

# **IBM ATA 133 RAID Controller User's Guide**

MAN-524  
2/6/03

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## **Revision History**

2/6/03 Initial release.

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## **Part Number**

DB15-000283-00

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## Preface

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The IBM PCI Bus Master ATA 133 RAID Disk Array Controller provides a cost-effective way to achieve higher transfer rates and reliability. IBM's IDE controller supports two IDE channels and up to four drives. It supports the following drive modes: PIO 0-4, DMA 0-2, and Ultra DMA 0-6. The RAID levels supported are RAID 0, 1, and 10. The highest data transfer rate in UDMA mode 4 is 66 MBs, in UDMA mode 5 is 100 MBs, and in UDMA mode 6 is 133 MBs. This manual describes the IBM ATA 133 RAID controller.

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**Package Contents** You should have received the following:

- An IBM ATA 133 RAID controller card
  - Two standard length 40-pin connector ATA-100/133 cables with two drive connectors
  - Two extended length 40-pin connector ATA-100/133 cables with one drive connector
  - The *IBM ATA 133 RAID Controller Quick Hardware Setup Guide* (hard copy)
  - A Driver and Documentation CD with utility programs, device drivers for various operating systems, and the following documentation:
    - The *IBM ATA 133 RAID Controller User's Guide* (on CD)
    - A software license agreement
- 

## FCC Regulatory Statement

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

***Warning:*** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Note:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a specific installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, try to correct the interference by one or more of the following measures:

- 1) Reorient or relocate the receiving antenna.
- 2) Increase the separation between the equipment and the receiver.
- 3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- 4) Consult the dealer or an experienced radio/TV technician for help.

***Shielded interface cables must be used with this product to ensure compliance with the Class B FCC limits.***

### LSI IDE PCI RAID Disk Array Controller

**Model Number:** Series 524



# 1 Overview

The IBM ATA 133 RAID controller is a short PCI adapter card that provides two IDE channels with ATA 133 capability. IBM ATA 133 provides a simple and cost-effective way to improve the performance and reliability of your storage subsystems. The RAID controller offers high transfer rates, and fault-tolerant data redundancy during high performance applications by using low-cost Ultra ATA drives in desktops, workstations, or low-end servers.

You can connect from one to four drives to this card using ATA 100/133 cables (Ultra ATA drives need special 80-pin IDE cables) and configure these drives using a simple setup menu embedded in the controller BIOS. The card supports the following drive modes: programmable input/output (PIO) 0-4, direct memory address (DMA) 0-2, and Ultra DMA 0-6.

In addition, the card supports RAID levels 0, 1, and 10. You can use striping (RAID 0) to improve performance or mirroring (RAID 1) to improve data security. RAID 10 provides both RAID 1 (disk mirroring) and RAID 0 (data striping). This manual describes RAID features, RAID levels, hardware installation, operating system installation, and technical assistance.

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## IBM ATA 133 RAID Controller Items

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The following items are included with the IBM ATA 133 RAID Controller:

- Two standard length 40-pin connector ATA-100/133 cables with two drive connectors
  - Two extended length 40-pin connector ATA-100/133 cables with one drive connector
  - A Driver and Documentation CD with utility programs, device drivers for various operating systems, and the following documentation:
    - *IBM ATA 133 RAID Controller User's Guide*
    - Software license agreement
- 

## Features

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**IDE Channels** The controller supports two IDE channels.

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**IDE Connectors** The controller has two 40-pin internal connectors.

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**Controller** The controller provides a single chip solution for a PCI-to-IDE/ATA controller. It receives PCI commands and data which it processes and sends to the IDE/ATA bus.

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Cont'd

## Features, Continued

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**Manageability/Disk Console** The manageability/disk console features include:

- configuration information display
  - online mirror rebuilding
  - online consistency checks
  - error logging and notification
  - control panel, property sheet, and Microsoft Configuration Console (MCC) plug-in
  - desktop management interface (DMI) agent
  - simple network management protocol (SNMP) agent
  - support for power management features
- 

**BIOS Features** The BIOS features include:

- RAID support before operating system loads
  - automatic detection and configuration
  - drive roaming capability
  - ability to handle configuration changes
  - support for Interrupt 13, and Enhanced Disk Drive Specification
  - support for PIO modes 0-4, DMA modes 0-2, and Ultra DMA modes 0-6 (0-6 for ATA/100 and ATA/133).
  - support for RAID levels 0, 1, and 10
  - multiple drive rebuilding
  - special handling of error log, spare drive, and rebuilding
  - support for BIOS boot specification (BBS)
  - co-existence with SCSI, CD, and ARMD devices
- 

**Driver features** The driver features include:

- automatic negotiation of the highest mode of data transfer
  - handling of both RAID and non-RAID drives
  - special interface for configuration information, configuration changes, and manageability
  - optimized disk access
  - support for RAID levels 0, 1, and 10
  - error logging in event log and on disks
  - support for online mirror rebuilding
  - support for consistency check for mirrored disks
  - support for Stand-by and Hibernation in Windows 2000
  - support for PIO modes 0-4, DMA modes 0-2, and Ultra DMA modes 0-6
- 

## Documentation

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The technical documentation set for the IBM ATA 133 RAID controller includes the *IBM ATA 133 RAID Controller Quick Hardware Setup Guide* (hard copy), and *IBM ATA 133 RAID Controller User's Guide* (on CD).

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## 2 Introduction to RAID

RAID (Redundant Array of Independent Disks) is an array (group) of multiple independent hard drives that provide high performance and fault tolerance. A RAID disk subsystem improves I/O (input/output) performance and reliability. The RAID array appears to the host computer as a single storage unit or as multiple logical units. I/O is expedited because several disks can be accessed simultaneously.

RAID systems improve data storage reliability and fault tolerance compared to single-drive computers. Data loss resulting from a hard drive failure can be prevented by reconstructing missing data from the remaining hard drives.

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### RAID Benefits

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RAID has gained popularity because it improves I/O performance, and increases storage subsystem reliability. RAID provides data security through fault tolerance and redundant data storage.

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**Improved I/O** Although hard drive capabilities have improved drastically, actual performance has improved only three to four times in the last decade. Computing performance has improved over 50 times during the same time period. RAID allows you to access several disks simultaneously.

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**Increased Reliability** The electromechanical components of a disk subsystem operate more slowly, require more power, and generate more noise and vibration than electronic devices. These factors reduce the reliability of data stored on disks. RAID systems improve data storage reliability and fault tolerance compared to single-drive computers. The additional drives make it possible to prevent data loss from a hard drive failure. You can reconstruct missing data from the remaining data.

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### In This Chapter

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Table 2-1 lists the topics discussed in this chapter.

**Table 2-1. Topics in This Chapter**

Major Topic	Subtopic
RAID Overview	
	Disk Striping Disk Mirroring Disk Spanning
RAID Terminology	
	Physical Drive Physical Drive States Array Array States Fault Tolerance Logical Drive Disk Rebuild Hot Spares Consistency Check
Configuration Strategies	
	Selecting a RAID Level Assigning RAID Levels

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## RAID Overview

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RAID is a collection of specifications that describe a system for ensuring the reliability and stability of data stored on large disk subsystems. A RAID system can be implemented in a number of different versions (or RAID levels). The standard RAID levels are 0, 1, 3, and 5. This controller supports RAID levels 0, 1, and 10 (spanned RAID 1 arrays).

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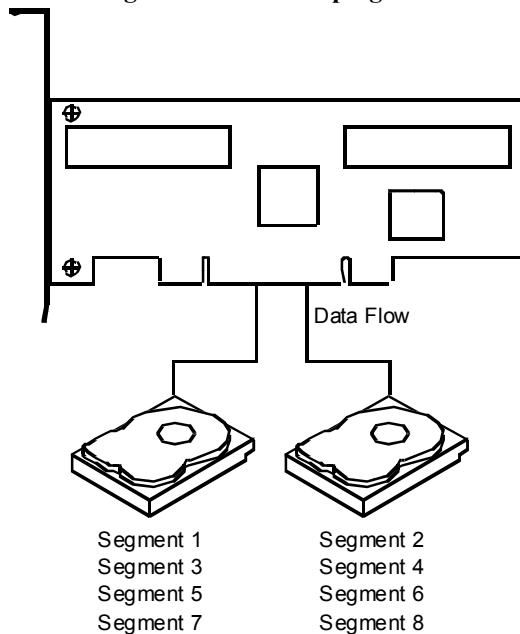
## Disk Striping

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Disk striping writes data across multiple hard drives instead of just one hard drive. Disk striping involves partitioning each drive storage space into stripes that can vary in size. These stripes are interleaved in a repeated sequential manner. The combined storage space is composed of stripes from each drive. IBM IDE supports stripe sizes of 32 KB to 4 MB.

For example, in a four-disk system using only disk striping (as in RAID level 0), segment 1 is written to disk 1, segment 2 is written to disk 2, and so on. Disk striping enhances performance because multiple drives are accessed simultaneously; but does not provide data redundancy.

**Figure 2-1. Disk Striping**



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**Stripe Width** Stripe width is the number of disks involved in an array where striping is implemented. For example, a four-disk array with disk striping has a stripe width of four.

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**Stripe Size** The stripe size is the length of the interleaved data segments that are written across multiple drives.

