1 Introduction

Welcome

Congratulations on the purchase of your new Ultra S2S RAID Controller. The Ultra S2S RAID Controller brings high-performance transfer rates and fault-tolerant RAID operations in an Ultra SCSI environment to the DEU disk array subsystem attached to any computing platform equipped with a standard Ultra SCSI host adapter. The Ultra S2S RAID Controller is a intelligent caching controller that supports standard RAID levels 0, 1, 0+1, 3, and 5 for multiple-drive arrays, and JBOD (just a bunch of drives) for single drive control.

This generation of RAID controller allows continuous access to data in the event of a disk drive failure. It also provides continuous access to the data in the event of a controller failure. This capability comes with a dual-active controller system, which uses two Ultra S2S RAID Controllers sharing access to the same array of disk drives. In the event of a controller failure, controller operations are assumed by the surviving controller through a process called fail-over. Once the failed controller is replaced, the new controller resumes processing array operations in a fail-back process. During fail-over and fail-back, write cache coherency is maintained with the disk drives.

New product enhancements include online RAID expansion (MORE™) which allows you to add one or more drives to a RAID set while the controller is online with the host system. Also, depending upon your choice of RAID configurations, the Ultra S2S RAID Controller appears to the operating system as one or more logical units, allowing you to maximize performance for your applications.

The programmable LUN mapping feature allows you to specify flexible LUN to system drive mappings. You can assign any specific LUN ID (or multiple LUN IDs) to any system drive on each channel or use a default setting. You can also assign “ownership” of a system drive to any combination of controller/channel, known as System Drive Affinity.

Another new feature is Drive Sizing, where previously when a drive failed it was required to replace the failed drive with a drive of equivalent size. If a larger capacity drive was used its capacity was defined as that of the smallest drive in the array. Now with Drive Sizing, the user can specify how much of the drive's total capacity should be used. This permits the user to take various size drives and make them appear to all be the same size from the perspective of the Ultra S2S RAID Controller.

Where to Find Answers

When you have questions about your RAID controller there are several places you can look to find answers. Refer to the following:

In this guide:	This user's guide provides detailed information for installing and using the Ultra S2S RAID Controller, the S2S Interface card and the AdminiStor PC Utilities software. The manual assumes that the reader is already familiar with the operating system environments where the controller will be installed.
ServerCare™ Service Support Program Guide:	Use this manual to locate telephone numbers for customer service, technical support, and conditions of the limited warranty.
DEU User's Guide:	Use this manual for procedures to install and use the DEU disk array subsystem. The manual also contains information on installing, configuring, and using the Ultra Extender and Differential Converter cards.
AdminiStor Agent User's Guides:	Use one of these manuals to install and use the SNMP-based network RAID subsystem management software (NetWare or Windows NT).
On the software diskettes:	Review the README files for last minute information about the release of the software products.

Features

Enhanced SCSI Performance:

- Ultra SCSI channels provide high-performance data transfers at up to 40MB/second
- System Drive Affinity which defines which SCSI host port(s) on which controller(s) a particular system drive may be accessed through. This solution provides system drive ownership to be assigned to one of the controllers in a duplex system
- Tagged-command queuing to the host allows processing of up to 64 simultaneous data requests
- User-defined performance tuning through selectable cache write policy and variable stripe width
- Disconnect/reconnect for SCSI bus optimization
- Configuration stored on disk and controller NVRAM (if the controller is replaced, disk and controller automatically reconfigure upon startup)

Managed RAID/SCSI Disk Arrays:

- Multiple RAID level support
- Online expansion allows drive(s) to be added to existing logical drives
- Array configuration and management without special software or drivers
- Support for all popular operating system environments (works independent from the OS)
- Connect up to 15 physical drives per drive channel
- Drives can be grouped and managed as a single very large array, as multiple large capacity drive groups, or as individual disk drives
- Industry standard Fast-20/Wide SCSI-3 (Ultra Wide) interface

Flexible User Interface:

- Software utility (AdminiStor PC Utilities) provides DOS-level control through a PC running ASPI drivers or Windows NT Pass-Through
- Serial communications permits array control through a standard VT100 (or equivalent) terminal

Automates RAID Functions:

- Automatic failed-drive detection
- Supports AEMI protocols for automatic rebuild of the array using a stand-by (hot spare) disk after a drive failure
- Transparent drive rebuild permits automatic rebuild of failed drives during normal operation without having to take the array off-line
- Automatic error detection/correction of parity errors and bad blocks
- Automatic sector re-mapping recovers defective media and corrects data errors
- Supports SAF-TE protocol for integrated monitoring of enclosure power supplies, fans, and temperature

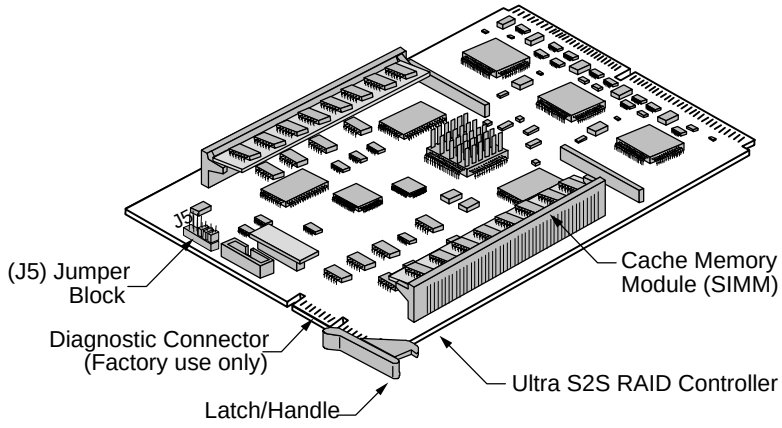
Continuous Operations:

- Each controller in a dual-active configuration monitors the status of its partner controller
- Failure of one controller in a dual-active configuration automatically initiates a process whereby the surviving controller handles operations for both controllers.

Ultra S2S RAID Controller Components

Some of the key components of the Ultra S2S RAID Controller include:

- Intel *i*960 RISC processor
- Memory and DRAM cache
- SCSI and I/O Functions



Processor

The Ultra S2S RAID Controller uses an Intel *i*960 RISC microprocessor which operates at 33 MHz, has 4 KB of instruction cache and 1 KB of data cache to manage all controller functions. These include: SCSI bus transfers, RAID processing, configuration, data striping, error recovery, and drive rebuild.

SCSI Bus

The Ultra S2S RAID Controller uses the Symbios Logic 53C770 SCSI I/O processor (SIOP) chip on each SCSI channel, allowing the controller to simultaneously communicate with the host system, and read or write data on several drives. Up to twelve (12) disk drives can be connected to each SCSI channel.

The controller supports the Fast-20/Wide SCSI-3 (Ultra Wide) standard, which is backward compatible with earlier SCSI standards.

Memory and DRAM Cache

The Ultra S2S RAID Controller implements a scalable memory design utilizing interleaved fast page mode, EDO, or self-refreshing DRAM.

Two SIMM locations are provided for standard, off-the-shelf, 36-bit 60ns (or faster) DRAM SIMMs. Since interleaving is required to provide maximum performance, an identical memory SIMM is required in each of the two SIMM sockets. Up to 128 MB of memory can be installed on the controller.

A fast 32-bit interface between the *i*960 CPU and the cache memory DRAM is provided by the Memory Control Unit (MCU), which is implemented in discrete programmable logic. In addition to memory control and addressing functions, the MCU provides the device mapping and decode for the non-volatile memory (NVRAM) and the electronically-erasable/programmable read-only memory (flash EEPROM).

Controller Firmware

The controller firmware contains the programs executed by the *i*960 CPU. The firmware resides in the on-board flash EEPROM. This memory device retains information even after power is off, and can be re-written to allow the controller firmware to be upgraded.

In addition to the stored programs in EEPROM, the NVRAM stores data on the current configuration of the controller and its attached disk drives. As the disk drive configuration change (example, drive fails) the NVRAM keeps a record of the changes.

Configuration on Disk

The configuration on disk allows the Ultra S2S RAID Controller to detect certain hardware changes when they occur, and automatically reconfigure accordingly. Automatic reconfiguration occurs after hardware changes such as:

- Change of controller in the event of a failure
- Change of target IDs (relocating drives) or replacement of drives
- Interchange of cables
- Drive failure occurs during a power down

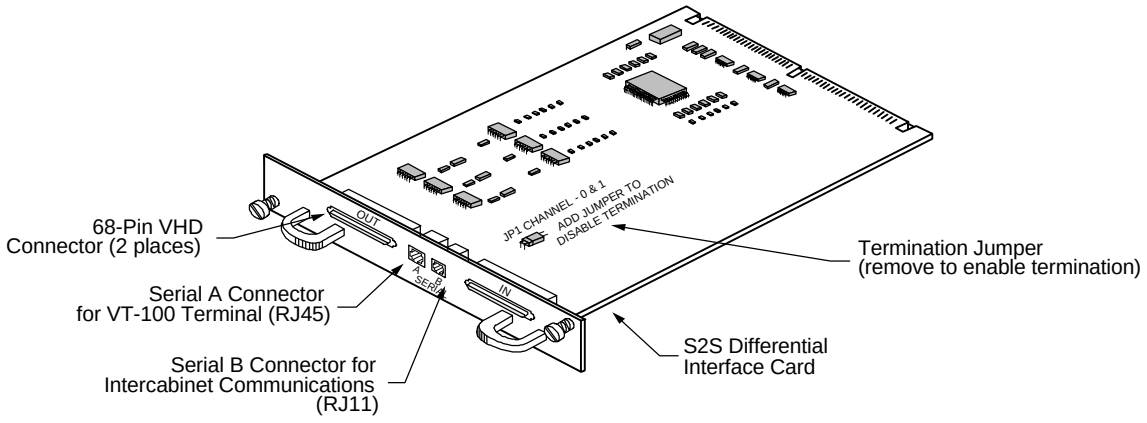
The configuration information is stored in the controller NVRAM and in the last 16 sectors of every working physical hard disk. This is information transparent to the operating system.

SCSI Functions

The Ultra S2S RAID Controller's *i*960 RISC processor and SCSI I/O processors provide an intelligent, high-performance SCSI interface and control. The controller manages and controls the SCSI bus arbitration between the controller and its connected devices, and all SCSI activity of the connected device.

Internally within the DEU, the lower bay drives are connected to the controller's Channel 0 SCSI I/O processor (SIOP) and the upper bay drives are connected to the controller's Channel 1 SCSI I/O processor. Up to twelve (12) drives can be connected to each of the SIOP channels. The upper and lower bays each contain up to four disk drives, expansion can be accomplished by connecting additional DEU subsystems through the Ultra Extender option card. Refer to the diagrams in the *Installation Chapter* of this User's Guide and the *Disk Expansion Unit User's Guide* for more information.

The controller provides one ultra wide SCSI channel out to the host system, which can be single-ended or differential. This connection is accomplished via either the S2S Single-ended Interface card or an S2S Differential Interface card. These cards will be installed in the upper (or right) option bay located on the rear panel of the DEU subsystem.



SCSI Bus Termination

When a SCSI-to-SCSI configuration exists, there are essentially two SCSI buses present: the host SCSI bus and the drive SCSI bus.

Host SCSI Bus:

The host SCSI bus consists of the host bus adapter, the data cable, the S2S Interface card, and the Ultra S2S RAID Controllers' host channel SCSI I/O processor. SCSI bus termination is required on the host SCSI bus and occurs at the host bus adapter and on the last S2S Interface card on the SCSI bus. Since multiple DEU subsystems can be daisy-chained together through this host SCSI bus, SCSI termination will need to be enabled only on the last S2S Interface card on the bus. A jumper located on the S2S Interface card (JP1) is removed to enable SCSI bus termination when the card is the last device in the SCSI bus chain (off-set one pin to act as a hold for the jumper).

For multiple cabinets disable SCSI bus termination on the interim S2S Interface cards by installing the jumper at JP1 and terminating the last S2S Interface card in the chain (removing jumper).

Drive SCSI Bus:

The drive SCSI bus consists of the Ultra S2S RAID Controllers disk channel 0 and 1 SCSI I/O processors, the backplane circuitry, the disk drives, and the I/O Interface card. If there are multiple cabinets connected in a master/slave configuration, the drive SCSI bus includes all cabinet drives, backplane circuitry, data cables, Ultra Extender cards, and I/O Interface cards.

The Ultra S2S RAID Controller supports active termination providing a stable quality SCSI termination signal. Drive SCSI bus termination is provided automatically by either the Ultra Extender or I/O Interface cards and requires no user intervention. The Ultra Extender or I/O Interface cards are designed to sense whether they are the last device on the SCSI bus and if so, automatically self terminate.

SCSI Address Selection (SCSI ID)

Controller ID Selection:

The SCSI ID of the Ultra S2S RAID Controller is set to a target address (SCSI ID) of 0 by default on power up. This setting should be adequate for a single cabinet configuration in stand-alone solutions. When multiple cabinets are used the target address of each Ultra S2S RAID Controller must be set to a unique SCSI ID that is available on the host SCSI bus. Use the “SCSI ID Menu > Set RAID Module ID” selection located on the DEU operator control panel to set the target address. (Refer to “Using the DEU” chapter – Options Menu selection in the *DEU User's Guide*.)

When the SCSI ID is changed, the subsystem will require power cycling to allow the new settings to take effect. Note that you will under normal conditions be setting the Drive IDs as the next step, you can set the RAID Module ID then access the menu and change the setting for SAFTE Chain ID functions before power cycling the subsystem. This saves you from power cycling the subsystem twice.

Drive ID Selection:

Each drive on each channel of the Ultra S2S RAID Controller must be configured for a target address (SCSI ID) that is different from the other devices. The DEU subsystem will automatically set the target address of each device during the power cycle after the appropriate "SAFTE Chain ID" selection is set on the DEU operator control panel. (Refer to the "Using the DEU" chapter – SAFTE Chain ID in the *DEU User's Guide*.)

Serial Communications

The Ultra S2S RAID Controller supports two serial asynchronous communication channels. The two channels are labeled on the S2S Interface Card as Serial A and B.

The Serial A connector is an RJ45 type connector and provides the communication link to a VT-100 (or equivalent) terminal and is used to configure the RAID subsystem.

The Serial B connector is an RJ11 type connector and provides the communication link between two Ultra S2S RAID Controllers for basic communications in a Dual-Active configuration. Cables are included in the accessory kits.

Dual Active Controllers

A dual-active (active-active) fault-tolerant configuration is provided when two DEU subsystems each with Ultra S2S RAID Controllers installed. This configuration allows two separate host systems continuous access to data in the event of a disk drive or controller failure. Refer to the installation chapter for diagram and setup information, and the configuration chapter for software configuration.

Should a fault occur in one controller, the other controller detects the failure and assumes operations for the failed controller. When the failed controller is subsequently removed and replaced with a functioning controller, the active functioning controller detects the presence of the new controller and relinquishes its assumed responsibilities to the new controller. This process is known as a fail-over and fail-back. Write cache coherency is maintained with the disk drives during this process.

The following requirements must be met to establish a dual-active controller environment:

- both controllers must have the same amount of memory
- both controllers must be at the same firmware level
- all disk SCSI channels must be connected one-to-one

Performance

The advantages of increased fault tolerance gained by the dual-active configuration provides an additional margin of fault tolerance. However, when operating in a dual-active mode and one controller fails, the performance of the single controller is somewhat degraded from that of a single controller in a single environment.

Drive Organization

The Ultra S2S RAID Controller organizes the drives connected as *drive groups* and *logical units*.

Drive Groups

When using the Ultra S2S RAID Controller, up to eight individual disk drives can be used together to form a pack or *drive group*. These physical drives make up the array's logical unit capacity. The controller supports up to eight drive groups. The number of drives in a drive group determines the possible RAID levels available when configuring the array.

A new feature of the controller is known as Drive Sizing. This solution allows the user to define how much of the drive's total capacity should be used. This permits the user to take various similarly sized drives and make them appear to all be the same size from the perspective of the controller.

Logical Units (LUNs)

A logical unit (system drive) is that portion of a drive group (or a combination of up to four drive groups) seen by the host system as a single logical device. Each logical unit is identified by its logical unit number (LUN). The Ultra S2S RAID Controller supports up to eight LUNs (system drives).

- A LUN can span up to four (4) drive groups
- A LUN can span up to a maximum of 32 drives
- A maximum of eight (8) LUNs per drive group
- A maximum number of eight (8) LUNs per group

Use the VT100 utility or the AdminiStor PC Utilities (RAIDfx) to configure the logical units from one drive group. Use only the AdminiStor PC Utilities to configure logical units that span more than one drive group.

Drive Management

The Ultra S2S RAID Controller functions that monitor and control the operation of the physical drives and logical units are instrumental to the controller's ability to perform RAID management and automated error recovery tasks.

Controlling Physical Drive States

The state of a physical drive refers to a SCSI drive's current operational status. At any given time, a SCSI drive can be in one of several states: Ready, Online, Standby, Rebuild, Dead, Format, or Unformatted. The operational status of a disk drive is indicated by a three-letter status code.

The controller stores the state of the attached SCSI drives in its non-volatile memory as well as on the disks. This information is retained even after the power is turned off.

These drive states are defined as:

- **Ready (RDY)** — a disk drive is operational, but not currently included in a drive group.
- **Online (ONL)** — a disk drive is on-line indicating it is powered on, has been defined as a member of a drive group and is operating properly.
- **Standby (SBY)** — a disk drive is in standby mode if it is powered on, able to operate properly, has not been defined as part of any drive group, and has been defined as a standby.
- **Dead (DED)** — a disk drive is dead if it is not present, is present but not powered on, or fails to operate properly and is killed by the controller (whether or not it has been defined as a member of a drive group).

- **Rebuild (RBL or WOL)** — a disk drive is in the process of being rebuilt *a)* during a RAID 1 rebuild, data is being copied from the mirrored drive to the replacement drive or *b)* during a RAID 3, RAID 5, or RAID 0+1 rebuild, data is being regenerated via the XOR redundancy algorithm and written to the replacement drive. (RBL is displayed when a VT100 terminal is used and WOL for the AdminiStor PC Utilities [RAIDfx])

- **Format (FMT)** — displayed when a disk drive is being formatted.

- **Unformatted (UNF**) — displayed when a disk drive needs to be formatted.

Controlling Logical Unit States

The state of a logical unit can be Online, Critical, or Offline. Note that the same term “online” is used for both physical drives and logical units.

These states are defined as:

- **Online** — a logical unit is on-line if all of its participating physical drives are on-line.

- **Critical** — a logical unit is considered critical when any of its physical drives is not on-line. Note that in a RAID 0 configuration, logical units are always in a critical state.

- **Offline** — a logical unit can be off-line under one of two conditions: *a)* it is configured with a redundant RAID level (1, 3, 5, 0+1) and two or more of its drives are not on-line, and/or *b)* it is configured as RAID 0 or JBOD and one or more of its drives is not on-line.

Controlling Standby Replacement Drives (Hot Spare)

The standby replacement drive (hot spare) is one of the most important features the controller provides to achieve a high degree of fault-tolerance. With the standby rebuild function, the controller performs a rebuild operation automatically when a disk drive fails and both of the following conditions are true: *a)* a standby disk drive of identical or larger capacity is found attached to the same controller, and *b)* all of the system drives that are dependent on the failed disk are configured in a RAID 1, RAID 3, RAID 5, or RAID 0+1 logical unit.

During the automatic rebuild process, system activity continues as normal. System performance may degrade slightly, however, during a rebuild. Priority of rebuild activity can be adjusted using the configuration utilities to adjust performance versus rebuild time.

A standby replacement drive can be created in one of two ways: *a)* a disk may be labeled a standby drive using the “Create Standby” option under the Configuration menu using the VT100 option, or *b)* when the configuration is created or changed using the software utility, all disks attached to one of the controllers channels that are not assigned to a drive group will be automatically labeled as standby replacement drives.

Disk Failure Detection

The controller automatically detects disk drive failures. A monitoring process running on the controller checks among other things, elapsed time on all commands issued to disks. A time-out causes the disk to be reset and the command will be retried. If the command time out occurs again, the disk is killed by the controller (state changed to Dead).

The controller also monitors SCSI bus parity errors and other potential problems. Any disk with too many errors will be killed by the controller.

Disk Media Error Management

The Ultra S2S RAID Controller manages SCSI disk media errors in a manner transparent to the user.

Disk drives are programmed to report errors. When a disk reports a media error during a read, the controller reads the data from the mirror (RAID 1 or RAID 0+1), or computes the data from the other blocks (RAID 3 or RAID 5), and writes the data back to the disk that encountered the error. If the write fails, or the following verify-of-data fails, the controller issues a REASSIGN command to the disk and then writes the data to a new location. Since the problem has been resolved, no error is reported to the system.

When the disk reports a media error during a write, the controller issues a REASSIGN command to the disk, and writes the data out to a new location on the disk.

Checking Consistency

A consistency check is a process that verifies the integrity of redundant data. For example, performing a consistency check of a mirrored drive assures that the data on both drives of the mirrored pair are exactly the same. To verify RAID 5 redundancy, a consistency check reads all associated data blocks, computes parity, reads parity, and verifies that the computed parity matches the read parity.

Cache Management

The Ultra S2S RAID Controller provides performance enhancements of data transfers through its on-board cache memory. The controller supports cache memory sizes from 8MB to 128MB. Cache memory is allocated by the controller memory management functions for Read Cache and Write Cache. Write cache policy is user-selectable for optimum performance with specific applications.

Controller Read Ahead

The Controller Read Ahead function improves data retrieval performance by allowing the controller to read into cache a full stripe of data at a time. This greatly improves the percentage of cache hits.

For example, if the stripe size is set to 8k and the host requests 1k of data, when this function is enabled the controller will read ahead the full 8k. When the host requests the next 1k block, that data will already be in the controller's cache. This function should remain enabled during normal controller operation.

Super Read Ahead

The Super Read Ahead function increases performance for applications that must access large blocks of sequential data. This function incorporate intelligent data request monitoring to track data requests by the host. With Super Read Ahead enabled, the controller detects requests for data that are stored in sequence on the drives. It reads the data into the cache so that the cache remains at least one request ahead of the host. This function should remain enabled during normal controller operations.

Write-Through Cache

Write-Through cache refers to a cache writing strategy whereby data is written to the drive before a completion status is returned to the host operating system. This caching strategy is considered more secure, since a power failure could cause a loss of data in Write-Back cache mode. However, Write-Through cache may result in lower performance because additional time is taken to complete the write transaction to disk.

Write-Back Cache

Write-Back cache refers to a caching strategy whereby write operations result in a completion status being sent to the host operating system as soon as the cache (not the disk drive) receives the write data. The target drive receives the data at a more appropriate time in order to increase controller performance.

In a dual-active configuration, write data is always copied to the cache of the second controller before completion status is issued to the host initiator.

NOTE: Write-Back cache mode is not recommended due to potential data loss in the event of a power outage.

RAID Management

RAID is an acronym for Redundant Array of Independent Disks. The Ultra S2S RAID Controller implements several different versions of the RAID technology and two special versions that are specific to this controller. Each version is referred to as a RAID level.

An appropriate RAID level is selected when the logical units are defined or created.

Supported RAID Levels

The Ultra S2S RAID Controller supports RAID levels 0, 1, 3, 0+1, 5, and JBOD. Drives within an individual subsystem can use different RAID levels and a single drive within the system can be configured to use more than one RAID level.

RAID Level	Description
RAID Level 0	RAID 0 implements block striping without redundancy. A minimum of two system drives are required for this configuration up to a maximum of eight system drives.
RAID Level 1	RAID 1 writes identical data to two system drives (mirroring). A minimum of two system drives are required for this configuration.
RAID Level 3	RAID 3 implements block striping and generation of parity data. Parity data is striped across the drives. A minimum of three drives is required and a maximum of 32 drives is supported.
RAID Level 0+1	RAID 0+1 implements block striping and writes identical data to two system drives.
RAID Level 5	RAID 5 implements block striping and generation of parity data. Parity data is striped across the system drives. A minimum of three system drives are required for this configuration.
JBOD	Known as “just a bunch of drives”, JBOD allows the controller to access the drives independently. This configuration has no redundancy and does not use striping.

Striping (RAID 0)

Striping refers to the storing of a sequential block of incoming data across multiple drives in a drive group. For example, if there are three drives in a drive group (or pack), the data is separated into blocks. A block of data can be specified to be either 16, 32, 64, or 128 sectors in depth. Block one of the data will be stored on drive one, block two on drive two, block three on drive three. Drive one will again be the location of the next block (block four); then block five is stored on drive two, block six on drive three, and so forth. This method can significantly increase disk system throughput, particularly for transferring large, sequential data blocks.

Mirroring (RAID 1)

Mirroring refers to the duplication of data on two disk drives. Each disk contains a copy of the data on the other drive.

Striping with Dedicated Parity Drive (RAID 3)

RAID level 3 data is striped in blocks across several physical drives and parity data on a separate drive. The benefits are that this level uses a fraction of the disk space required by RAID level 1 to achieve data redundancy. It provides good performance for transaction processing applications because each drive can read and write independently. Should a drive fail, the controller continues to allow reads and writes independently, while calculating and rebuilding the missing information using the parity data.

Striping with Mirroring (RAID 0+1)

RAID 0+1 is a combination of RAID 0 (striping) and RAID 1 (mirroring).

The advantages of RAID 0+1 are fully mirrored data and better performance than RAID 1. The disadvantage of RAID 0+1 is its 50% utilization capacity.

Striping with Parity (RAID 5)

Striping with parity provides complete data redundancy and requires only a fraction of the storage capacity required for mirroring.

In a system configured under RAID 5 (requires at least three drives) all data and parity blocks are divided between the drives in such a way that if any single drive is removed (or fails), the data on the missing drive can be reconstructed using the data on the remaining drives (XOR refers to the Boolean "Exclusive-OR" operator).

JBOD

JBOD is an acronym for Just a Bunch of Drives. The disk drives function independent of one another, just as they would on a non-RAID controller.

Striping and Stripe Size

Striping is the practice of writing data across two or more disk drives to a defined depth.

The stripe width is the number of drives within a drive group.

The stripe order is the order in which the SCSI drives appear within a drive group. It is critical that the selected stripe order is always maintained, to assure data integrity and the controller's ability to rebuild failed drives.

The stripe size is the size of the logically contiguous data block recorded on each drive within a logical unit. The default stripe size (depth) is 8KB. Stripe sizes of 16KB, 32KB, or 64KB can be selected through the user interface (Toolkit menu).

Larger stripe size ensures better performance for large sequential data transfers. Smaller stripe sizes are best suited for small random data transfers.

2 Installation

The installation of your Ultra S2S RAID Controller consists of installing the controller and the option card, setting any required jumpers, connecting the cables, and configuring the array.

Be sure to read the manual prior to proceeding with the installation. There are several possible configurations in which different option cards, jumper settings, and cabling are required.

