SATA RAID
SIL 3112
CONTROLLER
USER'S MANUAL

120410056E1N

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Important data protection information

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OVERVIEW

Product Overview

Silicon Image's SATARaid™ provides Serial ATA Software RAID functionality including Striping and Mirroring to enhance the industry's first proven PCI-to-SATA host controller product.

Two major challenges facing the storage industry today are 1) keeping pace with the increasing performance demands of computer systems by improving disk I/O throughput and 2) providing uninterrupted data accessibility after disk failure. With the SiI 3112 Serial ATA host controller and SATARaid, both of these problems can be solved.

RAID Striping greatly improves hard disk I/O performance by concurrently striping data across multiple drives. RAID Mirroring enables users to enjoy the confidence of continued data availability regardless of a disk failure by simultaneously writing the data to two drives (note that Striping and Mirroring cannot be simultaneously configured).

Standard with SATARaid software is a Graphical User Interface (GUI) that provides easy-to-use configurations for the different RAID Sets supported.

SATARaid Features

- RAID 0 and 1
- Hot Spare and on-line mirror rebuilding
- System GUI Monitoring Utility:
  - Displays logs and alerts users to vital RAID Set information
  - Manages RAID Set Functions (configures, rebuilds, etc.)
- RAID Set accommodates multiple sized HDDs
- HDDs function normally when not in RAID Sets
- Adjustable stripe size for RAID 0
- Automatically selects highest available transfer speed for all ATA and ATAPI devices
- Supports:
  - UDMA up to 150 MB/Sec.
  - All UDMA and PIO Modes
  - Up to 2 SATA devices
  - ACPI and ATA/ATAPI6

Introduction to RAID
(Redundant Array of Independent Disks)

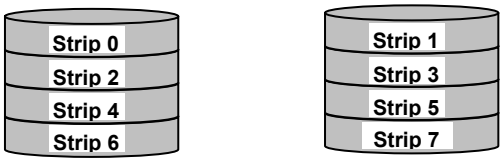
RAID technology is a sophisticated disk management system that manages multiple disk drives, enhancing I/O performance and providing redundancy in order to prevent the loss of data in case any of the individual disks fail.

SATARaid provides two RAID Set types, Striped (RAID 0) and Mirrored (RAID 1).

Disk Striping (RAID 0)

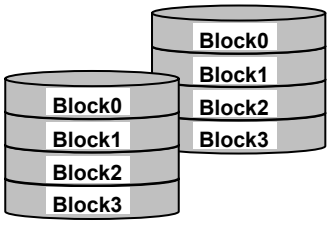
Striping is a performance-oriented, non-redundant data mapping technique. While Striping is discussed as a RAID Set type, it actually does not provide fault tolerance. With modern SATA and ATA bus mastering technology, multiple I/O operations can be done in parallel, enhancing performance. Striping arrays use multiple disks to form a larger virtual disk.

This figure shows a stripe set using two disks with stripe zero written to disk one, stripe one to disk two, and so forth.



Disk Mirroring (RAID 1)

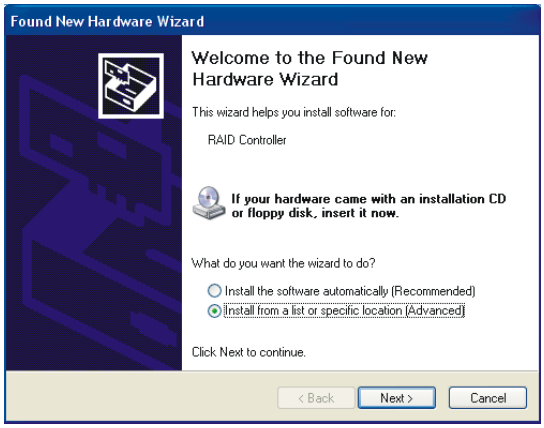
With Disk Mirroring there is a redundant disk that mirrors the main disk. Data that is written to the main disk is also written to the redundant disk. This redundancy provides fault tolerant protection from a single disk failure. If a read failure occurs on one drive, the system reads the data from the other drive.



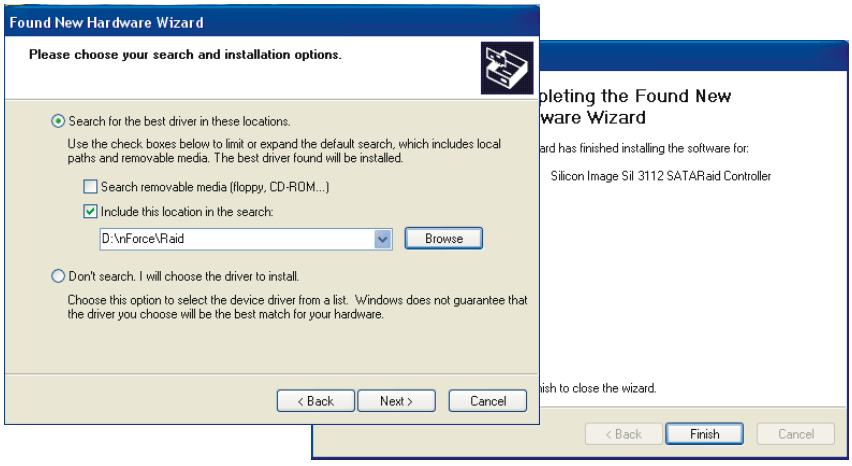
Installing Hardware Drivers

After you install your Windows Operating System to one of your hard disks (whether it is one of the SATA drives or an ATA drive), the “Found New Hardware Wizard” will appear prompting you to install the hardware drivers for the RAID controller (as shown below).

Select the “Install from a list or specific location (Advanced)” option and then click “Next”.



On the next screen, check the “Include this location in the search:” box. Click the “Browse” button, search for the path d:\nForce\Raid (note that drive letter may be different on your system) in the location text box and then click “Next” to install the driver. Finally, click “Finish” on the next screen to complete the installation.

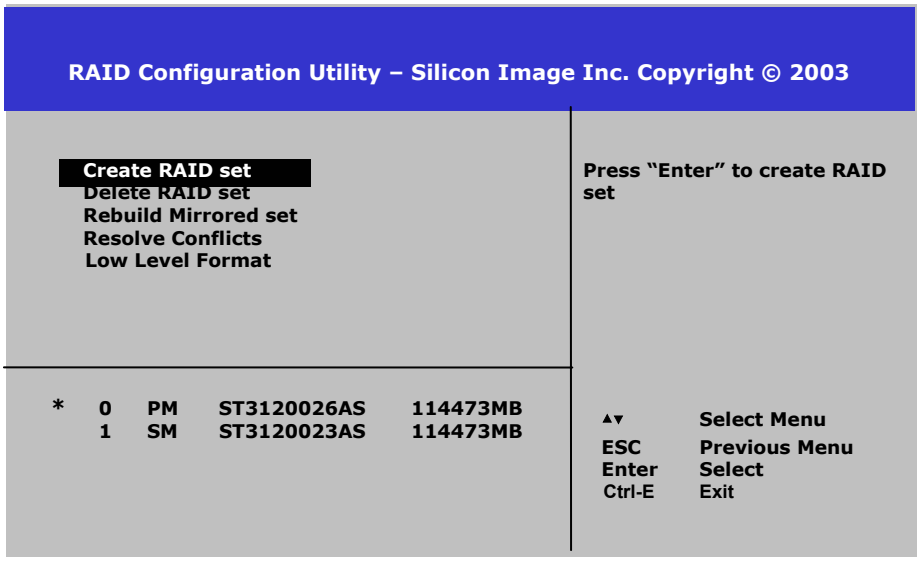


Creating/Deleting RAID Sets
(BIOS RAID Configuration Utility)

Creating and deleting RAID sets are done using the BIOS RAID Configuration Utility. During bootup, the following message will appear, pausing for a few moments allowing the user to enter the RAID utility.

"Press <CRTL-S> or F4 to enter RAID utility"

The BIOS RAID Configuration Utility screen will appear as shown below:



The top-left portion of the screen lists the basic functions. The bottom-left portion of the screen lists the SATA drives currently installed on the system. The top-right portion of the screen displays instructions and comments for the user. The bottom-right portion lists the command keys.

