ultra2 SCSI Adapter	01K7207
32 MB IBM NVRAM Battery-Backup Option	21H8979
8MB IBM NVRAM Battery-Backup Option	21H8973

Related service information

```
┌─ Note ──────────────────────────────────┐
│ Information in this section is for use with all │
│ ServeRAID adapters listed in this HMM.   │
└──────────────────────────────────────────┘
```

```
┌─ Important ─────────────────────────────┐
│ 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 supplement │
│ and the PS/2 Hardware Maintenance Manual │
│ (part number 83G8990, form number │
│ S52G-9971-02). │
└──────────────────────────────────────────┘
```

Safety information

The following section contains the safety information that you need to be familiar with before servicing an IBM mobile 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 non-conductive 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.

Danger

> **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.**

Danger

> **Pour éviter tout risque de choc électrique, ne manipulez pas de câbles ni de cordons et n'effectuez pas d'opération d'installation, de maintenance ou de reconfiguration pendant un orage.**

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, ungrounded 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. Power-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 machine, the part, the work mat, and the person handling the part are all at the same charge.

Note

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 listed below, 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.

Danger

> **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.**
>
> **To avoid shock hazard:**
>
> - **The power cord must be connected to a properly wired and grounded receptacle.**
> - **Any equipment to which this product will be attached must also be connected to properly wired receptacles.**
>
> **When possible, use one hand to connect or disconnect signal cables to prevent a possible shock from touching two surfaces with different electrical potentials.**
>
> **Electrical current from power, telephone, and communications cables is hazardous. To avoid shock hazard, connect and disconnect cables as described following when installing, moving, or opening covers of this product or attached devices.**

To Connect	To Disconnect
1. Turn Everything OFF.	1. Turn Everything OFF.
2. First, attach all cables to devices.	2. First, remove power cord(s) from outlet.
3. Attach signal cables to receptacles.	3. Remove signal cables from receptacles.
4. Attach power cord(s) to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

NOTE: In the UK, by law, the telephone cable must be connected after the power cord.	NOTE: In the UK, the power cord must be disconnected after the telephone cable.

⚠️

Caution:
When replacing the battery, use only the IBM recommended battery or an equivalent type battery recommended by the manufacturer. If the 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.

⚠️

Caution:
The Power Control button on the front of the server does not turn off the electrical current supplied to the server. The server also might have more than one power cord. To remove all electrical current from the server, ensure that all power cords are disconnected from the power source.

⚠ Perigo

Para evitar choques elétricos, não conecte ou desconecte nenhum cabo, nem efetue instalação, manutenção ou reconfiguração deste produto durante uma tempestade com raios.

Para evitar choques elétricos:

- **O cabo de alimentação deve ser conectado a um receptáculo corretamente instalado e aterrado.**
- **Todos os equipamentos aos quais este produto será conectado devem também ser conectados a receptáculos corretamente instalados.**

Quando possível, utilize uma das mãos para conectar ou desconectar cabos de sinal, para evitar um possível choque ao tocar duas superfícies com potenciais elétricos diferentes.

A corrente elétrica proveniente de cabos de alimentação, de telefone e de comunicação é perigosa. Para evitar choques elétricos, conecte e desconecte os cabos conforme descrito a seguir, ao instalar, movimentar ou abrir tampas deste produto ou de dispositivos conectados.

Para Conectar	**Para Desconectar**
1. DESLIGUE tudo.	1. DESLIGUE tudo.
2. Conecte primeiro todos os cabos nos dispositivos.	2. Remova primeiro o(s) cabo(s) de alimentação das tomadas.
3. Conecte os cabos de sinal nos receptáculos.	3. Remova os cabos de sinal dos receptáculos.
4. Conecte o(s) cabo(s) de alimentação nas tomadas.	4. Remova todos os cabos dos dispositivos.
5. LIGUE o dispositivo.	