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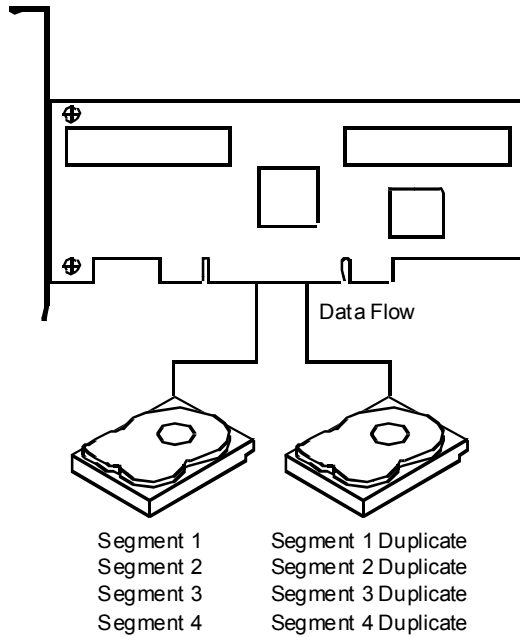
## Disk Mirroring

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With mirroring (used in RAID 1), data written to one hard drive is simultaneously written to another hard drive. If one hard drive fails, the contents of the other hard drive can be used to run the system and reconstruct the failed drive. The primary advantage of disk mirroring is that it provides 100% data redundancy. Since the contents of the hard drive are completely written to a second drive, it does not matter if one of the drives fails. Both drives contain the same data at all times. Either drive can act as the operational drive.

Disk mirroring provides 100% redundancy, but is expensive because each drive in the system must be duplicated.

**Figure 2-2. Disk Mirroring**

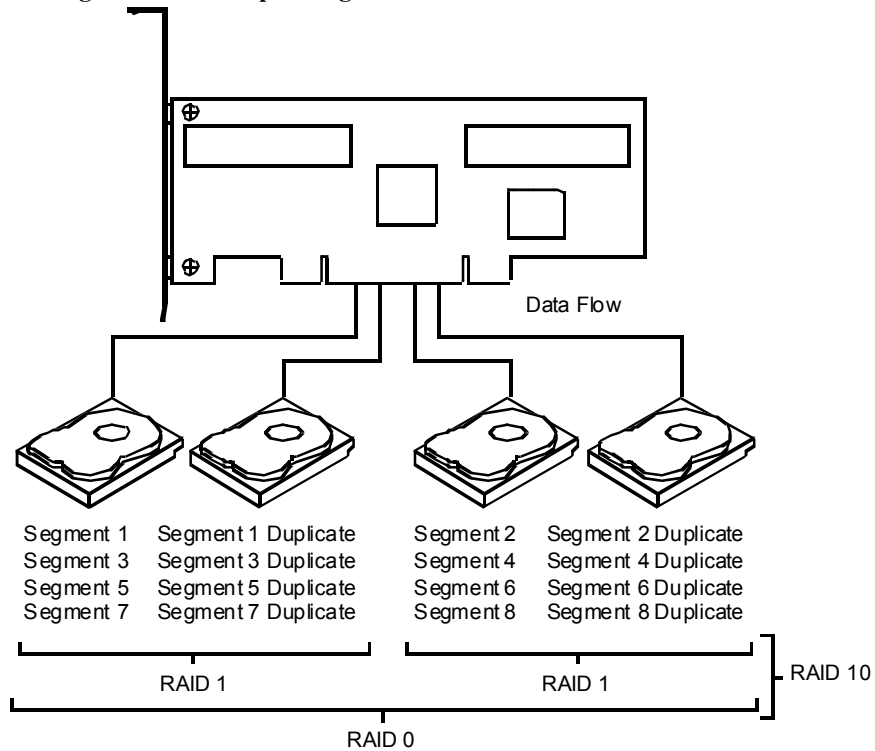


## Disk Spanning

Disk spanning allows multiple hard drives to function like one big drive. Spanning overcomes lack of disk space and simplifies storage management by combining existing resources or adding relatively inexpensive resources.

Spanning alone does not provide reliability or performance enhancements. Spanned logical drives must have the same stripe size and must be contiguous. In the following graphic, a pair of RAID 1 arrays are turned into a RAID 10 array.

Figure 2-3. Disk Spanning



## RAID Terminology

The following sections explain terms associated with RAID, including:

- physical drive
- physical drive state
- array
- array state
- logical drive
- rebuild
- hot spare
- consistency check
- fault tolerance

## Physical Drive

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The physical drive is the IDE hard drive that is connected by cable to the IBM IDE card. The hard drive contains platters that are coated with material that allows them to record data magnetically. Another important feature is the read/write head, which hovers over the surface of the platter. You can store and access data much more quickly on a hard drive than on a floppy disk.

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## Physical Drive States

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Table 2-2 describes the possible conditions of the physical drives.

**Table 2-2. Physical Drive States**

State	Description
Online	The drive is functioning normally and is a part of a configured array.
Spare	The drive is powered up and ready for use as a spare in case an online drive fails.
Failed	A fault has occurred in the drive, placing it out of service.
Rebuilding	The drive is being rebuilt with data from a failed drive.
Ready	The drive is available for configuration and is not yet part of an array.

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## Array

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A RAID array is a collection of physical drives governed by the RAID management software. A RAID array appears to the host computer as one or more logical drives.

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## Array States

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**Table 2-3. Array States**

State	Description
Online	The drive operating conditions are good. All configured drives are online.
Degraded	The drive operating condition is not optimal. One or more of the configured drives has failed.
Failed	The array has failed.
Offline	The array is not available for IBM IDE.

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## Logical Drive

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A logical drive is a partition in a physical array of disks that is made up of contiguous data segments on the physical disks. A logical drive can consist of an entire physical array or part of an array.

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## Fault Tolerance

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Fault tolerance is achieved through the use of mirroring (RAID 1). Mirroring provides 100% redundancy. See Disk Mirroring on page 5 for more information.

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## Disk Rebuild

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You rebuild a hard drive by recreating the data that had been stored on the drive before the drive failed. Rebuilding can be done only in arrays with data redundancy, such as RAID level 1.

IBM IDE automatically and transparently rebuilds failed drives with user-definable rebuild rates. If a hot spare is available, the rebuild starts automatically when a drive fails. Rebuilding can start automatically at boot up if the mirror drive is degraded and a spare is available.

**Note:** If a hot spare is not available, the failed hard drive must be replaced with a new hard drive so that the data on the failed drive can be rebuilt. The replacement hard drive capacity must be greater than or equal to the failed drive it replaces.

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## Hot Spares

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A hot spare is an extra, unused hard drive that is part of the RAID subsystem. It is usually in standby mode, ready for service if a drive fails. Hot spares permit you to replace failed array drives without system shutdown or user intervention.

IBM IDE implements automatic and transparent rebuilds using hot spare drives, providing a high degree of fault tolerance and zero downtime. The IBM IDE BIOS configurator allows you to specify physical drives as hot spares. When a hot spare is needed, IBM IDE automatically selects the spare and includes it in the configuration.

Note that spare drives are applicable only in arrays with redundancy, such as RAID 1 arrays.

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## Check Consistency

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In RAID, check consistency verifies the correctness of redundant data in an array and helps to find disk errors. For example, in a system with a mirrored drive, checking consistency means making sure that both the member-drives of the mirror contains the same data.

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## Configuration Strategies

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The most important factors in RAID array configuration are drive availability (fault tolerance), and drive performance.

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**Maximizing Drive Availability** You can maximize the drive availability by increasing fault tolerance. Use RAID 1 or mirror configuration to attain this objective.

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**Maximizing Drive Performance** You can optimize drive performance by using striping. Select RAID 0 or striping to configure an array for optimal performance.

---

**Performance and Availability** You can achieve both drive performance and availability. Select RAID 10 for this configuration. You will need four drives to configure RAID 10.

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## Selecting a RAID Level

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To ensure the best performance, you should select the optimal RAID level when you create a system drive. The optimal RAID level for your disk array depends on the following factors:

- Number of drives in the disk array
- Capacity of the drives in the array
- Need for data redundancy
- Disk performance requirements

Table 2-4 describes the factors you need to consider when selecting a RAID level.

**Table 2-4. Factors to Consider When Selecting a RAID Level**

Level	Description and Use	Pros	Cons	Number of Drives	Fault Tolerant
0	Data divided in blocks and distributed sequentially (pure striping). Use for non-critical data that requires high performance.	High data throughput for large files.	No fault tolerance. All data lost if any drive fails.	One to Four	No
1	Data duplicated on another disk (mirroring). Use for read-intensive fault-tolerant systems.	100 percent data redundancy.	Doubles disk space required. Reduced performance during rebuilds.	Two	Yes
10	Data divided in blocks and distributed sequentially and each block is duplicated to another disk.	100 percent data redundancy and High data throughput.	Four drives required.	Four	Yes

## Assigning RAID Levels

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Only one RAID level can be assigned to each array. Table 2-5 lists the drives required per RAID level.

**Table 2-5. Drives Required Per RAID Level**

RAID Level	Minimum Number of Physical Drives	Maximum Number of Physical Drives
0	One	Four
1	Two	Two
10	Four	Four





# 3 RAID Levels

There are six official RAID levels (RAID 0 through RAID 5). IBM IDE supports RAID levels 0, 1, and 10.

