

IBM ServeRAID

S10L-9938-00

**Adapters and Controllers**

**Hardware Maintenance Manual**

**November 1998**

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

**We Want Your Comments!  
(Please see page 221)**

**This Manual Supports:**

PC ServeRAID  
ServeRAID II  
ServeRAID 3H  
ServeRAID 3L



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**Note**

Before using this information and the products it supports, be sure to read the general information in "Notices" on page 228.

**First Edition (November 1998)**

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## 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 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, 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 35 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 179.

### 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 192.

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## 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.

---

### 注意和危險聲明 (简体中文)

重要事項：

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

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

在按說明執行任何操作前，請務必閱讀所有注意和危險聲明。

---

### 注意及危險聲明 (中文)

重要資訊：

本書中所有「注意」及「危險」的聲明均以數字開始。此一數字是用來作為交叉參考之用，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.

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## 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 사용됩니다.

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 읽도록 하십시오.

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

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## **Online Support**

Use the World Wide Web (WWW) or the IBM PC Company BBS to download Diagnostic, BIOS Flash, and Device Driver files.

File download address is:

**<http://www.pc.ibm.com/us/files.html>**

The IBM PC Company BBS can be reached at (919) 517-0001.

### **IBM Online Addresses:**

The HMM online address is:

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

The IBM PC Company Support Page is:

**<http://www.ibm.com/us/support/index.html>**

The IBM PC Company Home Page is:

**<http://www.pc.ibm.com>**

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## 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 BIOS and firmware 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) 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
```

(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.

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 33)
- IBM ServeRAID II Ultra SCSI Adapter (see “Symptom-to-FRU Index” on page 66)
- IBM Netfinity ServeRAID Adapter 3H Ultra2 SCSI Adapter (see “Symptom-to-FRU Index” on page 99)
- IBM Netfinity ServeRAID Adapter 3L Ultra2 SCSI Adapter (see “Symptom-to-FRU Index” on page 131)

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 33)
- IBM ServeRAID II Ultra SCSI Adapter (see “Symptom-to-FRU Index” on page 66)
- IBM Netfinity ServeRAID Adapter 3H Ultra2 SCSI Adapter (see “Symptom-to-FRU Index” on page 99)
- IBM Netfinity ServeRAID Adapter 3L Ultra2 SCSI Adapter (see “Symptom-to-FRU Index” on page 131)

010

(Step 010 continues)

(CONTINUED)

**010** (continued)

Run the diagnostic program for the ServeRAID adapter. If an Error Message indicates a failure, replace the adapter.

– or –

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.

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---

## IBM PC ServeRAID Adapter

The following information applies to the IBM PC ServeRAID Adapter.

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### 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**.

#### Note

Always keep a current backup of the ServeRAID configuration information. Dynamic changes may occur in the configuration due to hot-spare replacement.

### 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 your 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 133.

## **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 133. 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 33.

---

## 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 your 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.

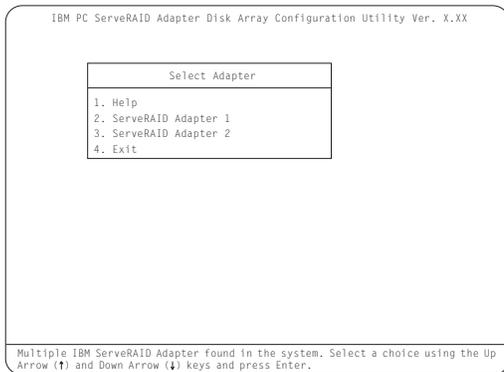
### Using the ServeRAID DOS Configuration Program

#### 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 your system, you will see a screen with multiple adapters. The screen may not look exactly like this one.



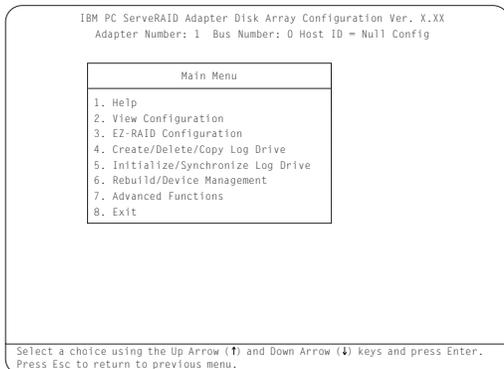
**Note**

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

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

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 your server, the Main Menu appears, as shown in the following figure.



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 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.

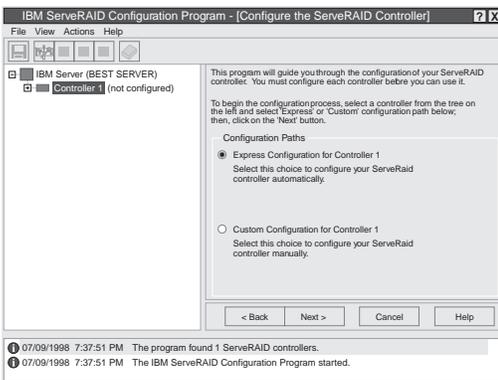
## Using the ServeRAID GUI-Based Configuration CD

To start the configuration program:

1. Insert the ServeRAID GUI-Based CD into the CD-ROM drive; then, turn on the server.

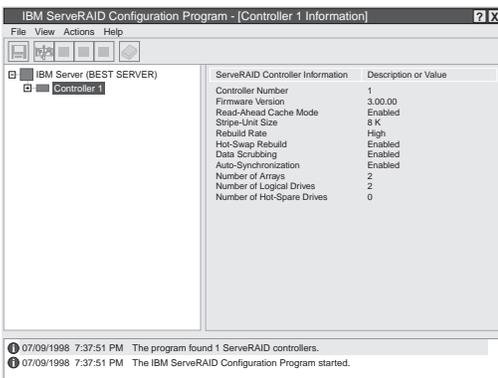
One of the following screens will appear:

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



Select the **Cancel** button to switch from the Configuration mode to the Information mode.

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



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

2. **Disable or Enable Read-Ahead Cache Mode:** This choice is available in the Information mode only. When read-ahead cache is set to *Enabled* (default setting), the ServeRAID adapter/controller transfers data from a disk to its local cache in increments equal to the stripe unit size. This provides excellent overall performance when workloads are steady and sequential. However, if the workload is random or the system I/O requests are smaller than the stripe unit size, reading ahead to the end of the stripe might degrade performance. When read-ahead cache is set to *Disabled*, the ServeRAID adapter/controller transfers data from a disk to local cache in increments equal to the system I/O request size, without reading ahead to the end of the stripe.
3. **Change the Rebuild Rate:** This choice is available in the Information mode only. You can select this choice to set the priority for Rebuild operations to *High* (default), *Medium*, or *Low*.
  - When the rebuild rate is set to *High*, the rebuild I/O request gets high priority in the execution order.
  - When the rebuild request is set from *High* to *Medium* in a heavily-loaded system, it can increase the rebuild time, but provide better system performance.
  - When the rebuild request is set from *High* or *Medium* to *Low* in a moderately- to heavily-loaded system, it can increase the disk rebuild time, but provides better system performance.

## 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 your 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 SERVER RAID 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 16.
  - Move adapter to a different PCI slot.
- If problem persists, replace the adapter/controller.

003

### DO THE OTHER CHANNELS ON THE SERVER RAID 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 16 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 16 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 18 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:2.02.00
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 17 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 27.

```
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)
Your 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 33.

