APPENDIX F

Serial Attached SCSI BIOS Configuration Utility

This appendix explains how to use the LSI Logic Fusion-MPT Serial Attached SCSI (SAS) BIOS Configuration Utility. This appendix contains the following sections:

- Fusion-MPT SAS BIOS Overview
- Starting the SAS BIOS Configuration Utility
- Configuration Utility Screens
- Performing RAID Configuration Tasks

Note - The information in this chapter applies to all Sun Fire X4100/X4100 M2 and X4200/X4200 M2 servers, unless otherwise noted in the text.

F.1 Fusion-MPT SAS BIOS Overview

The Fusion-MPT SAS BIOS features include:

- Configuration for up to 256 adapters; any four can be chosen for INT13 (bootrom) support
- Support for Message Passing Technology (MPT)
- Support for the LSI53C1064 devices
- Support for SAS devices

Note - At this time, these servers are shipped with support for the SAS1064 controller only. SATA devices are not supported in these servers at this time.

- Support for Integrated RAID initialization (with proper firmware)

The SAS BIOS is the bootable ROM code that manages SAS hardware resources. It is specific to a family of LSI Logic Fusion-MPT SAS controllers or processors. The Fusion-MPT SAS BIOS integrates with a standard system BIOS, extending the standard disk service routine provided through INT13h.

During the boot time initialization, the SAS BIOS determines whether the system BIOS has already installed other hard disks, such as an IDE drive. If such drives are already installed, the SAS BIOS maps any SAS drives it finds behind these drives. Otherwise, the SAS BIOS installs drives starting with the system boot drive. In this case, the system boots from a drive controlled by the SAS BIOS. The LSI Logic SAS BIOS supports the BIOS Boot Specification (BBS).

F.1.1 Boot Initialization With BIOS Boot Specification (BBS)

The Fusion-MPT SAS BIOS supports the BIOS Boot Specification (BBS), which allows you to choose which device to boot from by selecting the priority.

To use this feature, the system BIOS must also be compatible with the BBS. If the system supports the BBS, you can use the system BIOS Setup menu to select the boot order and drive order. In the system BIOS Setup, the Boot Connection Devices menu lists the available boot options. Use that menu to select the device and rearrange the order. Then exit to continue the boot process.

F.2 Starting the SAS BIOS Configuration Utility

If you have SAS BIOS version 6.xx, and it includes the Fusion-MPT SAS BIOS Configuration Utility, you can change the default configuration of the SAS host adapters. You may decide to change these default values if there is a conflict between device settings or if you need to optimize system performance.

The version number of the SAS BIOS appears in a banner displayed on the computer monitor during bootup. If the utility is available, this message also appears during bootup:

```
Press Ctrl+C to start LSI Logic Configuration Utility...
```

This message remains on the screen for about five seconds, giving you time to start the utility. If you press Ctrl+C, the message changes to:

```
Please wait, invoking LSI Logic Configuration Utility...
```

After a brief pause, the computer monitor displays the Main menu of the Fusion-MPT SAS BIOS Configuration Utility. These messages may appear during the boot process:

- `Adapter removed from boot order!`

  This message appears when an adapter was removed from the system or was relocated behind a PCI bridge.

- `Adapter configuration may have changed, reconfiguration is suggested!`

  This message appears if none of the information in the NVRAM is valid.

- `Updating Adapter List!`

  This message appears when fewer than four adapters are in the boot order and more adapters exist than are shown.

Caution - The SAS BIOS Configuration Utility is a powerful tool. If, while using it, you somehow disable all of the controllers, press Ctrl+E (or Ctrl+A on versions earlier than 5.00) after memory initialization during reboot to re-enable and reconfigure the controllers.

Note - Some devices detected by the Configuration Utility cannot be controlled by the SAS BIOS. Devices such as tape drives and scanners require that a device driver specific to that device be loaded. However, the SAS BIOS Configuration Utility does allow you to modify parameters for these devices.

F.3 Configuration Utility Screens

All SAS BIOS Configuration Utility screens are partitioned into the following areas, starting at the top of the screen:

- Header Area: This area lists static information text, including the product title and version.
- Menu Area: This area lists the current screen title and controller information when on screens other than Adapter List.
- Main Area: This is the main area for presenting data. This area has a cursor for item selection, horizontal scrolling, and vertical scrolling. The horizontal and vertical scroll bars appear here if needed.
- Footer Area: This area provides general help information text.

Note - The screens shown in this appendix are examples. The version numbers and the screen items shown are subject to change over the life of the product.

F.3.1 User Input Keys

The general key inputs that are listed in TABLE F-1 apply on all screens of the SAS BIOS Configuration Utility.

TABLE F-1 User Input Keys

Key	Definition	Description
F1	Help	Context-sensitive help for the field in which the cursor is positioned.

Key	Definition	Description
Arrow keys	Move cursor	Up, down, left, right movement to position the cursor.
Home/End	Select item	Select the item in which the cursor is positioned.
+/-	Change item	Items with values in [ ] brackets are modifiable. Numeric keypad + and numeric keypad - update a modifiable field to its next relative value.
Esc	Abort/Exit	The Esc key aborts the current context operation and/or exits the current screen. The user is asked to confirm, if changes have been made.
Enter	Execute <*item*>	Executable items are indicated by highlighted text and a different background color. Press Enter to execute the item's associated function. Throughout the GUI, selections that are not currently permissible are grayed out. The behavior of executable items varies throughout the Configuration Utility.

F.3.2 Adapter List Screen

When you start the Fusion-MPT SAS BIOS Configuration Utility, the Adapter List screen (shown below) appears.. This screen displays a scrolling list of up to 256 LSI Logic SAS host adapters in the system and information about each of them. TABLE F-2 describes the fields in this screen.

Use the arrow keys to select an adapter, then press Enter to view and modify the selected adapter's properties (and to access the other screens). After you select an adapter and press Enter, the adapter's devices are scanned and the Adapter Properties Screen appears.

To change the Adapter boot order, use the -, +, Insert, and Delete keys while on the Boot Order field. Press Insert or Delete to add or remove an adapter to or from the boot order. Press the - and + keys to modify an adapter's position in the boot order. If you make changes to the boot order, the Configuration Utility prompts you to save the changes before you exit the screen.