Note: Shielded I/O cables, such as those provided with the subsystem, must be used to prevent radio frequency interference.

You will need to reference the DEU User's Guide during the installation.

Supported Application

There are three types of installation covered in this user's guide. They include:

- Simplex — a DEU with an Ultra S2S RAID Controller connected to a single host.
- Duplex (Dual-Active) — two DEUs with Ultra S2S RAID Controllers connected to one host system.
- Duplex (Dual-Host Failover/Failback) — one or two DEUs with Ultra S2S RAID Controllers connector to two host systems.

Quick Start

For those of you who do not like to read manuals, a quick setup is provided to guide you through getting the Ultra S2S RAID Controller installed, configured, and online with a minimum of dialog and steps.

For each step, a cross reference to expanded information is provided for the subject matter in the specific chapter.

To setup your Ultra S2S RAID Controller:

1 Install the Ultra S2S RAID Controller into the front upper option card bay.

2 Install the S2S Interface card in the upper (or right) I/O slot at the rear of the subsystem. (Terminate the S2S Interface card per your configuration, refer to "Cabling Configuration" later in this section for information on supported configurations and their required termination.)

3 Connect the data cables. (Refer to "Cabling Configuration" later in this section for information on supported cabling configuration.)

4 Power up the subsystem. Using either a VT100 terminal or from DOS the Ultra S2S RAID Utilities (DACfx) configure and initialize the array(s). (Refer to "Method 1 – Using the RAID Utility" later in this section or "Method 2– Using the VT100 Mode" later in this section for detailed information on the configuration utilities.) Follow the instructions on the screen for the utilities software.

Note: Be sure to set the following options for proper operation and performance (Advanced Functions > Edit/View Parameters > Startup Parameters, Hardware Parameters, and SCSI Transfer options). Refer to "Advanced Functions" later in this section for detailed information.

This completes the Quick Start setup.

Setup

Caution: Printed circuit board components are sensitive to electrostatic discharge. To prevent operating failure or damage, observe the following: Establish a ground for yourself by using the wrist grounding strap, or by touching the metal chassis prior to handling or installing any printed circuit boards.

During the installation, references will be made to component locations. These references are made to the DEU subsystem when it is viewed from the rear panel. Common terms such as upper or lower refer to the tower based configurations, and right or left to the rack mount configurations.

Before beginning the installation you will need to consider the following:

- RAID Level — Support for RAID level 0, 1, 3, 5, 0+1, 10, 30, and 50. (Refer to the software configuration section.)

- Cabling Configuration — Each configuration type has different cabling requirements. Determine the number of subsystems that will be used per host adapter and refer to the diagrams for each supported configuration. When mixing configurations you will need to consider that there may be some physical server CPU limitations that apply, such as available expansion card slots, as well as, cabling length limitations. (Refer to the Cabling Configuration section.)

- When multiple subsystem are being used, identify which DEU subsystem will be the “master” subsystem and which will be the “slave” subsystem(s). Refer to the *DEU User's Guide*.

This section will describe the procedures to install the controller and I/O cards.

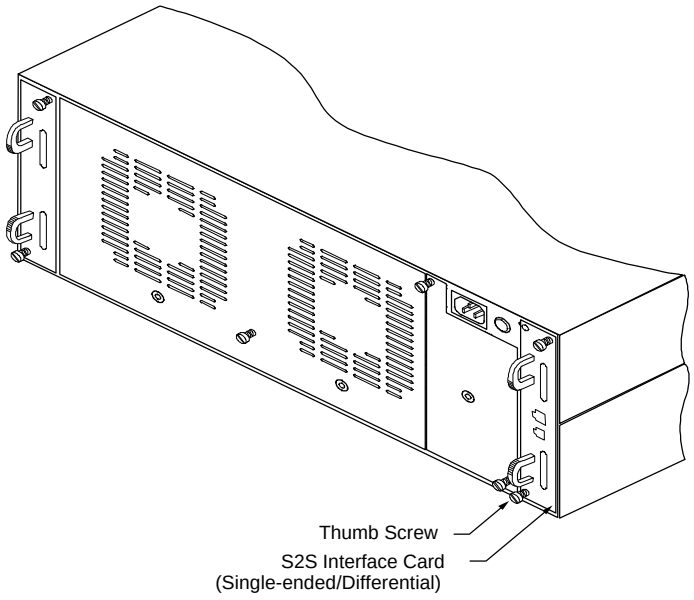
1 Power off your computer system or workstation.

Caution: Exercise care when handling any electrical component.

2 Refer to the "Setup" and "Component Installation" sections in the *DEU User's Guide* and follow the procedures for setting up the subsystem (i.e., installing configuration modules, disk drives, and power supplies).

3 On each master subsystem you will need to install the S2S Interface Card in the upper (or right) option slot.

Loosen the two thumb screws on the upper (or right) card slot and remove the I/O Interface card.



4 Set the host SCSI bus termination on the S2S Interface card. If the subsystem is at the end of the host SCSI bus, termination on the card is required. Remove the jumper (JP1) to enable termination. Offset the jumper pins to store the plastic jumper.

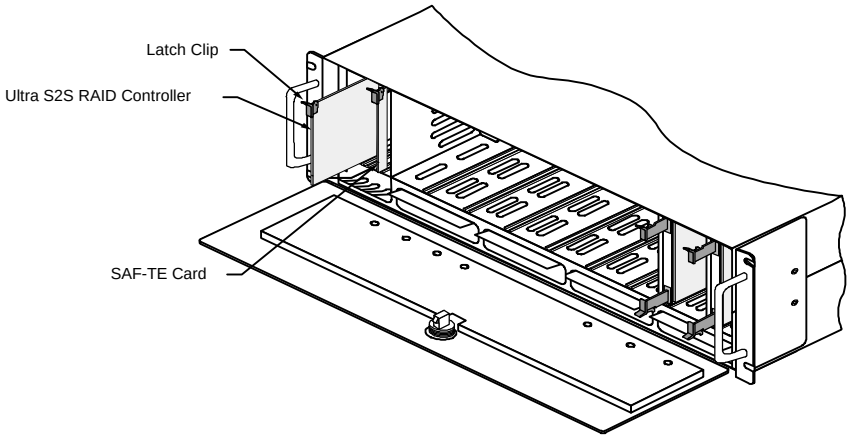
   If the subsystem is not at the end of the host SCSI bus, termination is not required. Verify that the jumper (JP1) is installed which disables termination.

5 Insert the S2S Interface card into the selected bay.

   The insertion process requires a slight amount of force. The process is made easier by placing both thumbs on the handles and applying the force. The card is completely seated when the card reaches its second position and is flush with the cabinet's back panel. Tighten the thumb screws. Do not overtighten the screws. The card is keyed and will only install one way, component side up or to the right.

6 (Master subsystem only) Install the Ultra S2S RAID Controller(s).

   Open the front door to the subsystem. Locate the controller in the accessory kit and be careful to handle the controller by its edges and/or the latch clip. Open the latching clip and carefully align the controller's card edges into the rails and insert the controller into the upper or left bay. Using both thumbs on the card's front edge press firmly to fully seat the controller. As the controller seats the latching clip will self secure. Verify that the card is seated and the latch clip is secure. (In the following illustration the rack-mount subsystem is used to illustrate the process.)



7 (Slave subsystems only) Remove the I/O Interface card in the top or right Option Card slot, and replace with an Ultra Extender Option card.

Refer to the *DEU User's Guide* for more information. Repeat this step for each slave subsystem in the configuration.

8 (VT100 Terminal use only) Connect the S2S Serial Communication cable to the S2S Feature card at the Serial A connector using the RJ45 connector plug. Connect the other end (DB9) to a VT100 terminal (or equivalent).

9 (Dual-Active configuration only) Connect one end of the S2S Cluster cable to the S2S Feature card at the Serial B connector on the first Master subsystem using the RJ11 connector plug. Connect the other end to the second Master subsystem S2S Feature card to the Serial B connector.

10 Connect the data cables. Refer to "Cabling Configuration" later in this section, to determine the required cables for your configuration.

Cabling Configuration

The cabling configuration section is divided into the following sections: Simplex Configurations, Duplex (Dual-Active) Configurations, and Duplex (Dual Host) Configurations. These sections provide a illustrated view of the cabinet and cabling scheme when operating the DEU subsystem(s) in a specific mode.

The Simplex configuration is the classic configuration supported. In this configuration a single host is attached to the DEU Ultra S2S RAID Controller to which all the drives in the array. Drives are fault tolerant when a RAID level providing redundancy is configured. In this configuration, if the controller or host bus adapter should fail, the data will not be available until the failure is corrected.

The Duplex (Dual-Active) configuration supports a single host attached to dual DEU subsystems each with Ultra S2S RAID Controllers installed through daisy chained cabling. This configuration ensures that if either controller fails, the other will take over its functions and continue to process system I/O operations. This is known as failover. Under normal conditions, when both controllers are functioning (active/active mode) both are actively processing data which improves performance.

The Duplex (Dual Host) configuration supports two host systems connected to dual DEU subsystems each with Ultra S2S RAID Controllers installed also through daisy chaining. The offers advances of being able to sustain data access in the event of a controller failure. If configured in a cluster or high availability environment, it is also able to sustain data access in the event of the failure of a server or host adapter. This is also known as failover/failback mode.

Cable length is a primary consideration when configuring the subsystems. For detailed information on the SCSI specification limitations, refer to the “Cabling Configuration” section in the *DEU User’s Guide*.

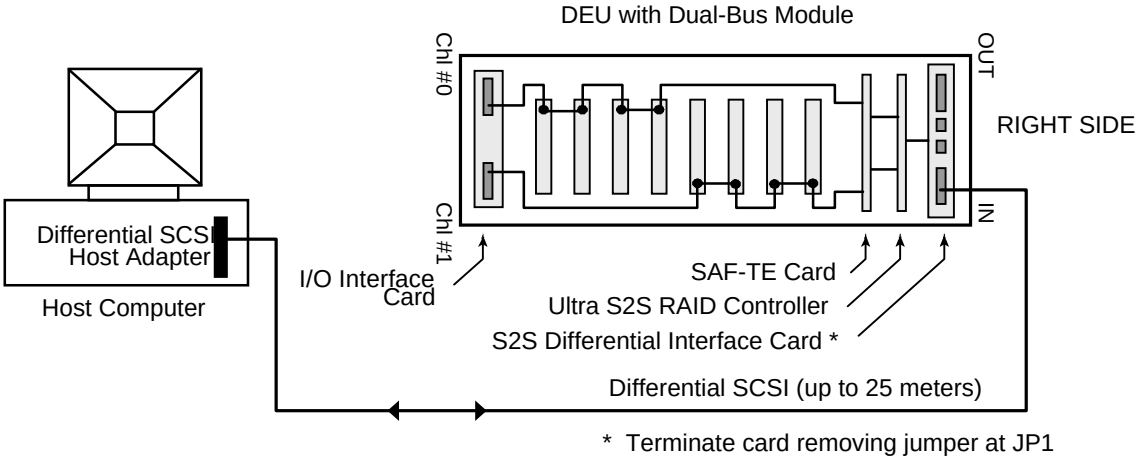
Simplex Configuration

Differential SCSI

Prior to beginning the cabinet cabling, identify the configuration for your installation. Note the card locations in the illustrations for each configuration. Install your cards and connect the cabling based on the diagrams shown.

Single Cabinet

This configuration provides a single cabinet solution from which an array can be created using up to eight (8) disk drives. Additional cabinets can be added to this configuration by referring to the next two cabling schemes using a Differential configuration. Terminate the S2S Interface card by removing the jumper at JP1.



1. Connect the host bus adapter (HBA) data cable to the “IN” port on the DEU cabinet S2S Interface card. Secure the cable connectors using the thumb screws.

2. Power up the DEU subsystem and accessing the OCP configure the SAFTE Chain ID setting to “None” (refer to the *DEU User's Guide*).

3. Power cycle the subsystem.

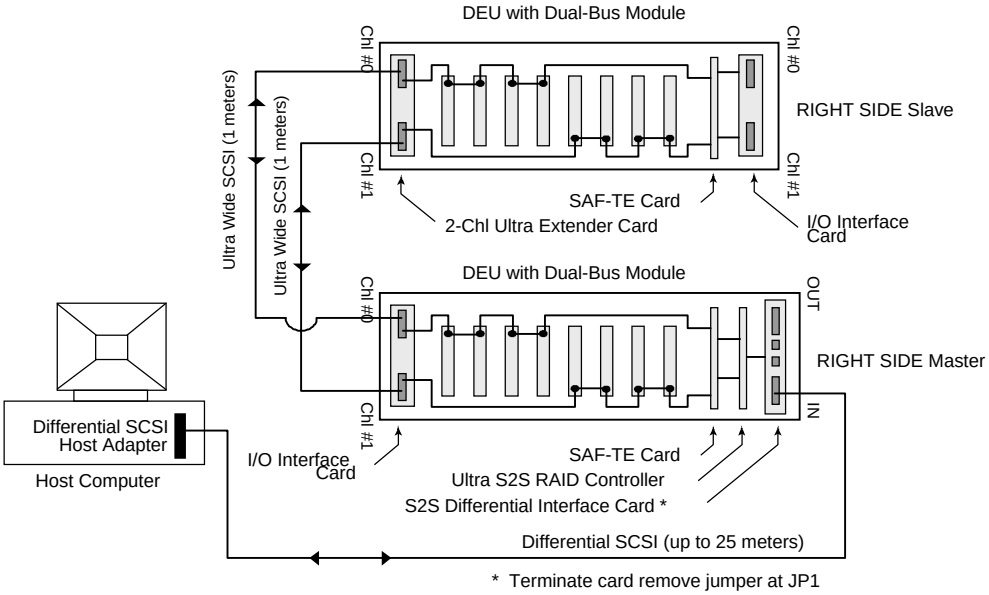
4. Proceed with completing the installation and configuring the array, refer to *Chapter 3 Configuration*.

One Master Cabinet and One Slave Cabinet

This configuration provides a master/slave cabinet solution from which an array can be created using up to sixteen (16) disk drives — 8 drives per drive group. Terminate the S2S Interface card by removing the jumper at JP1.

1 Connect the host bus adapter (HBA) data cable to the "IN" port on the Master cabinet S2S Interface card. Secure the cable connectors using the thumb screws.

2 Connect a one (1) meter data cable from the Master cabinet Ch #0 I/O Interface card to the Slave #1 cabinet Ch #0 Ultra Extender card connectors. Secure the cable connectors using the thumb screws.



3 Connect a one (1) meter data cable from the Master cabinet Ch #1 I/O Interface card to the Slave #1 cabinet Ch #1 Ultra Extender card connectors. Secure the cable connectors using the thumb screws.

4 Power up the DEU subsystems and accessing the OCP configure the SAFTE Chain ID settings to “Master” and “Slave 1” (refer to the *DEU User's Guide*). Labels are provided to identify the specific subsystems.

5 Power cycle the subsystems.

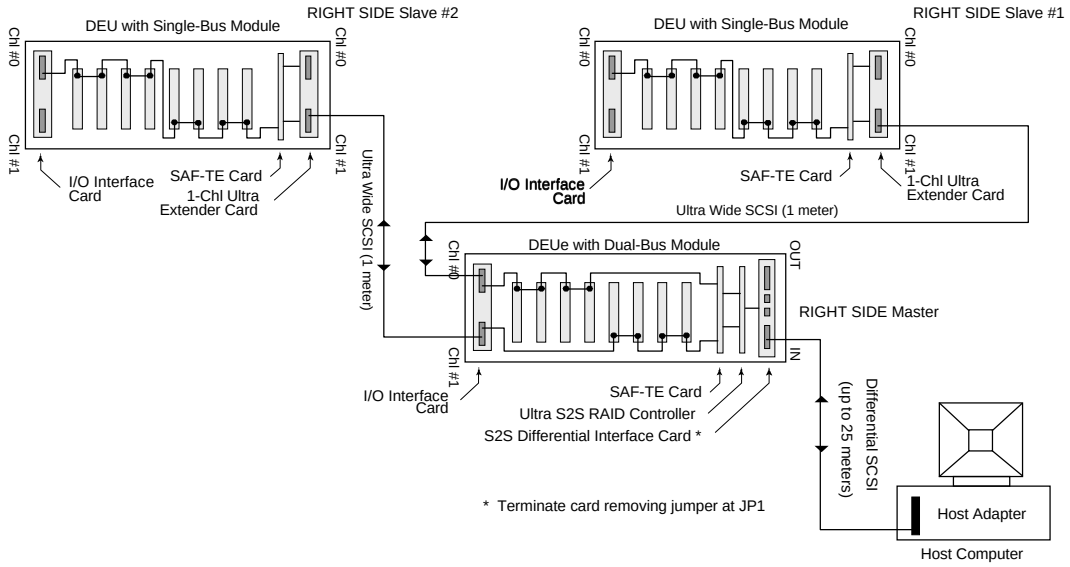
6 Proceed with completing the installation and configuring the array, refer to *Chapter 3 Configuration*.

One Master Cabinet and Two Slave Cabinets

This configuration provides one master and two slave cabinets solution from which an array can be created using up to thirty-two (32) disk drives — 8 drives per drive group. Terminate the S2S Interface card by removing the jumper at JP1.

1 Connect the host bus adapter (HBA) data cable to the “IN” port on the Master cabinet S2S Interface card. Secure the cable connectors using the thumb screws.

2 Connect a one (1) meter data cable from the Master cabinet Ch #0 I/O Interface card to the Slave #1 cabinet Ch #1 Ultra Extender card connectors. Secure the cable connectors using the thumb screws.



3 Connect a one (1) meter data cable from the Master cabinet Ch #1 I/O Interface card to the Slave #2 cabinet Ch #1 Ultra Extender card connectors. Secure the cable connectors using the thumb screws.

4 Power up the DEU subsystems and accessing the OCP configure the SAFTE Chain ID settings to "Master", "Slave 1", and "Slave 2" (refer to the *DEU User's Guide*). Labels are provided to identify the specific subsystems.

5 Power cycle the subsystems.

6 Proceed with completing the installation and configuring the array, refer to *Chapter 3 Configuration*.

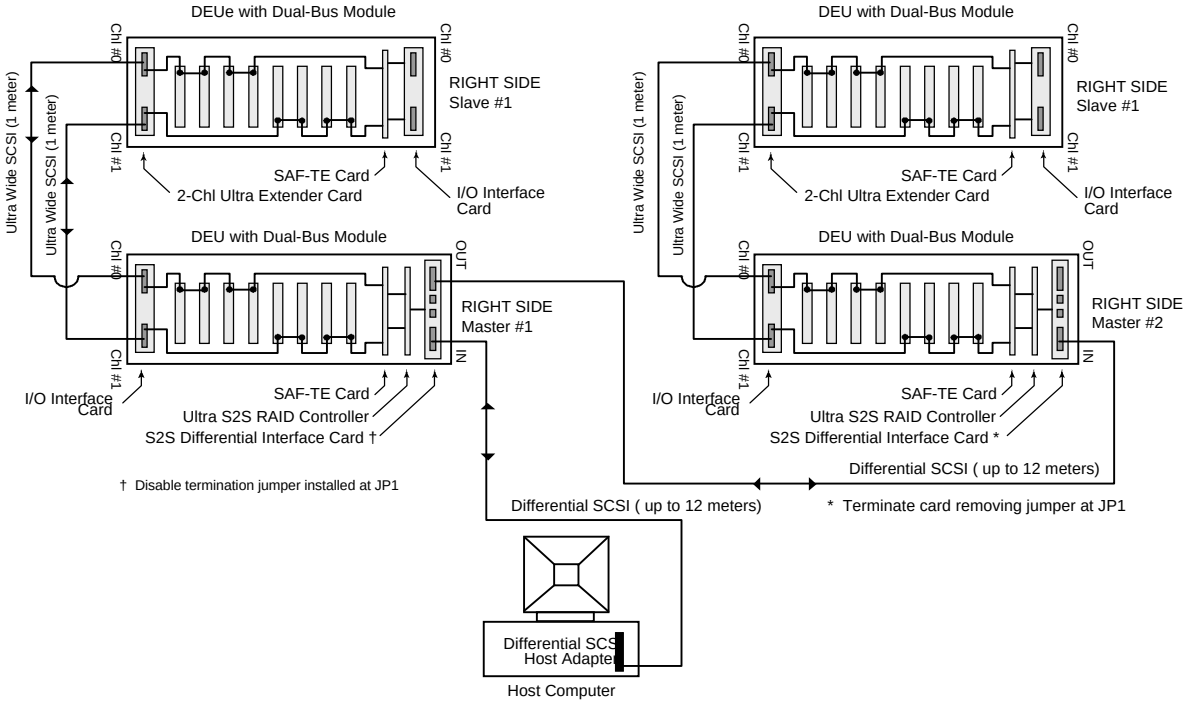
Two Master Cabinets and One Slave Cabinet for each Master

This configuration provides a two master and two slave cabinets solution from which an array can be created using up to thirty-two (32) disk drives — 8 drives per drive group. Terminate the S2S Interface card in the Master #2 cabinet by removing the jumper at JP1 and disable termination on the S2S Interface card in the Master #1 cabinet (jumper installed).

Note: Each device or controller on the SCSI bus must have a unique SCSI ID.

Recommended SCSI ID values are as follows:

Device/Controller	SCSI ID
First Host Adapter	7
Second Host Adapter	6
First S2S Controller	0
Second S2S Controller	1



1 Connect the host bus adapter (HBA) data cable to the “IN” port on the Master #1 cabinet S2S Interface card. Secure the cable connectors using the thumb screws.

2 Connect a one (1) meter data cable from the Master #1 cabinet S2S Interface card “OUT” port to the Master #2 cabinet S2S Interface card “IN” port. Secure the cable connectors using the thumb screws.

3 Connect a one (1) meter data cable from the Master cabinet Ch #0 I/O Interface card to the Slave #1 cabinet Ch #0 Ultra Extender card connectors. Secure the cable connectors using the thumb screws.

4 Connect a one (1) meter data cable from the Master cabinet Ch #1 I/O Interface card to the Slave #1 cabinet Ch #1 Ultra Extender card connectors. Secure the cable connectors using the thumb screws.

5 Repeat steps 3 and 4 for the second set of slave cabinets connected to the second master cabinet.

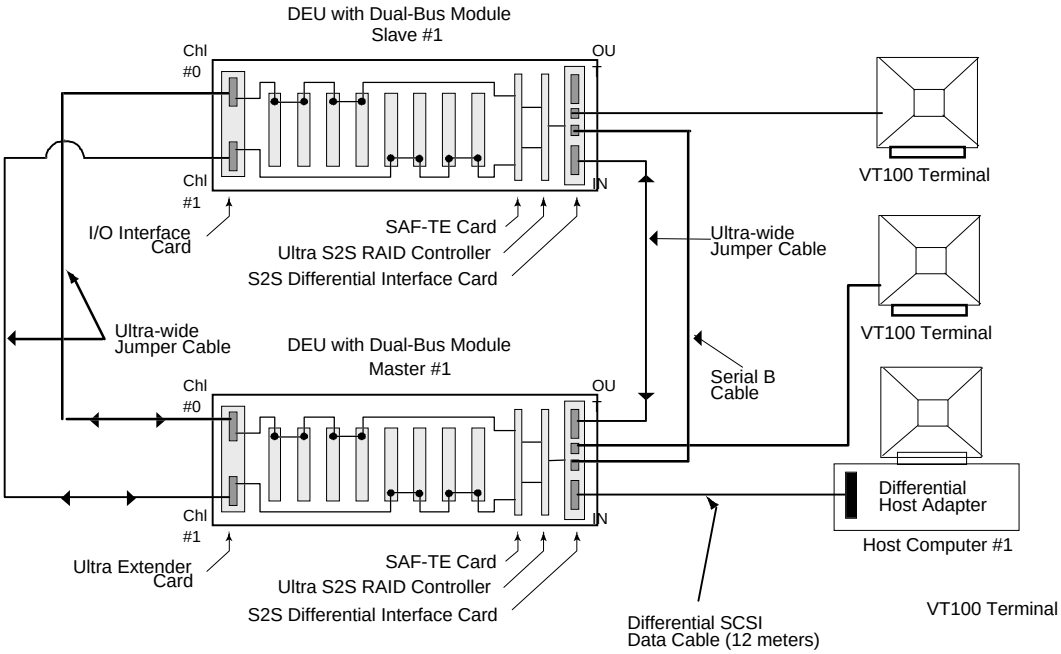
6 Power up the DEU subsystems and accessing the OCP configure the SAFTE Chain ID settings to "Master" and "Slave 1" (refer to the *DEU User's Guide*). Labels are provided to identify the specific subsystems.

7 Power cycle the subsystems.

8 Proceed with completing the installation and configuring the array, refer to *Chapter 3 Configuration*.

Dual Active (Active/Active) Configuration

The ST8000 can be configured to provide redundancy for S2S failures. When two cabinets containing S2S controllers are connected in dual active mode and an S2S fails, its alternate automatically takes control and manages the disks in both cabinets. This operation is invisible to the operating system and does not impact functionality. This figure illustrates the Dual Active Configuration.



Use the following procedure to establish the dual active configuration:

1. Configure a cabinet as a stand-alone device, not cabled to the second ST8000. Refer to the "Operator Control Panel Options Menu" in the *ST8000 Disk Expansion Unit User's Guide.*
2. Using the ST8000 LCD display, set the SAFTE CHAIN ID to NONE. Refer to "Configuraton– Starting AdminStor Utilities" in the *Ultra S2S RAID Controller User's Guide.*
3. Boot up the RAIDFX utility and set up the S2S parameters.

4 Set the ACTIVE-ACTIVE Parameters:

Force Simplex to DISABLE

Ctrlr Pres / FLT Signals to DISABLE

5 Exit the software and power down the ST8000.

6 Power up the second ST8000 and repeat steps 3 through 5.

7 Connect a 12 meter differential data cable from the Master cabinet “IN” port of the S2S Interface card to the differential host bus adapter in the host computer.

8 Connect an ultra wide jumper cable from the Master cabinet “OUT” port of the S2S Interface card to the Slave #1 cabinet “IN” port of the S2S Interface card.

9 Connect an ultra wide jumper cable from the Master cabinet “Channel #0” port of the Ultra Extender card to the Slave #1 cabinet “Channel #0” port of the I/O Interface card.

10 Connect an ultra wide jumper cable from the Master cabinet “Channel #1” port of the Ultra Extender card to the Slave #1 cabinet “Channel #1” port of the I/O Interface card.

11 Connect the Serial B cable for intercabinet communications to the Serial B connector on both S2S Interface Cards in the Master and Slave #1 cabinets.