## 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 (Code DRAM Error)

1. Install download jumpers. For jumper locations, see "Locations (IBM PC ServeRAID Adapter)" on page 34.
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 27. 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.)

**EF10** (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 34 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 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 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 adapter/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 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 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 adapter/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 adapter/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 hard disk drive to its previously assigned location, or after you install the original hard disk drives back in the server.
- F5** Accept. 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 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 adapter/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 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.
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 adapter/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 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 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 adapter/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 hard disk drive to its previously assigned location.

**F5** Accept. 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 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 adapter/controller will update the configuration.

---

**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.

---

**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.

---

**Your server has an error due to a Blocked Logical Drive.**

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

**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 14.

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
<b>Code not in table</b>	<b>Code not in table</b>	<b>Explanation:</b> The ServeRAID adapter/controller is not functioning properly. <b>Action:</b> Replace the adapter or embedded controller on the system board.
00	01	<b>Explanation:</b> Invalid flash configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
00	02	<b>Explanation:</b> Invalid NVRAM configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
00	03	<b>Explanation:</b> Invalid flash and NVRAM configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
01	08	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	18	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	28	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	38	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	48	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
01	58	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.

<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
01	68	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
01	78	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	88	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
03	98	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	A8	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
03	B8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	C8	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
03	D8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	E8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
03	F8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
07	08	<b>Explanation:</b> Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	0C	<b>Explanation:</b> Online/Rebuild drives are not responding and a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	18	<b>Explanation:</b> Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	1C	<b>Explanation:</b> Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding and a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	28	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	2C	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding; and, a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	38	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	3C	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	48	<b>Explanation:</b> Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	4C	<b>Explanation:</b> Online/Rebuild drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. <b>Action:</b> Press F4, F5, F6, or F10.

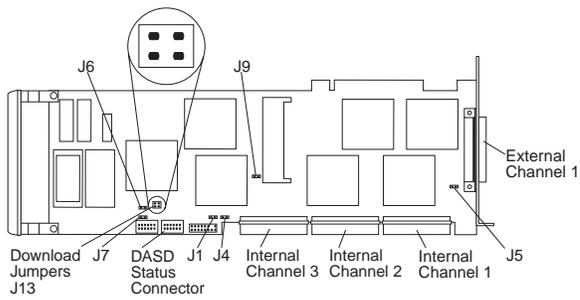
<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
07	58	<b>Explanation:</b> Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	5C	<b>Explanation:</b> Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. <b>Action:</b> Press F4, F5, F6, or F10.
07	68	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	6C	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. <b>Action:</b> Press F4, F5, F6, or F10.
07	78	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	7C	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F6, or F10.
09	00	<b>Explanation:</b> No error occurred. <b>Action:</b> No action is required.
09	10	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
09	20	<b>Explanation:</b> Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
09	30	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
0F	00	<b>Explanation:</b> No error occurred. <b>Action:</b> No action is required.
0F	10	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.

<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
<b>0F</b>	<b>20</b>	<b>Explanation:</b> Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
<b>0F</b>	<b>30</b>	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.



## Locations (IBM PC ServeRAID Adapter)

(FRU no. 76H3587)



### 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.

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## 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.

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### 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**.

#### Note

Always keep a current backup of the ServeRAID configuration information. Dynamic changes may occur in the configuration due to hot-spare replacement.

### 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 your 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 133.

### **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 133. 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 66.

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## 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

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## 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 your 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.

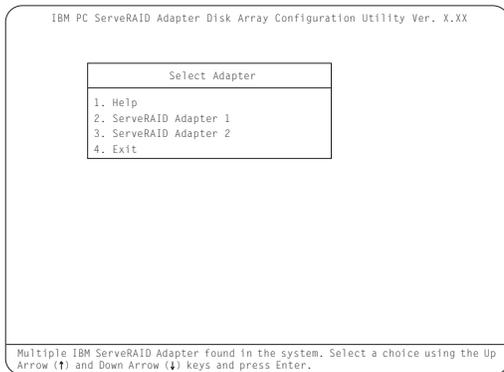
### Using the ServeRAID DOS Configuration Program

**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 your system, you will see a screen with multiple adapters. The screen may not look exactly like this one.



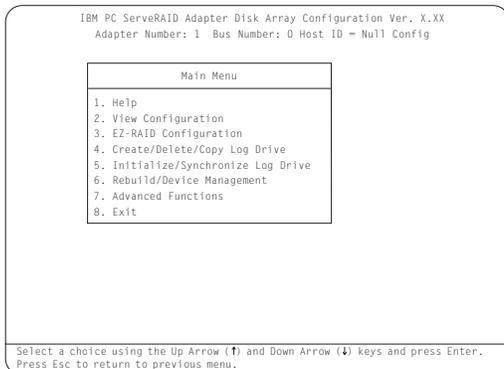
**Note**

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

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

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 your server, the Main Menu appears, as shown in the following figure.



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 your 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 and IBM ServeRAID 3H Adapters.

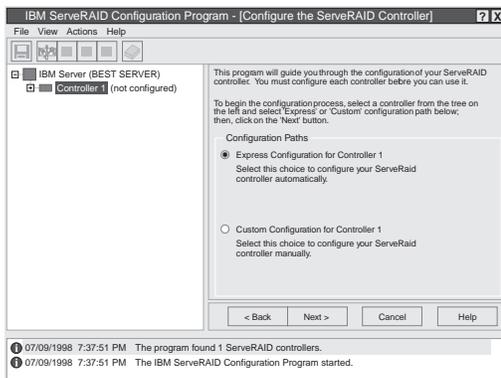
## Using the ServeRAID GUI-Based Configuration CD

To start the configuration program:

1. Insert the ServeRAID GUI-Based CD into the CD-ROM drive; then, turn on the server.

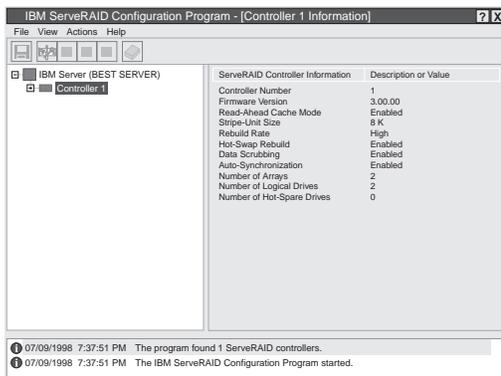
One of the following screens will appear:

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



Select the **Cancel** button to switch from the Configuration mode to the Information mode.

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



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

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

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

**Attention**

1. You might lose data if a power outage occurs while using the write-back mode without a Battery-Backup Cache device.
2. If you do not have a Battery-Backup Cache installed and Enabled and you set this feature to the write-back mode, wait at least 10 seconds after your last operation before you turn off your system. Failure to follow this practice can result in lost data.

3. **Disable or Enable Read-Ahead Cache Mode:** This choice is available in the Information mode only. When read-ahead cache is set to *Enabled* (default setting), the ServeRAID controller transfers data from a disk to its local cache in increments equal to the stripe unit size. This provides excellent overall performance when workloads are steady and sequential. However, if the workload is random or the system I/O requests are smaller than the stripe unit size, reading ahead to the end of the stripe might degrade performance. When read-ahead cache is set to *Disabled*, the ServeRAID controller transfers data from a disk to local cache in increments equal to the system I/O request size, without reading ahead to the end of the stripe.
4. **Change the Rebuild Rate:** This choice is available in the Information mode only. You can select this choice to set the priority for Rebuild operations to *High* (default), *Medium*, or *Low*.
  - When the rebuild rate is set to *High*, the rebuild I/O request gets high priority in the execution order.
  - When the rebuild request is set from *High* to *Medium* in a heavily-loaded system, it can

increase the rebuild time, but provide better system performance.

