Embedded MegaRAID® Software

User Guide

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Revision History

Version and Date	Description of Changes
June 2011	Initial release of document.

Table of Contents

Chapter 1: Overview

This manual explains the features of the Embedded MegaRAID® Software. It includes instructions for using the MegaRAID BIOS configuration utility, the MegaCLI command line utility, and the MegaRAID Storage Manager™ configuration utility.

You can use these three utilities to create storage configurations on drives controlled by Embedded MegaRAID Software. The manual also includes instructions for installing the Embedded MegaRAID Software drivers in Microsoft® Windows® systems and Linux® systems.

1.1 Embedded MegaRAID Software Features

The Embedded MegaRAID Software supports up to eight SATA ports, depending on the hardware platform. This application provides a cost-effective way to achieve higher transfer rates and reliability.

The following sections list the features of the driver, BIOS, the Ctrl+M Configuration Utility, and the disk management features.

1.1.1 Driver Features

The Embedded MegaRAID Software driver supports the following features:

- Support for 48-bit LBA
- Support for drive roaming
- Support for virtual drives larger than 2 TB
- Support for migration path from Embedded MegaRAID Software to MegaRAID SATA hardware (this feature requires support from hardware RAID)
- Automatic resumption of rebuilding, check consistency, full initialization, and background initialization
- Online mirror rebuilding
- Support for auto rebuild
- SATA CD/DVD-ROM support
- SATA tape support to allow backups to SATA tape devices
- Support for SATA 6Gb/s drives
- Support for Solid State Drives (SSDs)
- Optical device (CD/DVD) hot plug feature used to connect internal and external optical devices while the operating system is running
- Check consistency for RAID 1, RAID 5, and RAID 10
- Global hot spare support
- Soft Bad Block Management (SBBM) support
- Support for up to 8 physical drives and eight virtual drives
- Stripe size of 64 KB only
- Support for disk coercion, with options None, 128Mbytes, and 1Gbyte
- Hot plug support (drive insertion and removal)
- Support for array cache setting (a RAID 10 volume is considered as a single array, though it might have 2, 3, or 4 spans)
- Support for the random deletion of virtual drives
- Error logging and notification

- Support for Microsoft Windows Server® 2003, Microsoft Windows Server 2008, Microsoft Windows Server 2008R2, Microsoft Windows XP, Microsoft Windows Vista®, Microsoft Windows 7
- Support for Red Hat® Linux, SUSE Linux for 2.4 and 2.6 kernels

1.1.2   BIOS Features

The Embedded MegaRAID Software BIOS has the following features:

- Support for Interrupt 13 and Enhanced Disk Drive Specification
- Support for Int19h
- Option ROM size of 64 KB
- Support for BIOS Boot Specification (BBS) (If available in system BIOS, this allows you to select the controller from which to boot.)
- Support for power-on self test (POST)
- Support for Post Memory Management (PMM): Specification v7, July 2010
- Industry-standard EBDA
- POST and run-time BIOS support for device insertion and removal
- Support for the option to stop the boot process when the controller BIOS encounters an error during boot-up

The following features are supported by the BIOS and the Ctrl+M Configuration Utility:

- Automatic resumption of rebuilding, Check Consistency, and full initialization, and background initialization (BGI; BGI is for RAID 5 configurations only)

> **NOTE** The BIOS and the BIOS Configuration Utility (Ctrl+M) do not start or resume background initialization (BGI). If BGI is already in progress, you cannot start Check Consistency.

- Global hot spare support
- Soft Bad Block Management (SBBM) support
- Support for SATA 6Gb/s drives
- Support for RAID levels 0, 1, 5, and 10
- Support for auto rebuild
- Support for up to eight physical drives and eight virtual drives
- Stripe size of 64 KB only
- Support for disk coercion

1.1.3   HII Configuration Features

The HII Configuration Utility supports the following features:

- Ability to configure controllers, drive groups, and virtual drives in a pre-boot environment
- Ability to perform other configuration tasks in a pre-boot environment
- Ability to select and change the settings for some virtual drive parameters
- Ability to select a virtual drive as boot device (by default, virtual drive 0 is the boot drive)
- Support for RAID levels 0, 1, 5, and 10
- Support for running a consistency check
- Support for running a patrol read
- Ability to set the rates for the BGI, consistency check, and patrol read
- Ability to place drives online or offline
- Support for drive cache setting (RAID 10 volume is considered as a single array, though it can have 2, 3, or 4 spans)

- Support for virtual drives larger than 2 TB
- Support for random deletion of virtual drives

1.1.4   Manageability/Disk Console Features

The following features are available to manage the virtual drives and the physical drives in the system:

- Configuration information display (in HII Configuration Utility and MegaRAID Storage Manager)
- Support for RAID levels 0, 1, 5, and 10
- Online mirror rebuilding
- Online consistency checks
- Array management software
- Error logging and notification
- Support for hot device insertion and removal
- Automatic resume of rebuilding on restart
- Support for manual rebuild
- Ability to create up to eight virtual drives per configuration
- Auto-configuration support of newly added drive
- Support for global hot spares
- Support for disk coercion
- Drive group initialization support (fast and full)
- Virtual drive availability immediately after creation
- Supported stripe size of 64 KB only

1.1.5   UEFI Support

Significant challenges face operating system and platform developers to innovate using the legacy PC-AT BIOS boot environment. These challenges include memory constraints, maintenance challenges, and increased complexities because of a lack of industry-wide standards.

To handle these challenges, the Unified Extensible Firmware Interface (UEFI) was developed to perform the following activities:

- Define a clean interface between operating systems and the hardware platform at boot time.
- Support an architecture-independent mechanism for initializing add-in cards.

UEFI provides expanded platform support. The MegaRAID UEFI driver, a boot service device driver, handles block I/O requests and SCSI pass-through commands (SPT), and offers the ability to launch pre-boot MegaRAID management applications through a driver configuration protocol (DCP). The UEFI driver also supports driver diagnostic protocol, which allows administrators to access pre-boot diagnostics.

1.2   RAID Overview

This section provides a brief overview of the types of RAID configurations that Embedded MegaRAID Software supports.

The first step in creating a RAID storage configuration is to configure drives in drive groups (also known as arrays). As defined for Embedded MegaRAID Software, a drive group is a group of one to eight physical disks that is seen by the host computer system as one large disk drive, or virtual drive. Only one RAID level can be assigned to each array.

- A RAID 0 drive group consists of one to eight drives.
- A RAID 1 drive group consists of two drives.
- A RAID 5 drive group consists of three to eight drives.
- A RAID 10 drive group consists of four, six, or eight drives.

> **NOTE** Some hardware configurations do not support eight drives. Depending on the hardware, the actual maximum number of drives for RAID 0, RAID 5, and RAID 10 drive groups can be fewer than eight.

You can use any of these three strategies when creating RAID drive groups and virtual drives:

- **Maximize Fault Tolerance** – You can maximize fault tolerance to protect against loss of data by creating a RAID 1 drive group with mirroring. All data is written to the primary drive in the drive group and is also written (mirrored) to a second drive.
- **Maximize Virtual Drive Performance** – You can maximize virtual drive performance by creating a RAID 0 array with striping. Data is broken into segments and can be simultaneously written to or read from several different stripes on several different drives in the array.

  RAID 10 arrays combine both striping and mirroring to provide high data transfer rates and data redundancy.
- **Maximizing Storage Capacity** – You can maximize storage capacity when selecting a RAID level. Striping alone (RAID 0) requires less storage space than mirrored data (RAID 1) or distributed parity (RAID 5). RAID 5, which provides redundancy for one drive failure without duplicating the contents of entire drives, requires less space then RAID 1.

1.2.1 RAID 0 Description

RAID 0 provides disk striping across all drives in the drive group. RAID 0 does not provide any data redundancy, but offers the best performance of any RAID level. RAID 0 breaks up data into smaller segments called strips, and then stripes the data segments across each drive in the array. The size of each data segment is determined by the strip size, which is 64 KB.

> **NOTE** It is possible to create each disk as a single-drive RAID 0 drive group. However, spanning across single drive RAID 0 drive groups is not supported.

By breaking up a large file into smaller segments, and writing or reading from several drives at once, the Embedded MegaRAID Software utility can read or write the file faster. This feature makes RAID 0 ideal for applications that require high bandwidth but do not require fault tolerance.

Uses	Provides high data throughput, especially for large files; 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 eight

The following figure shows a RAID 0 array with two drives.

Figure 1 RAID 0 Array Example with Two Drives

Segment 1	Segment 2
Segment 3	Segment 4
Segment 5	Segment 6
Segment 7	Segment 8
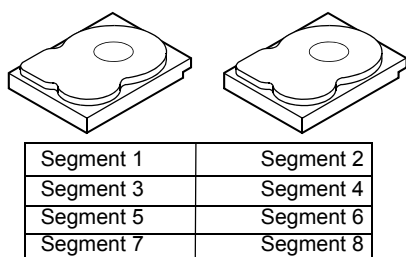
1.2.2   RAID 1 Description

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   Databases or any other mission-critical environment that requires fault tolerance

Strong Points   Provides complete data redundancy; RAID 1 is ideal for any application that requires fault tolerance

Weak Points   Requires twice as many drives; performance is impaired during drive rebuilds

Drives   Two

The following figure shows a RAID 1 drive group.

Figure 2 RAID 1 Array

Segment 1	Segment 1 Duplicated
Segment 2	Segment 2 Duplicated
Segment 3	Segment 3 Duplicated
Segment 4	Segment 4 Duplicated
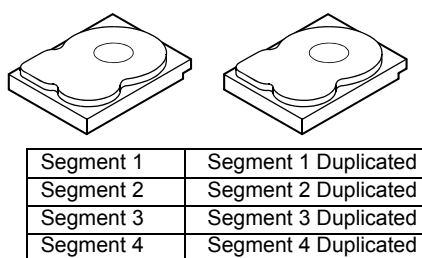
1.2.3   RAID 5 Description

RAID 5 includes disk striping at the block level and parity. Parity is the data's property of being odd or even, and parity checking is used to detect errors in the data. In RAID 5, the parity information is distributed to all drives. RAID 5 is best suited for networks that perform a lot of small input/output (I/O) transactions simultaneously.

NOTE RAID 5 is a premium feature. You might need to install a software key to enable RAID 5. The key you need depends on your supplier. Contact your supplier for more information.

RAID 5 addresses the bottleneck issue for random I/O operations. Because each drive contains both data and parity, numerous writes can take place concurrently.

Uses	Provides high data throughput. Use RAID 5 for transaction processing applications because each drive can read and write independently. If a drive fails, the RAID controller uses the parity drive to recreate all missing information. Use also for office automation and online customer service that requires fault tolerance. Use for any application that has high read request rates but low write request rates.
Strong Points	Provides data redundancy, high read rates, and good performance in most environments. Provides redundancy with lowest loss of capacity.
Weak Points	Not well suited to tasks requiring lot of small writes. Suffers more impact if no drive cache is used (clustering). Drive performance is reduced if a drive is being rebuilt or a background initialization is in progress. Environments with few processes do not perform as well because the RAID overhead is not offset by the performance gains in handling simultaneous processes.
Drives	Three to eight

The following figure shows a RAID 5 drive group with six drives.

Figure 3 RAID 5 Array

Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Parity (1-5)
Segment 7	Segment 8	Segment 9	Segment 10	Parity (6-10)	Segment 6
Segment 13	Segment 14	Segment 15	Parity (11–15)	Segment 11	Segment 12
Segment 19	Segment 20	Parity (16-20)	Segment 16	Segment 17	Segment 18
Segment 25	Parity (21-25)	Segment 21	Segment 22	Segment 23	Segment 24
Parity (26–30)	Segment 26	Segment 27	Segment 28	Segment 29	Segment 30

Note: Parity is distributed across all drives in the array.

1.2.4   RAID 10 Description

RAID 10, a combination of RAID 1 and RAID 0, has mirrored drives. It breaks up data into smaller blocks, and then stripes the blocks of data to each RAID 1 RAID set. Each RAID 1 RAID set then duplicates its data to its other drive. The size of each block is determined by the strip size parameter, which is 64 KB. RAID 10 can sustain one drive failure in each drive group while maintaining data integrity.

> **NOTE** On a RAID 10 array, you can create only one virtual drive, and that virtual drive must occupy the entire space of the RAID 10 array.

Uses	Works best for data storage that must have 100 percent redundancy of RAID 1 (mirrored drive groups) and that also needs the enhanced I/O performance of RAID 0 (striped drive groups); RAID 10 works well for medium-sized databases or any environment that requires a higher degree of fault tolerance and moderate to medium capacity
Strong Points	Provides both high data transfer rates and complete data redundancy
Weak Points	Requires twice as many drives
Drives	Four, six, or eight

The following figure shows a RAID 10 array with four drives.

Figure 4 RAID 10 Array
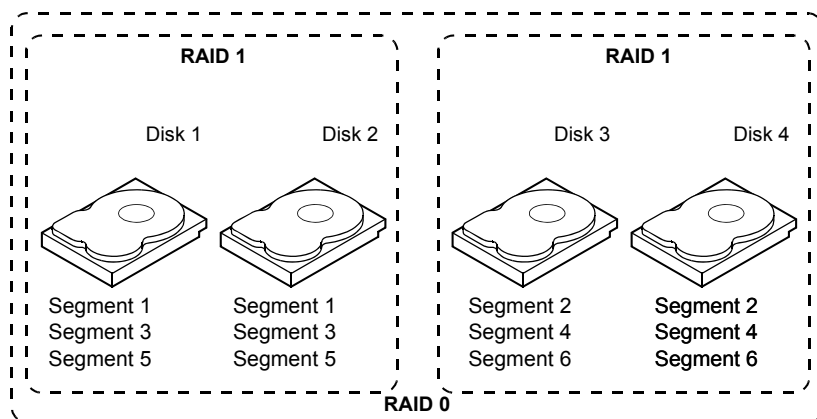
Chapter 2: Driver Installation

This chapter explains how to install the Embedded MegaRAID Software drivers for the following operating systems:

- Microsoft Windows Server 2008, 2008R2
- Microsoft Windows Workstation version 7
- Red Hat Enterprise Linux (RHEL) 5 and 6
- SUSE Linux Enterprise (SLES) 10 and 11

2.1 Windows Driver Installation

Perform the following steps to install the MegaRAID device driver in a new Windows operating system. The Windows operating system automatically adds the driver to the registry and copies the driver to the appropriate directory.

1. Start the Windows installation by booting from the appropriate Windows CD-ROM.

   The system BIOS must support booting from a CD-ROM. BIOS settings might require changes to allow CD-ROM booting. Refer to your system documentation.

2. Press **F6** when the following displays at the bottom of the screen, unless you are installing Windows Vista:

   ```
   Press F6 if you need...
   ```

   > **NOTE** For the system to recognize the new driver for Windows 2000, Windows XP, and Windows Server 2003, you must press **F6**. If you are installing Windows Vista, you do not need to press **F6**. For Windows Vista, after the first installation screen, an option displays to allow you to load the driver from either a floppy diskette or a USB key. Otherwise, it loads the default driver from the DVD.

3. Select **S** to specify an additional device when the screen displays:

   ```
   Setup could not determine the type of one or more mass storage devices...
   ```

   The system prompts for the manufacturer-supplied hardware support disk.

   > **NOTE** If the screen does not display this message after you press **F6**, then the setup program did not recognize the **F6** command. Reboot the system, and return to step 2.

4. Insert the driver diskette containing the Windows device driver and press **Enter**.

5. Select the appropriate MegaRAID adapter from the menu by using the arrow key to highlight it, and then press **Enter** to proceed.

6. Press **Enter** again to proceed.

7. Return to the Windows Setup screen.

   Windows displays a Welcome to Setup window.

8. Press **Enter** to continue.

9. Press **C** to continue the Microsoft Windows installation procedure.

10. Follow the Windows installation procedure.

11. Repeat this process for all the adapters on your system.

2.1.1 Updating the Windows Driver

Perform the following steps to update the Embedded MegaRAID Software driver for Windows or to install this driver on an existing system booted from a standard IDE drive.

1. Click **Start**, point to **Settings**, and then click **Control Panel**.
2. Double-click **System**, click the **Hardware** tab, and then click **Device Manager**.

   Device Manager starts.
3. In Device Manager, double-click **SCSI and RAID Controllers**, right-click the device for which you are installing the driver, and then click **Properties**.
4. On the Driver tab, click **Update Driver** to open the Update Device Driver wizard, and then follow the wizard instructions to update the driver.

2.1.2 Confirming the Windows Driver Installation

Perform the following steps to confirm that the Embedded MegaRAID Software driver for Windows is installed properly.

1. Click **Start**, point to **Settings**, and then click **Control Panel**.
2. Double-click **System**, click the **Hardware** tab, and then click **Device Manager**.

   Device Manager starts.
3. In Device Manager, double-click **SCSI and RAID Controllers**, right-click the device for which you are installing the driver, and then click **Properties**.
4. On the Driver tab, click **Driver Details** and verify that the driver information is correct.

2.2 Linux Driver Installation

This section explains the steps to install the Embedded MegaRAID device driver in a Red Hat Enterprise Linux installation or a SUSE Linux Enterprise Server installation.

2.2.1 Obtaining the Driver Image File

The Linux driver is offered in the form of a driver update disk. The required file is `dud-[driver version].img`, which is the driver update disk for the Embedded MegaRAID Software stack.

You can obtain the latest driver files from the Download Center on the LSI® website.

2.2.2 Preparing the Installation Disk or Disks for Linux

This section describes how to prepare the Linux installation disk or disks from the driver image files, using either the Windows operating system or the Linux operating system.

2.2.2.1 Preparing Installation Disks with the Windows Operating System

Under Windows, you can use the rawrite floppy image writer utility to create disk images from image files. The image writer can be downloaded from the Internet. Perform the following steps to build installation diskettes.

1. Copy the driver update disk image `dud-[driver version].img` and the file raw write.exe to a directory.
2. Confirm that the files are in the selected directory.

3. If necessary, use this command to change the file name of the driver update disk to a name with fewer than eight characters:

    ```
    copy dud-[driver version].img dud.img.
    ```

4. Open the DOS Command Prompt and navigate to the directory where `raw write.exe` is located.

5. Type the following command to create the installation diskette:

    ```
    raw write
    ```

6. Press **Enter**.

    You are prompted to enter the name of the boot image file.

7. Type the following:

    ```
    dud.img
    ```

8. Before you reboot, go to text console and follow these steps:

    a. Press **Ctrl**+**Alt**+**F2** goes to the text console.
    b. Enter the command `cat /proc/partitions` to get the major and minor number of floppy drive.
    c. Execute `mknod /dev/sd(x) b major minor`.
    d. Create a directory, such as `mkdir swr`.
    e. Mount the floppy drive to that directory `mount /dev/sd(x) swr`.
    f. Run the script `./replaceachi.sh`.
    g. Reboot the system.

9. Press **Enter**.

    You are prompted for the target drive diskette.

10. Insert a floppy diskette into the floppy drive and type:

    ```
    A:
    ```

11. Press **Enter**.

12. Press **Enter** again to start copying the file to the diskette.

13. After the command prompt returns and the floppy disk drive LED goes out, remove the diskette.

14. Label the diskette with the image name.

2.2.2.2 Preparing Installation Disks with the Linux Operating System

Under Red Hat Linux and SUSE Linux, you can use a driver diskette utility to create disk images from image files. Perform the following steps to create the driver update disk:

1. Copy the driver update disk image `dud-[driver version].img` to a Linux system.

2. Insert a blank floppy diskette into the floppy drive.

3. Confirm that the files are in the selected directory.

4. Create the driver update diskette using the following command:

    ```
    dd if=dud-[driver version].img of=/dev/fd0
    ```

5. After the command prompt returns and the floppy disk drive LED goes out, remove the diskette.

6. Label the diskette with the image name.

2.2.3 Installing the Red Hat Linux Driver on a New System

This section describes the fresh installation of the Red Hat Enterprise Linux 3, 4, 5, or 6 device driver on systems with the Embedded MegaRAID Software stack. After you prepare the installation disks with the driver image, perform the following steps to install the driver on a new system.

1. Boot to CD-ROM (Disk 1).

   The Red Hat introductory screen appears.

2. Type the following at the boot prompt:

   `linux dd noprobe` (it depends on the number of drives)

   For example, to install Red Hat Linux on a RAID 5 configuration with three drives, enter the following:

   linux dd noprobe=ata1 noprobe=ata2 noprobe=ata3

3. Press **Enter**.

   The prompt asks whether you have a driver disk.

4. Use the arrow key to select **Yes**, and then press **Enter**.

5. Select **fd0** to indicate you have a floppy diskette with the driver on it.

6. Insert the floppy diskette in the **A:/** drive and press **Enter**.

   The installer locates and loads the driver for your device. The following message appears:

   `Loading megasr driver...`

   The prompt at the next screen asks whether you have another driver.

7. Follow the Red Hat Linux installation procedure to complete the installation.

8. Reboot the system.

2.2.4 Updating the Red Hat Linux Driver (Generic)

Perform the following steps to update the Red Hat Linux driver or to install the Red Hat Linux driver in an existing system booted from a standard SATA drive or systems with the Embedded Software RAID stack.

1. Boot the system with the Red Hat Linux Installation CD from the primary controller or disk.

   The Red Hat introductory screen appears.

2. Mount the driver update diskette (DUD) using the following command:

   `#mount /dev/fd0 /mnt/floppy`

3. Unzip the `modules.cgz` file that is on the DUD to get driver images for different Red Hat operating systems:

   ```
   #mkdir -p /home/megasr
   #cd /home/megasr
   #cp /mnt/floppy/modules.cgz .
   #gunizip -S .cgz modules.cgz
   ```

   This action generates a new file named `modules`:

   `#cpio -ivd < modules`

   This action provides the following driver images:

   ```
   {<kernel version>,<kernel version>smp,
   <kernel version>BOOT }/megasr.o
   ```

4. Update the Megasr driver module for the required kernels using the following commands:

   `#cd /home/megasr`

   If the `/lib/modules/<kernel version>/update/` directory is present, use the following command:

   ```
   # cp <kernel version>/megasr.[o/ko]
   ```
   /lib/modules/<kernel version>/update/megasr.[o/ko]

   If the `/lib/modules/<kernel version>/update/` directory is not present, use the following command:

   ```
   # cp <kernel version>/megasr.[o/ko]
   /lib/modules/<kernel version>
   /kernel/drivers/scsi/megasr.[o/ko]
   ```

5. Create a Megasr driver entry in the configuration file. The Red Hat configuration file is `/etc/modules.conf`.

    If the Megasr entry is not present in `/etc/modules.conf`, add the following line:

    ```
    alias scsi_hostadapter megasr
    ```

    If the **ahci** SCSI driver entry (located on the following paragraph) is present in `/etc/modules.conf`, remove it. It must be removed; otherwise, the **ahci** driver takes control of the RAID controller without checking the subsystem device or Vendor ID. The **ahci** SCSI driver entry follows.

    ```
    alias scsi_hostadapter ahci
    ```

6. Create a new `initrd` image for the required kernel.

    Red Hat installation uses the `mk_initrd` command to create an `initrd` image. The following command creates an `initrd` image for the `<kernel version>smp` kernel in the boot directory:

    ```
    #mkinitrd /boot/initrd<kernel version>smp.img.new
    <kernel version>smp
    ```

7. Modify the `lilo.conf/grub.conf` file by adding newly created `initrd` or `initrds` as new entries in the `/etc/lilo.conf` file.

    The suggested method is to copy an existing LILO entry in the file and paste it as a new one. Then modify its kernel image name, `initrd` image name, and label name.

    Sample LILO Entry

    ```
    image=/boot/vmlinux-<kernel version>smp label=linuxnew
    initrd=/boot/initrd-<kernel version>smp.img.new
    read-only appended=root=LABEL=/ ”
    ```

    Sample Grub Entry

    ```
    title Red Hat Linux (<kernel version> with Megasr driver)
    root (hd0,0)
    kernel /vmlinuz-<kernel version> ro root=LABEL=/
    initrd /initrd-<kernel version>.img.new
    ```

8. Update the boot loader. If the boot loader is LILO, run the following LILO command to update the boot loader:

    ```
    #lilo
    ```

9. Reboot the system to the new boot loader entry.

2.2.5 Installing the SUSE Linux Enterprise Server 9, 10, or 11 Driver

This section describes the fresh installation of the SUSE Linux Enterprise Server 9, 10, or 11 driver on a system with the Embedded MegaRAID Software stack. Prepare installation disks with the driver image, and then perform the following steps to install the driver.

1. Create a RAID drive group using the Human Interface Infrastructure configuration utility. (See Chapter 4, Human Interface Infrastructure Configuration Utility.)

2. Boot the system using the SLES Disk.

3. When the first screen appears, select **Installation** on the menu.

4. Type the following in the Boot Options field:

    ```
    brokenmodules=achi
    ```

5. Press **F6** for the driver and select **Yes**.

6. Insert the driver update diskette in the **A:/** drive and press **Enter**.

    `Yes` appears under the F6 Driver heading.

7. Press **OK**. The following message appears:

    ```
    LSI Soft RAID Driver Updates added.
    ```

8. At the menu, select the driver update medium and press the **Back** button.

9. Continue and complete the installation process.

Chapter 3: MegaRAID BIOS Configuration Utility

Use the MegaRAID BIOS Configuration Utility (CU) to configure disk drive groups and virtual drives, and to perform other configuration tasks in a pre-boot environment.

3.1 Performing a Quick Configuration

This section provides high-level instructions for quickly configuring drive groups and virtual drives with the MegaRAID BIOS CU. These instructions are intended for users that are familiar with configuration utilities and tools. See Section 3.2, Configuring Drive Groups and Virtual Drives, for detailed configuration instructions. To ensure the best performance, select the optimal RAID level for the virtual drive you create. (For an explanation of RAID levels, see Chapter 1, Overview.)

Perform the following steps to configure drive groups and virtual drives using the MegaRAID BIOS CU:

1. Boot the system.
2. Press **Ctrl+M** to start the MegaRAID BIOS CU.
3. Select **Configure** from the Management menu.
4. Select a configuration method from the Configuration menu (Easy Configuration, New Configuration, or View/Add Configuration).
5. Create drive groups using the available drives.
6. Define the virtual drive or drives using the space in the drive groups.
7. Initialize the new virtual drive or drives.

3.2 Configuring Drive Groups and Virtual Drives

This section provides detailed instructions for configuring drive groups and virtual drives with the MegaRAID BIOS CU. Use drives with the same capacity when you create a storage configuration. If you use drives with different capacities in one array, the CU limits each drive to the capacity of the smallest drive.

The number of physical drives in a specific array determines the possible RAID levels that you can implement with the array.

- RAID 0 requires from one to eight physical drives.
- RAID 1 requires two physical drives.
- RAID 5 required three to eight physical drives.
- RAID 10 requires four, six, or eight physical drives.

The following screen appears when you start the MegaRAID BIOS CU and select a controller.

Figure 5 MegaRAID BIOS CU Main Menu Screen
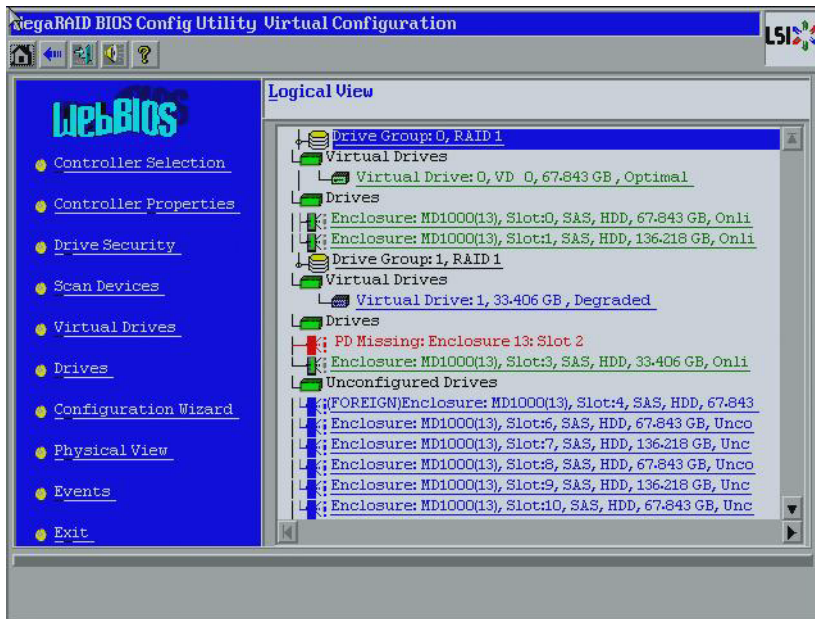
In the right frame, the screen shows the virtual drives configured on the controller, and the drives that are connected to the controller. In addition, the screen identifies drives that are foreign or missing.

> **NOTE** In the list of virtual drives, the drive nodes are sorted based on the order in which you added the drives to the drive group, rather than the physical slot order that displays in the physical trees.

> **NOTE** The minimum screen resolution for the MegaRAID BIOS CU is 640x480.

To toggle between the physical view and logical view of the storage devices connected to the controller, click **Physical View** or **Logical View** in the menu in the left frame. When the physical view screen appears, it shows the drive groups that are configured on this controller.

For drives in an enclosure, the screen shows the following drive information:

- Enclosure
- Slot
- Interface type (such as SATA)
- Drive type (HDD or SSD)
- Drive capacity
- Drive status (such as Online or Unconfigured Good)

The toolbar at the top of the MegaRAID BIOS CU has the buttons listed in the following table.

Table 1 MegaRAID BIOS CU Toolbar Icons

Icon	Description
	Click this icon to return to the main screen from any other MegaRAID BIOS CU screen.
	Click this icon to return to the previous screen that you were viewing.
	Click this icon to exit the MegaRAID BIOS CU program.
	Click this icon to turn off the sound on the onboard controller alarm.
	Click this icon to display information about the MegaRAID BIOS CU version, browser version, and HTML interface engine.

The following options are listed on the left of the main MegaRAID BIOS CU screen (the hotkey shortcut for each option is shown in parentheses next to the option name):

■ **Controller Selection (Alt+c)** – Select this option to view the Controller Selection screen, where you can select a different controller. You can then view information about the controller and the devices connected to it, or create a new configuration on the controller.

■ **Controller Properties (Alt+p)** – Select this option to view the properties of the currently selected controller. For more information, see Section 3.4.1, Viewing Controller Properties.

■ **Drive Security (Alt+r)** – Select this option to encrypt data on the drives and use disk-based key management for the data security solution. This solution protects your data in case of theft or loss of physical drives.

■ **Scan Devices (Alt+s)** – Select this option to have the MegaRAID BIOS CU rescan the physical and virtual drives for any changes in the drive status or the physical configuration. The MegaRAID BIOS CU displays the results of the scan in the physical and virtual drive descriptions.

■ **Virtual Drives (Alt+v)** – Select this option to view the Virtual Drives screen, where you can change and view virtual drive properties, delete virtual drives, initialize drives, and perform other tasks. For more information, see Section 3.4.2, Viewing Virtual Drive Properties, Policies, and Operations.

■ **Drives (Alt+d)** – Select this option to view the Drives screen, where you can view drive properties, create hot spares, and perform other tasks. For more information, see Section 3.4.3, Viewing Drive Properties.

■ **Configuration Wizard: (Alt+o)** – Select this option to start the Configuration Wizard and create a new storage configuration, clear a configuration, or add a configuration. For more information, see Section 3.3, Creating a Storage Configuration.

■ **Logical View/Physical View: (Alt+l) for Logical View; Alt+h for Physical View)** – Select this option to toggle between the Physical View screen and the Logical View screen.

■ **Events: (Alt+e)** – Select this option to view system events in the Event Information screen.

■ **Exit: (Alt+x)** – Select this option to exit the MegaRAID BIOS CU and continue with system boot.

3.3 Creating a Storage Configuration

This section explains how to use the MegaRAID BIOS CU Configuration Wizard to configure RAID drive groups and virtual drives to create storage configurations:

3.3.1 Selecting the Configuration with the Configuration Wizard

Follow these steps to start the Configuration Wizard, and select a configuration option and mode:

1. Click **Configuration Wizard** on the MegaRAID BIOS main screen.

   The first Configuration Wizard screen appears, as shown in the following figure.

Figure 6 MegaRAID BIOS Configuration Wizard Screen
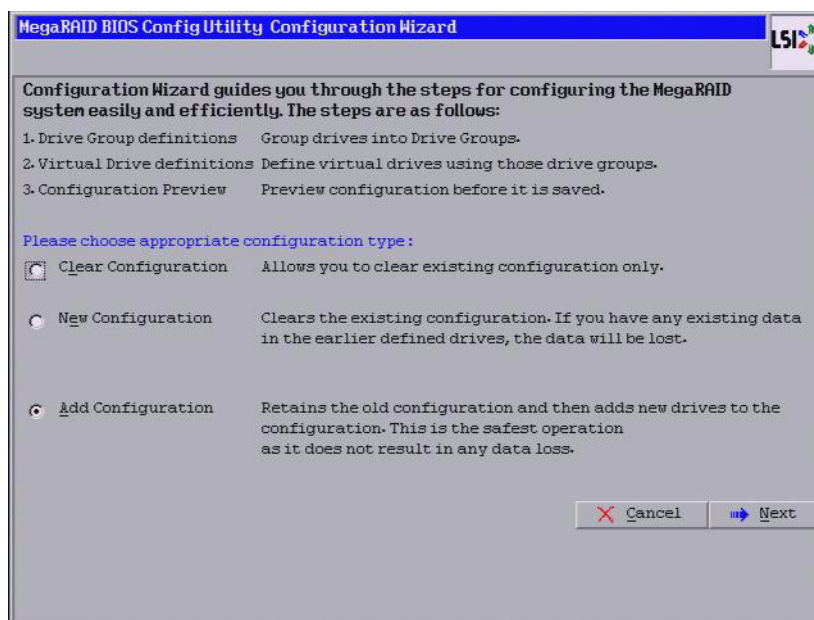
2. Select a configuration option.
   — **Clear Configuration** – Clears the existing configuration.
   — **New Configuration** – Clears the existing configuration and lets you create a new configuration.
   — **Add Configuration** – Retains the existing storage configuration and adds new drives to it (this does not cause any data loss).

   ⚠️ **CAUTION** If you choose to clear the existing configuration or to create a new configuration, the system deletes all of the existing data in the configuration. Make a backup of any data that you want to keep before you choose an option.

3. Click **Next**.

   A dialog box warns that you will lose data if you select **Clear Configuration** or **New Configuration**.

   The MegaRAID BIOS Configuration Method screen appears, as shown in the following figure.

Figure 7 MegaRAID BIOS Configuration Method Screen
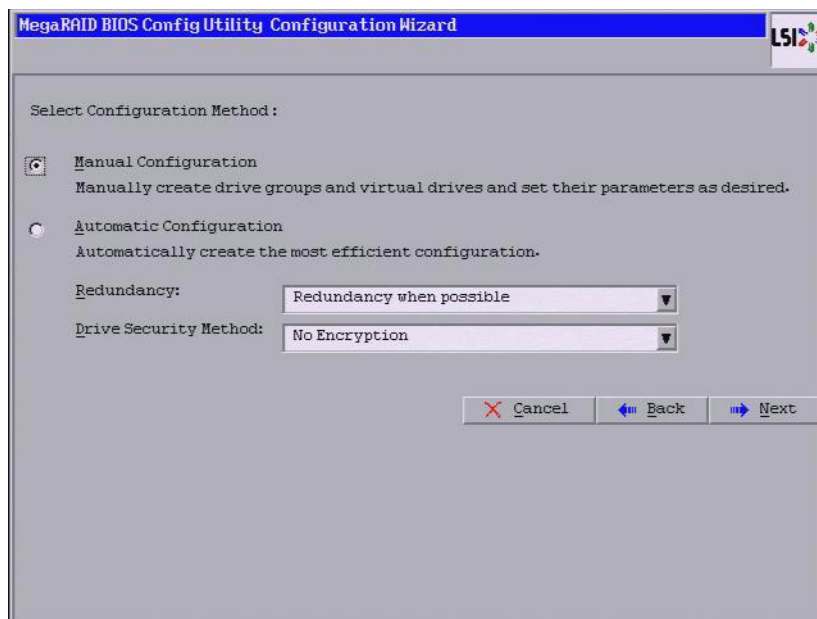
4. On this screen, select a configuration mode:

    — **Manual Configuration** – Allows you to control all attributes of the new storage configuration as you create drive groups and virtual drives, and set their parameters.

    — **Automatic Configuration**– Automatically creates an optimal RAID configuration.

        If you select **Automatic Configuration**, you can choose whether to create a redundant RAID drive group or a non-redundant RAID 0 drive group. Select one of the following options in the Redundancy field:

        - **Redundancy when possible**
        - **No redundancy**

        If you select Automatic Configuration, you can choose whether to use a drive security method. Select one of the following options in the Drive Security Method field:

        - **No Encryption**
        - **Drive Encryption**

5. Click **Next** to continue.

    If you select the Automatic Configuration option, continue with Section 3.3.2, Using Automatic Configuration.

    If you select Manual Configuration, continue with Section 3.3.3, Using Manual Configuration.

3.3.2   Using Automatic Configuration

Follow these instructions to create a configuration with automatic configuration, either with or without redundancy:

1. When the MegaRAID BIOS CU displays the proposed new configuration, review the information on the screen, and click **Accept** to accept it. (Or click **Back** to go back and change the configuration.)

    — **RAID 0** – If you select **Automatic Configuration** and **No Redundancy**, the MegaRAID BIOS CU creates a RAID 0 configuration.

    — **RAID 1** – If you select **Automatic Configuration** and **Redundancy when possible**, and only two drives are available, the MegaRAID BIOS CU creates a RAID 1 configuration.

    — **RAID 5** – If you select **Automatic Configuration** and **Redundancy when possible**, and three or more drives are available, the MegaRAID BIOS CU creates a RAID 5 configuration.

2. Click **Yes** when you are prompted to save the configuration.

3. Click **Yes** when you are prompted to initialize the new virtual drive or drives.

   The MegaBIOS CU begins a background initialization of the virtual drives.

   New RAID 5 virtual drives require a minimum number of drives for a background initialization to start. If there are fewer drives, the background initialization will not start.

3.3.3 Using Manual Configuration

This section contains the procedures for creating RAID drive groups for RAID levels 0, 1, 5, and 10.

3.3.3.1 Using Manual Configuration: RAID 0

RAID 0 provides drive striping across all drives in the RAID drive group. RAID 0 does not provide any data redundancy but offers excellent performance. RAID 0 is ideal for applications that require high bandwidth but do not require fault tolerance. RAID 0 also denotes an independent or single drive.

> **NOTE** RAID level 0 is not fault-tolerant. If a drive in a RAID 0 drive group fails, the whole virtual drive (all drives associated with the virtual drive) fails.

When you select **Manual Configuration** and click **Next**, the drive group Definition screen appears. You use this screen to select drives to create drive groups.

1. Hold the **Ctrl** key while you select two or more ready drives in the Drives panel on the left until you have selected all desired drives for the drive group.

2. Click **Add To Array** to move the drives to a proposed drive group configuration in the Drive Groups panel on the right, as shown in the following figure.

   To undo the changes, click **Reclaim**.

3. Choose whether to use drive encryption.

Figure 8 MegaRAID BIOS CU Drive Group Definition Screen
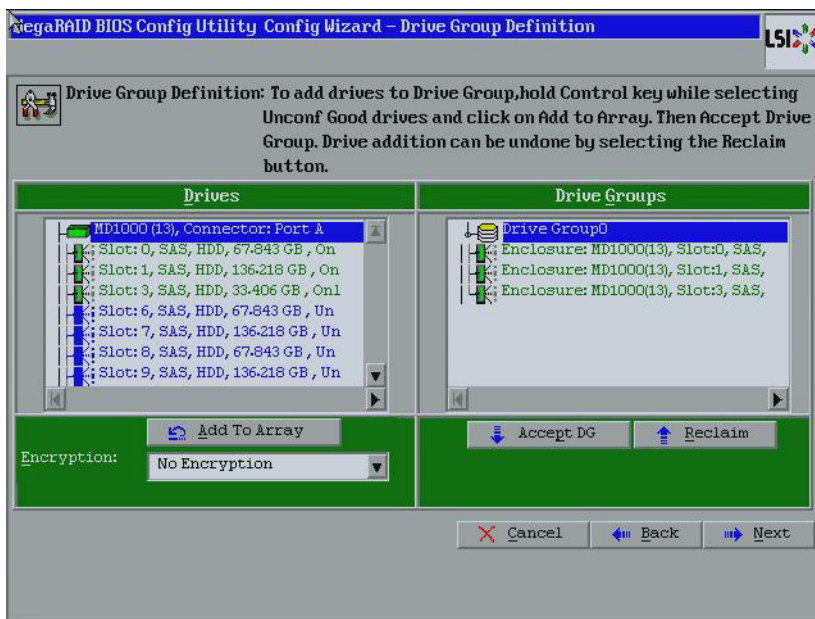
4. After you finish selecting drives for the drive group, click **Accept DG**.

5. Click **Next**.

    The Virtual Drive Definition screen appears, as shown in the following figure. This screen lists the possible RAID levels for the drive group.

    Use this screen to select the RAID level, strip size, read policy, and other attributes for the new virtual drives.

Figure 9 MegaRAID BIOS CU Virtual Drive Definition Screen
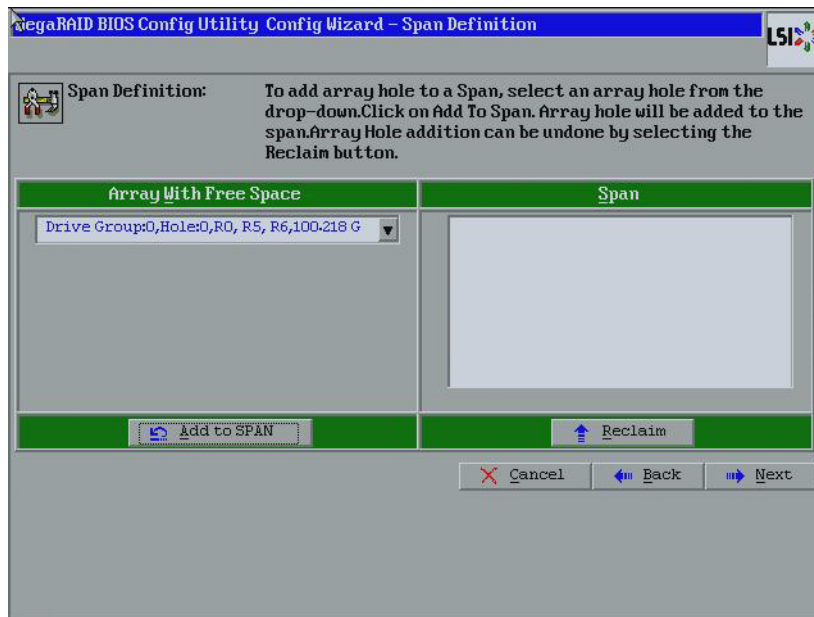
6. Change the virtual drive options from the defaults listed on the screen as needed.