Creating RAID Sets

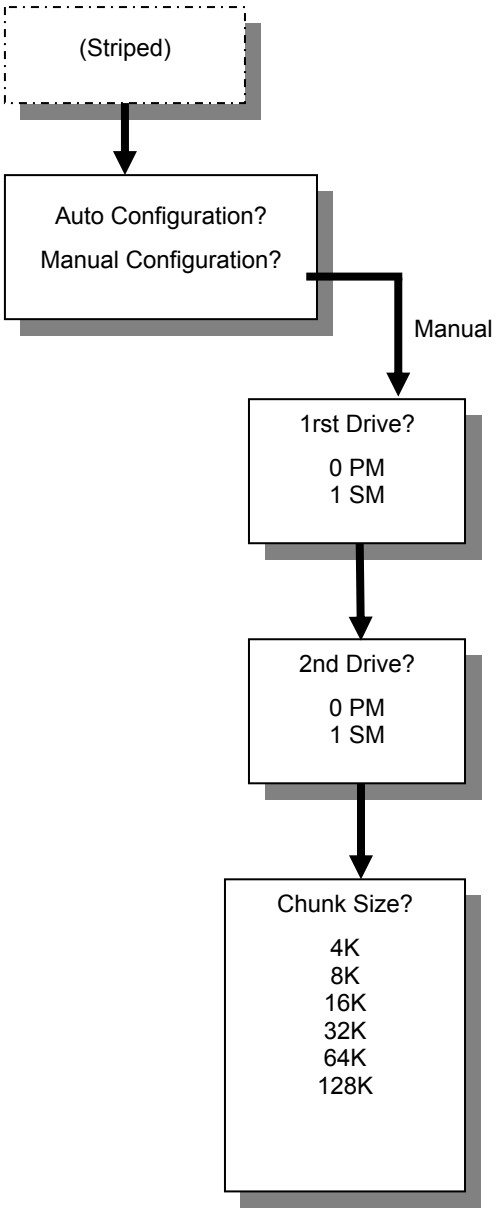
This mainboard supports only two SATARaid drives and so configuring RAID Sets is a relatively simple procedure.

1. From the BIOS RAID Configuration Utility select "Create RAID Set."
2. Choose either a "Striped" or "Mirrored" RAID Set. (note that a "Striped Set" and a "Mirrored Set" cannot be configured concurrently).

Important Note

Before you configure any SATA hard drives into your system, backup any important data as a safety precaution.

3. Select if you want the utility to Auto Configure the RAID Set or if you want to manually configure the RAID Set. Using the Manual method, there is a different set of options depending on whether you choose Striped or Mirrored.

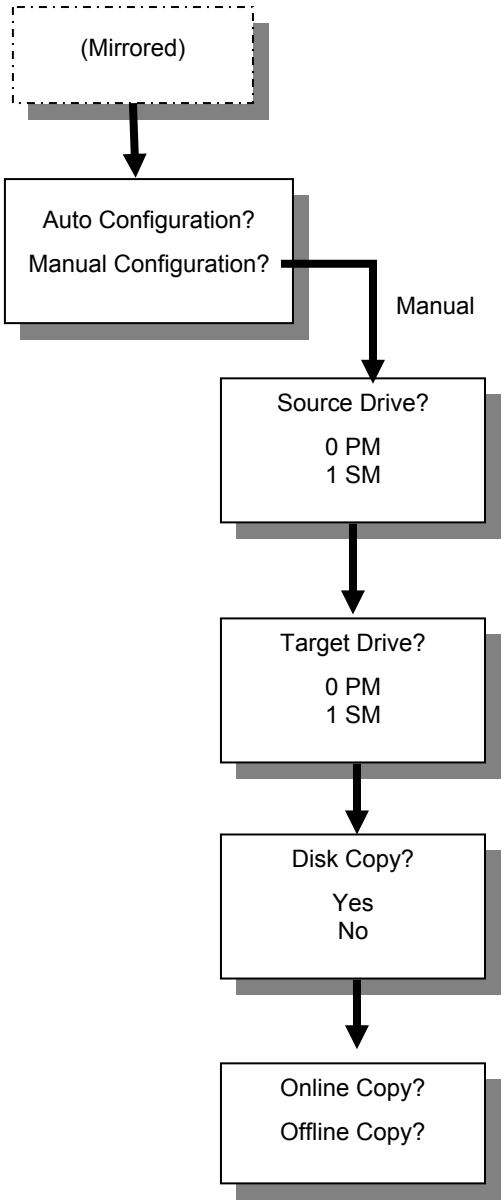


Select either manual or auto configuration.

Choose whether the first drive is the primary or secondary drive. “0 PM” represents the connector “SATA1” on the mainboard. “1 SM” represents SATA2” on the mainboard.

Choose whether the second drive is the primary or secondary drive. There will actually only be one option here and the option that displays will depend on your selection in the previous question.

Select the striping chunk size.



Select either manual or auto configuration. Note that you must use "Manual" if you are installing a disk that already contains data.

Choose the source drive as the primary or secondary drive. "0 PM" represents the connector "SATA1" on the mainboard. "1 SM" represents SATA2" on the mainboard.

Select the target drive. There will actually only be one option here and the option that displays will depend on your selection in the previous question.

Select whether you would like to perform a disk copy. This is only required when the source drive already contains data and you need to initialize the target drive with the same data.

Select whether you would like to perform the disk copy offline or online.

4. At the end, the utility will ask "Are You Sure?" before executing the new configuration. Confirm to finish.

Deleting RAID Sets

To remove one or more RAID sets, select “Delete RAID Set.”
Select the desired set and press Y when asked “Are You Sure?”

Rebuild Mirrored Sets

This function is used after a disk failure on one of the Mirrored disks. After installing the replacement disk, this function allows you to rebuild the replacement disk from the existing disk before you can begin using it.

Resolving Conflict

When a RAID set is created, the metadata written to the disk includes drive connection information (Primary Channel, Secondary Channel). If, after a disk failure, the replacement disk was previously part of a RAID set (or used in another system), it may have conflicting metadata, specifically in reference to the drive connection information. If so, this will prohibit the RAID set from being either created or rebuilt. In order for the RAID set to function properly, this old metadata must be first overwritten with the new metadata. To resolve this, select “Resolve Conflict” and the correct metadata, including the correct drive connection information will be written to the replacement disk.

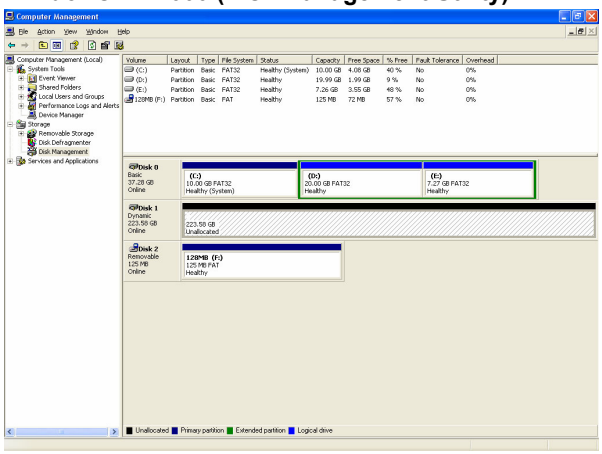
Low Level Format

Allows you to perform a low level format on the hard disks.

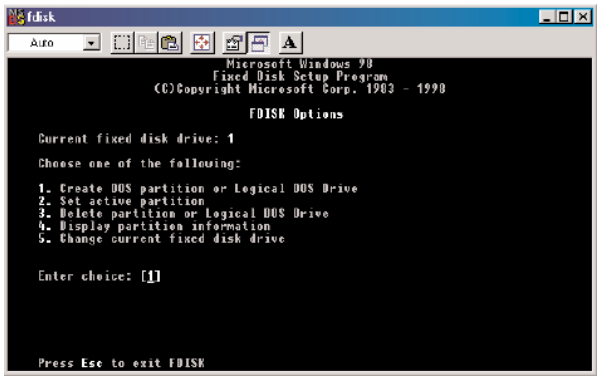
Creating/ Naming Partitions

After configuring the two physical SATA hard disks as a RAID set (done with the RAID BIOS Utility), we must partition the disks. That is, divide the space on the RAID set into several logical drives (e:, f:, g: etc). The creation and naming of partitions is something that is done within the Windows operating system. Windows XP/2000 both use the Disk Management utility. Windows 98/Me uses the “fdisk” utility.

Windows XP/2000 (Disk Management Utility)



Windows 98/ME (fdisk utility)



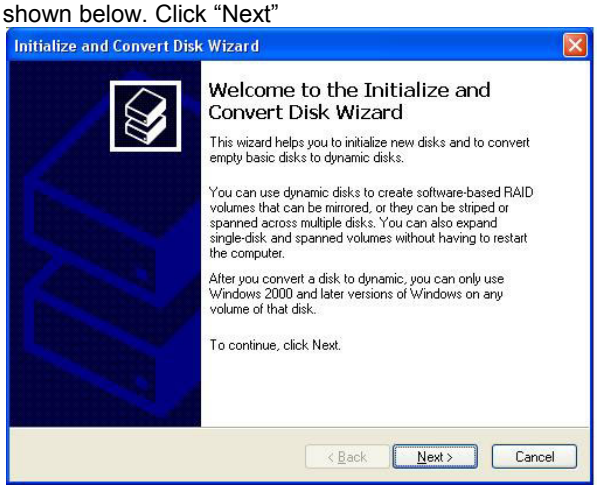
Creating Partitions in Windows XP/2000 Operating Systems

Note: Before creating any partitions, RAID sets must first be created/deleted using the BIOS RAID Utility (see Creating/Deleting RAID Sets).