Cuidado:
Ao substituir a bateria, utilize apenas o Número de Peça IBM 33F8354 ou um tipo de bateria equivalente recomendado pelo fabricante. Se seu sistema possuir um módulo com uma bateria de lítio, substitua-o apenas pelo mesmo tipo de módulo, produzido pelo mesmo fabricante. A bateria contém lítio e pode explodir se não for utilizada, manuseada e descartada de forma adequada.

Não:

- **Jogue ou coloque na água**
- **Aqueça a mais de 100°C (212°F)**
- **Conserte nem desmonte.**

Descarte a bateria conforme requerido pelas disposições e regulamentações locais.

Cuidado:
O botão de Controle de Energia na parte frontal do servidor não desliga a corrente elétrica fornecida ao servidor. O servidor pode também possuir mais que um cabo de alimentação. Para remover toda a corrente elétrica do servidor, assegure que todos os cabos de alimentação estejam desconectados da fonte de energia.

声明 1

⚠

危险！

为避免电击危险，请不要在暴风雨期间连接或断开任何电缆，
或是进行此产品的安装、维护或重新配置操作。

为避免电击危险：

– 电源线必须连接到适当的电线及接地插座。

– 此产品将要连接的所有设备也必须连接到正确接线的插座上。

如果可能，请使用一只手连接或断开连接信号电缆，以避免在
接触两个具有不同电势的表面时遭到电击。

电源线、电话线以及通信电缆中的电流非常危险。为避免电击，
请在安装、移动或打开本产品或连接设备的外盖时，按照下述
步骤连接或断开电缆。

要连接电缆	要断开电缆
1. 关闭所有设备。	1. 关闭所有设备。
2. 首先将所有电缆与设备连接。	2. 首先从电源插座拔下电源线。
3. 将信号线连接到插座。	3. 从插座拔下信号电缆。
4. 将电源线连接到电源插座。	4. 从设备上拔下所有电缆。
5. 打开设备。	

声明 2

⚠

注意！

当更换电池时，仅可使用 IBM 部件号为 33F8354 的产品或由制造商
推荐的同等电池。如果系统中有包含锂电池的模块，则只能使用由相
同制造商制造的相同类型模块更换。该电池含有锂，如果使用、操作
或处理不当会发生爆炸。

<u>不要：</u>

– 将其投入或浸于水中

– 加热超过100℃ （212℉）

– 修理或拆卸

应按照当地法规和条例对此电池进行处理。

声明 6

⚠

注意！

关闭服务器前端的电源控制按钮并不能完全切断供给服务器的电流。
服务器可能有多条电源线。为从服务器断开所有电流，应确保断开
所有电源线与电源的连接。

· 聲明 1

危險

為了避免雷擊，在閃電期間，請勿連接或拔掉本裝置上的任
何電纜線，或請勿安裝、維修或重新架構本產品。

為了避免雷擊：

- 電源線必須連接到接線及接地正確的插座。
- 本產品所連接的設備也必須連接到接線正確的插座。

儘可能使用單手來連接或拔掉信號電纜，以避免因接觸兩不
同電位的平面，而受到電擊。

電源、電話及通信電纜上均有電流流通。為了避免電擊，在
安裝、移動本產品，或開啟本產品的蓋子或與本產品連接之
裝置的蓋子時，請依照下列「連接」及「拔掉」電纜線的步
驟操作。

連接	拔掉
1. 關掉所有開關。	1. 關掉所有開關。
2. 首先，將所有電纜線連接到裝置。	2. 首先，自電源插座拔掉電源線。
3. 將信號電纜連接到信號插座。	3. 拔掉信號插座上的所有信號電纜。
4. 將電源線連接到電源插座。	4. 拔掉裝置上的所有電纜線。
5. 開啟裝置電源。	

· 聲明 2

注意：
更換電池時，只可使用 IBM 零件編號 33F8354 的電池，或廠商建議
的相當類型的電池。如您系統中的模組含有鋰電池，更換時，請使
用相同廠商製造的相同模組類型。如未正常使用、處理或捨棄含有
鋰的電池時，可能會造成爆炸。

嚴禁：.