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

## **Battery-Backup Cache**

The Battery-Backup Cache can be installed on IBM ServeRAID II and 3H 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.

An adapter with 32 MB of cache memory can use either an 8 MB or a 32 MB Battery-Backup Cache. However, a 32 MB Battery-Backup Cache will provide better performance.

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 your 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 SERVER RAID 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 48.
  - Move adapter to a different PCI slot.
- If problem persists, replace the adapter/controller.

003

### DO THE OTHER CHANNELS ON THE SERVER RAID 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 48 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 48 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.

## 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 50 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:2.02.00
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 49 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 60.

```
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: Z:0)
Your 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 66.

## 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 68.
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.

#### 6XXX (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 68.
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.

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

1. Install download jumpers. For jumper locations, see "Locations (IBM ServeRAID II Ultra SCSI Adapter)" on page 68.
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.

#### 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/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 60. 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 68 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 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 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 adapter/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 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 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 adapter/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 adapter/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 hard disk drive to its previously assigned location, or after you install the original hard disk drives back in the server.
- F5** Accept. 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 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 adapter/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 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.
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 adapter/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 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 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 adapter/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 hard disk drive to its previously assigned location.

**F5** Accept. 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 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 adapter/controller will update the configuration.

---

**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.

---

**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.

---

**Your server has an error due to a Blocked Logical Drive.**

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

**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 46.

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
<b>Code not in table</b>	<b>Code not in table</b>	<b>Explanation:</b> The ServeRAID adapter/controller is not functioning properly. <b>Action:</b> Replace the adapter or the system board with integrated controller.
00	01	<b>Explanation:</b> Invalid flash configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
00	02	<b>Explanation:</b> Invalid NVRAM configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
00	03	<b>Explanation:</b> Invalid flash and NVRAM configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
01	08	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	18	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	28	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	38	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	48	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
01	58	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
01	68	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
01	78	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	88	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
03	98	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	A8	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
03	B8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	C8	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
03	D8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	E8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.

<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
<b>03</b>	<b>F8</b>	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
<b>07</b>	<b>08</b>	<b>Explanation:</b> Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, or F10.
<b>07</b>	<b>0C</b>	<b>Explanation:</b> Online/Rebuild drives are not responding and a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
<b>07</b>	<b>18</b>	<b>Explanation:</b> Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
<b>07</b>	<b>1C</b>	<b>Explanation:</b> Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding and a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
<b>07</b>	<b>28</b>	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
<b>07</b>	<b>2C</b>	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding; and, a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
<b>07</b>	<b>38</b>	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
<b>07</b>	<b>3C</b>	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
<b>07</b>	<b>48</b>	<b>Explanation:</b> Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
<b>07</b>	<b>4C</b>	<b>Explanation:</b> Online/Rebuild drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. <b>Action:</b> Press F4, F5, F6, or F10.

BCS	ECS	Explanation and Possible Recovery Action
07	58	<b>Explanation:</b> Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	5C	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F6, or F10.
07	68	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	6C	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. <b>Action:</b> Press F4, F5, F6, or F10.
07	78	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	7C	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F6, or F10.
09	00	<b>Explanation:</b> No error occurred. <b>Action:</b> No action is required.
09	10	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
09	20	<b>Explanation:</b> Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
09	30	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
0F	00	<b>Explanation:</b> No error occurred. <b>Action:</b> No action is required.
0F	10	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.

<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
<b>0F</b>	<b>20</b>	<b>Explanation:</b> Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
<b>0F</b>	<b>30</b>	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. <b>Action:</b> 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

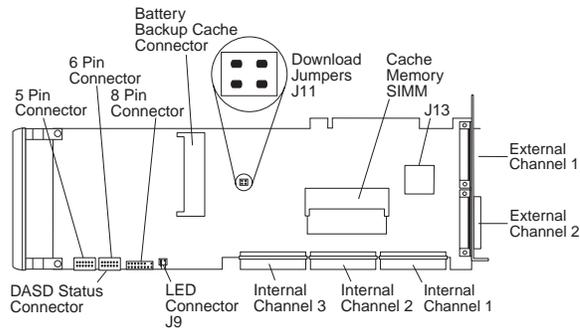
**Do not** replace any FRU until you have followed the POST (ISPR) Error Procedures (see “POST (ISPR) Error Procedures” on page 50). Only replace a ServeRAID II Adapter or controller if indicated to do so in the POST (ISPR) Error Procedures.

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 defective drives, termination, etc.)	1. Refer to “POST (ISPR) Error Procedures” on page 50 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. ServeRAID II Adapter/Controller

Problem	FRU/Action
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 50.
FFFF or other code not listed	<ul style="list-style-type: none"> <li>a. Refer to "POST (ISPR) Error Procedures" on page 50</li> <li>b. SCSI cable</li> <li>c. SCSI backplane</li> <li>d. Hard drive</li> <li>e. ServeRAID II Adapter/Controller</li> </ul>

## Locations (IBM ServeRAID II Ultra SCSI Adapter)

(FRU no. 76H3587)



### 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.

---

## 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.

---

### Diagnostics

All diagnostic operations for the ServeRAID 3H 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 IBM 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**.

#### Note

Always keep a current backup of the ServeRAID configuration information. Dynamic changes may occur in the configuration due to hot-spare replacement.

### Testing the ServeRAID Subsystem

You can use the ServeRAID Subsystem Diagnostic program to test the ServeRAID 3H 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 3H Adapter/Controller. Restart your server after the self-test completes.
  - **SCSI Device Self-test** runs diagnostic tests on the SCSI devices attached to the ServeRAID 3H 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 133.

### **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 133. Replace the drive physically; **do not** software-replace the drive.

View the ServeRAID 3H 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 Utility 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 99.

---

## 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
- Battery-Backup Option 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, and Enhanced-1
- Automatic data scrubbing in background
- Auto-synchronization

---

## Additional Service Information

The following additional service information supports IBM ServeRAID 3H 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 your 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.

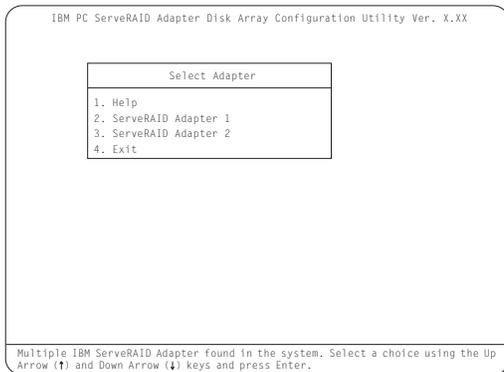
### Using the ServeRAID DOS Configuration Program

**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 3H Adapter performs a power-on self-test (POST). The POST checks the configuration information for the ServeRAID 3H 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 your system, you will see a screen with multiple adapters. The screen may not look exactly like this one.



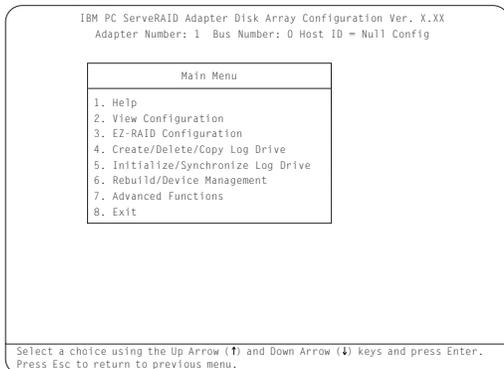
**Note**

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

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

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 your server, the Main Menu appears, as shown in the following figure.



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 restore or convert disk array information when you upgrade from an IBM ServeRAID adapter or an IBM Streaming adapter to an IBM Netfinity ServeRAID 3H Ultra2 Adapter/Controller:**

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 ServeRAID or an IBM Streaming RAID adapter for use with the IBM ServeRAID 3H Adapter/Controller. Since the IBM 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 ServeRAID 3H Adapter/Controller are the same as they were when using the IBM ServeRAID adapter or IBM Streaming RAID adapter.

**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 your ServeRAID 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 3H 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 3H 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 ServeRAID 3H 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 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 ServeRAID 3H Adapter/Controller 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 ServeRAID 3H 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 3H 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 and IBM ServeRAID 3H Adapters.

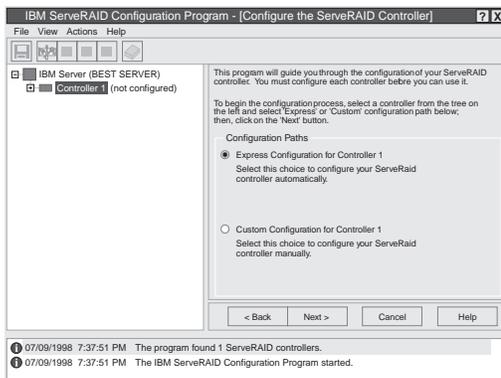
## Using the ServeRAID GUI-Based Configuration CD

To start the configuration program:

1. Insert the ServeRAID GUI-Based CD into the CD-ROM drive; then, turn on the server.

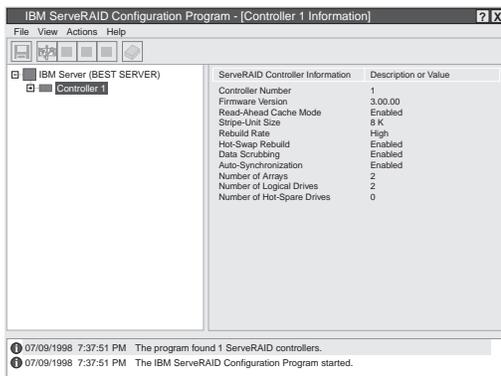
One of the following screens will appear:

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



Select the **Cancel** button to switch from the Configuration mode to the Information mode.

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



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

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

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

**Attention**

1. You might lose data if a power outage occurs while using the write-back mode without a Battery-Backup Cache device.
2. If you do not have a Battery-Backup Cache installed and Enabled and you set this feature to the write-back mode, wait at least 10 seconds after your last operation before you turn off your system. Failure to follow this practice can result in lost data.

3. **Disable or Enable Read-Ahead Cache Mode:** This choice is available in the Information mode only. When read-ahead cache is set to *Enabled* (default setting), the ServeRAID controller transfers data from a disk to its local cache in increments equal to the stripe unit size. This provides excellent overall performance when workloads are steady and sequential. However, if the workload is random or the system I/O requests are smaller than the stripe unit size, reading ahead to the end of the stripe might degrade performance. When read-ahead cache is set to *Disabled*, the ServeRAID controller transfers data from a disk to local cache in increments equal to the system I/O request size, without reading ahead to the end of the stripe.
4. **Change the Rebuild Rate:** This choice is available in the Information mode only. You can select this choice to set the priority for Rebuild operations to *High* (default), *Medium*, or *Low*.
  - When the rebuild rate is set to *High*, the rebuild I/O request gets high priority in the execution order.
  - When the rebuild request is set from *High* to *Medium* in a heavily-loaded system, it can

increase the rebuild time, but provides better system performance.

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

## **Battery-Backup Cache**

The Battery-Backup Cache can be installed on IBM ServeRAID adapters II and 3H. The Battery-Backup Cache does not disable the cache memory SIMM already attached to the ServeRAID 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 adapter notifies the host that it has completed the write operation even though the data hasn't yet been written to the hard drive.

An adapter with 32 MB of cache memory can use either an 8 MB or a 32 MB Battery-Backup Cache. However, a 32 MB Battery-Backup Cache will provide better performance.

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 equipped with a Battery-Backup Cache fails, the Battery-Backup Cache 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 your 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 82.
- 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 82 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 82 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.

## ServeRAID 3H 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 84 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:2.02.00
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 83 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 93.