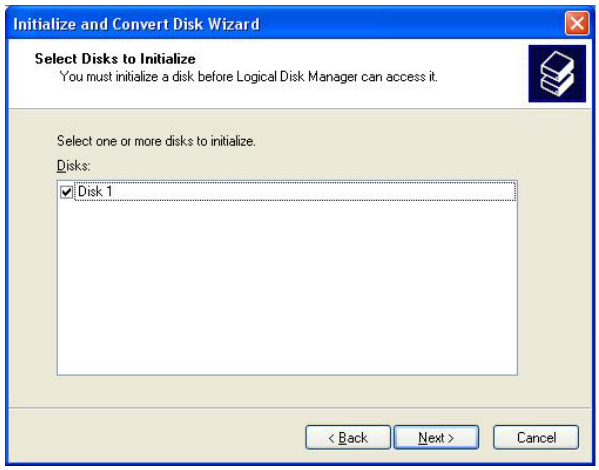
Initializing and Converting the Disks

1. After setting up the RAID Sets in the BIOS RAID Utility and rebooting the system, access the Disk Management utility using the following instructions beginning at the Control Panel Window.
   Control Panel ->Administrative Tools->Computer Management->Storage -> Disk Management

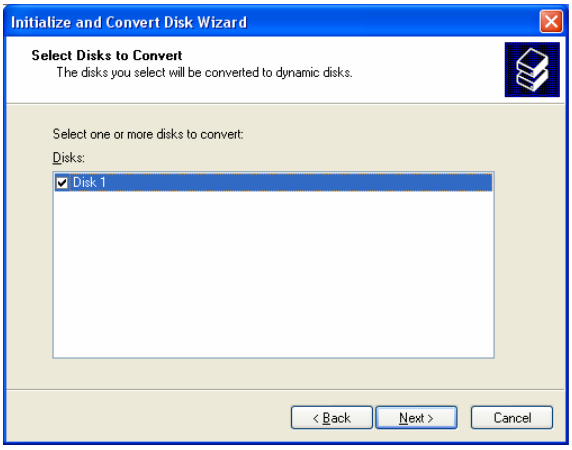
2. If this is the first time using the Disk Management Utility after configuring the RAID Set in BIOS, you will be prompted with the "Initialize and Convert Disk Wizard" as shown below. Click "Next"



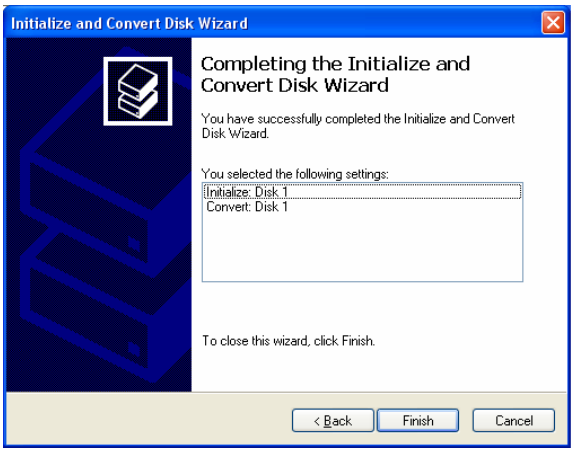
3. Check the box next to the RAID Set (in this case Disk 1) that needs initialization and click "Next".



4. Check the box next to the RAID Set (in this case Disk 1) that needs conversion and click “Next”.



5. On this next screen click “Finish” to complete.

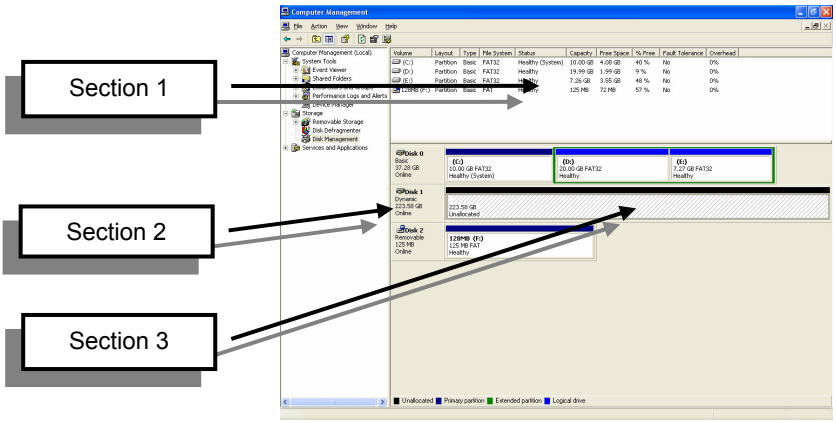


Using Disk Management Window to Partition Your Drive

Now that you have initialized the disks, again access the Disk Management Window from the Windows Control Panel as shown below:

Control Panel ->Administrative Tools->Computer Management->Storage -> Disk Management

Windows XP/2000



Take note of 3 sections of this screen:

SECTION 1: This section lists all formatted and available disks.

SECTION 2: This section reports on each disk set. DISK 1 in this example represents two 112 GB physical disks setup as a “Striped RAID Set” in the BIOS RAID Utility. Note that all of the disk space for the two striped disks are reported here. On mirrored disks however, only the disk space for one of the two disks are reported.

SECTION 3: This section displays all of the partitions for this RAID Set (DISK 1). In the image above, no partitions have been allocated and thus the RAID Set is unusable at this time.

Note: In Section 1, all disks should list the following: "Basic", "<*Disk Size*>" and "Online". If your disk is listed as "Unknown" or "Dynamic" rather than "Basic", follow the instructions below to change it to "Basic":

- If the disk reports as "**Unknown**," right-click on the disk (in SECTION 2) and click on "Write Signature".

  At this point, a window will appear with the disk in question (all "Unknown" disks may appear in this window).

  Make sure the box next to each disk is checked, then click "OK".

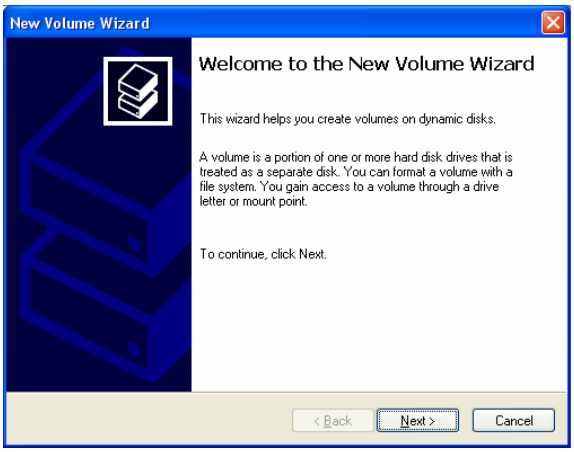
- If a disk reports as "**Dynamic**," right-click on SECTION 2 of that disk, and click on "Return disk to Basic..." Within seconds the disk should report as Basic.

Creating the Partitions

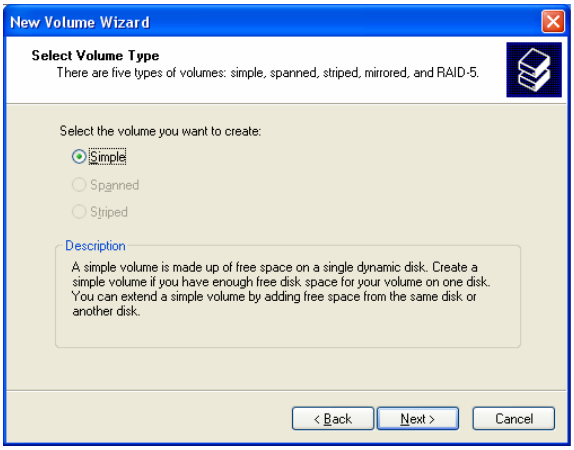
Note: In this section, our example system will include two 112 GB SATA drives that have been configured in the BIOS RAID Utility. The system will also contain an ATA drive (C:) that has already been configured with an operating system.

At this point, there should be one disk with "unallocated" partitions. This represents the RAID Set.

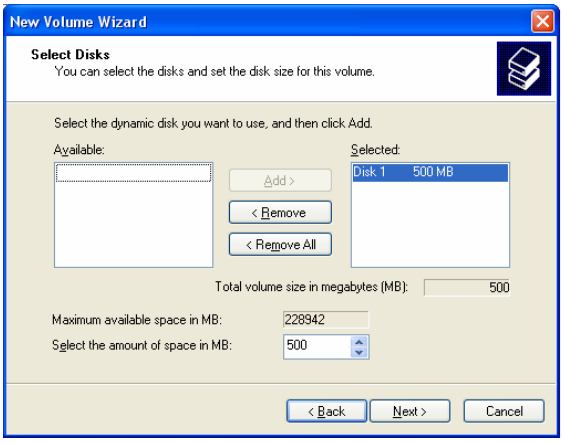
1. Right-click on the partition of the DISK 1 (Section 2) on the Disk Management window and click on "New Volume." The "New Volume Wizard" will appear as shown below. Click "Next.



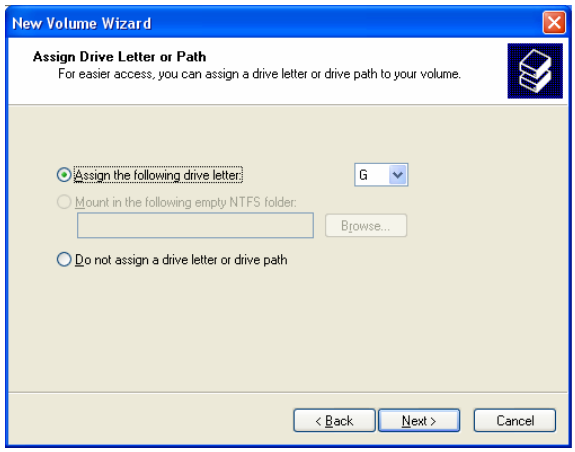
2. The next screen allows you to select the Volume Type. Select “Simple and click “Next”.