From the Adapter List screen (shown below), you can also press Alt+N to access the Global Properties screen. On this screen you can change global scope settings.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* Adapter List  Global Properties                                             *
* Adapter     PCI  PCI  PCI  PCI   FW Revision          Status    Boot         *
*             Bus  Dev  Fnc  Slot                                 Order        *
* SAS1064     02   03   00   00    1.04.00.00-IR        Enabled   0            *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
```

```
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
* Esc = Exit Menu       F1/Shift+1 = Help                                      *
* Alt+N = Global Properties -/+ = Alter Boot Order  Ins/Del = Alter Boot List  *
********************************************************************************
```

TABLE F-2 Adapter List Screen Field Descriptions

Field	Description
Adapter	The specific LSI Logic SAS controller type.
PCI Bus	The PCI Bus number (range 0x00 - 0xFF, 0 - 255 decimal) assigned by the system BIOS to an adapter.
PCI Dev	The PCI Device (range 0x00 - 0x1F, 0 - 31 decimal) assigned by the system BIOS to an adapter.
PCI Fnc	The PCI Function (range 0x00 - 0x7, 0 - 7 decimal) assigned by the system BIOS to an adapter.
PCI Slot	The PCI slot in which the controller is installed.
FW Revision	The Fusion MPT firmware version and type (IR or IT).
Status	Status indicates whether an adapter is eligible for LSI Logic software control, or whether it is reserved for control by non-LSI Logic software: • Enabled: The BIOS is either currently controlling the adapter or will attempt to control the adapter upon reload. • Disabled: The BIOS is either not controlling the adapter or will discontinue control of the adapter upon reload. Whether Enabled or Disabled, the user can still view and modify settings for the adapter. The Boot Support setting in the Adapter Properties menu can be used to change the status of this setting. The BIOS must be reloaded (the system must be rebooted) in order for a new Boot Support setting to take effect. • Error: The BIOS encountered a problem with the adapter. Adapter settings can be viewed and modified, but the available information and functionality may be limited.

Field	Description
Boot Order	The order in which adapters will boot when the system has more than one adapter. Up to four of the total adapters in a system may be selected as bootable. To add an adapter to the boot list, press Insert while on the Boot Order field. To remove an adapter from the boot list, press Delete while on the desired adapter's Boot Order field. Press the - or + keys to change the adapter's position in the boot order.

F.3.3 Global Properties Screen

To access the Global Properties screen (shown below), press Alt+N while on the Adapter List screen. To return to the Adapter List from Global Properties, press Alt+N again. TABLE F-3 describes the fields in this screen.

```
*********************************************************************************
* Adapter List  Global Properties                                               *
*                                                                               *
*                                                                               *
*                                                                               *
*                                                                               *
*                                                                               *
*       Pause When Boot Alert Displayed  [No]                                   *
*       Boot Information Display Mode    [Display adapters & installed devices] *
*       Support Interrupt                [Hook interrupt, the Default]          *
*                                                                               *
*       Restore Defaults                                                        *
*                                                                               *
*                                                                               *
* Esc = Exit Menu        F1/Shift+1 = Help                                      *
* Alt+N = Adapter List                                                          *
*********************************************************************************
```

TABLE F-3 Global Properties Screen Field Descriptions

Field	Description
Pause When Boot Alert Displayed	This option specifies whether the BIOS pauses for user acknowledgement after displaying an alert message during boot. To continue after displaying a message, select No. To wait for the user to press a key, select Yes.
Boot Information Display Mode	This option controls how much information the BIOS displays about adapters and devices during boot. Possible values are: • Display adapters only • Display adapters and all devices • Display minimal information

Field	Description
	• Display adapters & installed devices
Support Interrupt	This option allows you to prevent a hook on INT40, if required. Possible values are: • Hook interrupt (default) • Bypass interrupt hooks
Restore Defaults	Press Enter to restore the default settings.

F.3.4 Adapter Properties Screen

The Adapter Properties screen (shown below) allows you to view and modify adapter settings. It also provides access to all other screens. TABLE F-4 describes the fields of the screen.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* Adapter Properties -- SAS1064                                               *
*                                                                             *
*           Adapter                         SAS1064                           *
*           PCI Slot                        00                                *
*           PCI Address(Bus/Dev/Func)       02:03:00                          *
*           MPT Firmware Revision           1.04.00.00-IR                     *
*           SAS Address                     50003BA0:000003BA                 *
*           Status                          Enabled                           *
*           Boot Order                      0                                 *
*           Boot Support                    [Enabled BIOS & OS]               *
*                                                                             *
*           RAID Properties                                                   *
*                                                                             *
*           SAS Topology                                                      *
*                                                                             *
*           Advanced Adapter Properties                                       *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
* Esc = Exit Menu        F1/Shift+1 = Help                                    *
* Enter = Select Item    -/+ = Change Item                                    *
*******************************************************************************
```

TABLE F-4 Adapter Properties Screen Field Descriptions

Field	Description
Adapter	The specific LSI Logic SAS controller type.

Field	Description
PCI Slot	The PCI slot in which the controller is located.
PCI Address	The PCI address assigned to the adapter by the system BIOS. Bus value has range 0x00 - 0xFF, 0 - 255 decimal. Device value has range 0x00 - 0x1F, 0 - 31 decimal. Function has range 0x00 - 0x7, 0 - 7 decimal.
MPT Firmware Revision	The Fusion MPT firmware version and type (IR or IT).
SAS Address	The SAS Address assigned to this adapter.
Status	Indicates whether an adapter is eligible for LSI Logic software control, or whether it is reserved for control by non-LSI Logic software: • Enabled: The BIOS is either currently controlling the adapter or will attempt to control the adapter upon reload. • Disabled: The BIOS is either not controlling the adapter or will discontinue control of the adapter upon reload. Whether Enabled or Disabled, the user can still view and modify settings for the adapter. The Boot Support setting in the Adapter Properties menu can be used to change the status of this setting. The BIOS must be reloaded (the system must be rebooted) in order for a new Boot Support setting to take effect. • Error: The BIOS encountered a problem with the adapter. Adapter settings can be viewed and modified, but the available information and functionality may be limited.
Boot Order	The order in which adapters will boot when the system has more than one adapter. Up to four of the total adapters in a system may be selected as bootable.
Boot Support	Indicates whether an adapter is eligible for LSI Logic software control or whether it is reserved for control by non-LSI Logic software. The options are: • Enabled BIOS & OS (default): Both the BIOS and OS driver will control the adapter. • Enabled BIOS Only: The BIOS will control the adapter; OS drivers will not control it. Some OS drivers do not support this setting. For example, there is no way to disable an adapter in a Windows driver. • Enabled OS Only: The BIOS will not control the adapter; the OS driver will control the adapter. • Disabled: The BIOS will not control the adapter when loaded. However, the adapter will still be visible through the Configuration Protocol. Changes to this setting are reflected in the Status field on the main Adapter List menu. The new setting does not take effect until the BIOS is reloaded (that is, until the system is rebooted).

Field	Description
RAID Properties	Press Enter on this field to access this screen.
SAS Topology	Press Enter on this field to access this screen.
Advanced Adapter Properties	Press Enter on this field to access this screen.

F.3.5 SAS Topology Screens

The SAS Topology screen (shown below) presents a view of the adapter's SAS hierarchy. You can scroll right to view additional information about the devices (see SAS Topology Screens through "Invalid Cross-Reference Format".) Descriptions of the fields are given in TABLE F-5.