- 丟入或浸入水中
- 加熱超過攝氏100 度（華氏 212 度）
- 修補或拆解

處理廢棄電池時，請遵照當地法令規章處理。

· 聲明 6

注意：
伺服器前面的電源控制按鈕無法關閉供應伺服器的電流。本伺服器
可能有一條以上的電源線。如要移除伺服器上的所有電流，請確認
所有電源線已與電源分離。

Danger

**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.**

**Pour éviter tout risque de choc
électrique :**

- **Les cordons d'alimentation du
  présent produit et de tous les
  appareils qui lui sont connectés
  doivent être branchés sur des
  socles de prise de courant
  correctement câblés et mis à la
  terre.**

**Afin d'éviter tout risque de choc
électrique provenant d'une différence de
potentiel de terre, n'utilisez qu'une main,
lorsque cela est possible, pour
connecter ou déconnecter les cordons
d'interface.**

**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, 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

1. Mettez les unités hors tension.
2. Commencez par brancher tous les cordons sur les unités.
3. Branchez les câbles d'interface sur les prises.
4. Branchez les cordons d'alimentation sur un socle de prise de courant.
5. Mettez les unités sous tension.

Déconnexion

1. Mettez les unités hors tension.
2. Commencez pas débrancher les cordons alimentation des socles de prise de courant.
3. Débranchez les câbles d'interface des prises.
4. Débranchez tous les câbles des unités.

⚠️

Attention:
Remplacez la pile 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.

⚠️

Attention:
Le bouton de mise sous tension/hors tension
situé sur la face avant du serveur ne coupe pas
l'arrivée de courant électrique à l'intérieur de la
machine. Il se peut que votre serveur dispose de
plusieurs cordons d'alimentation. Pour isoler
totalement le serveur du réseau électrique,
débranchez tous les cordons d'alimentation des
socles de prise de courant.

Vorsicht

> **Aus Sicherheitsgründen bei Gewitter an diesem Gerät keine Kabel anschließen oder lösen. Ferner keine Installations-, Wartungs- oder Rekonfigurationsarbeiten durchführen.**
>
> **Aus Sicherheitsgründen:**
>
> - **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, um einen Stromschlag durch Berühren von Oberflächen mit unterschiedlichem elektrischem Potential zu vermeiden.**
>
> **Elektrische Spannungen von Netz-, Telefon- und Datenübertragungsleitungen sind gefährlich. Um einen Stromschlag zu vermeiden, nur nach den Anweisungen arbeiten, die für Installation, Transport oder Öffnen von Gehäusen dieses Produkts oder angeschlossenen Einheiten gelten.**

Kabel anschließen	Kabel lösen
1. Alle Geräte ausschalten und Netzstecker ziehen.	1. Alle Geräte ausschalten.
2. Zuerst alle Kabel an Einheiten anschließen.	2. Zuerst Netzstecker von Steckdose lösen.
3. Signalkabel an Anschlußbuchsen anschließen.	3. Signalkabel von Anschlußbuchsen lösen.
4. Netzstecker an Steckdose anschließen.	4. Alle Kabel von Einheiten lösen.
5. Gerät einschalten.	

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.

Achtung:
Mit dem Betriebsspannungsschalter an der
Vorderseite des Servers 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.

Pericolo

> **Per evitare il pericolo di scosse elettriche durante i temporali, non collegare o scollegare cavi, non effettuare l'installazione, la manutenzione o la riconfigurazione di questo prodotto.**
>
> **Per evitare il pericolo di scosse elettriche:**
>
> - **collegare il cavo 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 per evitare il rischio di scosse derivanti dal contatto con due superfici a diverso potenziale elettrico.**
>
> **La corrente elettrica circolante nei cavi di alimentazione, del telefono e di segnale è pericolosa. Per evitare scosse elettriche, collegare e scollegare i cavi come descritto quando si effettuano l'installazione, la rimozione o l'apertura dei coperchi di questo prodotto o durante il collegamento delle unità.**