```
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)
Your 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 3H Adapter or a system board containing an imbedded ServeRAID 3H 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 3H 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 99.

## 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 69 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 ServeRAID 3H Adapter/Controller.

### 2XXX thru 5XXX (Code DRAM Error)

1. Install download jumpers. For jumper locations, see "Locations (IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter)" on page 101.
2. Flash the adapter/controller with the latest IBM ServeRAID 3H BIOS/Firmware from the IBM Website.
3. Remove the jumpers.
4. If the error persists, replace ServeRAID 3H Adapter/Controller.

### 6XXX (Cache DRAM Error)

1. Reseat Cache Memory SIMM
2. Install download jumpers. For jumper locations, see "Locations (IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter)" on page 101.
3. Flash the adapter/controller with the latest IBM ServeRAID 3H BIOS/Firmware from the IBM Website.
4. Remove the jumpers.
5. If the error persists, replace ServeRAID 3H Adapter/Controller.

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

1. Install download jumpers. For jumper locations, see "Locations (IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter)" on page 101.
2. Flash the adapter/controller with the latest IBM ServeRAID 3H BIOS/Firmware from the IBM Website.
3. Remove the jumpers.
4. If the error persists, replace ServeRAID 3H Adapter/Controller.

**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/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 93. 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.)

**EF10** (Default ISPR)

- 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 3H 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 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 3H 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 adapter/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 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 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 adapter/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 adapter/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 hard disk drive to its previously assigned location, or after you install the original hard disk drives back in the server.
- F5** Accept. 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 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 adapter/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 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.
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 adapter/controller is not operational.

**Action:** Reseat the adapter. If problem persists, replace the ServeRAID 3H Adapter/Controller.

---

**Error: Cannot disable this adapter 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 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 adapter/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 hard disk drive to its previously assigned location.

**F5** Accept. 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 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 adapter/controller will update the configuration.

---

**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.

---

**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.

---

**Your server has an error due to a Blocked Logical Drive.**

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

**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 3H 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 3H 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 3H Adapter/Controller.

---

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

**Explanation:** The BIOS is unable to find any logical drives attached to any ServeRAID 3H controllers. Therefore the ServeRAID 3H 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 3H 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 80.

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
<b>Code not in table</b>	<b>Code not in table</b>	<b>Explanation:</b> The ServeRAID adapter/controller is not functioning properly. <b>Action:</b> Replace the adapter or the system board with integrated controller.
00	01	<b>Explanation:</b> Invalid flash configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
00	02	<b>Explanation:</b> Invalid NVRAM configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
00	03	<b>Explanation:</b> Invalid flash and NVRAM configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.
01	08	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	18	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	28	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	38	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild, Hot-Spare/Standby Hot-Spare, and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
01	48	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
01	58	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.