12 Secure all connectors using the thumb screws. Do not overtighten.

13 Connect VT100 terminals to serial connector A.

14 Set one cabinet SAFTE CHAIN ID to MASTER, the other to SLAVE 1.

15 Set both RAID MODULE IDs to the same number (eg: 4).

16 Set the upper and lower SCSI ID's on the second cabinet to 8-11 or higher. This setting avoids conflict with the RAID MODULE ID – the S2S – which will automatically use one number higher for the second controller (if both are set to 4, then the system will see them as ID 4 and 5). Refer to "Using the DEU Operators Control Panel – Options Menu – SCSI ID Menu" in the *ST8000 Disk Expansion Unit User's Guide*.

17 Power off both cabinets, wait at least 30 seconds, then power them on simultaneously.

18 Observe the message on the VT100 display indicating both controllers are active.

19 Load RAIDFX and configure the RAIDs for normal operation.

Duplex (Dual-Host) Configuration

Dual-Host Failover/Failback

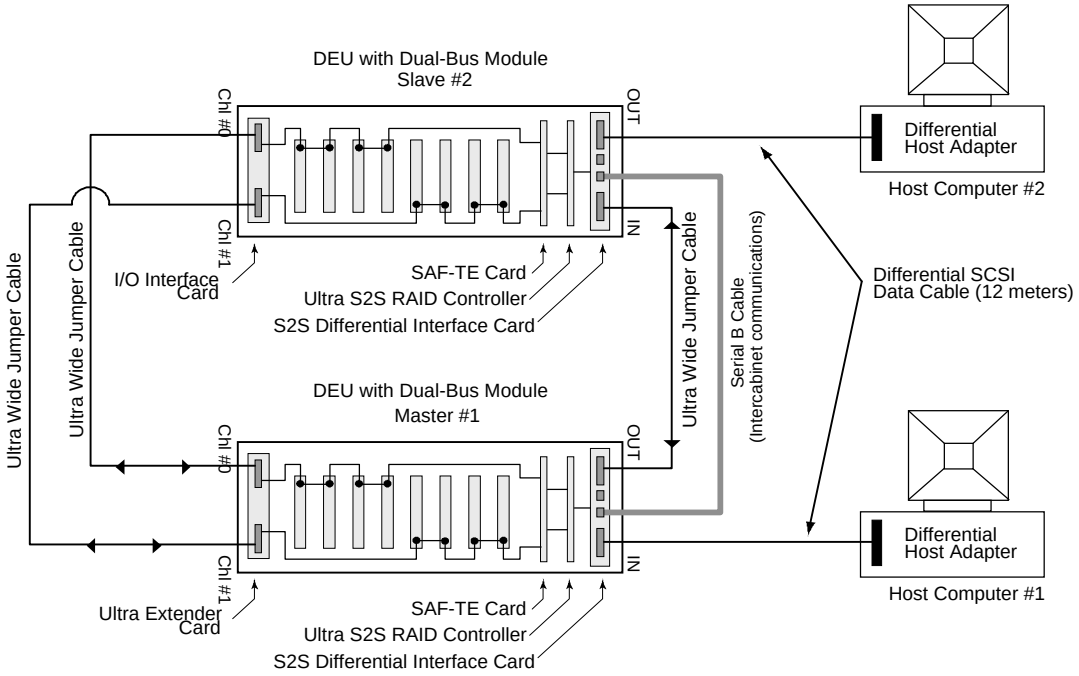
One Master Cabinet and One Slave Cabinet connected to Two Hosts

This configuration provides a dual-active (fail-over/fail-back) solution.

Note: Each device or controller on the SCSI bus must have a unique SCSI ID.

Recommended SCSI ID values are as follows:

Device/Controller	SCSI ID
First Host Adapter	7
Second Host Adapter	6
First S2S Controller	0



1 Connect a 12 meter differential data cable from the Master cabinet “IN” port of the S2S Interface card to the differential host bus adapter in the host computer #1.

2 Connect a 12 meter differential data cable from the Slave #2 cabinet “OUT” port of the S2S Interface card to the differential host bus adapter in the host computer #2.

3 Connect an ultra wide jumper cable from the Master cabinet “OUT” port of the S2S Interface card to the Slave #2 cabinet “IN” port of the S2S Interface card.

4 Connect an ultra wide jumper cable from the Master cabinet “Channel #0” port of the Ultra Extender card to the Slave #2 cabinet “Channel #0” port of the I/O Interface card.

5 Connect an ultra wide jumper cable from the Master cabinet “Channel #1” port of the Ultra Extender card to the Slave #2 cabinet “Channel #1” port of the I/O Interface card.

6. Connect the Serial B cable for intercabinet communications to the Serial B connector on both S2S Interface Cards in the Master and Slave #2 cabinets.

7. Secure all connectors using the thumb screws. Do not overtighten.

8. Power up the DEU subsystems and accessing the OCP configure the SAFTE Chain ID settings to "Master" and "Slave 2" (refer to the *DEU User's Guide*). Setting the slave cabinet to "Slave 2" will automatically set the SCSI IDs for each bank to IDs 10, 11, 12, and 13. The "Slave 1" automatic setting will cause a SCSI ID conflict with the second Ultra S2S RAID Controller. Labels are provided to identify the specific subsystems.

9. Power cycle the subsystems.

10. Proceed with completing the installation and configuring the array, refer to *Chapter 3 Configuration*.

11.

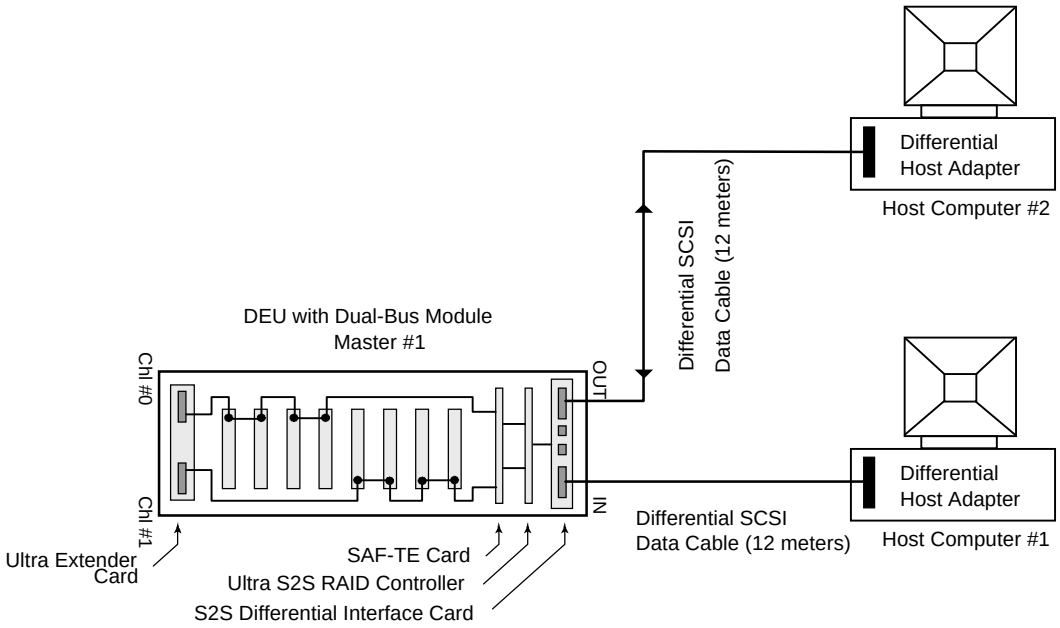
One Master Cabinet connected to Two Hosts

This configuration provides a dual-active (fail-over/fail-back) solution.

Note: Each device or controller on the SCSI bus must have a unique SCSI ID.

Recommended SCSI ID values are as follows:

Device/Controller	SCSI ID
First Host Adapter	7
Second Host Adapter	6
First S2S Controller	0
Second S2S Controller	1



1. Connect a 12 meter differential data cable from the Master cabinet “IN” port of the S2S Interface card to the differential host bus adapter in the host computer #1.

2. Connect a 12 meter differential data cable from the Master cabinet ‘OUT’ port of the S2S Interface card to the differential host bus adapter in the host computer #2.

3. Secure all connectors using the thumb screws. Do not overtighten.

4. Power up the DEU subsystems and accessing the OCP configure the SAFTE Chain ID settings to “Master.”

5. Power cycle the subsystem.

6. Proceed with completing the installation and configuring the array, refer to Chapter 3 Configuration.

3 Configuration

There are two possible methods to format, configure and initialize the disk array when using the Ultra S2S RAID Controller.

- Method 1 — Using the AdminiSTOR PC Utilities from a DOS-based PC and accessing the DEU through the host system SCSI adapter (DOS ASPI via SCSI to the controller), this method also includes NT Pass-Through (Windows NT via SCSI to the controller) *or*
- Method 2 — Using a VT100 terminal and accessing the DEU through the Serial A port (DOS SLP via host serial port COM1 to the controller). This option uses the onboard configuration utilities.

Method 1 — Using the AdminiStor PC Utility

This method will describe the various screens and elements of the configuration program. To run the utilities, the following will be required:

- DOS 6.22 or later
- A system with an ASPI compatible SCSI-3 or SCSI-2 host adapter
- A high-density floppy disk drive
- An ASPI driver for the host adapter installed (the driver must be loaded through CONFIG.SYS in DOS)

Once the configuration is completed, the resulting data is written to the controller's non-volatile memory and disk drive. Upon reboot the controller uses this information to organize the storage system's presentation to the operating system.

Installing the AdminiStor PC Utilities

Note: Before installing AdminiStor PC Utilities, create a backup copy of the software diskette(s).

1. Create a directory on your host computer's hard drive where the PC Utilities will reside (e.g., c:\nstor\pc_utils\).

2. Copy the contents of the AdminiStor PC Utilities diskette into the directory you created.

3. Change directories into the directory you created.

4. Review the Readme.txt file for any information that may not be included in this manual.

5. From a DOS command line or DOS window, type: `install` and press <Enter>.

   The install program will extract the program files and translate the Drive Size File if present.

Starting AdminiStor PC Utilities

Using DOS ASPI

Note: Your SCSI adapter's ASPI drivers must be installed prior to running AdminiStor PC Utilities — Raidfx.exe.

1. Change directories to the AdminiStor PC Utilities installation directory.
2. From the DOS command line, type: `raidfx` and press <Enter>.

When using the DOS-based utility, the SCSI ID of the Ultra S2S RAID Controller must be set to IDs 0 - 6. This enables the software to recognize the controller. To change the SCSI IDs refer to "SCSI ID Menu" in the DEU User's Guide, "Using the DEU" chapter.

Using Windows NT Pass-Through

There are three addressing methods available. AdminiStor PC Utilities — Raidfx uses all three methods simultaneously.

The software can be started in several different ways under Windows NT:

- Double-clicking a shortcut
- Double-clicking within NT Explorer
- Command line in a DOS window
- Selecting Run from the Start task bar
- A batch file

Unclaimed (HBA Addressing):

HBA Addressing indicates that Windows NT has not claimed ownership of the controller. To achieve this state:

1. Make sure the DEU subsystem with the Ultra S2S RAID Controller is powered Off.
2. Turn on the computer and boot Windows NT.
3. After Windows NT is up and running, turn on the DEU subsystem and let it complete its initialization.
4. Start AdminiStor PC Utilities — Raidfx. For example, from the Run option in the Start menu, type `c:\path\raidfx` and press <Enter>.

Claimed with Drive Letter (Logical Addressing):

An existing configuration on the controller is required for this addressing method:

1. Make sure the DEU subsystem with the Ultra S2S RAID Controller is powered On, configured, and fully initialized.
2. Turn on the computer and boot Windows NT. Windows NT will claim ownership of the controller.
3. Use the NT Disk Administrator to assign drive letters.
4. Start AdminiStor PC Utilities — Raidfx. For example, from the Run option in the Start menu, type `c:\path\raidfx` and press <Enter>.

Claimed without Drive Letter (Physical Addressing):

An existing configuration on the controller is required for this addressing method:

1. Make sure the DEU with the Ultra S2S RAID Controller is powered On.

2. Turn on the computer and boot Windows NT. Windows NT will claim ownership of the controller.

   If you do not assigned drive letters, Raidfx will use physical addressing to locate all the controllers that are not accessible by either the HBA addressing or Logical Addressing.

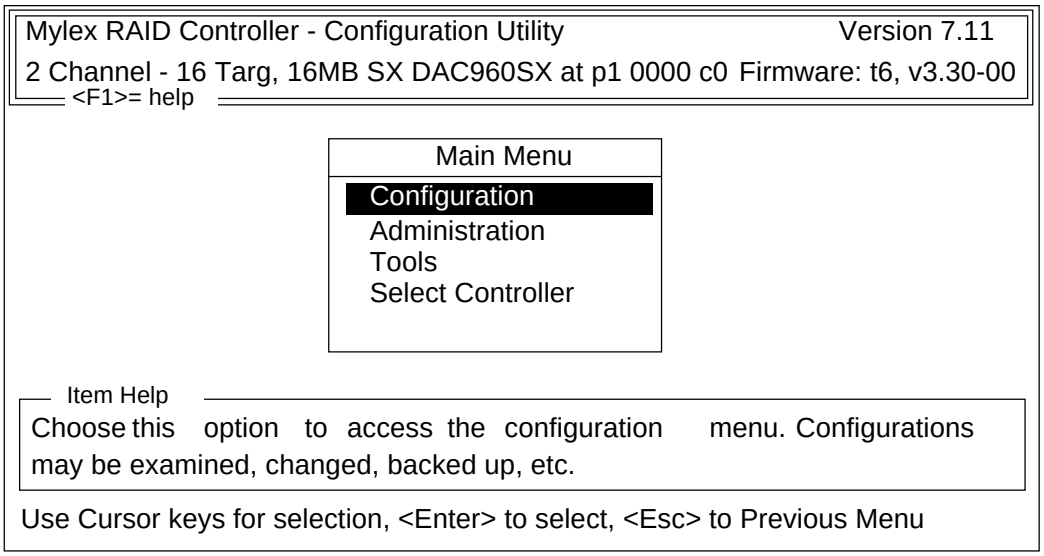
3. Start AdminiStor PC Utilities — Raidfx. For example, from the Run option in the Start menu, type `c:\path\raidfx` and press <Enter>.

Configuring the Array

Note: If more than one DEU subsystem(s) is connected to the host adapter you will be prompted to select the DEU on the host adapter at the specific ID to configure.

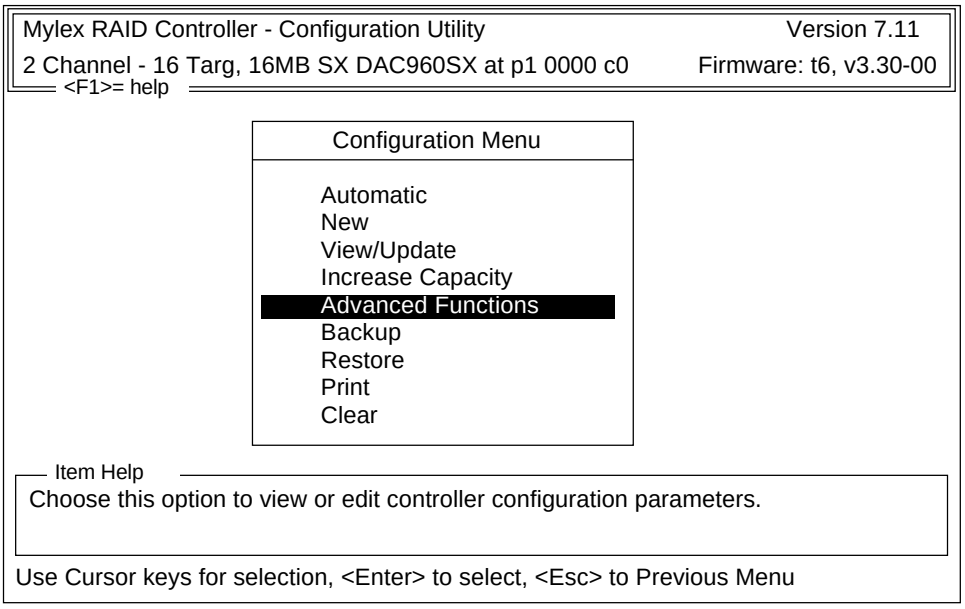
1 Select the *ID* of the subsystem you wish to configure and press <Enter>.

Normally, the utility will locate the controller and scan the devices attached to it. A screen will appear indicating the inquiry, followed by the AdminiStor PC Utilities screen.

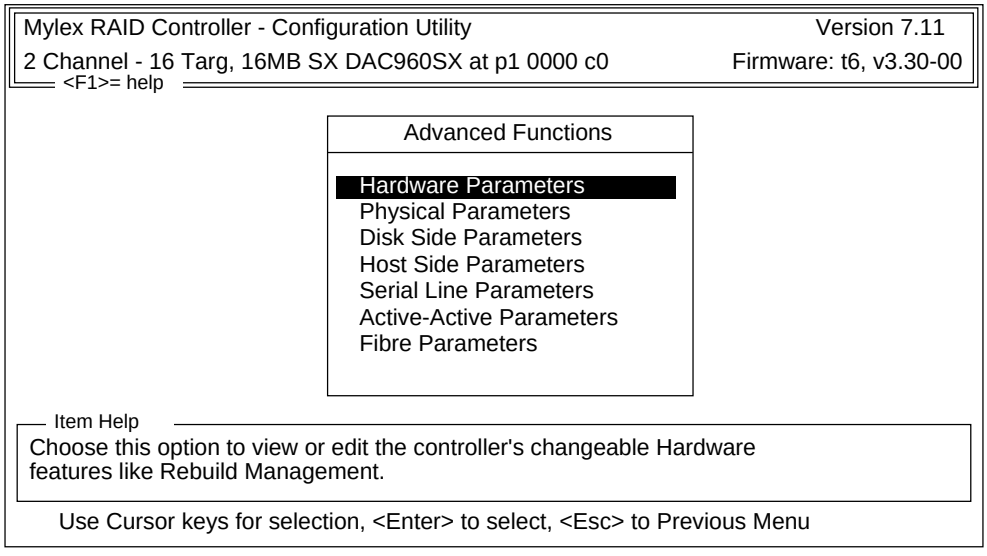


2 Choose *Configuration* from the Main menu and press <Enter>.

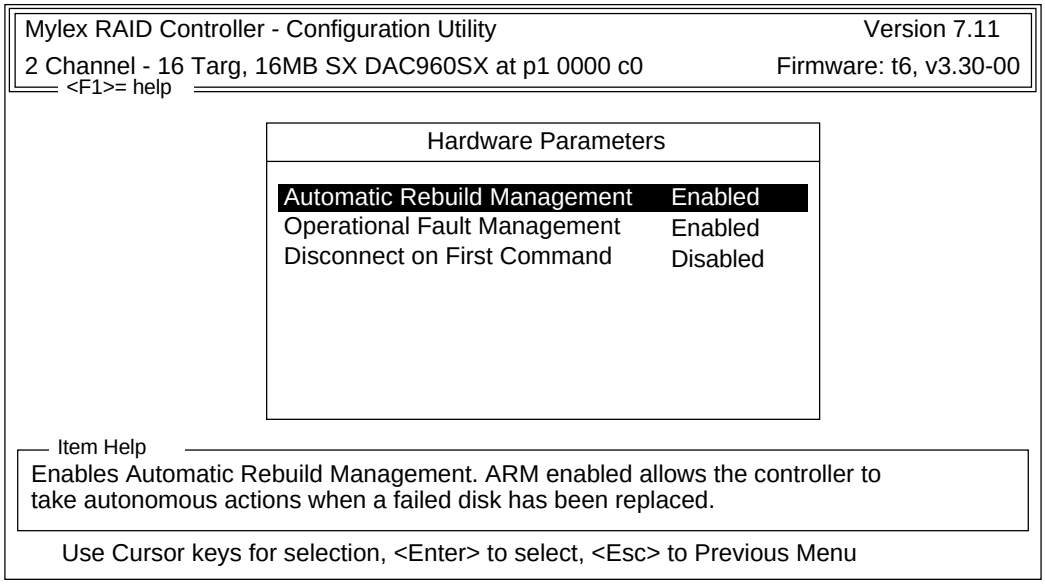
3 Select Advanced Functions from the Configuration menu. Use the arrow keys to highlight *Advanced Functions* and press <Enter>.



4 Use the arrow keys to highlight *Hardware Parameters* and press <Enter>.



Verify that the options “Automatic Rebuild Management” and “Operational Fault Management” are set to *Enabled*. Use the <Enter> key to switch each selection from Disabled to Enabled, if required.



Automatic Rebuild Management (ARM) controls whether the controller will automatically begin a rebuild operation on an existing spare drive when an active drive fails. If ARM is disabled, the controller will never automatically initiate a rebuild operation. However, the rebuild operation can be initiated manually through the VT100 emulator or AdminiStor PC Utilities — RAIDfx program. If ARM is enabled, the controller will automatically initiate a rebuild operation if an appropriately sized spare drive is available at the time of a drive failure.

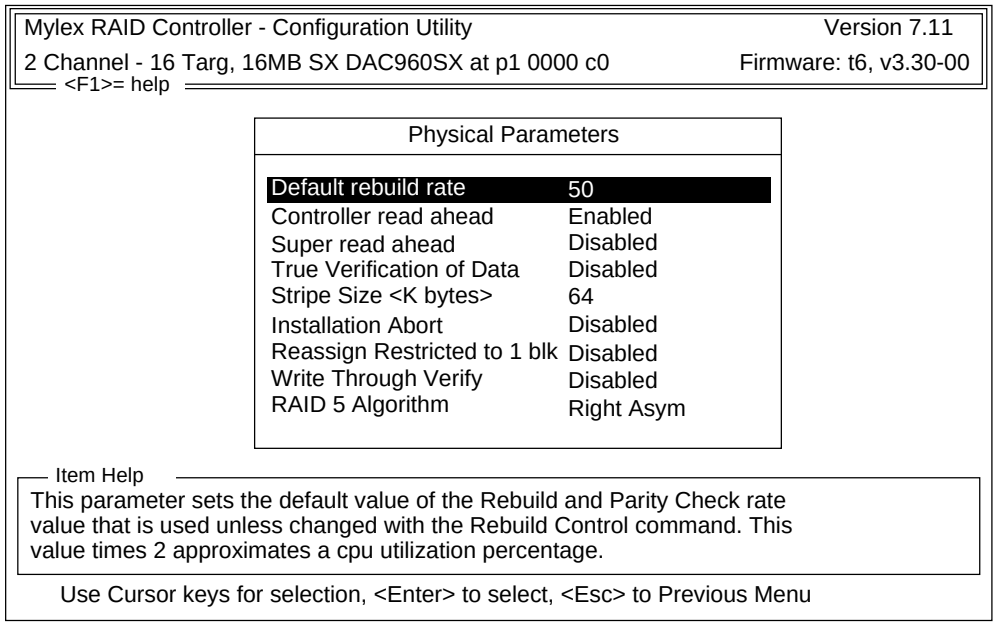
Operational Fault Management (OFM) controls whether the controller performs any environmental monitoring (AEMI or SAF-TE). OFM must be enabled for the controller to detect power supply, fan, and temperature failures. OFM must also be enabled for drive push/pulls to be detected and for ARM to work.

The default and recommended setting should be for both ARM and OFM to be *enabled*.

Note: The "Disconnect of First Command" option should be set to *Disabled*. With this bit enabled the controller will not grant disconnect privileges on the first command issued to back-end devices after a bus reset. This setting should be disabled.

5 Press <Esc> to return to the previous menu.

6 Use the arrow keys to highlight *Physical Parameters* and press <Enter>.



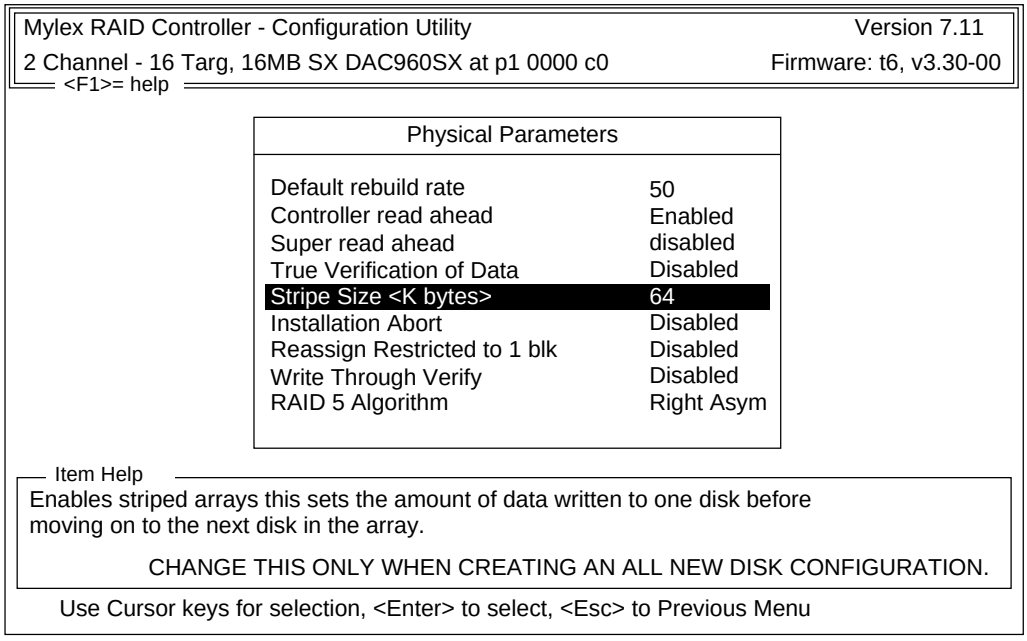
a Set the value for the "Default rebuild rate." This value is the percentage of controller activity devoted to the rebuild operation. A value of 50 indicates 50% CPU allocation to the rebuild. The default setting is *50*.

b Ensure that the "Controller read ahead" option is set to *Enabled* and the "Super read ahead" option is set to *Disabled*. These settings will ensure optimum performance.

c Ensure that the "True Verification of Data" option is set to *Disabled*. Enabling this feature may cause a degraded performance.

d Set the stripe size of the array. Use the arrow keys to select *Stripe size <K bytes>* and press <Enter> to change the value displayed. Repeat pressing the <Enter> key until the desired parameter value appears.

Caution: Data loss will occur if you change the stripe size on a controller with existing logical arrays. Always back up all of the drives before making a stripe size change, and always reconfigure and initialize the logical array after a new stripe size is saved.



The stripe size is defined as the size, in kilobytes (1024 bytes), of a single I/O operation. A stripe of data (data residing in actual physical disk sectors, which are logically ordered first to last) is divided over all disks in the Drive Group. The software default stripe size is 8 KB. The recommended stripe size is 64KB.

Once set, the stripe size cannot be changed without first copying all of the data off of the array, changing the stripe size, re-initializing the drives, and copying the saved data back onto the array. In a large capacity array, this operation could take several hours and inconvenience many people. You should evaluate your needs now and make any changes before the array is placed into service.