Per collegare	Per scollegare
1. SPEGNERE tutti i dispositivi.	1. SPEGNERE tutti i dispositivi.
2. Collegare prima tutti i cavi alle unità.	2. Rimuovere prima il(i) cavo(i) di alimentazione dalla presa elettrica.
3. Collegare i cavi di segnale alle prese.	3. Rimuovere i cavi di segnale dalle prese.
4. Collegare il(i) cavo(i) di alimentazione alla presa elettrica.	4. Rimuovere tutti i cavi dalle unità.
5. ACCENDERE le unità.	

Attenzione:
**Quando si sostituisce la batteria, utilizzare solo
una batteria IBM 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 smaltirla**

**Smaltire secondo la normativa in vigore (D.Lgs
22 del 5/2/97) e successive disposizioni nazionali
e locali.**

Attenzione:
**Il pulsante del controllo dell'alimentazione
situato nella parte anteriore del servente non
disattiva la corrente elettrica fornita al servente.
Il servente potrebbe anche avere più di un cavo
di alimentazione. Per disattivare la corrente
elettrica del servente, assicurarsi che tutti i cavi
di alimentazione siano scollegati dalla sorgente
di alimentazione.**

경고문 1

⚠

위험

전기 충격을 피하려면 날씨가 나쁠 때(예: 눈 또는 비가 오거나 천둥 번개가 칠
때)는 케이블을 연결하거나 끊지 않도록 하고 이 제품의 설치, 유지보수 또는 재구
성 등의 작업을 수행하지 않도록 하십시오.

전기 충격을 피하려면 다음과 같아야 합니다.

– 고압선은 적절한 배선 및 접지 상태의 콘센트로 연결되어야 합니다.

– 이 제품이 접속될 모든 장비도 적절한 배선 상태의 콘센트로 연결되어야 합니다.

다른 전위를 가진 두 표면을 만졌을 때 발생할 수 있는 전기 충격을 피하려면 한 손
으로 신호선을 연결하거나 끊으십시오.

전원, 전화 및 통신 케이블로부터 흘러 나오는 전류는 위험합니다. 전기 충격을 피
하려면 이 제품이나 접속 장치를 설치, 이동 및 덮개를 열 때 다음 설명에 따라 케
이블을 연결하고 끊도록 하십시오.

연결하려면	연결해제하려면
1. 모든 스위치를 켠다.	1. 모든 스위치를 끈다.
2. 먼저 모든 케이블을 장치에 연결한다.	2. 먼저 모든 케이블을 장치에 제거한다.
3. 신호선을 콘센트에 연결한다.	3. 신호선을 콘센트에서 제거한다.
4. 전원을 콘센트에 연결한다.	4. 장치에서 모든 케이블을 제거한다.
5. 장치 스위치를 켠다.	

경고문 2

⚠

주의:
배터리를 교체할 때는 IBM 부품 번호 &PN. 또는 제조업체에서 추천하는 동등한
유형의 배터리를 사용하십시오. 시스템에 리튬 배터리를 포함하는 모듈이 있으면
이것은 동일한 제조업체에서 생산된 동일한 모듈 유형으로만 교체하십시오.
배터리에는 리튬이 포함되어 있으므로 제대로 사용, 처리 또는 처분하지 않으면
폭발할 수 있습니다.

다음을 주의하십시오.

– 던지거나 물에 담그지 않도록 하십시오.
– 100℃(212℉) 이상으로 가열하지 않도록 하십시오.
– 수리하거나 분해하지 않도록 하십시오.

지역 법령이나 규정의 요구에 따라 배터리를 처분하십시오.

경고문 6

⚠

주의:
서버 앞쪽의 전원 제어 버튼을 꺼도 서버로 공급되는 전류가 차단되지 않습니다.
또한 서버에 둘 이상의 전선이 연결되어 있는 경우가 있습니다. 서버에서 모든
전류를 차단하려면 모든 전선이 전원으로부터 차단되어 있는지 확인하십시오.