<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
01	68	<b>Explanation:</b> No configuration was found in drives; or, Online/Rebuild and Ready/Standby drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
01	78	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	88	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
03	98	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	A8	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, F7, or F10.
03	B8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	C8	<b>Explanation:</b> A drive was imported from another system and it has valid configuration; and, Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, F7, or F10.
03	D8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
03	E8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.

BCS	ECS	Explanation and Possible Recovery Action
03	F8	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F7, or F10.
07	08	<b>Explanation:</b> Online/Rebuild drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	0C	<b>Explanation:</b> Online/Rebuild drives are not responding and a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	18	<b>Explanation:</b> Online/Rebuild and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	1C	<b>Explanation:</b> Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding and a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	28	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	2C	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding; and, a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	38	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
07	3C	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, a drive was found at the incorrect SCSI ID. <b>Action:</b> Press F4, F5, F6, or F10.
07	48	<b>Explanation:</b> Online/Rebuild drives are not responding and unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	4C	<b>Explanation:</b> Online/Rebuild drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. <b>Action:</b> Press F4, F5, F6, or F10.

<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
07	58	<b>Explanation:</b> Online/Rebuild and Hot Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	5C	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F6, or F10.
07	68	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	6C	<b>Explanation:</b> Online/Rebuild and Ready/Standby drives are not responding, a drive was found at the incorrect SCSI ID, and unidentified drives were found. <b>Action:</b> Press F4, F5, F6, or F10.
07	78	<b>Explanation:</b> Online/Rebuild, Ready/Standby, and Hot-Spare/Standby Hot-Spare drives are not responding; and, unidentified drives were found. <b>Action:</b> Press F4, F5, or F10.
07	7C	<b>Explanation:</b> 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. <b>Action:</b> Press F4, F5, F6, or F10.
09	00	<b>Explanation:</b> No error occurred. <b>Action:</b> No action is required.
09	10	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.
09	20	<b>Explanation:</b> Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
09	30	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
0F	00	<b>Explanation:</b> No error occurred. <b>Action:</b> No action is required.
0F	10	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare drives are not responding. <b>Action:</b> Press F4, F5, or F10.

<b>BCS</b>	<b>ECS</b>	<b>Explanation and Possible Recovery Action</b>
<b>0F</b>	<b>20</b>	<b>Explanation:</b> Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.
<b>0F</b>	<b>30</b>	<b>Explanation:</b> Hot-Spare/Standby Hot-Spare and Ready/Standby drives are not responding. <b>Action:</b> Press F4, F5, or F10.

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## 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

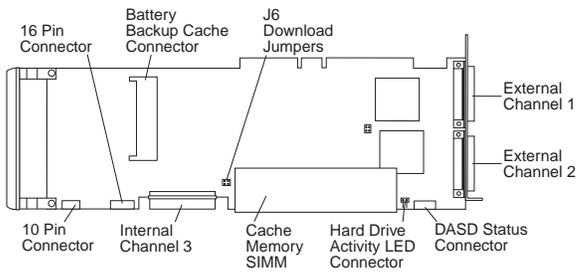
**Do not** replace any FRU until you have followed the POST (ISPR) Error Procedures (see “POST (ISPR) Error Procedures” on page 84). Only replace a ServeRAID 3H Adapter or controller if indicated to do so in the POST (ISPR) Error Procedures.

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 defective drives, termination, etc.)	1. Refer to “POST (ISPR) Error Procedures” on page 84 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. ServeRAID 3H Adapter/Controller

Problem	FRU/Action
EF10 (default ISPR)	a. Run diagnostics on DOS configuration program.
EFFF (Firmware code corrupt or download jumpers are in place)	a. Refer to "POST (ISPR) Error Procedures" on page 84.
FFFF or other code not listed	<ul style="list-style-type: none"> <li>a. Refer to "POST (ISPR) Error Procedures" on page 84</li> <li>b. SCSI cable</li> <li>c. SCSI backplane</li> <li>d. Hard drive</li> <li>e. ServeRAID 3H Adapter/Controller</li> </ul>

## Locations (IBM Netfinity ServeRAID 3H Ultra2 SCSI Adapter)

(FRU no. 01K7396)



### 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.

---

### Diagnostics

All diagnostic operations for the ServeRAID 3L 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 IBM 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**.

#### Note

Always keep a current backup of the ServeRAID configuration information. Dynamic changes may occur in the configuration due to hot-spare replacement.

### Testing the ServeRAID Subsystem

You can use the ServeRAID Subsystem Diagnostic program to test the ServeRAID 3L 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 3L Adapter/Controller. Restart your server after the self-test completes.
  - **SCSI Device Self-test** runs diagnostic tests on the SCSI devices attached to the ServeRAID 3L 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 133.

### **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 133. Replace the drive physically; **do not** software-replace the drive.

View the ServeRAID 3L 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 Utility 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 131.

---

## 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, and Enhanced-1
- 32-bit System PCI Data Bus
- Supports 40 MB per second per SCSI 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.

---

## Additional Service Information

The following additional service information supports IBM ServeRAID 3L 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 your 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.

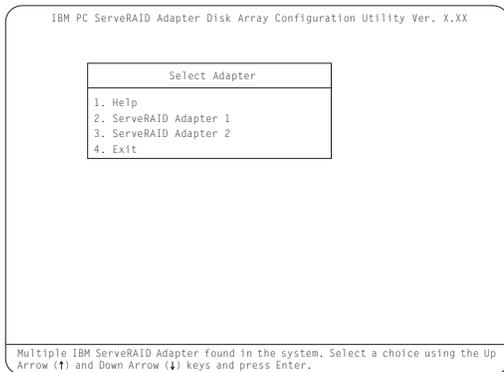
### Using the ServeRAID DOS Configuration Program

**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 3L Adapter performs a power-on self-test (POST). The POST checks the configuration information for the ServeRAID 3L 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 your system, you will see a screen with multiple adapters. The screen may not look exactly like this one.



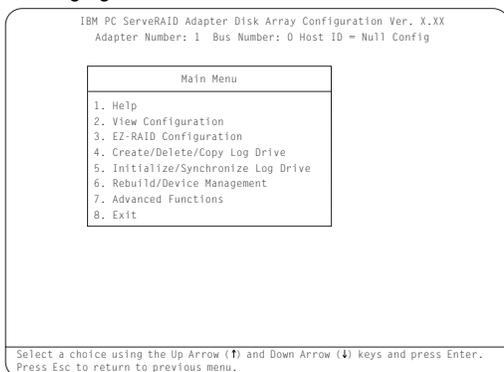
**Note**

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

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

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 your server, the Main Menu appears, as shown in the following figure.



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 restore or convert disk array information when you upgrade from an IBM PCI ServeRAID adapter or an IBM Streaming adapter to an IBM ServeRAID 3L**

**Adapter/Controller:**

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 ServeRAID or an IBM Streaming RAID adapter for use with the IBM ServeRAID 3L Adapter/Controller. Since the IBM 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 ServeRAID 3L Adapter/Controller are the same as they were when using the IBM ServeRAID adapter or IBM Streaming RAID adapter.

**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 your ServeRAID 3L 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 3L 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 3L 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 ServeRAID 3L 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 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 ServeRAID 3L Adapter/Controller 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 ServeRAID 3L 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 3L Adapter/Controller  
SCSI channel ID and speed.