The SAS Topology screen shows the following objects and their significant properties:

- Adapter
- PHYs
- Attached Devices
- Expanders/Enclosures

SAS Topology Screen

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* SAS Topology -- SAS1064                                                     *
*                   Device Identifier              Discovery   Device         *
* SAS1064(02:03:00)                                Status      Info           *
* * PHY  0                                         Good                       *
* * PHY  1                                         Good                       *
* * PHY  2          SEAGATE ST936701LSUN36G 0456   Good        SAS            *
* * PHY  3          SEAGATE ST973401LSUN72G 0356   Good        SAS            *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
```

```
*                                                                              *
*                                                                              *
* Esc=Exit   F1=Help   Alt+M=More Keys                                         *
* Alt+D=Device Properties   Alt+E=Expander Properties                          *
********************************************************************************
```

To expand the SAS topology display, select an expander or enclosure and press Enter to display all its PHYs/devices/bays. To collapse the display, press Enter again.

While the cursor is on the Device Identifier, you can perform the following actions:

- Press Alt+E to access a specific Expander Properties screen or press Alt+D to access a specific Device Properties screen.
- Press Enter while on an expander or enclosure to expand or collapse the display.
- Press Enter while on a device to activate the Locate LED.

At any time while on the screen press C to clear Device Mappings for non-present devices. Scroll the cursor to the right to display further information (see SAS Topology Screens through "Invalid Cross-Reference Format").

SAS Topology Screen 2, Negotiated Link Speed

```
********************************************************************************
* SAS Topology -- SAS1064                                                      *
*                    Device Identifier              Negotiated Link            *
* SAS1064(02:03:00)                                 Speed(Gbps)                *
* * PHY  0                                         Unknown                    *
* * PHY  1                                         Unknown                    *
* * PHY  2          SEAGATE ST936701LSUN36G 0456   3.0                        *
* * PHY  3          SEAGATE ST973401LSUN72G 0356   3.0                        *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
* Esc=Exit   F1=Help   Alt+M=More Keys                                         *
* Alt+D=Device Properties   Alt+E=Expander Properties                          *
********************************************************************************
```

SAS Topology Screen 3, Maximum Link Speed

```
********************************************************************************
* SAS Topology -- SAS1064                                                      *
*                    Device Identifier              Maximum Link               *
* SAS1064(02:03:00)                                 Speed(Gbps)                *
* * PHY  0                                         3.0                        *
* * PHY  1                                         3.0                        *
* * PHY  2          SEAGATE ST936701LSUN36G 0456   3.0                        *
* * PHY  3          SEAGATE ST973401LSUN72G 0356   3.0                        *
*                                                                              *
*                                                                              *
*                                                                              *
```

```
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
* Esc=Exit   F1=Help   Alt+M=More Keys                                         *
* Alt+D=Device Properties   Alt+E=Expander Properties                          *
********************************************************************************
```

SAS Topology Screen 4, Target Capabilities

```
********************************************************************************
* SAS Topology -- SAS1064                                                      *
*                    Device Identifier              Target                     *
* SAS1064(02:03:00)                                 Capabilities               *
* * PHY  0                                                                     *
* * PHY  1                                                                     *
* * PHY  2           SEAGATE ST936701LSUN36G 0456   SSP                        *
* * PHY  3           SEAGATE ST973401LSUN72G 0356   SSP                        *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
* Esc=Exit   F1=Help   Alt+M=More Keys                                         *
* Alt+D=Device Properties   Alt+E=Expander Properties                          *
********************************************************************************
```

SAS Topology Screen 5, Initiator Capabilities

```
********************************************************************************
* SAS Topology -- SAS1064                                                      *
*                    Device Identifier              Initiator                  *
* SAS1064(02:03:00)                                 Capabilities               *
* * PHY  0                                                                     *
* * PHY  1                                                                     *
* * PHY  2           SEAGATE ST936701LSUN36G 0456                              *
* * PHY  3           SEAGATE ST973401LSUN72G 0356                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
* Esc=Exit   F1=Help   Alt+M=More Keys                                         *
* Alt+D=Device Properties   Alt+E=Expander Properties                          *
********************************************************************************
```

TABLE F-5 SAS Topology Screens Field Descriptions

Field	Description
Device Identifier	The ASCII device identifier string extracted from the device's inquiry data.
Discovery Status	The status of SAS topology discovery on this directly attached PHY or on an expander. This field is only an indicator of an error being encountered. For specific details and the error value, see the Expander Properties page for expanders and the PHY Properties page for directly attached PHYs.
Device Info	Indicates whether a device is SAS or SATA, and whether the device has been selected as the boot device. (SATA is not supported on Sun Fire X4100 or Sun Fire X4200 servers at this time.)
Negotiated Link Speed	The negotiated link speed for this PHY, in Gbits/s. This field also indicates whether the PHY has been disabled.
Maximum Link Speed	The maximum hardware link rate possible for this PHY, in Gbits/s.
Target Capabilities	The target capabilities for this device. The following acronyms are used: • SSP - Serial SCSI Protocol • SMP - Serial Management Protocol
Initiator Capabilities	The initiator capabilities for this device. The following acronyms are used: • SSP - Serial SCSI Protocol • SMP - Serial Management Protocol

F.3.6 Device Properties Screen

The Device Properties screen (shown below) displays information about a specific device. To access this screen, press Alt+D on the SAS Topology screen when the cursor is on the Device Identifier field of a device.

Press Alt+N or Alt+P at any time while on this screen to cycle to the next or previous device.

```
*****************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                     *
* Device Properties -- SAS1064                                              *
*                                                                           *
*                                                                           *
*           Device Identifier   SEAGATE ST936701LSUN36G 0456                *
*           Scan Order          2                                           *
```

```
*           Device Information  SAS                                          *
*           SAS Address         5000C500:001047C9                            *
*           Serial Number       39000SZC            3LC                      *
*                                                                            *
*           Verify                                                           *
*                                                                            *
*                                                                            *
*                                                                            *
*                                                                            *
*                                                                            *
* Esc=Exit   F1=Help   Alt+M=More Keys                                       *
* Alt+N = Next Device    Alt+P = Previous Device    Enter = Select Item       *
******************************************************************************
```

TABLE F-6 Device Properties Screen Field Descriptions

Field	Description
Device Identifier	The ASCII device identifier string extracted from the device's inquiry data.
Scan Order	The scan order for this device. This is the equivalent of a SCSI ID in parallel SCSI.
Device Information	Indicates whether the device is SAS or SATA. (SATA is not supported on Sun Fire X4100 or Sun Fire X4200 servers at this time.)
SAS Address	The SAS address of this device.
Serial Number	The serial number of this device.
Verify	Press Enter to access the Verify All Sectors screen. From this screen you can start a verification of all sectors on the device (see Device Verify Screen). If needed, you can reassign defective Logical Block Addresses (LBAs), as described in the text following TABLE F-7.

F.3.7 Device Verify Screen

To access the Device Verify screen, press Enter on the appropriate field on the Device Properties screen. This screen includes an Elapsed Time and status bar, which begins incrementing when the operation is started and which shows the current progress of the operation.

When the Device Verify screen (shown below) appears, press Enter to begin the verify process. You may press Esc at any time to cancel the verify process. TABLE F-7 describes the fields of the screen.