**Table 3-1. Physical Drive States**

RAID Level	Type	Turn to
0	Standard	page 11
1	Standard	page 12
10	Standard	page 13

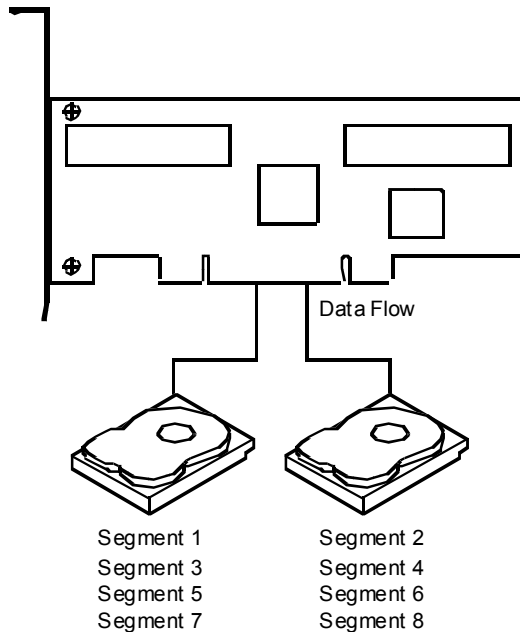
## RAID 0

RAID 0 provides disk striping across all configured drives in the RAID subsystem. RAID 0 does not provide any data redundancy, but does offer the best performance of any RAID level. RAID 0 breaks up data into smaller blocks and then writes a block to each drive in the array. The size of each block is determined by the stripe size parameter, set during the creation of the RAID set. RAID 0 offers high bandwidth.

By breaking up a large file into smaller blocks, IBM IDE can use multiple IDE channels and drives to read or write the file faster. RAID 0 involves no parity calculations to complicate the write operation. This makes RAID 0 ideal for applications that require high bandwidth but do not require fault tolerance.

- Uses** In any environment that does not require fault tolerance.
- Strong Points** Provides increased data throughput for large files. No capacity loss penalty for parity.
- Weak Points** Does not provide fault tolerance. All data lost if any drive fails.
- Drives** One to four

**Figure 3-1. RAID 0 Array**



## RAID 1

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RAID 1 duplicates all data from one drive to a second drive. RAID 1 provides complete data redundancy, but at the cost of doubling the required data storage capacity.

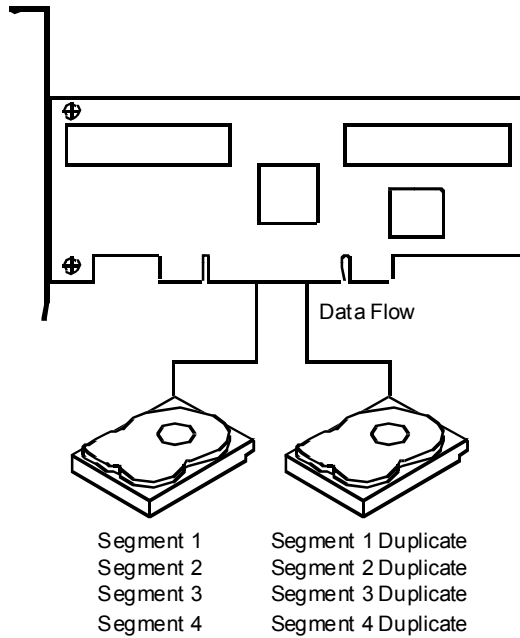
**Uses** Use RAID 1 for small databases or any other environment that requires fault tolerance but small capacity.

**Strong Points** RAID 1 provides complete data redundancy. RAID 1 is ideal for any application that requires fault tolerance and minimal capacity.

**Weak Points** RAID 1 requires twice as many hard drives. Performance is impaired during drive rebuilds.

**Drives** Two

**Figure 3-2. RAID 1 Array**

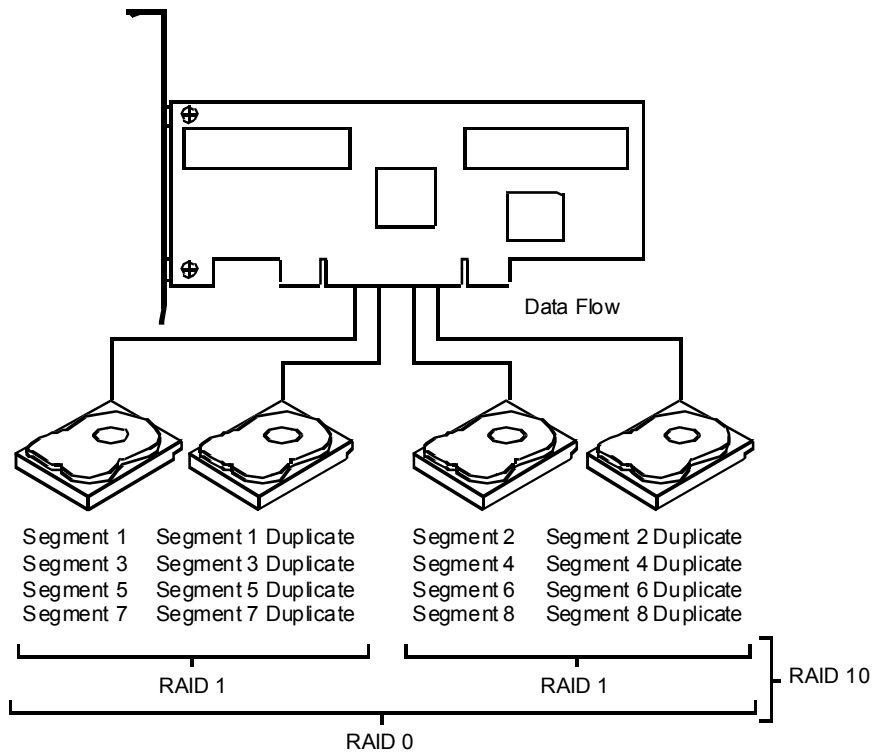


# RAID 10

RAID 10 provides both RAID 0 (data striping) and RAID 1 (disk mirroring). It requires two sets of RAID 1 drives (total of four drives). In RAID 10, data is striped across the two arrays and duplicated from one drive to the second drive in each RAID 1 array.

- Uses** Use RAID 10 for small databases or any other environment that requires fault tolerance and high data throughput, especially for large files.
- Strong Points** RAID 10 provides complete data redundancy. RAID 10 is ideal for any application that requires fault tolerance and increased data throughput.
- Weak Points** RAID 10 requires a minimum of four hard drives. Performance is impaired during drive rebuilds.
- Drives** Four

Figure 3-3. RAID 10 Array





# 4 Hardware Installation

**Requirements** You must have the following items before installing the IBM ATA 133 RAID controller:

- a IBM IDE controller
  - host computer with an available PCI expansion slot
  - IBM IDE installation diskettes
  - two 80-conductor Ultra ATA-100/133 cables
  - at least two IDE drives for RAID configuration
- 

## Installation Steps

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Perform the following steps to install the IBM ATA 133 RAID controller. Each step is described in detail in the following pages.

1. Unpack the RAID controller and inspect for damage.  
Make sure all items are in the package. If any parts are damaged or missing, contact IBM Support as outlined in Appendix A.
2. Turn the computer off, unplug the cord, and remove the cover.
3. Check the jumper settings on the RAID controller.  
See page 16 for the jumper settings.
4. Install the RAID controller.
5. Connect the ATA 100/133 cables to IDE drives.
6. Replace the computer cover, plug the computer in, and turn the power on.  
Be sure the IDE drives are powered up before or at the same time as the host computer.
7. Configure system BIOS.
8. Install software drivers for the desired operating systems.
9. Run MegaRAID Configuration Console.

This step is optional. See the *MegaRAID Configuration Console User's Guide* for more information.

---

## Step 1 Unpack

---

Unpack and install the hardware in a static-free environment. The IBM ATA 133 RAID controller is packed inside an anti-static bag between two sponge sheets. Remove the controller card and inspect it for damage. If the card appears damaged, or if any of items listed below are missing, contact IBM Support as outlined in Appendix A. You should also receive:

- Two standard length 40-pin connector ATA-100/133 cables with two drive connectors
  - Two extended length 40-pin connector ATA-100/133 cables with one drive connector
  - The *IBM ATA 133 RAID Controller Quick Hardware Setup Guide* (hard copy)
  - A Driver and Documentation CD with utility programs, device drivers for various operating systems, and the following documentation:
    - The *IBM ATA 133 RAID Controller User's Guide* (on CD)
    - Software license agreement
- 

## Step 2 Power Down

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Turn off the computer, remove the power cord from the back of the power supply, and remove the cover. Make sure the computer is turned off and disconnected from any networks before installing the controller card.

---

## Step 3 Set Jumpers

---

Make sure the jumper settings on the RAID card are correct. The jumpers are set at the factory and you probably do not need to change them. Table 4-1 describes the jumpers and connectors.