    Brief explanations of the virtual drive options follow.

    — **RAID level** – The drop-down menu lists the possible RAID levels for the virtual drive. Select RAID 0.

    — **Strip size** – The strip size is the portion of a stripe that resides on a single drive in the drive group. The stripe consists of the data segments that the RAID controller writes across multiple drives, not including parity drives. For example, consider a stripe that contains 64 KB of drive space and has 16 KB of data residing on each drive in the stripe. In this case, the stripe size is 64 KB and the strip size is 16 KB. You can set the strip size to 8, 16, 32, 64, 128, 256, 512, and 1024 KB. A larger strip size produces higher read performance. If your computer regularly performs random read requests, choose a smaller strip size. The default is 64 KB.

    — **Access policy** – Select the type of data access that is allowed for this virtual drive:

    * **RW** – Allow read/write access. This setting is the default.
    * **Read only** – Allow read-only access.
    * **Blocked** – Do not allow access.

    — **Read policy** – Specify the read policy for this virtual drive:

    * **Normal** – This setting disables the read ahead capability. This setting is the default.
    * **Ahead** – This setting enables read ahead capability, which allows the controller to read sequentially ahead of requested data and to store the additional data in cache memory, anticipating that the data is needed soon. This setting speeds up reads for sequential data, but there is little improvement when accessing random data.

— **Write policy** – Specify the write policy for this virtual drive:

- **WBack** – In Writeback mode, the controller sends a data transfer completion signal to the host when the controller cache has received all of the data in a transaction. This setting is recommended in Standard mode.

- **WThru** – In Writethrough mode, the controller sends a data transfer completion signal to the host when the drive subsystem has received all of the data in a transaction. This setting is the default.

- **Bad BBU** – Select this mode if you want the controller to use Writeback mode but the controller has no BBU or the BBU is bad. If you do not choose this option, the controller firmware automatically switches to Writethrough mode if it detects a bad or missing BBU.

> ⚠️ **CAUTION** LSI allows Writeback mode to be used with or without a battery. LSI recommends that you use *either* a battery to protect the controller cache, or an uninterruptible power supply (UPS) to protect the entire system. If you do not use a battery or a UPS, and there is a power failure, you risk losing the data in the controller cache.

— **I/O policy** – The I/O policy applies to reads on a specific virtual drive. It does not affect the read ahead cache.

- **Direct** – In direct I/O mode, reads are not buffered in cache memory. Data is transferred to the cache and the host concurrently. If the same data block is read again, it comes from cache memory. This setting is the default.

- **Cached** – In cached I/O mode, all reads are buffered in cache memory.

— **Drive cache** – Specify the drive cache policy:

- **Enable** – Enable the drive cache.

- **Disable** – Disable the drive cache.

- **NoChange** – Leave the current drive cache policy as is. This setting is the default.

— **Disable BGI** – Specify the background initialization status:

- **No** – Leave background initialization enabled. This setting means that a new configuration can be initialized in the background while you use the MegaRAID BIOS CU to do other configuration tasks. This setting is the default.

- **Yes** – Select **Yes** if you do not want to allow background initializations for configurations on this controller.

— **Select size** – Specify the size of the virtual drive in MB, GB, or TB. Normally, this size is the full size for RAID 0 shown in the Configuration panel on the right. You can specify a smaller size if you want to create other virtual drives on the same drive group.

7. Click **Accept** to accept the changes to the virtual drive definition.

   If you need to undo the changes, click **Reclaim**.

8. Click **Next** after you finish defining the virtual drives.

   The Configuration Preview screen appears, as shown in the following figure.

Figure 10 RAID 0 Configuration Preview
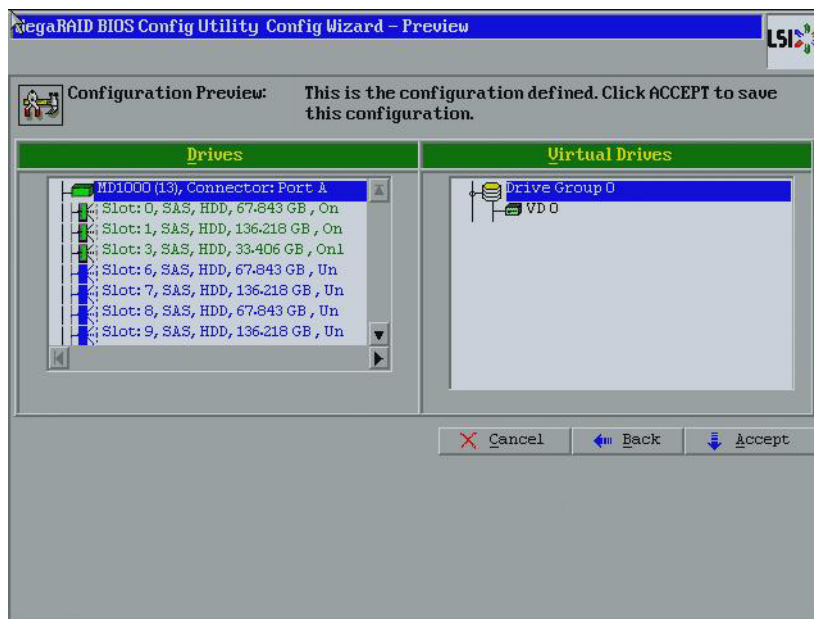
9. Check the information in the configuration preview.

10. If the virtual drive configuration is acceptable, click **Accept** to save the configuration. Otherwise, click **Back** to return to the previous screens and change the configuration.

11. If you accept the configuration, click **Yes** at the prompt to save the configuration.

The MegaRAID BIOS CU main menu appears.

3.3.3.2 Using Manual Configuration: RAID 1

In RAID 1, the RAID controller 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. It is appropriate for small databases or any other environment that requires fault tolerance but small capacity.

When you select **Manual Configuration** and click **Next**, the Drive Group Definition screen appears. You use this screen to select drives to create drive groups.

1. Hold **Ctrl** while you select two ready drives in the Drives panel on the left. You must select an even number of drives.

2. Click **Add To Array** to move the drives to a proposed drive group configuration in the Drive Groups panel on the right, as shown in the following figure.

   If you need to undo the changes, click **Reclaim**.

3. Choose whether to use drive encryption.

> **NOTE** A RAID 1 virtual drive can contain up to 16 drive groups and 32 drives in a single span. (Other factors, such as the type of controller, can limit the number of drives.) You must use two drives in each RAID 1 drive group in the span.

Figure 11 MegaRAID BIOS CU Drive Group Definition Screen
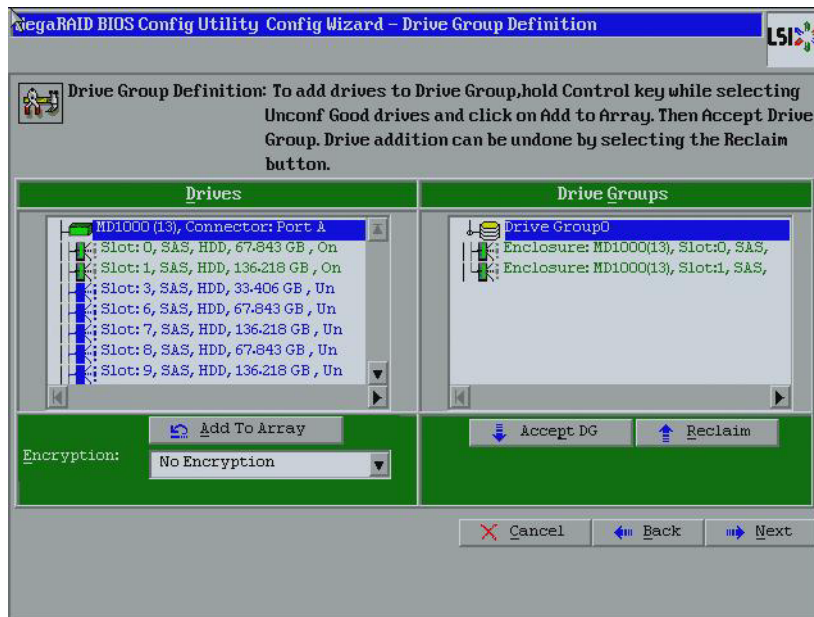

4. After you finish selecting drives for the drive group, click **Accept DG**.

5. Click **Next**.

   The Virtual Drive Definition screen appears, as shown in the following figure. You use this screen to select the RAID level, strip size, read policy, and other attributes for the new virtual drives.

Figure 12 MegaRAID BIOS CU Virtual Drive Definition Screen
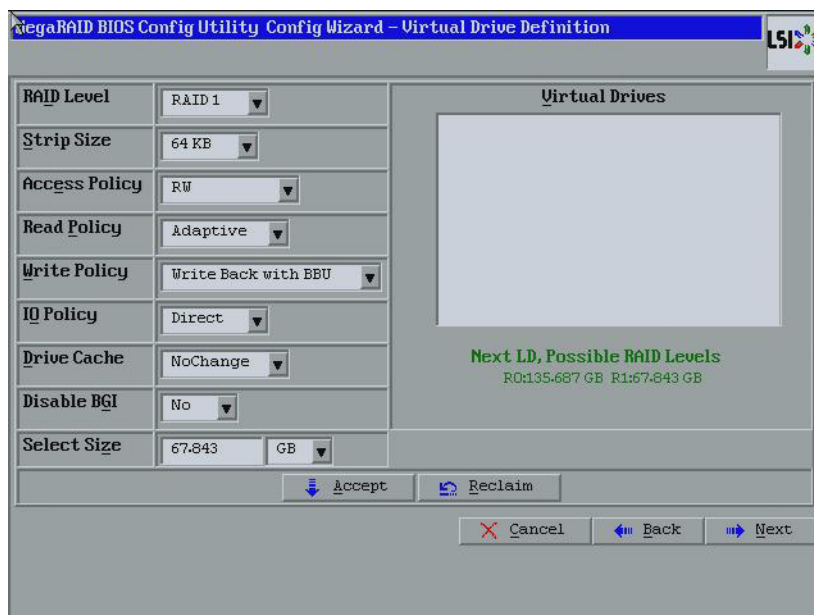
6. Change the virtual drive options from the defaults listed on the screen as needed.

Brief explanations of the virtual drive options follow.

— **RAID level** – The drop-down menu lists the possible RAID levels for the virtual drive. Select RAID 1.

— **Strip size** – The strip size is the portion of a stripe that resides on a single drive in the drive group. The stripe consists of the data segments that the RAID controller writes across multiple drives, not including parity drives. For example, consider a stripe that contains 64 KB of drive space and has 16 KB of data residing on each drive in the stripe. In this case, the stripe size is 64 KB and the strip size is 16 KB. You can set the strip size to 8, 16, 32, 64, 128, 256, 512, and 1024 KB. A larger strip size produces higher read performance. If your computer regularly performs random read requests, choose a smaller strip size. The default is 64 KB.

— **Access policy** – Select the type of data access that is allowed for this virtual drive:

- **RW** – Allow read/write access. This setting is the default.
- **Read only** – Allow read-only access.
- **Blocked** – Do not allow access.

— **Read policy** – Specify the read policy for this virtual drive:

- **Normal** – This setting disables the read ahead capability. This setting is the default.
- **Ahead** – This setting enables read ahead capability, which allows the controller to read sequentially ahead of requested data and to store the additional data in cache memory, anticipating that the data is needed soon. This setting speeds up reads for sequential data, but there is little improvement when accessing random data.

— **Write policy** – Specify the write policy for this virtual drive:

- **WBack** – In Writeback mode, the controller sends a data transfer completion signal to the host when the controller cache has received all of the data in a transaction. This setting is recommended in Standard mode.
- **WThru** – In Writethrough mode, the controller sends a data transfer completion signal to the host when the drive subsystem has received all of the data in a transaction. This setting is the default.
- **Bad BBU** – Select this mode if you want the controller to use Writeback mode but the controller has no BBU or the BBU is bad. If you do not choose this option, the controller firmware automatically switches to Writethrough mode if it detects a bad or missing BBU.

⚠ **CAUTION** LSI allows Writeback mode to be used with or without a battery. LSI recommends that you use *either* a battery to protect the controller cache, or an uninterruptible power supply (UPS) to protect the entire system. If you do not use a battery or a UPS, and there is a power failure, you risk losing the data in the controller cache.

— **I/O policy** – The I/O policy applies to reads on a specific virtual drive. It does not affect the read ahead cache.

- **Direct** – In Direct I/O mode, reads are not buffered in cache memory. Data is transferred to the cache and the host concurrently. If the same data block is read again, it comes from cache memory. This setting is the default.
- **Cached** – In Cached I/O mode, all reads are buffered in cache memory.

— **Drive policy** – Specify the drive cache policy:

- **Enable** – Enable the drive cache.
- **Disable** – Disable the drive cache.
- **NoChange** – Leave the current drive cache policy as is. This drive policy is the default.

— **Disable BGI** – Specify the background initialization status:

- **No** – Leave background initialization enabled. This setting means that a new configuration can be initialized in the background while you use the MegaRAID BIOS CU to do other configuration tasks. This setting is the default.
- **Yes** – Select **Yes** if you do not want to allow background initializations for configurations on this controller.

— **Select size** – Specify the capacity of the virtual drive or drives in MB, GB, or TB. Normally, this would be the full capacity for RAID 1 shown in the Configuration panel on the right. You can specify a smaller capacity if you want to create other virtual drives on the same drive group.

7. Click **Accept** to accept the changes to the virtual drive definition.

   If you need to undo the changes, click **Reclaim**.

8. Click **Next** after you finish defining the virtual drives.

   The Configuration Preview screen appears, as shown in the following figure.

Figure 13 RAID 1 Configuration Preview
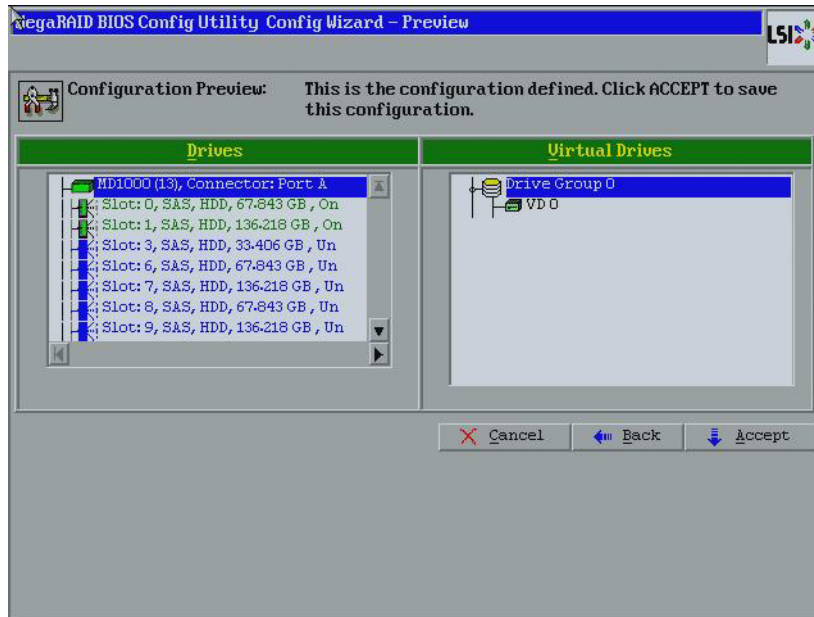
9. Check the information in the configuration preview.

10. If the virtual drive configuration is acceptable, click **Accept** to save the configuration. Otherwise, click **Back** to return to the previous screens and change the configuration.

11. If you accept the configuration, click **Yes** at the prompt to save the configuration.

    The MegaRAID BIOS CU main menu appears.

3.3.3.3 Using Manual Configuration: RAID 5

RAID 5 uses drive striping at the block level and parity. In RAID 5, the parity information is written to all drives. It is best suited for networks that perform a lot of small input/output (I/O) transactions simultaneously. RAID 5 provides data redundancy, high read rates, and good performance in most environments. It also provides redundancy with lowest loss of capacity.

RAID 5 provides high data throughput. RAID 5 is useful for transaction processing applications because each drive can read and write independently. If a drive fails, the RAID controller uses the parity drive to recreate all missing information. You can use RAID 5 for office automation and online customer service that require fault tolerance.

In addition, RAID 5 is good for any application that has high read request rates but low write request rates.

When you select **Manual Configuration** and click **Next**, the Drive Group Definition screen appears. You use this screen to select drives to create drive groups.

1. Hold **Ctrl** while you select at least three ready drives in the Physical Drives panel on the left.

2. Click **Add To Array** to move the drives to a proposed drive group configuration in the Drive Groups panel on the right, as shown in the following figure.

   If you need to undo the changes, click **Reclaim**.

Figure 14 MegaRAID BIOS CU Drive Group Definition Screen
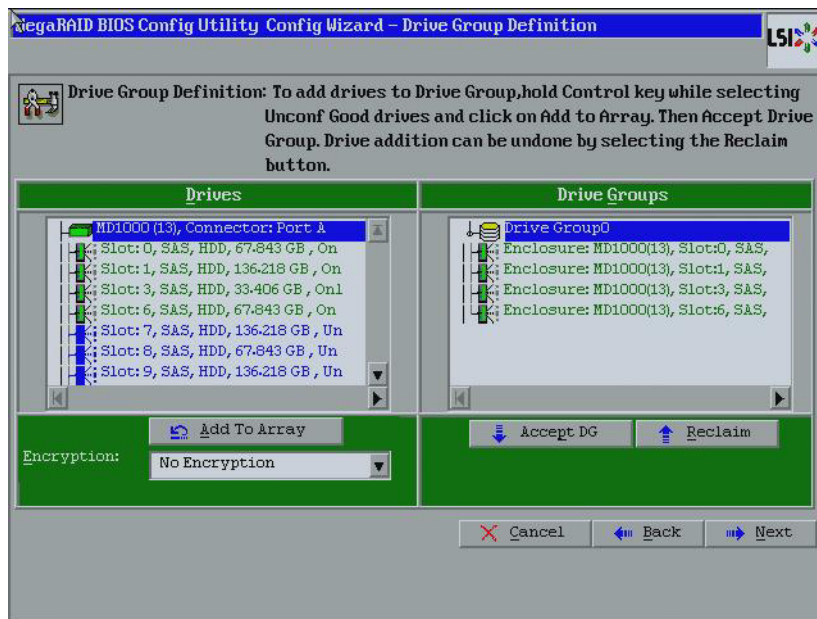
3. Choose whether to use drive encryption.

4. After you finish selecting drives for the drive group, click **Accept DG**.

5. Click **Next**.

   The Virtual Drive Definition screen appears, as shown in the following figure. You use this screen to select the RAID level, strip size, read policy, and other attributes for the new virtual drives.

Figure 15 MegaRAID BIOS CU Virtual Drive Definition Screen
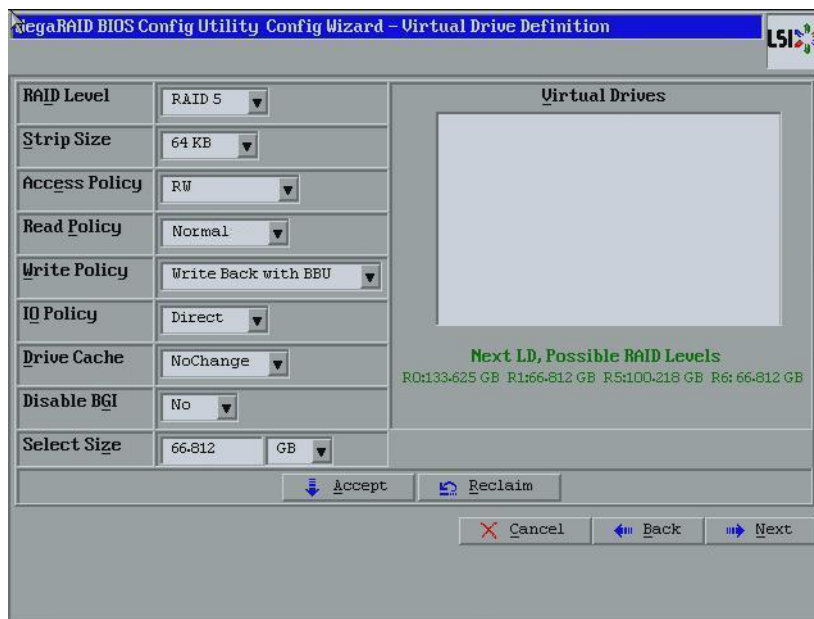
6.   Change the virtual drive options from the defaults listed on the screen as needed.

Brief explanations of the virtual drive options follow.

— **RAID level** – The drop-down menu lists the possible RAID levels for the virtual drive. Select RAID 5.

— **Strip size** – The strip size is the portion of a stripe that resides on a single drive in the drive group. The stripe consists of the data segments that the RAID controller writes across multiple drives, not including parity drives. For example, consider a stripe that contains 64 KB of drive space and has 16 KB of data residing on each drive in the stripe. In this case, the stripe size is 64 KB and the strip size is 16 KB. You can set the strip size to 8, 16, 32, 64, 128, 256, 512, and 1024 KB. A larger strip size produces higher read performance. If your computer regularly performs random read requests, choose a smaller strip size. The default is 64 KB.

— **Access policy** – Select the type of data access that is allowed for this virtual drive:

●   **RW** – Allow read/write access. This setting is the default.

●   **Read only** – Allow read-only access.

●   **Blocked** – Do not allow access.

— **Read policy** – Specify the read policy for this virtual drive:

●   **Normal** – This setting disables the read ahead capability. This setting is the default.

●   **Ahead** – This setting enables read ahead capability, which allows the controller to read sequentially ahead of requested data and to store the additional data in cache memory, anticipating that the data is needed soon. This setting speeds up reads for sequential data, but there is little improvement when accessing random data.

— **Write policy** – Specify the write policy for this virtual drive:

- **WBack** – In Writeback mode, the controller sends a data transfer completion signal to the host when the controller cache has received all of the data in a transaction. This setting is recommended in Standard mode.

- **WThru** – In Writethrough mode, the controller sends a data transfer completion signal to the host when the drive subsystem has received all of the data in a transaction. This setting is the default.

- **Bad BBU** – Select this mode if you want the controller to use Writeback mode but the controller has no BBU or the BBU is bad. If you do not choose this option, the controller firmware automatically switches to Writethrough mode if it detects a bad or missing BBU.

> ⚠️ **CAUTION** LSI allows Writeback mode to be used with or without a battery. LSI recommends that you use *either* a battery to protect the controller cache, or an uninterruptible power supply (UPS) to protect the entire system. If you do not use a battery or a UPS, and there is a power failure, you risk losing the data in the controller cache.

— **I/O policy** – The I/O policy applies to reads on a specific virtual drive. It does not affect the read ahead cache.

- **Direct** – In Direct I/O mode, reads are not buffered in cache memory. Data is transferred to the cache and the host concurrently. If the same data block is read again, it comes from cache memory. This setting is the default.

- **Cached** – In Cached I/O mode, all reads are buffered in cache memory.

— **Drive policy** – Specify the drive cache policy:

- **Enable** – Enable the drive cache.

- **Disable** – Disable the drive cache.

- **NoChange** – Leave the current drive cache policy as is. This drive policy is the default.

— **Disable BGI** – Specify the background initialization status:

- **No** – Leave background initialization enabled. This setting means that a new configuration can be initialized in the background while you use the MegaRAID BIOS CU to do other configuration tasks. This setting is the default.

- **Yes** – Select **Yes** if you do not want to allow background initializations for configurations on this controller.

> 🗒️ **NOTE** New RAID 5 virtual drives require at least five drives for a background initialization to start.

— **Select size** – Specify the size of the virtual drive in MB, GB, or TB. Normally, this would be the full size for RAID 5 shown in the Configuration panel on the right. You can specify a smaller size if you want to create other virtual drives on the same drive group.

7. Click **Accept** to accept the changes to the virtual drive definition.

   If you need to undo the changes, click **Reclaim**.

8. Click **Next** after you finish defining the virtual drives.

   The Configuration Preview screen appears, as shown in the following figure.

Figure 16 RAID 5 Configuration Preview
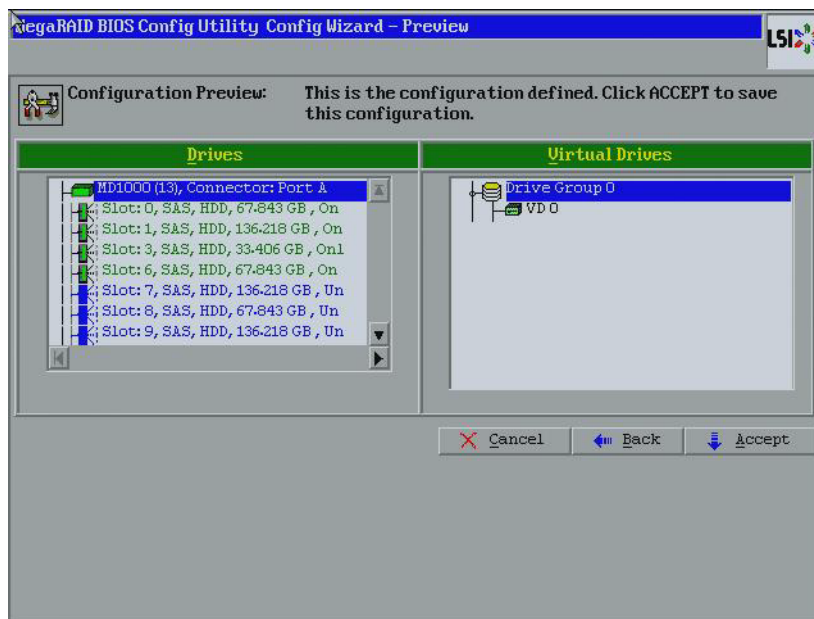
9. Check the information in the configuration preview.

10. If the virtual drive configuration is acceptable, click **Accept** to save the configuration. Otherwise, click **Cancel** to end the operation and return to the MegaRAID BIOS CU main menu screen, or click **Back** to return to the previous screens and change the configuration.

11. If you accept the configuration, click **Yes** at the prompt to save the configuration.

    The MegaRAID BIOS CU main menu screen appears.

3.3.3.4   Creating RAID 5 Virtual Drives If No Drives or Configuration Exist

If there are no drives attached to the host storage controller device or if there is no configuration on any of the attached drives, the operating system does not allow you to create a RAID 5 virtual drive. In both cases, you have to use the BIOS Configuration Utility (**Ctrl+M**) to create the initial configuration before you can create a RAID 5 virtual drive.

> **NOTE** If there are multiple storage host controllers, you have to create the initial configuration (using the BIOS Configuration Utility) for each controller before you can create RAID 5 configurations for the controllers.

3.3.3.5   Using Manual Configuration: RAID 10

RAID 10, a combination of RAID 1 and RAID 0, has mirrored drives. It breaks up data into smaller blocks, and then stripes the blocks of data to each RAID 1 drive group. Each RAID 1 drive group then duplicates its data to its other drive. The size of each block is determined by the stripe size parameter, which is 64 KB. RAID 10 can sustain one drive failure in each drive group while maintaining data integrity.

RAID 10 provides both high data transfer rates and complete data redundancy. It works best for data storage that must have 100 percent redundancy of RAID 1 (mirrored drive groups) and that also needs the enhanced I/O performance of RAID 0 (striped drive groups); it works well for medium-sized databases or any environment that requires a higher degree of fault tolerance and moderate to medium capacity.

When you select **Manual Configuration** and click **Next**, the Drive Group Definition screen appears.

You use the Drive Group Definition screen to select drives to create drive groups.

1. Hold the Ctrl key while you select two ready drives in the Drives panel on the left.

2. Click **Add To Array** to move the drives to a proposed two-drive drive group configuration in the Drive Groups panel on the right.

   If you need to undo the changes, click **Reclaim**.

3. Click **Accept DG** to create a RAID 1 drive group.

   An icon for the next drive group displays in the right panel.

4. Click on the icon for the next drive group to select it.

5. Hold the **Ctrl** key while you select two more ready drives in the Drives panel to create a second RAID 1 drive group with two drives.

6. Click **Add To Array** to move the drives to a second two-drive drive group configuration in the Drive Groups panel, as shown in the following figure.

   If you need to undo the changes, click **Reclaim**.

Figure 17 MegaRAID BIOS CU Drive Group Definition Screen
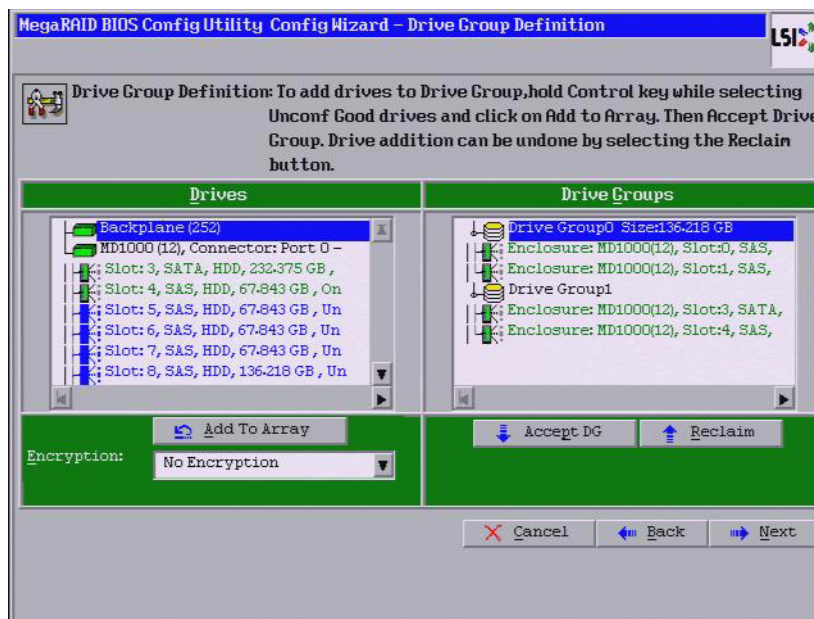
7. Choose whether to use drive encryption.

> **NOTE** RAID 10 supports a maximum of eight spans, with a maximum of 32 drives per span. (Other factors, such as the type of controller, can limit the number of drives.) You must use an even number of drives in each RAID 10 drive group in the span.

8. Repeat the previous three steps until you have selected all the drives you want for the drive groups.

9. After you finish selecting drives for the drive groups, select each drive group and click **Accept DG** for each.

10. Click **Next**.

The Span Definition screen appears, as shown in the following figure. This screen displays the drive group holes you can select to add to a span.

Figure 18 MegaRAID BIOS CU Span Definition Screen
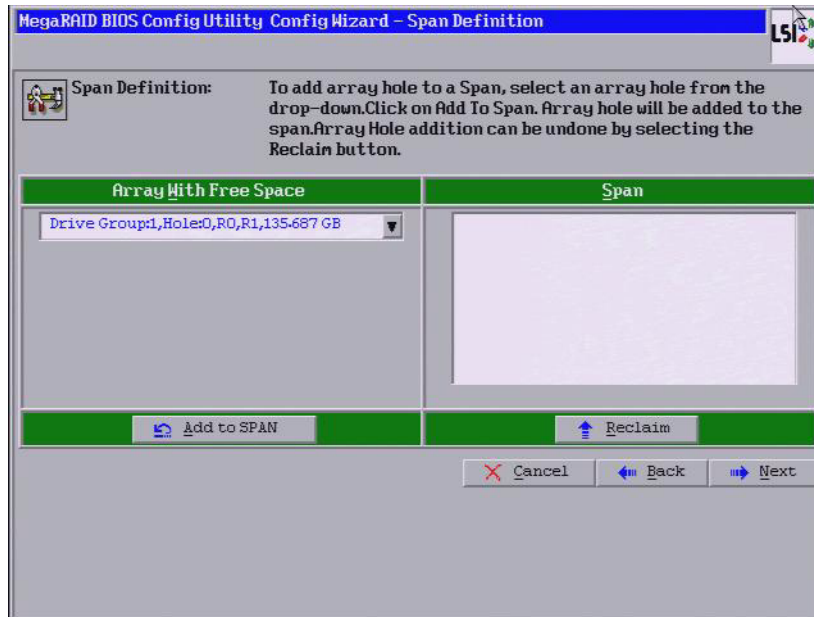
11. Under the heading Array With Free Space, hold **Ctrl** while you select a drive group with two drives, and click **Add to SPAN**.

The drive group you select displays in the right frame under the heading Span.

12. Hold the **Ctrl** key while you select a second drive group with two drives, and click **Add to SPAN**.

Both drive groups display in the right frame under Span.

13. If there are additional drive groups with two drives each, you can add them to the virtual drive.

14. Click **Next**.

The Virtual Drive Definition screen appears, as shown in the following figure. You use this screen to select the RAID level, strip size, read policy, and other attributes for the new virtual drives.

Figure 19 MegaRAID BIOS CU Virtual Drive Definition Screen
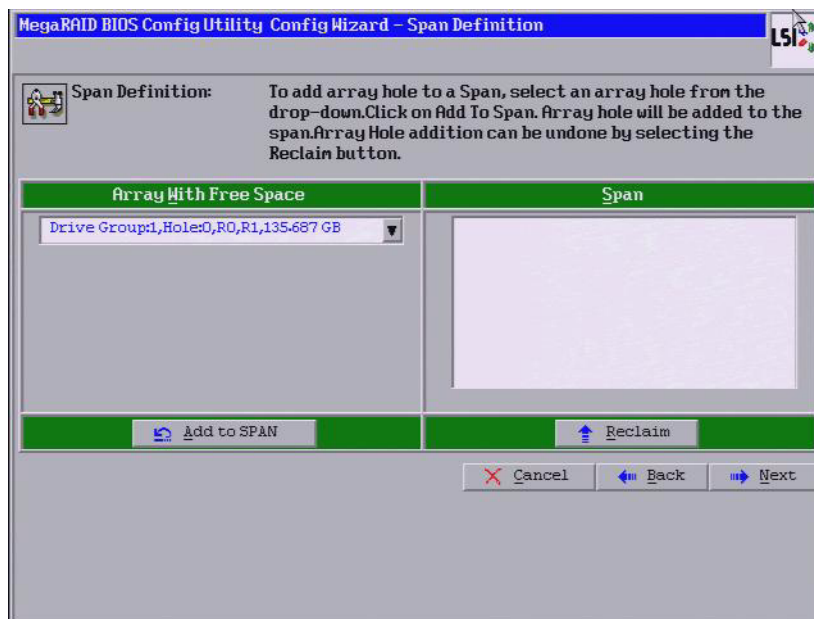
15. Hold the **Ctrl** key while you select two drive groups with two drives in the Configuration panel on the right.

> **NOTE** The MegaRAID BIOS Configuration Utility shows the maximum available capacity while creating the RAID 10 drive group. In version 1.03 of the utility, the maximum capacity of the RAID 10 drive group is the sum total of the two RAID 1 drive groups. In version 1.1, the maximum capacity is the capacity of the smaller drive group multiplied by two.

16. Change the virtual drive options from the defaults listed on the screen as needed.

    Brief explanations of the virtual drive options follow.

    — **RAID level** – The drop-down menu lists the possible RAID levels for the virtual drive. Select RAID 10.

    — **Strip size** –The strip size is the portion of a stripe that resides on a single drive in the drive group. The stripe consists of the data segments that the RAID controller writes across multiple drives, not including parity drives. For example, consider a stripe that contains 64 KB of drive space and has 16 KB of data residing on each drive in the stripe. In this case, the stripe size is 64 KB and the strip size is 16 KB. You can set the strip size to 8, 16, 32, 64, 128, 256, 512, and 1024 KB. A larger strip size produces higher read performance. If your computer regularly performs random read requests, choose a smaller strip size. The default is 64 KB.

    — **Access policy** – Select the type of data access allowed for this virtual drive:

        ● **RW** – Allow read/write access.

        ● **Read only** – Allow read-only access. this setting is the default.

        ● **Blocked** – Do not allow access.

    — **Read policy** – Specify the read policy for this virtual drive:

        ● **Normal** – This setting disables the read ahead capability. This setting is the default.

        ● **Ahead** – This setting enables read ahead capability, which allows the controller to read sequentially ahead of requested data and to store the additional data in cache memory, anticipating that the data is needed soon. This setting speeds up reads for sequential data, but there is little improvement when accessing random data.

— **Write policy** – Specify the write policy for this virtual drive:

- **WBack** – In Writeback mode, the controller sends a data transfer completion signal to the host when the controller cache has received all of the data in a transaction. This setting is recommended in Standard mode.
- **WThru** – In Writethrough mode, the controller sends a data transfer completion signal to the host when the drive subsystem has received all of the data in a transaction. This setting is the default.
- **Bad BBU** – Select this mode if you want the controller to use Writeback mode but the controller has no BBU or the BBU is bad. If you do not choose this option, the controller firmware automatically switches to Writethrough mode if it detects a bad or missing BBU.

> ⚠ **CAUTION** LSI allows Writeback mode to be used with or without a battery. LSI recommends that you use *either* a battery to protect the controller cache, or an uninterruptible power supply (UPS) to protect the entire system. If you do not use a battery or a UPS, and there is a power failure, you risk losing the data in the controller cache.

— **I/O policy** – The I/O policy applies to reads on a specific virtual drive. It does not affect the read ahead cache.

- **Direct** – In Direct I/O mode, reads are not buffered in cache memory. Data is transferred to the cache and the host concurrently. If the same data block is read again, it comes from cache memory. This setting is the default.
- **Cached** – In Cached I/O mode, all reads are buffered in cache memory.

— **Drive policy** – Specify the drive cache policy:

- **Enable** – Enable the drive cache.
- **Disable** – Disable the drive cache.
- **NoChange** – Leave the current drive cache policy as is. This drive policy is the default.

— **Disable BGI** – Specify the background initialization status:

- **No** – Leave background initialization enabled. This setting means that a new configuration can be initialized in the background while you use the MegaRAID BIOS CU to do other configuration tasks. This setting is the default.
- **Yes** – Select **Yes** if you do not want to allow background initializations for configurations on this controller.

— **Select size** – Specify the capacity of the virtual drive in MB, GB, or TB. Normally, this would be the full capacity for RAID 10 shown in the configuration panel on the right. You can specify a smaller capacity if you want to create other virtual drives on the same drive group.

17. Click **Accept** to accept the changes to the virtual drive definition.

    If you need to undo the changes, click **Reclaim**.

18. After you finish defining the virtual drives, click **Next**.

The Configuration Preview screen appears, as shown in the following figure.

Figure 20 RAID 10 Configuration Preview
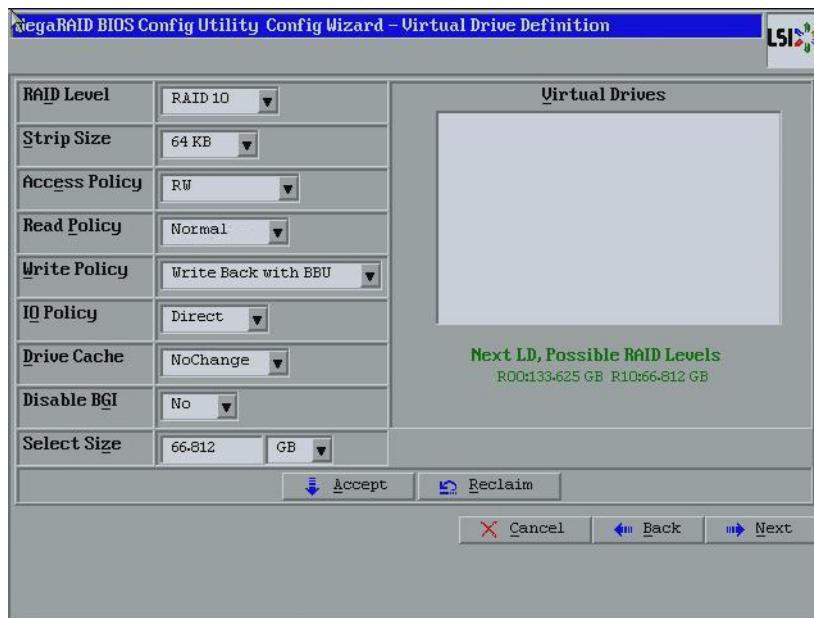
19. Check the information in the configuration preview.

20. If the virtual drive configuration is acceptable, click **Accept** to save the configuration. Otherwise, click **Cancel** to end the operation and return to the MegaRAID BIOS CU main menu, or click **Back** to return to the previous screens and change the configuration.

21. If you accept the configuration, click **Yes** at the prompt to save the configuration.

    The MegaRAID BIOS CU main menu screen appears.

3.4   Viewing and Changing Device Properties

This section explains how you can use the MegaRAID BIOS CU to view and change the properties for controllers, virtual drives, drives, and BBUs.

3.4.1   Viewing Controller Properties

The MegaRAID BIOS CU displays information for one LSI RAID controller at a time. If your computer system has multiple LSI RAID controllers, you can view information for a different controller by clicking **Controller Selection** on the main screen. When the Controller Selection screen appears, select the controller you want from the list.

Follow these steps to view the properties of the currently selected controller.

1. Click **Controller Properties** on the MegaRAID BIOS CU main menu screen.

   Three Controller Properties screens exist. The following figure shows the first screen.

Figure 21 First Controller Properties Screen

The information on this screen is read-only and cannot be modified directly. Most of this information is self-explanatory. The screen lists the number of virtual drives that are already defined on this controller, and the number of drives connected to the controller.

2. Click **Next** to view the second Controller Properties screen, as shown in the following figure.

Figure 22 Second Controller Properties Screen

3. Click **Next** to view the third Controller Properties screen, as shown in the following figure.

Figure 23 Third Controller Properties Screen
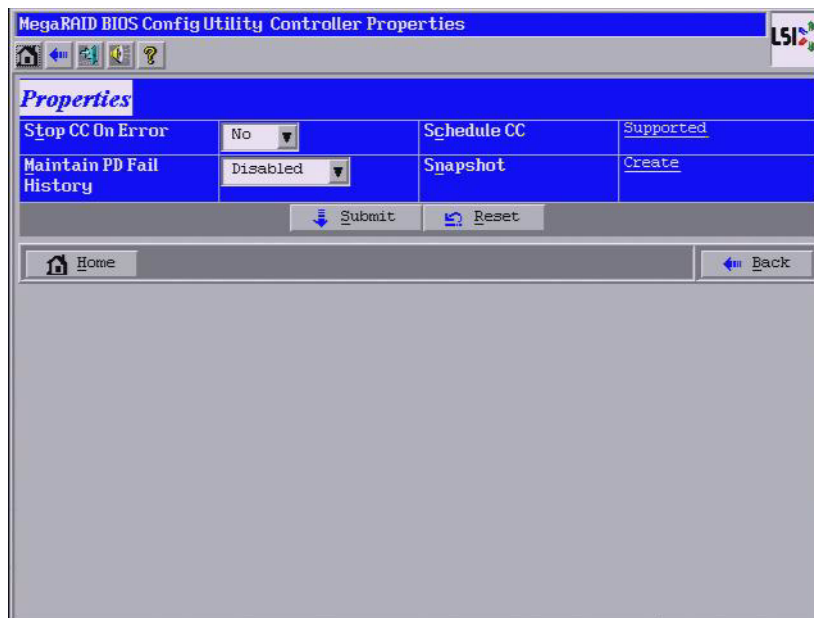
4. If you make changes to the options on this screen, click **Submit** to register them. If you change your mind, click **Reset** to return the options to their default values.