Peligro

> **Para evitar una posible descarga
> eléctrica, no conecte ni desconecte los
> cables ni lleve a cabo ninguna
> operación de instalación, de
> mantenimiento o de reconfiguración de
> este producto durante una tormenta
> eléctrica.**
>
> **Para evitar una posible descarga:**
>
> - **El cable de alimentación debe
>   conectarse a un receptáculo con
>   una instalación eléctrica correcta y
>   con toma de tierra.**
> - **Los aparatos a los que se conecte
>   este producto también deben estar
>   conectados a receptáculos con la
>   debida instalación eléctrica.**
>
> **Cuando sea posible, utilice una sola
> mano para conectar o desconectar los
> cables de señal a fin de evitar una
> posible descarga al tocar dos
> superficies con distinto potencial
> eléctrico.**
>
> **La corriente eléctrica de los cables de
> comunicaciones, teléfono y
> alimentación puede resultar peligrosa.
> Para evitar una posible descarga, siga
> las indicaciones de conexión y
> desconexión de los cables siempre que
> tenga que instalar, mover o abrir las
> cubiertas de este producto o de los
> dispositivos acoplados.**

Instrucciones de conexión	Instrucciones de desconexión
1. Apague todos los componentes (OFF).	1. Encienda todos los componentes (ON).
2. En primer lugar, conecte todos los cables a los dispositivos.	2. En primer lugar, retire los cables de alimentación de las tomas.
3. Conecte los cables de señal a los receptáculos.	3. Retire los cables de señal de los receptáculos.
4. Conecte los cables de alimentación a las tomas.	4. Retire todos los cables de los dispositivos.
5. Encienda el dispositivo (ON).	

Percaución:
Al cambiar la batería, utilice únicamente la batería IBM Número de pieza 33F8354 o un tipo de batería equivalente recomendado por el fabricante. Si el sistema tiene un módulo que contiene una batería de litio, sustitúyalo únicamente por el mismo tipo de módulo del mismo fabricante. La batería contiene litio y puede explotar si no se utiliza, manipula o desecha correctamente.

Lo que no debe hacer

- **Tirar o sumergir el producto en agua.**
- **Exponer el producto a una temperatura superior a 100°C.**
- **Reparar o desmontar el producto.**

Cuando quiera desechar la batería, siga las disposiciones y reglamentaciones locales.

Percaución:
El botón de control de alimentación del panel frontal del servidor no apaga la corriente eléctrica suministrada al servidor. Puede suceder que el servidor tenga más de un cable de alimentación. Para eliminar por completo la corriente eléctrica del servidor, asegúrese de desconectar todos los cables de alimentación del suministro de alimentación.

Send us your comments!

We want to know your opinion about this manual
(part number 09N1055). Your input will help us to
improve our publications.

Please photocopy this survey, complete it, and then
fax it to **IBM HMM Survey** at **919-543-8167 (USA)**.

Name _____

Phone Number _____

1. Do you like this manual?

   ☐ Yes   ☐ No

   _____

   _____

2. What would you like to see added, changed, or
   deleted in this manual?

   _____

   _____

3. What is your service experience level?

   ☐ Less than five years
   ☐ More than five years

   _____

   _____

4. Which Servers do you service most?

   _____

   _____

   _____

   _____

Thanks in advance for your response!

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 Diskette Version
    - Type and version level
- Hardware configuration
    - Print (print screen) configuration currently in use
    - BIOS level
- Operating system software
    - Type and version level

Important

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.

Phone numbers, U.S. and Canada

> **Note**
>
> EMEA customers should contact their Dealer or IBM Service organization.

Before you place a call to the Support Center, refer to "Problem determination tips" on page 308.