**Table 4-1. Jumpers and Connectors**

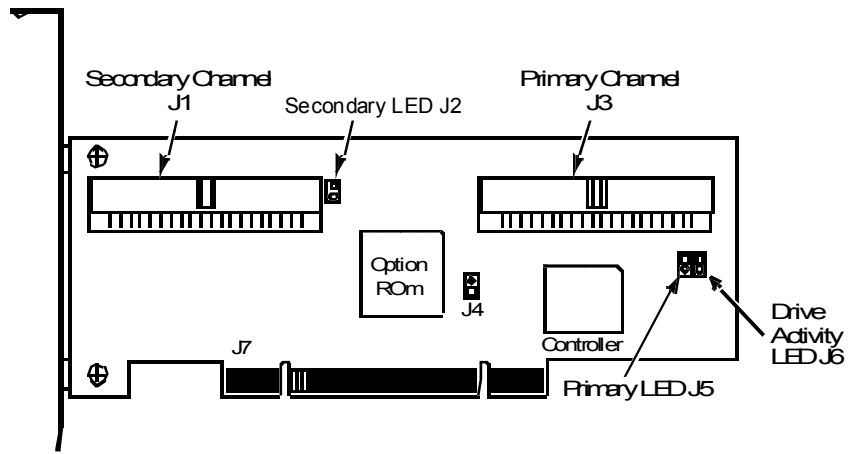
Item	Description	Type
J1	Secondary IDE channel connector: connects the secondary IDE drive to the RAID controller.	40-pin connector
J2	Secondary channel activity LED: this can be connected to an LED on the computer case to show activity on the secondary IDE channel.	2-pin header
J3	Primary IDE channel connector: connects the primary IDE drive to the RAID controller.	40-pin connector
J4	BA5_ENABLE (Base address 5): <i>must be open</i> (not jumpered) so that Base address 5 is enabled.	2-pin header
J5	Primary channel activity LED: this can be connected to an LED on the computer case to show activity on the primary IDE channel.	2-pin header
J6	Drive activity LED	2-pin header

**Note:** The connectors for the primary and secondary IDE channels (J1 and J3) are positioned in such a way that the pins are parallel to the board.

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### Step 3 Set Jumpers, continued

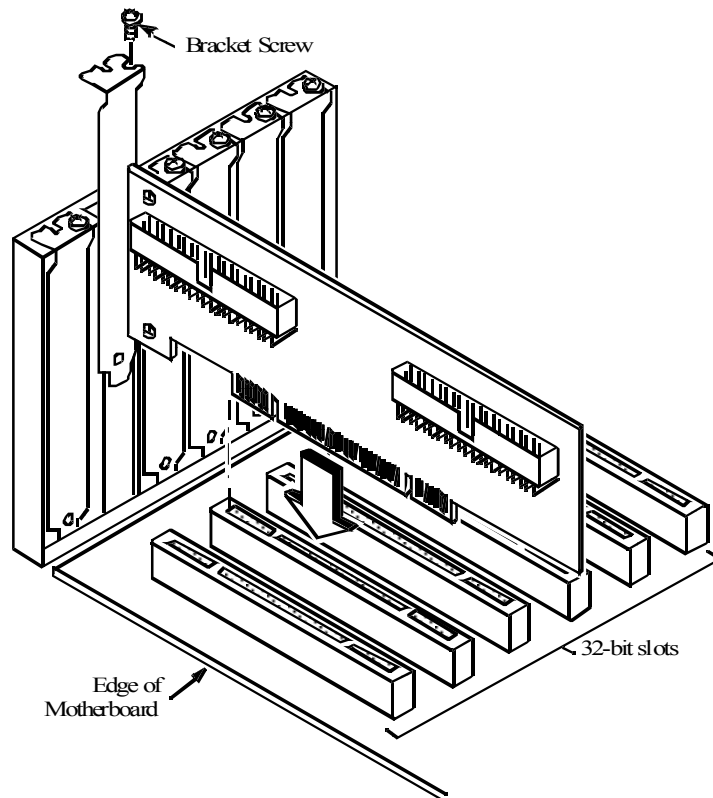
**IBM ATA 133 RAID controller layout** The following diagram displays the headers and connectors on the RAID controller.



### Step 4 Install IBM ATA 133 RAID Controller

Select a 3.3 V or 5 V PCI slot and align the RAID controller card bus connector to the slot. Press down gently but firmly to make sure that the card is properly seated in the slot. The bottom edge of the controller card should be flush with the slot.

Insert the card into a PCI slot as shown below. Attach the controller to the computer chassis with the bracket screw.



## Step 5 Connect IDE Cables

---

Before you install and connect the IDE hard drives, you must verify that each drive is set to Cable Select (CS) addressing mode. To verify this, see the IDE drive documentation.

Select the appropriate cables from the two types included with the RAID controller:

- For any configuration where more than two drives will be connected to the controller, select the standard length ATA-100/133 cables with two drive connectors.
- For 1U rack-mounted servers or in configurations where only two drives will be connected to the controller, select the extended length ATA-100/133 cables with single drive connector.

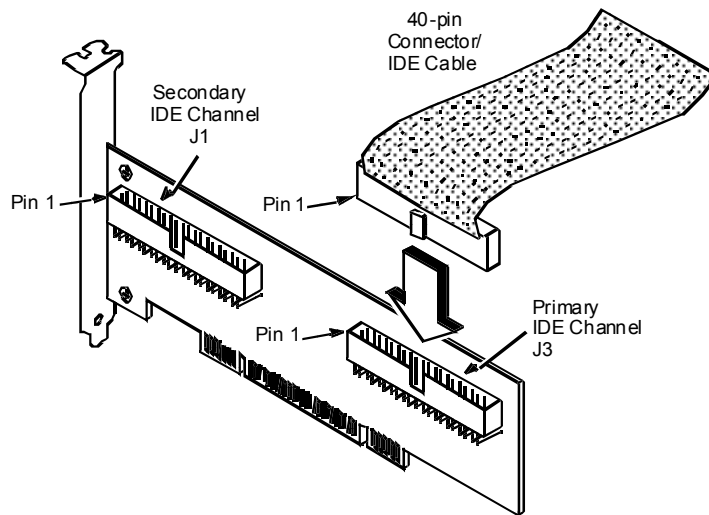
Use the selected ATA-100/133 cables to connect up to two IDE drives (one master and one slave) to each 40-pin IDE connector on the IBM ATA 133 RAID controller. When using the extended length cables, only one drive will be connected to each channel.

Connect the IDE cables to the IDE hard drives and the IDE connectors on the RAID controller. The controller provides two IDE connectors:

J1 is the Secondary IDE channel 40-pin connector.

J3 is the Primary IDE channel 40-pin connector.

Connect Pin 1 on the IDE cable to Pin 1 on the IDE connectors on the card (J1 and J3).





## Step 5 Connect IDE Cables, Continued

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### Correct Order for Attaching the Drives

Each of the standard length ATA-100/133 cables has a connector at each end for a master IDE device and another connector for a slave device. The following bullets explain how to properly connect one, two, three, or four IDE drives:

- **One IDE drive:** Attach it to the master connector on the cable for the primary IDE channel.
- **Two IDE drives:** Attach them to the master connectors on the two ATA-100/133 cables.

*The following bullets apply only to the standard-length ATA 100/133 cable with two drive connectors:*

- **Three IDE drives:** Attach them to the master and slave connectors on the cable for the primary IDE channel and the master connector on the cable for the secondary connector.
- **Four IDE drives:** Attach them to the master and slave connectors on both ATA-100/133 cables.

The following table displays the order in which you should connect the drives to the RAID controller (as described above).

**Table 4-2. Order for Attaching Drives**

Total Number of Drives	Primary IDE Channel (J3)	Primary IDE Channel (J1)
1	Master	---
2	Master	Master
3	Master and Slave	Master
4	Master and Slave	Master and Slave

**Note:** You have the option of setting a jumper to Cable Select (CS) and letting the ATA-100/33 cable set the address.

---

**Cable Suggestions** System throughput problems and malfunctioning can occur if proper IDE cables are not used. We recommend that you use 80-conductor, 40-pin Ultra ATA-100 or ATA-133 cables for all drives.

---

**Note:** Do not attach ATAPI drives to the IBM ATA 133 RAID controller. The controller does not support ATAPI devices, such as CD-ROM, SL120, and Zip drives. Connect only hard drives to the RAID controller and connect ATAPI devices to the IDE channels on the motherboard or to any other off-board IDE/ATAPI adapters.

---

## Step 6 Power Up

---

Replace the computer cover and reconnect the AC power cords. Turn power on to the host computer. Observe the messages that display during the boot process until you see the following message:

Press Ctrl-M to run MegaRAID IDE Setup Utility

---

## Step 7 Configure the System BIOS

---

When the "Press Ctrl-M" message appears on the screen, press the <Ctrl> key and <M> key immediately to run the BIOS Configuration Utility. See the *IBM ATA 133 RAID Controller User's Guide* on the Driver and Documentation CD for information about how to run and use this program.

---

## Step 8 Install the Operating System Driver

---

The IBM ATA 133 RAID controller can operate under MS-DOS® or any DOS-compatible operating system using the standard AT BIOS INT 13h Hard Disk Drive interface. To operate with other operating systems, you must install software drivers. IBM provides software drivers on the Driver and Documentation CD for the following operating systems:

- Microsoft Windows 2000 Server, Advanced Server, and Professional
- Microsoft Windows XP Professional
- Red Hat Linux 7.3

Refer to the *IBM ATA 133 RAID Controller User's Guide* on the Driver and Documentation CD for more information.

---

## Step 9 Run MegaRAID Configuration Console

---

Use the MegaRAID Configuration Console utility to display and configure the physical drives, arrays, and logical drives for the system. You can also perform consistency checks and rebuilds of the drives in the arrays.

See the *MegaRAID Configuration Console User's Guide* for more information about installing and using the utility.

---

# 5 Operating System Installation

This chapter contains the procedures for installing the Windows® 2000 operating systems when using the IBM ATA 133 RAID controller.

---

## Installing Windows 2000 Drivers

---

Perform the following steps to install the Windows 2000 driver onto the RAID-configured drives connected to the RAID controller.