The stripe size function is used to tune the controller performance for a specific environment or application. Generally, stripe size optimization is as follows:

- smaller stripe sizes provide better performance for random I/O (e.g., RAID 5, network file service, or OLTP processing)
- larger stripe sizes provide better performance for sequential transfers (e.g., RAID 0, RAID 1, digital video, etc.)

Note: Changing the stripe size alters the way data is written on the disk drives.

e Ensure that the option for “Installation Abort” is set to *Disabled*. This will prevent the controller from saving a configuration file when a possible problem exists with the file.

f Verify that the “Reassign Restricted to 1 blk” option is set to *Disabled*.

When enabled, the controller will only request a single block to be reassigned. When disabled, the controller will reassign all blocks in a failing request. Most disk drives are now configured to auto-reassign, plus there is some additional safety in reassigning all blocks in the request instead of just the one reported by the device. However this leaves the risk of reassigning blocks with no errors.

g Ensure that the option for “Write Through Verify” is set to *Disabled*.

This option enables disk write through verify. During error handling it turns on Force Unit Access for reads and writes. Force Unit Access is a SCSI control descriptor bit (CDB). It is not necessary to use this bit in error recovery because most drives are already configured for auto-reassign and write-cache disabled.

h Set the “RAID 5 Algorithm” option to Right Asymmetric (*Right Asym*).

This setting controls the layout of RAID 5 parity blocks within the redundancy group. The Right Asymmetric layout puts parity blocks on the first disk for the first stripe, the second disk for the second stripe, the third disk for the third stripe, etc.

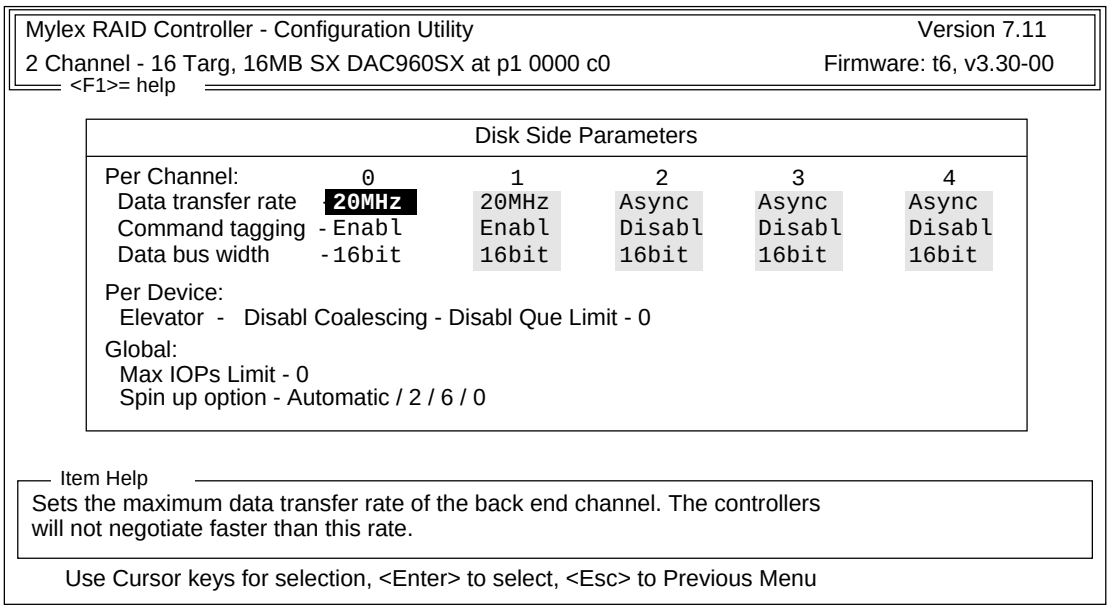
The Left Symmetric layout puts parity blocks on the last disk for the first stripe, the second to last disk for the second stripe, the third to last disk for the third stripe, etc.

Wrapping is dependent on the number of drives in the group. The following demonstrates this, where P denotes a parity block and D denotes a data block.

Right Asymmetric	**Left Symmetric**
P D D D	D D D P
D P D D	D D P D
D D P D	D P D D
D D D P	P D D D
P D D D	D D D P
Etc.	Etc.

7 Press <Esc> to return to the Advanced Functions menu.

8 Use the arrow keys to select *Disk Side Parameters* and press <Enter>.



a Ensure that the "Data transfer rate" value for both Channels is set to *20MHz*. This is the recommended setting for Ultra SCSI.

b Verify that the settings for "Command tagging" and "Data bus width" are configured to *Enabl* and *16bit*, respectively.

c Ensure the settings for the Device options are configured as follows:

"Elevator" — *Disabl*, "Coalescing" — *Disabl*, and "Que Limit" — *0*.

With regard to Elevator, when enabled, the controller orders commands to the drives based on the Logical Block Address (LBA) in an attempt to keep the heads moving in the same direction. The default and recommended setting is disabled. Although this parameter is available for performance tuning, modern disk drives do a better job of this.

With regard to Coalescing, when enabled, the controller attempts to combine small sequential requests into larger requests in an attempt to improve performance. The default and recommended setting is disabled.

Que Limit value controls the maximum number of drive command queue tags used by the controller. The available values are 2-230. The default value is 32 (RAIDfx value of 0 implies 32). The recommended value is the maximum command queue depth of the drive (or half that if duplex controllers will both be actively accessing the drive (e.g., a multi-system drive redundancy group where each controller accesses one or more system drives thus sharing the physical drives).

Maximum IOPs value controls the maximum number of host command queue tags (from all host ports) that the controller can process simultaneously. The available values are 64-244. The default and recommended value is 244 (RAIDfx value of 0 implies 244).

The controller ignores the value setting of zero (0) and instead substitutes the stated value (32 for Queue limit, and 244 for max IOP). Thus, if you enter a zero, the controller behaves the same as if you had entered 32 and 244 respectively. so the available effective values are as stated. A zero entry is a special case which is allowed, but which results in a non-zero effective value.

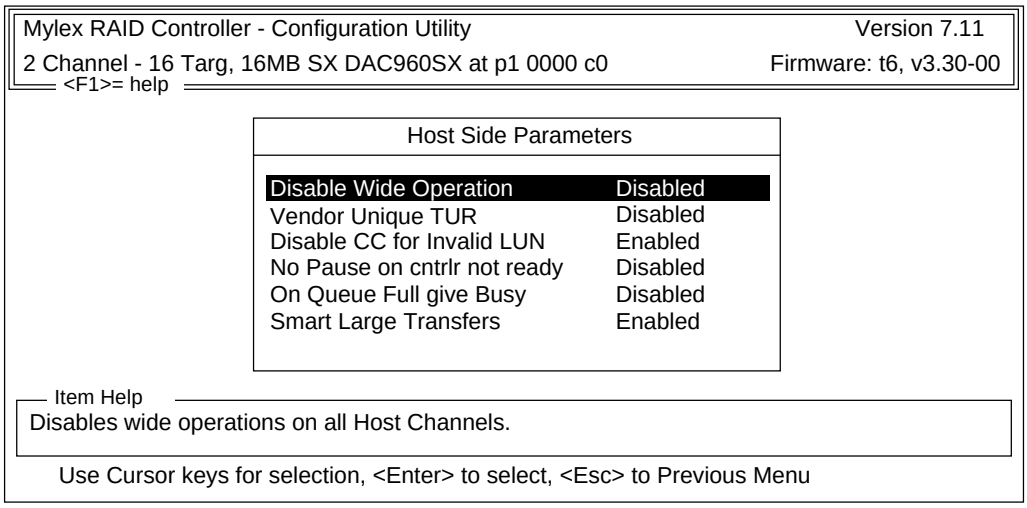
Note: For more information about the Queue Limits and Max IOPs, contact your service provider.

d Verify the setting for “Global Max IOPs Limit” is set to *0*.

e Ensure the settings for “Global Spin up option” is configured for *Automatic*, *2*, *6*, and *0*, as indicated in the illustration above.

9 Press <Esc> to return to the previous menu.

10 Use the arrow keys to select *Host Side Parameters*.



Referring to the illustration above, verify that your settings are configured as depicted. If not, use the arrow keys to move to the selection and press the <Enter> key to set the parameter.

Wide Operations — If this feature is disabled, the controller will not accept wide data transfer negotiation from the host. The default and recommended setting is for wide operations to be enabled (interface setting selection “Disabled”).

The Vendor Unique TUR is not used by this controller.

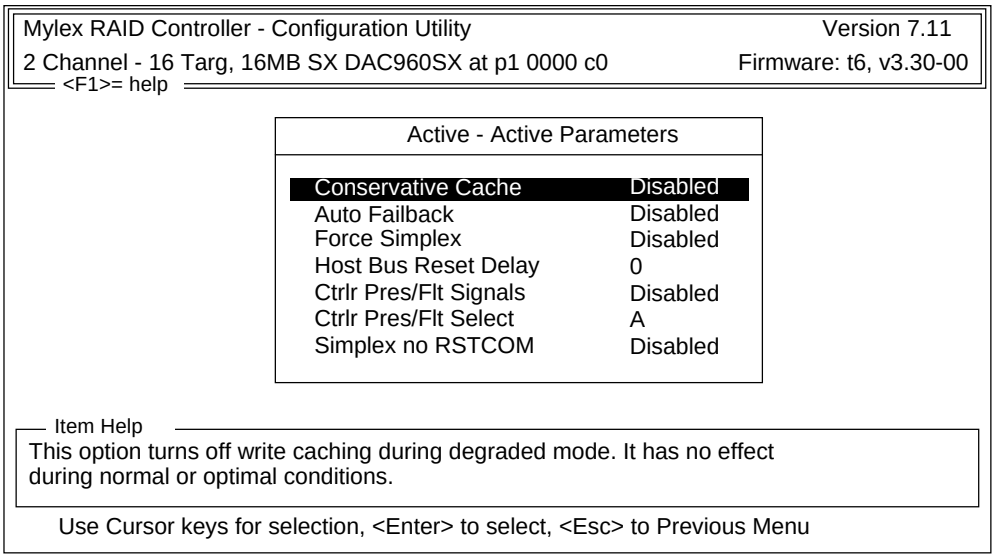
When “Disable CC for Invalid LUN” is disabled, the controller will return a check condition for any command to an invalid LUN, including the INQUIRY command. This a non SCSI-2 compliant. When “Disable CC for Invalid LUN” is enabled, the controller will respond to an INQUIRY command for an invalid LUN by setting the peripheral qualifier field to 1 (device supported, not connected) which is SCSI-2 compliant. The default and recommended setting is Enabled.

With this parameter “enabled”, the controller will respond with BUSY status instead of QUEUE FULL status. The default setting is “Disabled”, but the correct setting depends on the host driver.

The Smart Large Transfer feature is not used with this controller.

11 Press <Esc> to return to the previous menu.

12 (Optional for Dual Active Configurations) Use the arrow keys to select *Active - Active Parameters* and press <Enter>.



a Set the Conservative Cache parameter to "Disabled."

b Set the Auto Failback parameter to "Disabled." The option is not implemented for the DEU subsystem.

c For Simplex configurations, set the "Force Simplex" parameter to *Enable*. For Duplex configurations, set the option to *Disable*. This option must be disabled for duplex configurations.

d Set the "Host Bus Reset Delay" value to 0.

e Set the "Ctrlr Pres/Flt Signals" and the "Ctrlr Pres/Flt Select" options both to *Disabled*. These option, Controller Presence/Fault Signals (Select), informs the controller which hardware arrangement of controller presence and fault signals are implemented. These options are not implemented for the DEU subsystem.

f With regards to the "Simplex no RSTCOM" option, if this parameter is disabled, the controller asserts RSTCOM (partner reset signal) when operating in simplex mode. If this parameter is enabled, the controller does not assert RSTCOM when operating in simplex mode. The default value is "Disabled." However, for Simplex mode configurations, it is recommended to set the parameter to *Enabled*. this parameter has no effect on duplex mode configurations.

13 Press <Esc> to return to the previous menu.

14 Create the Drive Groups. To do this, choose from either Option 1 — *Automatic* or Option 2 — *New*.

Selecting Option 1 the software will automatically define (up to eight) the drives in the subsystem as one RAID 5 array. Use this method if you only want one array with no hot spare drive. (See "Option 1 — Automatic Configuration" later in this section.)

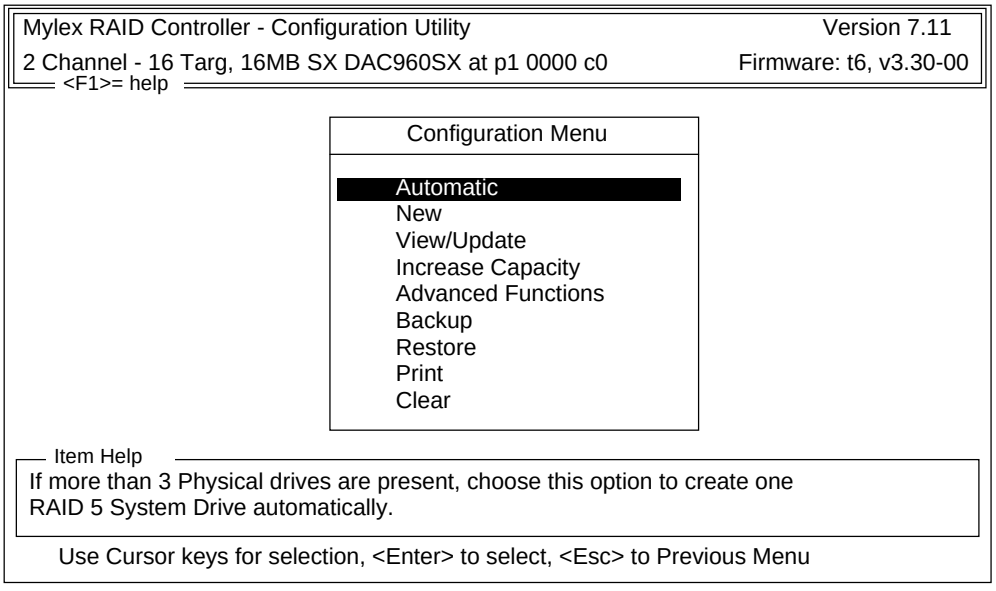
Selecting Option 2 allows you to manually define one or more arrays, making drive selections and selecting a drive for the hot spare. (See "Option 2 - New Configuration" later in this section.)

Option 1 — Automatic Configuration

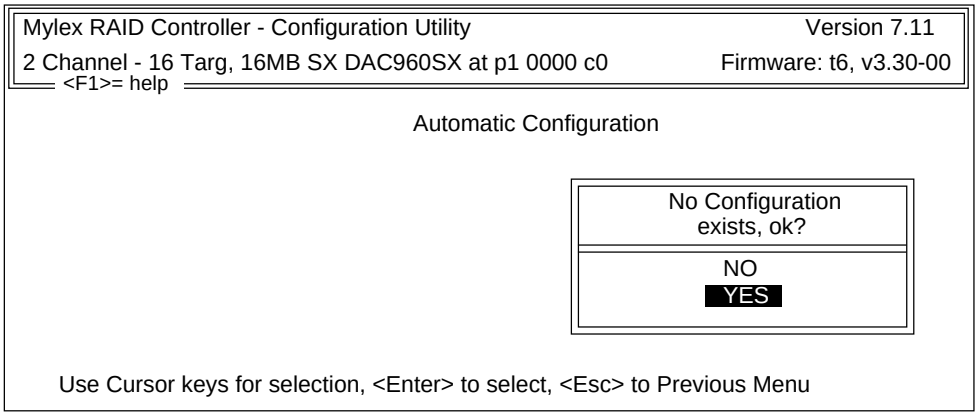
This option will automatically configure a RAID 5 system drive containing from three to eight disk drives. All drives must be the same size. The stripe size is taken from the current Stripe Size setting.

1 Use the arrow keys to highlight *Configuration* from the Main menu and press <Enter>.

Caution: Running Automatic Configuration will clear any pre-existing configuration, along with all programs and data on the disk array. If you wish to change an existing configuration, use the View/Update option.



2 Select *Automatic* and press <Enter>. If no previous configuration exists, you will be prompted. Select *YES* to continue.



3 On the next screen, select whether you wish to enable Write Cache and press <Enter>.

Select *NO* to enable write through, which writes data to the disk before acknowledging the write. This setting results in lower performance, but no data can be lost in a power failure/system crash.

Select *YES* to enable write back, which temporarily stores write data in the cache and acknowledges the Write command before writing to disk. This setting results in better performance at the expense of fault tolerance. If a power failure or system crash occurs, any data in the cache will be lost.

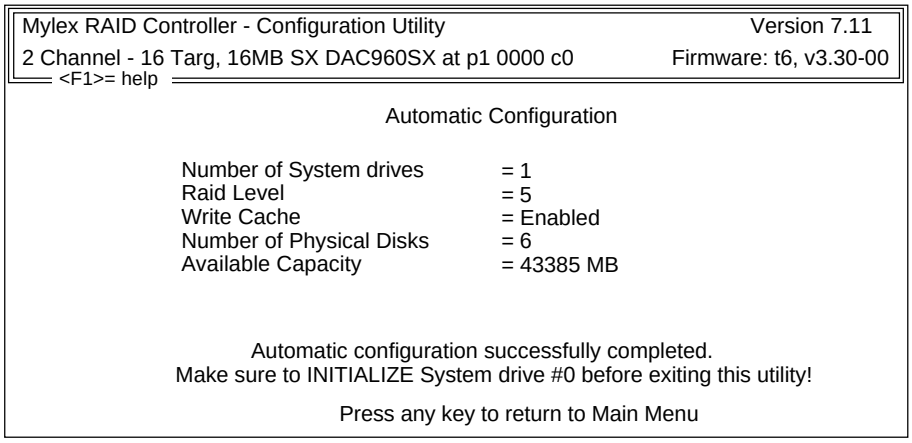
Note: When using system drives with Write Back cache, make it a point to wait for at least 15 seconds after the last operation before rebooting or powering off the subsystem. This is to ensure data in the cache is written to the disk before the system is rebooted. Also it is recommended to use an uninterruptable power supply (UPS) when enabling Write Back cache.

4 When you leave the configuration menu, the system will prompt you to save the configuration. Select YES to save, or NO to undo all your changes.

5 Next you will be asked if you want to reset the controllers. Select *YES*.

After reset, you will return to the Configuration menu.

6 The configuration will be written and displays a summary of the configuration. Press any key to return to the Main menu.

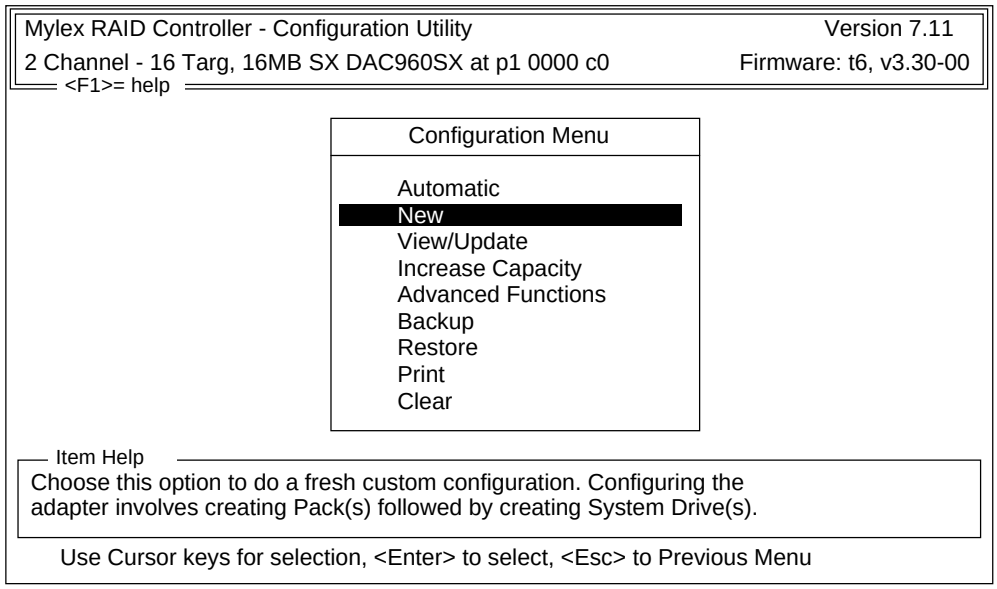


7 Skip now to “Initializing the System Drives” later in this section.

Option 2 - New Configuration

This section describes how to manually create a new configuration.

1 To create a new configuration, use the arrow keys to highlight *New* and press <Enter>.

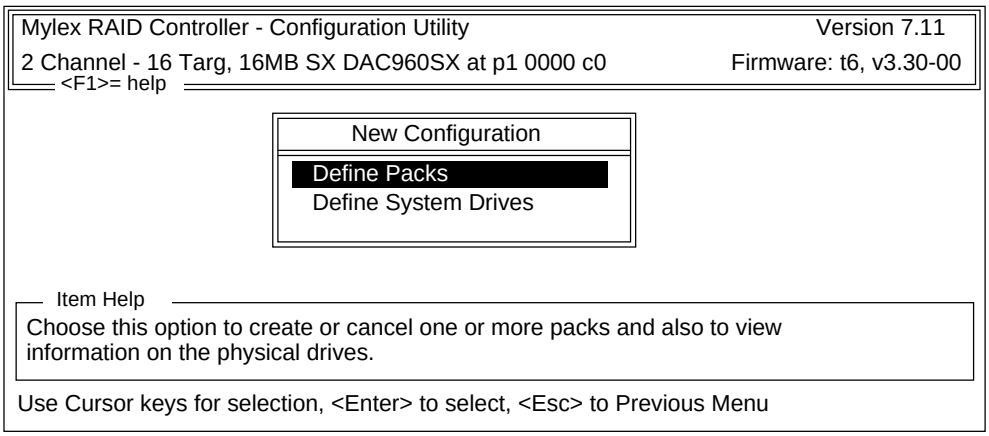


2 Select *Define Pack*s from the New Configuration menu.

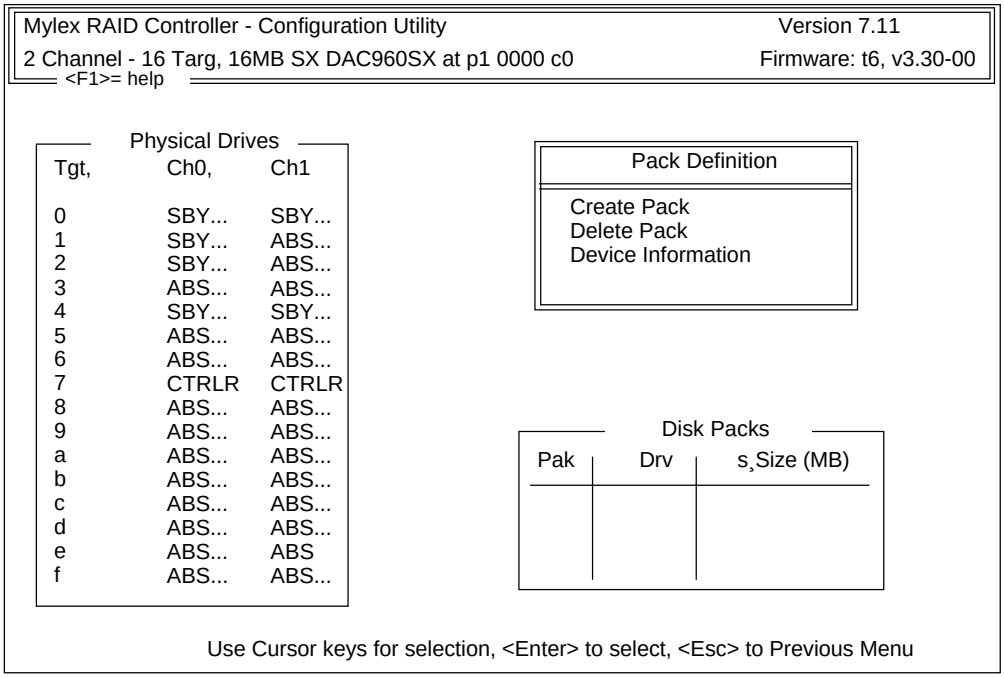
Packs can include disks on different channels. The number of drives in a pack determines the allowable RAID levels for all of the system drives created in that pack.

To use more than eight drives in a system drive, create two to four packs that are identical in number and size of disks. Then when you go to "Define System Drives", use this group of packs to create a spanned system drive.

If you want identical packs, but do not want spanned system drives, define the packs one at a time, creating a system drive out of each pack before defining the next pack.



Note: A pack is a logical grouping of physical disk drives.



3 Select Create Pack to define the pack. The software will highlight the first available device under the Physical Drives section.

Device Display	Device Status
ABS	Disk is absent.
SBY	Disk is a hot spare (standby) drive.
ONL	Disk is operational and is included in a pack.
ctrlr	Indicates controller.
OFL	Offline. The disk is not configured.
REB	Rebuild. The disk is marked ready to rebuild or is currently being rebuilt.
DED	Dead. The disk has failed, or has been removed or replaced, but not yet brought back into operation.

4 Select up to eight disk drives to be included in the pack. Highlight each disk, then press <Enter>. The highlight will move to the next available drive.

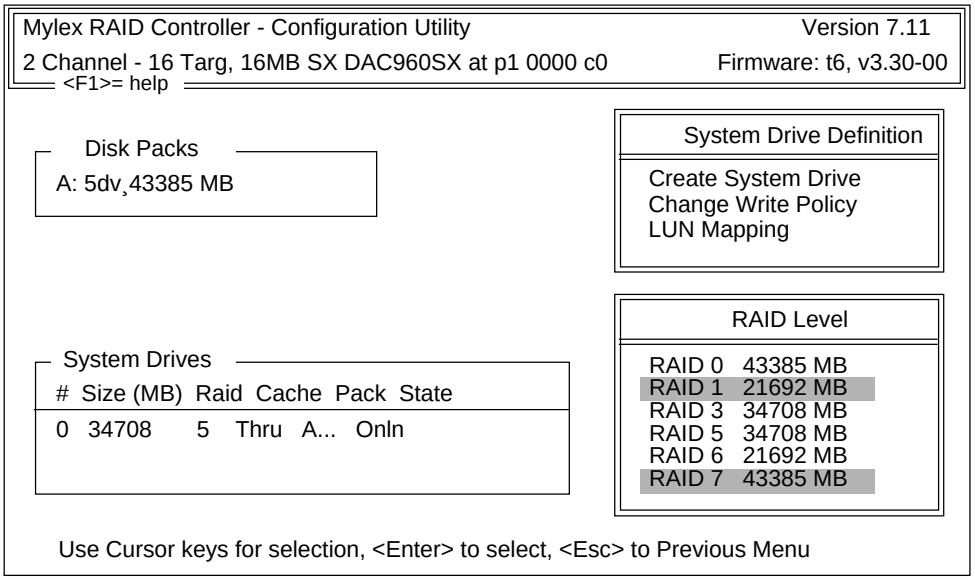
Note: If you would like to have a standby drive (Hot Spare), manually assign all but one drive and the software will automatically allocate the unassigned drive as the Hot Spare.