The following table describes the entries/options listed on the second and third Controller Properties screen. LSI recommends that you leave these options at their default settings to achieve the best performance, unless you have a specific reason for changing them.

Table 2 Controller Properties Menu Options

Option	Description
Battery Backup	This entry indicates whether the selected controller has a BBU. If present, you can click Present to view information about the BBU.
Set Factory Defaults	Use this option to load the default MegaRAID® BIOS CU settings. The default is **No**.
Cluster Mode	Use this option to enable or disable Cluster mode. The default is **Disabled**. A cluster is a grouping of independent servers that can access the same data storage and provide services to a common set of clients. When Cluster mode is disabled, the system operates in Standard mode.
Rebuild Rate	Use this option to select the rebuild rate for drives connected to the selected controller. The default is 30 percent. The rebuild rate is the percentage of system resources dedicated to rebuilding a failed drive. The higher the number, the more system resources devoted to a rebuild.
BGI Rate	Use this option to select the amount of system resources dedicated to background initialization of virtual drives connected to the selected controller. The default is 30 percent.
CC Rate	Use this option to select the amount of system resources dedicated to consistency checks of virtual drives connected to the selected controller. The default is 30 percent.
Reconstruction Rate	Use this option to select the amount of system resources dedicated to reconstruction of drives connected to the selected controller. The default is 30 percent.
Controller BIOS	Use this option to enable or disable the BIOS for the selected controller. The default is **Enabled**. If the boot device is on the selected controller, the BIOS must be enabled; otherwise, the BIOS should be disabled or it might not be possible to use a boot device elsewhere.
NCQ	Native Command Queuing (NCQ) gives an individual drive the ability to optimize the order in which it executes the read and write commands. The default is **Enabled**.

Table 2 Controller Properties Menu Options (Continued)

Option	Description
Coercion Mode	Drive coercion is a tool for forcing drives of varying capacities to the same capacity so they can be used in a drive group. The coercion mode options are **None**, **128MB-way**, and **1GB-way**. The default is **None**. The number you choose depends on how much the drives from various vendors vary in their actual capacity. LSI recommends that you use the 1GB coercion mode option.
S.M.A.R.T. Polling	Use this option to determine how frequently the controller polls for drives reporting a Predictive Drive Failure (S.M.A.R.T.: Self-Monitoring Analysis and Reporting Technology error). The default is 300 seconds (5 minutes).
Alarm Control	Select this option to enable, disable, or silence the onboard alarm tone generator on the controller. The default is **Disabled**.
Patrol Read Rate	Use this option to select the rate for patrol reads for drives connected to the selected controller. The default is 30 percent. The patrol read rate is the percentage of system resources dedicated to running a patrol read.
Cache Flush Interval	Use this option to control the interval (in seconds) at which the contents of the onboard data cache are flushed. The default is 4 seconds.
Spinup Drive Count	Use this option to control the number of drives that spin up simultaneously. The default is 2 drives.
Spinup Delay	Use this option to control the interval (in seconds) between spinup of drives connected to this controller. The delay prevents a drain on the system's power supply that would occur if all drives spun up at the same time. The default is 12 seconds.
StopOnError	Enable this option if you want the boot process to stop when the controller BIOS encounters an error during boot-up. The default is **Disabled**.
Spin Down Delay Time	Use this option to control the interval (in seconds) between spindown of drives connected to this controller. The delay prevents a drain on the system's power supply that would occur if all drives spun down at the same time. The default is 30 minutes.
Stop CC on Error	Enable this option if you want to stop a consistency check when the controller BIOS encounters an error. The default is **No**.
Maintain PD Fail History	Enable this option to maintain the history of all drive failures. The default is **Enabled**.
Schedule CC	Indicates whether the option to schedule the date and time for a consistency check is supported.
Snapshot	Use this option to create a snapshot of a volume. MegaRAID Recovery, also known as Snapshot, offers a simplified way to recover data and provides automatic protection for the boot volume. You can use the Recovery feature to take a snapshot of a volume and to restore a volume or file. Snapshot functionality allows you to capture data changes to the volume, and, if data is deleted accidentally or maliciously, restore the data from the view or roll back to a snapshot at a previous point-in-time (PiT). MegaRAID Recovery supports up to eight snapshots of PiTs for each volume.

3.4.2   Viewing Virtual Drive Properties, Policies, and Operations

The MegaRAID BIOS CU displays properties, policies, and operations for virtual drives.

To view these items for the currently selected virtual drive, click on a virtual drive icon in the right panel on the MegaRAID BIOS CU main screen.

The Virtual Drive screen appears, as shown in the following figure.

Figure 24 Virtual Drive Screen
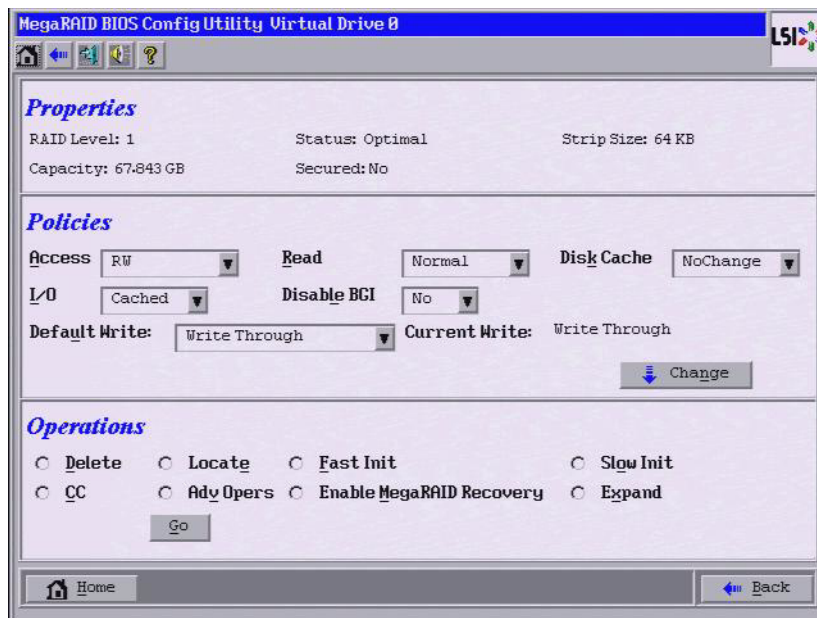
The Properties panel of this screen displays the virtual drive's RAID level, state, capacity, strip size.

The Policies panel lists the virtual drive policies that were defined when the storage configuration was created. For information about these policies, see Section 3.3.3, Using Manual Configuration. To change any of these policies, make a selection from the drop-down menu and click **Change**.

The Operations panel lists operations that can be performed on the virtual drive. To perform an operation, select it and click **Go**. Choose from the following options:

- Select **Delete** to delete this virtual drive. For more information, see Section 5.6.8, Delete Virtual Drive or Drives.

- Select **Locate** to make the LEDs flash on the drives used by this virtual drive. This works only if the drives are installed in a drive enclosure that supports SAFTE (SCSI-Accessed-Fault-Tolerant-Enclosure).

- Select **Fast Init** or **Slow Init** to initialize this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and then completes the initialization in the background. A slow initialization is not complete until the entire virtual drive has been initialized with zeroes. It is seldom necessary to use this option, because the virtual drive was already initialized when you created it.

    ⚠ **CAUTION** Before you run an initialization, back up any data on the virtual drive that you want to save. All data on the virtual drive is lost when you initialize the drive.

- Select **CC** to run a consistency check on this virtual drive. For more information, see Section 3.8, Checking Data Consistency. (This option is not available for RAID 0 virtual drives.)

- Select **AdvOpers** to access screens to remove drives, migrate RAID levels (that is, change the virtual drive configuration by adding a drive and changing the RAID level), and use MegaRAID Recovery.

- Select **Expand** to increase the capacity of a virtual drive to occupy the remaining capacity in the drive group. In addition, you can add drives to the virtual drive to increase capacity.

See Section 3.4.4, Expanding a Virtual Drive, for the procedure you can use to expand a virtual drive.

> ⚠ **CAUTION** Before you change a virtual drive configuration, back up any data on the virtual drive that you want to save.

3.4.3 Viewing Drive Properties

The Physical Drive screen displays the properties of a selected drive and enables you to perform operations on the drive. Two ways exist to access the Physical Drive screen:

- On the main menu screen, click on a drive in the right panel under the heading **Physical Drives**.
- On the main menu screen, click on **Physical Drives** in the left panel to display the Physical Drive screen. Then click on a drive in the right panel. Click on the **Properties** button, and click **Go**. The properties for the selected drive displays.

The following figure shows the Physical Drive screen.

Figure 25 Physical Drive Screen
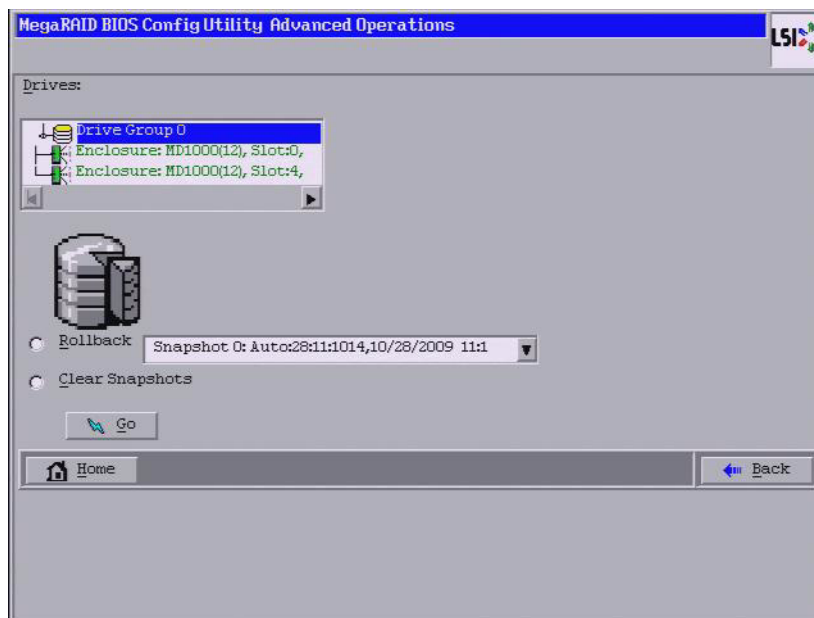
The drive properties are view-only and are self-explanatory. Note that the properties include the state of the drive.

Operations you can perform are listed at the bottom of the screen. After you select an operation, click **Go** to start the operation. The operations vary depending on the drive state. If the drive state is **Online**, the following operations appear:

- Select **MakeDriveOffline** if you want to force the drive offline.

> 🖊 **NOTE** If a good drive is part of a redundant drive group with a hot spare, and you force that drive offline, the date on the drive is rebuilt on the hot spare drive. The drive you forced offline goes into the *Unconfigured Bad* state. Access the BIOS utility to set the drive to the *Unconfigured Good* state.

- Select **Locate** to make the LED flash on the drive. This works only if the drive is installed in a drive enclosure.

If the drive state is Unconfigured Good, four additional operations appear on this screen:

- Select **Make Global HSP** to make a global hot spare, available to all of the virtual drives.
- Select **Make Dedicated HSP** to make a hot spare dedicated to a specific virtual drive.

  The MegaRAID BIOS CU displays the global hot spare as **Global** and the dedicated hot spare as **Ded**. The icon for the dedicated hot spare displays under its associated virtual drive. The drive number, drive state, drive capacity, and drive manufacturer display.

- Select **Enclosure Affinity** so if there are drive failures present on a split backplane configuration, then the hot spare is used first on the backplane side that it resides in.
- Select **Prepare for Remova**l to prepare the drive for removal from the enclosure.

  The **Prepare for Remova**l feature is different from spinning a drive down into powersave mode because it also involves flagging the drive as ready to remove. Therefore, if you choose to prepare a drive for removal, **Ready to Remove** displays in the device tree for that drive, instead of **Powersave**.

3.4.4 Expanding a Virtual Drive

You can increase the capacity of a virtual drive to occupy the remaining capacity in a drive group. In addition, you can add drives to the virtual drive to increase capacity.

Follow these steps to expand a virtual drive.

1. Access the Virtual Drive screen by clicking a virtual drive icon in the right panel on the MegaRAID BIOS CU main screen.

   The Virtual Drive screen appears, as shown in the following figure.

Figure 26 Virtual Drive Screen
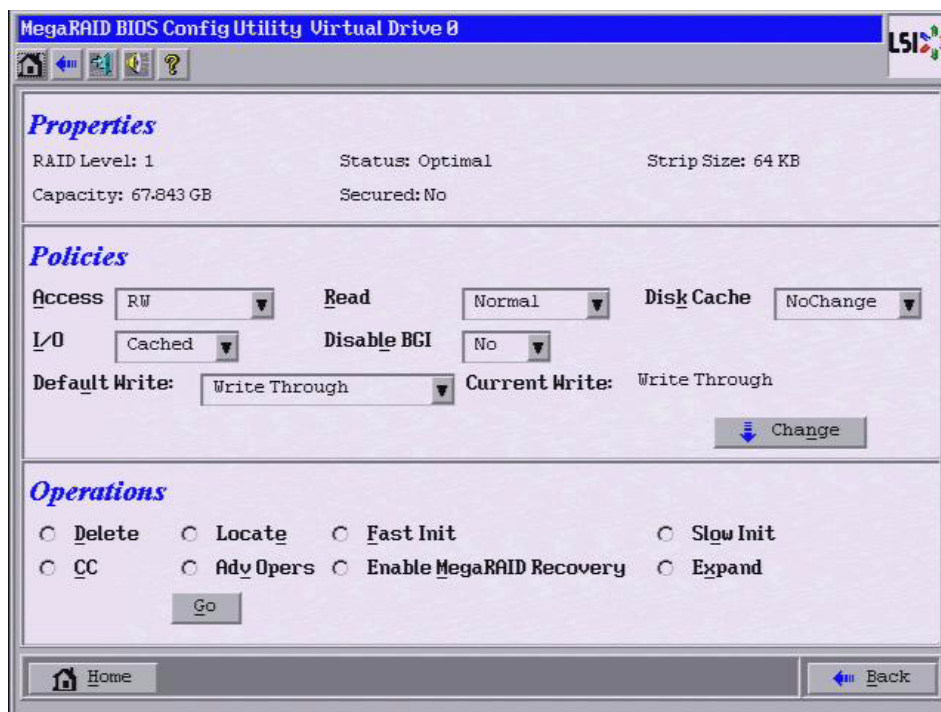
2. Click the **Expand** radio button, and then click **Go**.

   The Expand Virtual Drive screen appears, as shown in the following figure.

   Figure 27 Expand Virtual Drive Screen
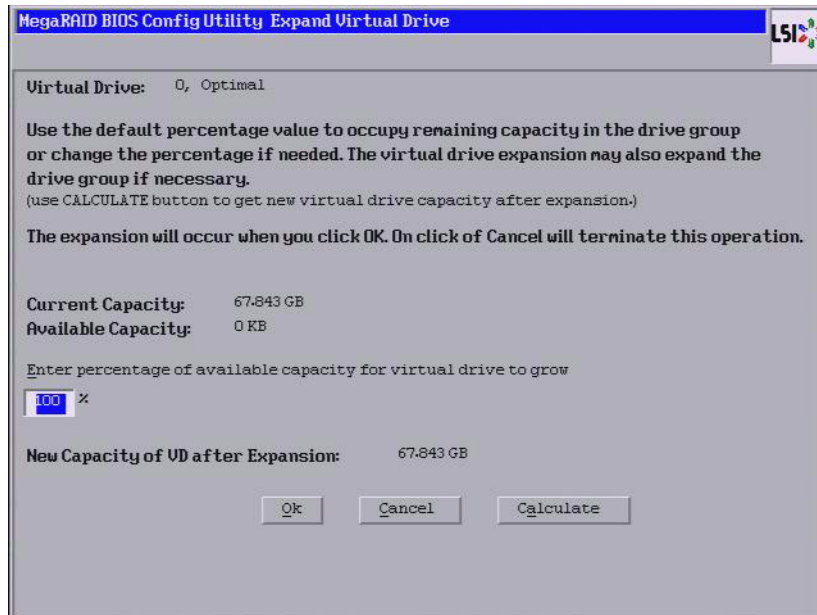
3. Enter the percentage of the available capacity that you want the virtual drive to use.

   For example, if there are 100 GB of capacity available and you want to increase the capacity of the virtual drive by 30 GB, select 30 percent.

4. Click **Calculate** to determine the capacity of the virtual drive after expansion.

5. Click **Ok**.

   The virtual drive expands by the selected percentage of the available capacity.

3.4.5   Creating a Global Hot Spare Drive

The MegaRAID BIOS CU enables you to create global hot spare drives (dedicated hot spare drives are not supported). A hot spare drive can automatically replace a failed drive in a redundant RAID 1, RAID 5, or RAID 10 drive group, to protect against data loss.

Important: When you select a disk drive for a global hot spare, be sure it is the same type of drive as the drives in the drive group that it protects.

You can create a hot spare when you are configuring a new storage configuration, as described in the previous sections. To add a hot spare drive to an existing redundant storage configuration, follow these steps:

1. Select **Objects** from the Management menu.

2. Select **Physical Drive**.

   A list of physical drives appears.

3. Select an unconfigured drive or Ready drive from the list, and press **Enter**.

4. When the Physical Drive Property menu appears, select **Make Hot Spare** and press **Enter**.

5. Select **Yes** from the pop-up menu to create the hot spare drive.

6. To remove a hot spare drive, perform steps 1 and 2 (listed previously), select the HOTSP disk, press **Enter**, select **Force Offline**, and press **Enter**. The status of the drive changes to READY, and it can then be used in another new array.

3.4.6 Initializing Virtual Drives

This section explains the two methods used to initialize a virtual drive with the MegaRAID BIOS CU.

If the Fast Init property is enabled, fast initialization is used. In fast initialization, the MegaRAID BIOS CU quickly writes zeroes to the first and last 8-MB regions of the new virtual drive.

If the Fast Init property is not enabled, the MegaRAID BIOS CU performs a complete initialization on the virtual drive. This process can take a long time if the physical disk drives are large.

> ⚠️ **CAUTION** When you initialize a virtual drive, all of the existing data on the virtual drive is erased.

3.4.6.1 First Initialization Method

Follow these steps to initialize a virtual drive using the Initialize menu.

1. On the Management Menu, select **Initialize**.
2. Use the spacebar to highlight the virtual drive to initialize.

    The virtual drive name is highlighted in yellow. To deselect it, highlight the virtual drive and press the spacebar again.
3. Press **F10**.
4. Select **Yes** at the prompt and press **Enter** to begin the initialization.

    A graph shows the progress of the initialization until it is complete.
5. After the initialization is complete, press **Esc** to return to previous menus.

    If you press **Esc** while initialization is in progress, the following options appear:
    — **Stop** – (Available only if **AutoResume** is enabled on the adapter: **Management Menu >> Objects >> Adapter >> AutoResume**.) The initialization is stopped, and the CU stores the percentage of the initialization already completed. If **AutoResume** is enabled, and if *Fast Init* is *not* enabled, the initialization resumes where it left off when you restart it, instead of starting over from 0 percent.
    — **Continue** – The initialization continues normally.
    — **Abort** – The initialization is completely aborted. If you restart initialization, it begins at 0 percent.

3.4.6.2 Second Initialization Method

Follow these steps to initialize a virtual drive using the Objects menu.

1. From the Management Menu, select **Objects >> Logical Drive**.

    A list of configured virtual drives appears.
2. Select a virtual drive, if there is more than one configured, and press **Enter**.
3. Select **Initialize** from the submenu, and press **Enter**.
4. Select **Yes** at the prompt, and press **Enter**.

    The CU displays a bar graph showing the initialization progress.
5. When initialization completes, press **Esc** to return to the previous menu.

    If you press **Esc** while initialization is in progress, the *Stop*, *Continue*, and *Abort* options are available, as explained earlier in this section.

3.5 Setting the Hard Disk Write Cache and Read Ahead Policies

You can use the MegaRAID BIOS CU to set the drive Write Cache and Read Ahead settings. Any read or write cache policy changes apply to all virtual drives on a drive group. In other words, if two virtual drives are defined on a single drive group and you change the Read Ahead setting on one virtual drive, the change also applies to the other virtual drive on the drive group.

The Disk Write Cache and Read Ahead policies can be set to **On** or **Off**.

- When the disk Write Cache is **On**, a write transaction is considered to be complete when all the data has been written to the disk cache. When disk Write Cache is **Off**, the write transaction is complete only when the data has been written to the disk.

- When disk Read Ahead is **On**, extra data is read sequentially ahead of the data that is actually requested, and this extra data is stored in a cache. If the additional read-ahead data is then requested, it can be read faster from the cache than from the disk directly.

> **NOTE** When the disk Write Cache is **On**, there is a danger that data could be lost if the power fails before the cached data is written to disk.

Follow these steps to view or change the virtual drive Write Cache or Read Ahead settings:

1. On the Management Menu, select **Objects >> Logical Drive >> Logical Drive >> View/Update Parameters**.
2. Use the arrow key to move the cursor to **Disk WC** or **Read Ahead**, and press **Enter**.
3. Use the arrow key to select **Off** or **On** for Disk WC (DWC) or Read Ahead.
4. When you see the prompt `Change DWC or Change Read Ahead`, use the arrow key to select **Off** or **On**, and then press **Enter** to change the cache setting.

   The settings are changed for all virtual drives defined on the drive group.

3.6 Rebuilding a Drive

The MegaRAID BIOS CU enables you to rebuild a drive of a redundant drive group if the drive group has a failed drive. If the failed drive is still good (that is, if the drive is physically present and its capacity is greater than or equal to the defined capacity of the drive group), it is rebuilt. If the drive is small, an error message appears and the MegaRAID BIOS CU does not allow the drive to be rebuilt. A rebuild cannot be started on a failed drive if its capacity is even 1 byte smaller than the defined capacity of the drive group.

Follow these steps to rebuild a drive:

1. Select **Rebuild** from the Management Menu.
2. When the list of drives appears, highlight the FAIL drive that you want to rebuild and press the **Spacebar** to select it.
3. After selecting the physical drive, press **F10**, and select **Yes** at the confirmation prompt.

   The rebuild process begins, and a graph shows the progress of the rebuild until it is complete. Although the CU changes the disk drive state to *Rebuild* at this point, the change does not appear on the screen while the rebuild is in progress.

   If the CU detects a media error on the source drive during rebuild, it initiates a sector read for that block. If the sector read fails, the CU adds entries to the Soft Bad Block Management (SBBM) table, writes this table to the target drive, and displays an error message.

   Additional error messages appear if the SBBM table is 80 percent full or 100 percent full. If the SBBM table is completely full, the rebuild operation is aborted, and the drive is marked as *FAIL*.

4. When the rebuild is complete, the CU displays the following message:

   `Rebuilding of Drive X Completed Successfully. Press Esc.`

   where X is the ID of the rebuilt drive.

5. Press **Esc** to display the Management Menu.

   The state of the rebuilt disk drive changes from *FAIL* to *ONLIN*.

   If you press **Esc** while the rebuild is running, the following options display:

- **Stop** – (Available only if **AutoResume** is enabled on the adapter: **Management Menu >> Objects >> Adapter >> AutoResume**.)

   The rebuild is stopped, and the CU stores the percentage of the rebuild already completed. If **AutoResume** is enabled, the rebuild resumes where it left off when you restart it, instead of starting over from 0 percent.

- **Continue** – The rebuild continues normally.

- **Abort** – The rebuild is completely aborted and the disk drive remains in the FAIL state. If you restart the rebuild, it begins at 0 percent.

3.7 Hot Plug Support

The MegaRAID BIOS CU supports hot plugging of drives. The following hot plug message appears when you insert or remove a drive:

`A Drive Has Been Inserted/Removed. Configuration Updated. Press ESC...`

After you press **Esc**, the inserted or removed drive is reflected in the list of drives that appears in the configuration utility.

Do not insert or remove a drive while you are defining a new virtual drive or while an initialization or other process is running.

The following bullets describe how the CU handles hot plugging when various actions occur:

- If the Physical Drive window or one of the Configuration windows is open when you insert or remove a drive, the window closes when the hot plug message appears.

- CU menus such as Select Boot Drive, Select Adapter, and Logical Drive menus completely or partially close when a drive is inserted or removed.

- If a Rebuild is in progress when you insert or remove a drive, the CU first displays the following message:

   `Rebuilding Of Drive Not Complete! Press Esc...`

   followed by the hot plug message. If the Rebuild was not affected by this hot plug event, it continues to rebuild from where it left off, provided that Auto Resume is enabled; otherwise, Rebuild starts over from the beginning. If the rebuilding drive group was affected by the hot plug event, the Rebuild aborts and the drive group status changes based on the hot plug operation.

- If an Initialization is in progress when you insert or remove a drive, the CU displays the following message:

   `Initialization of Array Not Complete! Press ESC...`

   followed by the hot plug message.

- If a consistency check is in progress when you insert or remove a drive, the CU displays the following message

   `CC Not Completed! Press ESC...`

   followed by the hot plug message.

3.8   Checking Data Consistency

The check consistency feature can be used on RAID 1, RAID 5, or RAID 10 virtual drives to verify the consistency of the data on the physical drives. The MegaRAID BIOS CU automatically corrects any differences found in the data when a consistency check is run.

Follow these steps to check consistency:

1.   On the Management Menu, select **Check Consistency**, and press **Enter**.

     A list of configured virtual drives appears.

2.   Highlight a virtual drive with the arrow keys.

3.   Press the spacebar to select the virtual drive to check for consistency.

> ✎ **NOTE** If you select a RAID 0 virtual drive, a message appears stating that a Check Consistency cannot be performed. To continue, deselect the virtual drive, highlight a redundant virtual drive, and press the spacebar again.

4.   Press **F10**.

5.   At the prompt, select **Yes** to start the Check Consistency process, and press **Enter**.

     A graph shows the progress of the Check Consistency operation until it is complete.

     If the MegaRAID BIOS CU finds any data inconsistencies while comparing the source and target drives, it fixes the inconsistency by writing the source data to the target drive. After the CU fixes the data, the following message appears at the bottom of the screen:

     `The Data on the Drives is inconsistent. Repair done!`

     If the MegaRAID BIOS CU finds a media error on the source drive, it pops up a dialog box with this message:

     `Error in Reading Sectors! Proceed Anyway (Y/N)?`

     If you press **Y**, the program skips the bad block and continues. If you press **N**, the program aborts the consistency check. The same message appears if the program finds a hard media error on the target drive.

     If you press **Esc** while a Check Consistency is running, the following options appear:

▪   **Stop** – (Available only if **AutoResume** is enabled on the adapter: **Management Menu >> Objects >> Adapter >> AutoResume**.) The Check Consistency is stopped, and the CU stores the percentage of the task already completed. If **AutoResume** is enabled, the Check Consistency resumes where it left off when you restart it, instead of starting over from 0 percent.

▪   **Continue** – The Check Consistency continues normally.

▪   **Abort** – The Check Consistency is completely aborted. If you restart it, it begins at 0 percent.

3.9   Viewing and Changing Device Properties

The MegaRAID BIOS CU allows you to view properties for controllers, virtual drives, and physical drives. You can also change some properties for adapters and virtual drives.

3.9.1   Viewing and Changing Adapter Properties

To view or change adapter properties, follow these steps:

1.   On the Management Menu, select **Objects >> Adapter**.

2.   Select a controller from the list.

The following list of adapter properties appears:

Property	Options	Default
Rebuild Rate	0 to 100 (% of system resources)	30
Chk Const Rate (check consistency rate)	0 to 100 (% of system resources)	30
FGI Rate (foreground initialization rate)	0 to 100 (% of system resources)	30
BGI Rate (background initialization rate)	0 to 100 (% of system resources)	30
Disk WC (disk write cache)	Off, On	Off (write through enabled)
Read Ahead	On, Off	On
BIOS State	Enable, Disable	Enable
Stop On Error	No, Yes	No
Fast Init	Enable, Disable	Enable
Auto Rebuild	On, Off	On
Auto Resume	Enable, Disable When enabled, you can stop a consistency check, rebuild, or initialization and resume it later where it left off, instead of aborting it and starting over.	Enable
Disk Coercion **NOTE** The Disk Coercion property can be accessed only when no configuration is present for the adapter. Otherwise, an error message appears.	None, 128MB, 1GB	1GB

3. If you want to change the value of a property, highlight it, and press **Enter**.

4. Select or type a different value for the property, and press **Enter**.

5. When you are finished, press **Esc** until you return to the Management Menu.

3.9.2 Viewing and Changing Virtual Drive Properties

To view or change virtual drive properties, follow these steps:

1. On the Management Menu, select **Objects >> Logical Drive**.

2. Select **View/Update Parameters**.

   The only virtual drive properties you can change are Disk WC (Disk Write Cache) and Read Ahead (see Section 3.5, Setting the Hard Disk Write Cache and Read Ahead Policies). The other properties are view-only.

3.9.3 Viewing Physical Drive Properties

To view physical drive properties, follow these steps:

1. On the Management Menu, select **Objects >> Physical Drive**.

2. Highlight a physical drive on the list that appears, and press **Enter**.

3. Select **Drive Properties** from the menu.

The drive properties are Device Type (Disk), Capacity, Product ID, and Revision No. These properties are view-only.

3.10 Forcing Drives Online or Offline

The MegaRAID BIOS CU enables you to force drives online or offline. You might want to force a drive of a redundant drive offline so that a hot spare drive automatically replaces it. An auto rebuild begins immediately if the MegaRAID BIOS CU finds a valid hot spare drive to replace the offline drive.

You might need to force a drive online if it has gone offline because of a power failure. The MegaRAID BIOS CU does not allow a drive to be forced online if its capacity is smaller than the defined capacity of the array.

To force a drive online or offline, follow these steps:

1. On the Management Menu, select **Objects >> Physical Drive**.
2. Highlight a physical drive that is a member of an array, and press **Enter**.
3. Select **Force Offline** or **Force Online** from the menu.

   If the drive was online, its status changes to FAIL. If it was offline, its status changes to ONLIN.

3.11 Configuring a Bootable Virtual Drive

The default boot virtual drive is LD 0. If you change the boot drive to another virtual drive, the BIOS and the CU preserve this change. However, if you delete the new boot virtual drive, you must be sure to configure another virtual drive for booting. The MegaRAID BIOS CU does not automatically select a different boot virtual drive.

Follow these steps to configure a bootable virtual drive:

1. On the Management Menu, select **Configure >> Select Boot Drive**.
2. Select a virtual drive from the list to be the designated boot drive.

3.12 Deleting a Virtual Drive

The MegaRAID BIOS CU allows you to delete any single virtual drive defined in the configuration (sometimes referred to as random deletion).

> ⚠️ **CAUTION** Before you delete a virtual drive, be sure to back up all the data you want to keep.

To delete a specified virtual drive, follow these steps:

1. Select **Objects >> Logical Drive**.
2. Highlight the virtual drive that you want to delete, and press **Delete**.
3. Select **Yes** when the confirmation message appears.

3.13   Clearing a Storage Configuration

> ⚠️ **CAUTION** Before you clear a storage configuration, be sure to back up all the data you want to keep.

To clear a storage configuration, follow these steps:

1. On the Management Menu, select **Configure >> Clear Configuration**.
2. When the message appears, select **Yes** to confirm.

   All of the virtual drives are deleted from the configuration.

Chapter 4: Human Interface Infrastructure Configuration Utility

The Human Interface Infrastructure (HII) Configuration Utility (CU) is used to configure controllers, drive groups, and virtual drives, and to perform other configuration tasks in a pre-boot environment.

This chapter describes how to configure controllers, drive groups, and virtual drives with the HII Configuration Utility. To ensure the best performance, select the optimal RAID level for the virtual drive you create. For an explanation of RAID levels, see Section 1.2, RAID Overview.

4.1 Accessing the Configuration Options Screen

You can use the Configuration Options screen to manage the controller, virtual drives, and physical drives.

Perform the following steps to access the Configuration Options screen.

1. Boot the system.
2. Press **F1** during bootup to enter setup.

   The System Configuration and Boot Management screen appears, as shown in the following figure.

Figure 28 System Configuration and Boot Management Screen
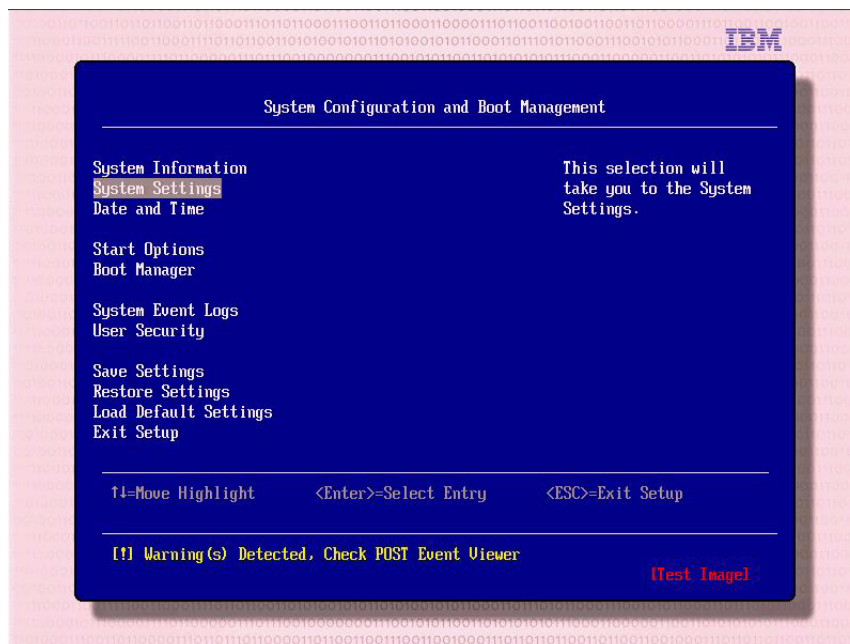
3. Highlight **System Settings** and press **Enter**.

The System Settings screen appears, as shown in the following figure.

Figure 29 System Settings Screen
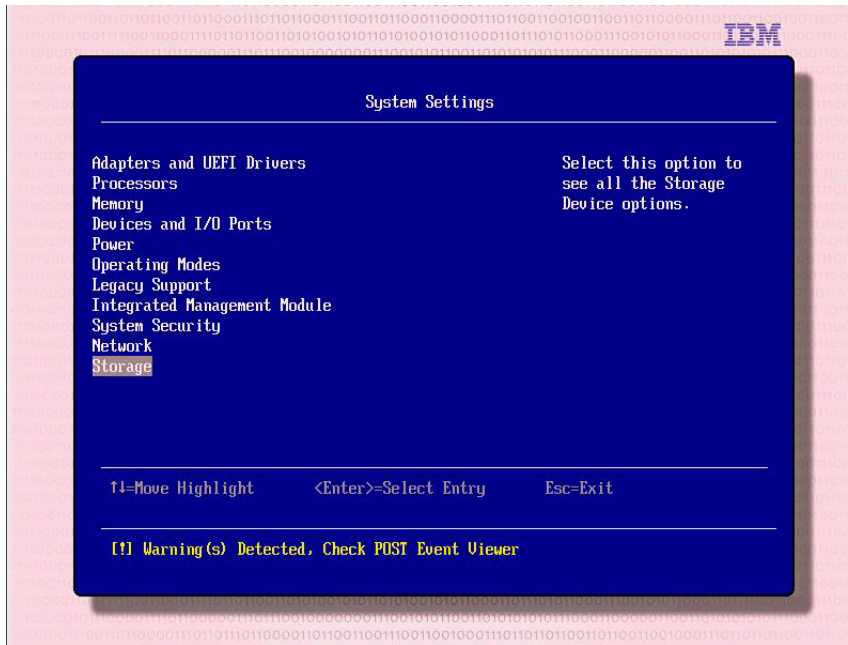
4. Highlight **Devices and I/O Ports** and press **Enter**.

The Devices and I/O Ports screen appears.

5. Verify that the **Configure SATA as** field is set to **RAID** on the Devices and I/O Ports screen.

6. If this field is set to RAID, press **Esc** to return to the **System Settings** screen.

If this field is not set to RAID, perform the following steps:

a. Highlight the **Configure SATA as** options and press **Enter**.

IDE, **AHCI**, and **RAID** appear as the options.

b. Highlight **RAID** and press **Enter**.

c. Press **Esc** until you return to the System Configuration and Boot Management screen.

d. Highlight **Save Settings** and press **Enter**.

e. Reboot your system.

f. Press **F1** during bootup to enter setup.

The System Configuration and Boot Management screen appears, as shown in Figure 28.

g. Highlight **System Settings** and press **Enter**.

The System Settings screen appears. The Storage menu option is now available on this screen.

7. Highlight **Storage** and press **Enter**.

   The Storage screen appears, as shown in the following figure.

   > **NOTE** If multiple controllers exist, multiple options appear on the Storage screen.

Figure 30 Storage Screen
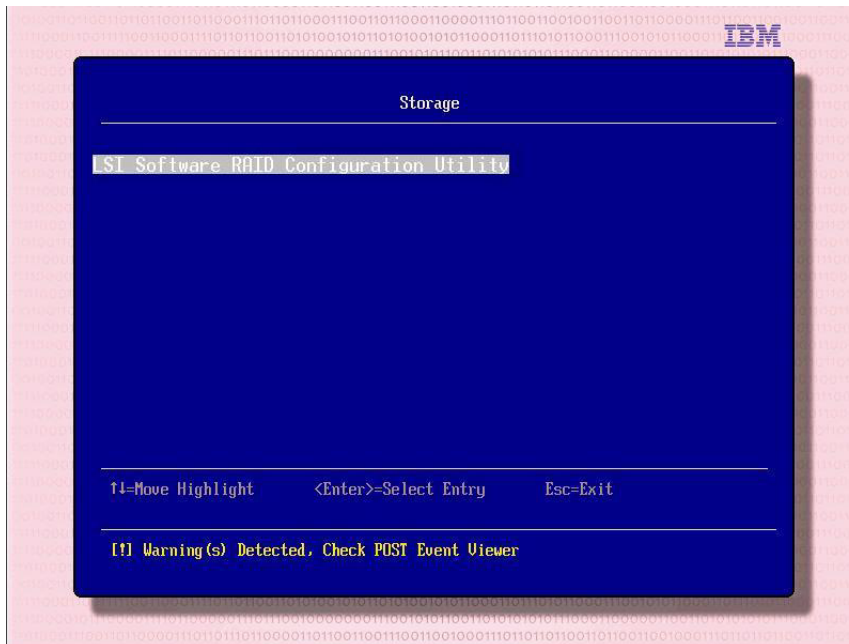
8. Highlight your controller and press **Enter**.

   The Configuration Options screen appears, as shown in the following figure. This screen lists the following management options:

   — **Controller Management** – Select this option to view and/or change the controller properties, save configurations, and perform other tasks. You can view information about the controller and the devices connected to it. For more information, see Section 4.2, Managing Controllers.

   — **Virtual Drive Management –** Select this option to access the Virtual Drive Management screen, where you can create virtual drive configurations, change the virtual drive name, delete virtual drives, initialize drives, and perform other tasks. For more information, see Section 4.3, Managing Virtual Drives.

   — **Drive Management –** Select this option to access the Drive Management screen, where you can view drive properties and perform other tasks. For more information, see Section 4.4, Managing Drives.

Figure 31 Configuration Options Screen
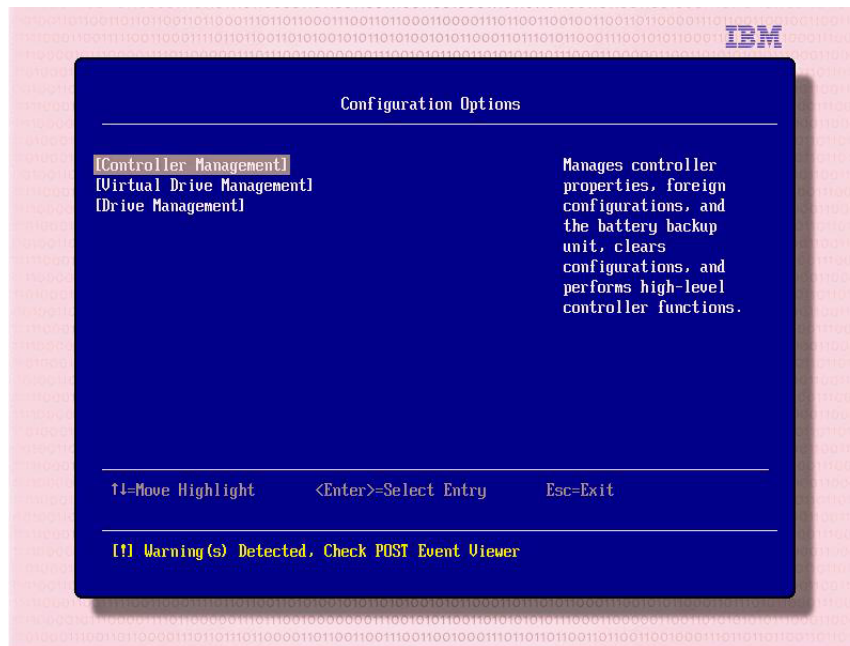
4.2   Managing Controllers

This section explains how you can use the HII configuration utility to view and change the properties for controllers, and clear a configuration.

4.2.1   Viewing Controller Properties

The HII configuration utility displays information for one controller at a time.

Perform the following steps to view the controller properties.

1.   Highlight **Controller Management** on the Configuration Options screen (see the previous figure) and press **Enter**.

The Controller Management screen appears, as shown in the following figure.