1. Boot the system with the Windows 2000 Boot Installation CD or diskette.
  2. Press <F6> when the following message displays:  
  
`Setup is inspecting your computers hardware configuration.`
  3. When installation prompts for a key after copying some files, press <S> to add an adapter.
  4. You are prompted for the driver diskette.
  5. Insert the driver diskette and press <Enter>.
  6. Select LSI Logic IBM IDE driver for the appropriate operating system from the list and click <OK>.
  7. Continue with the installation procedure.
- 

## Updating the Windows 2000 Driver

---

Perform the following steps to update the Windows 2000 driver or install the Windows 2000 driver into an existing system booted from a standard IDE drive controller.

1. Click on the Windows Start button. The Windows menu displays.
  2. Select Settings. The Settings menu displays to the right.
  3. Click on Control Panel. The Control Panel window displays.
  4. Select IDE Adapters.
  5. Select Drivers tab.
  6. If the IBM ATA 133 RAID controller is already installed, it appears in the list as “LSI Logic MegaRAID IDE Controller”. Select it and remove by clicking the “Remove” button.
  7. Click the Add button.
  8. Select the Have Disk button. Insert the disk into the diskette drive.
  9. Select drive letter A: and click on <OK>.
  10. Select “LSI Logic MegaRAID IDE Controller” and click on <OK>.
  11. After Windows 2000 copies the driver, reset the system.
-

## Confirming the Windows 2000 Driver Installation

---

Perform the following steps to confirm that the Windows 2000 driver is installed properly.

1. Click on the Windows Start button. The Windows menu displays.
2. Select Settings. The Settings menu displays to the right.
3. Click on Control Panel. The Control Panel window displays.
4. Select IDE Adapters.
5. Select the Drivers tab.

If the RAID board is installed, it appears in the list as “LSI Logic MegaRAID IDE Controller”.

6. Select the Devices tab.

If drives are connected to the RAID controller and configured properly, you will see one or more entries as “LSI Logic MegaRAID IDE #xx” under “LSI Logic MegaRAID IDE Controller”.

---

## Installing DOS

---

For DOS, no driver installation is required. The RAID controller ROM BIOS contains the low-level driver for IBM IDE that is necessary for MS-DOS.

---

# 6 BIOS Configuration Utility

The BIOS Configuration Utility configures disk arrays and logical drives. Because the utility resides in the BIOS, its operation is independent of the operating systems on your computer.

The BIOS Configuration Utility is a character-based utility that you can run by pressing <Ctrl><M> when the system boots. Use this utility to perform the following:

- Create hot spare drives.
  - Configure physical arrays and logical drives.
  - Initialize one or more logical drives.
  - Access controllers, logical drives, and, physical drives individually.
  - Rebuild failed hard drives.
  - Verify that the redundancy data in logical drives using RAID level 1 or 5 is correct.
  - Select a host adapter to work on.
- 

## Starting the BIOS Configuration Utility

---

When the host system boots, hold the <Ctrl> key and press the <M> key when the following appears:

```
HA -0 (Bus 1 Dev 6) Type: Standard FW x.xx SDRAM=128MB
0 Logical Drives found on the Host Adapter
Adapter BIOS Disabled, No Logical Drives handled by BIOS
0 Logical Drive(s) handled by BIOS
Press <Ctrl><M> to Enable BIOS Configuration Utility
Press <Ctrl><H> to Enable WebBIOS
```

For each controller in the host system, the firmware version, dynamic random access memory (DRAM) size, and the status of logical drives on that adapter display. If you do not press <Ctrl><M> within a few seconds of the prompt, the system continues the boot procedure.

After you press a key to continue, the Management Menu screen displays.

---

## Configuring Arrays and Logical Drives

---

Perform the following steps to configure arrays and logical drives:

1. Designate hot spares (optional).
  2. See "Designating Drives as Hot Spares" for more information.
  3. Select a configuration method and create arrays using the available physical drives. See "Selecting the Configuration Method" for more information.
  4. Define logical drives using the space in the arrays.
  5. Save the configuration information.
  6. Initialize the new logical drives.
-

## Designating Drives as Hot Spares

---

Hot spares are physical drives that are powered up along with the RAID drives and usually stay in a standby state. If a hard drive used in a RAID logical drive fails, a hot spare will automatically take its place and the data on the failed drive is reconstructed on the hot spare. Hot spares can be used for RAID levels 1, 5, and 10. Each controller supports up to eight hot spares.

The methods for designating physical drives as hot spares are:

- Pressing <F4> while creating arrays in Easy, New or View/Add Configuration mode, or
  - Using the Objects—> Physical Drive menu.
- 

### <F4> Key

When you select any configuration option, a list of all physical devices connected to the current controller appears. Perform the following steps to designate a drive as a hot spare:

1. Press the arrow keys to highlight a hard drive that has a READY indicator.
2. Press <F4> to designate the drive as a hot spare. The indicator changes to HOTSP.
3. Save the configuration.

### Objects Menu

Perform the following steps to designate a hot spare:

1. Select Objects—> Physical Drive. A physical drive selection screen appears.
  2. Select a hard drive in the Ready state and press <Enter> to display the action menu for the drive.
  3. Press the arrow keys to select Make HotSpare and press <Enter>. The indicator for the selected drive changes to HOTSP.
- 

## Selecting the Configuration Method

---

**Using Easy Configuration** In Easy Configuration, each physical array you create is associated with exactly one logical drive. Easy Configuration does not delete the existing configuration. You can modify the following parameters:

- RAID level
- Stripe size
- Write policy
- Read policy
- Cache policy

If logical drives have already been configured when you select Easy Configuration, the configuration information is not disturbed. Perform the following steps to create arrays using Easy Configuration.

1. Select Configure—> Easy Configuration from the BIOS Configuration Utility Management Menu.

The array selection menu appears. Hot key information displays at the bottom of the screen. The hot key functions are:

- <F2> Display the manufacturer data and error count for the selected drive.
- <F3> Display the logical drives that have been configured.
- <F4> Designate the selected drive as a hot spare.

2. Press the arrow keys to highlight specific physical drives.
- 

Cont'd

### Using Easy Configuration, cont'd

3. Press the spacebar to associate the selected physical drive with the current array.

The indicator for the selected drive changes from READY to ONLIN A[array number]-[drive number]. For example, ONLIN A2-3 means hard drive 3 in array 2.

4. Add physical drives to the current array as desired.

Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the array are treated as if they have the capacity of the smallest drive in the array.

The number of physical drives in a specific array determines the RAID levels that can be implemented with the array. RAID 0 requires one or more physical drives, RAID 1 requires two, and RAID 10 requires at least three physical drives.

5. Press <Enter> after you finish creating the current array.

A window entitled Select Configurable Array(s) appears. It displays the array and array number, such as A-00.

6. Press the spacebar to select the array.

Span information, such as Span-1, displays in the array box. You can create multiple arrays, then select them to span them.

**NOTE:** You can press <F2> to display the number of drives in the array, their channel and ID, and <F3> to display array information, such as the stripes, slots, and free space.

7. Press <F10> to configure logical drives.

The window at the top of the screen shows the logical drive currently being configured.

The headings are:

LD	The logical drive number
RAID	The RAID level
Size	The logical drive size
#Stripes	The number of stripes (physical drives) in the associated physical array
StrpSz	The stripe size
DriveState	The state of the logical drive

8. Highlight RAID and press <Enter> to set the RAID level for the logical drive.

The available RAID levels for the current logical drive display.

9. Select a RAID level and press <Enter> to confirm.

10. Click Advanced Menu to open the menu.

11. Set the Stripe Size on the Advanced Menu.

Stripe Size specifies the size of the segments written to each disk in a RAID 0, 1, or 5 logical drive. You can set the stripe size to 2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces better read performance, especially if your computer does mostly sequential reads. If you are sure that your computer does random read requests more often, select a small stripe size. The default is 64 KB.

12. Set the Write Policy on the Advanced Menu.

Write Policy sets the caching method to write-back or write-through.

---

Cont'd

### Using Easy Configuration, cont'd

In Write-back caching, the controller sends a data transfer completion signal to the host when the controller cache has received all the data in a transaction. This setting is recommended in standard mode.

In Write-through caching, the controller sends a data transfer completion signal to the host when the disk subsystem has received all the data in a transaction. This is the default setting if cluster mode is enabled.

Write-through caching has a data security advantage over write-back caching. Write-back caching has a performance advantage over write-through caching.

13. Set the Read Policy on the Advanced Menu.

Read-ahead enables the read-ahead feature for the logical drive. You can set this parameter to No-Read-Ahead, Read-ahead, or Adaptive.

No-Read-Ahead specifies that the controller does not use read-ahead for the current logical drive.

Read-ahead specifies that the controller uses read-ahead for the current logical drive.

Adaptive specifies that the controller begins using read-ahead if the two most recent disk accesses occurred in sequential sectors. If all read requests are random, the algorithm reverts to No-Read-Ahead, however, all requests are still evaluated for possible sequential operation. This is the default setting.

14. Set Cache Policy on the Advanced Menu.

Cache Policy applies to reads on a specific logical drive. It does not affect the Read-ahead cache.

Cached I/O specifies that all reads are buffered in cache memory.

Direct I/O specifies that reads are not buffered in cache memory. Direct I/O does not override the cache policy settings. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. This is the default setting.

15. Press <Esc> to exit the Advanced Menu.

16. After you define the current logical drive, select Accept and press <Enter>.

The array selection screen appears if any unconfigured hard drives remain.

17. Repeat step 7 through step 16 to configure another array and logical drive.

18. When finished configuring logical drives, press <Esc> to exit Easy Configuration.

A list of the currently configured logical drives appears.