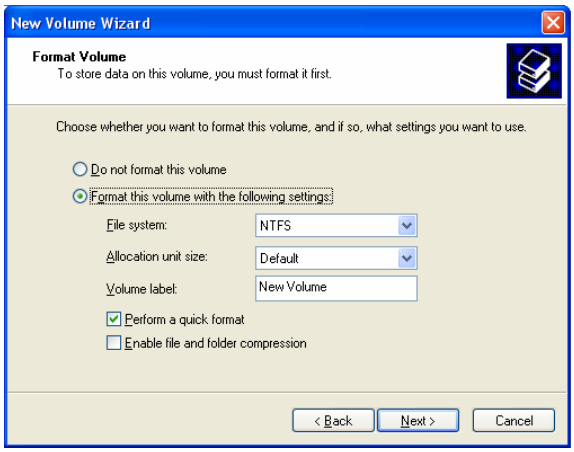
3. The next window allows you to set up the partition size of the partition that you are creating. Since this is a Striped RAID set utilizing two 112 GB disk drives, the largest partition that you can create is approximately 224 GB. In the example below we are creating a 500 MB partition. Click “Next”.



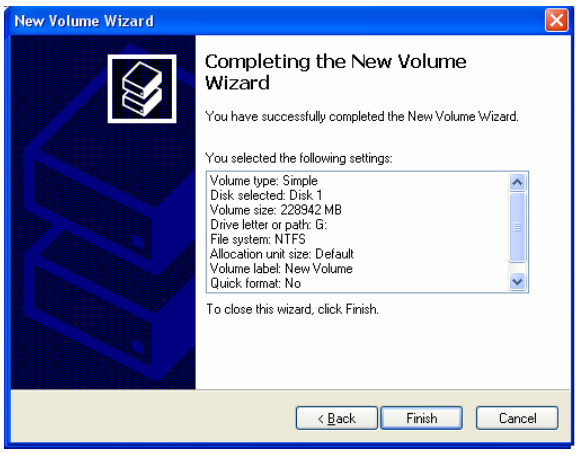
4. The next window designates the drive letter of the partition.



5. The next window allows the user to label the volume name and choose the type of formatting to take place upon the creation of the partition. Name the volume (we suggest a generic but descriptive name such as STRIPED SET or something specific to the usage such as FINANCIAL, CRITICAL, MISCELLANEOUS, etc.). Check the box next to “quick format.”. Click “Next”.



6. The next window is a summary window listing all of the selections made. Click “Finish”.

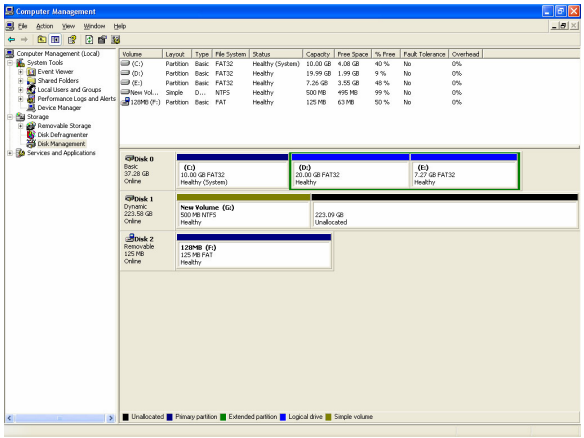


In the Disk Management Window, Section 2 for DISK1 should display the new partition with a label of “Healthy”. This section may also display “Formatting” which indicates that formatting is still taking place. This phase may take a few minutes depending on the size of the partition. Do not attempt to create a partition for the next disk until the disk currently being formatted is complete and reports “Healthy”.

7. Repeat this procedure for any remaining partitions you would like to configure.

When you have finished configuring your partitions, close the Data Management window by clicking on the close button marked “X” in the top right corner of the window.

Click on the “My Computer” icon on the Desktop. The new 500 MB partition should now be visible and appropriately named. Data may now be written to and read from that partition.



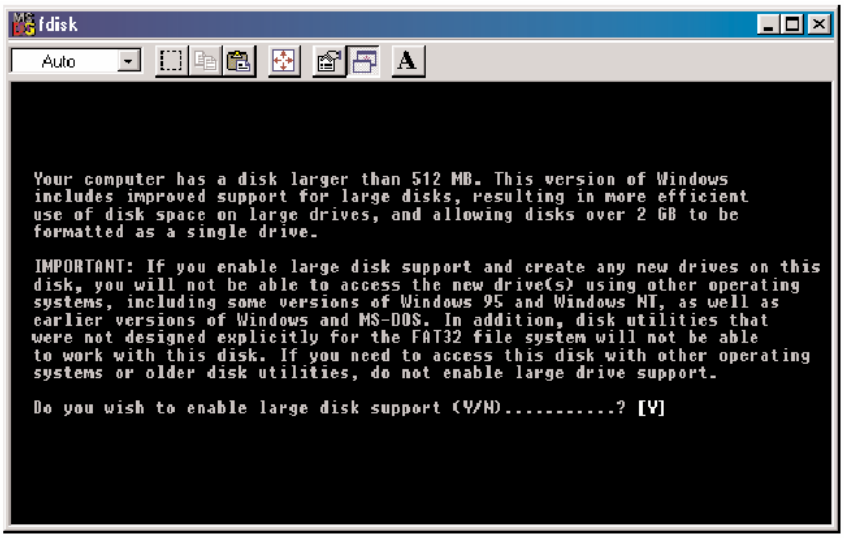
Creating Partitions in Windows 98/Me Operating Systems

> **Note**: Before creating any partitions, RAID sets must first be created/deleted using the BIOS RAID Utility (see Creating/Deleting RAID Sets).

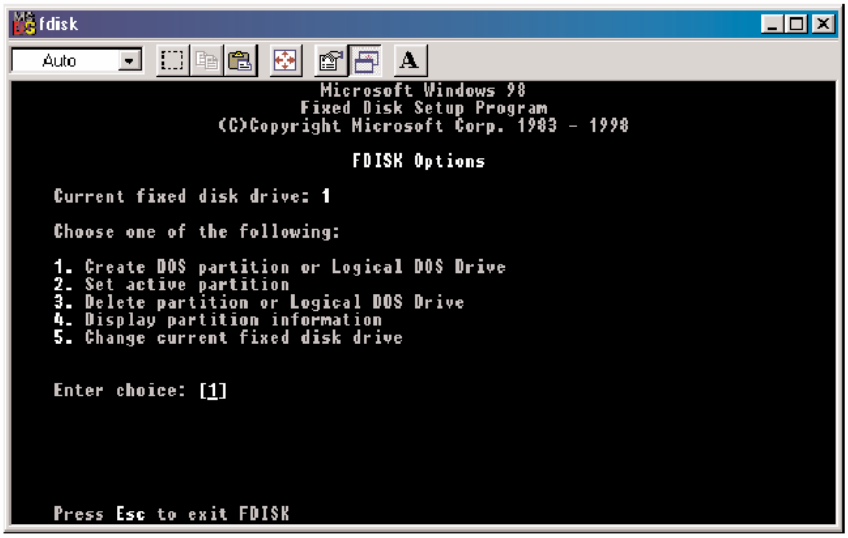
Windows 9x uses the “fdisk” utility to partition its disks.

Partitioning the disks using the FDISK Utility

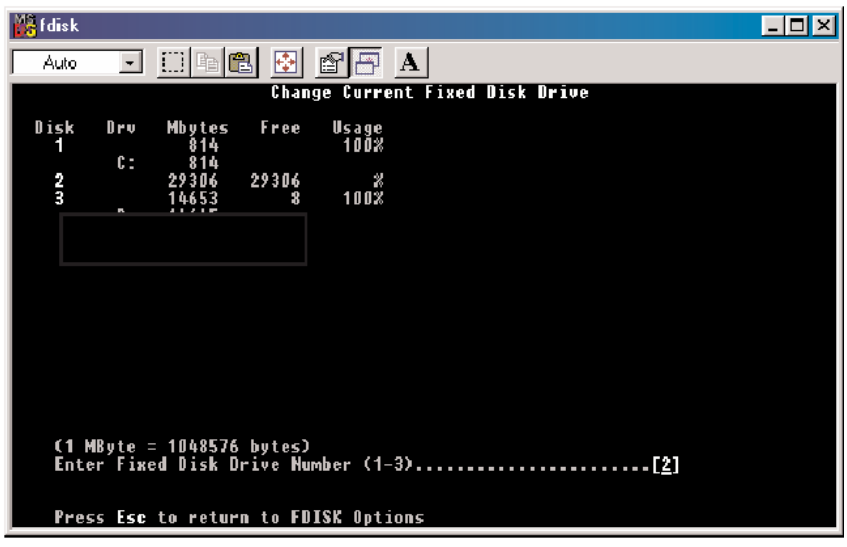
1. Click on the **START** button and select RUN
2. Select **Run...**
3. Type **fdisk**
4. Click **OK.** The screen below will appear. Press “Enter”.