Figure 32 Controller Management Screen
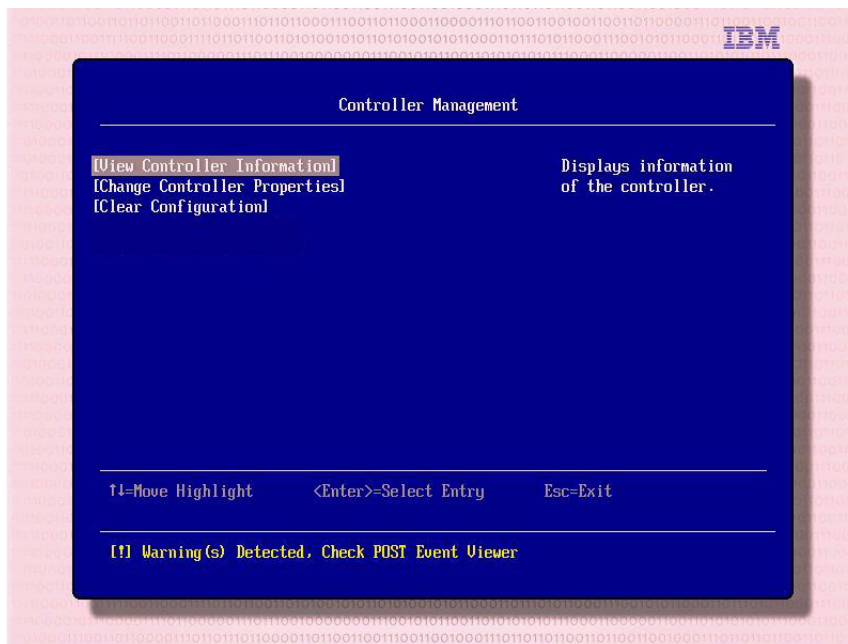
2. Highlight **View Controller Information** and press **Enter**.

The **Controller Management** >> **View Controller Information** screen appears, as shown in the following figure.

Figure 33 Controller Management >> **View Controller Information Screen**

The information on this screen is read-only. This screen presents basic information such as the number of virtual drives that are defined on this controller and the number of drives connected to the controller.

The following table defines the controller properties.

Table 3 Controller Properties

Property	Description
Controller Marketing Name	LSI Embedded MegaRAID.
Serial Number	The manufacturer-assigned serial number.
PCI ID	The ID number for the Peripheral Component Interconnect local bus.
Host Interface	The type of interface used by the computer host system, such as PCI-E.
Host Port Count	The maximum number of ports supported by the software RAID controller in which devices (such as CD-ROM and disks) can be connected.
PCI Slot Number	The number of the PCI slot in which the selected controller is installed.
Drive Count	The number of drives connected to the selected controller.
Virtual Drive Count	The number of virtual drives supported by the selected controller.
Encryption Capable	Indicates whether the controller offers the ability to encrypt data on the drives. This solution provides data protection in the event of theft or loss of physical drives.
Minimum Stripe Size	The minimum length of the data segments that the controller writes across multiple drives, not including the parity drives. The default minimum stripe size is 64 KB.
Maximum Stripe Size	The maximum length of the data segments that the controller writes across multiple drives, not including the parity drives. The default maximum stripe size is 64 KB.

4.2.2 Changing Controller Properties

You can use the HII configuration utility to change the properties for a controller. Perform the following steps to change information for a controller.

1. Highlight **Controller Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

    The Controller Management screen appears, as shown in the following figure.

Figure 34 Controller Management Screen
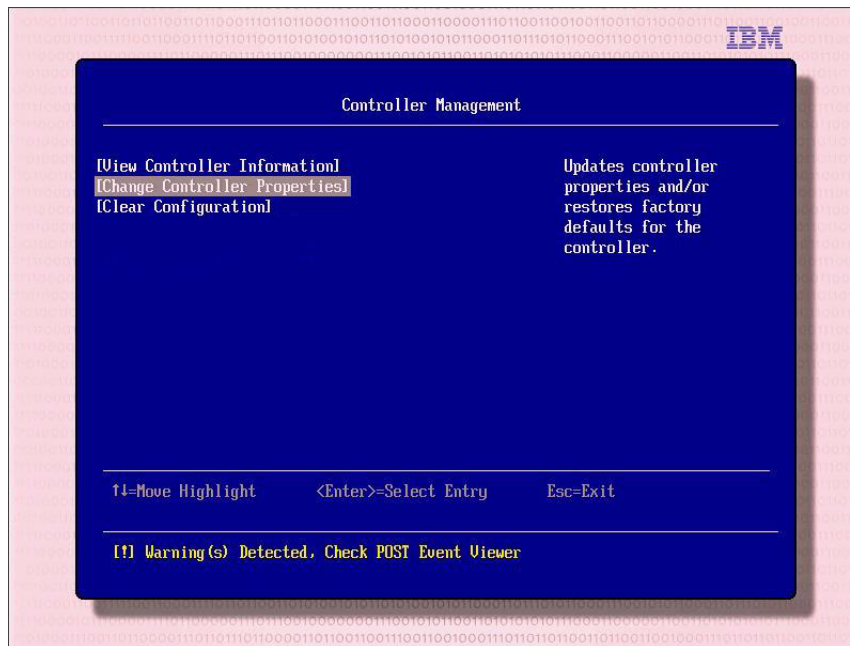
2.   Highlight **Change Controller Properties** and press **Enter**.

     The **Controller Management** >> **Change Controller Properties** screen appears, as shown in the following figure.

Figure 35 Controller Management >> **Change Controller Properties Screen**
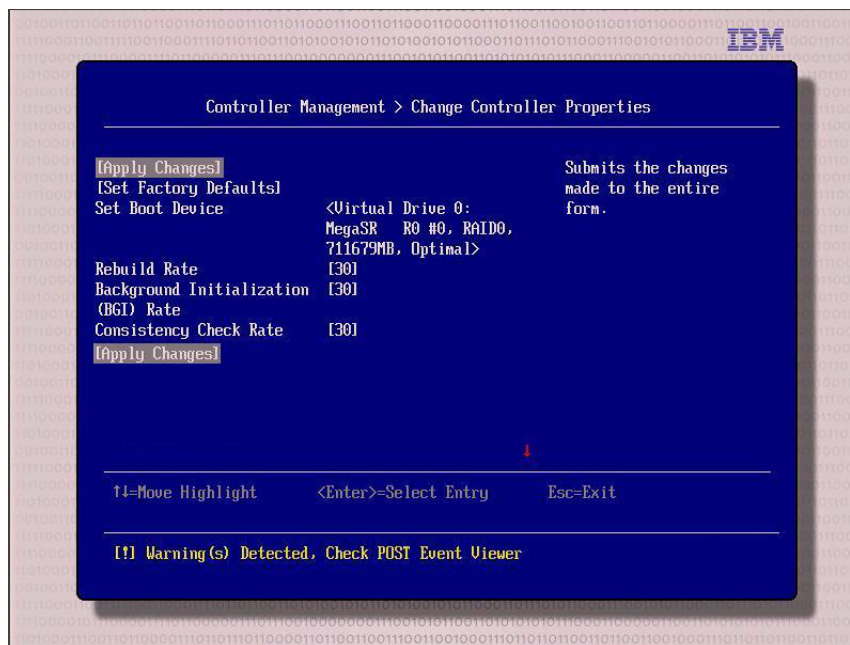
3. Change the following controller properties as desired.

   a. **Set Factory Defaults** – Use the arrow keys to move the cursor to this property and press **Enter**. On the Confirm screen, select **Yes** to confirm your selection.

   b. **Set Boot Device** – Use the arrow keys to move the cursor to this property and press **Enter**. Select a virtual drive to set as the boot device or select **None**.

   c. **Rebuild Rate** – Use the arrow keys to move the cursor to this property. Press + (the plus key) to increase the rate or press - (the minus key) to decrease the rate.

   d. **Background Initialization (BGI) Rate** – Use the arrow keys to move the cursor to this property. Press + (the plus key) to increase the rate or press – (the minus key) to decrease the rate.

   e. **Consistency Check Rate** – Use the arrow keys to move the cursor to this property. Press + (the plus key) to increase the rate or press – (the minus key) to decrease the rate.
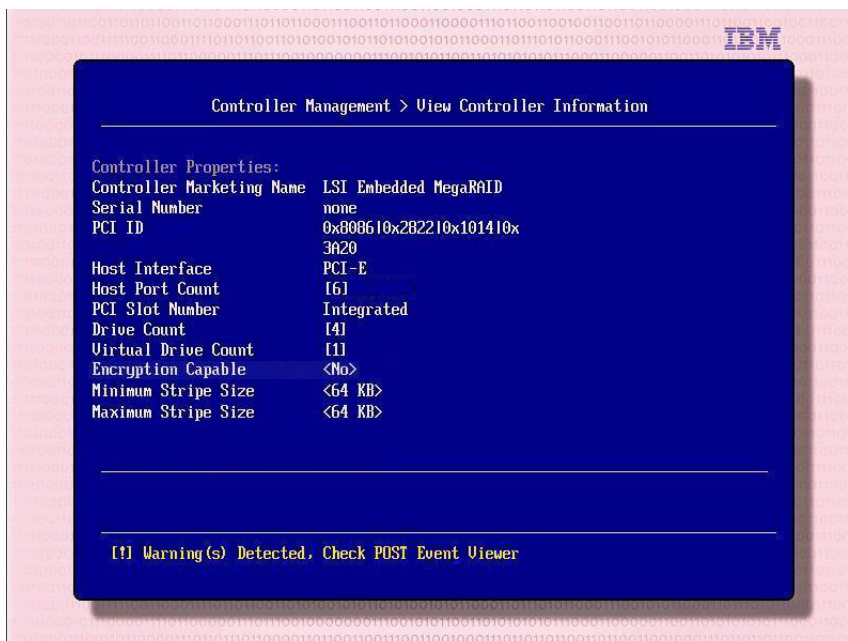
   The following table defines these controller properties.

Table 4 Changing Controller Properties

Property	Description
Set Factory Defaults	Resets factory default values for all of the controller properties.
Set Boot Devices	Selects the virtual drive to use as the boot device.
Rebuild Rate	The percentage of central processing unit (CPU) resources devoted to rebuilding data onto a new drive after a drive in a storage configuration has failed. The default value is 30 percent.
Background Initialization (BGI) Rate	Background initialization is a check for media errors on the drives when you create a virtual drive. It is an automatic operation that starts five minutes after you create the virtual drive. This check ensures that striped data segments are the same on all of the drives in the drive group. The default value is 30 percent.
Consistency Check Rate	A consistency check is an operation that verifies that all stripes in a virtual drive with a redundant RAID level are consistent and that automatically fixes any errors. The consistency check rate is the rate at which consistency check operations are run on a computer system. The default value is 30 percent.

4. Highlight **Apply Changes** and press **Enter** to register your changes.

   Your changes are registered and the controller properties are changed.

4.2.3   Clearing Configurations

Perform the following steps to clear all existing configurations on the controller.

1. Highlight **Controller Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

2. Highlight **Clear Configuration** on the Controller Management screen (see Figure 32) and press **Enter**.

3. Highlight **Yes** to confirm your selection on the Confirm screen.

   This action clears the existing configurations.

4.3   Managing Virtual Drives

You can use the Virtual Drive Management screen to create virtual drive configurations, view and change the virtual drive properties, delete virtual drives, initialize drives, and perform other tasks related to the virtual drives.

4.3.1   Configuring Virtual Drives

This section provides detailed instructions for configuring drive groups and virtual drives with the HII configuration utility.

Use drives with the same capacity when you create a storage configuration. If you use drives with different capacities in the same drive group, the CU limits each drive to the capacity of the smallest drive.

The number of physical drives in a specific array determines the possible RAID levels that you can implement with the array.

- RAID 0 requires from one to eight physical drives.
- RAID 1 requires two physical drives.
- RAID 5 required three to eight physical drives.
- RAID 10 requires four, six, or eight physical drives.

> **NOTE** The stripe size is read-only. You cannot change the settings for this property.

Follow these steps to access the Virtual Drive Management screen and create a virtual drive configuration.

1. Highlight **Virtual Drive Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

   The Virtual Drive Management screen appears, as shown in the following figure.

Figure 36 Virtual Drive Management Screen
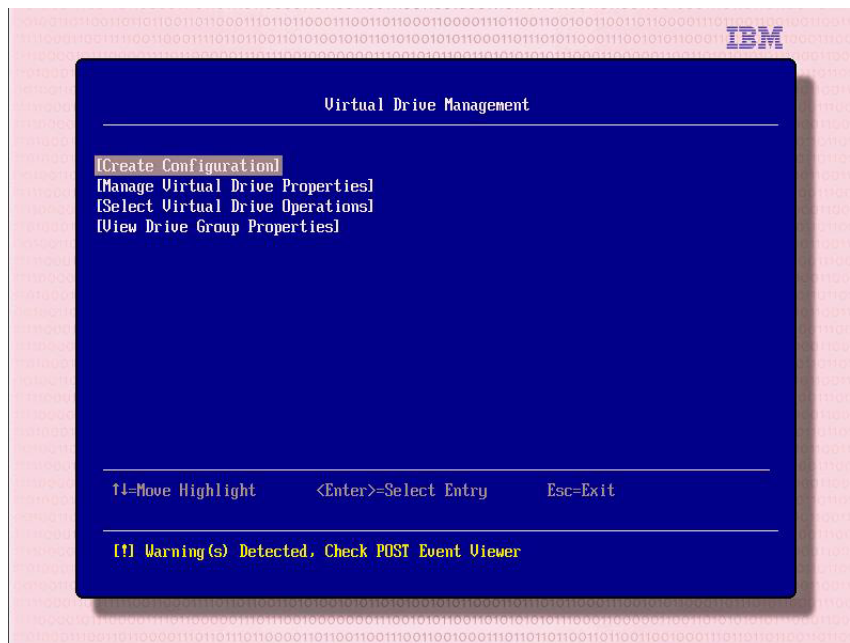
2. Highlight **Create Configuration** and press **Enter**.

The **Virtual Drive Management** >> **Create Configuration** screen appears, as shown in the following figure.

Figure 37 Virtual Drive Management >> **Create Configuration Screen**
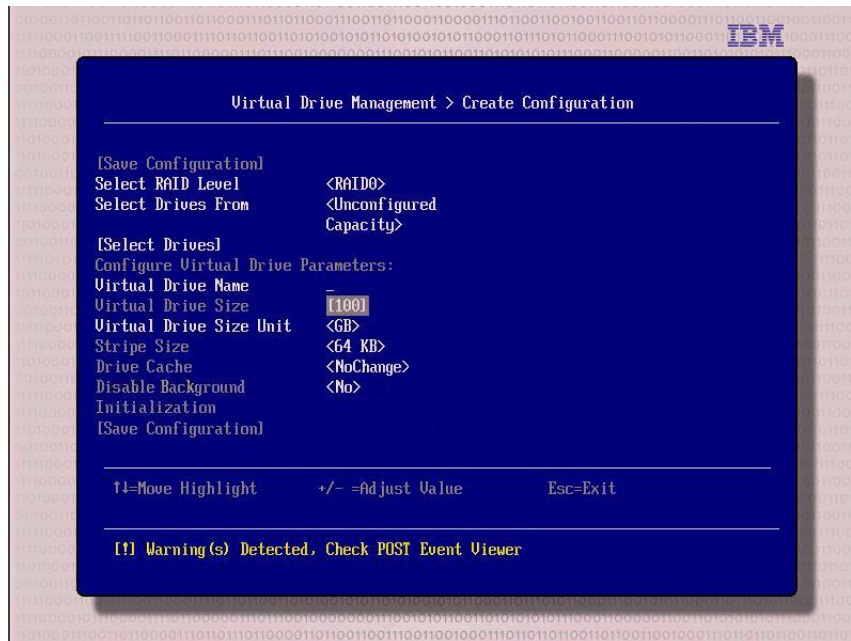
3. Use the arrow keys to select any highlighted fields (one at a time) that you want to change the setting for and press **Enter**.

4. Select the setting for each property that you want to change from the default.

You can change the settings for the following fields on this screen:

— **Select RAID Level** – The possible RAID levels for the virtual drive. See Section 1.2, RAID Overview, for more information about the RAID levels.

— **Select Drives From** – The sources that you can use to select drives for the virtual drive. The options are Unconfigured Capacity and Free Capacity.

— **Select Drives** – Select this button and a screen appears that lists Unconfigured Good drives or free capacity, depending on the value you selected in the Select Drive From field.

— **Virtual Drive Name** – Enter the name of the virtual drive.

— **Virtual Drive Size:** – Enter the capacity of the virtual drive. Normally, this value is the full capacity of the drive. You can specify a smaller capacity if you want to create other virtual drives on the same drive group.

— **Virtual Drive Size Unit** – Enter the unit of capacity you want to use for the virtual drive. The options are MB, GB, and TB.

— **Stripe Size** – A stripe consists of the data segments that the RAID controller writes across multiple drives, not including parity drives. The default is 64 KB. This setting is read-only.

4.3.2 Managing Virtual Drive Properties

After you create a virtual drive, you can use the Virtual Drive Management screen to change the name of the virtual drive.

> 🖉 **NOTE** You can change only the virtual drive name for the virtual drive that is selected. The other virtual drive properties are read-only.

Perform the following steps to access the virtual drive properties screen and change the name of the virtual drive.

1. Highlight **Virtual Drive Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

   The Virtual Drive Management screen appears, as shown in the following figure.

Figure 38 Virtual Drive Management Screen
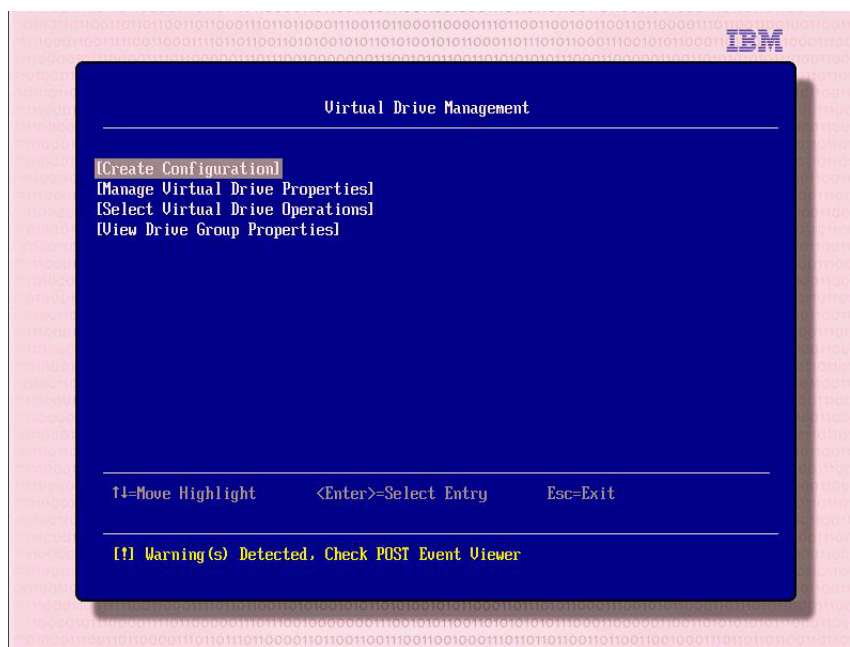
2. Highlight **Manage Virtual Drive Properties** and press **Enter**.

    The **Virtual Drive Management** >> **Manage Virtual Drive Properties** screen appears, as shown in the following figure.

Figure 39 Virtual Drive Management >> **Manage Virtual Drive Properties Screen**

3. Highlight the **Virtual Drive Name** field and press **Enter**.

4. Enter a different name for the virtual drive and press **Enter**.

5. Highlight **Apply Changes** and press **Enter** to make the selected change.

    The name of the virtual drive is changed.

4.3.3   Selecting Virtual Drive Operations

You can use the Virtual Drive Management screen to select and launch operations related to the virtual drive properties.

Perform the following steps to access the virtual drive operations screen and carry out operations for the virtual drive properties.

1. Highlight **Virtual Drive Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

    The Virtual Drive Management screen appears, as shown in the following figure.

Figure 40 Virtual Drive Management Screen
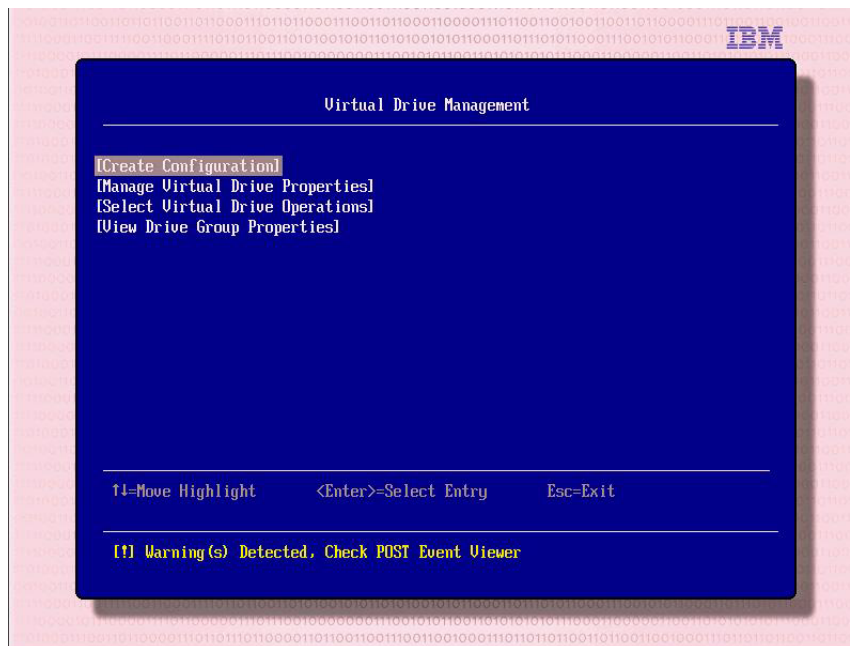
2. Highlight **Select Virtual Drive Operations** and press **Enter**.

    The **Virtual Drive Management** >> **Select Virtual Drive Operations** screen appears, as shown in the following figures.

Figure 41 Select Virtual Drive Operations Screen
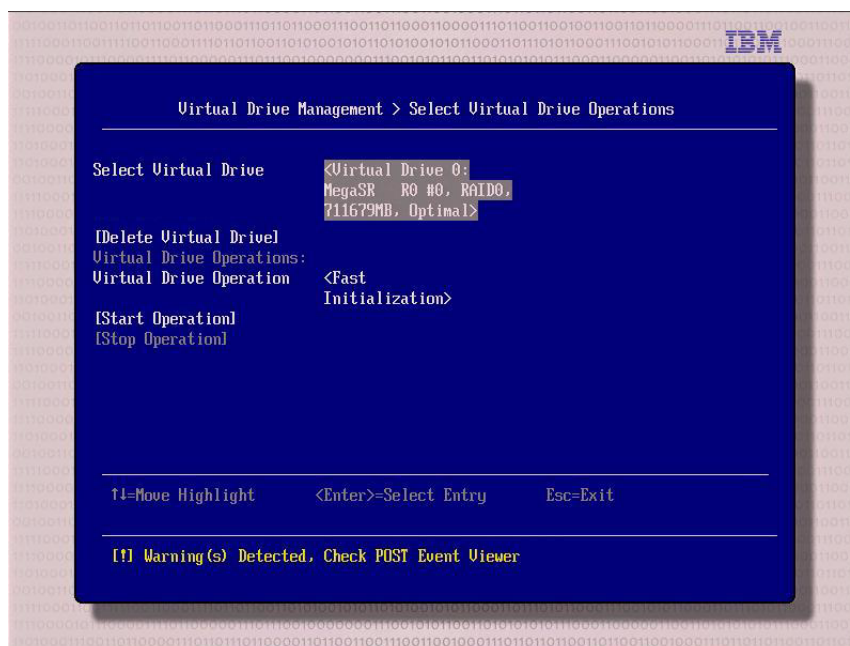
3. Highlight each operation you want to carry out and press **Enter**.

   The following two operations appear.

   — **Select Virtual Drive** – Select the virtual drive you want to carry out operations on. The screen displays the virtual drive number, virtual drive name, RAID level, virtual drive capacity, and virtual drive status.

   — **Virtual Drive Operation** – Select Fast Initialization or Slow Initialization to initialize this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and then completes the initialization in the background. A slow initialization is not complete until the entire virtual drive has been initialized with zeroes. It is seldom necessary to use this option, because the virtual drive was initialized when you created it.

   > **NOTE** If you have redundant virtual drives, you have the option to perform the Check Consistency operation.

4. Highlight **Start Operation** and press **Enter**.

   The confirmation screen appears.

   > **NOTE** The Start Operation option and the Stop Operation option toggle based on the current status of the operation. For example, after you start an operation, the Start Operation field is no longer highlighted, and the Stop Operation field is highlighted.

5. Highlight **Yes** and press **Enter** to confirm that you want to carry out the operations.

   > **NOTE** After you choose an operation and select **Start Operation**, the progress bar appears, showing zero percent. To see the change in percentages, return to the previous page and then access this page again.

4.3.4 Viewing Drive Group Properties

You can use the Virtual Drive Management screen to access the drive group properties screen and view the properties. The drive group contains the drives that are used to create the virtual drive.

Perform the following steps to access the drive group properties screen and view the drive group properties.

1. Highlight **Virtual Drive Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

   The Virtual Drive Management screen appears, as shown in the following figure.

Figure 42 Virtual Drive Management Screen
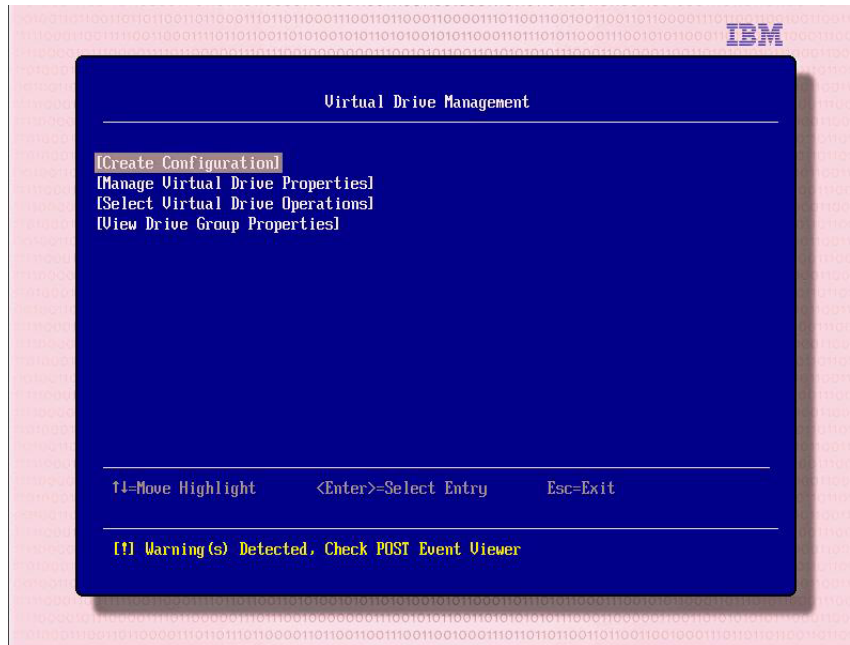
2. Highlight **View Drive Group Properties** and press **Enter**.

   The **Virtual Drive Management** >> **View Drive Group Properties** screen appears, as shown in the following figure.

Figure 43 View Drive Group Properties Screen

The screen displays the drive group number, drive group name, RAID level, virtual drive capacity, and virtual drive status.

3. Highlight the drive group and press **Enter**.

The drive group properties and any free capacity appear in the list, as shown in the following figure.

Figure 44 Drive Group Properties Screen and Free Space
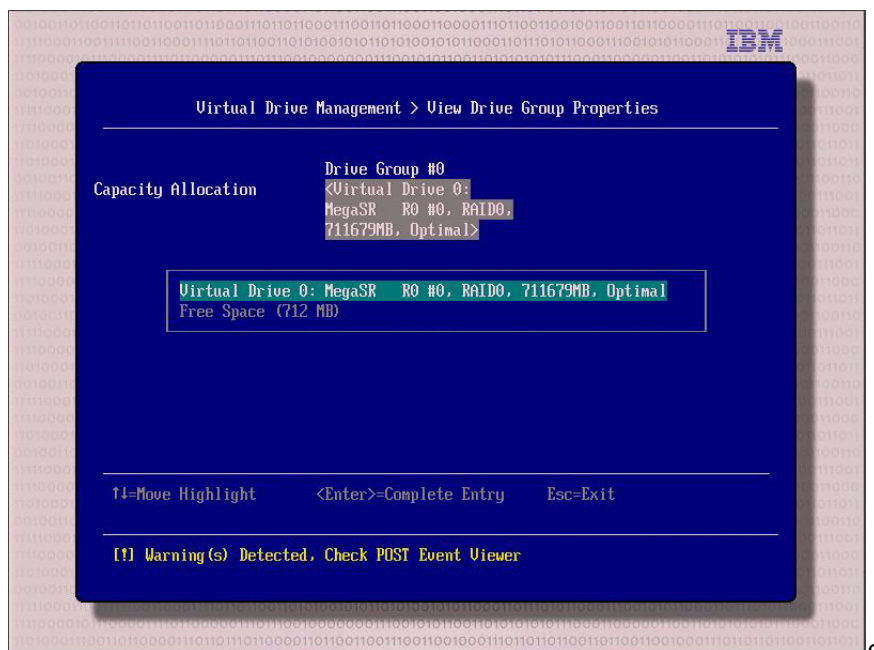
4.4   Managing Drives

You can use the Drive Management screen to view and change the physical drive properties of the drives in a drive group.

4.4.1   Viewing Drive Properties

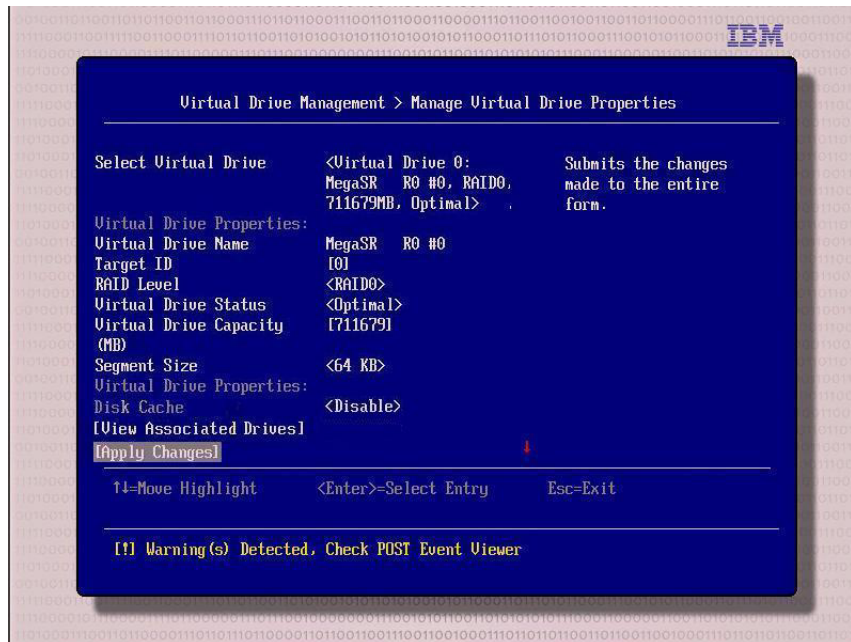Perform the following steps to access the drive properties screen and view the values for the properties.

1. Highlight **Drive Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

   The Drive Management screen appears, as shown in the following figure.

Figure 45 Drive Management Menu Screen
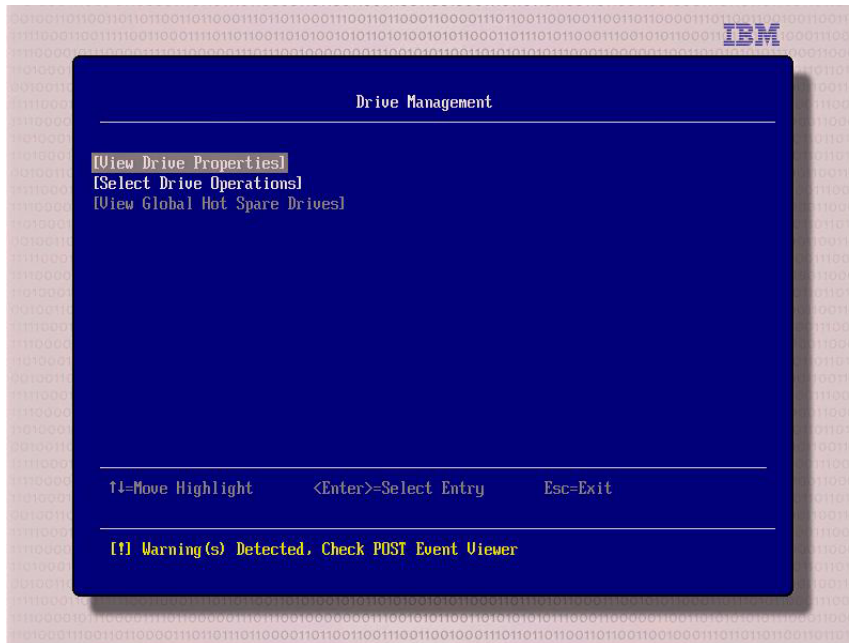
2. Highlight **View Drive Properties** and press **Enter**.

   The **Drive Management** >> **View Drive Properties** screen appears, as shown in the following two figures. This screen contains additional options that you can scroll down to view. Figure 46 shows the first options; Figure 47 shows the additional options.

Figure 46 Drive Management >> **View Drive Properties Screen**
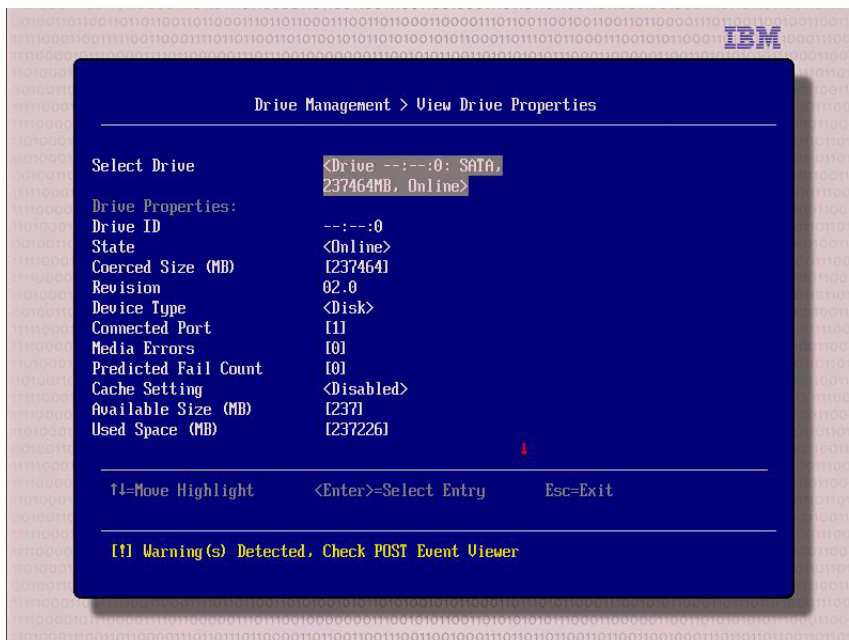
Figure 47 Drive Management >> View Drive Properties Screen
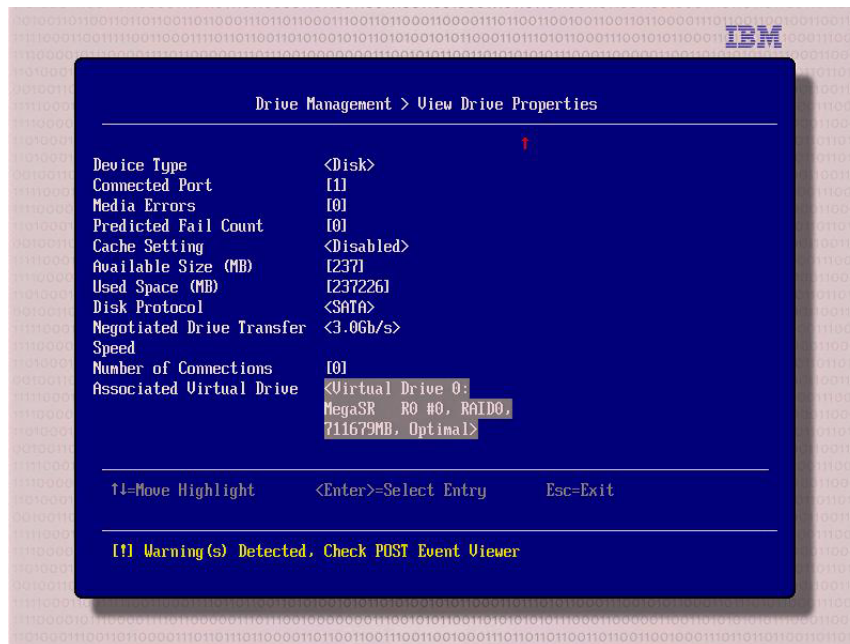
You can highlight the Associated Virtual Drive field and press **Enter** to view the properties. However, you cannot change the values in this field.

The following list shows the drive properties and their values.

— **Select Drive** – The drive number, drive slot, drive type, drive capacity, and drive status of the selected drive.

— **Drive ID** – The ID and the drive slot of the selected drive.

— **State** – The state of the selected drive, such as Online, Offline, or Unconfigured Good.

— **Coerced Size (MB)** – The capacity to which the selected drive has been coerced to make it compatible with other drives that are nominally the same capacity.

— **Revision** – The firmware revision of the drive.

— **Device Type** – Indicates the type of device selected, such as a drive, tape, or CD/DVD-ROM.

— **Connected Port** – Indicates the port to which the selected drive is connected.

— **Media Errors** – Indicates the number of media errors on the drive. Media errors are physical defects on the drive.

— **Predicted Fail Count** – Indicates the predicted number of drive failures.

— **Cache Setting** – Indicates the disk cache setting of the drive. The options are Disabled or Enabled.

— **Available Size (MB)** – Indicates the free capacity of the selected drive.

— **Used Space (MB)** – Indicates the configured space of the selected drive in MB.

— **Disk Protocol** – Indicates the type of drive selected, such as SATA.

— **Negotiated Drive Transfer Speed** – Indicates the negotiated link speed for the data transfer to or from the selected drive.

— **Number of Connections** – Indicates the number of devices connected.

— **Associated Virtual Drive** – Indicates the virtual drive number, virtual drive name, RAID level, virtual drive capacity, and virtual drive status.

4.4.2   Selecting Drive Operations

Perform the following steps to access the drive operations screen and carry out the operations.

1. Highlight **Drive Management** on the Configuration Options screen (see Figure 31) and press **Enter**.

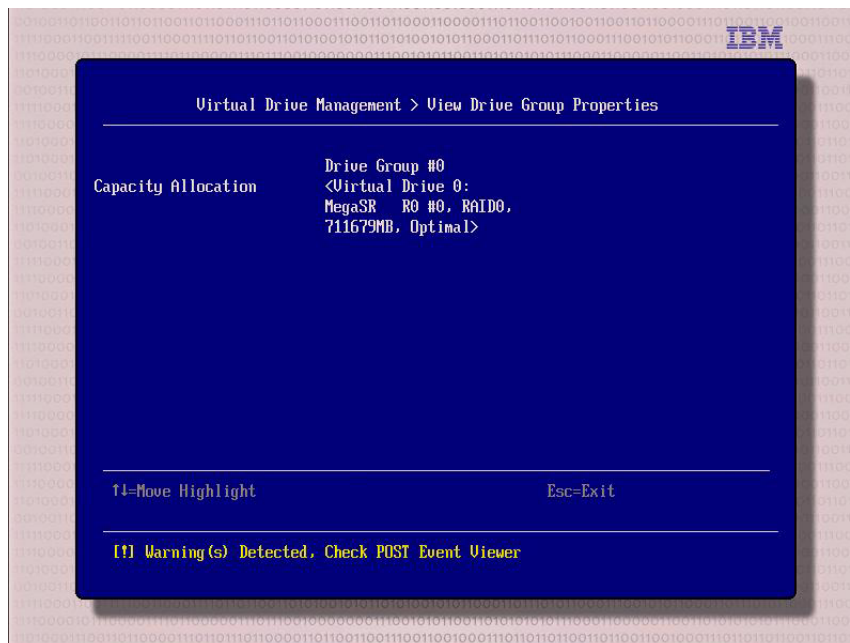   The **Drive Management** screen appears, as shown in the following figure.

Figure 48 Drive Management Screen
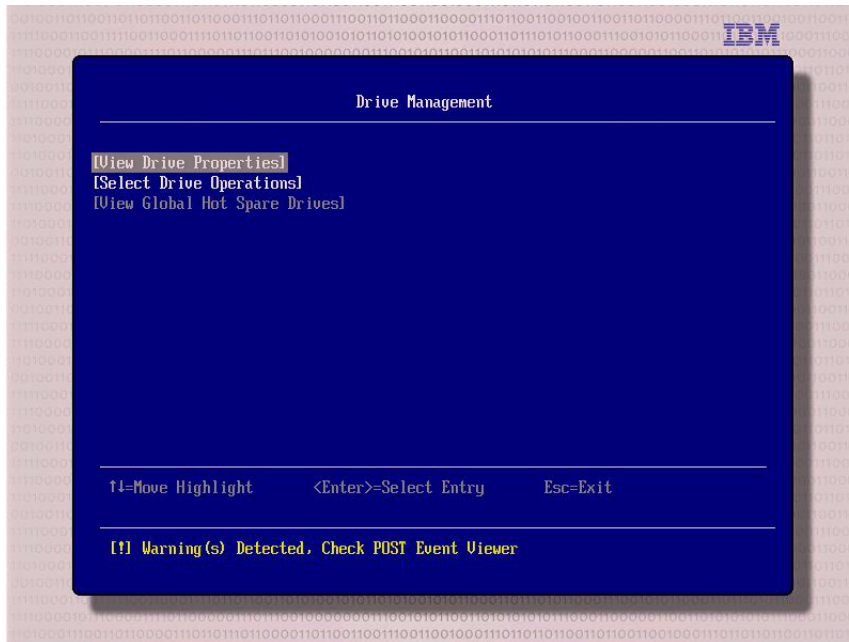
2. Highlight **Select Drive Operations** and press **Enter**.

    The **Drive Management** >> **Select Drive Operations** screen appears, as shown in the following figure.