19. Respond to the Save prompt.

After you respond to the Save prompt, the Configure menu appears.

20. Initialize the logical drives you have just configured.

See "Initializing Logical Drives" for more information.

---

Cont'd



**Using New Configuration** If you select New Configuration, the existing configuration information on the selected controller is destroyed when the new configuration is saved. In New Configuration, you can modify the following logical drive parameters:

- RAID level
- Stripe size
- Cache write policy
- Read policy
- Cache policy
- Logical drive size
- Spanning of arrays

**NOTE:** Selecting New Configuration erases the existing configuration information on the selected controller. To use the spanning feature and keep the existing configuration, use View/Add Configuration.

1. Select Configure—> New Configuration from the BIOS Configuration Utility Management Menu.

An array selection window displays the devices connected to the current controller. Hot key information appears at the bottom of the screen. The hot key functions are:

- <F2> Display drive data and error count for the selected drive.
- <F3> Display the logical drives that have been configured.
- <F4> Designate the selected drive as a hot spare.
- <F10> Display the logical drive configuration screen.

2. Press the arrow keys to highlight specific physical drives.

3. Press the spacebar to associate the selected physical drive with the current array.

The indicator for the selected drive changes from READY to ONLINE A[array number]-[drive number]. For example, ONLINE A2-3 means hard drive 3 in array 2.

4. Add physical drives to the current array as desired.

**NOTE:** Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the array are treated as if they have the capacity of the smallest drive in the array.

The number of physical drives in a specific array determines the RAID levels that can be implemented with the array.

RAID 0 requires one or more physical drives per array.

RAID 1 requires two physical drives per array.

RAID 10 requires at least four physical drives per array.

5. Press <Enter> after you finish creating the current array.

A window entitled Select Configurable Array(s) appears. It displays the array, and array number, such as A-00.

---

Cont'd

### Using New Configuration, cont'd

6. Press the spacebar to select the array.

Span information, such as Span-1, displays in the array box. You can create multiple arrays, then select them to span them.

NOTE: You can press <F2> to display the number of drives in the array, their channel and ID, and <F3> to display array information, such as the stripes, slots, and free space.

7. Press <F10> to configure a logical drive.

The logical drive configuration screen appears. Span=Yes displays on this screen if you select two or more arrays to span.

The window at the top of the screen shows the logical drive that is currently being configured as well as any existing logical drives. The column headings are:

LD	The logical drive number
RAID	The RAID level
Size	The logical drive size
#Stripes	The number of stripes (physical drives) in the associated physical array
StrpSz	The stripe size
Drive-State	The state of the logical drive

8. Highlight RAID and press <Enter> to set the RAID level for the logical drive.

A list of the available RAID levels for the current logical drive appears.

9. Select a RAID level and press <Enter> to confirm.

10. Highlight Span and press <Enter>.

The choices are:

Yes     Array spanning is enabled for the current logical drive. The logical drive can occupy space in more than one array.

No      Array spanning is disabled for the current logical drive. The logical drive can occupy space in only one array.

This controller supports spanning of RAID 1 arrays only. You can span two or more contiguous RAID 1 arrays into a RAID 10 array.

For two arrays to be spanned, they must have the same stripe width (they must contain the same number of physical drives) and must be consecutively numbered.

For example, assuming array 2 contains four hard drives, it can be spanned only with array 1 and/or array 3, and only if arrays 1 and 3 also contain four hard drives. If the two criteria for spanning are met, the controller automatically allows spanning. If the criteria are not met, the Span setting makes no difference for the current logical drive.

11. Highlight a spanning option and press <Enter>.

---

Cont'd

### Using New Configuration, cont'd

12. Move the cursor to Size and press <Enter> to set the logical drive size.

**NOTE:** The full drive size is used when you span logical drives; you cannot specify a smaller drive size.

13. By default, the logical drive size is set to all available space in the array(s) being associated with the current logical drive, accounting for the Span setting.

14. Click Advanced Menu to open the menu for logical drive settings.

15. Set the Stripe Size on the Advanced Menu.

See "step 11" in "Using Easy Configuration" for information about the Stripe Size.

16. Set the Write Policy on the Advanced Menu.

See "step 12" in "Using Easy Configuration" for information about the Write Policy.

17. Set the Read Policy on the Advanced Menu.

See "step 13" in "Using Easy Configuration" for information about the Read Policy.

18. Set the Cache Policy on the Advanced Menu.

See "step 14" in "Using Easy Configuration" for information about the Cache Policy.

19. Press <Esc> to exit the Advanced Menu.

20. After you define the current logical drive, select Accept and press <Enter>.

If space remains in the arrays, the next logical drive to be configured appears.

21. Repeat step 7 to step 20 to create an array and configure another logical drive.

If the array space has been used, a list of the existing logical drives appears.

22. Press any key to continue, then respond to the Save prompt.

23. Initialize the logical drives you have just configured.

See "Initializing Logical Drives" for more information.

---

### Using View/Add Configuration

View/Add Configuration allows you to control the same logical drive parameters as New Configuration without disturbing the existing configuration information. You can also enable the Configuration on Disk feature. See "Using View/Add Configuration" for instructions on View/Add Configuration.

1. Select Configure—> View/Add Configuration from the BIOS Configuration Utility Management Menu.

An array selection window displays the devices connected to the current controller. Hot key information appears at the bottom of the screen. The hot key functions are:

<F2> Display the manufacturer data and error count for the selected drive.

<F3> Display the logical drives that have been configured.

<F4> Designate the selected drive as a hot spare.

<F10> Display the logical drive configuration screen.

---

Cont'd

### Using View/Add Configuration, cont'd

2. Press the arrow keys to highlight specific physical drives.

3. Press the spacebar to associate the selected physical drive with the current array.

The indicator for the selected drive changes from READY to ONLIN A[array number]-[drive number]. For example, ONLIN A2-3 means hard drive 3 in array 2.

4. Add physical drives to the current array as desired.

**NOTE:** Try to use drives of the same capacity in a specific array. If you use drives with different capacities in an array, all drives in the array are treated as if they have the capacity of the smallest drive in the array.

The number of physical drives in a specific array determine the RAID levels that can be implemented with the array.

RAID 0 requires one or more physical drives per array.

RAID 1 requires two physical drives per array.

RAID 10 requires at least four physical drives per array.

**NOTE:** Dell™ does not recommend using RAID 0 in the cluster environment. RAID 0 is not redundant and provides no data protection.

5. Press <Enter> after you finish creating the current array.

A window entitled Select Configurable Array(s) appears. It displays the array, and array number, such as A-00.

6. Press the spacebar to select the array.

Span information, such as Span-1, displays in the array box. You can create multiple arrays, then select them to span them.

**NOTE:** You can press <F2> to display the number of drives in the array, their channel and ID, and <F3> to display array information, such as the stripes, slots, and free space.

7. Press <F10> to configure a logical drive.

The logical drive configuration screen appears. Span=Yes displays on this screen if you select two or more arrays to span.

The logical drive that is currently being configured and any existing logical drives display. The column headings are:

LD	The logical drive number
RAID	The RAID level
Size	The logical drive size
#Stripes	The number of stripes (physical drives) in the associated physical array
StrpSz	The stripe size
Drive-State	The state of the logical drive

---

Cont'd

### Using View/Add Configuration, cont'd

8. Highlight RAID and press <Enter> to set the RAID level for the logical drive.

The available RAID levels for the current logical drive appear.

9. Select a RAID level and press <Enter> to confirm.

10. Highlight Span, press <Enter>, and select on Yes or No:

Yes     Array spanning is enabled for the current logical drive. The logical drive can occupy space in more than one array.

No      Array spanning is disabled for the current logical drive. The logical drive can occupy space in only one array.

This controller supports spanning for RAID 1 arrays only. You can span two or more contiguous RAID 1 logical drives into a RAID 10 array.

For two arrays to be spanned, they must have the same stripe width (they must contain the same number of physical drives) and they must be consecutively numbered.

For example, assuming array 2 contains four hard drives, it can be spanned only with array 1 and/or array 3, and only if arrays 1 and 3 also contain four hard drives. If the two criteria for spanning are met, the controller automatically activates spanning. If the criteria are not met, the Span setting makes no difference for the current logical drive.

11. Highlight a spanning option and press <Enter>.

12. Move the cursor to Size and press <Enter> to set the logical drive size.

By default, the logical drive size is set to all available space in the array(s) associated with the current logical drive, accounting for the Span setting.

**NOTE:** The full drive size is used when you span logical drives; you cannot specify a smaller drive size.

13. Click Advanced Menu to open it.

14. Set the Stripe Size on the Advanced Menu.

See "step 11" in "Using Easy Configuration" for information about the Stripe Size.

15. Set the Write Policy on the Advanced Menu.

See "step 12" in "Using Easy Configuration" for information about the Write Policy.

16. Set the Read Policy on the Advanced Menu.

See "step 13" in "Using Easy Configuration" for information about the Read Policy.

17. Set the Cache Policy on the Advanced Menu.

See "step 14" in "Using Easy Configuration" for information about the Cache Policy.

18. After you define the current logical drive, select Accept and press <Enter>.

If space remains in the arrays, the next logical drive to be configured appears.

19. Repeat step 7 to step 18 to create an array and configure another logical drive.

If all array space is used, a list of the existing logical drives appears.

20. Press any key to continue, then respond to the Save prompt.

21. Initialize the logical drives you have just configured.

See "Initializing Logical Drives" for more information.