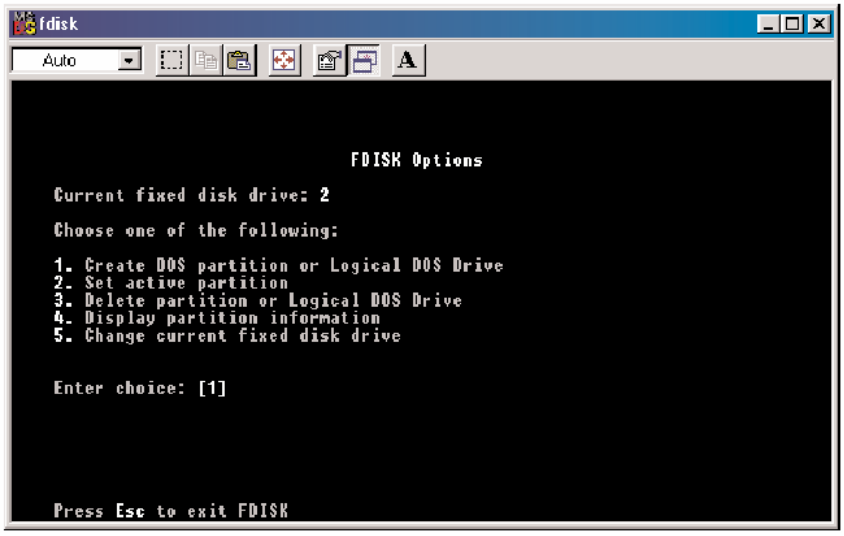
5. The **FDISK Options** window will appear. The Current Fixed Drive will be set to the System Drive (normally C:\). In order to create partitions, the current fixed drive needs to be changed. Enter the choice "**5"** and press **Enter**.



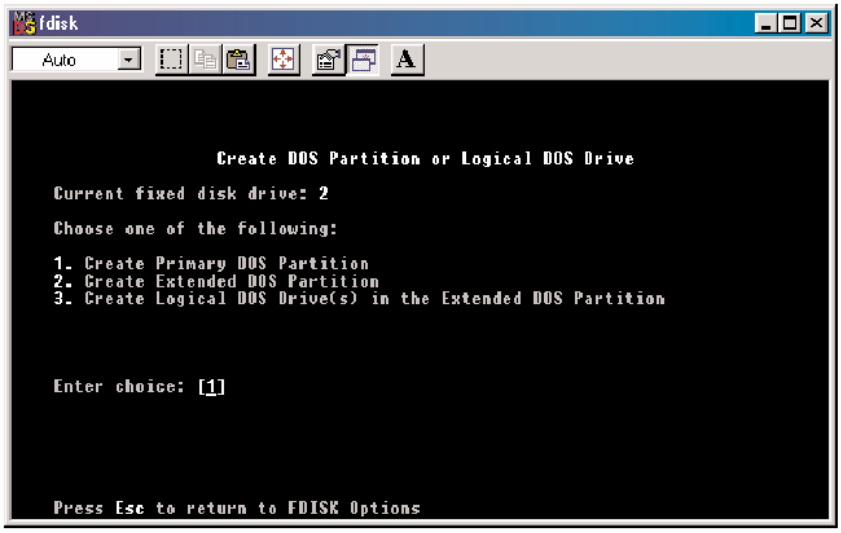
6. On this next screen, enter the disk number that you want change to the current fixed drive and press **Enter**.



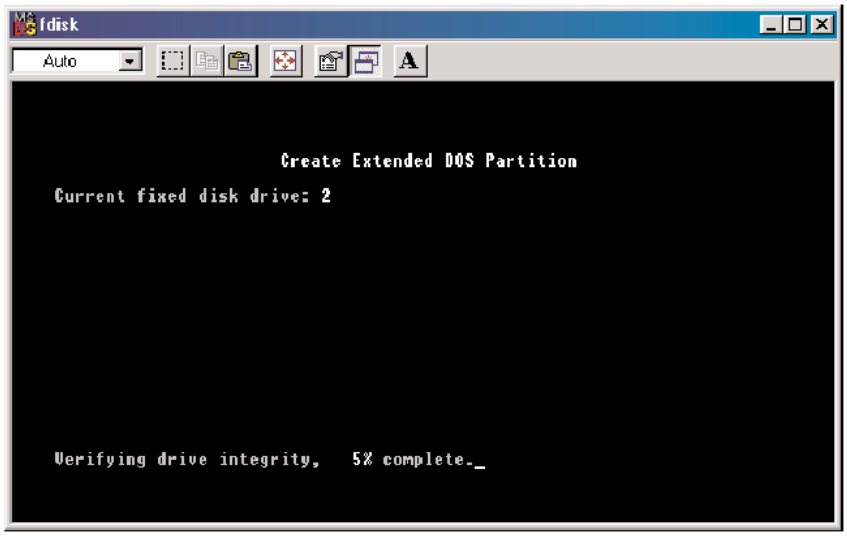
7. After returning to the FDISK Options screen, enter the choice **"1"** and press **Enter**.



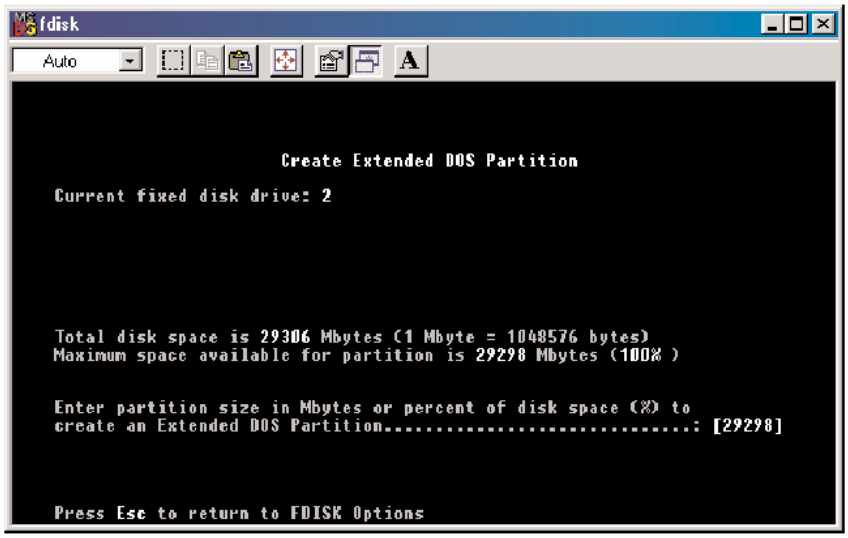
8. The following window will appear. Enter the choice "**2**" to create an extended partition and press **Enter**.



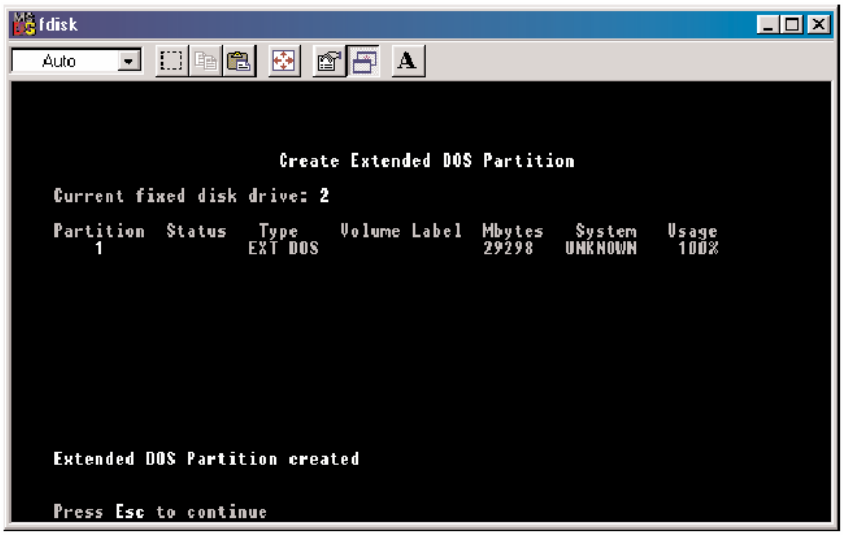
The following window will appear with a progress indicator. Wait until it finishes.