```
*******************************************************************************
* Device Verify -- SAS1064                                                    *
*                                                                             *
*      Device Identifier   SEAGATE ST936701LSUN36G 0456                       *
*      SAS Address         5000C500:001047C9                                  *
*      Serial Number       39000SZC            3LC                            *
*                                                                             *
*      All sectors on the device will be verified.                            *
*      Press Enter to continue or any other key to cancel.                    *
*                                                                             *
*                                                                             *
*                                                                             *
*      Elapsed Time:       00:00:00                                           *
*                                                                             *
*      Percent                                                                *
*      Complete    0%                                              100%       *
*                  ************************************************           *
*                  *                                              *           *
*                  ************************************************           *
*                                                                             *
* Esc=Exit   F1=Help   Alt+M=More Keys                                        *
*******************************************************************************
```

TABLE F-7 Device Verify Screen Field Descriptions

Field	Description
Device Identifier	The ASCII device identifier string extracted from the device's inquiry data.
SAS Address	The SAS address of this device.
Serial Number	The serial number of this device.
Elapsed Time	The total time elapsed since the Format or Verify operation started.
Percent Complete	Graphical status bar that shows the current completion status of the operation.

If the Logical Block Addresses (LBAs) can be reassigned, or need to be reassigned, the following prompt appears:

```
Reassign the block?

(Yes, No, All, nonE, Cancel)
```

The reassignment options are as follows:

- Yes: Reassign only this block. If another block needs to be reassigned in the future, display the prompt again.
- No: Do not reassign this block. If another block needs to be reassigned in the future, display the prompt again.

- All: Reassign the current block, and automatically reassign other blocks that need it, without displaying the prompt again.
- nonE: Do not reassign the current block, and do not automatically reassign any other blocks that need it. Do not display the prompt again.
- Cancel: Do not reassign anything, and stop the verification process.

F.3.8 Advanced Adapter Properties Screen

The Advanced Adapter Properties screen (shown below) allows you to view and modify infrequently accessed adapter settings. TABLE F-8 describes the fields of the screen.

The Advanced Adapter Properties screen provides access to advanced Device Properties and PHY Properties. To modify the Link Error Settings Threshold Count and Threshold Time, press Enter while the cursor is on the desired field and type the new value.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* Advanced Adapter Properties -- SAS1064                                      *
*                                                                             *
*           IRQ                          0B                                   *
*           NVM                          Yes                                  *
*           IO Port Address              A800                                 *
*           Chip Revision ID             02                                   *
*                                                                             *
*           Spinup Delay (Secs)          [ 2]                                 *
*           CHS Mapping                  [SCSI Plug and Play Mapping]         *
*                                                                             *
*           Link Error                   Threshold  Threshold                 *
*           Settings                     Count      Time(Secs)                *
*           Invalid DWORDs                 0             0                  *
*           Loss of DWORD Sync             0             0                  *
*           Running Disparity Errors       0             0                  *
*           PHY Reset Errors               0             0                  *
*                                                                             *
*           Advanced Device Properties                                        *
*           PHY Properties                                                    *
*           Restore Defaults                                                  *
* Esc = Exit Menu       F1/Shift+1 = Help                                     *
* Enter = Select Item   -/+ = Change Item                                     *
*******************************************************************************
```

TABLE F-8 Advanced Adapter Properties Screen Field Descriptions

Field	Description
IRQ	The Interrupt Request Line used by the adapter. The system BIOS assigns this value.
NVM	Indicates whether an adapter has nonvolatile memory (NVM) associated with it. An adapter's configuration is stored in its associated NVM.

Field	Description
IO Port Address	The I/O Port Address used to communicate with the adapter. The system BIOS assigns this number.
Chip Revision ID	The Revision ID of this adapter.
Spinup Delay	The number of seconds to wait between spinups of devices attached to this adapter. Staggered spinups balance the total electrical current load on the system during boot. The default value is 2 seconds, with choices between 1 and 10 seconds.
CHS Mapping	Defines how the Cylinder Head Sector values are mapped onto a disk without pre-existing partition information. CHS Mapping allows two settings: • SCSI Plug and Play Mapping (default) automatically determines the most efficient and compatible mapping. • Alternate CHS Mapping utilizes an alternate, possibly less efficient, mapping that may be required if a device is moved between adapters from different vendors. Note: Neither of these options has any effect after a disk has been partitioned using the FDISK command. To change the CHS Mapping on a partitioned disk, use the FDISK command to delete all partitions. Then reboot the system to clear memory. Otherwise, the old partitioning data will be reused.
Link Error Settings	• Invalid DWORDs: The number of invalid dwords that have been received, outside of PHY reset sequences, since the last PHY Link Error Reset. • Loss of DWORD Sync: The number of times, since the last PHY Link Error Reset, that DWORD synchronization was lost and the link reset sequence occurred. • Running Disparity Errors: The number of DWORDS with running disparity errors that have been received, outside of PHY reset sequences, since the last PHY Link Error Reset. • PHY Reset Errors: The number of times the PHY reset sequence has failed, since the last PHY Link Error Reset.
Threshold Count	Link error count threshold values. When a Link Error Count exceeds a Threshold Count within the Threshold Time (secs) the Fusion-MPT FW may reduce the link rate. Press Enter on any of these fields to modify the value.
Threshold Time (secs)	Time, in seconds, over which to apply the Threshold Count. When a Link Error Count exceeds a Threshold Count within the Threshold Time (secs) the Fusion-MPT FW may reduce the link rate. Press Enter on any of these fields to modify the value.
Advanced Device Properties	Press Enter to view and modify Advanced Device Properties (see Advanced Device Properties Screen).

Field	Description
PHY Properties	Press Enter to view and modify PHY properties (see PHY Properties Screen).
Restore Defaults	Press Enter to restore the default values for all items on this screen.

F.3.9 Advanced Device Properties Screen

The Advanced Device Properties screen (shown below) allows you to view and modify infrequently accessed device settings. TABLE F-9 describes the fields of the screen.

```
*************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                 *
* Advanced Device Properties -- SAS1064                                 *
*                                                                       *
*           Maximum INT 13 devices for this adapter    24               *
*           Maximum Target device spinups               1               *
*                                                                       *
*           IO Timeout for Block Devices                10              *
*           IO Timeout for Block Devices(Removable)     10              *
*           IO Timeout for Sequential Devices           10              *
*           IO Timeout for Other devices                10              *
*                                                                       *
*           LUNs to Scan for Block Devices             [All]            *
*           LUNs to Scan for Block Devices(Removable)  [All]            *
*           LUNs to Scan for Sequential Devices        [All]            *
*           LUNs to Scan for Other Devices             [All]            *
*                                                                       *
*           Removable Media support                    [None]           *
*                                                                       *
*           Restore Defaults                                            *
*                                                                       *
*                                                                       *
* Esc = Exit Menu       F1/Shift+1 = Help                               *
* Enter = Select Item   -/+ = Change Item                               *
*************************************************************************
```

F.3.10 PHY Properties Screen

The PHY Properties screen (shown below) allows you to view and modify PHY-specific settings. TABLE F-9 describes the fields of the screen.