---

## Drive Roaming

---

The RAID controller supports drive roaming (also known as Configuration on Disk). Drive roaming saves configuration information both in the non-volatile random access memory (NVRAM) and on the hard drives attached to the controller. If the controller is replaced, the new controller can detect the RAID configuration, maintaining the integrity of the data on each drive even if the drives have changed target IDs.

Perform the following steps to add support for drive roaming:

1. Hold the <Ctrl> key down and press the <M> key during system boot to run the BIOS Configuration Utility.
  2. Select Configure—> View/Add Configuration.
  3. Select Disk when asked to use Disk or NVRAM.
  4. Select Save.
  5. Press <Esc> to exit the BIOS Configuration Utility.
  6. Reboot the computer.
- 

## Initializing Logical Drives

---

Initialize each new logical drive you configure. You can initialize the logical drives using the following methods:

- Batch Initialization. The Initialize option on the Management Menu screen lets you initialize up to 40 logical drives simultaneously.
  - Individual Initialization. You can use either the Initialize option on the Management Menu screen or the Objects—> Logical Drive—> Initialize action menu to initialize an individual drive.
- 

### Batch Initialization

Perform the following steps to initialize more than one drive at a time:

1. Select Initialize from the BIOS Configuration Utility Management Menu.

A list of the current logical drives appears.

2. Press the spacebar to select the desired logical drive for initialization.
3. Press <F2> to select/deselect all logical drives.
4. After you finish selecting logical drives, press <F10> and select Yes from the confirmation prompt.

The progress of the initialization for each drive is shown in bar graph format.

5. When initialization is complete, press any key to continue or press <Esc> to display the Management Menu.
- 

Cont'd

### Individual Initialization

You can use either the Initialize option from the Management Menu screen or the Objects—> Logical Drive—> Initialize menu to initialize an individual drive.

Perform the following steps to use the Initialize option from the Management Menu screen:

1. Select Initialize from the BIOS Configuration Utility Management Menu.

A list of the current logical drives appears.

2. Press the spacebar to select the desired logical drive for initialization.
3. Press <F2> to select/deselect all logical drives.
4. After you finish selecting logical drives, press <F10> and select Yes from the confirmation prompt.

The progress of the initialization for each drive is shown in bar graph format.

5. When initialization is complete, press any key to continue or press <Esc> to display the Management Menu.

To use the Objects—> Logical Drive—> Initialize menu, perform the following steps:

1. Select the Objects—> Logical Drive from the BIOS Configuration Utility Management Menu.
2. Select the logical drive to be initialized.
3. Select Initialize from the action menu.

Initialization progress appears as a bar graph on the screen.

4. When initialization completes, press any key to display the previous menu.
- 

### Deleting Logical Drives

---

This RAID controller supports the ability to delete any unwanted logical drives and use that space for a new logical drive. You can have an array with multiple logical drives and delete a logical drive without deleting the whole array.

After you delete a logical drive, you can create a new one. You can use the "RAID Management Utilities" to create the next logical drive from the non-contiguous free space ('holes'), and from the newly created arrays. The configuration utilities provide a list of configurable arrays where there is a space to configure.

**NOTICE:** The deletion of the logical drive can fail under the following conditions: During a rebuild, initialization or check consistency of a logical drive, if that drive has a higher logical drive number than the drive you want to delete

To delete logical drives in the BIOS Configuration Utility, perform the following steps:

1. Select Objects—> Logical Drive from the BIOS Configuration Utility Management Menu.

The logical drives display

2. Use the arrow key to highlight the logical drive you want to delete.
3. Press <Del> to delete the logical drive.

This deletes the logical drive and makes the space it occupied available for you to make another logical drive.

---

## Formatting Physical Drives

---

You can do low-level formatting of drives using the BIOS Configuration Utility. Because most hard drives are low-level formatted at the factory, this step is usually not necessary. Usually, you must format a disk if:

- The hard drive was not low-level formatted at the factory, or
- An excessive number of media errors have been detected on the hard drive.

**NOTE:** You cannot low-level format a drive if it is already in an array.

---

### Viewing Media Errors

Check the View Drive Information screen for the drive to be formatted. Perform the following steps to display this screen which contains the media errors:

1. Select Objects—> Physical Drives from the Management Menu.
2. Select a device.
3. Press <F2>.

The error count displays at the bottom of the properties screen. If you feel that the number of errors is excessive, you should probably format the hard drive. If more than 32 media errors were detected, the RAID controller automatically puts the drive in FAIL state. This occurs even in a degraded RAID set. The errors are displayed as they occur. In cases such as this, formatting the drive can clear up the problem.

You do not have to select Format to erase existing information on your drives, such as a DOS partition. That information is erased when you initialize logical drives.

---

### Formatting Drives

You can format the physical drives using:

- Individual Formatting. Select Objects—> Format from the Physical Drive action menu for a physical drive.
- 

### Individual Formatting

1. Select Objects—> Physical Drives from the BIOS Configuration Utility Management Menu.

A device selection window displays the devices connected to the current controller.

2. Press the arrow keys to select the physical drive to be formatted and press <Enter>.
3. Select Format.

Formatting can take some time, depending on the drive capacity.

4. When formatting completes, press any key to display the previous menu.
-



## Rebuilding Failed Hard Drives

---

If a hard drive fails in an array that is configured as a RAID 1 or 5 logical drive, you can recover the lost data by rebuilding the drive.

---

### Rebuild Types

Table 5-1. Rebuild Types describes automatic and manual rebuilds.

**Table 5-1. Rebuild Types**

Type	Description
Automatic Rebuild	If you have configured hot spares, the RAID controller automatically tries to use them to rebuild failed drives. If you replace a failed drive with a hard drive in the same slot, the rebuild begins automatically.
Manual Rebuild	Manual rebuild is necessary if no hot spares with enough capacity to rebuild the failed drives are available. Select Management Menu—> Rebuild or Objects—> Physical Drives—> Rebuild on the BIOS Configuration Utility.

---

### Automatic Rebuild

Select Management Menu—> Objects—> Physical Drive to display the physical drives screen while a rebuild is in progress. The drive indicator for the hot spare drive has changed to REBLD A[array number]-[drive number], indicating the hard drive being replaced by the hot spare.

---

### Manual Rebuild – Rebuilding an Individual Drive

1. Select Objects—> Physical Drive from the BIOS Configuration Utility Management Menu.

A device selection window displays the devices connected to the current controller.

2. Press the arrow keys to select the physical drive to rebuild, then press <Enter>.

3. Select Rebuild from the action menu and respond to the confirmation prompt.

Rebuilding can take some time, depending on the drive capacity.

4. When the rebuild is complete, press any key to display the previous menu.

---

### Manual Rebuild – Batch Mode

1. Select Rebuild from the BIOS Configuration Utility Management Menu.

A device selection window displays the devices connected to the current controller. The failed drives have FAIL indicators.

2. Press the arrow keys to highlight any failed drives to be rebuilt.

3. Press the spacebar to select the desired physical drive for rebuild.

4. After you select the physical drives, press <F10> and select Yes at the prompt.

The indicators for the selected drives change to REBLD. Rebuilding can take some time, depending on the number of drives selected and the drive capacities.

5. When the rebuild is complete, press any key to continue.

6. Press <Esc> to display the Management Menu.

---

## Using Online Volume Extension

---

Online Volume Extension allows the controller to determine the drive capacity. With online volume extension, you can use the drive space of a hard drive that was just added to an existing drive array, without rebooting the operating system. Online volume extension is not supported in cluster mode.

### Locating and Enabling

The Online Volume Extension option is labeled FlexRAID Virtual Sizing in the BIOS Configuration Utility and is found in the Objects—> Logical Drive—> View/Update Configuration menu. Enable this option after you configure a logical drive and before you exit the BIOS Configuration Utility.

The ability to use this feature for an existing logical drive depends on the firmware version. Older firmware versions may not allow you to enable this feature once you have saved the configuration.

Perform the following steps to enable online volume extension in the <Ctrl><M> BIOS Configuration Utility, in which it is known as FlexRAID Virtual Sizing:

1. Select FlexRAID Virtual Sizing from the Logical Drive—> Logical DriveView—> Update Properties menu.

The Logical Drive menu is on the BIOS Configuration Utility Objects menu.

2. Select Enabled to enable FlexRAID Virtual Sizing.

Set this option to Enabled before you add a physical drive to a logical drive.

After you have created a logical drive set, the partition of the drive should be as large as the virtual size of the logical drive. After you have created a logical array set, the drive partition can be as large as the full size of the logical drive. However, this is the full virtual drive size, not the actual physical drive size.

## Running a Consistency Check

---

Select this option to verify the redundancy data in logical drives that use RAID levels 1 and 10.

The parameters of the existing logical drives appear. Discrepancies are automatically corrected, assuming always that the data is correct. However, if the failure is a read error on a data drive, the bad data block is reassigned with the generated data. Perform the following steps to run Check Consistency:

1. Select Check Consistency from the BIOS Configuration Utility Management Menu.
2. Press the arrow keys to highlight the desired logical drives.
3. Press the spacebar to select or deselect a drive for consistency checking.
4. Press <F2> to select or deselect all the logical drives.
5. Press <F10> to begin the consistency check.

A progress indicator for each selected logical drive displays.

6. When the check is finished, press any key to clear the progress display.

7. Press <Esc> to display the Management Menu.

(To check an individual drive, select Objects—> Logical Drives on the Management Menu, the desired logical drive(s), then Check Consistency on the action menu.)