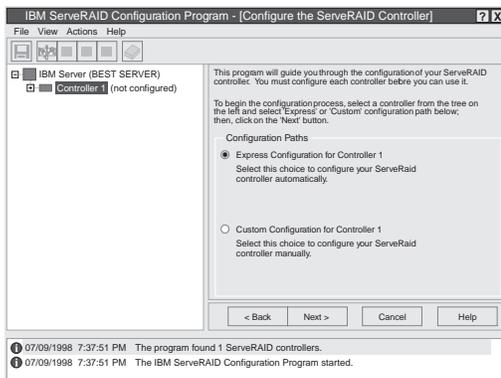
## Using the ServeRAID GUI-Based Configuration CD

To start the configuration program:

1. Insert the ServeRAID GUI-Based CD into the CD-ROM drive; then, turn on the server.

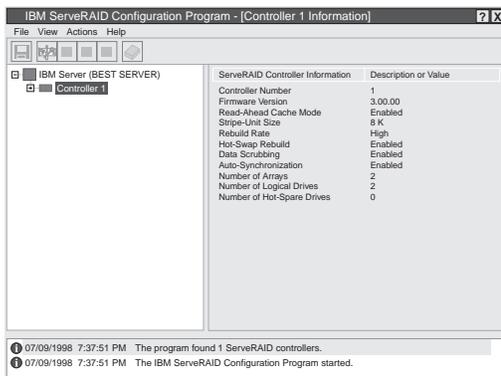
One of the following screens will appear:

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



Select the **Cancel** button to switch from the Configuration mode to the Information mode.

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



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

2. **Disable or Enable Read-Ahead Cache Mode:** This choice is available in the Information mode only. When read-ahead cache is set to *Enabled* (default setting), the ServeRAID controller transfers data from a disk to its local cache in increments equal to the stripe unit size. This provides excellent overall performance when workloads are steady and sequential. However, if the workload is random or the system I/O requests are smaller than the stripe unit size, reading ahead to the end of the stripe might degrade performance. When read-ahead cache is set to *Disabled*, the ServeRAID controller transfers data from a disk to local cache in increments equal to the system I/O request size, without reading ahead to the end of the stripe.
3. **Change the Rebuild Rate:** This choice is available in the Information mode only. You can select this choice to set the priority for Rebuild operations to *High* (default), *Medium*, or *Low*.
  - When the rebuild rate is set to *High*, the rebuild I/O request gets high priority in the execution order.
  - When the rebuild request is set from *High* to *Medium* in a heavily-loaded system, it can increase the rebuild time, but provides better system performance.
  - When the rebuild request is set from *High* or *Medium* to *Low* in a moderately- to heavily-loaded system, it can increase the disk rebuild time, but provides better system performance.

## 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 your 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 115.
- ServeRAID 3L 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 115 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 115 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.

---

## 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 3L 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 117 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: 2.02.00
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 116 and correct the problem. Please note that your version may be different from the one shown. 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 126.

```
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)
Your 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 3L 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 3L 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 131.

## 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 103 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 ServeRAID 3L Adapter/Controller.

### 2XXX thru 8XXX (Code DRAM Error)

1. Install download jumpers.
2. Flash the adapter/controller with the latest IBM ServeRAID 3L BIOS/Firmware from the IBM Website.
3. Remove the jumpers.
4. If the error persists, replace ServeRAID 3L Adapter/Controller.

### 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/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 126. 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.)

**EF FE** (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 download jumpers.
3. If the 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 3L 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 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 3L 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 adapter/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 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 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 adapter/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 adapter/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 hard disk drive to its previously assigned location, or after you install the original hard disk drives back in the server.
- F5** Accept. 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 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 adapter/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 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
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 adapter/controller is not operational.

**Action:** Reseat the adapter. If problem persists, replace the ServeRAID 3L Adapter/Controller.

---

**Error: Cannot disable this adapter 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 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 adapter/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 hard disk drive to its previously assigned location.

**F5** Accept. 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 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 adapter/controller will update the configuration.

---

**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.

---

***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. Start the ServeRAID 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.

---

**Your server has an error due to a Blocked Logical Drive.**

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

**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 3L 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 3L 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 3L Adapter/Controller.

---

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

**Explanation:** The BIOS is unable to find any logical drives attached to any ServeRAID 3L controllers. Therefore the ServeRAID 3L 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 3L 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 113.

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
<b>Code not in table</b>	<b>Code not in table</b>	<b>Explanation:</b> The ServeRAID adapter/controller is not functioning properly. <b>Action:</b> Replace the adapter or the system board with integrated controller.
00	01	<b>Explanation:</b> Invalid flash configuration. <b>Action:</b> Start the IBM ServeRAID Configuration CD and follow the instructions that appear on the screen.

---

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

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

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

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

---

## 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.

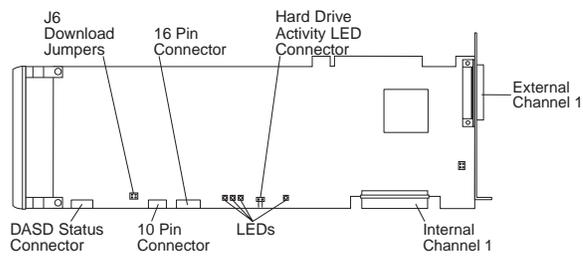
### Note

**Do not** replace any FRU until you have followed the POST (ISPR) Error Procedures (see "POST (ISPR) Error Procedures" on page 117). 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 (Code DRAM 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 defective drives, termination, etc.)	1. Refer to "POST (ISPR) Error Procedures" on page 117 2. SCSI cable 3. SCSI backplane 4. Hard drive 5. ServeRAID 3L Adapter/Controller
EF10 (default ISPR)	a. Run diagnostics on DOS configuration program.
EF10 (default ISPR)	a. Refer to "POST (ISPR) Error Procedures" on page 117.
EF10 (default ISPR)	a. Refer to "POST (ISPR) Error Procedures" on page 117 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)



### 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

### Note

Information in this section is for use with all ServeRAID adapters listed in this HMM.

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)

When a hard disk drive goes defunct (DDD), a Rebuild operation is required to reconstruct the data for the device in its respective disk array. The ServeRAID adapters and 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 adapters and controllers set the RAID level-0 logical drives to *Blocked* during a Rebuild operation. After the Rebuild operation completes, you can unblock the RAID level-0 logical drives, and access them once again. But remember, the logical drive might contain damaged data.

Before you rebuild a drive, review the following guidelines and general information.

## 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 your 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 IPSPMON 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 IPSPMON.EXE or Netfinity Manager. IPSPMON.EXE is available on the IBM ServeRAID Command Line Programs Diskette from the IBM web site:

<http://www.us.pc.ibm.com/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 IPSPMON 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:Ax Cx Bxx 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 IPSPMON 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 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 177. 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**.

### Method 2

1. Boot to the ServeRAID DOS Configuration Diskette.
2. Select **Advanced Functions**.
3. Select **Init/View Synchronize Config**.
4. If there are drives connected to the adapter that are either not showing up or not showing up as Ready (RDY), then select **Initialize**

**Configuration.** This restores the factory default settings on the ServeRAID adapter and resets all functional hard disk drives to the RDY state.

5. Select **Configuration Synchronization** from the Init/View Synchronize Config. menu.
6. From this menu, select **Hard Disk Drive** as source. This retrieves the configuration information from the hard drive. A confirmation window appears. Select **Yes** if you want to restore the configuration or **No** if you do not want to restore the configuration.

**Method 3:** In the event that you are unable to import the configuration from the hard drive, you can attempt to restore the configuration from your backed up diskette.

1. Boot to the ServeRAID DOS Configuration Diskette.
2. Select **Advanced Functions**.
3. Select **Restore/Convert Saved Configuration**.
4. Insert the diskette that contains the backed up configuration, and press **Enter**.
5. A list of backup configuration names appears. Select the correct configuration name and press **Enter**.
6. A confirmation window appears. Select **Yes** to restore the configuration or **No** to return to the previous menu.

## 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 144

### 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 140
- “One DDD Drive, One DHS Drive, No RBL” on page 141
- “More Than One DDD Drive, One DHS, No RBL” on page 142
- “One DHS Drive, One or More DDD Drives, and One RBL Drive” on page 143

**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 Administration Utility, 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.

- 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!

- 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.
- Choose **Set Device State** and choose the DHS drive. Change its state from DHS to HSP.
- 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 146
- "More Than Two DDD Drives, No RBL" on page 148

**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 135 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 158 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 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 136 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 135 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 158 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.



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## ServeRAID Reference Information

This section provides reference information and gives instructions for solving common ServeRAID problems.

### Configuration Programs

A GUI-based configuration program and a DOS configuration program is available for configuring a ServeRAID subsystem. The GUI-based program is located on the CD shipped with the option and on ServerGuide Version 4.0.5. The DOS program is available on the IBM web site. The DOS configuration program provides adapter diagnostic tests and a limited diagnostic test of the SCSI devices that are attached to the ServeRAID adapter.

### Mini-Configuration Program

The ServeRAID Mini-Configuration program is a quick way to display the current settings for the ServeRAID adapter/controller. You can also use this program to perform a limited set of the configuration functions performed by the ServeRAID Configuration Utility program.

This program is invoked by pressing **Ctrl+I** when the ServeRAID Mini-Configuration prompt appears after powering on your system.

### 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.

### Administration and Monitoring Utility

The Administration and Monitoring Utility contains ServeRAID monitoring programs for several operating systems that the ServeRAID adapter supports. You can monitor the ServeRAID

Configuration Utility program in the local and remote systems by using these programs.

### **Miscellaneous Programs**

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

### **Monitoring the Adapter Status in a Local System**

The Administration and Monitoring Utility Diskette provides monitoring programs that you can use to perform disk array maintenance tasks. Because the monitoring programs reside on top of the operating system, you do not need to restart the server. Instead, you can perform tasks such as the following from the active operating system desktop:

- Choose the adapter that you want to monitor.
- View information about drives connected to the adapter and change the drive state.
- Reassign a drive to replace a defunct drive.

Some operating systems provide additional features, such as adding and deleting a logical drive. Refer to the README file on the Administration and Monitoring Utility for specific information and installation instructions.

### **Monitoring Adapter Status from a Remote System**

The ServeRAID WIN32-based Administration and Monitoring Utility provides a graphical-user interface that enables you to monitor ServeRAID configuration changes being performed on your server while it is fully operational. You can create an array, delete an array, create a logical drive, change the RAID level, dynamically increase the logical drive size, rebuild an array, and perform other basic ServeRAID configuration functions.

Depending on your network operating system, you can run this program either locally on the server or remotely using TCP/IP.

- You can use the WIN32-based program locally with:
  - Microsoft Windows NT
- You can use the WIN32-based program remotely using TCP/IP and a Background Server component with:
  - Microsoft Windows NT
  - IBM OS/2 Warp Server and OS/2 LAN Server
  - Novell NetWare 3.12 and 4.1x
  - SCO OpenServer 5.0.x
  - SCO Unixware 7.0

**Note:** If you use SCO OpenServer or Unixware, you must perform all administration functions from a remote WIN32-based client.

See the README file on the Administration and Monitoring Utility for instructions on installing and using this monitoring utility.

## 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 156

### **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 164 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 IPSSSEND 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 168 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 165 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 157

- “Error Correction Code (ECC)” on page 157
- “Predictive Failure Analysis”

**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:** 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 154).

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 IPSSSEND program or the IBM ServeRAID Administration and Monitoring Utility.

## Using the IPSSSEND 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
```