Figure 49 Drive Management >> **Select Drive Operations**
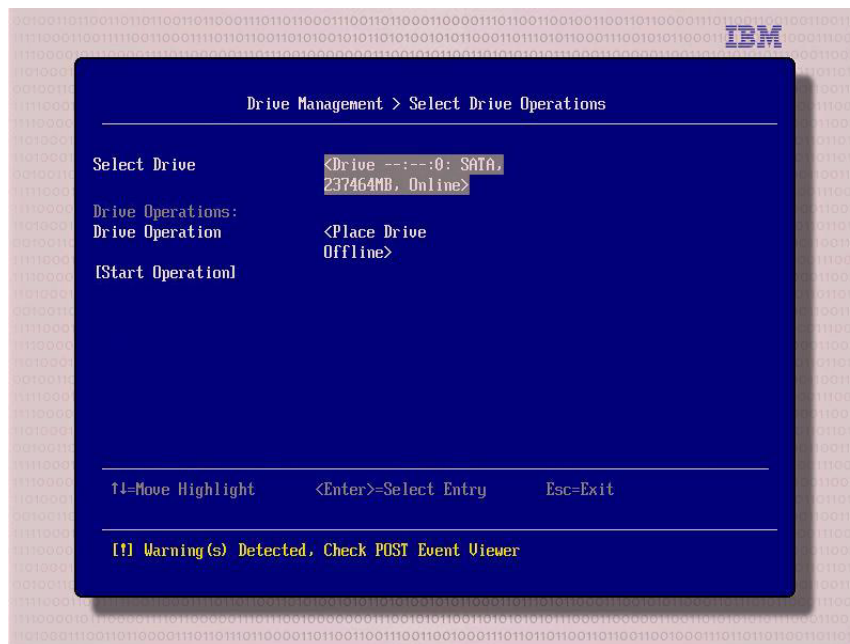
3. Highlight an operation and press **Enter**.

    The following items define the drive operations:

    — **Select Drive** – Select the drive you want to carry out operations on. The screen displays the drive number, slot number, drive type, drive capacity, and drive status.

    — **Drive Operation** – Make a drive offline or online. The options are Place Drive Offline and Place Drive Online.

    > **NOTE** If a good drive is part of a redundant drive group with a hot spare, and you force that drive offline, the data on the drive rebuilds to the hot spare drive. The drive you forced offline goes into the *Unconfigured Bad* state.

4. Highlight **Start Operation** and press **Enter**.

    The confirmation screen appears.

5. Highlight **Yes** and press **Enter**.

    The controller performs the selected operations.

Chapter 5: MegaCLI Command Tool

This chapter describes the commands for the MegaCLI Command Tool and how to use them.

The MegaCLI Command Tool (CT) is a command line interface application that you can use to configure and maintain storage configurations created with Embedded MegaRAID Software.

> **NOTE** The MegaCLI CT utility runs in the Microsoft Windows and Linux environments. For DOS, the utility is called MegaDCLI CT and it supports a subset of the full command set.

5.1   MegaCLI CT Overview

MegaCLI CT and MegaDCLI CT are command line interface applications you can use to configure and manage storage configurations under Embedded MegaRAID Software. You can use these command tools to perform the following tasks:

- Configure virtual drives and create configurations on the adapter
- Display the configuration on the adapter
- Display and change virtual drive's properties on the adapter
- Display and change physical drive's properties on the adapter
- Display and change adapter properties
- Load a configuration to the adapter from a file
- Save an adapter configuration to a file
- Start or stop rebuild, consistency check, and initialization
- Suspend and display an ongoing background initialization
- Display relevant user messages on the console or write them to the log file
- Work in silent mode, if selected (no messages are displayed on the console)
- Display adapter inventory data in a single command
- Customize output strings
- Exit with predefined success or failure exit codes
- Set some predefined environment variables, such as number of adapters and number of virtual drives after the execution of CT
- Display help on how to use the command line options of CT

5.2   Exception Handling

MegaCLI CT exits with exit code 0 for all successful operations. In case of failure, it exits with exit code 1 to 255, depending on the failure conditions. For example, assume that a rebuild is started on three physical drives. MegaCLI CT successfully starts rebuilding the first drive but fails to start rebuilding the second drive. If this happens, MegaCLI CT does not attempt to start rebuilding the third drive; instead, it exits with an error exit code. In this case, the error code is EXIT_ERR_START_RBLD. So even if the command was partially successful, an error code is still generated.

Some operations, such as GetNumberOfAdapters or GetNumberOfLogicalDrives return with the actual number of controllers or virtual drives. These return values are special cases and do not reflect any error conditions based on the return code, which in these cases contains meaningful values.

5.3 Command Line Abbreviations and Conventions

This section explains the abbreviations and conventions used with MegaCLI Configuration Utility commands.

5.3.1 Abbreviations Used in the Command Line

The following table lists the abbreviations for the virtual drive parameters used in the following sections.

Table 5 Command Line Abbreviations

Abbreviation	Description
WB	Writeback write policy
WT	Writethrough write policy
ADRA	Adaptive read ahead read policy
RA	Read ahead read policy
NORA	Normal read policy (No read ahead)
DIO	Direct I/O cache policy
CIO	Cached I/O cache policy

5.3.2 Conventions

You can specify multiple values for some options. You can enter commands for a single adapter (-aN), multiple selected adapters (-a0,1,2) or all adapters (-aALL). These options are denoted as -aN| -a0,1,2|-aALL in the command line syntax used in this chapter. The following table lists all of the conventions used in the command line options and specifies that you can enter commands for one controller, multiple controllers, or all controllers.

> **NOTE** All options in the MegaRAID Command Tool are position-dependent, unless otherwise specified.

Table 6 Conventions

Convention	Description
MegaCLI	Specifies the command line interface used. Type MegaCLI under Microsoft Windows and Linux.
|	Specifies "or," meaning you can choose between options.
-aN	N specifies the adapter number for the command.
-a0,1,2	Specifies the command is for adapters 0, 1, and 2. You can select two or more controllers in this manner.
-aALL	Specifies the command is for all adapters.
-Lx	x specifies the virtual drive number for the command.
-L0,1,2	Specifies the command is for virtual drives 0, 1, and 2. You can select two or more virtual drives in this manner.
-Lall	Specifies the command is for all virtual drives.
[E0:S0,E1,S1,…]	Specifies when one or more physical devices must be specified in the command line. Each [E:S] pair specifies one physical device where E means device ID of the enclosure in which a drive resides, and S means the slot number of the enclosure.

Table 6 Conventions (Continued)

Convention	Description
[ ]	Indicates that the parameter is optional.
{ }	Indicates that the parameters are grouped and that they must be given at the same time.
-Force	Specifies that the MegaCLI utility does not ask you for confirmation before it performs this command. You might lose data using this option with some commands.

You can specify the -Silent command line option for all possible functions of the MegaCLI CT. If you enter this option at the command line, no messages appear on the screen.

Some MegaCLI CT commands that are supported in hardware RAID configurations are *not* supported under Embedded MegaRAID Software. These commands include the following commands:

- Adapter Cache Flush (-AdpCacheFlush)
- Set Adapter Properties: Only the RebuildRate, BgiRate, CCRate, and CoercionMode properties are supported
- Get Adapter Properties: Only the RebuildRate, BgiRate, CCRate, and CoercionMode properties are supported
- Cluster Enable is not supported
- Set Adapter Time (-AdpSetTime)
- Foreign configuration (-CfgForeign)
- Virtual Drive Reconstruction (-LDRecon)
- Set Virtual Drive Properties (-LDSetProp)
- Display Enclosure Information (-EncInfo)
- Mark Configured Physical Disk Drive as Missing (-PDMarkMissing)
- Display List of Missing Physical Disk Drives (-PDGetMissing)
- Diagnostics (-AdpDiag, -AdpBatTest, -AdpNVRAM)

The following sections describe the MegaCLI CT commands.

> **NOTE** The Embedded MegaRAID Software utility does not support write policy, read policy, or I/O policy. Software RAID supports only enabling and disabling the drive's write cache and read-ahead functions.

> **NOTE** MegaCLI CT for Embedded MegaRAID Software does not support the concept of disk enclosures, except for a default *Enclosure 0* (E0). Some of the commands support an E0:Sn syntax that enables you to specify a drive in a particular *slot* in this default enclosure.

5.4   Adapter Commands

You can use the commands in this section to set or display properties related to the adapter or adapters.

> **NOTE** The Embedded MegaRAID Software drivers function as virtual *adapters* or *controllers*. Because the drivers are not actual hardware components, some of the adapter parameters do not apply to them.

5.4.1 Display Adapter Information

Use the command in the following table to display information on adapter parameters such as the number of virtual drives and initiator ID.

Table 7 Display Adapter Information

Syntax	`MegaCLI –AdpAllInfo -aN|-a0,1,2|-aALL`
Description	Displays parameters on the selected adapter or adapters. Displayed information includes initiator ID, current status of auto rebuild, alarm, number of virtual drives, rebuild rate, bus number/device number, present RAM, settings, serial number of the board, and address.

5.4.2 Enable or Disable Automatic Rebuild

Use the command in the following table to turn automatic rebuild on or off for the selected adapter or adapters. If you have configured hot spares and enabled automatic rebuild, the RAID adapter automatically tries to use them to rebuild failed disks. Automatic rebuild also controls whether a rebuild starts when a drive that was part of the array is reinserted.

Table 8 Enable or Disable Automatic Rebuild

Syntax	`MegaCLI –AdpAutoRbld -Enbl|-Dsbl|-Dsply -aN|-a0,1,2|-aALL`
Description	Enables or disables automatic rebuild on the selected adapter or adapters.
	The `-Dsply` option shows the status of the automatic rebuild state.

5.4.3 Set Adapter Properties

This command sets the properties on the selected adapter or adapters. For example, for `{RebuildRate -val}`, you can enter a value between 0 percent and 100 percent. (The rebuild rate is the percentage of the compute cycles dedicated to rebuilding failed drives.) At 0 percent, the rebuild is done only if the system is not doing anything else. At 100 percent, the rebuild has a higher priority than any other system activity.

> **NOTE** The default rebuild rate of 30 percent is recommended.

Use the command in the following table to display or set adapter properties.

Table 9 Set Adapter Properties

| Syntax | `MegaCLI –AdpSetProp {CacheFlushInterval –val}|{RebuildRate –val}|`
`{PatrolReadRate –val}|{BgiRate –val}|{CCRate –val}| {ReconRate –val}|`
`{SpinupDriveCount –val}|{SpinupDelay –val}|{CoercionMode –val} |`
`{ClusterEnable –val}|{PredFailPollInterval –val}| {BatWarnDsbl –val}|`
`{EccBucketSize –val}|{EccBucketLeakRate –val}|{AbortCCOnError`
`–val}|AlarmEnbl | AlarmDsbl | AlarmSilence |{SMARTCpyBkEnbl –val} |`
`-AutoDetectBackPlaneDsbl | -CopyBackDsbl | -LoadBalanceMode | NCQEnbl |`
`NCQDsbl | {SSDSMARTCpyBkEnbl -val} | {MaintainPdFailHistoryEnbl -val} |`
`{EnblSpinDownUnConfigDrvs -val} | {EnblSSDPatrolRead -val} |`
`AutoEnhancedImportEnbl | AutoEnhancedImportDsbl | {-UseFDEOnlyEncrypt`
`-val} | {-PrCorrectUncfgdAreas -val} | -aN| -a0,1,2|-aALL` |

Table 9 Set Adapter Properties (Continued)

Description	Sets the properties on the selected controller or controllers. The possible settings are: ■ CacheFlushInterval – Cache flush interval in seconds. Values: 0 to 255. ■ RebuildRate – Rebuild rate. Values: 0 to 100. ■ PatrolReadRate – Patrol read rate. Values: 0 to 100. ■ BgiRate – Background initilization rate. Values: 0 to 100. ■ CCRate – Consistency check rate. Values: 0 to 100. ■ ReconRate – Reconstruction rate. Values: 0 to 100. ■ SpinupDriveCount – Maximum number of drives to spin up at one time. Values: 0 to 7. ■ SpinupDelay – Number of seconds to delay among spinup groups. Values: 0 to 7. ■ CoercionMode – Drive capacity Coercion mode. Values: 0 - None, 1 - 128 MB, 2 - 1 GB. **NOTE** The coercion type can be set only when there is no configuration present on the adapter.
Description (Continued)	■ ClusterEnable – Cluster is enabled or disabled. Values: 0 - Disabled, 1 - Enabled. ■ PredFailPollInterval – Number of seconds between predicted fail polls. Values: 0 to 65535. ■ BatWarnDsbl – Disable warnings for missing battery or missing hardware. Values: 0 - Enabled, 1 - Disabled. ■ EccBucketSize – Size of ECC single-bit-error bucket. Values: 0 to 255. ■ EccBucketLeakRate – Leak rate (in minutes) of ECC single-bit-error bucket. Values: 0 to 65535. ■ AbortCCOnError – Abort the consistency check if an error occurs during the process. ■ AlarmEnbl – Set alarm to Enabled. ■ AlarmDsbl– Set alarm to Disabled. ■ AlarmSilence– Silence an active alarm. ■ SMARTCpyBkEnbl– Enable copyback operation on Self-Monitoring Analysis and Reporting Technology (SMART) errors. Copyback is initiated when the first SMART error occurs on a drive that is part of a virtual drive. ■ AutoDetectBackPlaneDsbl– Detect automatically if the backplane has been disabled. ■ CopyBackDsbl– Disable or enable the copyback operation. ■ LoadBalanceMode – Disable or enable the load balancing mode. ■ NCQEnbl – Enable the native command queueing. ■ NCQDsbl – Disable the native command queueing. ■ SSDSMARTCpyBkEnbl – Enable copyback operation on Self-Monitoring Analysis and Reporting Technology (SMART) errors on a Solid State Drive (SSD). Copyback is initiated when the first SMART error occurs on a SSD that is part of a virtual drive. ■ MaintainPdFailHistoryEnbl – Enable maintenance of the history of a failed drive. ■ EnblSpinDownUnConfigDrvs – Enable spindown of unconfigured drives. ■ EnblSSDPatrolRead – Enable the patrol read operation (media scan) on a SSD. ■ AutoEnhancedImportEnbl – Enable the automatic enhanced import of foreign drives. ■ AutoEnhancedImportDsbl – Disable the automatic enhanced import of foreign drives. ■ UseFDEOnlyEncrypt – Use encryption on FDE drives only. ■ PrCorrectUncfgdAreas – Correct any media errors found during a patrol read process.

5.4.4 Display Specified Adapter Properties

Use the command in the following table to display specified properties on the selected adapter or adapters.

Table 10 Display Specified Adapter Properties

Syntax	`MegaCLI –AdpGetProp CacheFlushInterval	RebuildRate	PatrolReadRate| BgiRate	CCRate	ReconRate	SpinupDriveCount	SpinupDelay	CoercionMode	PredFailPollInterval	ClusterEnable	BatWarnDsbl	EccBucketSize	EccBucketLeakRate	EccBucketCount	AlarmDsply	AbortCCOnError	AutoDetectBackPlaneDsbl	CopyBackDsbl	LoadBalanceMode	SMARTCpyBkEnbl	SSDSMARTCpyBkEnbl	MaintainPdFailHistoryEnbl	EnblSpinDownUnConfigDrvs	EnblSSDPatrolRead	NCQDsply	UseFDEOnlyEncrypt	WBSupport	AutoEnhancedImportDsbl	PrCorrectUncfgdAreas	DsblSpinDownUnConfigDrvs	-aN|-a0,1,2|-aALL`
Description	Displays the properties on the selected controller or controllers. ■ `EccBucketCount` – Count of single-bit ECC errors currently in the bucket. ■ `WBSupport` – Enables support for the Writeback option as the write policy. ■ `DsblSpinDownUnConfigDrvs` – Disable spindown of unconfigured drives. See the previous table for explanations of the other options.

5.4.5 Set Time and Date on Controller

Use the command in the following table to set the time and date on the selected controller or controllers.

Table 11 Set Time and Date on Controller

Convention	`MegaCLI –AdpSetTime yyyymmdd HH:mm:ss -aN|-a0,1,2|-aALL`
Description	Sets the time and date on the controller. This command uses a 24-hour format. For example, 7 p.m. displays as `19:00:00`. The order of date and time is reversible.

5.4.6 Display Adapter Time

Use the command in the following table to display the current time and date of the selected adapter.

Table 12 Display Adapter Time

Syntax	`MegaCLI –AdpGetTime -aN`
Description	Displays the time and date on the controller. This command uses a 24-hour format. For example, 7 p.m. would display as `19:00:00`.

5.4.7 Set Factory Defaults

Use the command in the following table to set the factory defaults on the selected adapter or adapters.

Table 13 Set Factory Defaults

Syntax	`MegaCLI -AdpFacDefSet -aN|-a0,1,2|-aALL`
Description	Sets the factory defaults on the selected adapter or adapters. You cannot set the factory defaults if the adapter already has a configuration defined on it.

5.5   Event Log Commands

5.5.1   Manage the Event Log Entries

Use the command in the following table to manage the event entries in the event log for the selected adapter or adapters.

Table 14 Event Log Management

Syntax	`MegaCLI -AdpEventLog -GetEventlogInfo |{-GetEvents	GetSinceShutdown| GetSinceReboot	IncludeDeleted	{GetLatest <number>} -f <filename>} |Clear -aN|-a0,1,2|-aALL`
Description	The RAID driver maintains a volatile circular list of 100 events, which is deleted at reboot. The following command options are available: ■ `-GetEventlogInfo` – Displays overall event information such as total number of events, newest sequence number, oldest sequence number, shutdown sequence number, reboot sequence number, and clear sequence number. ■ `-GetEvents` – Gets event log entry details. The information shown consists of the total number of entries and the details of each error log entry. Start_entry specifies the initial event log entry when displaying the log. ■ `-GetSinceShutdown` – Displays all the events since last adapter shutdown. ■ `-GetSinceReboot` – Displays all the events since last adapter reboot. ■ `-IncludeDeleted` – Displays all events, including deleted events. ■ `-GetLatest` – Displays the latest number of events, if it exists. The event data is written to the file in reverse order. ■ `-Clear` – Clears the event log for the selected adapter or adapters.

5.6   Configuration Commands

You can use the commands in this section to create storage configurations.

5.6.1 Add RAID 0, 1, or 5 Configuration

Use the command in the following table to add a RAID level 0, 1, or 5 configuration to the existing configuration on the selected adapter. For RAID level 10, see Section 5.6.3, Add RAID 10 Configuration.

Table 15 Add RAID 0, 1, or 5 Configuration

Syntax	`MegaCLI -CfgLDAdd  -R0|-R1|-R5[[E0]:Sn] [ -szXXXXXXXX [-szYYYYYYYY [...]]] [-strpszM] [-Hsp[E5:S5,...]] [-afterLdX]  -aN`
Description	Adds a RAID level 0, 1 or 5 configuration to a specified adapter. Even if no configuration is present, you have the option to write the configuration to the adapter. ■ `-Rx[[E0]:Sn]` – Used to specify the RAID level and the physical drive enclosure/slot numbers for a drive group. **NOTE** No enclosure number is needed for simple swap configurations, in which a drive is not part of an enclosure. For example, in a RAID 1 configuration with a drive in slot 2 that is not in an enclosure, and a drive in an enclosure in slot 3, the syntax is -R1[:2,1:3]. ■ `-strpszM` – Used (optionally) to specify a stripe size. You can set the stripe size to 64 KB. ■ `-Hsp[Ex:Sx,…]` – Used to create a global hot spare, with physical drive enclosure/slot numbers specified. ■ `-szXXXX` – Used to specify the size of a virtual drive, where XXXX is a decimal number of MB. However, the actual size of the virtual drive might be smaller, because the driver requires the number of blocks from physical drives in each virtual drive to be aligned to the stripe size. This option can also be used to create a configuration on the free space available in the array. ■ `-AfterLdX` – Used to specify which free slot should be used (optional). By default, MegaCLI CT uses the first free slot available in the array. This option has no meaning if the array is not already used for configuration.

5.6.2 Configure Each Disk as RAID 0

Use the command in the following table to configure each physical disk in Unconfigured-Good state as RAID 0.

NOTE The MegaCLI CT does not support spanning across these single-drive RAID 0 configurations.

Table 16 Configure Each Disk as RAID 0

Syntax	MegaCLI –CfgEachDskRAID0 [{WT | WB }] [{NORA | RA | ADRA}] [{Direct | Cached}] [{-strpszM} -aN|-a0,1,2|-aALL
Description	Configures each physical disk in Unconfigured-Good state as RAID 0 on this controller. The options {WT |WB} {NORA | RA | ADRA} {Direct | Cached} must be entered in the sequence that is shown. ■ WT – Used to select Write-through caching, in which a write transaction is considered to be complete when all the data has been written to the disk cache. ■ WB – Used to select Write-back caching, in which the write transaction is complete only when the data has been written to the disk. ■ NORA – Used to select Normal Read Ahead caching, which specifies that the controller reads only the requested data and does not read ahead for the current virtual drive. ■ RA – Used to select Read Ahead caching, which specifies that data is read sequentially ahead of the data that is actually requested and is stored in a cache. If the additional read-ahead data is then requested, it can be read faster from the cache than from the disk directly. Read-Ahead supplies sequential data faster, but is not as effective when accessing random data. ■ ADRA – Used to select Adaptive Read Ahead, which specifies that the controller begins using Read Ahead caching 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. If you select Read Ahead, there is a danger that data could be lost if the power fails before the cached data is written to disk. ■ Direct – Used to specify that the controller does not buffer reads in cache memory. Data is transferred to cache and the host concurrently. If the same data block is read again, it comes from cache memory. ■ Cached – Used to specify that the controller buffers all reads in cache memory. ■ {-strpszM} – Used to specify the size of the segments written to each drive in the configuration. You can set the stripe size to 64 KB.

5.6.3   Add RAID 10 Configuration

Use the command in the following table to add a RAID 10 configuration to the existing configuration on the selected adapter. For RAID levels 0, 1 or 5, see Section 5.6.1, Add RAID 0, 1, or 5 Configuration.

NOTE On a RAID 10 array, you can create only one virtual drive, and that virtual drive must occupy the entire space of the RAID 10 array.

Table 17 Add RAID 10 Configuration

Syntax	MegaCLI –CfgSpanAdd -R10| –Array0[E0:Sn] –Array1[E0:Sn] [...] [{WT | WB}] [{NORA | RA | ADRA}] [{Direct | Cached}] [{-strpszM}] -aN
Description	Creates a RAID level 10 (spanned) configuration from the specified arrays. Even if no configuration is present, you must use this option to write the configuration to the adapter. Multiple arrays are specified using the –ArrayX[E0:Sn,...] option. (Note that *X* starts from 0, not 1.) All the arrays must have the same number of physical drives. At least two arrays must be provided. The options {WT |WB} {NORA | RA | ADRA} {Direct | Cached} must be entered in the sequence that is shown.

5.6.4 Clear Existing Configuration

Use the command in the following table to clear the existing storage configuration on the selected adapter or adapters.

Table 18 Clear Existing Configuration

Syntax	MegaCLI –CfgClr -aN|-a0,1,2|-aALL
Description	Clears the existing storage configuration.

5.6.5 Display Existing Configuration

Use the command in the following table to display the virtual drive and physical disk drive information for the configuration on the selected adapter or adapters. This command also provides information about the remaining unconfigured space.

Table 19 Display Existing Configuration

Syntax	`MegaCLI  –CfgDsply -aN|-a0,1,2|-aALL`
Description	Displays the existing configuration on the selected adapter or adapters, which includes the virtual drive and component physical drive related details.

5.6.6 Save Adapter Configuration

Use the command in the following table to save the configuration for the selected adapter or adapters to the given file name.

Table 20 Save Adapter Configuration

Syntax	`MegaCLI –CfgSave  –fFileName  -aN`
Description	Saves the configuration for the selected adapter or adapters to the given file name, in binary format. The command also stores the controller properties structure in the file.

5.6.7 Restore Configuration Data from File

Use the command in the following table to read the configuration from the file and load it on the selected adapter or adapters. You can restore the read/write properties and RAID configuration using hot spares.

Table 21 Restore Configuration Data from File

Syntax	`MegaCLI –CfgRestore  –fFileName  -aN`
Description	Reads the configuration from the file and loads it on the adapter. MegaCLI can store or restore all read and write adapter properties, all read and write properties for virtual drives, and the RAID configuration including hot spares.
	NOTE The `–CfgSave` option stores the configuration data and adapter properties in the file. Configuration data has only the device ID and sequence number information of the physical drives used in the configuration. The `CfgRestore` option fails if the same device IDs of the physical drives are not present. The utility does not validate the setup before restoring the configuration.

5.6.8   Delete Virtual Drive or Drives

Use the command in the following table to delete one or more virtual drives on the selected adapter or adapters.

Table 22 Delete Virtual Drives

Syntax	MegaCLI –CfgLDDel–Lx|-L0,1,2|-Lall -aN|-a0,1,2|-aALL
Description	Deletes one virtual drive, multiple virtual drives, or all the selected virtual drives on selected adapter or adapters.

5.6.9   Display Free Space

Use the command in the following table to display the free space that is available to use for configuration on the selected adapter or adapters.

Table 23 Display Free Space

Syntax	`MegaCLI –CfgFreeSpaceInfo -aN|-a0,1,2|-aALL`
Description	Displays all the free space available for configuration on the selected adapter or adapters. The information includes the number of disk groups, the number of spans in each disk group, the number of free space slots in each disk group, the start block, and the size (in both blocks and MB) of each free space slot.

5.7   Virtual Drive Commands

You can use the commands in this section to select settings for the virtual drives and to perform actions on them.

5.7.1   Display Virtual Drive Information

Use the command in the following table to display information about virtual drives on the selected adapter or adapters.

Table 24 Display Virtual Drive Information

Syntax	`MegaCLI –LDInfo –Lx|-L0,1,2|-Lall -aN|-a0,1,2|-aALL`
Description	Displays information about the virtual drive or drives on the selected adapter or adapters. This information includes the name, RAID level, RAID level qualifier, size in MB, state, stripe size, number of drives, and span depth. It also displays activity progress, if any, including initialization, background initialization, and consistency check.

5.7.2   Display Virtual Drive Disk Cache Settings

Use the command in the following table to display the disk cache settings for the virtual drive or drives on the selected adapter or adapters.

Table 25 Display Virtual Drive Cache Settings

Syntax	MegaCLI –LDGetProp -DskCache -Lx|-L0,1,2| -Lall -aN|-a0,1,2|-aALL
Description	Displays the disk cache settings of the virtual drive or drives. `–DskCache` – Displays physical drive cache policy. **NOTE** Embedded MegaRAID Software does not support setting virtual drive parameters.

5.7.3 Manage Virtual Drive Initialization

Use the command in the following table to manage initialization of the virtual drive or drives on the selected adapter or adapters.

> ✎ **NOTE** This command is not supported in DOS.

Table 26 Manage Virtual Drive Initialization

Syntax	`MegaCLI -LDInit -Start [Fast	Full] |-Abort|-ShowProg|-ProgDsply -Lx|-L0,1,2|-Lall -aN|-a0,1,2|-aALL`
Description	Allows you to select the following actions for virtual drive initialization: ■ `-Start` – Starts the initialization (writing 0s) on the virtual drive or drives and displays the progress (optional). The fast initialization option initializes the first 100 MB on the virtual drive. The full option allows you to initialize the entire virtual drive. ■ `-Abort` – Aborts the ongoing initialization on the LD or LDs. ■ `-ShowProg` – Displays the snapshot of the ongoing initialization, if any. ■ `-ProgDsply` – Displays the progress of the ongoing initialization until at least one initialization is completed or a key is pressed.

5.7.4 Manage Consistency Check

Use the command in the following table to manage a data consistency check (CC) on the virtual drives for the selected adapter or adapters.

> ✎ **NOTE** This command is not supported in DOS.

Table 27 Manage Consistency Check

Syntax	`MegaCLI -LDCC -Start|-Abort|-ShowProg|-ProgDsply -Lx|-L0,1,2|-Lall -aN|-a0,1,2|-aALL`
Description	Allows you to select the following actions for a data consistency check: ■ `-Start` – Starts a CC on the virtual drive or drives, and then displays the progress (optional) and time remaining. ■ `-Abort` – Aborts an ongoing CC on the virtual drive or drives. ■ `-ShowProg` – Displays a snapshot of an ongoing CC. ■ `-ProgDsply` – Displays ongoing CC progress until at least one CC is completed or a key is pressed.

5.7.5 View Ongoing Background Initialization

Use the command in the following table to view ongoing background initialization of the selected virtual drives, after the `-LDInit` command has been issued to start the initialization. This function completes only when all background initialization processes complete or you press a key to exit.

> ✎ **NOTE** This command is not supported in DOS.

Table 28 View Ongoing Background Initialization

Syntax	MegaCLI –LDBI -Enbl|-Dsbl|-GetSetting|-ShowProg|-ProgDsply –Lx| -L0,1,2|-Lall -aN|-a0,1,2|-aALL
Description	Displays ongoing background initialization of the selected virtual drives. This function completes only when all background initialization processes complete or you press a key to exit. ■ -Enbl, -Dsbl – Enables or disables the background initialization on the given adapter or adapters. ■ -ProgDsply – Allows you to view ongoing background initialization until all background initialization processes complete or you press a key to exit. ■ -ShowProg – Displays current progress value. ■ -GetSetting – Displays current background initialization setting (enabled or disabled).

5.7.6   Display Virtual Drive and Physical Drive Information

Use the command in the following table to display information about the virtual drives and physical disk drives for the selected adapter or adapters, such as the number of virtual drives, RAID level, and physical disk drive size.

Table 29 Display Virtual Drive and Physical Disk Drive Information

Syntax	MegaCLI –LDPDInfo -aN|-a0,1,2|-aALL
Description	Displays information about the virtual drive or drives and physical disk drive or drives on the selected adapter or adapters. Displays information including the number of virtual drives, the RAID level of the virtual drives, and physical drive size information, which includes the raw size, coerced size, uncoerced size, and address.

5.7.7   Display Number of Virtual Drives

Use the command in the following table to display the number of virtual drives attached to the adapter.

Table 30 Display Number of Virtual Drives

Syntax	MegaCLI –LDGetNum -aN|-a0,1,2|-aALL
Description	Displays the number of virtual drives attached to the adapter. The return value is the number of virtual drives.

5.8   Drive Commands

You can use the commands in this section to select settings for the drives and perform actions on them.

5.8.1   Display Drive Information

Use the command in the following table to display information about the drives on the selected adapter or adapters.

Table 31 Display Physical Disk Drive Information

Syntax	MegaCLI –PDInfo -aN|-a0,1,2|-aALL –PhysDrv[E0:Sn,..]
Description	Provides information about the drives connected to the enclosure and controller slot. This includes information such as the enclosure number, slot number, device ID, sequence number, drive type, capacity (if a drive), foreign state, and inquiry data. -Physdrv[E0:S0,...]: Specifies the physical drive enclosure and the slots for the drives to provide information about.

5.8.2 Set the Drive State to Online

Use the command in the following table to set the state of a drive to Online. In an online state, the drive is working normally and is a part of a configured virtual drive.

Table 32 Set Physical Disk Drive State to Online

Syntax	MegaCLI –PDOnline –PhysDrv[E0:Sn....] -aN|-a0,1,2|-aALL
Description	Changes the drive state to *Online*. –Physdrv[E0:S0,...]: Specifies the physical drive enclosure and the slots for the drives.

5.8.3 Set the Drive State to Offline

Use the command in the following table to set the state of a drive to Offline. In the offline state, the virtual drive is not available to the controller.

Table 33 Set Physical Disk Drive State to Offline

Syntax	MegaCLI –PDOffline –PhysDrv[E0:S....] -aN|-a0,1,2|-aALL
Description	Changes the drive state to *Offline*. –Physdrv[E0:S0,...]: Specifies the physical drive enclosure and the slots for the drives.

5.8.4 Change the Drive State to Unconfigured-Good

Use the command in the following table to change the state of a drive from Unconfigured-Bad to Unconfigured-Good.

Table 34 Set Physical Disk Drive State to Unconfigured-Good

Syntax	MegaCLI –PDMakeGood –PhysDrv[E0:Sn...] -aN|-a0,1,2|-aALL
Description	Changes the drive state to *Unconfigured Good*. –Physdrv[E0:S0,...]: Specifies the physical drive enclosure and the slots for the drives. Force: Force the drive to the *Unconfigured Good* state.

5.8.5 Change the Drive State

Use the command in the following table to change the drive state, as it relates to hot spares, and to associate the drive to an enclosure and to a drive group for the selected controller or controllers.

Table 35 Change Drive State

Convention	MegaCLI –PDHSP {–Set [{-Dedicated -ArrayN |-Array0,1...}] [-EnclAffinity] [-nonRevertible] }	-Rmv -PhysDrv[E0:S0,E1:S1,...] -aN|-a0,1,2|-aALL
Description	Changes the drive state (as it relates to hot spares) and associates the drive to an enclosure and virtual drive on a single controller, multiple controllers, or all controllers: –Set: Changes the drive state to *dedicated hot spare* for the enclosure. –Array0: Dedicates the hot spare to a specific drive group number N. –EnclAffinity: Associates the hot spare to a selected enclosure. –Rmv: Changes the drive state to *ready* (removes the hot spare). –Physdrv[E0:S0,...]: Specifies the physical drive enclosure and the slots for the drives. You can get the list of arrays by using the CLI command CfgDsply. In the results of the CfgDsply command, the number associated with DISK GROUPS is the array number.

5.8.6   Manage a Drive Initialization

Use the command in the following table to manage a drive initialization on the selected controller or controllers.

Table 36 Drive Initialization

Convention	MegaCLI –PDClear -Start |-Stop|-ShowProg |-ProgDsply -PhysDrv[E0:S0,E1:S1....] -aN|-a0,1,2|-aALL
Description	Manages initialization or displays initialization progress on a single controller, multiple controllers, or all controllers: –Start: Starts initialization on the selected drive or drives. –Stop: Stops an ongoing initialization on the selected drive or drives. –ShowProg: Displays the current progress percentage and time remaining for the initialization. This option is useful for running the application through scripts. –ProgDsply: Displays the ongoing clear progress. The routine continues to display the initialization progress until at least one initialization is completed or a key is pressed.

5.8.7   Manage Global Hot Spares

Use the command in the following table to manage the configuration and assignment of global hot spares. Make sure the capacity of the hot spare drive is equal to or larger than the capacity of the disks in the drive group and that it is the same type of drive.

> **NOTE** The hot spare drive rebuilds a failed drive even if the hot spare drive and the drives in the drive group are different types of drives. After the rebuild is completed, LSI recommends that you replace the new drive group member with a drive of the same type.

Table 37 Manage Hot Spares

Syntax	MegaCLI –PDHSP {-Set	-Rmv} -PhysDrv[E0:Sn....] -aN|-a0,1,2|-aALL
Description	■ –Set – Changes the physical disk drive state to hot spare for the enclosure. ■ –Rmv – Changes the physical drive state to ready (removes the hot spare).

5.8.8   Rebuild a Drive

Use the command in the following table to start or stop a rebuild on a physical disk drive and display the rebuild progress. When a physical disk in an array fails, you can rebuild the physical disk by recreating the data that was stored on the physical disk before it failed.

Table 38 Rebuild Physical Disk Drive

Syntax	MegaCLI –PDRbld –Start |-Stop|-ShowProg |-ProgDsply –PhysDrv [E0:Sn....] -aN|-a0,1,2|-aALL
Description	Manages a drive rebuild or displays the rebuild progress on a single controller, multiple controllers, or all controllers. Note that the drive must meet the capacity requirements before it can be rebuilt, and it must be part of a drive group: ■ –Start: Starts a rebuild on the selected drive or drives and displays the rebuild progress (optional). ■ –Stop: Stops an ongoing rebuild on the selected drive or drives. ■ –ShowProg: Displays the current progress percentage and time remaining for the rebuild. This option is useful for running the application through scripts. ■ –ProgDsply: Displays the ongoing rebuild progress. This routine displays the rebuild progress until at least one initialization is completed or a key is pressed. ■ –Physdrv[E0:S0,...]: Specifies the physical drive enclosure and the slots for the drives.

5.8.9 Locate Physical Disk Drive or Drives and Activate LED

Use the command in the following table to locate physical disk drive or drives by flashing the drive activity LED.

Table 39 Locate Drive and Activate LED

Syntax	`MegaCLI -PDLocate -Start |-Stop -PhysDrv[E0:Sn....] -aN|-a0,1,2|-aALL`
Description	Locates the drive or drives for the selected controller or controllers and activates the drive activity LED. `-Physdrv[E0:S0,...]`: Specifies the physical drive enclosure and the slots for the drives.

5.8.10 Replace Configured Disk Drives and Start Automatic Rebuild

Use the command in the following table to replace a configured physical disk drive and start an automatic rebuild of the drive.

Table 40 Replace Configured Disk Drives and Start Automatic Rebuild

Syntax	MegaCLI –PDReplaceMissing –PhysDrv[E0:Sn] –ArrayX –RowY -aN
Description	Replaces the configured physical drives, and then starts an automatic rebuild. The specified array Index and row must be a missing drive.

5.8.11 Prepare Unconfigured Physical Drives for Removal

Use the command in the following table to prepare an unconfigured physical disk drive or drives for removal from the selected adapter or adapters.

Table 41 Prepare Unconfigured Physical Disk Drives for Removal

Syntax	`MegaCLI -PDPrpRmv [-Undo] -PhysDrv[E0:Sn....] -aN|-a0,1,2|-aALL`
Description	Prepares unconfigured physical drive or drives for removal. The drive is spun down, and the drive state is set to unaffiliated, which marks it as offline even though it is not a part of configuration. The `-Undo` option undoes this operation, and the physical disk is marked as Unconfigured-Good.

5.8.12 Display Number of Physical Drives

Use the command in the following table to display the total number of physical disk drives attached to an adapter.

Table 42 Display Number of Physical Disk Drives

Syntax	`MegaCLI -PDGetNum -aN|-a0,1,2|-aALL`
Description	Displays the total number of physical disk drives attached to an adapter. The return value is the number of physical disk drives.

5.8.13 Display List of Physical Drives

Use the command in the following table to display a list of the physical drives connected to the selected adapter or adapters.

Table 43 Display List of Physical Drives

Syntax	`MegaCLI –PDList –aN|-a0,1..|-aAll`
Description	Displays information about all physical disk drives connected to the selected adapter or adapters. This information includes information such as the drive type, size, and serial number.

5.9 Miscellaneous Commands

The commands in this section are used to display various information.

5.9.1 Display MegaCLI Version

Use the command in the following table to display the version number of the MegaCLI utility.

Table 44 Display MegaCLI Version

Syntax	`MegaCLI –v`
Description	Displays the version number of the MegaCLI utility.

5.9.2 Display MegaCLI Help

Use the command in the following table to display help information for the MegaCLI utility.

Table 45 Display MegaCLI Help

Syntax	`MegaCLI –h|–Help|?`
Description	Displays help for the MegaCLI utility.

Chapter 6: MegaRAID Storage Manager Overview and Installation

MegaRAID Storage Manager (MSM) is a configuration and monitoring utility used with Embedded MegaRAID Software. This chapter provides a brief overview of the MegaRAID Storage Manager and explains how to install it on the supported operating systems.

6.1 Overview

MegaRAID Storage Manager can be installed either on the local system that contains the MegaRAID controllers that you wish to monitor, or on a remote system such as a workstation or a laptop with network connectivity to the system you wish to monitor. Because of these options, the system hardware and software requirements for installing MegaRAID Storage Manager might differ from the system requirements for the MegaRAID controller or controllers you are using.

MegaRAID Storage Manager enables you to configure, monitor, and maintain storage configurations created under Embedded MegaRAID Software. The MegaRAID Storage Manager graphical user interface (GUI) makes it easy for you to create and manage storage configurations.

NOTE MegaRAID Storage Manager can be used to manage a wide range of MegaRAID controllers. Some MegaRAID Storage Manager features are not applicable for Embedded MegaRAID Software.

6.1.1 Creating Storage Configurations

MegaRAID Storage Manager enables you to easily configure the controllers, disk drives, and virtual disks on your workstation or server. The Simple Configuration mode and the Advanced Configuration mode greatly simplify the process of creating drive groups and virtual drives. You can use the these configuration modes to create the best possible configuration with the available hardware.

You can create the following types of configurations:

- **Simple configuration** – Specifies a limited number of settings and has the system select drives for you. This option is the easiest way to create a virtual drive.
- **Advanced configuration** – Lets you choose additional settings and customize virtual drive creation. This option provides greater flexibility when creating virtual drives for your specific requirements.

See Section 8.1, Creating a New Storage Configuration, for the procedures used to create storage configurations.

6.1.2 Monitoring Storage Devices

MegaRAID Storage Manager displays the status of virtual disks, physical disks, and other storage devices on the workstation or server that you are monitoring. System errors and events are recorded in an event log file and are displayed on the screen. Special device icons appear on the screen to notify you of disk failures and other events that require immediate attention.

6.1.3 Maintaining Storage Configurations

You can use MegaRAID Storage Manager to perform system maintenance tasks such as running consistency checks on arrays that support redundancy.

6.2　Hardware and Software Requirements

MegaRAID Storage Manager has the following hardware requirements:

- PC-compatible computer with an IA-32 (32-bit) Intel® Architecture processor or an EM64T (64-bit) processor and at least 128 MB of system memory

  > **NOTE** LSI recommends that you use at least 1 Gbyte of system memory.

- Physical drive with at least 50 MB available free space

MegaRAID Storage Manager supports these operating systems:

- Microsoft Windows Server versions 2008, 2008R2
- Red Hat Enterprise Linux (RHEL) 5 and 6
- SUSE Linux Enterprise Server (SLES) 10 and 11, with latest updates and service packs

Refer to your server documentation and to the operating system documentation for more information on hardware requirements and operating system requirements.

6.3　Installation

This section explains how to install (or reinstall) MegaRAID Storage Manager on your workstation or server.

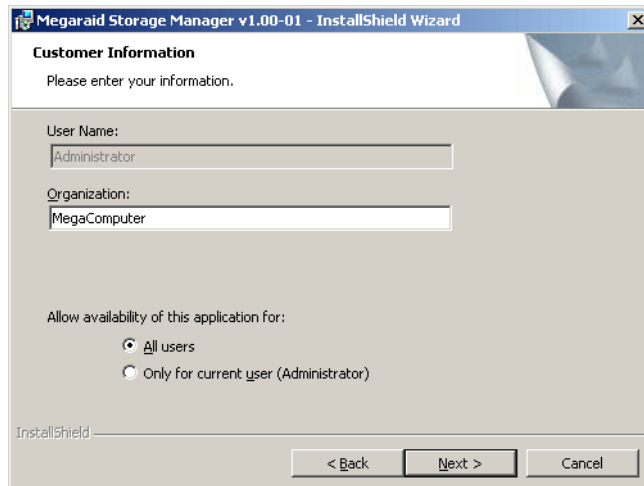### 6.3.1　Installing MegaRAID Storage Manager on Microsoft Windows

Follow these steps to install MegaRAID Storage Manager on a system running a Microsoft Windows operating system:

1. Unzip the zip file containing MegaRAID Storage Manager in Windows Explorer.
2. Double-click the `setup.exe` file to start the installation program.
3. When the Welcome screen appears, click **Next**.