Authorized Dealers or Servicers

Number	Information
800-937-3737	IBM Business Partner Education
800-426-2472	IBM Customer Engineer Technical Support
800-IBM-DEAL	IBM Dealer Support Center
800-342-6672	IBM Direct Desktop Software Sales
303-924-4015	IBM Part Number ID and Look Up
800-426-7763	IBM PC HelpCenter
800-237-5511	IBM Software Defect Support (CSDs)
800-327-5711	IBM Software Ordering (Publications)
800-426-1484	IBM Supplies Technical Hotline
800-388-7080	IBM Warranty Parts Claims Center

U.S. Customers and Helpware Subscribers

Number	Information
800-426-8322	Customer Education Business Unit
800-999-0052	Customized Operational Services
800-237-4824	EduQuest (Educational Computers)
800-964-8523	End User HelpDesk Support
800-742-2493	IBM Anti-Virus Services
800-447-4700	IBM Authorized Dealer Referrals
800-426-2468	IBM Dealer Referral
800-426-3333	IBM Information Referral Service
800-IBM-SERV	IBM Service
800-772-2227	IBM PC HelpCenter and HelpDesk
800-426-7282	IBM Technical Manuals
800-426-9402 (Ext. 150)	Multimedia Information Center
800-241-1620	Multimedia HelpCenter
800-342-6672	OS/2 Information Line
800-237-5511	OS/2 Support Services
800-284-5933	Prodigy
914-962-0310	Prodigy User Questions
800-547-1283	Technical Coordinator Program SystemXtra for Personal Systems LAN Automated Distribution/2 OS/2 Bulletin Board OS/2 Application Assistance Center
800-551-2832	Technical Solutions Magazine

IBM Canada Customer and Servicer Support

Number	Information
800-661-PSMT	Business Partner Marketing Support
905-316-5556	Business Partner Marketing Support - Toronto
514-938-6048	Business Partner Marketing Support - French
800-465-4YOU	Customer Relations
800-IBM-SERV	Customer Service Dispatch
800-263-2769	Customer Service Parts
800-465-2222	Customer Support Center (ISC)
416-443-5701	Customer Service Repair Centre
800-505-1855	Dealer Support Group (DSG)
800-465-7999	HelpClub Registration / IBM Direct
905-316-3299	HelpFax - Toronto
800-565-3344	HelpPC
905-513-3355	IBM Certification Administrator Mail to: 50 Acadia Drive Markham, Ontario L3R 0B3
800-661-2131	IBM Education (A+ Course)
800-268-3100	IBM Information Network Support
800-387-8343	IBM PC Service Partners
800-487-7426	International Warranty Registration
800-663-7662	Lexmark Product Information
800-IBM-9990	PartnerLine
800-263-2769	Parts Orders, Exchange or Emergency
416-443-5808 (Fax)	Parts Regular Orders, Exchange
416-443-5755	Parts Orders, Inquiries
514-938-3022	PC Co Bulletin Board - Montreal
905-316-4255	PC Co Bulletin Board - Markham
604-664-6464	PC Co Bulletin Board - Vancouver
204-934-2735	PC Co Bulletin Board - Winnepeg
800-661-7768	PS Marketing Support (PSMT)
800-565-3344	PS/1 Warranty Customer Helpline
800-387-8483	PS/1 Warranty Service (DOAs)
800-465-1234	Publications Ordering
905-316-4148	Service Management Support
905-316-4100 (Fax)	Service Management Support
905-316-4150	Service (Warranty) Manager
905-316-4100 (Fax)	Service (Warranty) Manager
905-316-4872	Service Quality Programs
905-316-4100 (Fax)	Service Quality Programs
800-661-2131	Skill Dynamics (Education)
800-565-3344	ThinkPad EasyServe

Number	Information
416-443-5835 (Fax)	Warranty Claim Fulfillment
905-316-2445	Warranty Claim Reimbursement
905-316-3515 (Fax)	Warranty Claim Reimbursement
416-443-5778	Warranty Claim Parts Inquiry
800-505-1855	Warranty Provider Support Hotline
800-267-7472	Warranty Service, ThinkPad

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