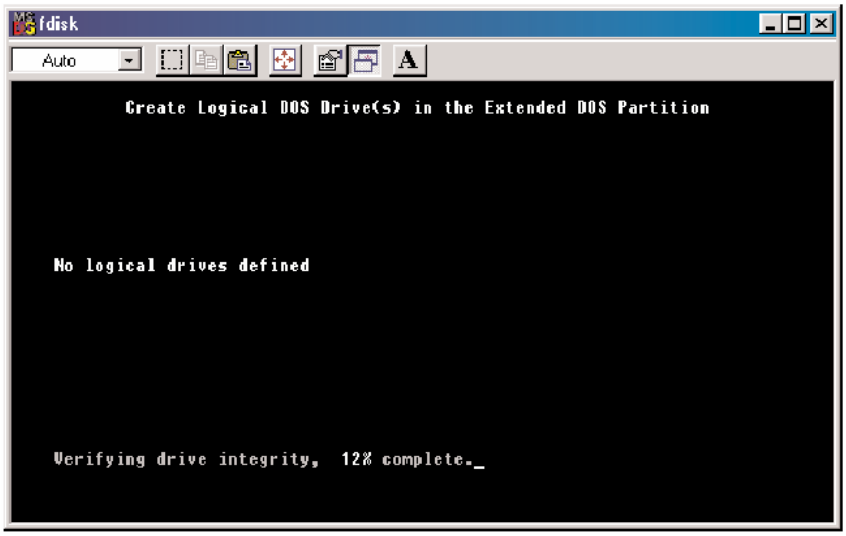
9. This next window explains how much space will be available in the partition. Press **Enter**.



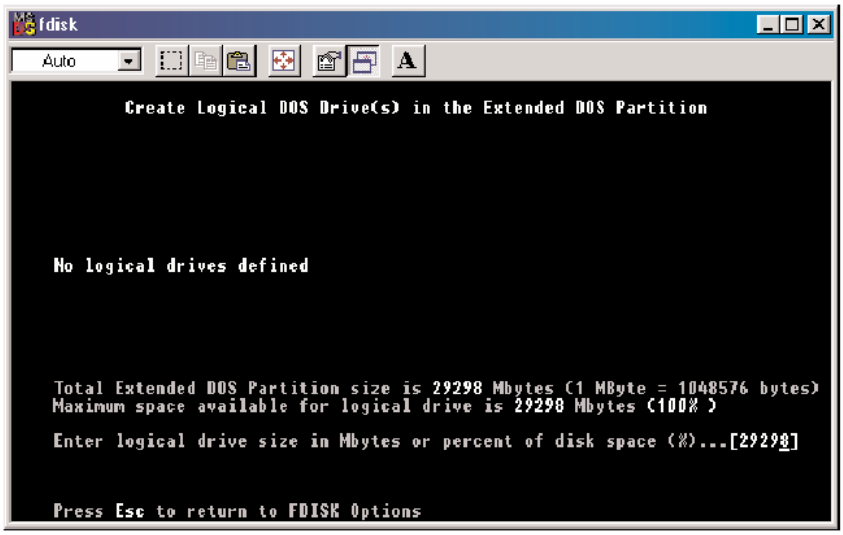
10. This next window shows that the partition has been successfully created. Press "**Esc**".



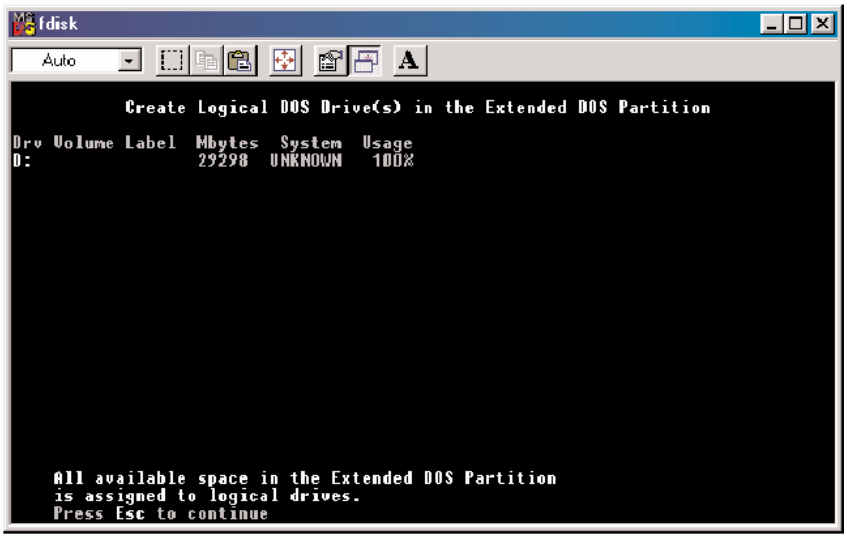
This next screen shows that FDISK is now creating a logical drive. Wait until complete.



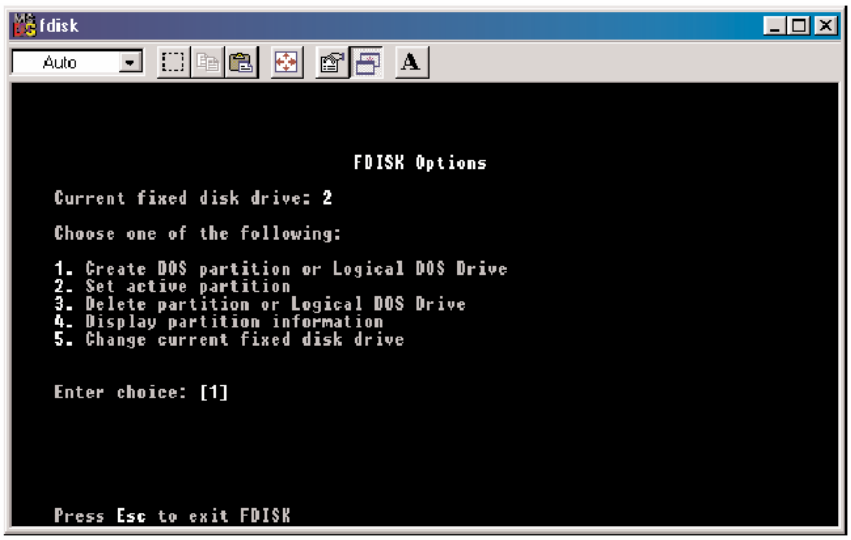
11. The next screen reports partition size. Press “Enter”



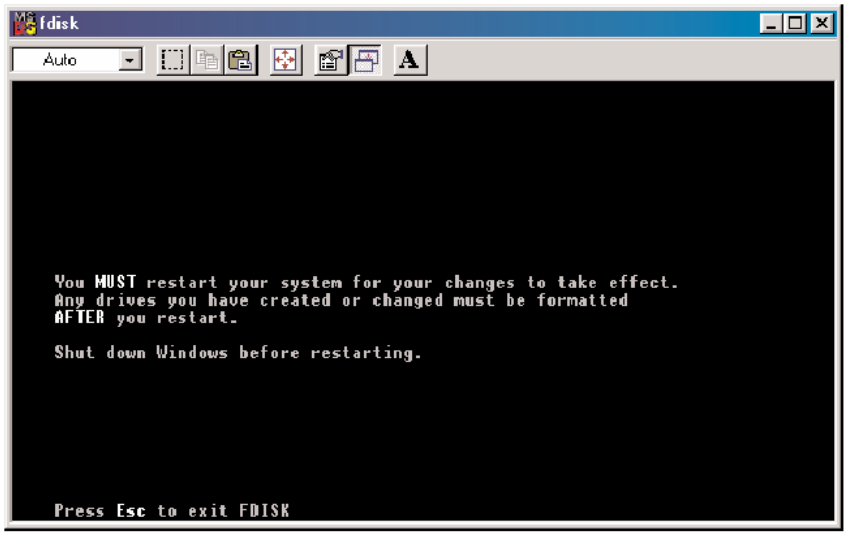
12. This window now displays the drive, its drive letter and size. Press **Esc**.



13. If another drive needs to be partitioned, repeat the process, starting by changing the fixed disk drive (Press 5). If done, press “Esc”.



14. If you pressed “Esc” in the previous step, the following window will display reminding you to reboot your system.



15. After restarting the computer, and rebooting Windows 9x, double-click on the “My Computer” icon.
16. Right-click on each new drive and select Format.

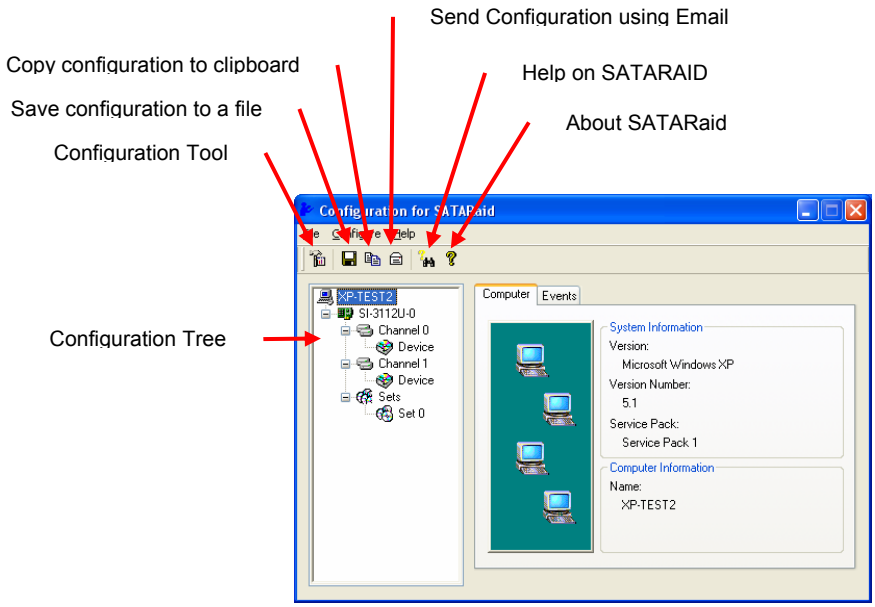
    Only a FULL format will be accepted at this point. Select “Full Format”, enter the Label Name for the drive or RAID set (if desired) and click “OK”.
17. Once the drive has been formatted, repeat the procedure for each new drive, after which the new drives will be ready for use.