   If MegaRAID Storage Manager is already installed on this system, the Program Maintenance screen appears. Read the screen text and select **Modify**, **Repair**, or **Remove**.

4.   When the next screen appears, read and accept the user license, and click **Next**.

The Customer Information screen appears, as shown in the following figure.

Figure 50 Customer Information Screen

5.   Enter your user name and organization name. In the bottom part of the screen, select an installation option:
     —   If you select **All users**, any user with administrative privileges can use this version of MegaRAID Storage Manager to view or change storage configurations.
     —   If you select **Only for current user**, the MegaRAID Storage Manager shortcuts and associated icons are available only to the user with this user name.

6.   Click **Next** to continue.

7.   On the next screen, accept the default Destination Folder, or click **Change** to select a different destination folder. Click **Next** to continue.

The Setup Type screen appears, as shown in the following figure.

Figure 51 Setup Type Screen
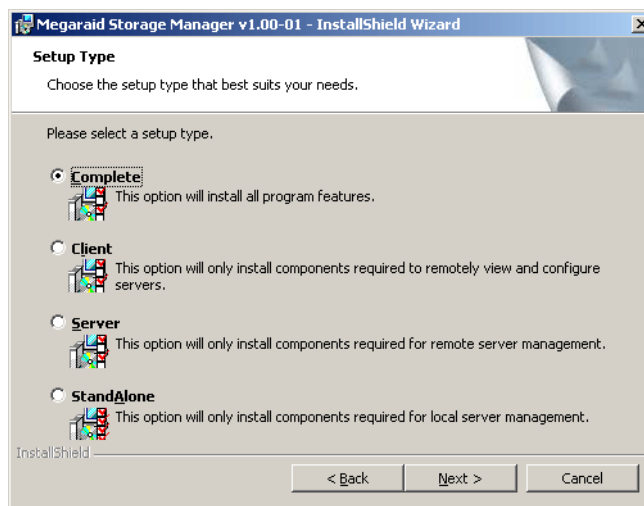
8. Select one of the Setup options.

   The screen text explains the options.

   — Normally, you select **Complete** if you are installing MegaRAID Storage Manager on a server. This option installs the complete MSM.

   — Select **Client** if you are installing MegaRAID Storage Manager on a PC that is used to view and configure servers over a network.

   Master GUI, Monitor Configurator, Help files for both MSM and Monitor Configurator, and DebugLog are available. The following files are not available: Popup, SNMP, Monitor, Framework, Storelib and Storelib-IR, StorelibJNI, and StorelibIRJNI.

   — Select **Server** to install only those components required for remote server management.

   Popup, SNMP, Monitor, Framework, Storelib and Storelib-IR, StorelibJNI, and StorelibIRJNI are available. Master GUI, Monitor Configurator, Help files for both MSM and Monitor Configurator, and DebugLog are not available.

   — Select **StandAlone** if you use MegaRAID Storage Manager to create and manage storage configurations on a stand-alone workstation.

   All of the components are available except for the Network Capability Plugin.

9. Click **Next** to proceed.

10. Click **Install** to install the program.

11. Click **Finish** when the final Configuration Wizard screen appears.

If you select **Client** installation for a PC used to monitor servers, and if there are no available servers with a registered framework on the local subnet (that is, servers with a complete installation of MegaRAID Storage Manager), you cannot connect to a remote server unless you first edit the `startupui.bat` file. Specifically, you must add the IP address of the remote server to the end of the startupui.bat file.

For example, to connect to a remote framework on server 192.168.0.10, add the IP address to the end of `startupui.bat` as shown in this example:

```
start JRE\bin\javaw -classpath .;GUI.jar GUI.VivaldiStartupDialog
ajsgyqkj=71244 192.168.0.10
```

Be sure to include a space in front of the IP address, as shown in the example.

6.3.2 Installing MegaRAID Storage Manager for Linux

Follow these steps to install MegaRAID Storage Manager on a system running Red Hat Linux or SUSE Linux:

1. Copy the `MSM_linux_installer...tar.gz` file to a temporary folder.

2. Untar the `MSM_linux_installer...tar.gz` file using the following command:

   ```
   tar -zxvf MSM_linux_installer...tar.gz
   ```

   A new disk directory is created.

3. Go to the new **disk** directory.

4. In the **disk** directory, find and read the `readme.txt` file.

5. To start the installation, enter the following command:

   ```
   ./install.sh
   ```

If you select **Client** installation for a PC used to monitor servers, and if there are no available servers with a registered framework on the local subnet (that is, servers with a complete installation of MegaRAID Storage Manager), you cannot connect to a remote server unless you first edit the `startupui.sh` file. Specifically, you must add the IP address of the remote server to the end of the `startupui.sh` file.

For example, to connect to a remote framework on server 192.168.0.10, add the IP address to `startupui.sh` as shown in this example:

```
start JRE\bin\javaw -classpath .;GUI.jar GUI.VivaldiStartupDialog
ajsgyqkj=71244 192.168.0.10
```

Be sure to include a space in front of the IP address, as shown in the example.

6.3.3   Linux Installation Messages

One or more of the following messages can appear while you are installing MegaRAID Storage Manager on a Linux system:

- `More than one copy of MegaRAID Storage Manager has been installed.`

  This message indicates that you have installed more than one copy of MegaRAID Storage Manager. (You can perform this installation by using the `rpm-force` command to install the `rpm` file directly, which is not recommended, instead of using the `install.sh` file.) In such cases, you must uninstall all the `rpm` files manually before installing MegaRAID Storage Manager with the procedure listed previously.

- `The version is already installed.`

  This message indicates that the version of MegaRAID Storage Manager you are trying to install is already installed on the system.

- `The installed version is newer.`

  This message indicates that a version of MegaRAID Storage Manager is already installed on the system, and it is a newer version than the version you are trying to install.

- `Exiting installation.`

  This message appears when the installation is complete.

- `RPM installation failed.`

  This message indicates that the installation failed for some reason. Additional message text explains the cause of the failure.

Chapter 7: MegaRAID Storage Manager Screen and Menus

This chapter explains how to start MegaRAID Storage Manager and describes the MegaRAID Storage Manager main menu screen and menus.

7.1 Starting MegaRAID Storage Manager

Follow these steps to start MegaRAID Storage Manager and view the main menu screen:

1. Start the program using the method required for your operating system environment:

   — To start MegaRAID Storage Manager on a Microsoft Windows system, select **Start >> Programs >> MegaRAID Storage Manager >> StartupUI**, or double-click the MegaRAID Storage Manager shortcut on the desktop.

   > **NOTE** If a warning appears stating that Windows Firewall has blocked some features of the program, click **Unblock** to allow MegaRAID Storage Manager to start. (The Windows Firewall sometimes blocks the operation of programs that use Java.)

   — To start MegaRAID Storage Manager on a Red Hat Linux system, select **Applications >> System Tools >> MegaRAID Storage Manager StartupUI**.

   — To start MegaRAID Storage Manager on a SUSE Linux/SLES system, select **Start >> System >> More Programs >> MegaRAID Storage Manager**.

   When the program starts, the Select Server window appears, as shown in the following figure. The remote servers display, along with their IP address, operating system, and health status.

Figure 52 Select Server Window
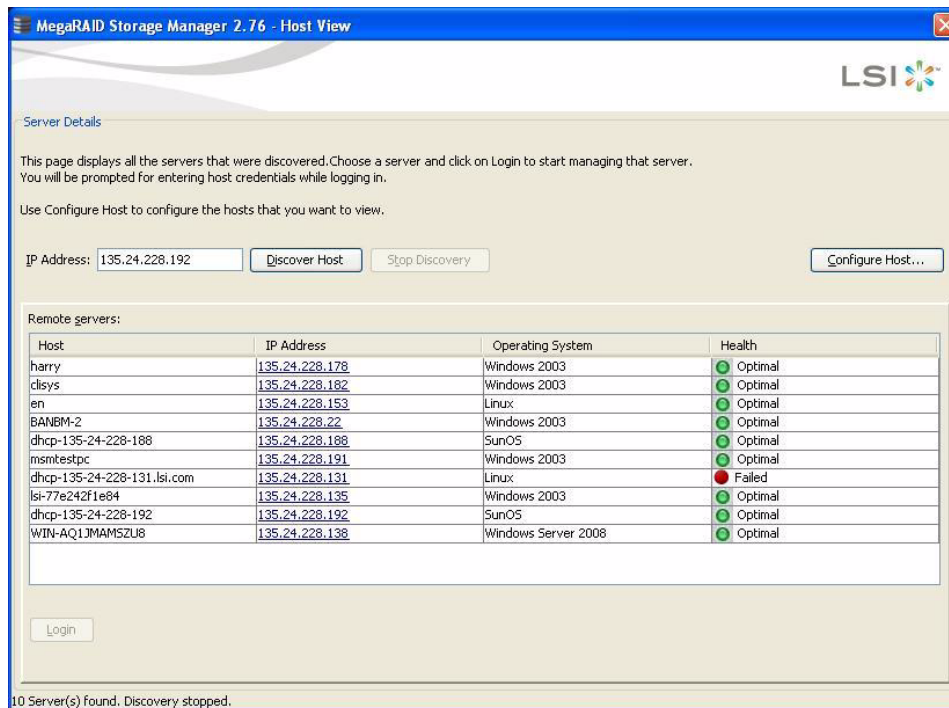
If the circle in the server icon is orange instead of green, it means that the server is running in a degraded state—for example, because a drive used in a virtual drive has failed. If the circle is red, the storage configuration in the server has failed.

> **NOTE** To access servers on a different subnet, type in the box at the bottom of the screen the IP address of a server in the desired subnet where MegaRAID Storage Manager is running, and click **Update**. If you check the **Connect to remote server at: IP** address box, you can also access a standalone (remote) installation of MegaRAID Storage Manager, if it has a network connection.

2. Double-click the icon of the server that you want to access.

   The Server Login window appears, as shown in the following figure.

Figure 53 Server Login Window

3. Enter your user name and password.

   The question mark icon opens a dialog box that explains what you need for full access to the server and for view-only access to the server.

4. Select an access mode from the drop-down menu for **Login Mode**, and click **Login**.
   — Select **Full Access** if you need to both view and change the current configuration.
   — Select **View Only** if you need to only view and monitor the current configuration.

   > **NOTE** If the computer is connected to a network, this procedure is the login to the computer itself, not the network login.

5. Enter the root/administrator user name and password to use the Full Access mode.

   > **NOTE** In Linux, users belonging to the root group can log in. You do not have to be the user *root*.

   If your user name and password are correct for the Login mode you have chosen, the MegaRAID Storage Manager main menu appears.

7.2   MegaRAID Storage Manager Main Menu Screen

This section describes the MegaRAID Storage Manager main menu screen, which is shown in the following figure.

Figure 54 MegaRAID Storage Manager Main Menu Screen
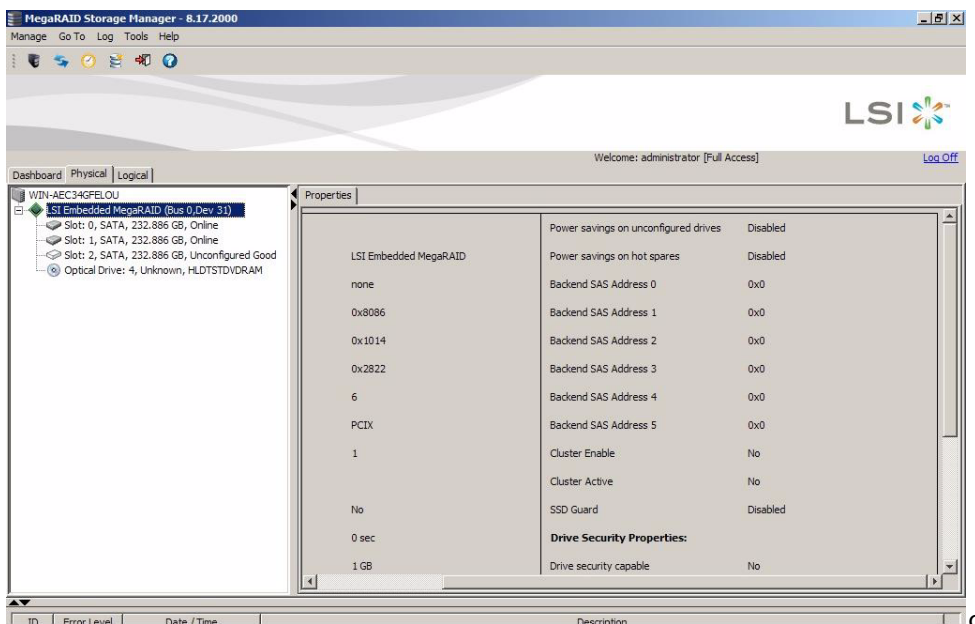
The following sections describe the panels and the menu options that appear on this screen.

7.2.1   Dashboard/Physical View/Logical Views

The left panel of the MegaRAID Storage Manager main menu screen displays the Dashboard view, the Physical view, or the Logical view of the system, and the related devices, depending on which tab is selected.

7.2.1.1   Dashboard View

The Dashboard view shows an overview of the system and covers the following features:

—   Properties of the virtual drives and the physical drives

—   Total capacity, configured capacity, and unconfigured capacity

—   Background operations in progress

—   MSM features and their status (enabled or disabled)

—   Actions you can perform

—   Links to Online Help

The following figure shows the Dashboard view.

Figure 55 MSM Dashboard View
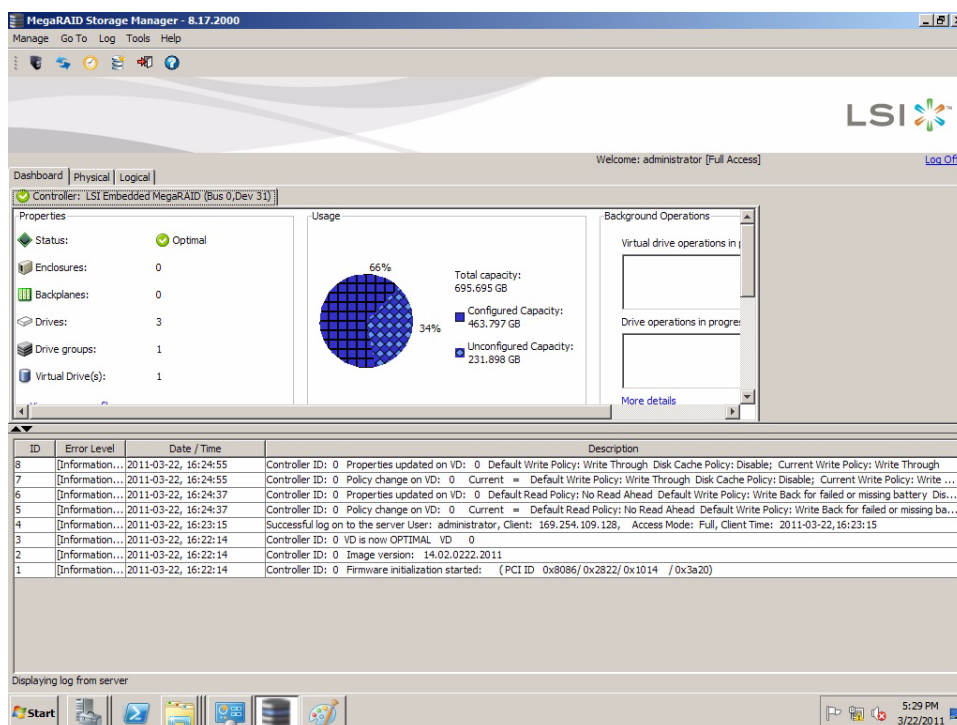

7.2.1.2   Physical View

The Physical view shows the hierarchy of physical devices in the system. At the top of the hierarchy is the system itself, followed by the controller and the backplane.

One or more controllers are installed in the system. The controller label identifies the controller so that you can easily differentiate between multiple controllers. Each controller has one or more ports.

Drives and other devices are attached to the ports. The properties for each device appear in the right panel of the screen under the Properties tab.

The following figure shows the Physical view and the Properties tab.
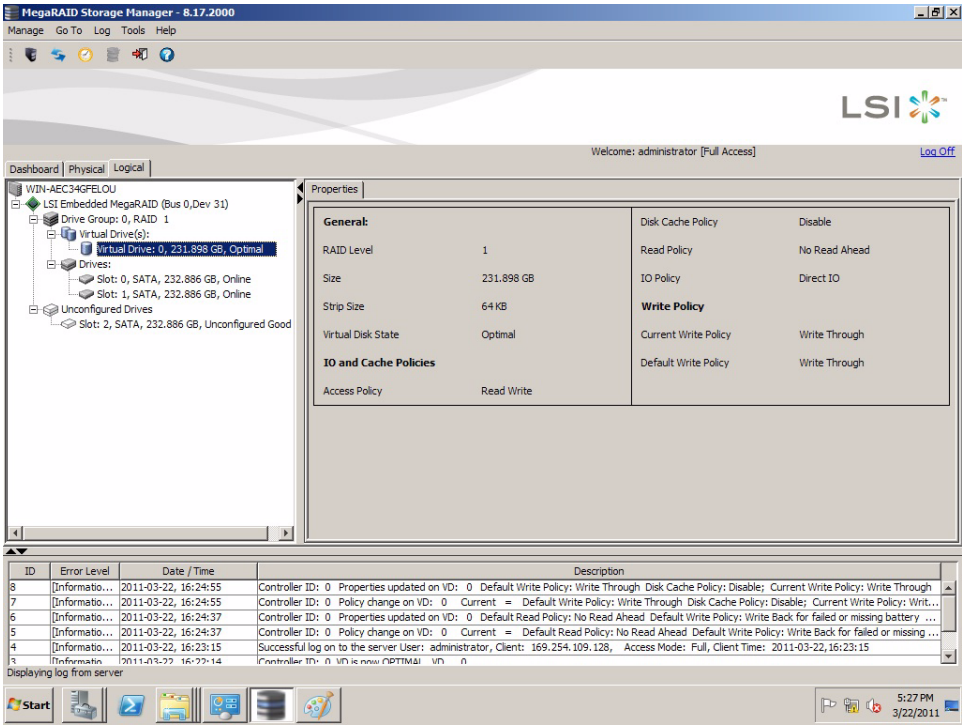
Figure 56 MSM Physical View
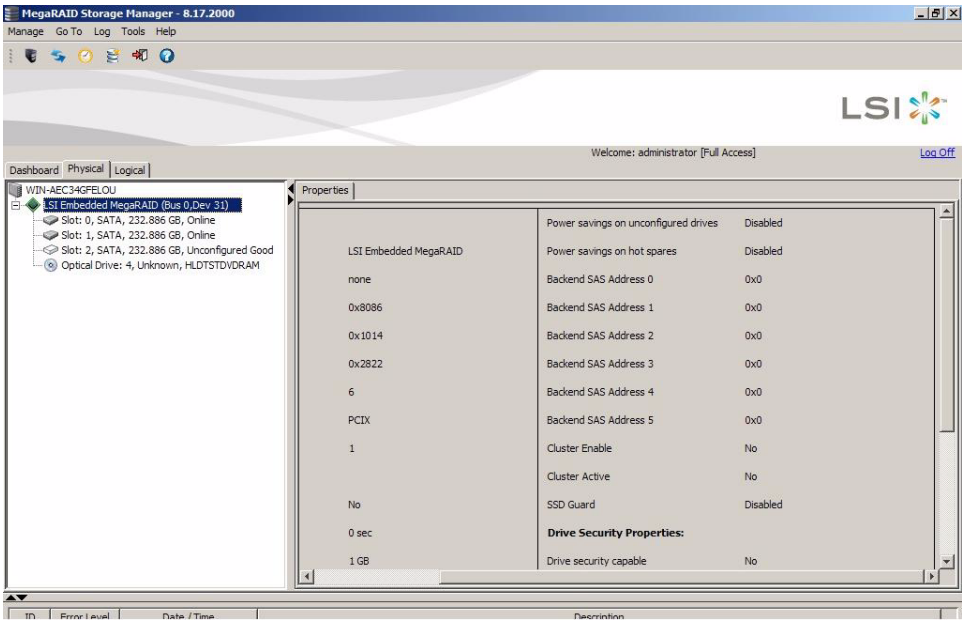
7.2.1.3   Logical View

The Logical view shows the hierarchy of controllers, virtual drives, and the drives and drive groups that make up the virtual drives. The properties for these components appear in the right panel under the Properties tab.

The following figure shows the Logical view.

Figure 57 MSM Logical View

The following icons in the left panel represent the controllers, drives, and other devices:

	Status
	System
	Controller
	Backplane
	Port
	Drive group
	Virtual drive
	Online drive
	Global hot spare
	Tape drive
	CD-ROM
	Foreign Drive
	Unconfigured Foreign Drive
	Unconfigured Drive

> **NOTE** MegaRAID Storage Manager shows the icons for tape drive devices, but the utility does not support tape-related operations. If these operations are required, use a separate backup application.

A red circle to the right of an icon indicates that the device has failed. For example, this icon indicates that a drive has failed: .

A yellow circle to the right of an icon indicates that a device is running in a partially degraded state. For example, this icon indicates that a virtual drive is running in a degraded state because a drive has failed: .

7.2.2 Event Log Panel

The lower part of the MegaRAID Storage Manager main menu screen displays the system event log entries. New event log entries appear during the session. Each entry has an ID, an error level indicating the severity of the event, the timestamp and date, and a brief description of the event.

For more information about the event log, see Section 9.1, Monitoring System Events. For more information about the event log entries, see Appendix A: Events and Messages.

7.2.3 Menu Bar

Brief descriptions of the main selections on the MegaRAID Storage Manager menu bar follow. Specific menu options are described in more detail in Chapter 9, Monitoring System Events and Storage Devices, and Chapter 10, Maintaining and Managing Storage Configurations, of this manual.

7.2.3.1 Manage Menu

The Manage menu has a Refresh option for updating the display in the MegaRAID Storage Manager main menu screen (refresh is seldom required; the display normally updates automatically) and an Exit option to end your session on MegaRAID Storage Manager. The Server menu item shows all the servers that were discovered by a scan. In addition, you can perform a check consistency, initialize multiple virtual groups, and show the progress of group operations on virtual drives.

7.2.3.2 Go To Menu

The Go To menu is available when you select a controller, drive group, physical drive, virtual drive, or battery backup unit in the main menu screen. The menu options vary depending on the type of device selected in the left panel of the MegaRAID Storage Manager main menu. The options also vary depending on the current state of the selected device. For example, if you select an offline drive, the Make Drive Online option appears in the Physical Drive menu.

Configuration options are also available, in which you access the Configuration Wizard to configure drive groups and virtual drives. To access the Wizard, select the controller in the left panel, and then select **Go To >> Controller >> Create Virtual Drive**.

7.2.3.3 Log Menu

The Log menu includes options for saving and clearing the message log. For more information about the Log menu, see Appendix A: Events and Messages.

7.2.3.4 Tools Menu

On the Tools menu you can select **Tools >> Configure Alerts** to access the Configure Alerts screen, which you can use to set the alert delivery rules, event severity levels, exceptions, and email settings. For more information, see Section 9.2, Configuring Alert Notifications.

7.2.3.5 Help Menu

On the Help menu you can select **Help >> Contents** to view the MegaRAID Storage Manager online help file. You can select **Help >> About MegaRAID Storage Manager** to view version information for MegaRAID Storage Manager.

> **NOTE** When you use the MegaRAID Storage Manager Online Help, you might see a warning message that Internet Explorer has restricted the file from showing active content. If this warning appears, click on the active content warning bar and enable the active content.

> **NOTE** If you are using the Linux operating system, you must install Firefox® or Mozilla® for the MegaRAID Storage Manager Online Help to display.

Chapter 8: Configuration

This chapter explains how to use MegaRAID Storage Manager to create and modify storage configurations on LSI RAID controllers.

The LSI RAID controllers support RAID 0, RAID 1, RAID 5, and RAID 10 storage configurations. The Configuration Wizard allows you to create new storage configurations and modify the configurations. To learn more about RAID and RAID levels, see Section 1.2, RAID Overview.

> **NOTE** You cannot create or modify a storage configuration unless you are logged on to a server with administrator privileges.

8.1 Creating a New Storage Configuration

You can use the MegaRAID Storage Manager to create new storage configurations on systems with LSI RAID controllers. You can create the following types of configurations:

- **Simple configuration** – Specifies a limited number of settings and has the system select drives for you. This option is the easiest way to create a virtual drive.
- **Advanced configuration** – Lets you choose additional settings and customize virtual drive creation. This option provides greater flexibility when creating virtual drives for your specific requirements.

This section describes the virtual drive parameters and explains how to create simple storage configurations and advanced storage configurations.

8.1.1 Selecting Virtual Drive Settings

This section describes the virtual drive settings that you can select when you use the advanced configuration procedure to create virtual drives. Change these parameters only if you have a specific reason for doing so. It is usually best to leave them at their default settings.

- **Initialization state** –Initialization prepares the storage medium for use. Specify the initialization status:
  - **No Initialization** (default) – The new configuration is not initialized and the existing data on the drives is not overwritten.
  - **Fast Initialization** – This option allows you to start writing data to the virtual drive immediately.
  - **Full Initialization** – A complete initialization is done on the new configuration. You cannot write data to the new virtual drive until the initialization is complete. A full initialization can take a long time if the drives are large.

    > **NOTE** New RAID 5 virtual drives require at least five drives for a background initialization to start.

- **Stripe size** –Stripe size of 64 KB only.
- **Read policy** –Specify the read policy for this virtual drive:
  - **No read ahead** (default) – Disables the read ahead capability. Read ahead capability allows the controller to read sequentially ahead of requested data and to store the additional data in cache memory, anticipating that the data is needed soon. Read ahead capability speeds up reads for sequential data, but there is little improvement when accessing random data.

- **Write policy** –Specify the write policy for this virtual drive:
  - — **Write Through** – In this mode, the controller sends a data transfer completion signal to the host when the drive subsystem has received all of the data in a transaction. This option eliminates the risk of losing cached data in case of power failure.
  - — **Always Write Back** – In this mode, the controller sends a data transfer completion signal to the host when the controller cache has received all of the data in a transaction.
- **I/O policy** –The I/O policy applies to reads on a specific virtual drive. It does not affect the read ahead cache.
  - — **Direct I/O** (default) – In this mode, reads are not buffered in cache memory. Data is transferred to the cache and the host concurrently. If the same data block is read again, it comes from cache memory.
  - — **Cached I/O** – Provides faster processing, and Direct I/O ensures that the cache and the host contain the same data.
- **Access policy** –Select the type of data access that is allowed for this virtual drive.
  - — **Read/Write** (default) – Allow read/write access. This setting is the default.
  - — **Read only** – Allow read-only access.
  - — **Blocked** – Do not allow access.
- **Disk cache policy** –Select a cache setting for this drive:
  - — **Enabled** – Enable the disk cache.
  - — **Disabled** – Disable the disk cache.
  - — **Unchanged** (default) – Leave the current disk cache policy unchanged.

8.1.2 Optimum Controller Settings for CacheCade - SSD Caching Software Guard

CacheCade – SSD Guard™, a feature that is unique to MegaRAID, increases the reliability of CacheCade – SSD Guard software by automatically copying data from a drive with potential to fail to a designated hot spare or newly inserted drive.

CacheCade – SSD Guard works by looking for a predictive failure while monitoring the SDD Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) error log. If errors indicate a CacheCade – SSD Guard software failure is imminent, MegaRAID Storage Manager starts a rebuild to preserve the data on the CacheCade – SSD Guard software and sends appropriate warning event notifications.

The following table contains the optimum settings for the CacheCade feature.

Table 46 Optimum Controller Settings for CacheCade - SSD Guard

Policy	Optimum Setting
Write Policy	Write Back
I/O Policy	Cached I/O
Read Policy	No Read Ahead
Stripe Size	64KB

8.1.3 Optimum Controller Settings for FastPath

MegaRAID FastPath is a high-performance I/O accelerator for CacheCade - SSD Guard software drive groups connected to a MegaRAID controller card. CacheCade - SSD Guard software has a read performance advantage over HDDs and use less power. This feature dramatically boosts storage subsystem bandwidth and overall transactional application performance when used with a 6 Gb/s MegaRAID SATA+SAS controller.

Table 47 Optimum Controller Settings for CacheCade - SSD Guard

Policy	Optimum Setting
Write Policy	Write Through
I/O Policy	Direct I/O
Read Policy	No Read Ahead
Stripe Size	64KB

8.1.4 Creating a Virtual Drive Using Simple Configuration

Simple configuration is the quickest and easiest way to create a new storage configuration. When you select simple configuration mode, the system creates the best configuration possible using the available drives.

NOTE You cannot created RAID 10 spanned drives using the simple configuration procedure. To create RAID 10 spanned drives, use the advanced configuration procedure described in Section 8.1.5, Creating a Virtual Drive Using Advanced Configuration.

Follow these steps to create a new storage configuration in simple configuration mode.

1. Click the **Dashboard** tab on the main menu screen.

    The Create Virtual Drive option appears in the Actions section of the Dashboard, as shown in the following figure.

Figure 58 Virtual Drive Creation Menu
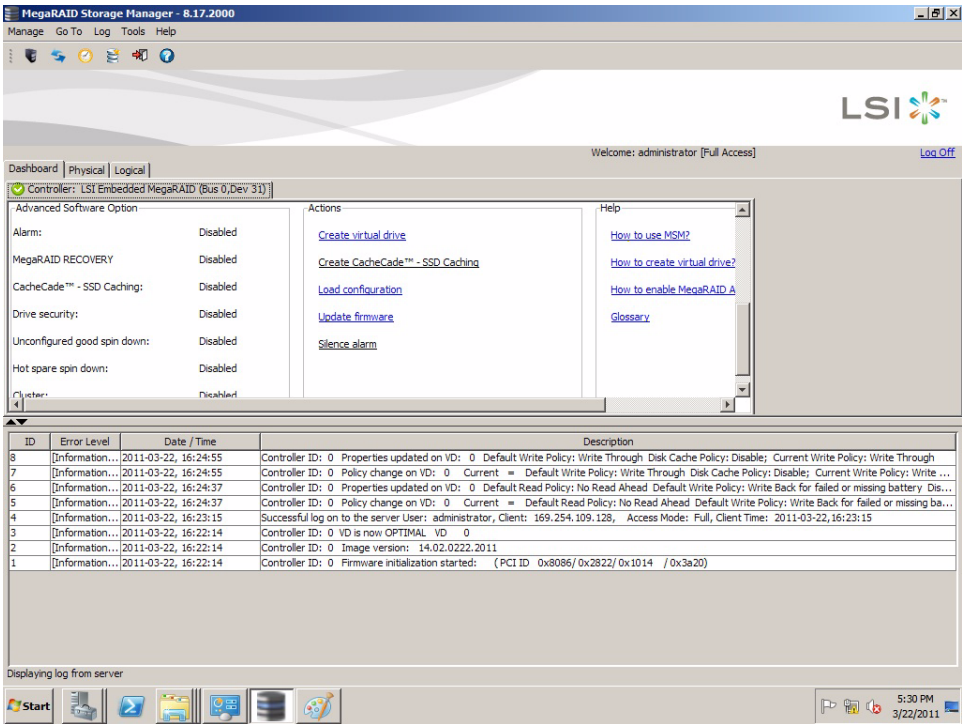
2. Click **Create Virtual Drive**.

    The dialog box for the configuration mode (Simple or Advanced) appears, as shown in the following figure.

Figure 59 Virtual Drive Simple Configuration Mode
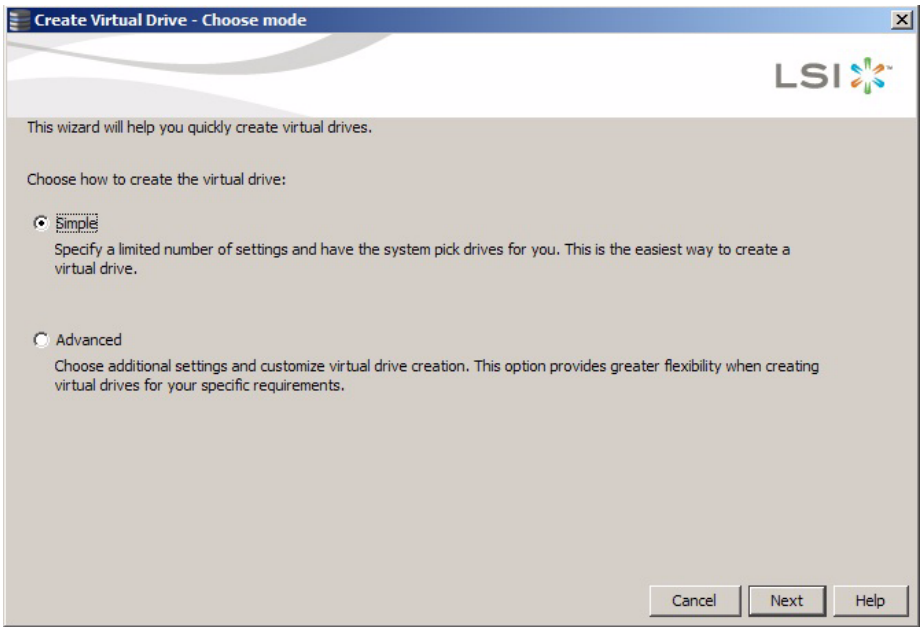
3. Click **Simple** and press **Next**.

   The Create Virtual Drive screen appears, as shown in the following figure.

   Figure 60 Create Virtual Drive Screen
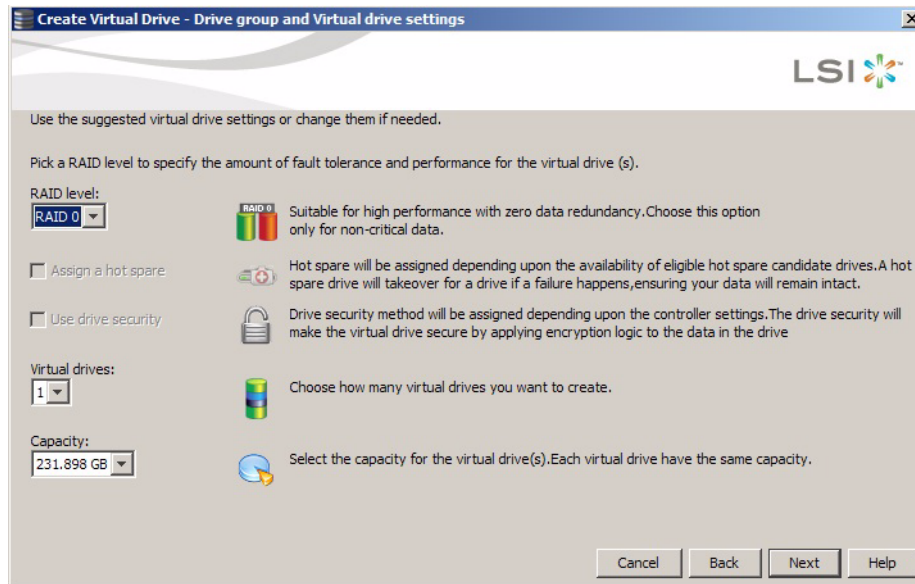
4. Select the RAID level desired for the virtual drive.

   When you use simple configuration, the RAID controller supports RAID levels 1 and 5. In addition, it supports independent non-redundant drives (configured as RAID 0). The screen text gives a brief description of the RAID level that you select. The RAID levels that you can choose depend on the number of drives available. To learn more about RAID levels, see Section 1.2, RAID Overview.

5. Use the drop-down menu in the **Virtual drives** field to choose how many virtual drives you want to create.

6. Select the capacity of the virtual drive or drives.

   Each virtual drive has the same capacity.

7. Click **Next**.

    The **Create Virtual Drive - Summary** window appears, as shown in the following figure. This window shows the selections you made for simple configuration.

    Figure 61 Create Virtual Drive - Summary Window
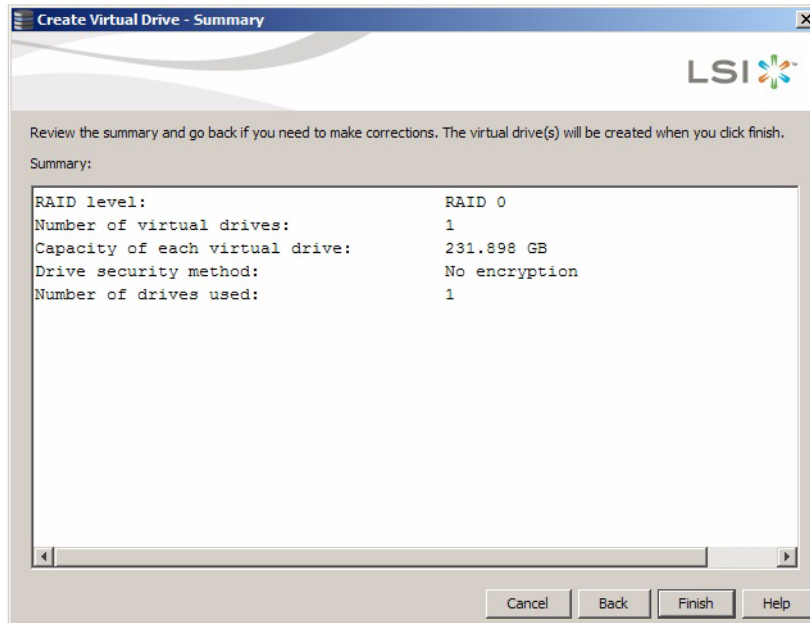
8. Click **Back** to return to the previous screen to change any selections or click **Finish** to accept and complete the configuration.

    The new virtual drive is created after you click **Finish**. After the configuration is completed, a dialog box notifies you that the virtual drives were created successfully.

8.1.5   Creating a Virtual Drive Using Advanced Configuration

The advanced configuration procedure provides an easy way to create a new storage configuration. Advanced configuration gives you greater flexibility than simple configuration because you can select the drives and the virtual drive parameters when you create a virtual drive. In addition, you can use the advanced configuration procedure to create spanned drive groups.

Follow these steps to create a new storage configuration in the advanced configuration mode.

1. Click the **Dashboard** tab on the MSM main menu screen.

   The Create Virtual Drive option appears in the Actions section of the Dashboard, as shown in the following figure.

   Figure 62 Virtual Drive Creation Menu
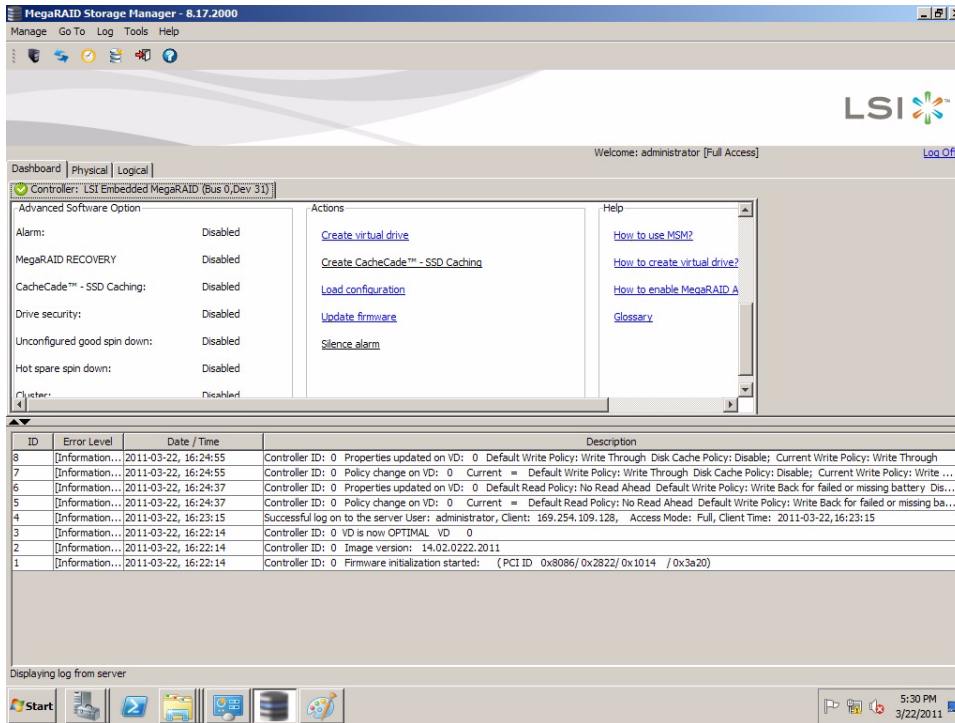
2. Click **Create Virtual Drive** in the Actions section of the screen.

   The dialog box for the configuration mode (Simple or Advanced) appears, as shown in the following figure.

   Figure 63 Virtual Drive Advanced Configuration Mode
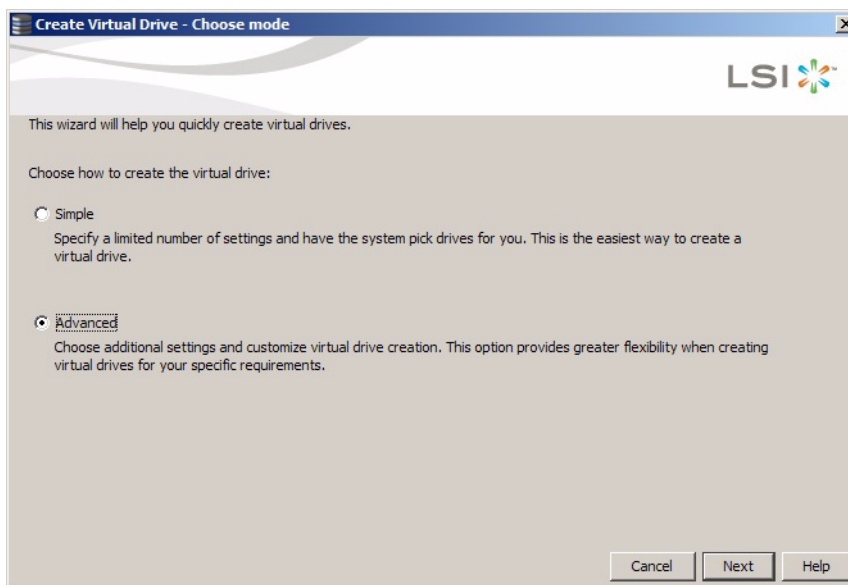
3. Click **Advanced** and then click **Next**.

    The Create Drive Group Settings dialog box appears, as shown in the following figure.