## Exiting the BIOS Configuration Utility

---

Perform the following steps to exit the BIOS Configuration Utility:

1. Press <Esc> when the BIOS Configuration Utility Management Menu displays.
2. Select Yes at the prompt.
3. You must reboot the computer.

The BIOS message appears again.

4. Press <Esc> when the BIOS Configuration Utility prompt appears.
-



# 7 Troubleshooting

## Drive Connection Tips

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1. If you have two drives, connect one per channel.
  2. The performance of IBM ATA 133 RAID controller is best with one drive per channel.
  3. Use the same type of drives or drives with similar capability (in terms of speed and capacity).
  4. Do not use dissimilar drives on the same channel.
  5. Always use 80-conductor Ultra ATA-100/133 cables.
  6. Ensure that proper jumper settings are used for Master and Slave in each channel. You have the option of using the Cable Select (CS) jumper setting and letting the ATA-100/133 cable set the address.
  7. Do not connect any ATAPI devices (CD, ZIP, LS120 etc.) to the IBM IDE controller.
-

## Problems and Suggested Solutions

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Table 7-1 describes the problems you might encounter, along with suggested solutions.

**Table 7.1 Problems and Suggested Solutions**

<b>Problem</b>	<b>Suggested Solution</b>
The sign on message does not appear during boot up (If the card is properly installed, you should see the sign on message).	<ol style="list-style-type: none"><li>1. Check whether the RAID controller is inserted all the way down in the PCI slot.</li><li>2. Move the card to a different PCI slot.</li><li>3. If System BIOS is set for silent boot, then no message will appear on screen. This is not a problem. To make sure, set the silent boot option to disabled in the system BIOS.</li></ol>
Drive(s) connected to RAID controller are not detected OR The system hangs when controller ROM scans the IDE channels.	<ol style="list-style-type: none"><li>1. Make sure the Ultra ATA-100/133 cables are used.</li><li>2. Make sure that the cable ends are connected properly.</li><li>3. Make sure that the power cables to the drives are connected properly.</li><li>4. Make sure that the Master/Slave jumpers are used properly.</li><li>5. Change cables.</li><li>6. If everything fails, change the drive(s).</li></ol>
BIOS reports that a mirrored array is in degraded mode.	Make sure all physical drives are properly connected and are powered on. Reconnect, replace, or rebuild any drive that has failed.
One of the hard drives in a mirrored array has failed.	Replace the drive with another drive that has the same capacity.
If this message displays while booting: “NO ROM BASIC SYSTEM HALTED”	There are no active partitions. Run FDISK to set the active partition.
Operating system does not boot.	Check the system BIOS configuration for PCI interrupt assignments. Make sure some Interrupts are assigned for PCI.  Make sure that you have properly selected the Boot Device in the system BIOS setup (CMOS Setup).

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# A Getting Help and Technical Assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This appendix contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your xSeries or IntelliStation system, and whom to call for service, if it is necessary.

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## Before You Call

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Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Go to the IBM Support Web site at <http://www.ibm.com/pc/support/> to check for technical information, hints, tips, and new device drivers.
- Use an IBM discussion forum on the IBM Web site to ask questions.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the publications that are provided with your system and software. The information that comes with your system also describes the diagnostic tests that you can perform. Most xSeries and IntelliStation systems, operating systems, and programs come with information that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the information for the operating system or program.

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## Using the Documentation

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Information about your IBM xSeries or IntelliStation system and preinstalled software, if any, is available in the documentation that comes with your system. That documentation includes printed books, online books, README files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/pc/support/> and follow the instructions. Also, you can order publications through the IBM Publications Ordering System at <http://www.elink.ibm.com/public/applications/publications/cgi-bin/pbi.cgi>

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## Getting Help and Information from the World Wide Web

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On the World Wide Web, the IBM Web site has up-to-date information about IBM xSeries and IntelliStation products, services, and support. The address for IBM xSeries information is <http://www.ibm.com/eserver/xseries/>. The address for IBM IntelliStation information is <http://www.ibm.com/pc/intellistation/>.

You can find service information for your IBM products, including supported options, at <http://www.ibm.com/pc/support/>. If you click **Profile** from the support page, you can create a customized support page. The support page has many sources of information and ways for you to solve problems, including:

- Diagnosing problems, using the IBM Online Assistant
  - Downloading the latest device drivers and updates for your products
  - Viewing Frequently Asked Questions (FAQ)
  - Viewing hints and tips to help you solve problems
  - Participating in IBM discussion forums
  - Setting up e-mail notification of technical updates about your products
- 

## Software Service and Support

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Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with xSeries servers, IntelliStation workstations, and appliances. For information about which products are supported by Support Line in your country or region, go to <http://www.ibm.com/services/sl/products/>. For more information about Support Line and other IBM services, go to <http://www.ibm.com/services/>, or go to <http://www.ibm.com/planetwide/> for support telephone numbers.

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## Hardware Service and Support

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You can receive hardware service through IBM Integrated Technology Services or through your IBM reseller, if your reseller is authorized by IBM to provide warranty service. Go to <http://www.ibm.com/planetwide/> for support telephone numbers. In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

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# B Warranty Information

## Warranty Information

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This section contains information about your warranty period and the service and support that are provided by your warranty.

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## Warranty Period

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The warranty period varies by machine type and country or region.

Contact your place of purchase for warranty service information. Some IBM Machines are eligible for on-site warranty service depending on the country or region where service is performed.

**Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician.**

The IBM Machine Warranties Web site at [http://www.ibm.com/servers/support/machine\\_warranties/](http://www.ibm.com/servers/support/machine_warranties/) contains a worldwide overview of the IBM Statement of Limited Warranty for IBM Machines, a glossary of terms used in the Statement of Limited Warranty, Frequently Asked Questions (FAQ), and links to Product Support Web pages. The IBM Statement of Limited Warranty is available from this Web site in 29 languages in Portable Document Format (PDF).

**Machine** – IBM ATA 133 RAID Controller

Country or region	Warranty Period	Service delivery method
Worldwide	3 years	Customer carry-in or mail-in

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## Problem Determination

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Prior to on-site warranty service, you are required to go through problem determination with an IBM service specialist call center technician. The service specialist will run diagnostic tests on the hardware and check the software.

**Running diagnostics:** The IBM service specialist will help you determine whether your equipment is functioning as specified. It might be necessary to isolate the failing xSeries, Netfinity, or IntelliStation system; IBM component; or both from any active production environment to run diagnostics and perform defect-isolation programs. You are responsible for making the system, IBM component, or both available for running diagnostics and defect-isolation programs.

**Checking software:** The IBM service specialist will help you ensure that the correct BIOS code, firmware, device drivers, and other supporting IBM software are installed and correctly configured. It might be necessary to manually gather information about the relevant software levels or run IBM-approved utility programs to gather this information. It might be necessary to isolate the failing system from any active production environment to gather this information. You are responsible, with assistance from the service specialist, for gathering this information. The IBM Statement of Limited Warranty does not include on-site assistance with this activity.

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## Warranty Service and Support

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With the original purchase of an IBM xSeries or IntelliStation system, you have access to extensive service and support. During the IBM Machine warranty period, you may call IBM or your reseller for problem-determination assistance under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:

- **Problem determination** - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- **IBM hardware repair** - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service, either on-site or at an IBM service center as determined by IBM.
- **Engineering Change management** - Occasionally, there might be changes that are required after a product has been shipped from IBM. In those instances, IBM will make Engineering Changes (ECs) available that apply to your hardware.
- **Customer replaceable units (CRUs)** - Some parts of IBM xSeries and IntelliStation systems are designated as customer replaceable units. IBM ships CRUs to you for replacement by you. CRUs include keyboards, monitors, memory, diskette drives, hard disk drives, and mice (this list is not inclusive of all CRUs).

The following items are not covered under warranty service:

- Replacement or use of non-IBM parts. All IBM parts contain a 7-character identification in the format IBM FRU XXXXXXXX.
- Identification of software problem sources.
- Installation of customer replaceable units (CRUs).
- Installation and configuration of BIOS code, firmware, or device drivers that are designated as customer installable.

See the IBM Statement of Limited Warranty for a full explanation of IBM warranty terms. Be sure to retain your proof of purchase to obtain warranty service.

Please have the following information ready when you call:

- The machine type and model of your IBM hardware product (if available)
  - Serial numbers of your IBM hardware products
  - A description of the problem
  - The exact wording of any error messages
  - Hardware and software configuration information
-

## International Warranty Service

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If you travel with your xSeries or IntelliStation system or relocate it to a country or region where your system is sold and serviced by IBM or IBM resellers authorized to perform warranty service, International Warranty Service (IWS) is available during the warranty period. Eligible IBM systems are identified by their four-digit machine types.

You can obtain IWS through the service delivery method (such as depot, carry-in, or on-site) provided in the servicing country or region. Service methods and procedures vary by country or region, and some service or parts might not be available in all countries and regions. Service centers in certain countries or regions might not be able to service all models of a particular machine type. In addition, some countries or regions might have fees and restrictions that apply at the time of service.

To determine whether your system is eligible for IWS, go to <http://www.ibm.com/pc/support/> and click **Warranty lookup**.

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## Purchasing Additional Services

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During and after the warranty period, you can purchase additional services, such as support for IBM and non-IBM hardware, operating systems, and application programs; network setup and configuration; upgraded or extended hardware repair services; and custom installations. Service availability and service name might vary by country or region.

For more information about these services, contact your IBM marketing representative.

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