DAC960SI SCSI to SCSI Disk Array Controller

User Guide and Reference Manual

Manual Version 2.0

P/N: 771941-D02

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SCSI to SCSI
Disk Array Controller

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About This Manual

This DAC960SI™ User Guide and Reference Manual provides information about the features, functions, and options of the Mylex® DAC960SI SCSI-to-SCSI Disk Array Controller operating with firmware version 1.5 or greater.

This manual is designed to provide operations and reference information for the experienced system administrator or computer technician who is familiar with the principles and conventions of the Small Computer System Interface (SCSI) and with Redundant Array of Independent Disks (RAID) technology.

Chapter 1 contains an overview of the DAC960SI Controller features, options and specification.

Chapter 2 provides block-diagram level description of the DAC960SI and a description its RAID and SCSI functionality.

Chapter 3 describes the DAC960SI LCD and VT100 user interfaces and the various methods for making the controller ready to use

Chapters 4, 5, and 6 provide detailed descriptions of the DAC960SI front panel LCD menu screens.

The Appendices provide troubleshooting reference material with the DAC960SI controller error messages.

Refer to the *DACCF Utilities Installation Guide and User Manual* for detailed information about how to use that software utility to configure, initialize, and operate the DAC960SI and its connected RAID disk array(s).

Note: Even if you do not plan to use the software utilities, be sure to read Chapter 2, *Configuration Strategies*, in the DACCF manual for important information on creating and using RAID disk arrays with DAC960 controllers.

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Introduction

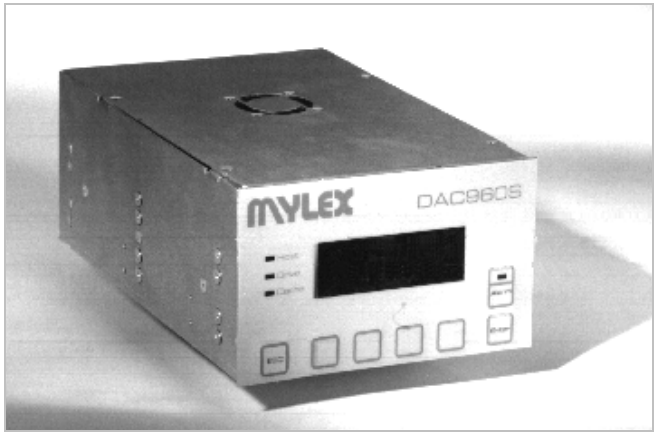

Figure 1-1. DAC960SI Disk Array Controller

Description

The DAC960SI (Internal) SCSI-to-SCSI Disk Array Controller brings RAID functionality and performance to any computing platform equipped with a standard SCSI interface. The built-in keypad and liquid crystal display (LCD) user interface eliminates the need for special host software or drivers for array configuration and management.

The DAC960SI is an intelligent, caching controller that supports industry-standard RAID levels (0, 1, 5, and 0+1) for multiple-drive arrays or single-drive control functionality. The DAC960SI provides high-speed, fault-tolerant RAID disk operations for all popular operating environments. Operating systems see the disk array as if it is just another very large hard drive.

The compact form-factor (about the same size as a 5¼ inch full-height drive) permits mounting in a server drive bay or a stand-alone external cabinet. A built-in Array Enclosure Management Interface (AEMI) supports monitoring of power supplies, fans, and temperature in AEMI-compliant cabinets.

Controller Functions and Features

Key Features

1. Complete RAID/SCSI disk array configuration and management without special software or drivers
2. Flexible user interface – full-function front panel keypad and LCD display, or control from a VT100™ terminal (or equivalent)
3. Automatic rebuild after disk failure without user intervention
4. SCSI performance enhancement for faster data transfers
5. Automatic fault monitoring and recovery increases system availability

Key 1 -
Manages RAID/SCSI Disk Arrays

- Supports multiple RAID levels (0, 1, 5, and 0 + 1) allowing you to select the desired combination of storage capacity, data availability (redundancy) and I/O transfer performance for any data application
- Supports all popular operating systems and network environments because it works independently from the operating system
- Connects up to 35 SCSI drives (using optional daughter board)
- Drives can be grouped and managed as a single very-large-capacity disk drive (up to 2TB), as multiple large-capacity drive groups, or as individual disk drives
- Industry-standard Fast/Wide SCSI-2 interface supports any SCSI hard disk drive