Figure 64 Create Drive Group Settings Dialog Box
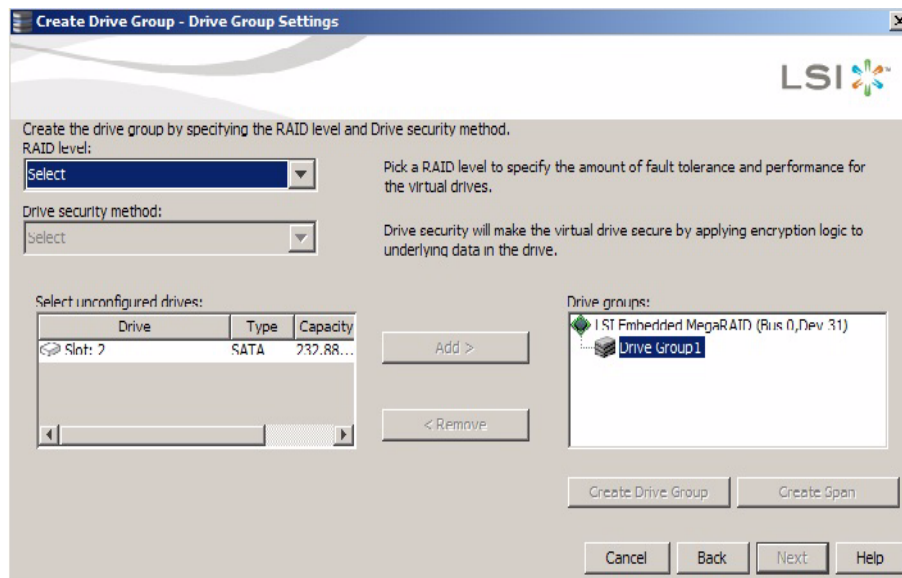
4. Perform the following actions in the Create Drive Group Settings dialog box:

    a. Select the RAID level desired for the drive group from the drop-down menu.

        The drive group appears in the **Drive groups** field.

        The RAID controller supports RAID levels 1, 5, and 10. In addition, it supports independent drives configured as RAID 0. The screen text gives a brief description of the RAID level you select. Which RAID levels you can choose depend on the number of drives available.

    b. Select *unconfigured* drives from the list of drives and click **Add>** to add them to the drive group.

        The selected drives appear under **Drive Group {number}**.

    c. If you are creating a RAID 10 drive group, perform the following steps. If not, go to step d.

📎	**NOTE** On a RAID 10 array, you can create only one virtual drive, and that virtual drive must occupy the entire space of the RAID 10 array.

    — Click **Create Span** to create a second span in the drive group.

    — Select *unconfigured* drives from the list of drives and click **Add>** to add them to the second drive group.

        The selected drives appear under the second span, **Span {number}**, below the second drive group, **Drive Group {number}**.

    — Click **Create Drive Group** to make a drive group with the spans.

    — Click **Next** to complete the steps for a RAID 10 configuration.

    d. Click **Create Drive Group** to make a drive group.

e. Click **Next** to complete this step.

The Virtual drive settings window appears, as shown in the following figure. The drive group and the default virtual drive settings appear. The options to update the virtual drive or remove the virtual drive are grayed out until you create the virtual drive.

Figure 65 Virtual Drive Settings Dialog Box
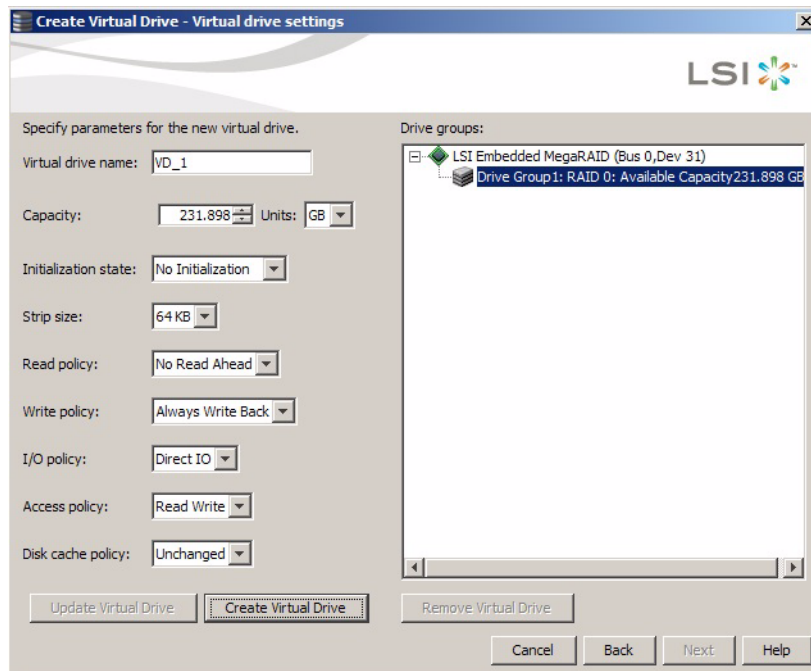
5. Select the virtual drive settings to fit your environment.

See Section 8.1.1, Selecting Virtual Drive Settings, for more information about the virtual drive settings.

6. Click **Create Virtual Drive**.

The new virtual drive appears under the drive group. The options **Update Virtual Drive** and **Remove Virtual Drive** are available. **Update Virtual Drive** allows you to change the virtual drive settings, and **Remove Virtual Drive** allows you to delete the virtual drive.

7. Click **Next**.

   The **Create Virtual Drive - Summary** window appears, as shown in the following figure. This window shows the selections you made for the advanced configuration.

Figure 66 Virtual Drive Summary Window
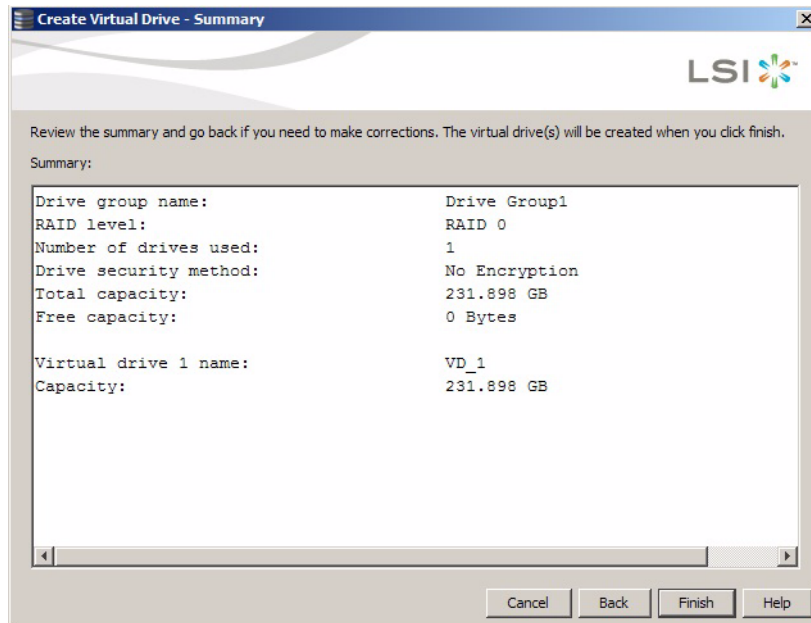
8. Click **Back** to return to the previous screen to change any selections or click **Finish** to accept and complete the configuration.

   After you click **Finish**, the new storage configuration is created and initialized.

   After the configuration is completed, a dialog box notifies you that the virtual drives have been successfully created. If more drive capacity exists, the dialog box asks whether you want to create more virtual drives. If no more drive capacity exists, you are prompted to close the configuration session.

9. Select **Yes** or **No** to indicate whether you want to create additional virtual drives.

   If you select **Yes**, the system takes you to the Create Virtual Drive screen, as shown in Figure 60. If you select **No**, the utility asks whether you want to close the wizard.

10. If you selected **No** in the previous step, select **Yes** or **No** to indicate whether you want to close the wizard.

    If you select **Yes**, the configuration procedure closes. If you select **No**, the dialog box closes and you remain on the same page.

8.2　Changing Adjustable Task Rates

Follow these steps if you need to change the adjustable rates for rebuilds, and other system tasks that run in the background:

> **NOTE** Leave the adjustable task rates at their default settings to achieve the best system performance. If you raise the task rates above the defaults, foreground tasks run more slowly and it might seem that the system is not responding. If you lower the task rates below the defaults, rebuilds and other background tasks might run very slowly and might not complete within a reasonable time. If you decide to change the values, record the original default value here so you can restore them later, if necessary:
> **Rebuild Rate:** _____
> **Background Initialization (BGI) Rate:** _____
> **Check Consistency Rate:** _____

1. Select a controller icon in the **Physical** tab or the **Logical** tab in the left panel of the MegaRAID Storage Manager main menu screen.

2. Select **Go To >> Controller >> Set Adjustable Task Rates** from the menu bar, as shown in the following figure.

Figure 67 Set Adjustable Task Rates Menu
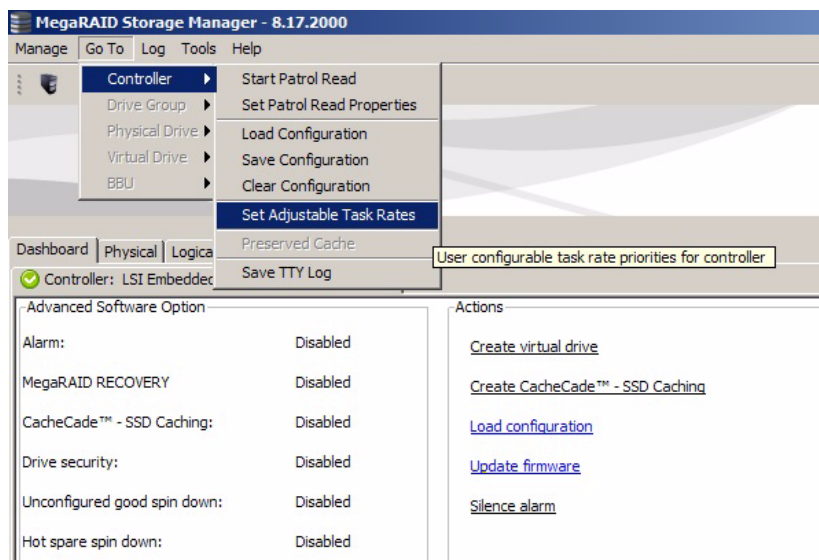
The Set Adjustable Task Rates dialog box appears, as shown in the following figure.

Figure 68 Set Adjustable Task Rates Dialog Box
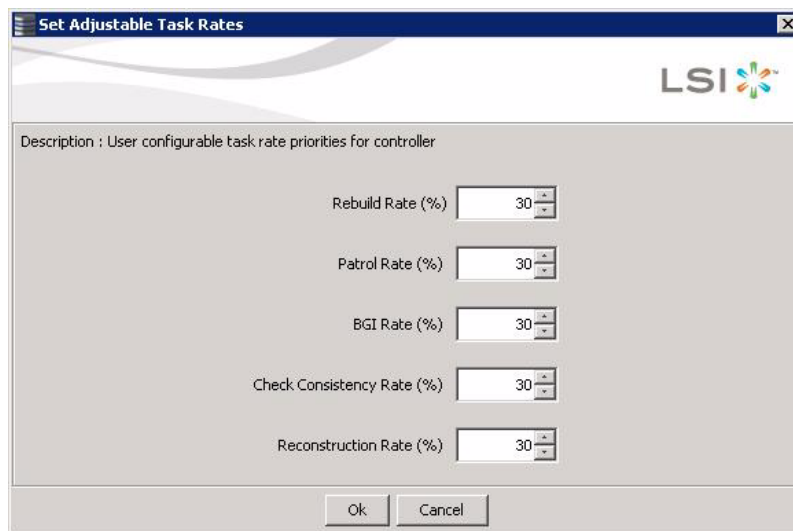
3. Enter changes, as needed, to the following task rates:
   — Rebuild Rate
   — Patrol Read
   — Background Initialization (BGI) (for fast initialization)
   — Check Consistency (for consistency checks).
   — Reconstruction

   Each task rate can be set from 0 to 100 percent. The higher the number, the faster the activity runs in the background, possibly impacting other system tasks.

4. Click **OK** to accept the new task rates.

5. When the warning message appears, click **OK** to confirm that you want to change the task rates.

8.3   Changing Virtual Drive Properties

You can change the read policy, the write policy, and the other virtual drive properties at any time after a virtual drive is created. Follow these steps to change the virtual drive properties.

1. Select a virtual drive icon in the **Physical** tab or the **Logical** tab in the left panel of the MegaRAID Storage Manager main menu screen.

2. Select **Go To** >> **Virtual Drive** >> **Set Virtual Drive Properties** from the menu bar, as shown in the following figure.

Figure 69 Set Virtual Drive Properties Menu
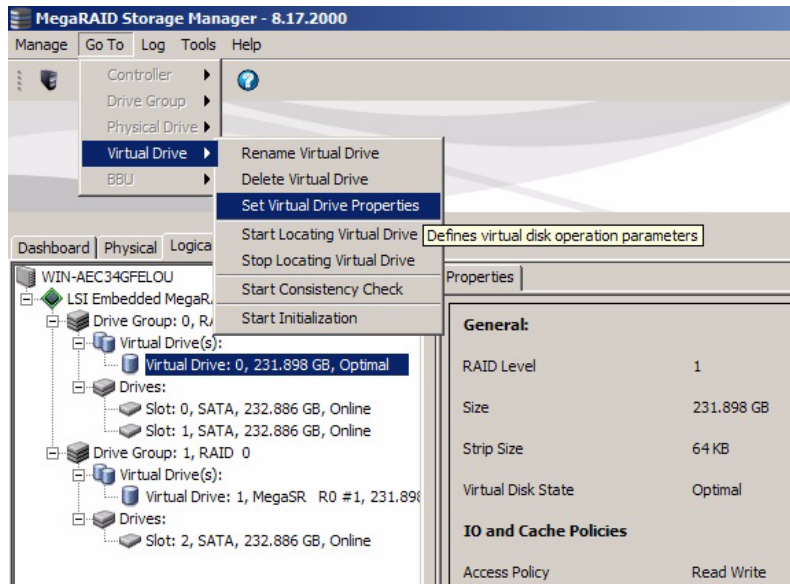
The Set Virtual Drive Properties dialog box appears, as shown in the following figure.

Figure 70 Set Virtual Drive Properties Screen
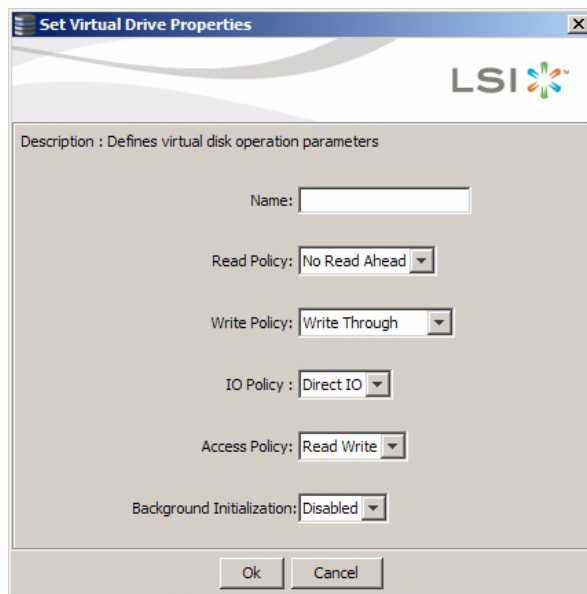
3. Change the virtual drive properties as needed.

   For information about these properties, see Section 8.1.1, Selecting Virtual Drive Settings.

4. Click **Ok** to accept the changes.

   The virtual drive settings are updated.

8.4 Deleting a Virtual Drive

> **NOTE** Be sure to back up the data that is on the virtual drive before you delete it. Be sure that the operating system is not installed on this virtual drive.

You can delete virtual drives to rearrange the storage space. To delete a virtual drive, follow these steps.

1. Back up all user data that is on the virtual drive you want to delete.

2. On the MegaRAID Storage Manager main menu screen, select the **Logical** tab, and click the icon of the virtual drive you want to delete.

3. Select **Go To >> Virtual Drive >> Delete Virtual Drive**.

4. When the warning messages appear, click **Yes** to confirm that you want to delete the virtual drive.

> **NOTE** You are asked twice whether you want to delete a virtual disk to avoid deleting the virtual disk by mistake.

Chapter 9: Monitoring System Events and Storage Devices

This chapter explains how to use MegaRAID Storage Manager to monitor the status of drives, virtual drives, and other storage devices.

9.1 Monitoring System Events

The MegaRAID Storage Manager utility monitors the activity and performance of all controllers in the system and the storage devices connected to them. When an event occurs (such as the creation of a new virtual drive or the removal of a drive) an event message appears in the log at the bottom of the MegaRAID Storage Manager main menu screen, as shown in the following figure.

You can use MegaRAID Storage Manager to alert you about events. Settings exist for the delivery of alerts, the severity level of events, exceptions, and email settings.

Figure 71 Event Information Window
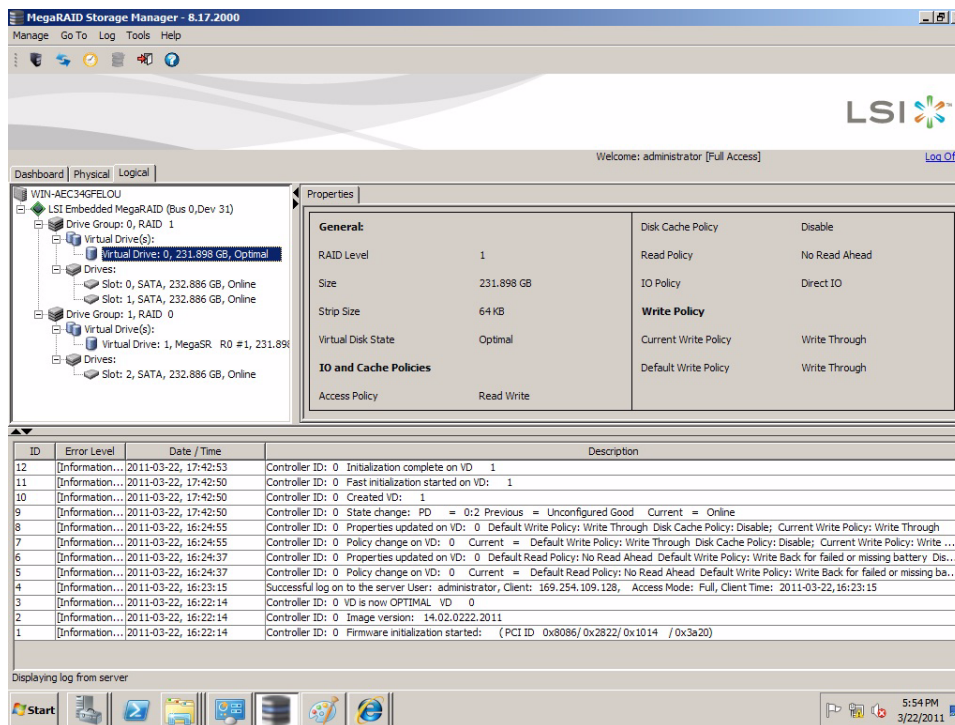
Each message that appears in the event log has a severity level that indicates the importance of the event, as shown in the following table, a date and timestamp, and a brief description. You can click an event to display the same information in a window. (For a list of all events, see .)

Table 48 Event Severity Levels

Severity Level	Meaning
Information	Informational message. No user action is necessary.
Warning	Some component might be close to a failure point.

Table 48 Event Severity Levels (Continued)

Severity Level	Meaning
Critical	A component has failed, but the system has not lost data.
Fatal	A component has failed, and data loss has occurred or will occur.

The Log menu has four options:

- **Save** – Saves the current log to a `.log` file.
- **Save as Text** – Saves the current log in `.txt` format.
- **Clear** – Clears the current log information. You have the option of saving the log first.
- **Load** – Enables you to load a local `.log` file.

The following figure shows the log menu.

Figure 72 Log Menu
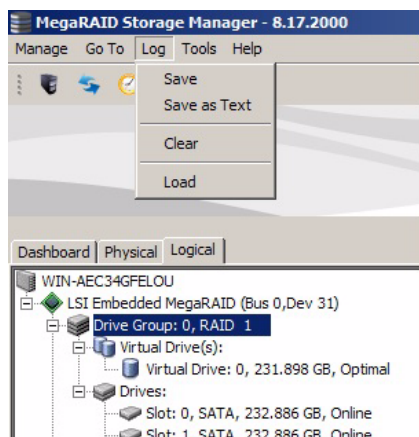
9.2   Configuring Alert Notifications

The Alert Notification Configuration feature allows you to control and configure the alerts that MegaRAID Storage Manager sends when various system events occur.

To access this screen, select **Tools >> Configure Alerts** on the main menu screen, as shown in the following figure.

Figure 73 Alert Notification Configuration Menu

The Alerts Notification Configuration screen appears, as shown in the following figure. The screen contains three tabs: **Alert Settings**, **Mail Server**, and **Email**. You can use each tab to perform tasks for that topic.

Figure 74 Alerts Notification Configuration Screen
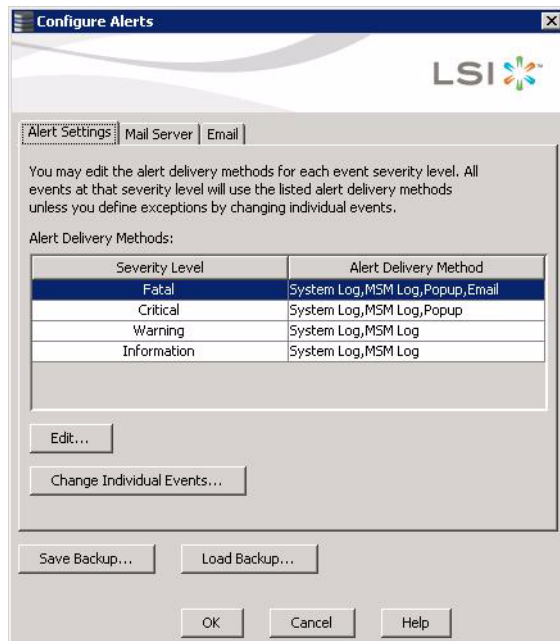
You can select the **Alert Settings** tab to perform the following actions:

- Select the methods for the delivery of alerts.
- Change the severity level of events.
- Save an `.xml` backup file of the entire alert configuration.
- Load all of the values from a previously saved backup into the dialog to edit or send to the monitor.

> **NOTE** When you load a saved backup file, all unsaved changes made in the current session are lost.

Select the **Mail Server** tab to perform the following actions:

- Enter or edit the sender email address.
- Enter the name of the SMTP server.
- Require authentication of the email server.
- Save an `.xml` backup file of the entire alert configuration.
- Load all of the values from a previously saved backup into the dialog to edit or send to the monitor.

> **NOTE** When you load a saved backup file, all unsaved changes made in the current session are lost.

Select the **Email** tab to perform the following actions:

- Add new email addresses for recipients of alert notifications.
- Send test messages to the recipient email addresses.
- Remove email addresses of recipients of alert notifications.
- Save an `.xml` backup file of the entire alert configuration.
- Load all of the values from a previously saved backup into the dialog to edit or send to the monitor.

> **NOTE** When you load a saved backup file, all unsaved changes made in the current session are lost.

9.2.1 Setting Alert Delivery Methods

You can select the methods used to send alert deliveries, including by pop-up, email, system log, or MSM log. You can select the alert delivery methods for each event severity level (Information, Warning, Critical, and Fatal).

Perform the following steps to select the alert delivery methods:

1. On the Alerts Notification Configuration screen, click the **Alerts Setting** tab.
2. Under the **Alerts Delivery Methods** heading, select one of the severity levels.
3. Click **Edit**.

   The Alert Notification Delivery Methods dialog box appears, as shown in the following figure.

Figure 75 Alert Notification Delivery Methods Dialog Box
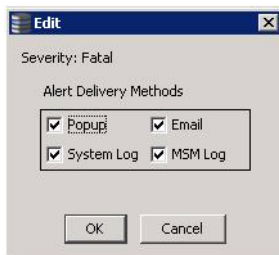
4. Select the desired alert delivery methods for alert notifications at the event severity level.
5. Click **OK** to set the delivery methods used for the severity level that you selected.

9.2.2 Changing Alert Delivery Methods for Individual Events

You can change the alert delivery options for an event without changing the severity level.

1. On the Alerts Notification Configuration screen, click the **Alerts Setting** tab.

   The the **Alerts Setting** portion of the screen appears, as shown in Figure 74.

2. Click **Change Individual Events**.

    The **Change Individual Events** dialog box appears, as shown in the following figure.

    The dialog box shows the events by their ID number, description, and severity level.

Figure 76 Change Individual Events Dialog Box
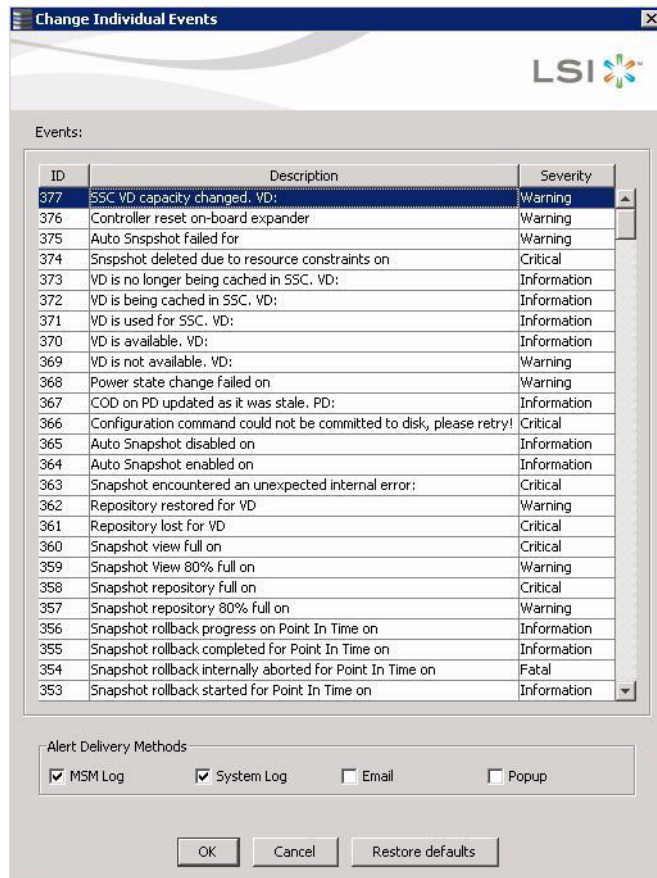
3. Click an event in the list to select it.

    The current alert delivery methods appear for the selected event under the **Alert Delivery Methods** heading.

4. Select the desired alert delivery methods for the event.

5. Press ESC to return to the **Alerts Notification Configuration** screen.

6. Click **OK**.

    This saves all of the changes made to the event.

9.2.3   Changing the Severity Level for Individual Events

See Table 48 for details about the severity levels.

To change the event severity level for a specific event, perform the following steps.

1. On the Alerts Notification Configuration screen, click the **Alerts Setting** tab.

    The **Alerts Setting** portion of the screen appears.

2. Click **Change Individual Events**.

   The **Change Individual Events** dialog box appears, as shown in the previous figure. The dialog box shows the events by their ID number, description, and severity level.

3. Click an event in the list to select it.

   The current alert delivery methods appear for the selected event.

4. Click the **Severity** cell for the event.

   The Event Severity drop-down menu appears for that event, as shown in the following figure.

Figure 77 Change Individual Events Severity Level Menu
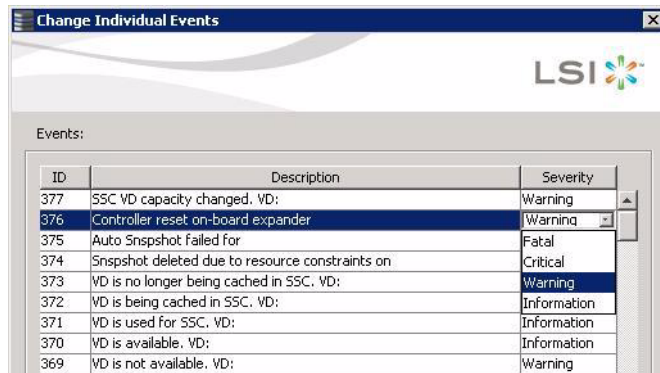
5. Select a different severity level for the event from the menu.

6. Press ESC to return to the **Alerts Notification Configuration** screen.

7. Click **OK** to save all of the changes made to the events.

9.2.4   Multiple Events Displayed in a Single Pop-Up Window

You can view multiple events in a single pop-up window, as shown in the following figure.

Figure 78 Pop-Up for Multiple Events
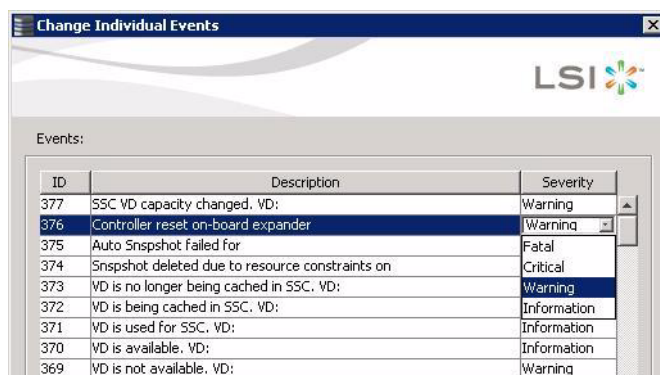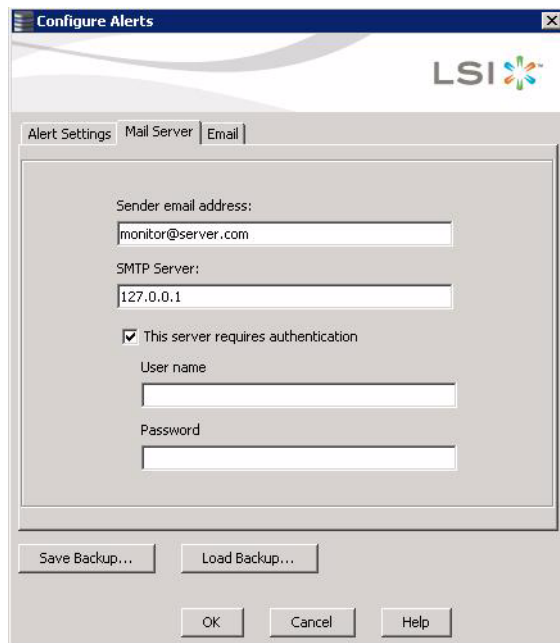
9.2.5 Entering or Editing the Sender Email Address and SMTP Server

You can use the **Alerts Notification Configuration** screen to enter or edit the sender email address and the SMTP server.

1. On the Alerts Notification Configuration screen, click the **Mail Server** tab.

   The **Mail Server** options appear, as shown in the following figure.

   Figure 79 Mail Server Options

2. Enter a new sender email address in the **Sender email address** field or edit the existing sender email address.
3. Click **OK**.

9.2.6 Authenticating a Server

You can use the Alerts Notification Configuration screen to authenticate the SMTP server, providing an extra level of security. The authentication check box enables the **User name** and **Password** fields when selected by default. Clearing the check box disables these fields.

Perform the following steps to enter or edit the address:

1. On the Alerts Notification Configuration screen, click the **Mail Server** tab.

   The **Mail Server** options appears, as shown in the previous figure. The authentication check box is selected by default.
2. Enter a user name in the **User name** field.
3. Enter the password in the **Password** field.
4. Click **OK**.

9.2.7 Saving Backup Configurations

You can save an `.xml` backup file of the entire alert configuration. This includes all the settings on the three tabs.

1. On the Alerts Notification Configuration screen, click the **Alert Setting** tab, **Mail Server** tab, or **Email** tab.

2. Click **Save Backup**.

   The drive directory appears.

3. Enter a file name with an `.xml` extension for the backup configuration (in the format `filename.xml`).

4. Click **Save**.

   The drive directory disappears.

5. Click **OK**.

   The backup configuration is saved, and the Alert Notification Configuration screen closes.

9.2.8 Loading Backup Configurations

You can load all of the values from a previously saved backup into the dialog (all tabs) to edit or send to the monitor.

> **NOTE** If you choose to load a backup configuration and the Configure Alerts dialog currently contains changes that have not yet been sent to the monitor, the changes are lost. You are prompted to confirm your choice.

1. On the Alerts Notification Configuration screen, click the **Alert Setting** tab, **Mail Server** tab, or **Email** tab.

2. Click **Load Backup**.

   A message warns that when you load a saved backup file, all unsaved changes made in the current session are lost.

3. Click **Yes**.

   The drive directory appears, from which you can select a backup configuration to load.

4. Select the backup configuration file (it should be in `.xml` format).

5. Click **Open**.

   The drive directory disappears.

6. Click **OK**.

   The backup configuration is loaded and the Alerts Notification Configuration screen closes.

9.2.9 Adding Email Addresses of Recipients of Alert Notifications

The **Email** tab portion of the Alerts Notification Configuration screen shows the email addresses of recipients of the alert notifications. MegaRAID Storage Manager sends alert notifications to those email addresses. Use the screen to add or remove email addresses of recipients, and to send test messages to recipients that you add.

To add email addresses of recipients of the alert notifications, perform the following steps:

1. Click the **Email** tab on the Event Notification Configuration screen.

   The **Email** section of the screen appears, as shown in the following figure.

Figure 80 Email Settings
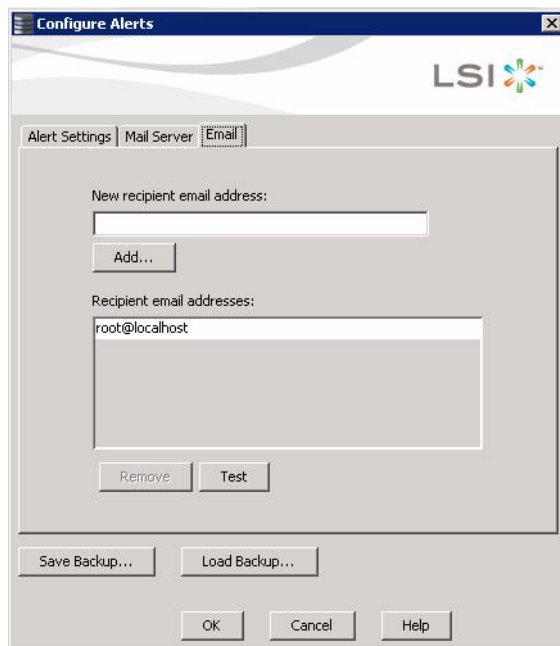
2. Enter the email address you want to add in the **New recipient email address** field.

3. Click **Add**.

The new email address appears in the **Recipient email addresses** field.

9.2.10 Testing Email Addresses of Recipients of Alert Notifications

Use the **Email** tab portion of the Alerts Notification Configuration screen to send test messages to the email addresses that you added for the recipients of alert notifications.

1. Click the **Email** tab on the Event Notification Configuration screen.

The **Email** section of the screen appears, as shown in the following figure.

2. Click an email address in the **Recipient email addresses** field.

3. Click **Test**.

4. Confirm whether the test message was sent to the email address.

If MegaRAID Storage Manager cannot send an email message to the email address, an error message appears.

9.2.11 Removing Email Addresses of Recipients of Alert Notifications

Use the **Email** tab portion of the Alerts Notification Configuration screen to remove email addresses of the recipients of alert notifications.

1. Click the **Email** tab on the Event Notification Configuration screen.

The **Email** section of the screen appears, as shown in the previous figure.

2. Click an email address in the **Recipient email addresses** field.

The **Remove** button, which was grayed out, is now active.

3. Click **Remove**.

The email address is deleted from the list.

9.3 Monitoring Controllers

> **NOTE** The Embedded MegaRAID Software drivers act as virtual *controllers*. Because these are not actual hardware storage controllers installed in the computer system, some of the controller properties shown in the following screen do not apply to them.

When MegaRAID Storage Manager is running, you can see the status of all controllers in the left panel of the MegaRAID Storage Manager main menu screen. If the controller is operating normally, the controller icon looks like this: ◆ . If the controller has failed, a small red circle appears to the right of the icon. (See Section 7.2.1, Dashboard/Physical View/Logical Views, for a complete list of device icons.)

To display complete controller information, click a controller icon in the left panel of the MegaRAID Storage Manager main menu screen. The controller properties display in the right panel, as shown in the following figure.

Figure 81 Controller Properties
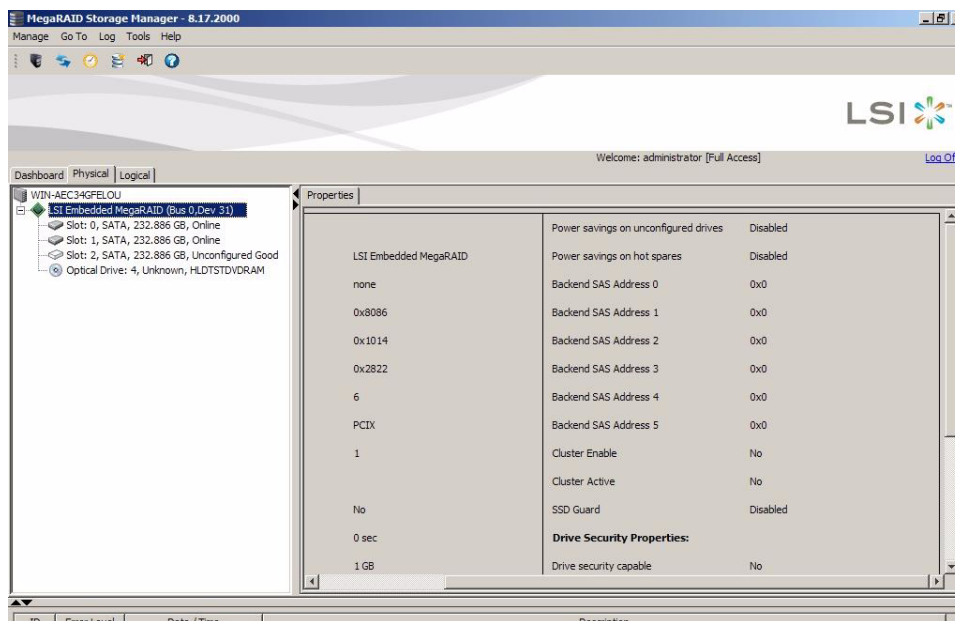
Most of the information on this screen is self-explanatory. Note that the *Rebuild Rate*, *Patrol Read Rate*, *Reconstruction Rate*, *Consistency Check Rate*, and *BGI Rate* (background initialization) are all user selectable. For more information about these rates, see Section 8.2, Changing Adjustable Task Rates.

The controller properties are defined in Appendix A: Events and Messages.

9.4 Monitoring Drives

When MegaRAID Storage Manager is running, you can see the status of all drives in the left panel of the MegaRAID Storage Manager main menu screen. If the drive is operating normally, its icon looks like this: ▱ .

If the drive has failed, a small red circle appears to the right of the icon, like this: ▱ ● . (See Section 7.2.1, Dashboard/Physical View/Logical Views, for a complete list of device icons.)

To display complete drive information, click a drive icon in the left panel of the MegaRAID Storage Manager main menu screen. The drive properties appear in the right panel, as shown in the following figure.

Figure 82 Drive Information
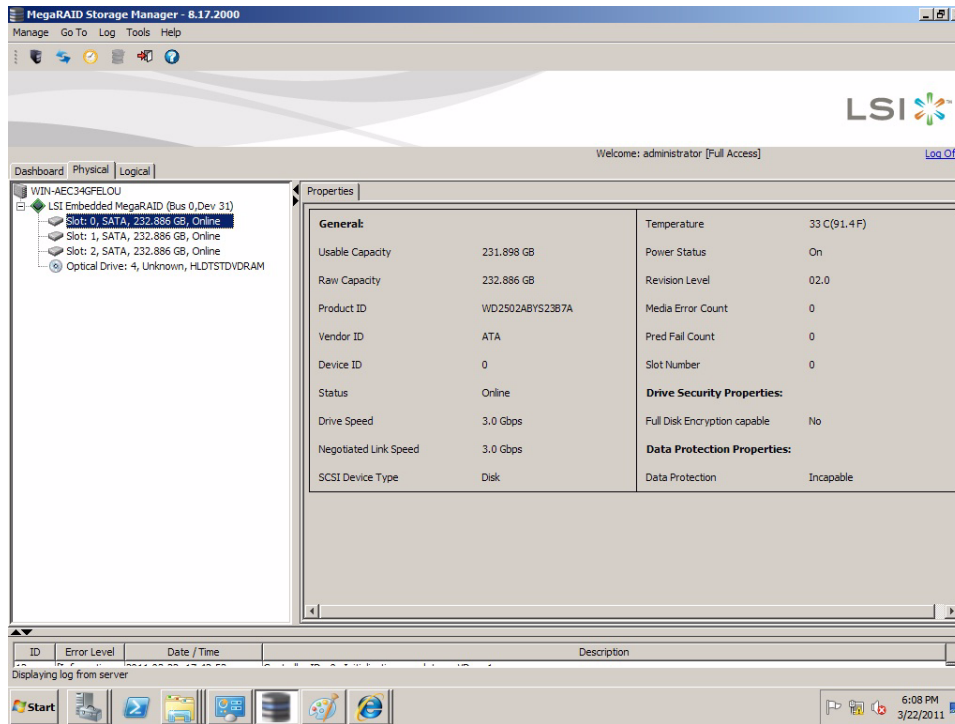
The information on this panel is self-explanatory. No user-selectable properties for physical devices exist. Icons for other storage devices such as CD-ROM drives and DAT drives can also appear in the left panel.

If the drives are in a drive enclosure, you can identify which drive is represented by each drive LED on the enclosure. Follow these steps to locate the drive:

1. Click the drive icon in the left panel.

2. Click **Go To >> Physical Drive >> Start Locating Drive**.

   The LED on the drive in the enclosure starts blinking to show its location.

   > **NOTE** LEDs on drives that are global hot spares do not blink.

3. To stop the drive LED on the enclosure from blinking, select **Go To >> Physical Drive >> Stop Locating Drive**.

To display a graphical view of a drive, click a drive icon in the left panel of the MegaRAID Storage Manager main menu screen, and click the **Graphical View** tab. In Graphical View, the drive's storage capacity is color coded according to the legend shown on the screen:

- Configured space is blue.
- Available space is white.
- Reserved space is red.

When you select a virtual drive from the drop-down menu, the drive space used by that virtual drive appears in green.

9.5   Running a Patrol Read

A patrol read periodically verifies all sectors of drives connected to a controller, including the system reserved area in the RAID configured drives. A patrol read can be used for all RAID levels and for all hot spare drives. This operation is initiated only when the controller is idle for a defined time period and has no other background activities.

You can set the patrol read properties and start the patrol read operation, or you can start the patrol read without changing the properties.