Using Silicon Image SATARaid GUI

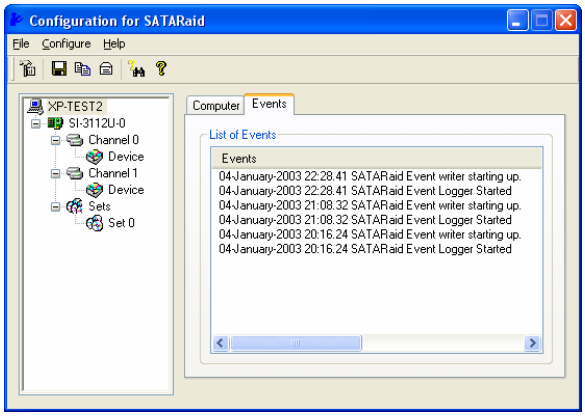
The SATARaid GUI offers the user or system administrator the ability to easily monitor and configure notification alerts for the RAID Set. To launch the GUI, simply double-click on the icon located in the bottom right hand corner of the desktop.

If the icon does not appear in the bottom right hand corner of the desktop, find where the application was saved and launch from there. Upon launching the GUI, the first window should appear as follows, displaying basic system information.

Main Screen

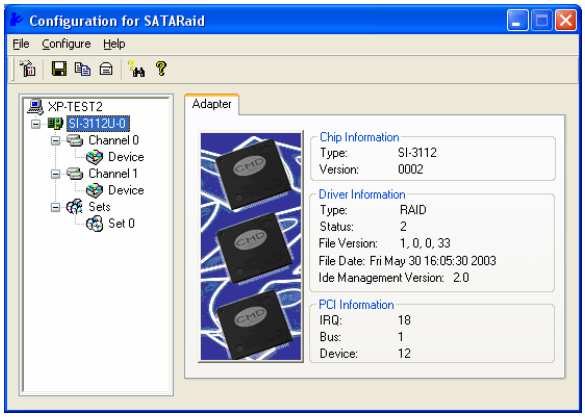


Events Log Tab (Main Screen)



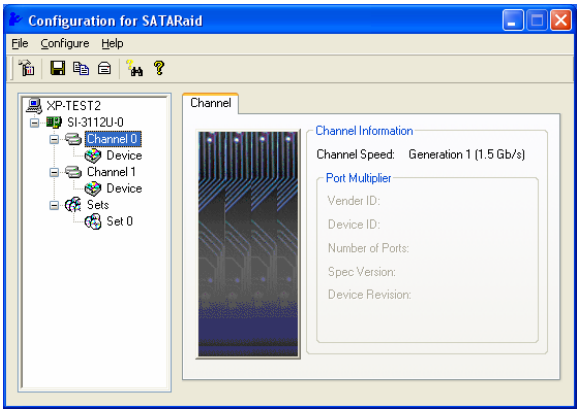
Disk Storage Subsystem Level

Clicking on a disk storage subsystem item will provide specific information for that component as shown below.



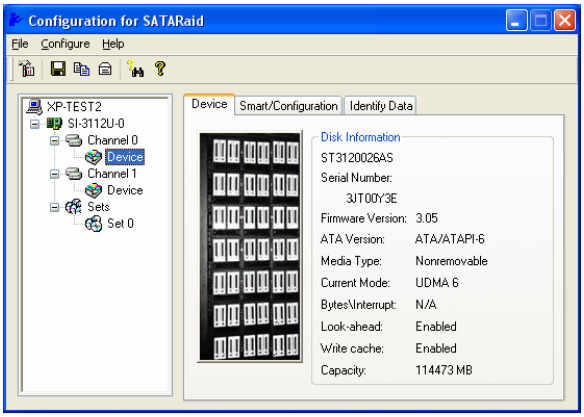
Channel Level

Selecting a specific channel, either Channel 1 or Channel 0 will provide channel information.

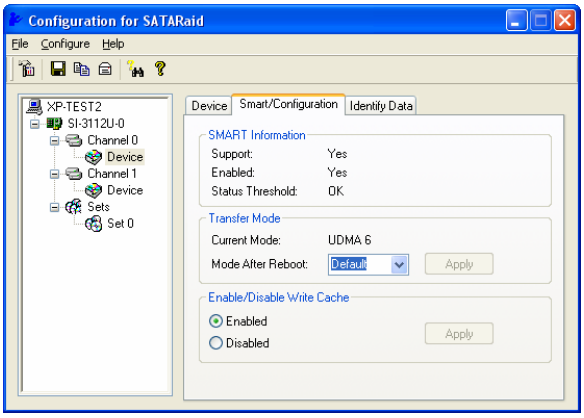


Device Level

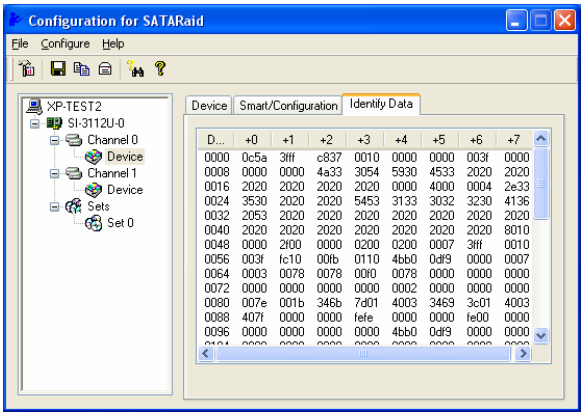
Selecting a specific drive reports all pertinent information for that drive, including Configuration and Disk Identification information.



Smart Configuration Tab (Device Level).

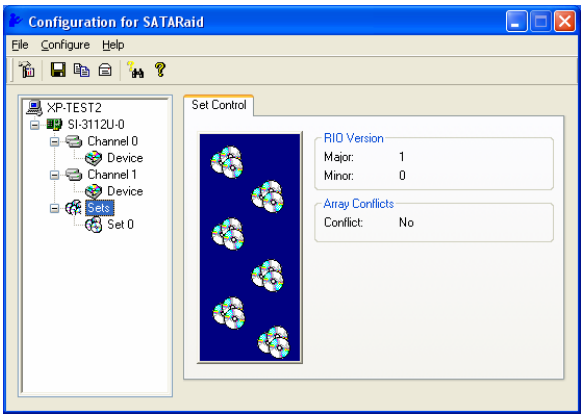


Identify Data Tab (Device Level)



Sets Level

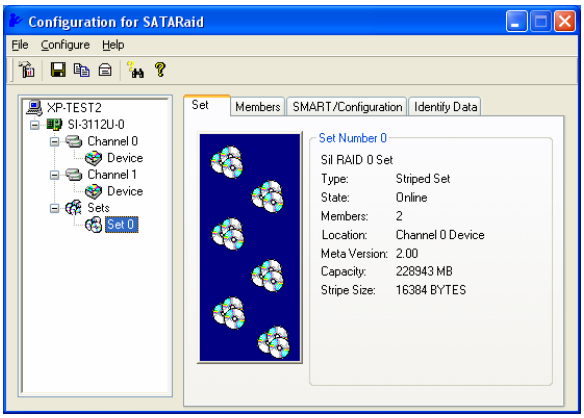
Selecting the Sets item will provide information on the RIO Version as well as Array Conflict information:



Sets Detail Level

By selecting a specific RAID set, such as Set 0, the type of RAID set, the number of members and capacity are reported.

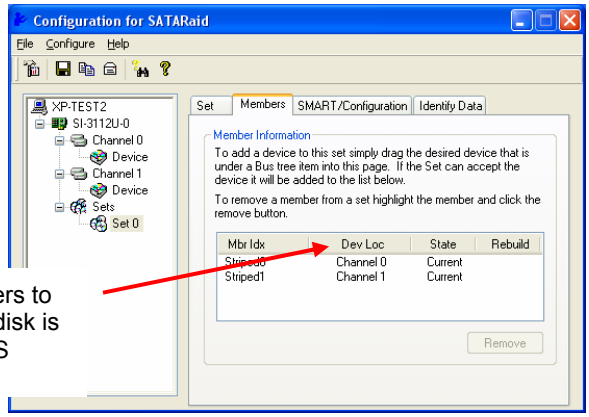
Set Tab



Members Tab

The Members tab of this window reports the device identification (corresponding with the information in the BIOS) and the State of each device.