Note - The Link Error Settings values on this screen only display the current values for this PHY and cannot be modified. To modify the Threshold values, return to the Advanced Adapter Properties screen.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* PHY Properties -- SAS1064                                                   *
*                                                                             *
*           PHY                          2 (3rd of 4 PHYs)                    *
*           SAS Port                     2                                    *
*           Link Status                  Enabled, 3.0 Gbps                    *
*           Discovery Status             00000000                             *
*                                                                             *
*           Device Identifier            FUJITSU MAV2073RCSUN72G 0301         *
*           Scan Order                   2                                    *
*           Device Information           SAS                                  *
*           SAS Address                  500000E0:10D26642                    *
*                                                                             *
*           Link Error                   Link Error  Threshold  Threshold    *
*           Settings                     Count       Count      Time(Secs)    *
*           Invalid DWORDs                  0           0             0       *
*           Loss of DWORD Sync              0           0             0       *
*           Running Disparity Errors        0           0             0       *
*           PHY Reset Errors                0           0             0       *
*           Reset Link Error Counts                                           *
*                                                                             *
* Esc = Exit Menu       F1/Shift+1 = Help                                     *
* Enter = Reset Phy error logs    Alt+N = Next Phy    Alt+P = Previous Phy    *
*******************************************************************************
```

TABLE F-9 PHY Properties Screen Field Descriptions

Field	Description
PHY	The PHY number for which this information applies.
SAS Port	The associated SAS Port (0 to N), as configured on this adapter.
Link Status	The PHY link status. Possible values are: • Enabled, Unknown Link Rate • PHY Disabled • Enabled, negotiation failed • Enabled, 1.5 Gbps • Enabled, 3.0 Gbps
Discovery Status	A 32-bit hexadecimal value indicating the discovery status for the PHY or expander. Currently defined values are: • Discovery Completed Successfully 0x00000000 • Loop Detected 0x00000001 • Unaddressable Device Exists 0x00000002 • Multiple Ports 0x00000004 • Expander Error 0x00000008 • SMP Timeout 0x00000010 • Out of Route Entries 0x00000020 • SMP Response Index Does Not Exist 0x00000040 • SMP Response Function Failed 0x00000080

Field	Description
	• SMP CRC Error 0x00000100
Device Identifier	The ASCII device identifier string extracted from the device's inquiry data.
Scan Order	The scan order for this device. This is the equivalent of a SCSI ID for parallel SCSI.
Device Information	Indicates whether a device is SAS or SATA. (SATA is not supported on Sun Fire X4100 and Sun Fire X4200 servers at this time.)
SAS Address	The SAS address of this device.
Link Error Settings	• Invalid DWORDs: The number of invalid DWORDs that have been received, outside of PHY reset sequences, since the last PHY Link Error Reset. The count stops when it reaches the maximum value. • Loss of DWORD Sync: The number of times, since the last PHY Link Error Reset, that DWORD synchronization was lost and the link reset sequence occurred. The count stops when it reaches the maximum value. • Running Disparity Errors: The number of DWORDs with running disparity errors that have been received, outside of PHY reset sequences, since the last PHY Link Error Reset. The count stops when it reaches the maximum value. • PHY Reset Errors: The number of times the PHY reset sequence has failed, since the last PHY Link Error Reset. The count stops when it reaches the maximum value.
Link Error Count	Actual link error count values since the last PHY Link Error Reset. The counts stop when they reach their maximum value.
Threshold Count	Link error count threshold values. When a Link Error Count exceeds a Threshold Count within the Threshold Time (secs), the Fusion-MPT FW may reduce the link rate.
Threshold Time (secs)	Time, in seconds, over which to apply Threshold Count. When a Link Error Count exceeds a Threshold Count within the Threshold Time (secs), the Fusion-MPT FW may reduce the link rate.

Reset Link Error Counts	Press Enter to reset the Link Error Counts for this PHY or all PHYs. This operation issues a PHY Link Error Reset - SAS IO Unit Control Request Message.0
	
	Note: When you press Enter, the following prompt appears:
	
	`Are you sure you want to reset Phy error counts?`
	
	`Reset error counts for this Phy only`

Field	Description
	Reset error counts for all Phys Cancel

F.3.11 Integrated RAID Configuration and Management Screens

Integrated RAID configuration and management involves many screens, all of which are accessed by selecting RAID Properties on the Adapter Properties Screen.

- If no RAID volumes are currently configured, you are asked to create a RAID volume.
- If at least one RAID volume is currently configured, you are shown the current volume(s) for management purposes.

The screens in the RAID configuration and management area are:

- Select New Array Type
- Create New Array
- View Array
- Manage Array

F.3.11.1 Select New Array Type Screen

Select the type of array to create, as shown below.

The two new array type options are described in the text that appears on the screen. No further explanation is needed.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* Select New Array Type -- SAS1064                                            *
*                                                                             *
*                                                                             *
*      Create IM Volume        Create Integrated Mirror Array of 2            *
*                              disks plus an optional hotspare. Data          *
*                              on the primary disk may be migrated.           *
*                                                                             *
*                                                                             *
*      Create IS Volume        Create Integrated Striping array of            *
*                              2 to 8 disks.                                  *
*                              ALL DATA on array disks will be DELETED!       *
*                                                                             *
* Esc = Exit Menu       F1/Shift+1 = Help                                     *
* Enter = Choose array type to create     Esc = Return to Adapter Properties  *
*******************************************************************************
```

F.3.11.2 Create New Array Screen

The Create New Array screen (shown below) allows you to select disks for a new array. TABLE F-10 describes the fields of the screen.

For an IM volume, when the first disk is added you are asked about the data on the disks. You have two options:

- Press M to keep the existing data and migrate to an IM array. Disk synchronization will occur.
- Press D to overwrite existing data, and create a new IM array. ***All data on all disks in the array will be deleted.*** No synchronization occurs.