To set the patrol read properties and then start a patrol read, follow these steps:

1.   Click a controller icon in the left panel of the MegaRAID Storage Manager main menu screen.

2.   Select **Go To >> Controller >> Set Patrol Read Properties**.

Figure 83 Start Patrol Read Menu
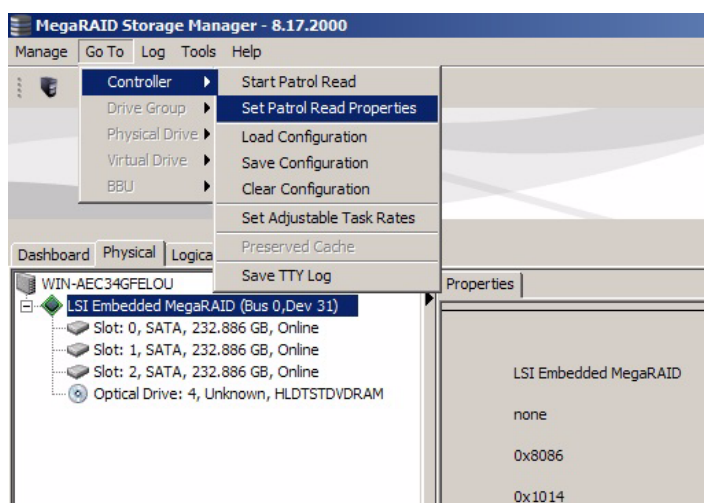
The Patrol Read - Set properties screen displays, as shown in the following figure.

Figure 84 Patrol Read Configuration
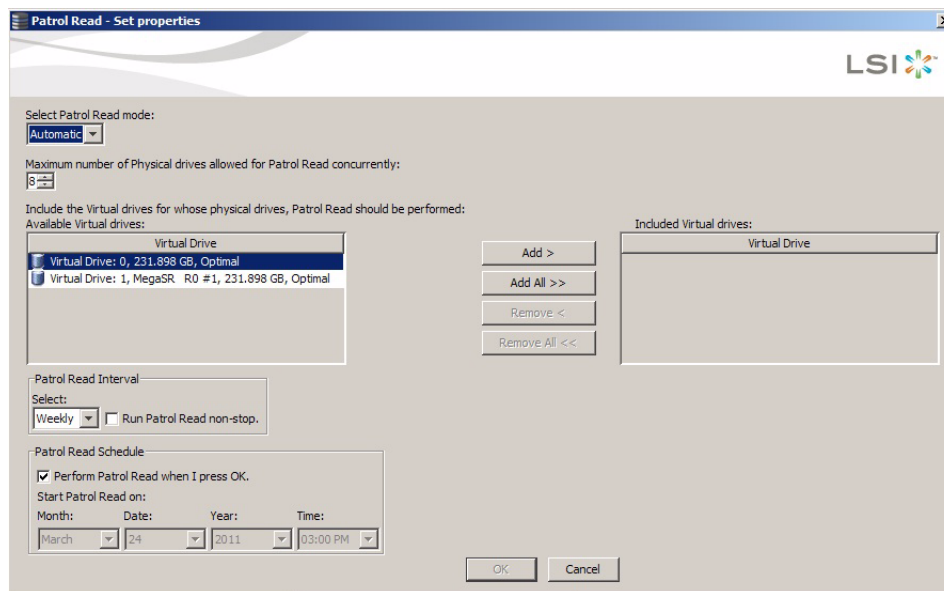
3. Select a mode for a patrol read. The options are:

    — **Automatic** – Patrol read runs automatically at the time interval you specify on this screen.

    — **Manual** – Patrol read runs only when you manually start it by selecting **Start Patrol Read** – From the controller Options panel.

    — **Disabled** – Patrol read does not run.

4. Specify the maximum number of drives to include in the patrol read.

    Eight drives is the maximum supported by Embedded MegaRAID Software.

5. Click virtual drives in the list under the heading **Virtual Drives** to include in the patrol read and click **Add >>** or click **Add All >>** to include all of the virtual drives.

6. (Optional) Change the frequency at which the patrol read runs.

    The default frequency is weekly (168 hours), which is suitable for most configurations. The other options are hourly, daily, and monthly.

    > **NOTE** LSI recommends that you leave the patrol read frequency and other patrol read settings at the default values to achieve the best system performance. If you decide to change the values, record the original default value here so you can restore them later, if necessary:
    > **Patrol Read Frequency:** _____
    > **Continuous Patrolling:** Enabled/Disabled
    > **Patrol Read Task Rate:** _____

7. (Optional) Set Patrol Read to run at a specific time.

    The default is for the patrol read to start when you click **OK** on this screen. To change the default so that the patrol read starts at a specific time, follow these steps (otherwise, skip this step and proceed to the next step):

    a. Uncheck the box **Perform Patrol Read when I click OK**.

    b. Select the month, year, day, and time to start patrol read.

8. Click **OK** to enable your patrol read selections.

> ✏ **NOTE** Patrol read does not report on its progress while it is running. The patrol read status is reported in the event log only.

To start a patrol read without changing the patrol read properties, follow these steps:

1. Click a controller icon in the left panel of the MegaRAID Storage Manager main menu screen.
2. Select **Go To >> Controller >> Start Patrol Read** in the menu bar.
3. When prompted, click **Yes** to confirm that you want to start a patrol read.

9.5.1   Patrol Read Task Rates

You can change the patrol read *task rate*. The task rate determines the amount of system resources that are dedicated to a patrol read when it is running. LSI recommends, however, that you leave the patrol read task rate at its default setting.

If you raise the task rate above the default, foreground tasks run more slowly and it might seem that the system is not responding. If you lower the task rate below the default, rebuilds and other background tasks might run very slowly and might not complete within a reasonable time. For more information, about the patrol read task rate, see Section 8.2, Changing Adjustable Task Rates.

9.6   Monitoring Virtual Drives

When MegaRAID Storage Manager is running, you can see the status of all virtual drives. If a virtual drive is operating normally, the icon looks like this: 🗄 . If the virtual drive is running in Degraded mode (for example, if a drive has failed), a small yellow circle appears to the right of the icon: 🗄🟡. A red circle indicates that the virtual drive has failed and data has been lost.

When the Logical tab is selected, the left panel of the MegaRAID Storage Manager main menu screen shows which drives are used by each virtual drive. The same drive can be used by multiple virtual drives.

To display complete virtual drive information, click the **Logical** tab in the left panel and click a virtual drive icon in the left panel. The properties appear in the right panel. The following figure shows the Properties panel for a virtual drive.

Figure 85 Virtual Drive Properties
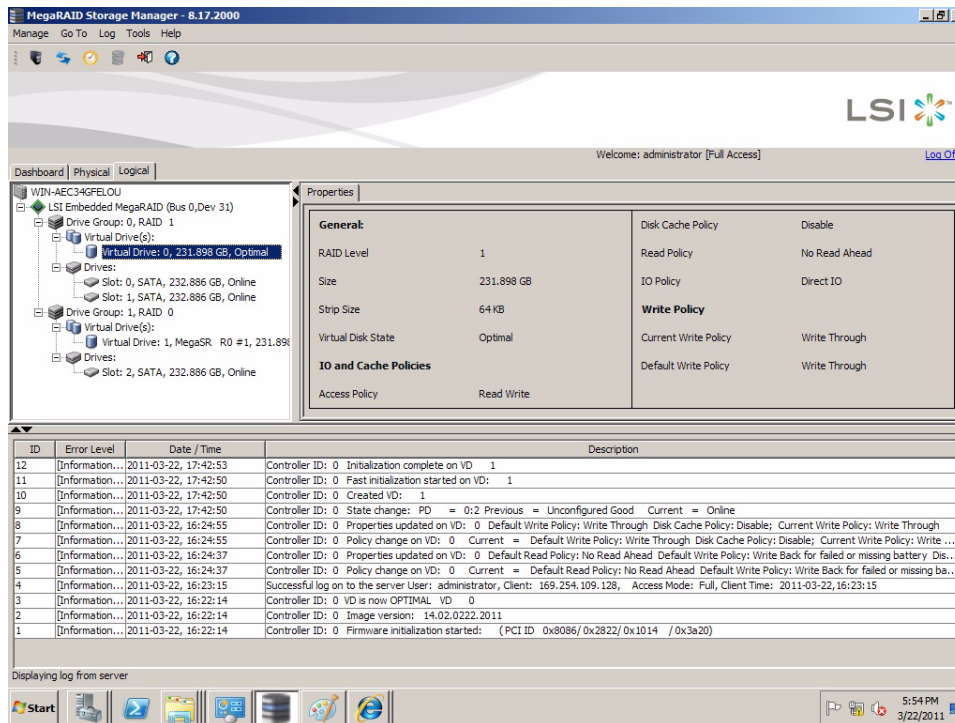
The RAID level, stripe size, and access policy of the virtual drive are set when the virtual drive is configured.

> **NOTE** You can change the read policy, write policy, and other virtual drive properties. See Section 8.3, Changing Virtual Drive Properties, for the procedure you can use to change these properties.

If the drives in the virtual drive are in an enclosure, you can identify them by making their LEDs blink. To do this, follow these steps:

1. Click the virtual drive icon in the left panel.

2. Click **Go To >> Virtual Drive >> Start Locating Virtual Drive** or right-click a virtual drive and select **Start Locating Virtual Drive** from the menu.

   The LEDs on the drives in the virtual drive start blinking (except for hot spare drives).

3. To stop the LEDs from blinking, click **Go To >> Virtual Drive >> Stop Locating Virtual Drive**.

9.7   Monitoring Enclosures

When MegaRAID Storage Manager is running, you can see the status of all enclosures connected to the server by selecting the **Physical** tab in the left panel. If an enclosure is operating normally, the icon looks like this: . If the enclosure is not functioning normally—for example, if a fan has failed—a small yellow or red circle appears to the right of the icon.

9.8   Monitoring Rebuilds and Other Processes

MegaRAID Storage Manager allows you to monitor the progress of rebuilds and other lengthy operations in the Group Show Progress window.

Follow these steps to monitor the progress of these operations.

1.   Select **Manage >> Show Progress** on the menu bar, as shown in the following figure.

Figure 86 Group Show Progress Menu
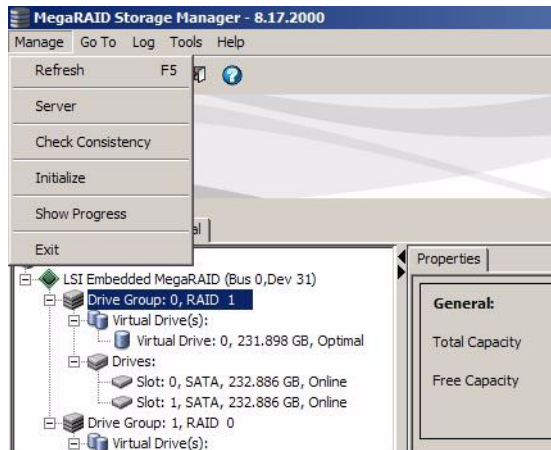
The Group Show Progress window appears, as shown in the following screen.

Figure 87 Group Show Progress Window
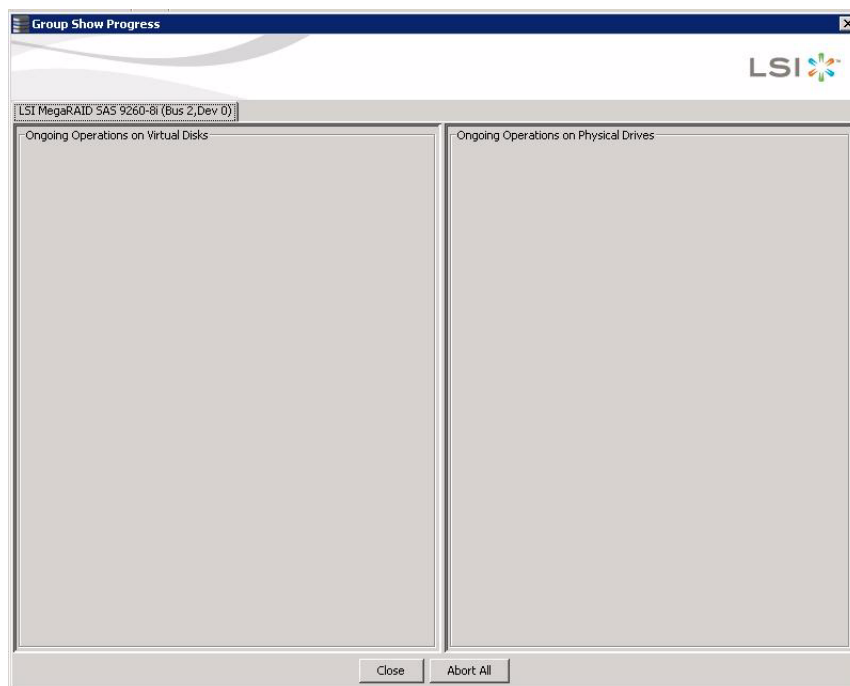
Operations on virtual drives appear in the left panel of the Group Show Progress window, and operations on drives appear in the right panel. The following operations appear in this window:

- Background or foreground initialization of a virtual drive (see Section 10.1, Initializing a Virtual Drive)
- Rebuild (see Section 10.4, Rebuilding a Drive)
- Check Consistency (see Section 10.2, Running a Consistency Check)

2. (Optional) Click **Abort All** to abort all ongoing processes.

3. Click **Close** to close the window.

Chapter 10: Maintaining and Managing Storage Configurations

This chapter explains how to use MegaRAID Storage Manager to maintain and manage storage configurations.

10.1 Initializing a Virtual Drive

To initialize a virtual drive after completing the configuration process, follow these steps:

1. Select the **Logical** tab in the left panel of the MegaRAID Storage Manager main menu screen, and click the icon of the virtual drive that you want to initialize.
2. Select **Go To >> Virtual Drive >> Start Initialization**.

    The initialize dialog box appears.
3. Select the virtual drive or drives to initialize.

    > ⚠️ **CAUTION** Initialization erases all data on the virtual drive. Make sure to back up any data you want to keep before you initialize. Make sure the operating system is not installed on the virtual drive you are initializing.

4. Select the **Fast Initialization** check box if you want to use this option.

    If you leave the box unchecked, MegaRAID Storage Manager runs a Full Initialization on the virtual drive. For more information, see Section 10.1.1, Running a Group Initialization.
5. Click **Start** to begin the initialization.

    You can monitor the progress of the initialization. For more information, see Section 9.8, Monitoring Rebuilds and Other Processes.

10.1.1 Running a Group Initialization

Initialization prepares the storage medium for use. You can run an initialization on multiple drives at one time. Follow these steps to run a group initialization.

1. Click **Manage >> Initialize**.

    The Group Initialization appears, as shown in the following figure.

Figure 88 Group Initialization Dialog Box
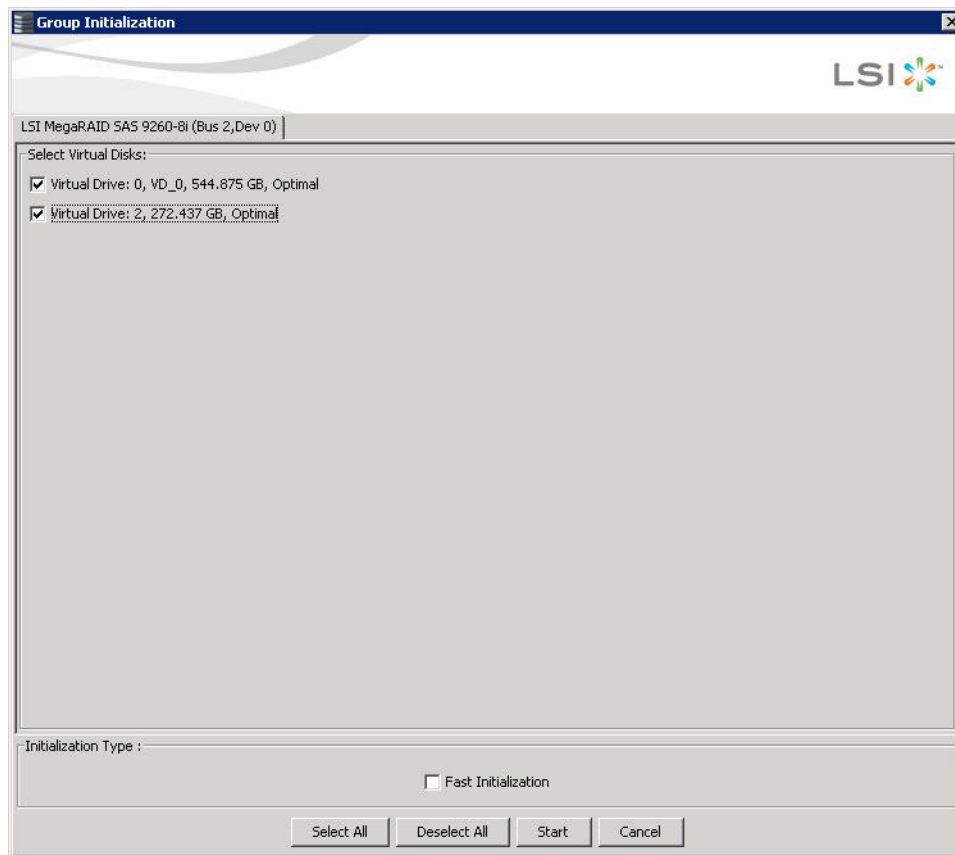
2. Check the virtual drives to run the initialization on or click **Select All** to select all of the virtual drives.

3. Click **Start**.

    You can monitor the progress of the group initialization. See Section 9.8, Monitoring Rebuilds and Other Processes, for more information.

10.2 Running a Consistency Check

The Consistency Check operation verifies correctness of the data in virtual drives that use RAID levels 1, 5, and 10. (RAID 0 does not provide data redundancy). For example, in a system with parity, checking consistency means computing the data on one drive and comparing the results to the contents of the parity drive.

You should run a consistency check on fault-tolerant virtual drives periodically. You must run the consistency check if you suspect that the virtual drive data might be corrupted. Be sure to back up the data before running a consistency check if you think the data might be corrupted.

To run a consistency check, first set the consistency check properties and then schedule the consistency check. This section explains how to set the properties, schedule the check, and run the consistency check.

10.2.1 Running a Group Consistency Check

You can run a consistency check on multiple drives at one time. Follow these steps to run a group consistency check.

1. Click **Manage >> Check Consistency**.

    The Group Consistency Check appears, as shown in the following figure.

Figure 89 Group Consistency Check Dialog Box
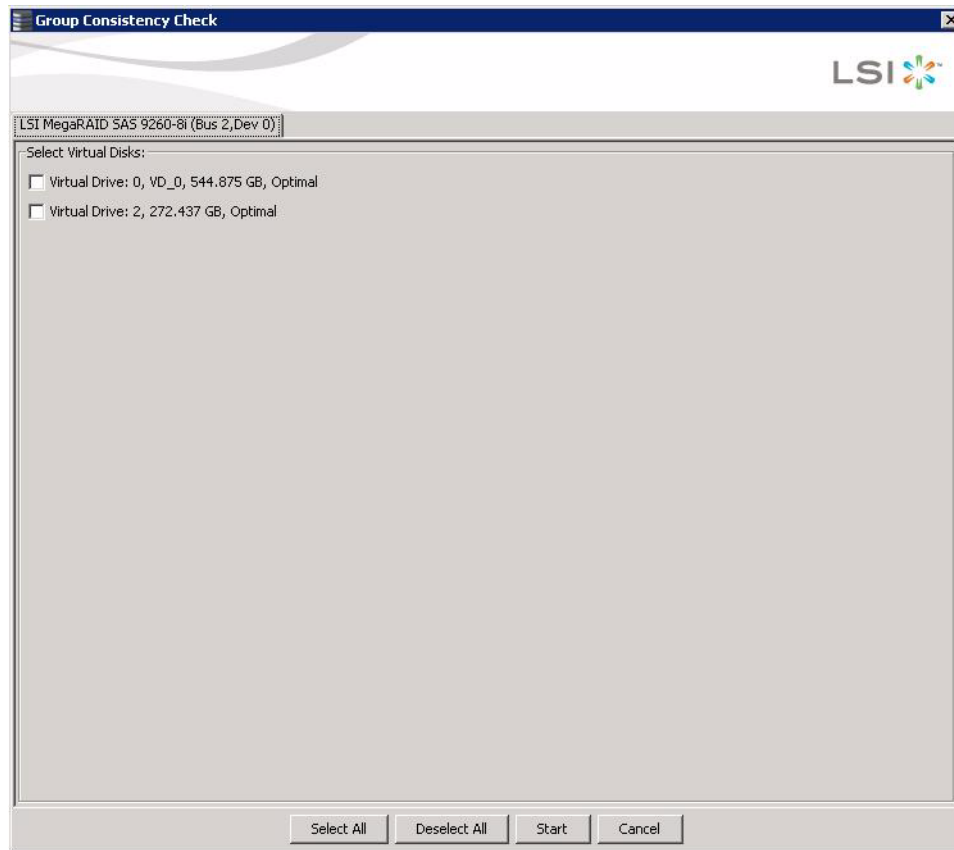
2. Check the virtual drives to run the consistency check on or click **Select All** to select all of the virtual drives.

3. Click **Start**.

    You can monitor the progress of the group consistency check. See Section 9.8, Monitoring Rebuilds and Other Processes, for more information.

10.3 Scanning for New Drives

You can use the Scan for Foreign Configuration option to find drives with foreign configurations. A foreign configuration is a RAID configuration that already exists on a replacement set of physical disks that you install in a computer system. In addition, if one or more drives are removed from a configuration, by a cable pull or drive removal, for example, the configuration on those drives is considered a foreign configuration by the RAID controller. Drives that are foreign are listed on the physical drives list with a special symbol in MegaRAID Storage Manager.

The utility allows you to import the existing configuration to the RAID controller or clear the configuration so you can create a new configuration using these drives. You can preview the foreign configuration before you decide whether to import it.

MegaRAID Storage Manager normally detects newly installed drives and displays icons for them in the MegaRAID Storage Manager main menu screen. If for some reason MegaRAID Storage Manager does not detect a new drive (or drives), you can use the Scan for Foreign Configuration command to find it.

Follow these steps to scan for a foreign configuration:

1. Select a controller icon in the left panel of the MegaRAID Storage Manager main menu screen.

2. Select **Go To >> Controller >> Scan for Foreign Configuration**.

   If MegaRAID Storage Manager detects any new drives, it displays a list of them on the screen. If not, it notifies you that no foreign configuration is found.

3. Follow the instructions on the screen to complete the drive detection.

10.4   Rebuilding a Drive

If a single drive in a RAID 1, RAID 5, or RAID 10 virtual drive fails, the system is protected from data loss. If hot spare disks are available, a failed drive is rebuilt automatically without any user intervention. A failed drive must be replaced, and the data on the drive must be rebuilt on a new drive to restore the system to fault tolerance. (You can choose to rebuild the data on the failed drive if the drive is still operational.) If hot spare drives are available, the failed drive is rebuilt automatically without any user intervention.

If a drive has failed, a red circle appears to the right of the drive icon: 🖴 🔴 . A small yellow circle appears to the right of the icon of the virtual drive that uses this drive: 🗄 🟡 . This indicates that the virtual drive is in a degraded state; the data is still safe, but data could be lost if another drive fails.

Follow these steps if you need to rebuild a drive:

1. Right-click the icon of the failed drive, and select **Rebuild**.

2. Click **Yes** when the warning message appears.

   If the drive is still good, a rebuild starts. You can monitor the progress of the rebuild in the Group Show Progress window by selecting **Manage >> Show Progress**.

   If the drive cannot be rebuilt, an error message appears. Continue with the next step.

3. Shut down the system, disconnect the power cord, and open the computer case.

4. Replace the failed drive with a new drive of equal capacity.

5. Close the computer case, reconnect the power cord, and restart the computer.

6. Restart MegaRAID Storage Manager.

   When the new drive spins up, the drive icon changes back to normal status, and the rebuild process begins automatically. You can monitor the progress of the rebuild in the Group Show Progress window by selecting **Manage >> Show Progress**.

10.5   Making a Drive Offline or Missing

If a drive is currently part of a redundant configuration and you want to use it in another configuration, you can use MegaRAID Storage Manager commands to remove the drive from the first configuration and change the drive state to Unconfigured Good.

⚠ **CAUTION** After you perform this procedure, all data on that drive is lost.

To remove the drive from the configuration without harming the data on the virtual drive, follow these steps:

1. In the MegaRAID Storage Manager main menu, click **Go To >> Physical Drive >> Make Drive (O)ffline**.

   The drive status changes to Offline.

2. Click **Go To >> Physical Drive >> (M)ark Drive as Missing**.

   The drive status changes to Unconfigured Good.

   ⚠ **CAUTION** After you perform this step, the data on this drive is no longer valid.

3. If necessary, create a hot spare drive for the virtual drive from which you have removed the drive.

   When a hot spare is available, the data on the virtual drive is then rebuilt. You can now use the removed drive for another configuration.

   ⚠ **CAUTION** If MegaRAID Storage Manager detects that a drive in a virtual drive has failed, it makes the drive offline. If this happens, you must remove the drive and replace it. You can make the drive so that another configuration cannot use it by using the **Mark physical disk as missing** command and the **Rescan** command.

Appendix A: Events and Messages

MegaRAID Storage Manager monitors the activity and performance of all controllers in the workstation and the devices attached to them. When an event occurs, such as the start of an initialization, an event message appears in the log at the bottom of the MegaRAID Storage Manager main menu screen.

This appendix lists the MegaRAID Storage Manager events that can appear in the event log.

> **NOTE** MegaRAID Storage Manager can be used to manage a wide range of MegaRAID controllers. Some of the events and messages listed in this appendix are not applicable to Embedded MegaRAID Software.

Each message that appears in the event log has an error level that indicates the severity of the event, as shown in the following table.

Table 49 Event Error Levels

Error Level	Meaning
Information	Informational message; no user action is necessary.
Warning	Some component may be close to a failure point.
Caution	A component has failed, but the system has not lost data.
Fatal	A component has failed, and data loss has occurred or will occur.
Dead	A catastrophic error has occurred, and the controller has died. This event is seen only after the controller has been restarted.

The following table lists all of the MegaRAID Storage Manager event messages. The event message descriptions include placeholders for specific values that are determined when the event is generated. Some of the error messages are relevant only for hardware RAID.

Table 50 Event Messages

Number (Hex)	Number (Decimal)	Type	Event Text
0x0000	0	Information	Firmware initialization started (PCI ID %04x/%04x/%04x/%04x)
0x0001	1	Information	Firmware version %s
0x0002	2	Fatal	Unable to recover cache data from TBBU
0x0003	3	Information	Cache data recovered from TBBU successfully
0x0004	4	Information	Configuration cleared
0x0005	5	Warning	Cluster down; communication with peer lost
0x0006	6	Information	%s ownership changed from %02x to %02x
0x0007	7	Information	Alarm disabled by user
0x0008	8	Information	Alarm enabled by user
0x0009	9	Information	Background initialization rate changed to %d%%
0x000a	10	Fatal	Controller cache discarded due to memory/battery problems
0x000b	11	Fatal	Unable to recover cache data due to configuration mismatch
0x000c	12	Information	Cache data recovered successfully
0x000d	13	Fatal	Controller cache discarded due to firmware version incompatibility
0x000e	14	Information	Consistency Check rate changed to %d%%
0x000f	15	Dead	Fatal firmware error: %s

Table 50 Event Messages (Continued)

Number (Hex)	Number (Decimal)	Type	Event Text
0x0010	16	Information	Factory defaults restored
0x0011	17	Information	Flash downloaded image corrupt
0x0012	18	Caution	Flash erase error
0x0013	19	Caution	Flash timeout during erase
0x0014	20	Caution	Flash error
0x0015	21	Information	Flashing image: %s
0x0016	22	Information	Flash of new firmware image completes
0x0017	23	Caution	Flash programming error
0x0018	24	Caution	Flash timeout during programming
0x0019	25	Caution	Flash chip type unknown
0x001a	26	Caution	Flash command set unknown
0x001b	27	Caution	Flash verify failure
0x001c	28	Information	Flush rate changed to %d seconds
0x001d	29	Information	Hibernate command received from host
0x001e	30	Information	Event log cleared
0x001f	31	Information	Event log wrapped
0x0020	32	Dead	Multi-bit ECC error: ECAR=%x, ELOG=%x, (%s)
0x0021	33	Warning	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s)
0x0022	34	Dead	Not enough controller memory
0x0023	35	Information	Patrol Read complete
0x0024	36	Information	Patrol Read paused
0x0025	37	Information	Patrol Read Rate changed to %d%%
0x0026	38	Information	Patrol Read resumed
0x0027	39	Information	Patrol Read started
0x0028	40	Information	Rebuild rate changed to %d%%
0x0029	41	Information	Reconstruction rate changed to %d%%
0x002a	42	Information	Shutdown command received from host
0x002b	43	Information	Test event: %s
0x002c	44	Information	Time established as %s; (%d seconds since power on)
0x002d	45	Information	User entered firmware debugger
0x002e	46	Warning	Background Initialization aborted on %s
0x002f	47	Warning	Background Initialization corrected medium error (%s at %lx
0x0030	48	Information	Background Initialization completed on %s
0x0031	49	Fatal	Background Initialization corrected medium error (%s at %lx, %s at %lx)
0x0032	50	Fatal	Background Initialization detected uncorrectable double medium errors (%s at %lx on %s)
0x0033	51	Caution	Background Initialization failed on %s
0x0034	52	Progress	Background Initialization progress on %s is %s
0x0035	53	Information	Background Initialization started on %s
0x0036	54	Information	Policy change on %s from %s to %s
0x0038	56	Warning	Consistency Check aborted on %s

Table 50 Event Messages (Continued)

Number (Hex)	Number (Decimal)	Type	Event Text
0x0039	57	Warning	Consistency Check corrected medium error (%s at %lx, %s at %lx)
0x003a	58	Information	Consistency Check done on %s
0x003b	59	Information	Consistency Check done with corrections on %s, (corrections=%d)
0x003c	60	Fatal	Consistency Check detected uncorrectable double medium errors (%s at %lx on %s)
0x003d	61	Caution	Consistency Check failed on %s
0x003e	62	Fatal	Consistency Check failed with uncorrectable data on %s
0x003f	63	Warning	Consistency Check found inconsistent parity on %s at strip %lx
0x0040	64	Warning	Consistency Check inconsistency logging disabled on %s (too many inconsistencies)
0x0041	65	Progress	Consistency Check progress on %s is %s
0x0042	66	Information	Consistency Check started on %s
0x0043	67	Warning	Initialization aborted on %s
0x0044	68	Caution	Initialization failed on %s
0x0045	69	Progress	Initialization progress on %s is %s
0x0046	70	Information	Fast initialization started on %s
0x0047	71	Information	Full initialization started on %s
0x0048	72	Information	Initialization complete on %s
0x0049	73	Information	Properties updated to %s (from %s)
0x004a	74	Information	Reconstruction complete on %s
0x004b	75	Fatal	Reconstruction of %s stopped due to unrecoverable errors
0x004c	76	Fatal	Reconstruct detected uncorrectable double medium errors (%s at %lx on %s at %lx)
0x004d	77	Progress	Reconstruction progress on %s is %s
0x004e	78	Information	Reconstruction resumed on %s
0x004f	79	Fatal	Reconstruction resume of %s failed due to configuration mismatch
0x0050	80	Information	Reconstructing started on %s
0x0051	81	Information	State change on %s from %s to %s
0x0052	82	Information	Clear aborted on %s
0x0053	83	Caution	Clear failed on %s (Error %02x)
0x0054	84	Progress	Clear progress on %s is %s
0x0055	85	Information	Clear started on %s
0x0056	86	Information	Clear completed on %s
0x0057	87	Warning	Error on %s (Error %02x)
0x0058	88	Information	Format complete on %s
0x0059	89	Information	Format started on %s
0x005a	90	Caution	Hot Spare SMART polling failed on %s (Error %02x)
0x005b	91	Information	Inserted: %s
0x005c	92	Warning	%s is not supported
0x005d	93	Warning	Patrol Read corrected medium error on %s at %lx
0x005e	94	Progress	Patrol Read progress on %s is %s
0x005f	95	Fatal	Patrol Read found an uncorrectable medium error on %s at %lx
0x0060	96	Caution	Predictive failure: %s

Table 50 Event Messages (Continued)

Number (Hex)	Number (Decimal)	Type	Event Text
0x0061	97	Fatal	Puncturing bad block on %s at %lx
0x0062	98	Information	Rebuild aborted by user on %s
0x0063	99	Information	Rebuild complete on %s
0x0064	100	Information	Rebuild complete on %s
0x0065	101	Caution	Rebuild failed on %s due to source drive error
0x0066	102	Caution	Rebuild failed on %s due to target drive error
0x0067	103	Progress	Rebuild progress on %s is %s
0x0068	104	Information	Rebuild resumed on %s
0x0069	105	Information	Rebuild started on %s
0x006a	106	Information	Rebuild automatically started on %s
0x006b	107	Caution	Rebuild stopped on %s due to loss of cluster ownership
0x006c	108	Fatal	Reassign write operation failed on %s at %lx
0x006d	109	Fatal	Unrecoverable medium error during rebuild on %s at %lx
0x006e	110	Information	Corrected medium error during recovery on %s at %lx
0x006f	111	Fatal	Unrecoverable medium error during recovery on %s at %lx
0x0070	112	Information	Removed: %s
0x0071	113	Warning	Unexpected sense: %s, CDB%s, Sense: %s
0x0072	114	Information	State change on %s from %s to %s
0x0073	115	Information	State change by user on %s from %s to %s
0x0074	116	Warning	Redundant path to %s broken
0x0075	117	Information	Redundant path to %s restored
0x0076	118	Information	Dedicated Hot Spare PD %s no longer useful due to deleted array
0x0077	119	Caution	SAS topology error: Loop detected
0x0078	120	Caution	SAS topology error: Unaddressable device
0x0079	121	Caution	SAS topology error: Multiple ports to the same SAS address
0x007a	122	Caution	SAS topology error: Expander error
0x007b	123	Caution	SAS topology error: SMP timeout
0x007c	124	Caution	SAS topology error: Out of route entries
0x007d	125	Caution	SAS topology error: Index not found
0x007e	126	Caution	SAS topology error: SMP function failed
0x007f	127	Caution	SAS topology error: SMP CRC error
0x0080	128	Caution	SAS topology error: Multiple subtractive
0x0081	129	Caution	SAS topology error: Table to table
0x0082	130	Caution	SAS topology error: Multiple paths
0x0083	131	Fatal	Unable to access device %s
0x0084	132	Information	Dedicated Hot Spare created on %s (%s)
0x0085	133	Information	Dedicated Hot Spare %s (%s) disabled
0x0086	134	Caution	Dedicated Hot Spare %s no longer useful for all arrays
0x0087	135	Information	Spare created on %s (%s)
0x0088	136	Information	Spare %s (%s) disabled

Table 50 Event Messages (Continued)

Number (Hex)	Number (Decimal)	Type	Event Text
0x0089	137	Caution	Spare %s does not cover all arrays
0x008a	138	Information	Created %s
0x008b	139	Information	Deleted %s
0x008c	140	Information	Marking %s inconsistent due to active writes at shutdown
0x008d	141	Information	Battery Present
0x008e	142	Warning	Battery Not Present
0x008f	143	Information	New Battery Detected
0x0090	144	Information	Battery has been replaced
0x0091	145	Caution	Battery temperature is high
0x0092	146	Warning	Battery voltage low
0x0093	147	Information	Battery started charging
0x0094	148	Information	Battery is discharging
0x0095	149	Information	Battery temperature is normal
0x0096	150	Fatal	Battery needs replacement - SOH Bad
0x0097	151	Information	Battery relearn started
0x0098	152	Information	Battery relearn in progress
0x0099	153	Information	Battery relearn completed
0x009a	154	Caution	Battery relearn timed out
0x009b	155	Information	Battery relearn pending: Battery is under charge
0x009c	156	Information	Battery relearn postponed
0x009d	157	Information	Battery relearn will start in 4 days
0x009e	158	Information	Battery relearn will start in 2 day
0x009f	159	Information	Battery relearn will start in 1 day
0x00a0	160	Information	Battery relearn will start in 5 hours
0x00a1	161	Information	Battery removed
0x00a2	162	Information	Current capacity of the battery is below threshold
0x00a3	163	Information	Current capacity of the battery is above threshold
0x00a4	164	Information	Enclosure (SES) discovered on %s
0x00a5	165	Information	Enclosure (SAFTE) discovered on %s
0x00a6	166	Caution	Enclosure %s communication lost
0x00a7	167	Information	Enclosure %s communication restored
0x00a8	168	Caution	Enclosure %s fan %d failed
0x00a9	169	Information	Enclosure %s fan %d inserted
0x00aa	170	Caution	Enclosure %s fan %d removed
0x00ab	171	Caution	Enclosure %s power supply %d failed
0x00ac	172	Information	Enclosure %s power supply %d inserted
0x00ad	173	Caution	Enclosure %s power supply %d removed
0x00ae	174	Caution	Enclosure %s EMM %d failed
0x00af	175	Information	Enclosure %s EMM %d inserted
0x00b0	176	Caution	Enclosure %s EMM %d removed

Table 50 Event Messages (Continued)

Number (Hex)	Number (Decimal)	Type	Event Text
0x00b1	177	Warning	Enclosure %s temperature sensor %d below warning threshold
0x00b2	178	Caution	Enclosure %s temperature sensor %d below error threshold
0x00b3	179	Warning	Enclosure %s temperature sensor %d above warning threshold
0x00b4	180	Caution	Enclosure %s temperature sensor %d above error threshold
0x00b5	181	Caution	Enclosure %s shutdown
0x00b6	182	Warning	Enclosure %s not supported; too many enclosures connected to port
0x00b7	183	Caution	Enclosure %s firmware mismatch (EMM %d)
0x00b8	184	Warning	Enclosure %s sensor %d bad
0x00b9	185	Caution	Enclosure %s phy bad for slot %d
0x00ba	186	Caution	Enclosure %s is unstable
0x00bb	187	Caution	Enclosure %s hardware error
0x00bc	188	Caution	Enclosure %s not responding
0x00bd	189	Information	SAS/SATA mixing not supported in enclosure; %s disabled
0x00be	190	Information	Enclosure (SES) hotplug on %s was detected, but is not supported
0x00bf	191	Information	Clustering enabled
0x00c0	192	Information	Clustering disabled
0x00c1	193	Information	PD too small to be used for auto-rebuild on %s
0x00c2	194	Information	BBU enabled; changing WT virtual disks to WB
0x00c3	195	Warning	BBU disabled; changing WB virtual disks to WT
0x00c4	196	Warning	Bad block table on %s is 80% full
0x00c5	197	Fatal	Bad block table on %s is full; unable to log block %lx
0x00c6	198	Information	Consistency Check Aborted Due to Ownership Loss on %s
0x00c7	199	Information	Background Initialization (BGI) Aborted Due to Ownership Loss on %s
0x00c8	200	Caution	Battery/charger problems detected; SOH Bad
0x00c9	201	Warning	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s); warning threshold exceeded
0x00ca	202	Caution	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s); critical threshold exceeded
0x00cb	203	Caution	Single-bit ECC error: ECAR=%x, ELOG=%x, (%s); further reporting disabled
0x00cc	204	Caution	Enclosure %s Power supply %d switched off
0x00cd	205	Information	Enclosure %s Power supply %d switched on
0x00ce	206	Caution	Enclosure %s Power supply %d cable removed
0x00cf	207	Information	Enclosure %s Power supply %d cable inserted
0x00d0	208	Information	Enclosure %s Fan %d returned to normal
0x00d1	209	Information	BBU Retention test was initiated on previous boot
0x00d2	210	Information	BBU Retention test passed
0x00d3	211	Caution	BBU Retention test failed!
0x00d4	212	Information	NVRAM Retention test was initiated on previous boot
0x00d5	213	Information	NVRAM Retention test passed
0x00d6	214	Caution	NVRAM Retention test failed!
0x00d7	215	Information	%s test completed %d passes successfully
0x00d8	216	Caution	%s test FAILED on %d pass. Fail data: errorOffset=%x goodData=%x badData=%x

Table 50 Event Messages (Continued)

Number (Hex)	Number (Decimal)	Type	Event Text
0x00d9	217	Information	Self check diagnostics completed
0x00da	218	Information	Foreign Configuration Detected
0x00db	219	Information	Foreign Configuration Imported
0x00dc	220	Information	Foreign Configuration Cleared
0x00dd	221	Warning	NVRAM is corrupt; reinitializing
0x00de	222	Warning	NVRAM mismatch occurred
0x00df	223	Warning	SAS wide port %d lost link on PHY %d
0x00e0	224	Information	SAS wide port %d restored link on PHY %d
0x00e1	225	Warning	SAS port %d, PHY %d has exceeded the allowed error rate
0x00e2	226	Warning	Bad block reassigned on %s at %lx to %lx
0x00e3	227	Information	Controller Hot Plug detected
0x00e4	228	Warning	Enclosure %s temperature sensor %d differential detected
0x00e5	229	Information	Disk test cannot start. No qualifying disks found
0x00e6	230	Information	Time duration provided by host is not sufficient for self check
0x00e7	231	Information	Marked Missing for %s on array %d row %d
0x00e8	232	Information	Replaced Missing as %s on array %d row %d
0x00e9	233	Information	Enclosure %s Temperature %d returned to normal
0x00ea	234	Information	Enclosure %s Firmware download in progress
0x00eb	235	Warning	Enclosure %s Firmware download failed
0x00ec	236	Warning	%s is not a certified drive
0x00ed	237	Information	Dirty cache data discarded by user
0x00ee	238	Information	PDs missing from configuration at boot
0x00ef	239	Information	VDs missing drives and will go offline at boot: %s
0x00f0	240	Information	VDs missing at boot: %s
0x00f1	241	Information	Previous configuration completely missing at boot
0x00f2	242	Information	Battery charge complete
0x00f3	243	Information	Enclosure %s fan %d speed changed
0x00f4	244	Information	Dedicated spare %s imported as global due to missing arrays
0x00f5	245	Information	%s rebuild not possible as SAS/SATA is not supported in an array
0x00f6	246	Information	SEP %s has been rebooted as a part of enclosure firmware download. SEP will be unavailable until this process completes.
0x00f7	247	Information	Inserted: %s Info: %s
0x00f8	248	Information	Removed: %s Info: %s
0x00f9	249	Information	%s is now OPTIMAL
0x00fa	250	Warning	%s is now PARTIALLY DEGRADED
0x00fb	251	Caution	%s is now DEGRADED
0x00fc	252	Fatal	%s is now OFFLINE
0x00fd	253	Warning	Battery requires reconditioning; please initiate a LEARN cycle

Table 50 Event Messages (Continued)

Number (Hex)	Number (Decimal)	Type	Event Text
0x00fe	254	Warning	VD %s disabled because RAID-5 is not supported by this RAID key
0x00ff	255	Warning	VD %s disabled because RAID-6 is not supported by this controller
0x0100	256	Warning	VD %s disabled because SAS drives are not supported by this RAID key