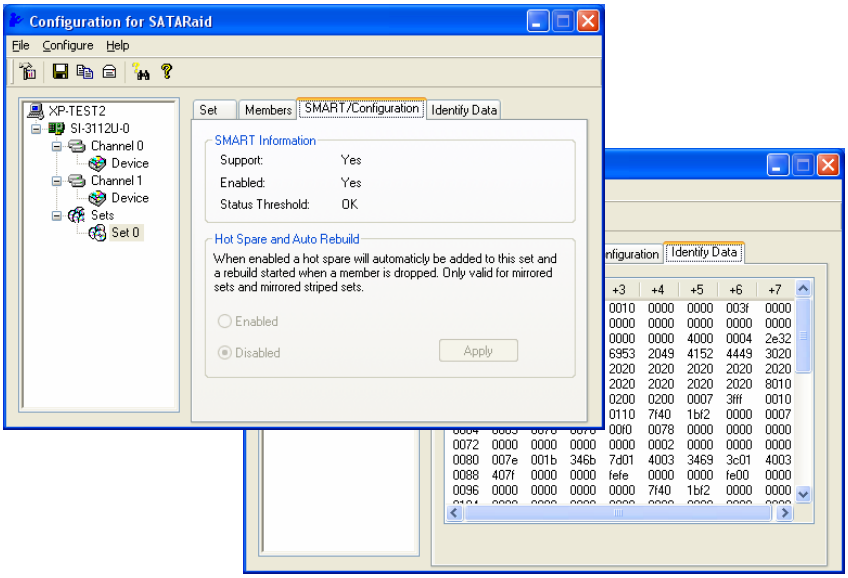
Besides reporting information, the Members tab of a Mirrored set allows the user to remove a specific drive from that set, as well as add a designated Spare drive to a Mirrored set that has experienced a disk failure. Removing a drive from a striped set is not allowed because it would destroy all the data. Note that when a Mirrored Set is first created, the State of the "destination" drive may report as Rebuild for as much as 30-90 minutes depending on the size of the disk.



The Device Loc refers to how each physical disk is reported in the BIOS RAID utility.

SMART/Configuration Tab & Identity Data Tabs

SMART and Configuration information, as well as Data Identification are provided for each Set.

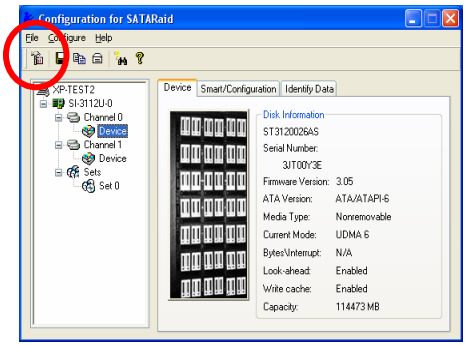


SATARaid Configuration Tool

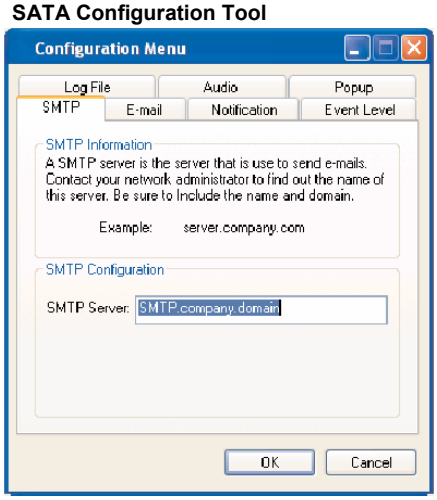
The SATARaid Configuration Tool provides users and system administrators with tools for administering workstations or servers with the SATARaid features implemented.

By clicking on the toolbox icon in the top left portion of the SATARaid GUI window, you can access the SATARaid Configuration Tool. The user may configure SATARaid features including customizing the settings for SMTP, E-mail Alerts, Event Level alert notification, Log File location, Audio options, and Popup Alerts.

SATARaid GUI window

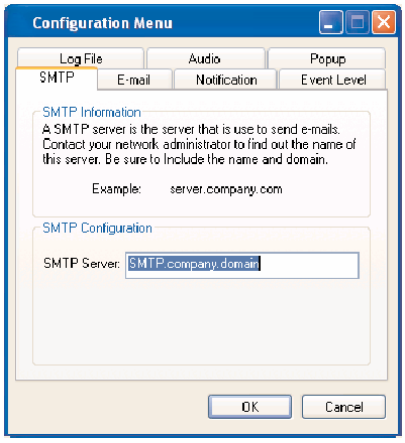


SATA Configuration Tool



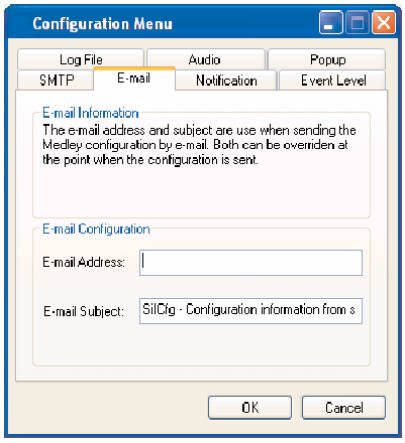
SMTP

This is the SMTP server that is used to deliver alert notification e-mail and system configurations from an SATARaid system. Contact your network administrator for this information. Both the name and domain must be entered.



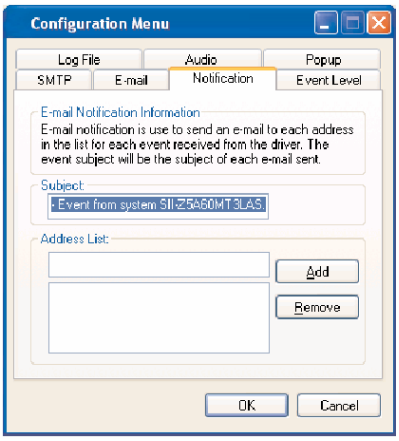
E-Mail

The current SATARaid configuration may be sent via e-mail to a specific recipient. Using the e-mail tab in the SATARaid Configuration Menu, the user may set the default e-mail address and subject line to where the configurations should be sent. You will be given the option however of changing the recipient when you invoke the "Send Configuration" function from the SATARaid GUI window.

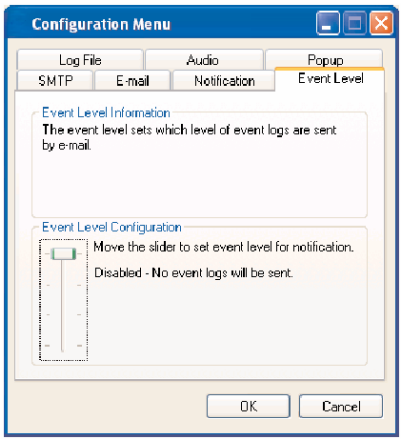


Notification

When certain events occur, SATARaid may be configured to send notices to assigned individual e-mail addresses. Using the Notification tab, all e-mail addresses that are to receive the notices must be entered here.



Event Level



The system may be configured to deliver e-mail notifications when certain events occur. You can determine which alerts that are sent depending on the severity of the problem. The different levels are:

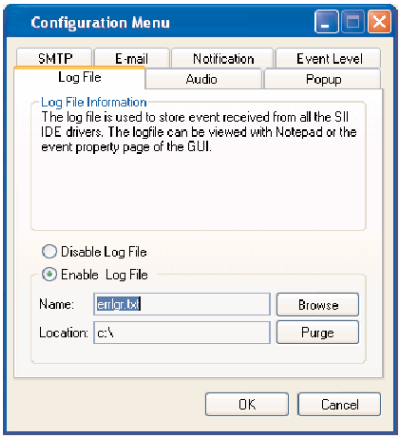
Disabled
- No event logs will be sent.

Informational Event Level
- Informational
- Warnings
- Errors

Warning Event Level
- Warnings
- Errors

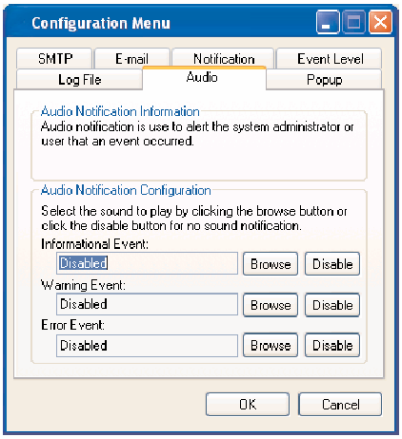
Errors Event Level
- Errors

Log File



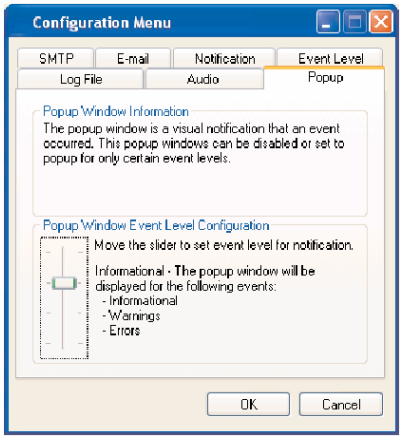
The log file is used to store event information received from all the Silicon Image RAID drivers. The log file is a text file and can be viewed with Notepad or SATARaid. Use the Log File tab to set where the log file should be stored as well as the name of the file.

Audio



The user may set different audio alerts for the different levels of events.

Popup



The popup window is a visual notification that an event has occurred. The popup window can be disabled or set to popup for only certain event levels. The different levels are:

Disabled
- No popup windows will occur.

Informational Event Level
- Informational
- Warnings
- Errors

Warning Event Level
- Warnings
- Errors

Errors Event Level
- Errors