After the volume is configured, press C to create the array. You are asked to save changes, which will create the array. After the array is created, the utility returns you to the Adapter Properties screen.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* Create New Array -- SAS1064                                                 *
*   Array Type:                       IM                                      *
*   Array Size(MB):                   69618                                   *
*                                                                             *
* Scan  Device Identifier             RAID   Hot    Drive      Pred  Size     *
* ID                                  Disk   Spr    Status     Fail  (MB)     *
*   2   FUJITSU MAV2073RCSUN72G 0301  [Yes]  [No]   Primary    ---    70007   *
*   3   FUJITSU MAV2073RCSUN72G 0301  [Yes]  [No]   Secondary  ---    70007   *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
* Esc = Exit Menu       F1/Shift+1 = Help                                     *
* Space/+/- = Select disk for array or hotspare    C = Create array           *
*******************************************************************************
```

TABLE F-10 Create New Array Screen Field Descriptions

Field	Description
Array Type	The type of array being created: IM or IS.
Array Size	The size of the array, in Mbytes.
Scan ID	The order in which devices are scanned.
Device Identifier	The ASCII device identifier string extracted from the device's inquiry data.

Field	Description
RAID Disk	Specifies whether the disk is part of a RAID array (Yes or No). This field is grayed out under the following conditions: • The disk does not meet the minimum requirements for use in a RAID array. • The disk is not large enough to mirror existing data on the primary drive. • This disk has been selected as the hotspare for the RAID array.
Hot Spr	Specifies whether the disk is the hotspare for a RAID array (Yes or No). RAID Arrays are not required to have a hotspare. Only one hotspare per RAID array is permitted. You can define a hotspare when you create an array or at any time after creation, if the array is made up of two disks or fewer. This field is grayed out under the following conditions: • The disk does not meet the minimum requirements for use in a RAID array. • The array already has a hotspare. • The array is made up of the maximum number of disks (three). • The disk is not large enough to mirror existing data on the primary disk. • Integrated Striping firmware is used. (Striped arrays do not support hotspares.)
Drive Status	• Ok: Disk is online and fully functional. • Missing: Disk is not responding. • Failed: Disk has failed. • Initing: Disk is initializing. • CfgOffln: Disk is offline at host's request. • UserFail: Disk is marked failed at host's request. • Offline: Disk is offline for some other reason. • Inactive: Disk has been set inactive. • Not Syncd: Data on disk is not synchronized with the rest of the array. • Primary: Disk is the primary disk for a two-disk mirror and is operating properly. • Secondary: Disk is the secondary disk for a two-disk mirror and is operating properly. • Wrg Type: Device is not compatible for use as part of a RAID array. • Too Small: Disk is too small to mirror existing data. • Max Dsks: Maximum number of disks allowed for this type of array. reached, or Maximum number of total IR disks on a controller reached. • No SMART: Disk does not support SMART, cannot be used in an array. • Wrg Intfc: Device interface (SAS) differs from existing IR disks.
Pred Fail	Indicates whether SMART is predicting device failure (Yes or No).
Size(MB)	The size of the device, in Mbytes (1 Mbyte = (1024 x 1024) = 1,048,576 bytes). If the device is part of a two-disk array, this field reflects the size of the array, not the size of the individual disk. If the device is part of an array of three or more disks, this field is the size that the disk makes up within the array. Note: When creating a striped array, the usable size of the array is determined by the number of drives, multiplied by the size of the smallest drive in the array. In arrays consisting of different sized drives, excess space on larger drives is unusable.

F.3.11.3 View Array Screen

The View Array screen (shown below) allows you to view the current array configuration. Press Alt+N to view the next array. Press C to create a new array. TABLE F-11 describes the fields of the screen.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* View Array -- SAS1064                                                       *
*      Array                     1 of 1                                       *
*      Identifier                LSILOGICLogical Volume  3000                 *
*      Type                      IM                                           *
*      Scan Order                2                                            *
*      Size(MB)                  69618                                        *
*      Status                    Optimal                                      *
*                                                                             *
*      Manage Array                                                           *
*                                                                             *
* Scan  Device Identifier             RAID   Hot    Drive      Pred  Size     *
* ID                                  Disk   Spr    Status     Fail  (MB)     *
*   3   FUJITSU MAV2073RCSUN72G 0301  Yes    No     Secondary  No     69618   *
*   4   FUJITSU MAV2073RCSUN72G 0301  Yes    No     Primary    No     69618   *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
* Esc = Exit Menu       F1/Shift+1 = Help                                     *
* Enter=Select Item  Alt+N=Next Array  C=Create an array                      *
*******************************************************************************
```

TABLE F-11 View Array Screen Field Descriptions

Field	Description
Array	The number of the array.
Identifier	The identifier of the array.
Type	The RAID type of the array.
Scan Order	The scan order of the array.
Size(MB)	The size of the array.
Status	The status of the array.

Field	Description
Scan ID	The order in which devices are scanned.
Device Identifier	The ASCII device identifier string extracted from the device's inquiry data.
RAID Disk	Specifies whether the disk is part of a RAID array (Yes or No). This field is grayed out under the following conditions: • The disk does not meet the minimum requirements for use in a RAID array. • The disk is not large enough to mirror existing data on the primary drive. • This disk has been selected as the hotspare for the RAID array.
Hot Spr	Specifies whether the disk is the hotspare for a RAID array (Yes or No). RAID Arrays are not required to have a hotspare. Only one hotspare per RAID array is permitted. You can define a hotspare when you create an array or at any time after creation, if the array is made up of two disks or fewer. This field is grayed out under the following conditions: • The disk does not meet the minimum requirements for use in a RAID array. • The array already has a hotspare. • The array is made up of the maximum number of disks (three). • The disk is not large enough to mirror existing data on the primary disk. • Integrated Striping firmware is used. (Striped arrays do not support hotspares.)
Drive Status	• Ok: Disk is online and fully functional. • Missing: Disk is not responding. • Failed: Disk has failed. • Initing: Disk is initializing. • CfgOffln: Disk is offline at host's request. • UserFail: Disk is marked failed at host's request. • Offline: Disk is offline for some other reason. • Inactive: Disk has been set inactive. • Not Syncd: Data on disk is not synchronized with the rest of the array. • Primary: Disk is the primary disk for a two-disk mirror and is operating properly. • Secondary: Disk is the secondary disk for a two-disk mirror and is operating properly. • Wrg Type: Device is not compatible for use as part of a RAID array. • Too Small: Disk is too small to mirror existing data. • Max Dsks: Maximum number of disks allowed for this type of array. reached, or Maximum number of total IR disks on a controller reached. • No SMART: Disk does not support SMART, cannot be used in an array. • Wrg Intfc: Device interface (SAS) differs from existing IR disks.
Pred Fail	Indicates whether SMART is predicting device failure (Yes or No).
Size(MB)	The size of the device, in Mbytes (1 Mbyte = (1024 x 1024) = 1,048,576 bytes). If the device is part of a two-disk array, this field reflects the size of the array, not the size of the individual disk. If the device is part of an array of three or more disks, this field is the size that the disk makes up within the array.

Field	Description
	Note: When creating a striped array, the usable size of the array is determined by the number of drives, multiplied by the size of the smallest drive in the array. In arrays consisting of different sized drives, excess space on larger drives is unusable.

F.3.11.4 Manage Array Screen

The Manage Array screen (shown below) is used to manage the current array. TABLE F-12 describes the fields of the screen.

If you select Manage hotspare, the utility displays a hotspare management screen that has the same layout as the Create New Array screen.