Key 2 -
Flexible User Interface

- Front panel keypad and LCD interface controls all array configuration and management functions independent of the host operating system
- Serial communications port permits array control through a standard VT100 (or equivalent) terminal or over a network
- Software utility (DACCF) provides DOS-level control through a PC running ASPI drivers

Key 3 -
Automates RAID Functions

- Automatic failed-drive detection
- Automatic rebuild of the array using 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, bad blocks, etc.
- Automatic sector re-mapping recovers defective media and corrects data errors

Key 4 -
Enhances SCSI Performance

- Fast/Wide SCSI channels provide high-performance data transfers at up to 20 MB/second/channel
- 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
- User-defined rebuild priority to optimize controller performance during automatic or manual rebuild cycles
- Disconnect/reconnect capability for enhanced performance and SCSI bus optimization

Key 5 -
Increases System Availability

- Built-in diagnostics provide controller and drive fault monitoring during-power-on and continuous operation
- Status messages and audible alarms notify the administrator or user of critical conditions
- Supports AEMI protocols for integrated monitoring of enclosure power supplies, fans, and temperature
- Battery backup option protects data in the controller cache in the event of a power interruption

Standard Package Contents

- DAC960SI Disk Array Controller
- Configuration & Utilities software diskette
- Installation Guide
- User Guide and Reference Manual

Options

- DBI960S-3 Daughter Board, 3-channel upgrade
- DBB960S-650 Battery Back-up Module with 650 mA battery

User-Supplied Items

- Suitable enclosure, cabinet, or full-height drive bay
- PC-compatible power supply (included with most RAID enclosures)
- Mounting hardware required by the enclosure (rails, screws, etc.)
- SCSI cable(s) to interconnect the controller with the host and the disk drives or disk arrays

The following optional items may also be required, depending on the application:

- Serial communications null-modem cable
- VT100 compatible terminal or equivalent
- IBM PC® or compatible system running MS-DOS®

Product Identification

The DAC960SI is manufactured in different configurations that support Fast, Wide, or Differential SCSI channels, contain different sizes of cache memory, or provide additional host/drive channel capability through the use of the DBI960S optional daughterboard.

A product identification label is located on the top of the controller to provide specific information for each DAC960SI. This label is the definitive source of product identification information for installation or technical support issues.

Note: Since most models are similar in their outside appearance, visual identification of a specific model controller can be difficult. Don't guess. Read the label.

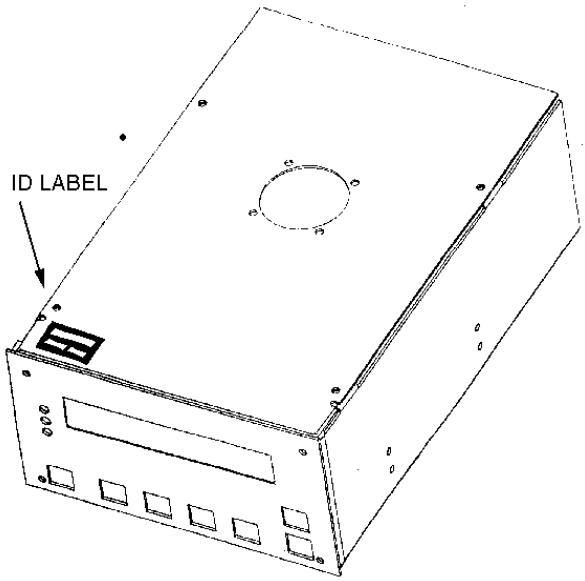

Figure 1-2. Controller Identification Label

Table 1-1. Controller Identification by Part Number

Controller Part Number	SCSI Channels				DBI960S-3 Option Installed
	Host		Drives		
	Qty	Type	Qty	Type	
DAC960SI-2V-*n*	1	Wide	2	Fast/Wide	No
DAC960SI-2D-*n*	1	Wide Differential	2	Fast/Wide	No
DAC960SI-2-*n*	1	Wide	2	Fast	No
DAC960SI-5-*n*	1 or 2	Wide	5 or 4	Fast	Yes
DAC960SI-2W-*n*	1	Wide	2	Fast/Wide	No
DAC960SI-5W-*n*	1 or 2	Wide	5 or 4	Fast/Wide	Yes