### Using the Administration and Monitoring Utility

1. Start the Administration and Monitoring Utility program with one of the following methods:
  - Select the IBM ServeRAID Administration icon on the desktop
  - Select **IBM ServeRAID Administration** from the Start menu
2. Select the adapter that the device is attached to
3. In the window that appears, select **Device Event Table**

#### Note

Target Devices are all addressable devices on the SCSI bus other than the controller itself.

The table is a set of flags and counters. The following items are presented for each Channel Index and SCSI ID:

#### PARITY EVENT COUNTER -

Counts the number of times the device has reported a SCSI Bus Parity Error.

#### SOFT EVENT COUNTER -

Soft Events are conditions detected and reported by a SCSI Target Device through a mechanism known as "SCSI Sense Data". SCSI defines 15 basic types of Sense Data errors, with hundreds of additional sub-types.

#### PFA EVENT FLAG -

YES indicates the device has reported a PFA event to the adapter. PFA Events are reported through the system to identify drives which should be replaced.

#### HARD EVENT COUNTER -

These are SCSI problems which are not typically related to a problem with a SCSI target device.

#### MISC EVENT COUNTER -

All other unexpected SCSI events are counted in this category. These events are most likely not caused by the ServeRAID adapter itself, but target

devices should not be replaced based only on a value in this counter (see below).

These event counters are debugging aids only. No automatic recovery actions are taken based on the values in these counters. There is not an absolute threshold for event counts which indicate that a drive should be replaced. A pattern of entries for a particular device or channel may indicate a problem. The ServeRAID adapter internally filters the types of events and will mark a disk drive defunct (DDD) when appropriate.

These entries may be cleared by the user.

### **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.

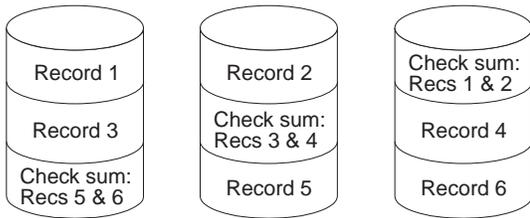
If a drive determines that a failure is likely, then it notifies the ServeRAID adapter of a possible future failure. This notification is included as a Device Event Table entry. Any drive with a PFA entry in the Device Event Table should be replaced as soon as possible.

***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 your 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.

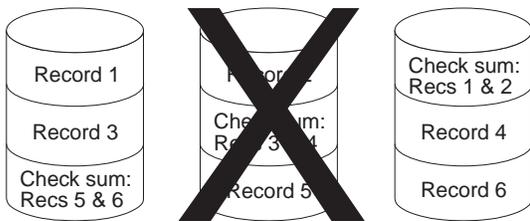


**Note**

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.

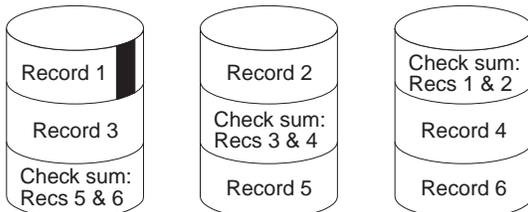
**Grown Sector Media Error Protection:** As the drive attempts to read data in a read request, it determines that Record 1 of Disk 1 has a bad sector, as pictured below. If the media error is minor, the drive corrects or remaps the information using the drive ECC information, which is transparent to 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.