5 Press <Esc> to stop selecting drives and proceed with creating the pack.

The software displays the pack in the Disk Packs window on the lower right side of the screen. Each pack listed displays the number of drives included, and the total number of megabytes.

Note: If you select more than eight (8) drives, the system will automatically move the cursor out of the selection window and creates the pack.

6 If required, define additional packs, repeating steps 2 through 5.



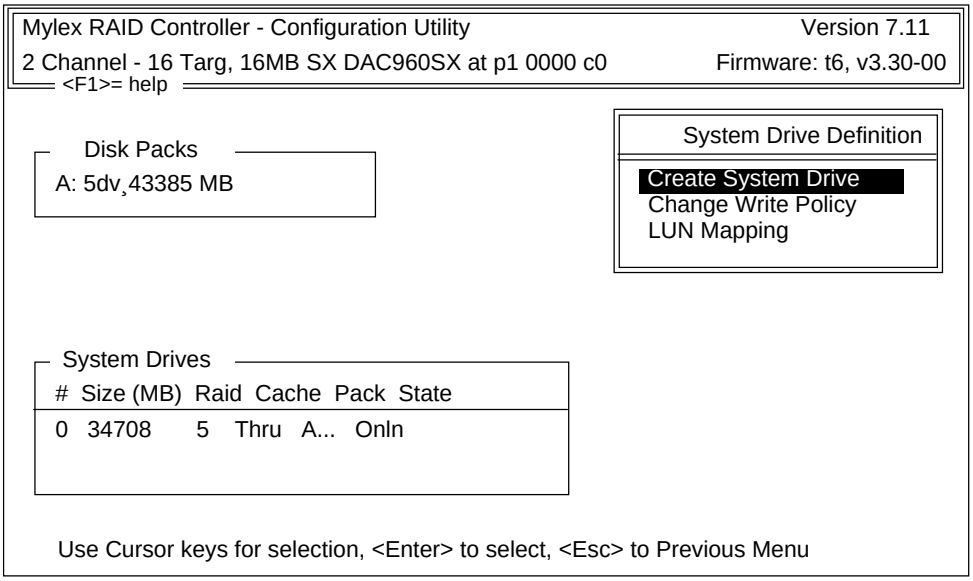
7 Press <Esc> to return to the Pack Definition menu.

Defining System Drives

After you define the packs, you will use them to create system drives. System drives have the following properties:

- More than one system drive can be defined on a single pack; or a system drive can span one to four packs.
- The minimum size of a system drive is 8 MB. The maximum size is 2 TB (terabytes).
- Up to eight system drives can be created per controller.
- Each system drive has a RAID level which is selected (subject to the number of disks in the system drive's pack).
- Each system drive has its own write policy (write-back or write through).
- Each system drive has its own LUN Affinity.

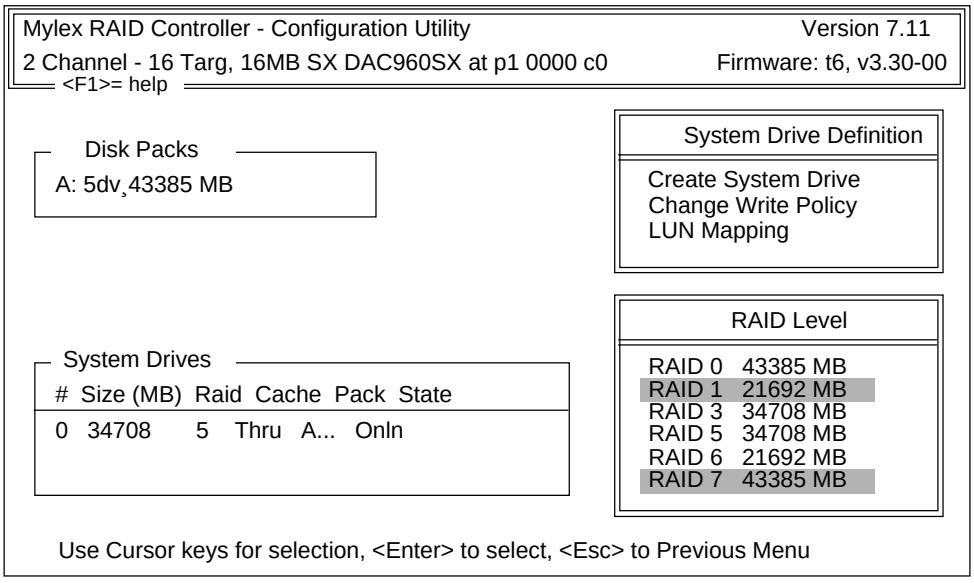
1 From the Configuration menu, select *Define System Drives*.



2 Select *Create System Drive* from the System Drive Definitions window. The program will prompt you for the RAID Level.

This screen displays the defined packs, including identifier, number of disk drives, and total megabytes per pack. It will also show existing system drives.

3 Choose the RAID Level you want to use for this system drive and press <Enter>. The table shows the supported RAID levels.



Field Name	RAID Level	Number of Drives
RAID 0	0	2 to 8
RAID 1	1	2
RAID 3	3	3 to 8
RAID 5	5	3 to 8
RAID 6	0+1	3 to 8
RAID 7	JBOD	1

4 The software will prompt you for the size (in megabytes) for the system drive's space. It will automatically display the maximum size for the selected RAID level. Enter the size you want and press <Enter>.

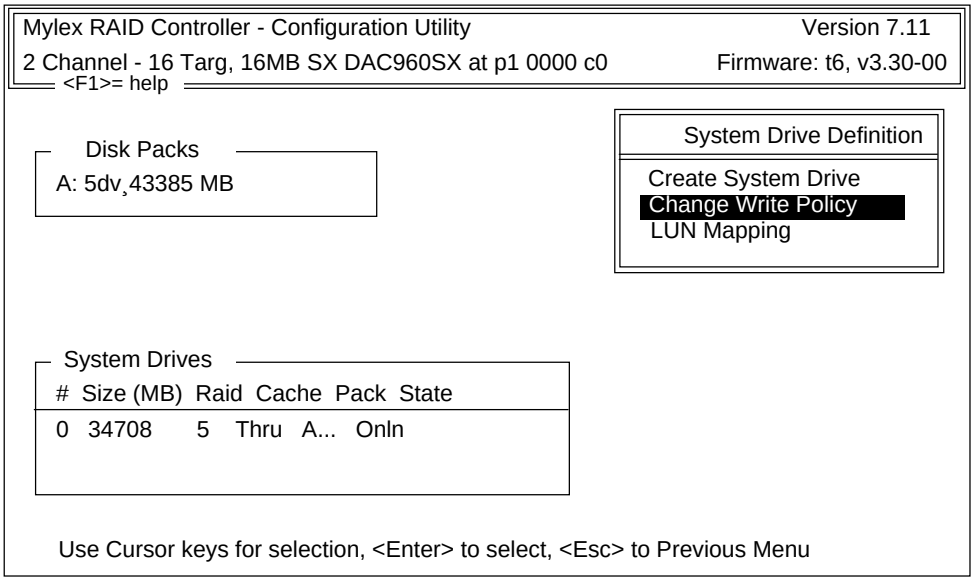
Based on the number of megabytes you enter, the software assigns the necessary number of packs to this system drive. That is, if you enter a size smaller than the size of the next available pack, the program will assign the pack to the system drive. If the next size you enter for another system drive still falls on the same pack, the next system drive will be assigned to the same pack.

If you enter a number greater than the size of the next available pack, the software assigns the next two packs to the system drive, and so on. If you want to span a system drive across two or more packs, the packs must be all identical in size and number of disks.

5 After defining the system drive, the software displays a summary of your selections in the SysDrv Info window. It will prompt you to "Create System Drive." Select *YES* to proceed and *NO* to start again.

6 If required, create additional System Drives by repeating the preceding steps 1 through 5.

7 (Optional) Change the write policy. Select *Change Write Policy* from the System Drive Definition menu. The cursor highlights the first system drive in the System Drives window.



8 Select the system drive you want to change and press <Enter>. This will toggle the choices from "BACK" (write back) and THRU (write through).

9 Press <Esc> to exit the System Drives window.

Mapping LUNs

This option is used to enable LUN mapping. LUN mapping assigns system drives to specific controller and ports, using a LUN (logical unit number) for each system drive. The LUN Mapping menu option provides the following options:

- No LUN mapping/Simple In-line LUN Mapping/Complex Table LUN Mapping (three LUN mapping types selectable on the menu)
- Change Mapping

No LUN Mapping:

Select this option if you do not want to specify any LUN mapping.

Simple LUN Mapping:

Simple LUN Mapping is the assignment of LUNs to system drives in a restricted manner. A system drive may have zero (0) or one (1) LUN assignments (access pathes) on each available host port. LUNs are assigned beginning with zero (0) and continue in sequence.

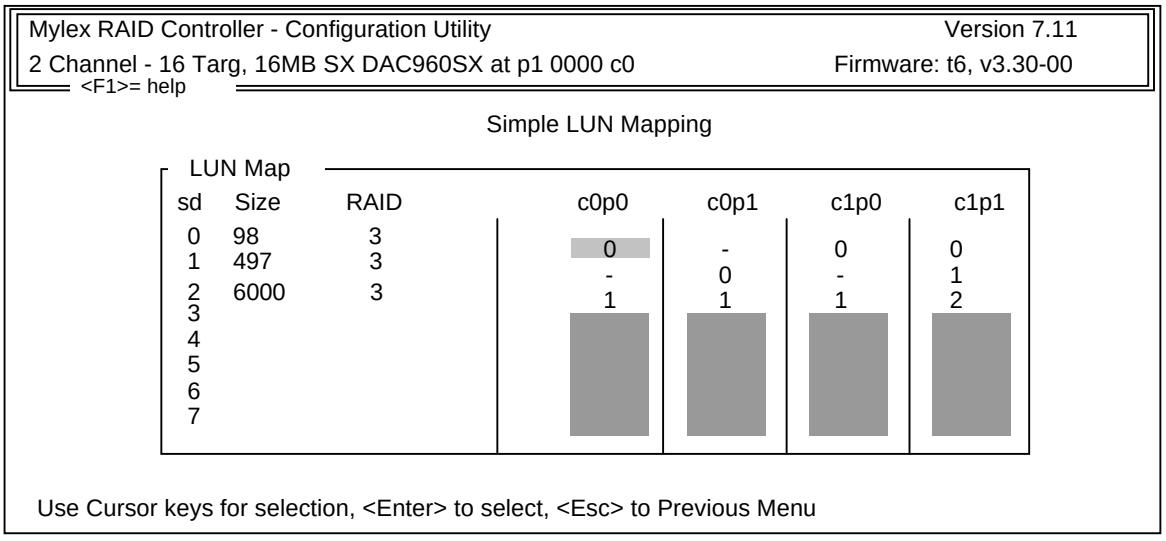
Note: If there are only four system drives, then four LUNs are unassigned per host port.

To select the Simple In-line LUN Mapping option:

1 Select LUN Mapping from the System Drive Definition menu.

2 Toggle to Simple In-line LUN Mapping.

3 Select *Change Mapping*. The software displays the Simple LUN Mapping screen.



The following table defines the fields displayed in the Simple LUN Mapping screen.

Field Name	Description
sd	System drive number.
Size	Size of the system drive, in megabytes.
RAID	RAID level.
c0p0	Controller 0 Port 0 LUN
c0p1	Controller 1 Port 1 LUN
c1p0	Controller 1 Port 0 LUN
c1p1	Controller 1 Port 1 LUN

The table below defines the allowable values for the Simple LUN Mapping fields.

LUN Mapping Option	Description
- (hyphen)	There is no connection to a system drive on this access path.
0 through 7	The LUN used to map the connection between this system drive and this controller and port.

4 To change the LUN mapping, use the arrow keys to make your selection and press <Enter>.

5 When you have completed the changes, press <Esc> to exit.

Complex LUN Mapping:

Complex LUN Mapping is the assignment of LUNs to system drives in a totally flexible manner. A system drive may have one, multiple, or no assignments (access paths) on any or all available host ports. LUNs may be assigned in any order.

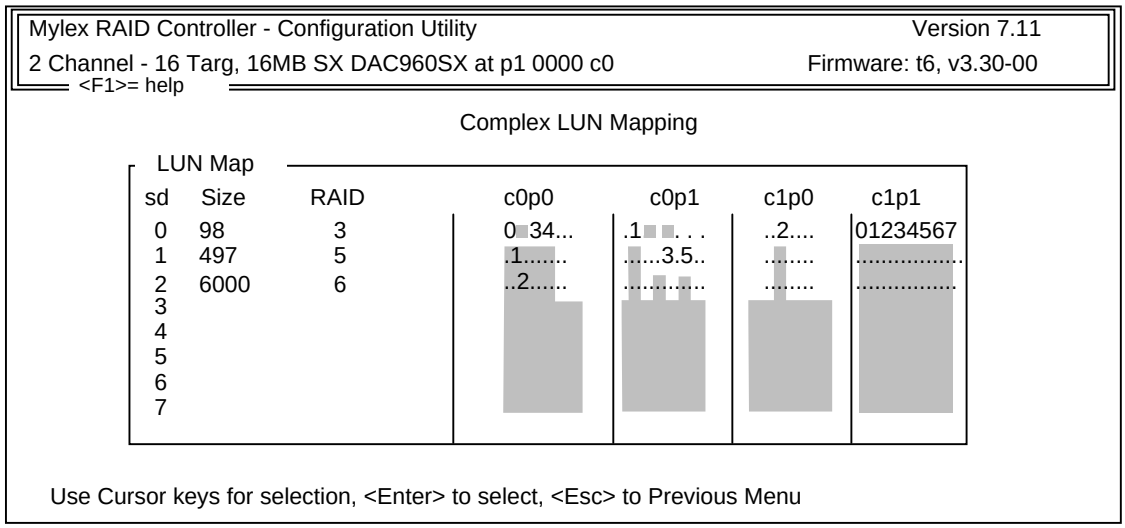
Note: If there are only four system drives, then four LUNs may be reused as alternate or additional assignments per host port.

To select the Complex Table LUN Mapping option:

1. Select LUN Mapping from the System Drive Definition menu. The program displays the LUN Mapping Selection menu.

2. Toggle the selection to Complex Table LUN Mapping.

3. Select Change Mapping. The software displays the Complex LUN Mapping screen.



The following table defines the fields displayed in the Complex LUN Mapping screen.

Field Name	Description
sd	System drive number.
Size	Size of the system drive, in megabytes.
RAID	RAID level.
c0p0	Controller 0 Port 0 LUN
c0p1	Controller 0 Port 1 LUN
c1p0	Controller 1 Port 0 LUN
c1p1	Controller 1 Port 1 LUN

The table below defines the allowable values for the Complex LUN Mapping fields.

LUN Mapping Option	Description
. (dot)	There is no connection to a system drive on this access path.
0 through 7	The LUN used to map the connection between this system drive and this controller and port.

4 To change the LUN mapping, use the arrow keys to make your selection and press <Enter>.

5 When you have completed the changes, press <Esc> to exit.

A warning will appear if a system drive has no access path (no affinity).

Saving the Configuration:

When you leave the New configuration menu, the system will prompt you to save the configuration.

1 Select YES to save, or NO to undo all your changes.

2 Next you will be asked if you want to reset the controllers. Select YES.

After reset, you will return to the Configuration menu.

This completes the New configuration, proceed with "Initializing the System Drives" next in this section.

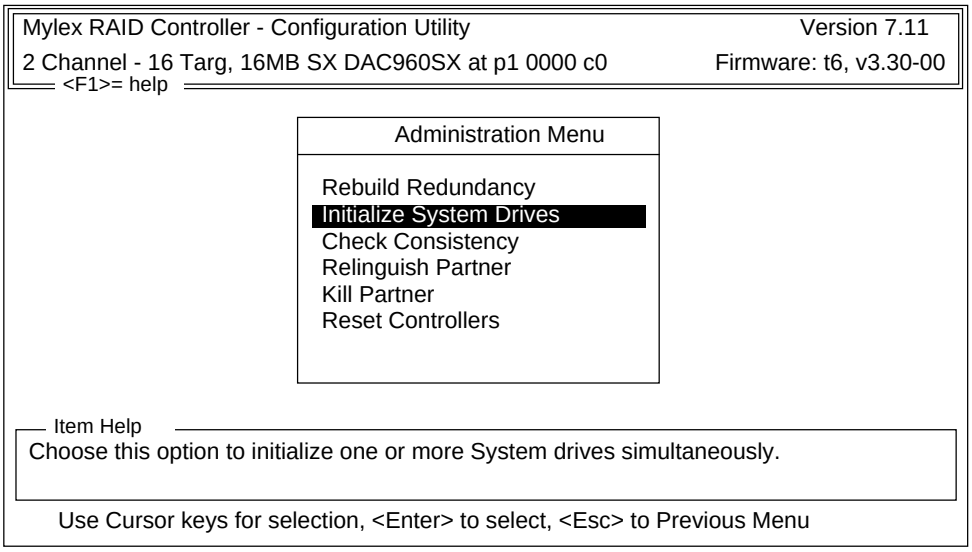
Initializing the System Drives

After you have configured the System Drives, you must initialize them.

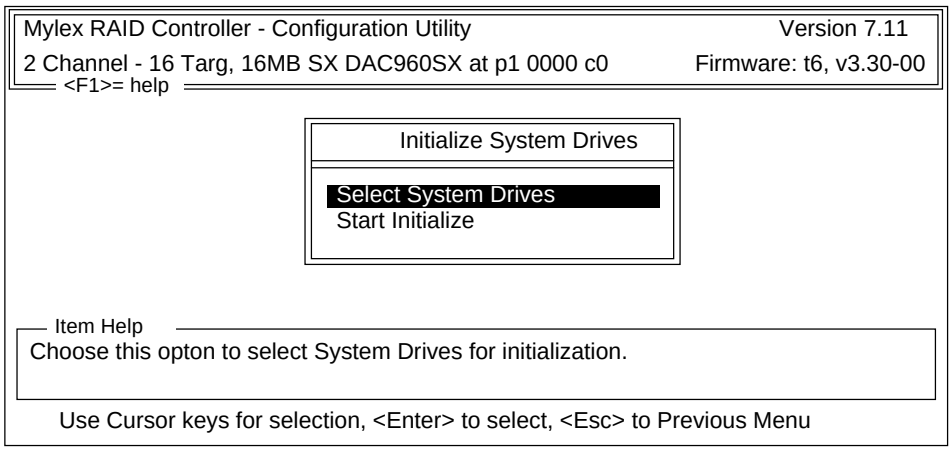
Caution: Failure to initialize a System Drive may result in unpredictable drive behavior, such as the inability to boot or load the operating system, or failure of a consistency check. Any data placed on an uninitialized System Drive is at risk.

To initialize one, several, or all System Drives, proceed with the following:

1 Select *Administration* from the Main menu.

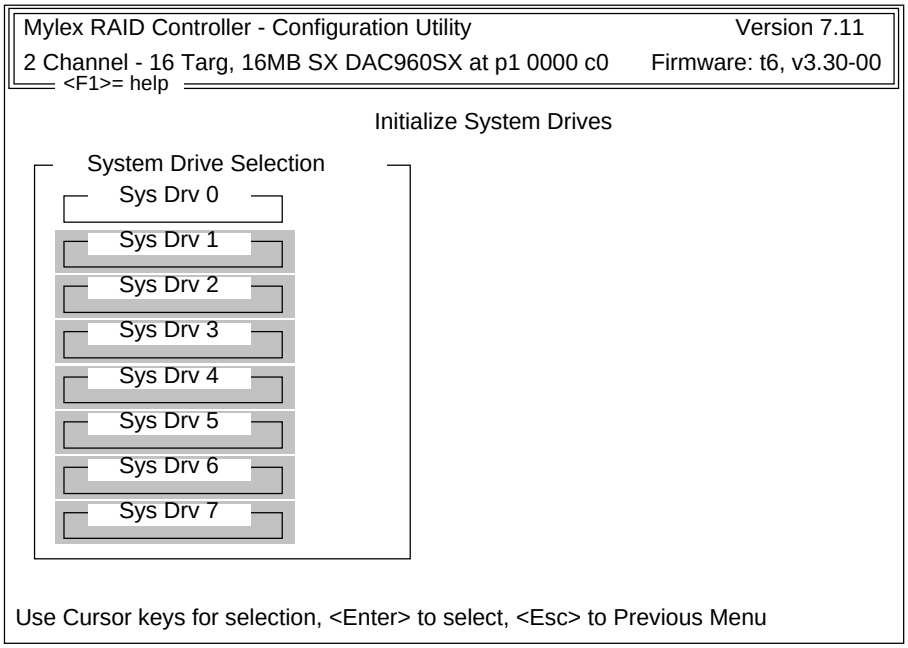


2 Select *Initialize System Drives* from the Administration menu.

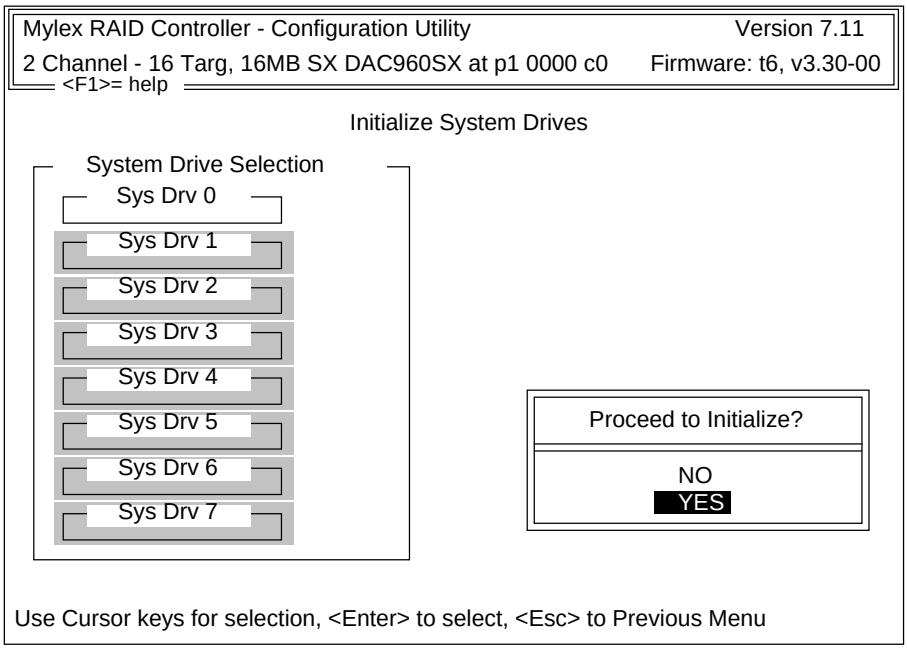


3 Choose *Select System Drives* from the Initialize System Drives menu. The software will display a precautionary message, press any key to continue.

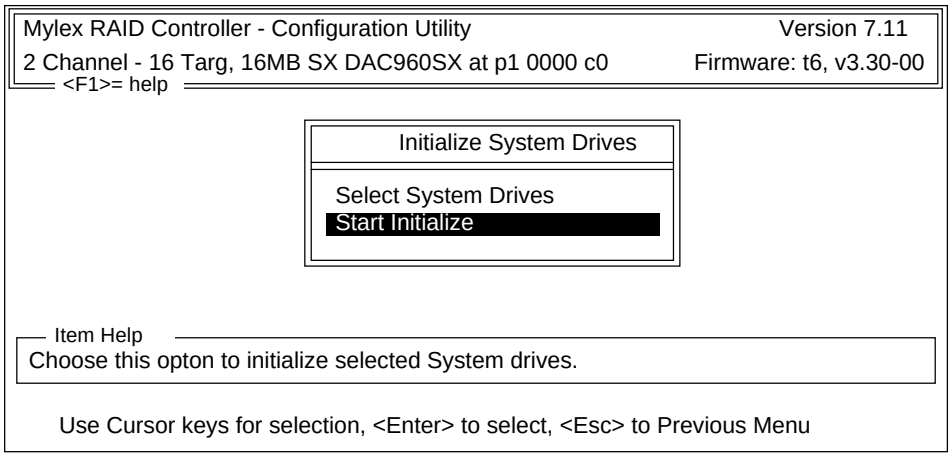
4 From the list of all configured System Drives, select the System Drive(s) you wish to initialize.



A check mark will appear next to the system drive selected for initialization. You can select up to eight (8) System Drives. Press the <Esc> key to return to the previous menu The software will prompt you to proceed. Select *YES* to continue with initialization, or *NO* to cancel.



5 Select *Start Initialize* from the Initialize System Drives menu.



Note: The amount of time the initialization takes is dependent upon the size of the drives and the RAID level chosen.

Once the initialization is complete, a message is displayed, press any key to return to the Administration menu.

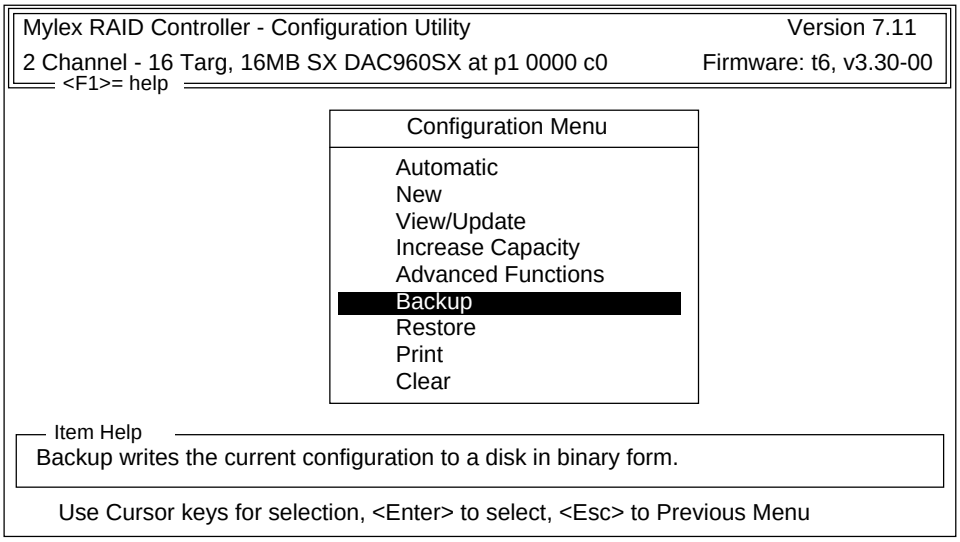
6 Press the <Esc> key to exit to the Main menu. Press <Esc> to exit the Main menu and choose *YES* to quit the AdminiStor PC Utilities program.

7 Reboot your system.

Backing Up the Configuration File

It is highly recommended to make a backup copy of the configuration file, in the event you would need to recover the system.