If you select Synchronize Array, Activate Array, or Delete Array, you are prompted to confirm the choice by pressing Y for yes or N for no.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
* Manage Array -- SAS1064                                                     *
*                                                                             *
*      Identifier                LSILOGICLogical Volume  3000                 *
*      Type                      IM                                           *
*      Scan Order                2                                            *
*      Size(MB)                  69618                                        *
*      Status                    Optimal                                      *
*                                                                             *
*      Manage Hot Spare                                                       *
*                                                                             *
*      Synchronize Array                                                      *
*                                                                             *
*      Activate Array                                                         *
*                                                                             *
*      Delete Array                                                           *
*                                                                             *
*                                                                             *
* Esc = Exit Menu       F1/Shift+1 = Help                                     *
* Enter = Select Item                                                         *
*******************************************************************************
```

TABLE F-12 Manage Array Screen Field Descriptions

Field	Description
Identifier	The identifier of the array.
Type	The RAID type of the array.

Field	Description
Scan Order	The scan order of the array.
Size(MB)	The size of the array.
Status	The status of the array.
Manage Hot Spare	Press Enter to modify the array hotspare configuration. This field is grayed out under the following conditions: • The array is inactive. • The array is at its maximum number of devices. • Integrated Striping firmware is used. Striped arrays do not support hotspares, so no modifications can be made to an array after it is created.
Synchronize Array	Press Enter to synchronize the RAID array. This field is grayed out under the following conditions: • The array is inactive. • The array does not need to be resynchronized. • The adapter's MPT FW does not support the feature. • Integrated Striping firmware is used.
Activate Array	This field is used to activate a RAID array.
Delete Array	This field is used to delete the currently displayed RAID array.

F.3.11.5 Exit Screen

It is important to exit the SAS BIOS Configuration Utility correctly, because some changes take effect only when you exit.

From the Adapter List, press the Esc key to exit.

In addition, a similar Exit screen appears when you exit most other screens, and it can be used to save settings. The Exit screen is shown below. Some options on the Exit screen might be grayed out, indicating that they are not available at this time.

```
*******************************************************************************
* LSI Logic MPT Setup Utility  v6.02.00.00 (2005.07.08)                       *
*                                                                             *
*                                                                             *
*                                                                             *
*                                                                             *
```