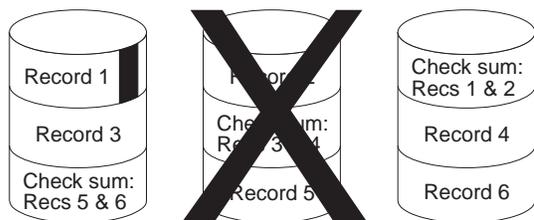
For example:

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 your 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.us.pc.ibm.com/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" on page 168

**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 *data scrubbing*.

*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, 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.us.pc.ibm.com/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 your 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.

The table below shows the utilities available for the IBM PC ServeRAID Adapter in specific operating system environments. With the exception of Netfinity Manager, the utilities below can be downloaded from

**<http://www.us.pc.ibm.com/files.html>**

The section following the table discusses the benefits of the utilities and how to obtain, install and use them.

<b>Windows NT</b>	<b>Netware</b>	<b>OS/2</b>	<b>SCO</b>
Netfinity Manager 5 and above IBM ServeRAID Configuration Diskette IPSSSEND ServeRAID Administration and Monitoring Utility	Netfinity Manager 5 and above IBM ServeRAID Configuration Diskette IPSSSEND ServeRAID Administration and Monitoring Utility	Netfinity Manager 5 and above IBM ServeRAID Configuration Diskette IPSSSEND ServeRAID Administration and Monitoring Utility	IBM ServeRAID Configuration Diskette IPSSSEND ServeRAID Administration and Monitoring Utility

**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 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.us.pc.ibm.com/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.

## ServeRAID Adapter Administration and Monitoring Utility

### *Instructions for Initiating Data Scrubbing*

1. Choose the desired logical drive.
2. Select "Sync Drive" to execute the data scrubbing operation.

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

#### **Note**

Only one synchronization command can be active at a time.

## IPSSSEND.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 IPSSSEND utility:** The IBM PC ServeRAID and ServeRAID II Adapters provide the IPSSSEND utility as a means for data scrubbing under all supported operating systems. The IPSSSEND utility is available on the IBM ServeRAID Supplemental Diskette at:

<http://www.us.pc.ibm.com/files.html>

Search on "ServeRAID."

The IPSSSEND 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 IPSSSEND 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.









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## 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.** SCSI ID

**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 parity information, if necessary. For a high level of data protection, perform data scrubbing weekly.

**DDD.** Defunct drive.

## GLOSSARY OF TERMS

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.

## GLOSSARY OF TERMS

### 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

## GLOSSARY OF TERMS

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

## GLOSSARY OF TERMS

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. (May be referred to as "bay" in earlier programs.)

**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 135). 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.

## GLOSSARY OF TERMS

**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

## GLOSSARY OF TERMS

the data is written to the device. (3) Compare with *write-back*.

---

## Parts Listing

<b>Part Name</b>	<b>FRU No.</b>
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 3H 3rd Channel Cable	01K7249
IBM Netfinity ServeRAID 3H/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



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## 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).

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## 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.

### Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

When handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those 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**

1. Turn Everything OFF.
2. First, attach all cables to devices.
3. Attach signal cables to receptacles.
4. Attach power cord(s) to outlet.
5. Turn device ON.

**To Disconnect**

1. Turn Everything OFF.
2. First, remove power cord(s) from outlet.
3. Remove signal cables from receptacles.
4. Remove all cables from devices.

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 your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

**Do not:**

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

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



**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**

1. DESLIGUE tudo.
2. Conecte primeiro todos os cabos nos dispositivos.
3. Conecte os cabos de sinal nos receptáculos.
4. Conecte o(s) cabo(s) de alimentação nas tomadas.
5. LIGUE o dispositivo.

**Para Desconectar**

1. DESLIGUE tudo.
2. Remova primeiro o(s) cabo(s) de alimentação das tomadas.
3. Remova os cabos de sinal dos receptáculos.
4. Remova todos os cabos dos dispositivos.



**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

1. 关闭所有设备。
2. 首先将所有电缆与设备连接。
3. 将信号线连接到插座。
4. 将电源线连接到电源插座。
5. 打开设备。

#### 要断开电缆

1. 关闭所有设备。
2. 首先从电源插座拔下电源线。
3. 从插座拔下信号电缆。
4. 从设备上拔下所有电缆。

## 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。

#### 不要：

- 将其投入或浸于水中
- 加热超过100°C (212°F)
- 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通過。為了避免電擊，在安裝、移動本產品，或開啓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

1. 關掉所有開關。
2. 首先，將所有電纜線連接到裝置。
3. 將信號電纜連接到信號插座。
4. 將電源線連接到電源插座。
5. 開啓裝置電源。

拔掉

1. 關掉所有開關。
2. 首先，自電源插座拔掉電源線。
3. 拔掉信號插座上的所有信號電纜。
4. 拔掉裝置上的所有電纜線。

• 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**

1. Alle Geräte ausschalten und Netzstecker ziehen.
2. Zuerst alle Kabel an Einheiten anschließen.
3. Signalkabel an Anschlußbuchsen anschließen.
4. Netzstecker an Steckdose anschließen.
5. Gerät einschalten.

**Kabel lösen**

1. Alle Geräte ausschalten.
2. Zuerst Netzstecker von Steckdose lösen.
3. Signalkabel von Anschlußbuchsen lösen.
4. Alle Kabel von Einheiten lösen.

**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**

1. SPEGNERE tutti i dispositivi.
2. Collegare prima tutti i cavi alle unità.
3. Collegare i cavi di segnale alle prese.
4. Collegare il(i) cavo(i) di alimentazione alla presa elettrica.
5. ACCENDERE le unità.

**Per scollegare**

1. SPEGNERE tutti i dispositivi.
2. Rimuovere prima il(i) cavo(i) di alimentazione dalla presa elettrica.
3. Rimuovere i cavi di segnale dalle prese.
4. Rimuovere tutti i cavi dalle 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 server non disattiva la corrente elettrica fornita al server. Il server potrebbe anche avere più di un cavo di alimentazione. Per disattivare la corrente elettrica del server, 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 재구성 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 전원을 가진 두 표면을 만졌을 때 발생할 수 있는 전기 충격을 피하려면 한 손으로 신호선을 연결하거나 끊으십시오.

전원, 전화 및 통신 케이블로부터 분리 나오는 전류는 위험합니다. 전기 충격을 피하려면 이 제품이나 접속 장치를 설치, 이동 및 덮개를 열 때 다음 설명에 따라 케이블을 연결하고 끊도록 하십시오.

연결하려면	연결해제하려면
1. 모든 스위치를 켜다.	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 켜다.	

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. 배터리는 리튬이 포함되어 있으므로 제대로 사용, 처리 또는 처분하지 않으면 폭발할 수 있습니다.

다음은 주의하십시오.

- 덩지거나 물에 담그지 않도록 하십시오.
- 100°C(212°F) 이상으로 가열하지 않도록 하십시오.
- 수리하거나 분해하지 않도록 하십시오.

지역 법령이나 규정의 요구에 따라 배터리를 처분하십시오.

경고문 6



주의:

서버 앞쪽의 전원 제어 버튼을 껐도 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).	



**Precaución:**

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 10L9938). 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.

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## 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 222.

### Authorized Dealers or Servicers

Number	Information
919-517-0001	Bulletin Board Service - PC Company
800-528-7705	Bulletin Board Service - TSS Only
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
919-517-0001	Bulletin Board Service - PC Company
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
800-465-3299	HelpFax
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 - Winnipeg
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)

<b>Number</b>	<b>Information</b>
800-565-3344	ThinkPad EasyServe
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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