1 Select *Configuration* from the Main menu, and choose *Backup* from the Configuration menu.



2 Enter the directory and name of the file to be used for *the* backup file and press <Enter>.

3 Press the <Esc> key to return to the Configuration menu and <Esc> again to quit the software.

Method 2 — Using the VT100 Mode

This method will describe the various screens and elements used with the built-in configuration/administration utilities. With a VT100 terminal connected, message monitoring can also be performed.

To perform this configuration, the following will be required:

- VT100 compatible terminal (set at 19,200 baud, no parity, 8 data bits and 2 stop bits)
- Serial A inter-cabinet communication cable (provided)
- Dual-Active Configuration — perform all configuration procedures from Controller #0 only

Once the configuration is completed, the resulting data is written to the controller's non-volatile memory and flash EEPROM. Upon reboot the controller uses this information to organize the storage system's presentation to the operating system.

Connecting the Terminal

1. Verify that the power is OFF to the DEU subsystem.
2. Connect the serial cable from the VT100 terminal serial connector to the Serial A port on the S2S Interface card located on the back panel of the DEU. subsystem.
3. Power ON the terminal and the DEU subsystem.

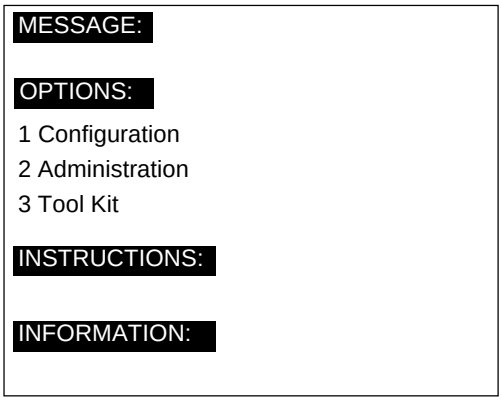
Configuring the Controllers Parameters

1 Press the <Ctrl> and the <Break> keys on the terminal keyboard to access the utility menu.

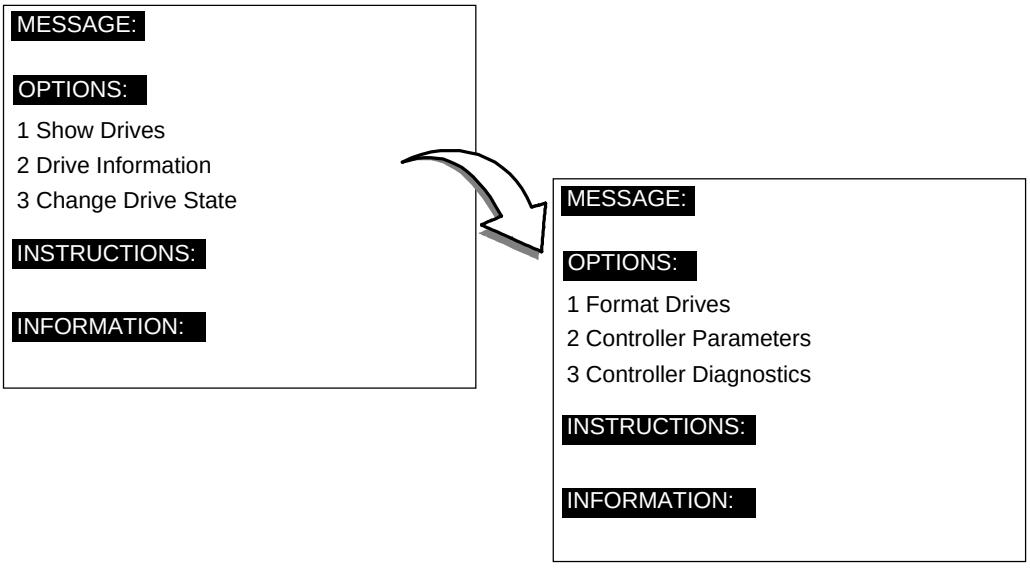
A password prompt will appear. Since the password option is not supported, clear the prompt by pressing the <Enter> key.

2 From the Main menu, select *Tool Kit*, press the <3> key and press <Enter>.

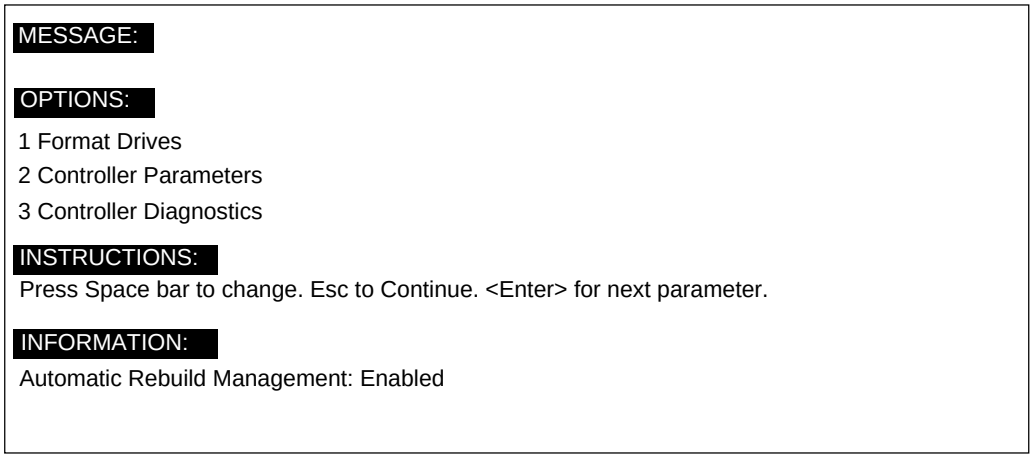
This selection will provide access to the drive and controller utilities.



3 Press <N> to view more options. Select *Controller Parameters*, press the <2> key and press <Enter>.



From this point you will need to step through all the settings to configure your controller. Use the <Space Bar> to toggle between choices and the <Enter> key to move to the next selection.



Note: For detailed information about each option, refer to "Option 2 - New Configuration" earlier in this section.

a Set “Automatic Rebuild Management” to *Enabled*.

b Set “Operational Fault Management” to *Enabled*.

c Set “Controller Read Ahead” to *Enabled*.

d Set “Super Read Ahead” to *Disabled*.

e Set “Command Tagging, Channel #0” to *Enabled*.

f Set “Command Tagging, Channel #1” to *Enabled*.

g Set “Force 8-bit SCSI, Channel #0” to *Disabled*.

h Set “Force 8-bit SCSI, Channel #1” to *Disabled*.

i Set “Conservative Cache Mode” to *Disabled*.

j Set “Force Simplex Mode” to *Disabled*.

k Set “Installation Abort” to *Disabled*.

l Set “Broad Reassign Mode” to *Disabled*.

m Set “Controller Present/Fault Signals” to *Disabled*.

n Set “Automatic Failback” to *Disabled*.

o Set “Simplex No Reset” to *Disabled*.

p Set “SCSI Transfer rate, Channel #0” to *20 MB/s*.

q Set “SCSI Transfer rate, Channel #1” to *20 MB/s*.

r Set “Spinup option” to *Automatic*.

s Set “Number of disks per spin” to *2*.

t Set “Spin-up initial delay (seconds)” to *6*.

u Set “Spin-up sequence delay (seconds)” to *0*.

v Set “Stripe size in KB=” 64.

w Set “Logical Block Size in Bytes” to *512*.

x Set “Rebuild rate” to *50*.

y Set “Serial Channel A” to *SLP/VT100*.

z Set “Controller Present/Fault Selection” to *A*.

aa Set “Host Bus Reset Delay (0=OFF)” to *0*.

MESSAGE:

OPTIONS:

1 Format Drives
2 Controller Parameters
3 Controller Diagnostics

INSTRUCTIONS:

Press Space bar to change. Esc to Continue. <Enter> for next parameter.

INFORMATION:

Enter "Y" to save changes.

4 Press <Y> to save changes.

5 Press <Esc> to return to the Main menu.

Dual Active Parameter Settings

The following should be set when configuring a Dual Active configuration:

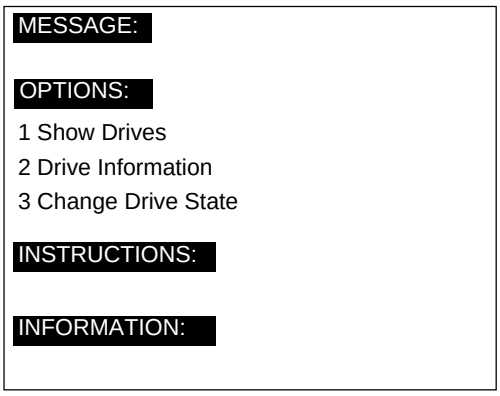
- Force Simplex should be disabled for both controllers
- Controller Present/Fault Signal should be disabled for both controllers
- Controller Present/Fault Select should be disabled for both controllers
- Auto Failback should be disabled on both controllers

Configuring the Array

Before beginning the configuration process, make sure the controller sees all of the installed drives. To do this, use the Show Drives function under the Toolkit menu.

1 Select *Toolkit* from the Main menu. Press the <3> key and press <Enter>.

2 Select Show Drives, press the <1> key and press <Enter>.



The system displays information about the drives on the first channel, including the drive state and system drive ID. The default state for all drives is Standby. Drive states are: Standby (S), Online (O), Dead (D), Offline (X), Rebuild (R), and Empty (E). You will also see “ENV” which indicates the SAF-TE controller.

3 To display the next channel, press the <Enter> key.

Note: Be sure to make a note of the available drives and their locations.

Create Array

1 Select *Toolkit* from the Main menu, press the <3> key and press <Enter>.

2 Choose *Show Drives* by pressing the <3> key and press <Enter>.

```
MESSAGE:

OPTIONS:  1
1 Show Drives
2 Drive Information
3 Change Drive State

ENTER PRAMETER:


INSTRUCTIONS:
Press any key to continue

Chan   #0:   Status   ONL    ONL    ONL    ENV    ONL - - - - - - - -
Chan   #1:   Status   ONL    ONL    SBY    ENV    SBY - - - - - - - -
             SDRV# - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Note: Make a note of the drives and their locations. You will need this information during the Create Array function.

Drive numbering is: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, and f.

3 Select *Configuration* from the Main menu, press the <1> key and press <Enter>.

4 Select *Create Array* from the Configuration menu, press the <3> key and press <Enter>.

5 Select the drive channel that contains the drive you want to add to the array and press <Enter>. The system will prompts for the Target ID.

6 Select the SCSI ID of the drive you want to add and press <Enter>.

7 Repeat the channel and drive selection steps (5 and 6) for each drive. The display adds each drive to the screen as it is selected.

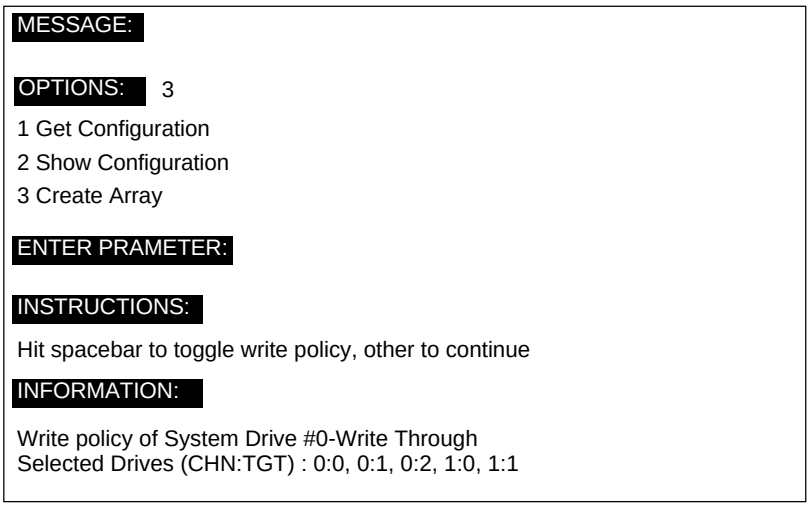
```
MESSAGE:

OPTIONS:  3
1 Get Configuration
2 Show Configuration
3 Create Array

ENTER PRAMETER:


INSTRUCTIONS:
Enter Channel Number
INFORMATION:
Select the drives (up to 8) for the Array, <Esc> to end selection
Selected Drives (CHN:TGT) : 0:0, 0:1, 0:2, 1:0
```

8 Press <Esc> when finished. The system will prompt you for the RAID level. Enter the value for the RAID level (i.e., 0, 1, 3, 5, 6, etc.).

```
MESSAGE:

OPTIONS:  3
1 Get Configuration
2 Show Configuration
3 Create Array

ENTER PRAMETER:  5

INSTRUCTIONS:
Enter RAID Level for the System Drive
INFORMATION:
Possible RAID Levels  =  RAID0,  RAID3,  RAID5,  RAID6
Selected Drives  (CHN:TGT) :  0:0,  0:1,  0:2,  1:0,  1:1
```

9 You will be prompted for the size of the System Drive. It will automatically display the maximum size as a default. Enter the desired size and press <Enter>.

10 Next you will be prompted to enter the cache write policy. Make your choice by toggling the selection using the <Space Bar> and press <Enter>.



Write Through sets the controller to “no write cache” and Write Back sets it to “enable the write cache.” Write Through cache strategy provides more security than Write Back and Write Back provides a higher data throughput performance.

Note: When using system drives with Write Back cache, make it a point to wait for at least 15 seconds after the last operation before rebooting or powering OFF the DEU. This is to ensure data in the cache is written to the disk before the system is rebooted.

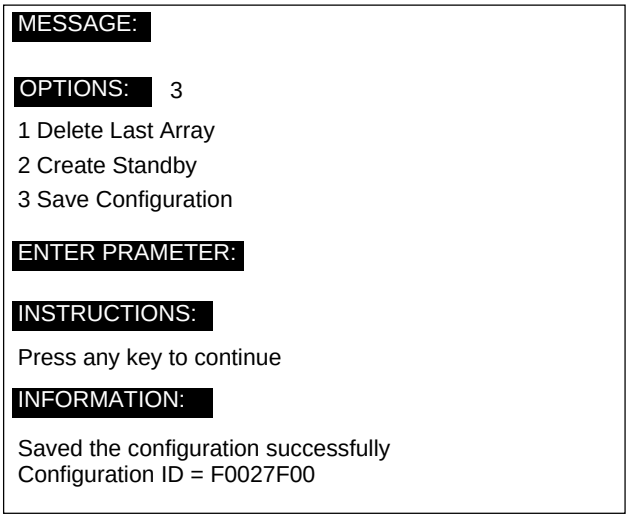
11 The system will prompt you for the drive affinity settings. System drive affinity defines which SCSI host port(s) on which controller(s) a particular system drive may be accessed through. System drives are presented as SCSI LUNs. Set the system drive affinity for this system drive by pressing the <Space Bar> toggling through the choices.

12 Press the <Esc> key when you have completed your selections.

Save Configuration

1 From the Configuration menu, press the <N> key for more options.

2 Choose *Save Configuration*, press the <3> key and press <Enter>.

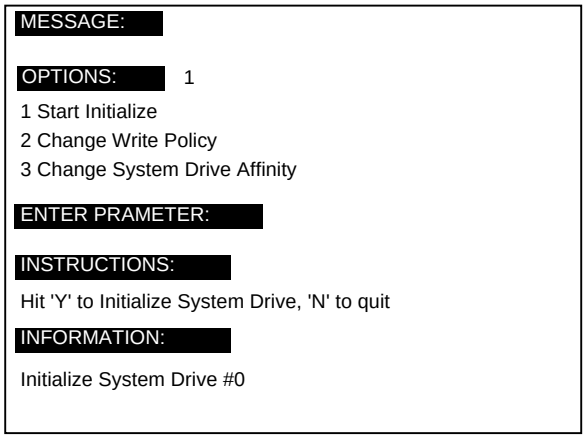


3 Select “Y” (YES) to save the configuration. Press any key to continue.

Initializing the Array

1 From the Main menu choose *Configuration*, press the <1> key and press <Enter>.

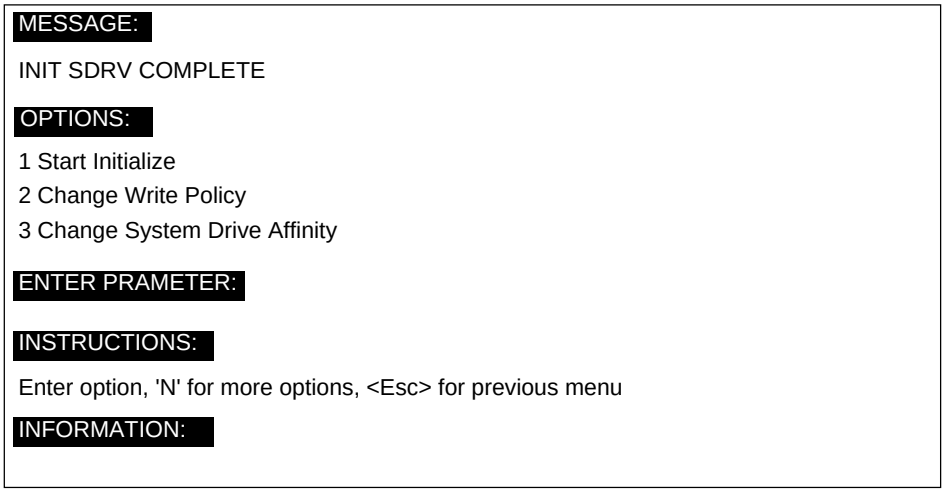
Press the <N> key for more options.



2 Select *Start Initialize*, press the <2>key and press <Enter>.

3 Select the System Drive to be initialized. Enter the System drive ID and press <Enter>.

4 Verify that your selection is correct and press “Y” to start the initialization. Press “N” to cancel the selection.



5 The following message will be displayed: “INIT STARTED.”

6 Press any key to return to the previous menu.

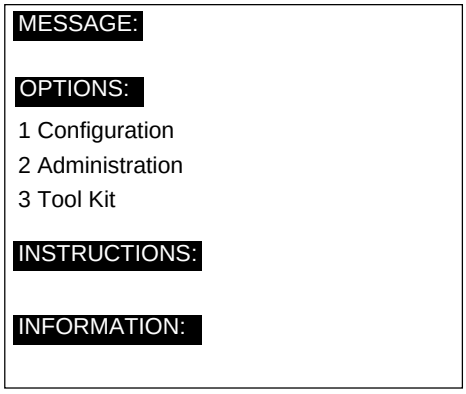
7 Press <Esc> twice to return to the Main menu. This screen displays the status progress of the initialization. When the process is complete, the system displays the message: “INIT SDRV COMPLETE.”

The array is now ready.

This completes the configuration and initialization using the VT100 terminal mode.

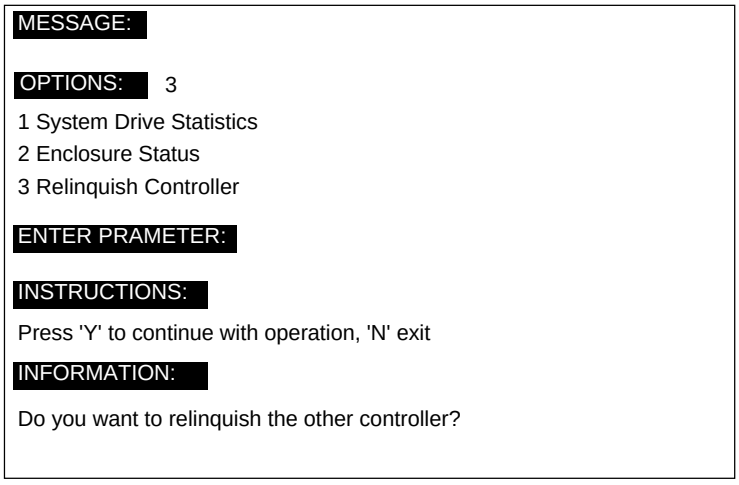
Relinquish Partner (Dual-Active only)

1 From the Main menu, press the <2> key and press <Enter>.



2 Press the <N> key to view more options.

3 Select *Relinquish Controller*, press the <3> key and press <Enter>.



4 Press “Y” to continue, or “N” to exit. Press any key to return to the previous menu and <Esc>.

5 Use the selection Show Configuration on both controllers to ensure they show the same configuration.

VT100 Menu Functions

The following descriptions are given for each of the functions provided by the VT100 menu options .

Configuration menu Options

Function	Description
Get Configuration	This function loads the current saved configuration data into the controllers temporary work space.
Show Configuration	This menu selection allows the user to review the current configuration data.
Delete Last Array	This menu selection allows the user to remove the last drive group created from the configuration.
Create Standby	This menu selection allows the user to specify a drive that will serve as a “hot spare” or standby drive.
Save Configuration	This selection will save the current configuration data.
Start Initialization	This selection will start the initialization of drives in the array.
Change Write Policy	This selection allows you change the cache write policies from write through to write back.
Change SD Affinities	This selection provides the ability to assign System Drive (SD) affinity.
Show SD Affinities	This selection displays the current System Drive affinity.
Show LUN to SD Mapping	This menu selection displays the Logical Unit Number (LUN) to System Drive mappings.

Administration Menu Options

Function	Description
Rebuild/Check Rate	This menu selection allows the user to specify the controller rebuild and parity check priority rate.
Start Rebuild	This menu selection allows the user to start a rebuild process.
Start Parity Check	This menu selection allows the user to start a parity check on a logical drive.
LUN Statistics	This menu selection provides statistical data about the logical drives.
SDRV Statistics	This menu selection provides information about the existing System Drives.
Enclosure Status	This selection provides information about the enclosure's
Relinquish Partner	This menu selection brings a controller in a duplex environment out of reset mode and places it back in service.
Kill Partner	This menu selection, in a duplex environment, places the controller into reset mode. Surviving controller assumes the duties of the partner controller.
Reset Controller	This selection, simplex or duplex, causes the controller(s) to go through a cold start.
Add Capacity	This selection provides the dynamic RAID set expansion feature allowing the addition of dries to a given RAID set while the controller is on-line with the host.

Toolkit Menu Options

Function	Description
Show Drives	This function displays the operational state of drives in the array (online=ONL, dead=DED, standby=SBY, rebuild=RDY, or not used = .), and the logical unit number associated with each drive.
Drive Information	This menu selection allows the user to get specific information about an individual drive.
Change Drive State	This menu selection allows the user to set a drive operational state to online, dead, or standby.
Format Drive	This menu selection allows the user to perform a low-level format on drives not assigned to an array.
Controller Params	This selection allows you to view current controller(s) paramters.
Controller Diag	This menu selection performs an controller diagnostics routine.
AEMI Scan	N/A

4 Administering the Array

Overview

During the operational life of the array, you may have a need to make additions or changes to certain array update or management functions. For example:

- rebuilding redundancy in the array after a failed drive is replaced
- running a consistency check to verify data and parity information
- resetting controllers after a configuration change occurs
- initialize new system drives
- increase the array capacity
- change the write policy
- duplex configurations, bringing a partner controller back into service after replacement
- duplex configurations, kill the partner controller

Most of these functions are performed from the Administration menu or in some cases the Configuration menu.

Caution: Do not attempt to use these functions during I/O activity. Allow at least five seconds after I/O activity has ceased for all writes in the write cache to be written to the disk.

Increasing Array Capacity

Mylex On-line RAID Expansion (MORE) is a dynamic RAID set expansion option which allows the addition of drives (capacity) to a given RAID set while the controller is on-line with the host. MORE accommodates expansion on RAID0, RAID 1, RAID 3, RAID 5, and RAID 0+1 (RAID 6) arrays.

The added capacity that becomes available upon completion of data migration can be treated in one of two ways:

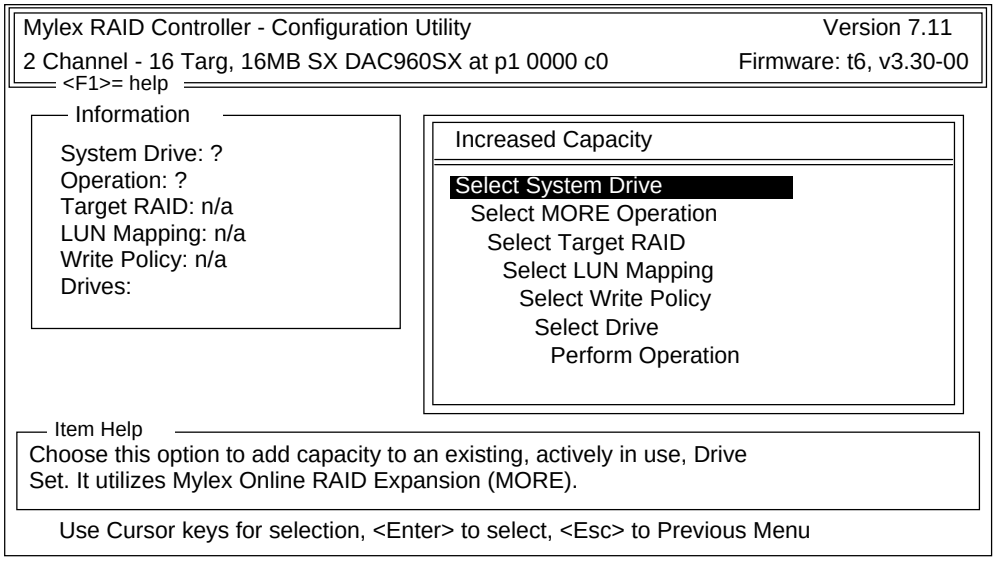
- Add System Drive — this option retains the size of the original (defined) system drive, and restripes the system drive's data across a larger number of drives. After restriping, new unused space becomes available which can be used to define one or more additional system drives, not exceeding a maximum of eight for both new and previously-defined system drives.

- Enlarge System Drive — this option appends the added capacity to the system drive specified for expansion in the Increase Capacity request. This option can be selected when only one system drive is defined on the set of physical drives undergoing expansion. If more than one system drive exists on the same set of drives, you must use the Add System Drive option.

  Note: MORE is supported only in the single controller (simplex) operating mode. A dual-active system can be put into simplex mode by using the Kill Partner option on the Administration menu. Then the Increased capacity function can be selected from the Configuration menu while forced simplex is in effect. Return to duplex mode by using Relinquish Partner.

To begin increasing the capacity:

1 Select *Increased Capacity* from the Configuration menu. The Increased Capacity screen appears, showing information on the left side of the screen and the defined sequenced steps on the right.



2 Select the *Select System Drive* option from the sequence menu.

3 From the table of configured system drives, press <Enter> to select one system drive for expansion. Only one system drive can be selected as the target for expansion.

4 Choose the Select MORE Operation option from sequenced menu.

5 In the Operation Definition menu, choose your MORE operation by press <Enter> to toggle between *Add System Drive* and *Enlarge System Drive*.

If you choose *Add System Drive*, you can move down to the Create option and change Disabled to Enabled if you want a new system drive to be created automatically when expansion has completed. If Disabled is selected, the capacity will remain unconfigured and available after expansion. When Create is Enabled, you can then move down to the Initialize option and select Enabled if you want automatic initialization of the new system drive.

If you choose *Enlarge System Drive*, the Create option is Disabled since no new system drive will be created. Initialize is set to Enabled, since it will be necessary to initialize the enlarged system drive.

6 Press <Esc> after selecting the operation definition to continue on to the next step.

7 The next two sub-steps are applicable only if you have chosen "Add System Drive" and you have elected to create the system drive now by enabling the Create option.

a Select the Select Target RAID option from the Increased Capacity sequence menu.

b In the RAID level menu, choose from among the RAID levels available for your new system drive. Highlight the RAID level you want to press <Enter>.

8 This option is applicable only if you chose: Add System Drive, Create was set to Enabled, and Simple or Complex LUN Mapping is in effect.

This option sets LUN mapping only for the new system drive. The LUN mapping of the original system drive is already set and cannot be changed. If Select LUN Mapping is unavailable, skip to Select Write Policy, step 9.

a Choose *Select LUN Mapping* from the sequence menu.

You will see either the Simple LUN Mapping menu or the Complex LUN Mapping menu, depending on the type of LUN mapping that was assigned to the original system drive.

b In the Simple (or Complex) LUN Mapping menu, use the cursor keys to highlight your LUN preferences, and press <Enter> to select.

c Press <Esc> when your choices are complete to continue.

9 Select Write Policy, this option is available under the following conditions: Add System Drive was chosen and Create was set to Enabled.

This option sets the write policy (Write Through or Write Back) for the "new" system drive. The write policy of the original system drive is already set and cannot be changed through this option.

If Select Write Policy is unavailable, skip to Select Drive in step 10.

a Select the *Select Write Policy* option from the sequence menu.

b In the Write Policy menu, select either *Write Through* or *Write Back* as desired and press <Enter>.

10 Select Drive, in both expansion types (Add System Drive or Enlarge System Drive) it is necessary to select the available (standby) physical drives that will be used as the source of the added capacity.

a Select the *Select Drives* option from sequence menu.

A list of physical drives is presented. Unavailable targets are browned out. Available targets are labeled SBY (standby).

b Highlight an available target drive that you wish to use and press <Enter> to select it. Repeat this step for additional targets to select.

When a target drive is selected for the expansion process, its label changes to SBY MOR.

c Press <Esc> after you have completed your selections to continue on to the final step.

11 This is the final step in the expansion process. Now that you have defined the nature of your MORE, start the data migration.

a Select the *Perform Operation* option from the sequenced menu.

Increase Capacity is a non-reversible operation. A warning message indicates this and a prompt is displayed.

b Select *YES* to proceed with expansion, or *NO* to return to the sequence menu.

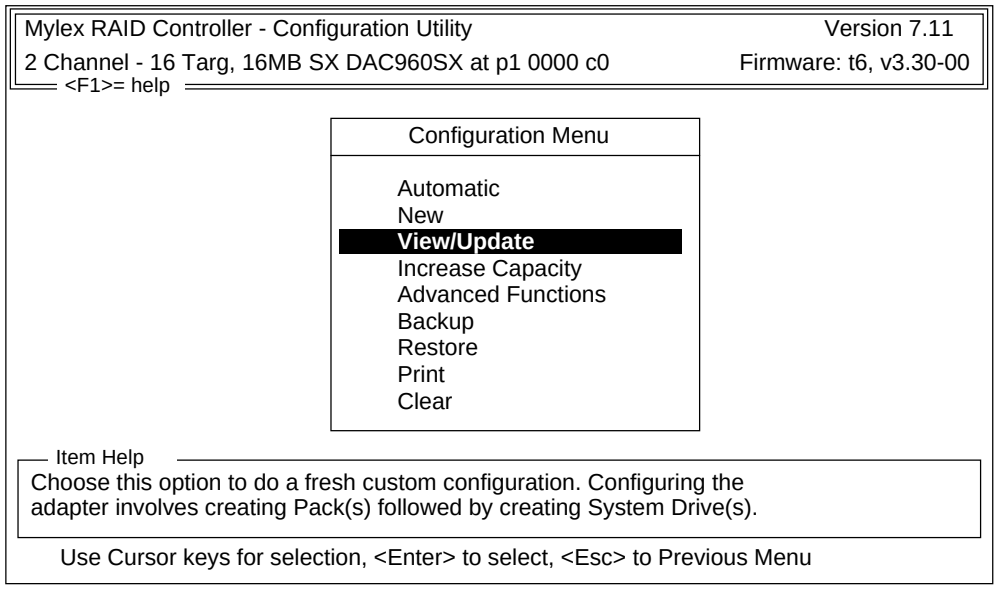
If you select NO, you may go back to any step in the sequence and change your settings before starting the expansion, or you may cancel expansion completely by pressing <Esc> and selecting YES at the “Terminate the Increase Capacity operation?” prompt.

c Press any key when expansion is complete, then press <Esc> to return to the Configuration menu.

Manual Configuration

This section describes how to manually change a configuration.

1 To change a configuration, use the arrow keys to highlight *View/Update* and press <Enter>.

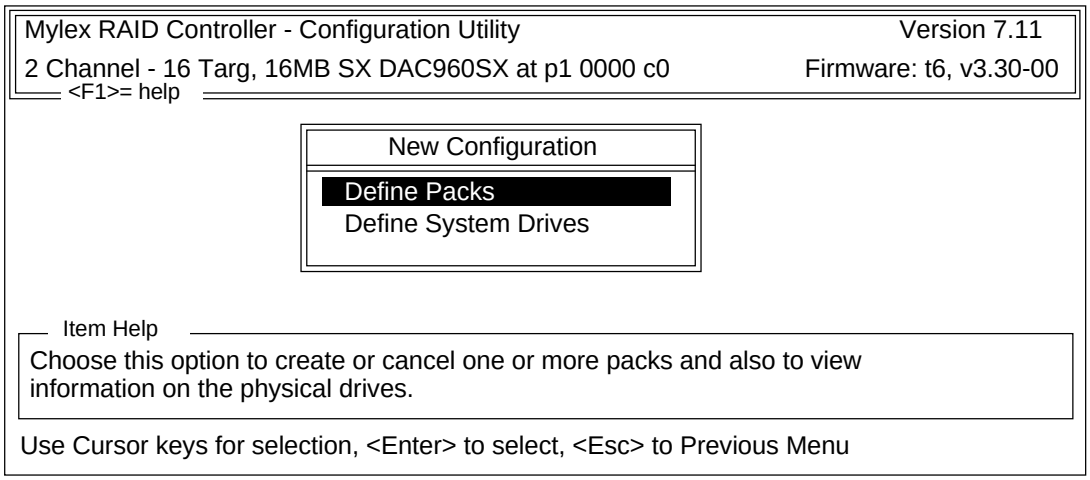


2 Select *Define Pack*s from the Configuration menu.

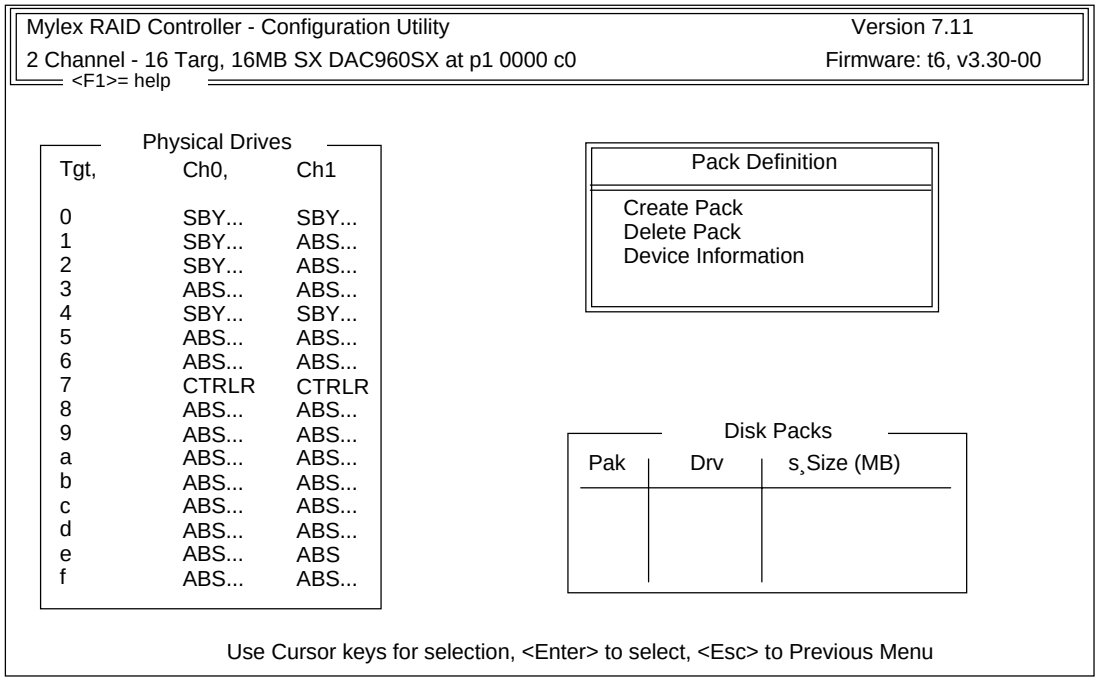
Packs can include disks on different channels. The number of drives in a pack determines the allowable RAID levels for all of the system drives created in that pack.

To use more than eight drives in a system drive, create two to four packs that are identical in number and size of disks. Then when you go to “Define System Drives”, use this group of packs to create a spanned system drive.

If you want identical packs, but do not want spanned system drives, define the packs one at a time, creating a system drive out of each pack before defining the next pack.



Note: A pack is a logical grouping of physical disk drives.



3 Select Create Pack to define the pack. The software will highlight the first available device under the Physical Drives section.

Device Display	Device Status
ABS	Disk is absent.
SBY	disk is a hot spare (standby) drive.
ONL	Disk is operational and is included in a pack.
ctrlr	Indicates controller.
OFL	Offline. The disk is not configured.
REB	Rebuild. The disk is marked ready to rebuild or is currently being rebuilt.
DED	Dead. The disk has failed, or has been removed or replaced, but not yet brought back into operation.

4 Select up to eight disk drives to be included in the pack. Highlight each disk, then press <Enter>. The highlight will move to the next available drive.

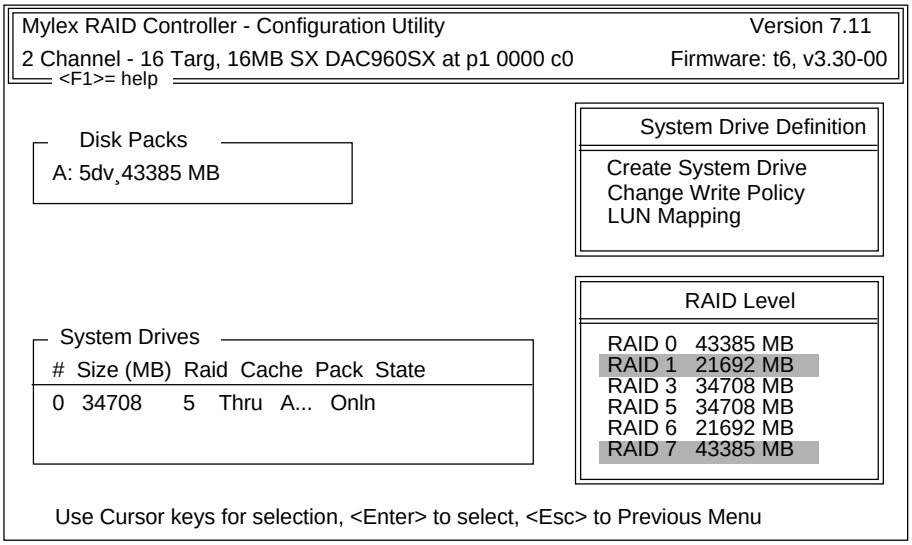
Note: If you would like to have a standby drive (Hot Spare), manually assign all but one drive and the software will automatically allocate the unassigned drive as the Hot Spare.

5 Press <Esc> to stop selecting drives and proceed with creating the pack.

The software displays the pack in the Disk Packs window on the lower right side of the screen. Each pack listed displays the number of drives included, and the total number of megabytes.

Note: If you select more than eight (8) drives, the system will automatically move the cursor out of the selection window and creates the pack.

6 If required, define additional packs, repeating steps 2 through 9.



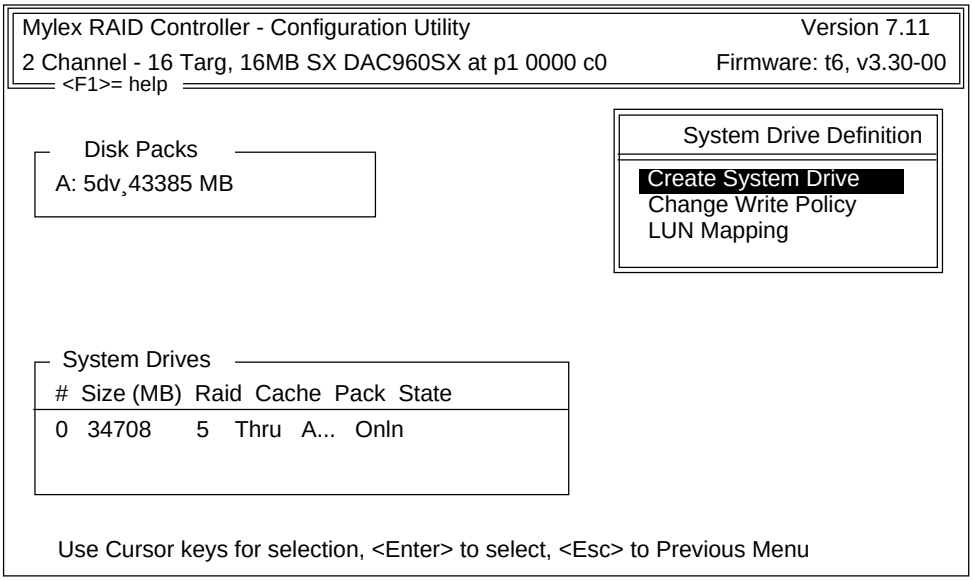
7 Press <Esc> to return to the Pack Definition menu.

Defining System Drives

After you define the packs, you will use them to create system drives. System drives have the following properties:

- More than one system drive can be defined on a single pack; or a system drive can span one to four packs.
- The minimum size of a system drive is 8 MB. The maximum size is 2 TB (terabytes).
- Up to eight system drives can be created per controller.
- Each system drive has a RAID level which is selected (subject to the number of disks in the system drive's pack).
- Each system drive has its own write policy (write-back or write through).
- Each system drive has its own LUN Affinity.

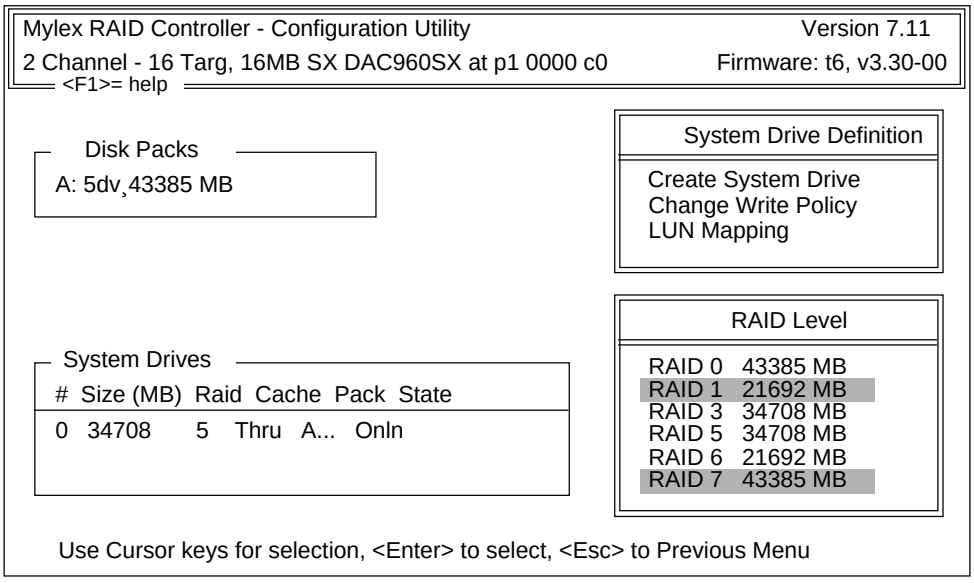
1 From the Configuration menu, select *Define System Drives*.



2 Select *Create System Drive* from the System Drive Definitions window. The program will prompt you for the RAID Level.

This screen displays the defined packs, including identifier, number of disk drives, and total megabytes per pack. It will also show existing system drives.

3 Choose the RAID Level you want to use for this system drive and press <Enter>. The table shows the supported RAID levels.



Field Name	RAID Level	Number of Drives
RAID 0	0	2 to 8
RAID 1	1	2
RAID 3	3	3 to 8
RAID 5	5	3 to 8
RAID 6	0+1	3 to 8
RAID 7	JBOD	1

4 The software will prompt you for the size (in megabytes) for the system drive's space. It will automatically display the maximum size for the selected RAID level. Enter the size you want and press <Enter>.

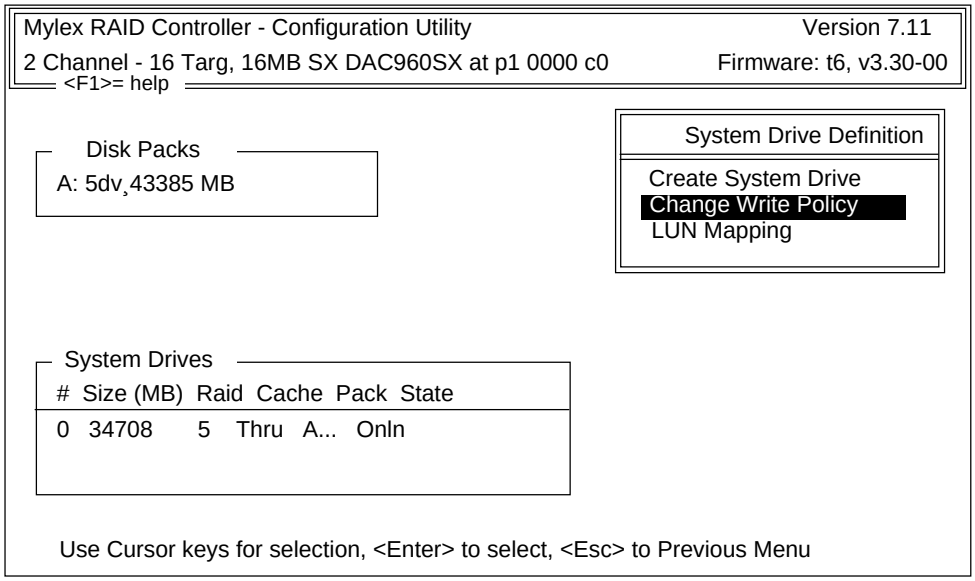
Based on the number of megabytes you enter, the software assigns the necessary number of packs to this system drive. That is, if you enter a size smaller than the size of the next available pack, the program will assign the pack to the system drive. If the next size you enter for another system drive still falls on the same pack, the next system drive will be assigned to the same pack.

If you enter a number greater than the size of the next available pack, the software assigns the next two packs to the system drive, and so on. If you want to span a system drive across two or more packs, the packs must be all identical in size and number of disks.

5 After defining the system drive, the software displays a summary of your selections in the SysDrv Info window. It will prompt you to "Create System Drive." Select *YES* to proceed and *NO* to start again.

6 If required, create additional System Drives repeating the preceding steps 1 through 5.

7 (Optional) Change the write policy. Select *Change Write Policy* from the System Drive Definition menu. The cursor highlights the first system drive in the System Drives window.



8 Select the system drive you want to change and press <Enter>. This will toggle the choices from "BACK" (write back) and "THRU" (write through).

9 Press <Esc> to exit the System Drives window.

Mapping LUNs

This option is used to enable LUN mapping. LUN mapping assigns system drives to specific controller and ports, using a LUN (logical unit number) for each system drive. The LUN Mapping menu option provides the following options:

- No LUN mapping/Simple In-line LUN Mapping/Complex Table LUN Mapping (three LUN mapping types selectable on the menu)
- Change Mapping

No LUN Mapping:

Select this option if you do not want to specify any LUN mapping.

Simple LUN Mapping:

Simple LUN Mapping is the assignment of LUNs to system drives in a restricted manner. A system drive may have zero (0) or one (1) LUN assignments (access paths) on each available host port. LUNs are assigned beginning with zero (0) and continue in sequence.

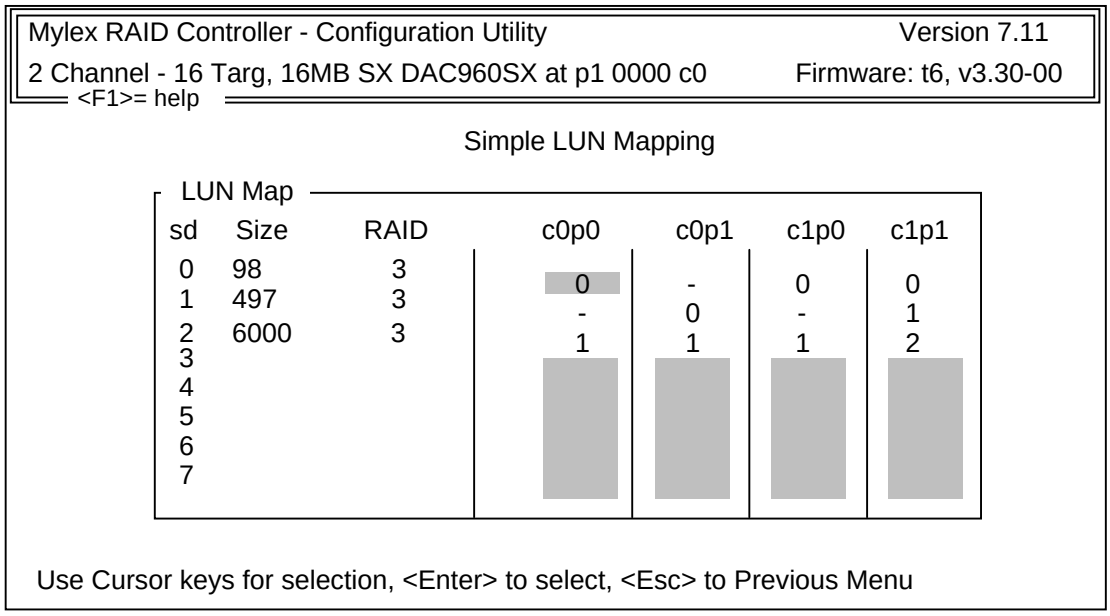
Note: If there are only four system drives, then four LUNs are unassigned per host port.

To select the Simple In-line LUN Mapping option:

1 Select LUN Mapping from the System Drive Definition menu.

2 Toggle to Simple In-line LUN Mapping.

3 Select *Change Mapping*. The software displays the Simple LUN Mapping screen.



The following table defines the fields displayed in the Simple LUN Mapping screen.

Field Name	Description
sd	System drive number.
Size	Size of the system drive, in megabytes.
RAID	RAID level.
c0p0	Controller 0 Port 0 LUN
c0p1	Controller 0 Port 1 LUN
c1p0	Controller 1 Port 0 LUN
c1p1	Controller 1 Port 1 LUN

The table below defines the allowable values for the Simple LUN Mapping fields.

LUN Mapping Option	Description
- (hyphen)	There is no connection to a system drive on this access path.
0 through 7	The LUN used to map the connection between this system drive and this controller and port.

4 To change the LUN mapping, use the arrow keys to make your selection and press <Enter>.