```
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                     Adapter and/or device property changes have been made.   *
*                      Cancel Exit                                             *
*                      Save changes then exit this menu                        *
*                      Discard changes then exit this menu                     *
*                      Exit the Configuration Utility and Reboot               *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
* Esc = Exit Menu        F1/Shift+1 = Help                                     *
*                                                                              *
********************************************************************************
```

F.4 Performing RAID Configuration Tasks

This section contains the following information and instructions for using the Configuration Utility to set up RAID:

- RAID Implementation and Support
- Creating a RAID 0 Volume
- Creating a RAID 1 Volume
- Creating a Second RAID Volume
- Viewing RAID Volume Properties
- Managing Hot Spares
- Synchronizing an Array
- Activating an Array
- Deleting an Array
- Locating a Disk Drive

Note - The RAID firmware needs at least 64 MB of unused disk space at the end of each drive to store metadata.

F.4.1 RAID Implementation and Support

The LSISAS1064 controller supports the Integrated RAID hardware solution, which is a highly integrated, low-cost RAID solution. It is designed for systems requiring redundancy and high availability, but not requiring a full-featured RAID implementation.

Integrated RAID includes Integrated Mirroring (IM or RAID 1) and Integrated Striping (IS or RAID 0) technology. Integrated RAID is OS independent, easy to install and configure, and does not require a special driver. A RAID Volume is seen as a single drive by the host BIOS and OS.

The LSISAS1064 controller is based on the Fusion-MPT (Message Passing Technology) architecture. The Fusion -MPT architecture requires only a thin device driver that is independent of the I/O bus. LSI Logic provides the device drivers for various operating environments.

The ILOM Service Processor monitors the GPIOs from the SAS1064 controller. If the controller indicates a failure, the service processor lights the fault LED on the corresponding disk drive and logs the error in the SP event log.

F.4.1.1 Automatic Data Resynchronization and Hotspares

Caution - Possible data loss: If you insert an drive that has been configured with a RAID volume into a server that did not previously have its drives configured with RAID volumes, the existing drive(s) in the server will be converted to RAID volumes during automatic synchronization and any existing data on the existing drive(s) in the server will be erased. Before permanently removing an drive that is part of an active RAID volume, use the LSI Configuration Utility to delete the RAID volume from the drive to avoid causing this problem.

The SCSI parameters, including RAID volumes configuration, are set up using the LSI BIOS configuration utility accessible by pressing the CTRL+C keys during the boot process. The LSI RAID firmware and BIOS is OS-independent and you set up RAID while in MPTBIOS POST, before booting to an OS.

The parameters are saved in both the NVRAM and the disk drives. The RAID firmware needs 64 MB of unused disk space at the end of each drive to store the metadata.

The metadata stored on the disk drives contains sufficient information to restore and reactivate the RAID volumes in case the NVRAM is lost (for example, when the motherboard is replaced). However, if removed, the disk drives must first be labelled to make sure that they are placed back in the same disk bays from which they were removed when reinstalled. When the system is powered on, the RAID volumes are automatically activated and resynchronization is automatically performed.

One of the disk drives can be set up as a hotspare disk if a RAID 1 (mirroring) volume is already set up. If one of the two disk drives used in the RAID 1 volume fails, the hotspare drive automatically replaces it in the volume and resync is immediately performed.

It must be noted that, until the resync is completed, the system is vulnerable to a failure of the now “primary” disk (the disk left from the original mirrored volume) since full data redundancy is not yet achieved. When the bad disk is replaced, the new disk automatically becomes the new hotspare disk for the mirrored volume.

F.4.1.2 RAID Level Support

The following items describe the RAID level support for these servers:

- RAID 1 (mirroring) is supported.
- RAID 0 (striping) is supported.
- LSI RAID 1E or IME (mirroring over more than two drives) is not supported.
- RAID 0+1 and 1+0 are not supported by the SAS1064 controller.

F.4.1.3 RAID Volume Support

The following items describe the RAID volumes supported for these servers:

- Up to two active RAID volumes are supported per system (RAID 0, RAID 1 or both).
- A striped volume (RAID 0) can contain up to four disk drives.
- A mirrored volume (RAID 1) can contain up to two disk drives.
- One disk drive can be set up as hotspare for a RAID 1 array (one hotspare disk per controller maximum).
- Volumes are transparent to the OS and are seen as a single physical disk drive no matter how many drives they contain.

F.4.1.4 RAID Combination Support

Possible RAID Combinations in a four-drives server are listed below:

- Two drives RAID 0 + two drives non-RAID
- Two drives RAID 1 + two drives non-RAID
- Two drives RAID 0 + two drives RAID 1
- Two drives RAID 0 + two drives RAID 0
- Two drives RAID 1 + Two drives RAID 1
- Three drives RAID 0 + one drive non-RAID
- Four drives RAID 0
- Two drives RAID 1 + one hotspare drive + one drive non-RAID
- Four drives non-RAID

F.4.2 Creating a RAID 0 Volume

A RAID 0 volume, also referred to as Integrated Striping (IS), offers the ability to stripe data across multiple hard disks. This can increase storage capacity and performance by combining multiple disks into one logical volume.

Note - Use RAID 0 with caution. The only advantage of RAID 0 is to improve the overall disk performance by striping data over several disk drives. By doing this, it decreases reliability because the failure of any drive

within the striped volume results in a complete loss of data. In addition, any disk drive included in a RAID 0 volume becomes non-hot-swappable.

Follow these steps to create a RAID 0 volume on an adapter that does not currently have a volume configured.

1. In the Configuration Utility, select an adapter from the Adapter List.

2. Select the RAID Properties option.

3. When you are prompted to create either an IS volume or an IM volume, select Create IS Volume.

The next screen shows a list of disks that can be added to a volume.

4. Move the cursor to the RAID Disk column. To add a disk to the volume, change the "No" to "Yes" by pressing the + key, - key, or space bar.

As disks are added, the Array Size field changes to reflect the size of the new volume. There are several limitations when creating a RAID 0 volume:

- All disks must be SAS (with SMART support).
- Disks must have 512-byte blocks and must not have removable media.
- There must be at least two drives in a valid volume.
- No more than eight drives are allowed in a volume.
- Hot spare drives are not allowed for RAID 0 volumes.

Note - RAID 0 does not provide any data protection in the event of disk failure. It is primarily used to increase speed.

Note - Once the number of disks in a RAID volume is set, it cannot be changed.

---

5. When the volume has been fully configured, press C and select Save changes, then exit this menu to commit the changes.

The Configuration Utility will pause while the array is being created.

F.4.3 Creating a RAID 1 Volume

A RAID 1 volume, also referred to as Integrated Mirroring (IM), offers the ability to mirror data from one hard disk onto another one. This can increase reliability by combining multiple disks into one logical volume. Follow these steps to create a RAID 1 volume on an adapter that does not currently have a volume configured.

1. In the Configuration Utility, select an adapter from the Adapter List.

2. Select the RAID Properties option.

3. When you are prompted to create either an IS volume or an IM volume, select Create IM Volume.

The next screen shows a list of disks that can be added to a volume.

4. Move the cursor to the RAID Disk column. To add a disk to the volume, change the “No” to “Yes” by pressing the + key, - key, or space bar.

When the first disk is added, the utility will prompt you to keep existing data or overwrite existing data.

5. Press M to keep the existing data on the first disk or press D to overwrite it.

If you keep the existing data, this is called a migration. The first disk will be mirrored onto the second disk, so the data you want to keep must be on the first disk added to the volume. Data on all other disks will be lost.

As disks are added the Array Size field will change to reflect the size of the new volume. There are several limitations when creating a RAID 1 volume:

- All disks must be SAS (with SMART support).
- Disks must have 512-byte blocks and must not have removable media.
- There must be two drives in a valid volume.

6. (Optional) Add a hotspare to the volume by moving the cursor to the Hot Spare column and pressing the + key, - key, or space bar.

7. When the volume has been fully configured, press C and select Save changes, then exit this menu to commit the changes.

The Configuration Utility will pause while the array is being created.

Note - RAID 1 provides protection against the failure of a single disk. When a disk fails, it is rebuilt to a hotspare if one is available. This can greatly increase the level of protection that RAID 1 provides.

Note - Even though multiple volumes can be created, the hotspare is a global hotspare. Only one active hotspare is allowed for all volumes.

F.4.4 Managing Hot Spares

Follow these steps to add a hotspare to a RAID 1 volume.

1. Select Manage Hot Spare.

2. Select a disk from the list by pressing the + key, - key, or space bar.

Note - A hotspare must be valid RAID disk, as defined in Creating a RAID 1 Volume.

3. **After you select the hotspare disk, press C.**
4. **Select Save changes then exit this menu to commit the changes.**

   The Configuration Utility will pause while the hotspare is being added.

Follow these steps to delete a hotspare from a RAID 1 volume.

1. **Select Manage Hot Spare.**
2. **Remove the current hotspare disk from the list by pressing the + key, - key, or space bar.**
3. **After you clear the hotspare, press C.**
4. **Select Save changes then exit this menu to commit the changes.**

   The Configuration Utility will pause while the hotspare is being removed.

F.4.5 Creating a Second RAID Volume

The LSI Logic SAS controllers support two active RAID volumes. If one volume is already configured, follow these steps to add a second volume.

1. **In the Configuration Utility, select an adapter from the Adapter List.**
2. **Select the RAID Properties option.**

   This displays the current volume.

3. **Press C to create a new volume.**
4. **Create the new volume:**
   - To create a second RAID 0 volume, continue with Step 2 of Creating a RAID 0 Volume.
   - To create a second RAID 1 volume, continue with Step 2 of Creating a RAID 1 Volume.

F.4.6 Viewing RAID Volume Properties

Follow these steps to view the properties of RAID volumes.

1. **In the Configuration Utility, select an adapter from the Adapter List.**
2. **Select the RAID Properties option.**

   The properties of the current volume are displayed.

3. **If more than one volume is configured, press Alt+N to view the next array.**
4. **To manage the current array, press Enter when the Manage Array item is selected.**

F.4.7 Synchronizing an Array

Synchronizing an array means that the firmware synchronizes the data on the secondary disk(s) with the data on the primary disk of the mirror. Follow these steps to start a synchronization for a RAID 1 volume.

1. **Select Synchronize Array.**
2. **Press Y to start the synchronization, or N to cancel it.**

Note - If the server is rebooted before the volume synchronization is completed, the resync resumes when the server boots.

F.4.8 Activating an Array

An array can become inactive if, for example, it is removed from one controller or computer and moved to another one. The Activate Array option enables you to reactivate an inactive array that has been added to a system. This option is only available when the selected array is currently inactive.

1. **Select Activate Array.**
2. **Press Y to proceed with the activation, or press N to abandon it.**

   After a pause, the array becomes active.

Note - When activating two arrays (typically after a motherboard replacement) the status of the second array is shown as "degraded" according to the LSI BIOS as it waits to sync. However, this does not indicate a hardware malfunction.

Note - If there is a global hot-spare disk on the controller to which you have moved the array, the BIOS checks when you activate the array to determine if the hot-spare is compatible with the new array. An error message appears if the disks in the activated array are larger than the hot-spare disk or if the disks in the activated array are not the same type as the hot-spare disk (SATA versus SAS).

F.4.9 Deleting an Array

Caution - Before deleting an array, be sure to back up all data on the array that you want to keep.

Follow these steps to delete a selected array.

1. **Select Delete Array.**
2. **Press Y to delete the array, or press N to abandon the deletion.**

   After a pause, the firmware deletes the array.

Note - Once a volume has been deleted, it cannot be recovered. When a RAID 1 volume is deleted, the data is preserved on the primary disk. The master boot records (MBR) of other disks in the array are deleted. For other RAID types, the master boot records of all disks are deleted.

F.4.10 Locating a Disk Drive

There are several ways to physically locate a disk drive, as long as the firmware is correctly configured and the drives support disk location.

- During RAID creation, when a disk is set to Yes as part of a RAID volume, its locate LED is enabled. When it is set back to No or the RAID volume is created, the locate LED is cleared.
- Disks can also be located from the SAS Topology screen. To locate a disk, move the cursor to the disk and press Enter. The Locate LED on the disk remains activate until the next key is pressed.