5 When you have completed the changes, press <Esc> to exit.

Complex LUN Mapping:

Complex LUN Mapping is the assignment of LUNs to system drives in a totally flexible manner. A system drive may have one, multiple, or no assignments (access paths) on any or all available host ports. LUNs may be assigned in any order.

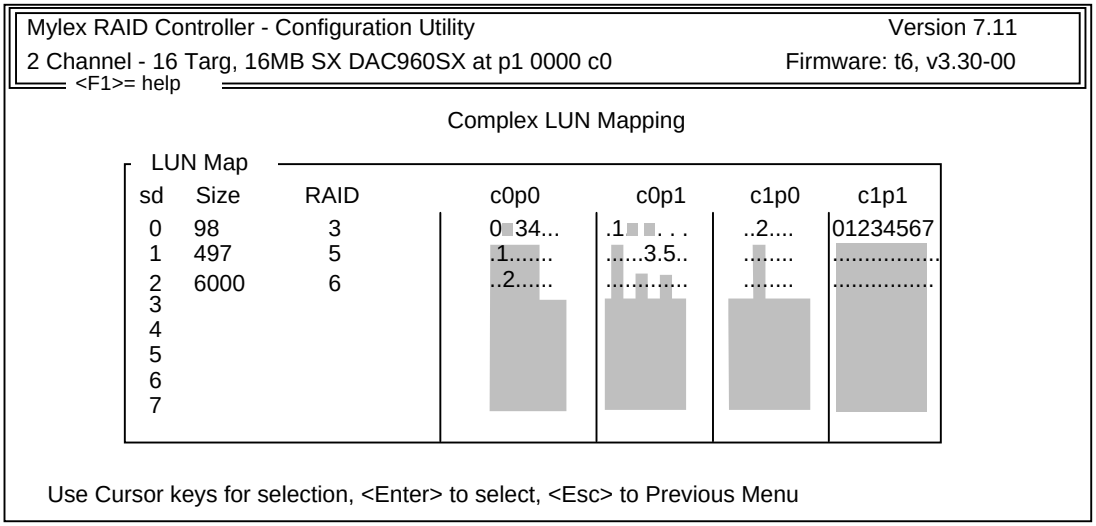
Note: If there are only four system drives, then four LUNs may be reused as alternate or additional assignments per host port.

To select the Complex Table LUN Mapping option:

1 Select *LUN Mapping* from the System Drive Definition menu. The program displays the LUN Mapping Selection menu.

2 Toggle the selection to *Complex Table LUN Mapping.*

3 Select Change Mapping. The software displays the Complex LUN Mapping screen.



The table below defines the fields displayed on the Complex LUN Mapping screen.

Field Name	Description
sd	System drive number.
Size	Size of the system drive, in megabytes.
RAID	RAID level.
c0p0	Controller 0 Port 0 LUN
c0p1	Controller 0 Port 1 LUN
c1p0	Controller 1 Port 0 LUN
c1p1	Controller 1 Port 1 LUN

The table below defines the allowable values for the Complex LUN Mapping fields.

LUN Mapping Option	Description
. (dot)	There is no connection to a system drive on this access path.
0 through 7	The LUN used to map the connection between this system drive and this controller and port.

4 To change the LUN mapping, use the arrow keys to make your selection and press <Enter>.

5 When you have completed your changes, press <Esc> to exit.

A warning will appear if a system drive has no access path (no affinity).

Saving the Configuration:

When you leave the New configuration menu, the system will prompt you to save the configuration.

1 Select YES to save, or NO to undo all your changes.

2 Next you will be asked if you want to reset the controllers. Select YES.

After reset, you will return to the Configuration menu.

This completes the New configuration, proceed with "Initializing the System Drives" next in this section.

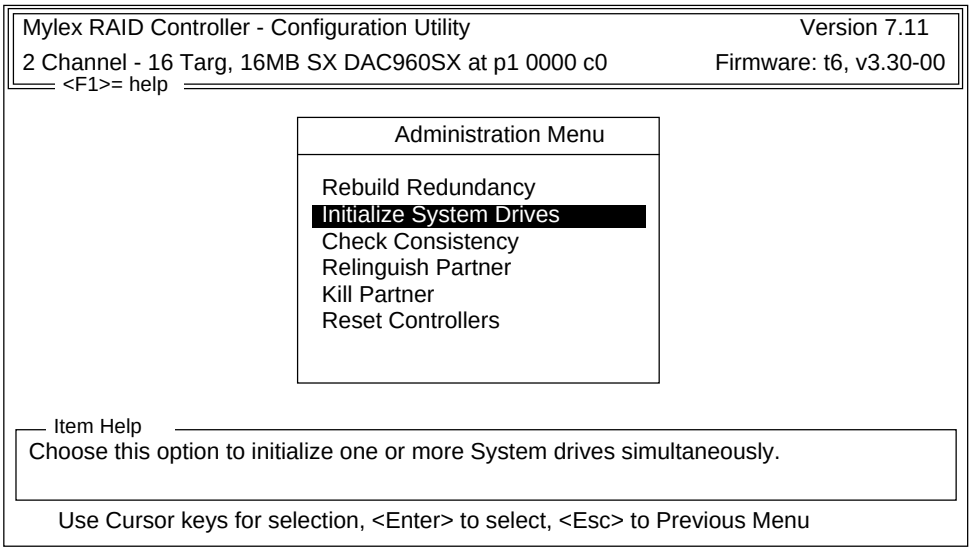
Initializing the System Drives

After you have configured the System Drives, you must initialize them.

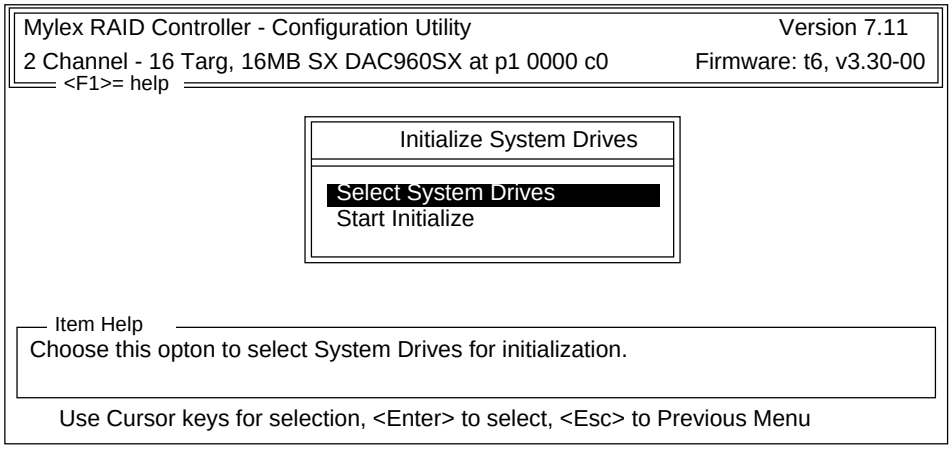
Caution: Failure to initialize a System Drive may result in unpredictable drive behavior, such as the inability to boot or load the operating system, or failure of a consistency check. Any data placed on an uninitialized System Drive is at risk.

To initialize one, several, or all System Drives, proceed with the following:

1 Select *Administration* from the Main menu.

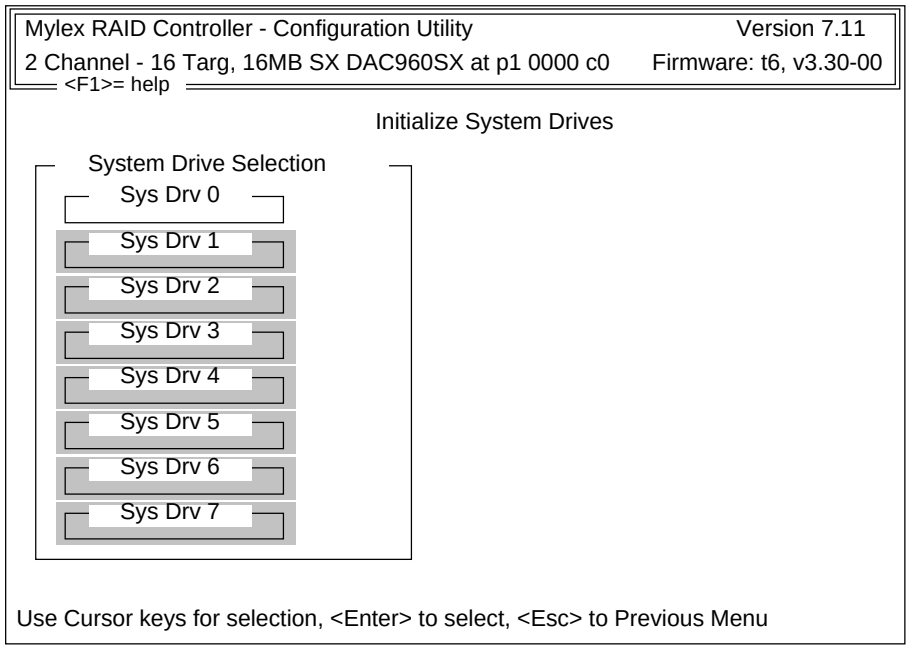


2 Select *Initialize System Drives* from the Administration menu.

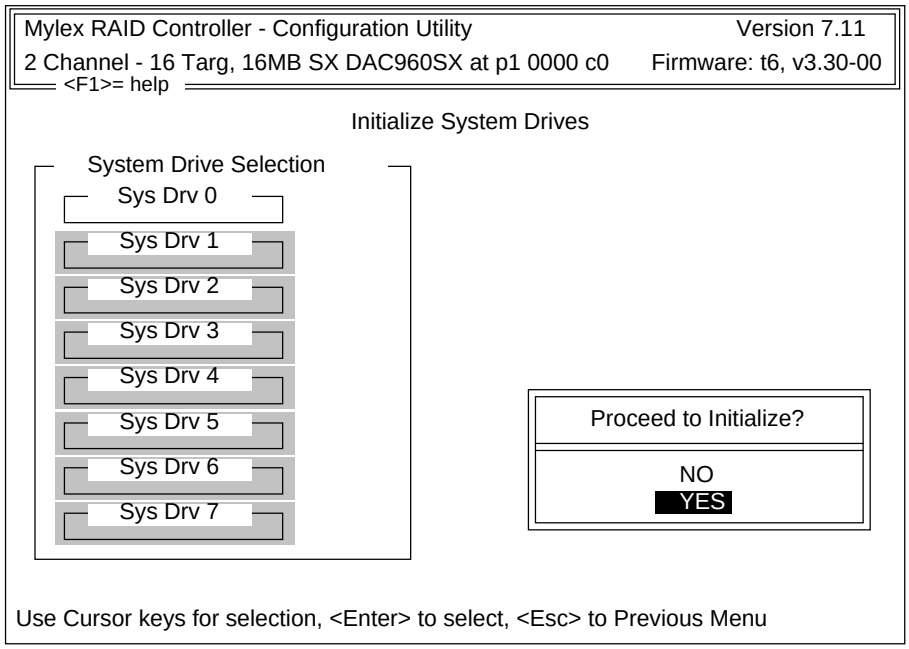


3 Choose *Select System Drives* from the Initialize System Drives menu. The software will display a precautionary message, press any key to continue.

4 From the list of all configured System Drives, select the System Drive(s) you wish to initialize.



A check mark will appear next to the system drive selected for initialization. You can select up to eight (8) System Drives. Press the <Esc> key to return to the previous menu The software will prompt you to proceed. Select *YES* to continue with initialization, or *NO* to cancel.



5 Select *Start Initialize* from the Initialize System Drives menu.

Note: The amount of time the initialization takes is dependent upon the size of the drives and the RAID level chosen.

Once the initialization is complete, a message is displayed, press any key to return to the Administration menu.

6 Press the <Esc> key to exit to the Main menu. Press <Esc> to exit the Main menu and choose *YES* to quit the AdminiStor PC Utilities program.

7 Reboot your system.

Rebuilding Drives

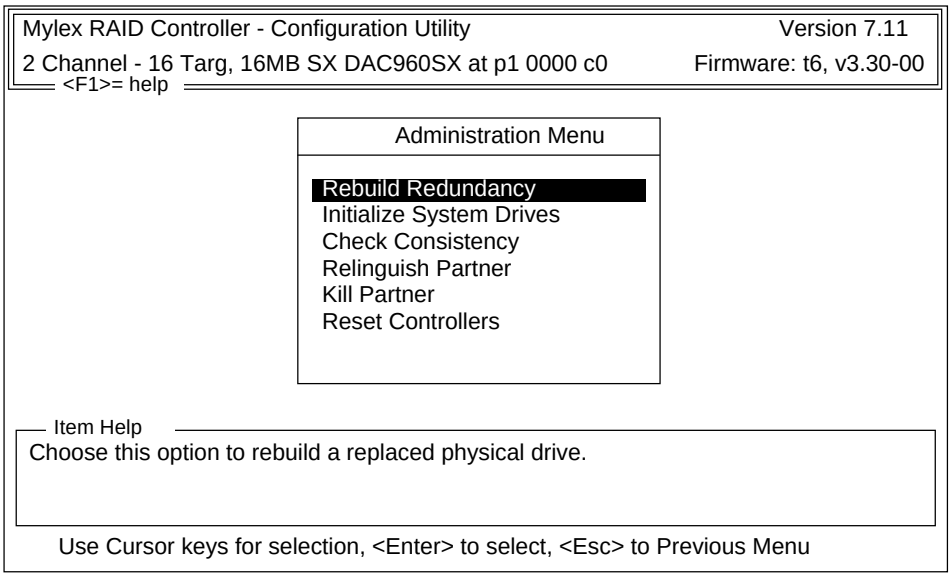
If a drive fails in a RAID level 1, 3, 5, or 0+1 (RAID 6) environment, the controller will continue to function without any interruption. However, the controller can tolerate no further physical drive failures, as data on the drives is no longer redundant. During this period, the array is considered to be in a "Critical" state.

To restore the system's redundancy (fault tolerance), the failed drive needs to be replaced with a drive of the same or greater size, and the data needs to be "rebuilt" on the new drive. To do so, use the Rebuild Redundancy option on the Administration menu.

Note: If you are operating in a duplex environment, you must perform a rebuild using Controller C-0.

To rebuild a physical drive:

1. Select *Rebuild Redundancy* from the Administration menu. If there is a drive that requires rebuilding, AdminiStor PC Utilities (RAIDfx) displays the rebuild screen.



2 Select the drive to be rebuilt. The drive to be rebuilt will be indicated by the letters DED (for “Dead drive” or REB.

3 Press <Enter> to initiate the rebuild.

The software rebuilds the drive, displaying its progress on the screen. If the drive contains more than one system drive, the system drives are rebuilt sequentially, beginning with the system drive with the lowest numerical value.

4 When the Rebuild is complete, the software displays a message. Press any key to return to the Administration menu.

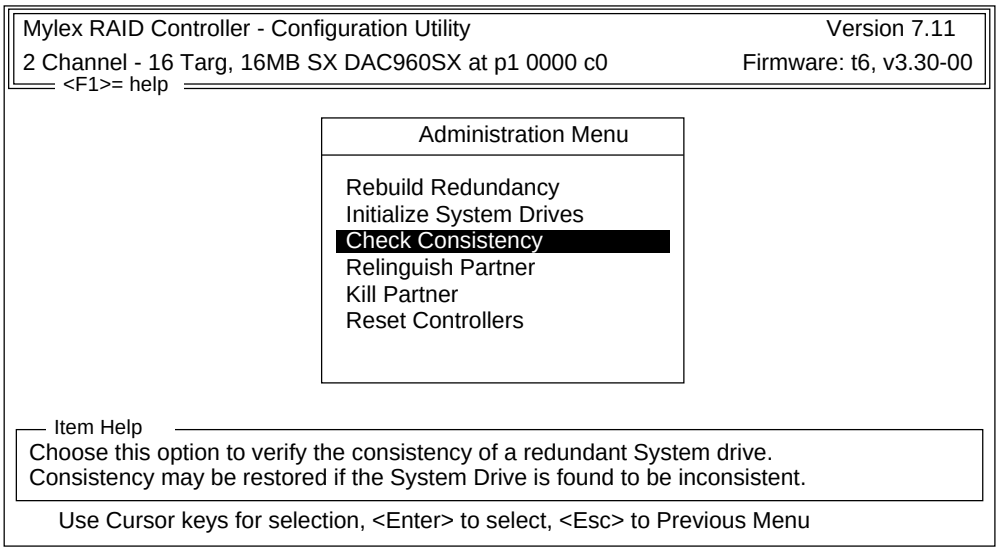
Running a Consistency Check

A consistency check compares the data and parity information on redundant system drives to ensure that they can continue to function in the event of a physical drive failure. You can use Check Consistency on arrays with RAID levels 1, 3, 5, and 0+1 (RAID 6). If a difference between the data and its generated parity is detected, the consistency check process can resolve the generated parity is detected, the consistency check process can resolve the difference. Only one system drive at a time can be checked for consistency.

To verify (and if necessary, correct) the integrity of a redundant system drive, do the following:

1 Select *Check Consistency* from the Administration menu. The software displays the Consistency Check menu.

2 Choose *Select System Drive* from the Consistency Check menu. The software displays the system drives.



3 Select the system drive you want to check.

4 Select Start Check from the Consistency Check menu.

5 A confirmation box appears, asking if you want to automatically restore consistency to the drive.

Caution: Restoring data consistency could mean loss of data in the blocks that were found inconsistent, resulting in data corruption and/or loss of data. Use the consistency check with caution.

- Select YES to restore consistency to the selected system drive. Be aware that potential data loss could result from this action.
- Select NO to cancel the restoration of consistency between the data and parity information contained on this system drive.

If you are unsure that you have a backup copy of the data on this system drive, select the NO option, make a backup of the information on the system drive, and then perform the consistency check.

6 Press <Enter> to start the process. The software begins the consistency check, displaying a progress report.

7 When the check is complete, the software displays a message. Press any key to return to the Administration menu.

Using Kill Partner and Relinquish Partner

Kill Partner

In a duplex environment, this function places a partner controller into reset mode. The surviving controller assumes the duties of the partner controller. It may be necessary to use the command before an Increase Capacity.

Caution: Make sure you do not kill the wrong partner.

To kill a controller and place it in reset mode:

1 Select Kill Partner from the Administration menu.

2 Select YES at the “Kill Partner?” prompt.

The software (RAIDfx) sends a command to the selected controller to reset both controllers, then waits for normal operations to resume.

3 Replace the failed controller and bring the new controller back on-line.

Relinquish Partner

Relinquish Partner brings a partner controller in a duplex environment out of reset mode and places it back in service. This command is used when a failed controller has been replaced.

To bring the replaced controller back on-line:

1. Select Relinquish Partner from the Administration menu.

2. Select YES at the “Relinquish Controller?” prompt.

   The software sends a command to the selected controller to remove the reset signal from its partner controller. The partner returns to normal operation.

Drive Roaming

The purpose of drive roaming is to allow users of the DAC960SX to move disk drives around to different channel/target ID locations while the system is powered down. This is needed for two reasons; (1) to allow easier disassembly and assembly of the product, and (2) to allow for potential performance gains by optimizing the channel usage. Drive Roaming works by marking each disk with its physical location in the system. During boot, any changes in the physical locations of drives are detected and the drives are re-mapped to preserve the integrity of the logical system drives. Drive Roaming is always enabled, therefore there is no option in RAIDfx.

Warning: The Drive Roaming feature does not permit foreign drives (i.e., drives that were not previously part of the system) to be inserted into the system while it is powered down. Do not insert new drives into the system while it is powered down.

5 Maintenance

Overview

During the operational life of the array, you may require the use of maintenance tools to mange your system. These are available from the Tools menu.

Get New Drives

This function performs a STARTDEV, INQUIRY, and GETDEVSTATE on each drive position that is currently considered empty. If you have installed new drives, you can run this function to identify the drive positions that now contains drives, which can then be used in a pack.

To run Get New Drives:

1. Select Get New Drives from the Tools menu. The software displays a confirmation prompt. This function disrupts back end operations and could take a while to run.

2. Select YES at the “Examine Controller for Newly Installed Drives?” prompt to proceed.

   The software scans the channels for new disk drives, and displays a window showing any new drives found. When you press exit, the software adds the newly identified drives, if any, to the Physical Drives window. The drives are now available for use.

Bad Block Table

This function reads the Bad Block Table from the controller and displays it on the screen. A bad block is a section on a disk that cannot reliably store information. Identifying the number and location of bad blocks can help troubleshoot a failed rebuild operation or help predict a physical drive failure. The controller saves two tables: a Rebuild BBT and a Write Back BBT.

Rebuild BBT

During a rebuild operation, data is read from existing redundant drives in the drive group, reconstructed by the controller, and then written to the replacement drive. If a read error (on an existing drive) occurs during a rebuild, the process will fail. In that case, one of the existing drives (not the replacement drive) has errors.

Select the View Rebuild BBT option to determine which drive has errors.

Write Back BBT

During normal operation if you have a system drive's write policy set to write back, a second bad block table is maintained in the controller's memory. This table is updated whenever an error occurs during a read or write operation.

View BBTs

To view the bad block tables:

1. Select *Bad Block Table* from the Tools menu. The software displays a window showing the two table options.
2. Select the table you want to view.

3 Press any key to scroll down through the blocks. When you exit the display, a prompt appears to save the BBT to disk.

4 A bad block table is cleared after viewing. If you want to save the information, select *YES*.

The software prompts you for a path and filename for the data. If you don't want to save the data, select NO.

Error Counts

The controller maintains several error count tables of disk errors that are encountered during normal operation. Error Count Tables can be used to monitor the health of a device and to indicate when a device needs to be repaired or replaced.

To view the error counts for a device:

1. Select *Error Counts* from the Tools menu. The software displays the Examine Error Counts screen, with the first drive highlighted.

2. Select the target drive you want to examine.

   The software will display the Error Counts window, which shows the following information:

   - Channel and target.
   - Parity errors — a count of the SCSI bus parity errors that occurred while this device was transferring information on the bus.
   - Soft errors — a count of CHECK CONDITION errors reported by the device. These errors are typically generated when a bad sector on the disk is encountered. Such errors are recovered by the controller (if the device is part of a redundant system drive) by generating the data from the remaining disks. The bad sector on the device is also eliminated by writing back the data onto the disk and reading to verify, since a verify failure results in the reassignment of data to a different sector. Soft errors may occur during normal operation if the device has bad sectors.

- Hard errors — a count of hardware errors on the device. During normal operation, the hard error count for any device should be zero. The following conditions cause the hardware error count to be incremented for a device:

  - SIOP interrupt for “Illegal instruction detected”

  - SIOP interrupt for “Gross error”

  - SCSI device executed illegal/unsupported phase sequence

- Miscellaneous errors — all other errors:

  - Device times out on a command issued to it by the controller

  - Active device was busy when the controller attempted to send it a command

Error counters have the following properties:

- A maximum of 127 errors can be recorded for each device in each table

- Error counters can be reset to 0 by power-cycling the controller

3 Press any key to hide the error counts information.

4 Select another target drive, or press <Esc> to return to the Tools menu.

Change Disk State

Change Disk State allows you to change the state of one or more disks. To change a disk state:

1. Select *Change Disk State* from the Tools menu. The software displays the Change Disk Drive State screen.

2. Select the disk you wish to change.

   The software displays the New State window, which shows the disk states. Only the highlighted options are allowed for the currently selected drive. Disk states (device statuses) are listed below:

   - DEAD
   - OFFLINE
   - REBULD
   - ONLINE
   - STANDBY

3. Select the state you want to change the highlighted disk to and left click again or press <Enter>.

   The software changes the state of the currently selected disk. When the change is complete, the description of the drive's state in the physical drives window will show the new state.

4. Repeat steps 2 and 3 for each disk you want to change.

Drive Size File

Previous versions of the firmware for the controller used a drive sizing algorithm which took the capacity of the smallest drive in a RAID group and used that to determine the total RAID group size. Mixtures of different drive types with slightly different drive sizes in an array can lead to problems when a drive failure takes place. Since the actual size of the drive is used to find a replacement, a replacement drive that is slight smaller than the failed drive will not be used in a drive rebuild. For example, in an array composed of 4.2 GB and 4.0 GB drives, a failed 4.2 GB drive cannot be replaced with a 4.0 GB drive.

The solution is to allow the user to define how much of the drive's total capacity should be used. This information is stored in the drive size file.

1 To open to the Drive Size menu, select *Drive Size File* from the Tools menu.

The Drive Size menu is displayed. You may create a preliminary drive size file based on:

- the drives attached to the currently-selected, or
- all drives attached to all available controllers

Once a preliminary drive size file is created, you can view (browse) the file within AdminiStor PC Utilities (RAIDfx), but you will need to open file (drvsize.dat) in a text editor to make changes and save your working file.

2 Select *Create from Current* or *Create from All* from the Drive Size menu.

The file "drvsize.dat" is created based either on the drives attached to the current controller, or all drives attached to all available controllers.

3 Press <Esc> to return to the Drive Size menu.

4 Select View to browse the “drvsize.dat” file that was just created. This may also be used at any time to verify the contents of the Drive Size File.

5 To edit the drive size file, open *drvsize.dat* in a text editor and make your required changes.

Note: The general idea is to set the size of each drive to a common setting. For example, drives of 4.0 GB, 4.02 GB, and 4.2 GB configured in a single RAID group can all be set to 4 GB in the drive size file. You can only set a drive to a size equal to or smaller than its actual size. For example, you cannot set a 3.5 GB drive to 4 GB using the drive size file.

Firmware

This version of AdminiStor PC Utilities (RAIDfx) allows you to customize and/or change the firmware in the controller system.

Customize

This option accesses the firmware customization menu where you can modify or adjust parameters and strings in the firmware image. Adjustable parameters are type, miscellaneous, and debug bytes. Modifiable strings are error messages for the display and inquiry text.

Download

This option accesses the firmware download menu to allow the firmware in the controller to be changed. This may be done as the last phase of the customization process, or purely to upgrade the product.

Note: Customizing or downloading firmware is are advanced options and should only be carried out with great care by an experienced system administrator.

If you need additional information about these options, consult the help topics for the Firmware by pressing <F1> while viewing the Firmware menu.

Save Accel File

This option allows you to save information about the current set of controllers into an accelerator file (accel.dat) that will be used to speed startup the next time AdminiStor PC Utilities (RAIDfx) is started. This faster startup is accomplished by using information in the accelerator file rather than invoking a full scan. If your host/controller setup is stable, this method works well. If changes are being made frequently, the fill scan method is best.

Note: If accelerated startup does not work properly, full scan is automatically invoked.

To save an accelerator file:

1 Select *Save Accel File* from the Tools menu.

2 Select *YES* at the "Save Accelerate File?" prompt.

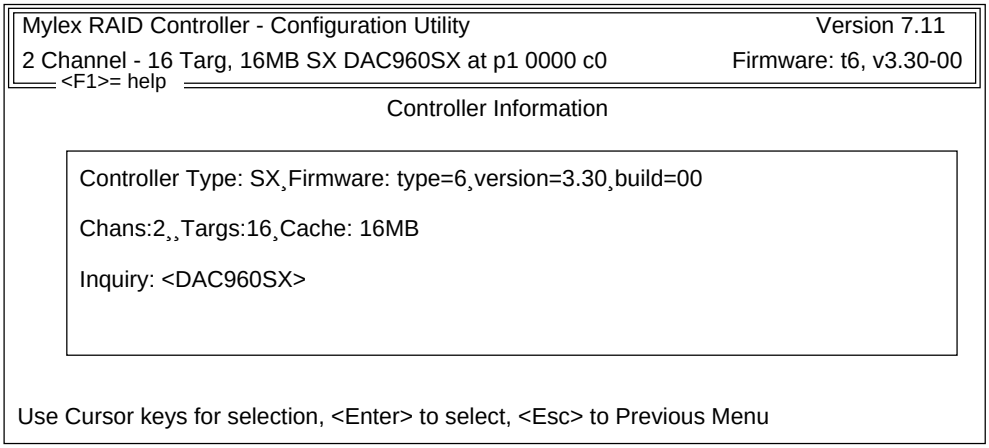
3 Press any key to return to the Tools menu.

Controller Information

This option allows you to view information about the currently selected controller.

To view controller information:

1 Select *Controller Info* from the Tools menu. A Controller Information screen appears.



2 Press any key to return to the Tools menu.

A Technical Information

Specifications

Ultra S2S RAID Controller (DAC960SX)

CPU	Intel i960 RISC 32-bit microprocessor @ 33 MHz
Memory	
Module Type	Two DRAM, 72-pin SIMMs
Size	70ns self-refreshing, parity
	Minimum: 8MB - Two 1M x 36 (4MB)
	Optional: 16MB - Two 2M x 36 (8MB)
	32MB - Two 4M x 36 (16MB)
Cache	64MB - Two 8M x 36 (32MB)
	128MB - Two 16M x 36 (64MB)
	Write: Selectable, Write Through or Write Back
	Read: Always enabled
Firmware	Flash EEPROM, 256K x 8
SCSI	
I/O Processors	Symbios 53C770®, one per channel
Transfer Rate	Up to 40 MB/second (synchronous)
Communications	
Serial Port	One asynchronous, 10-pin, RS232
Baud Rate	19,200 bps
Data Bits	8
Stop Bits	2
Parity	Odd, Even, or None
Signals	Tx, Rx, CTS, RTS, DSR, DTR, DCD

RAID levels supported	RAID level 0, Block striping without redundancy.	
	RAID level 1, Mirroring.	
	RAID level 3, Striping.	
	RAID level 6 (0 +1), Block striping and writes identical data two drives.	
	RAID level 5, Block striping and generation of parity data. Parity data is striped across drives.	
	RAID level 7 JBOD, (Just a bunch of drives) accesses each drive independently.	
Environmental		
Temperature	Operating:	0°C to +50°C
	Storage:	-20°C to +70°C
Humidity	Operating:	10% to 90% rh
(non-condensing)	Non-operating:	10% to 90% rh
Altitude	Operating:	Up to 10,000 ft. (3,048 m)
	Non-operating:	Up to 50,000 ft. (15,240 m)