n = cache size in MB

Controls, Indicators, and Connectors

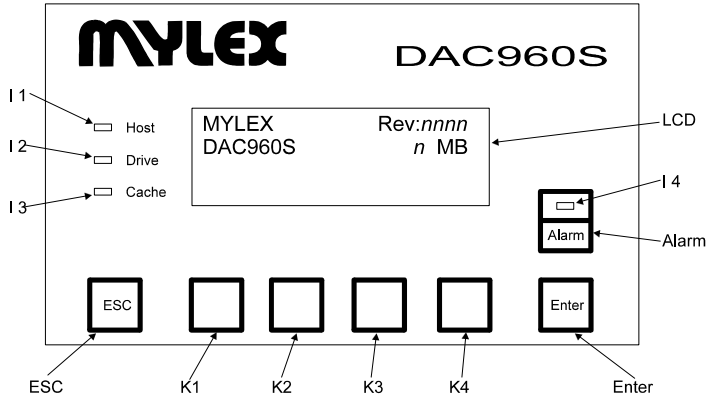

Figure 1-3. DAC960SI Front Panel

Table 1-2. Front Panel Controls and Indicators

Item	Description
I 1	LED Indicator, Host Data Transfer
I 2	LED Indicator, Drive Activity
I 3	LED Indicator, Data in Write Cache
I 4	Fault Indication LED, Alarm status
LCD	Display, four-line LCD, Provides menus, status and indication
ESC	Function Key, Escape; Go back to the previous screen
K 1	Variable Function Key
K 2	Variable Function Key
K 3	Variable Function Key
K 4	Variable Function Key
Enter	Function Key, Enter; Executes selected commands
Alarm	Function Key, Resets audible alarm

3-Channel Distribution Boards

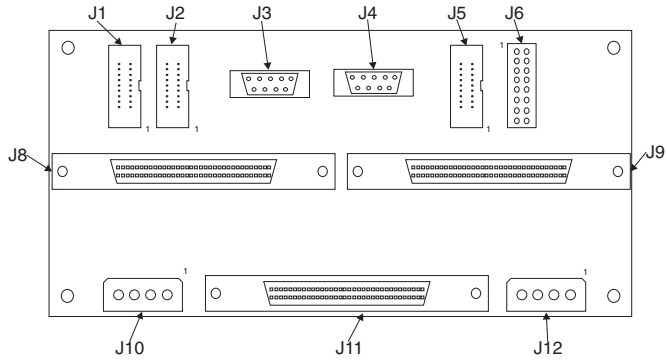

Figure 1-4. DBX960S-3-FSV Distribution Board

Table 1-3. Fast SCSI, 3-Ch. Distribution Board Connectors and Jumpers

Connector	Description
J1	Fault Indication, Drive Channel 0
J2	Fault Indication, Drive Channel 1
J3	Serial Port
J4	Reserved **(DO NOT USE, controller damage may occur!)**
J5	AEMI (Array Enclosure Management Interface) Port
J6	Configuration Jumpers
J7	Not used
J8	Fast/Wide SCSI Connector, Drive Channel 0
J9	Fast/Wide SCSI Connector, Drive Channel 1
J10	Power Connector
J11	Fast/Wide SCSI Connector, Host Channel 0
J12	Power Connector

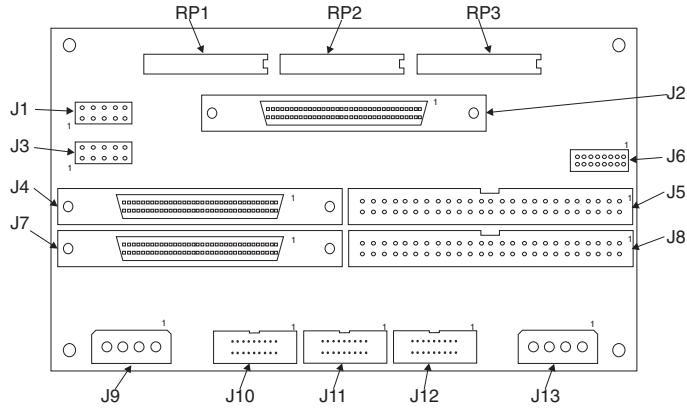

Figure 1-5. DAC960SI-2D-*n* Differential SCSI Distribution Board

Table 1-4. Differential SCSI Distribution Board Connectors and Jumpers

Connector	Description
J1	Serial Port
J2	Fast/Wide Differential SCSI Connector, Host Channel 0
J3	Reserved **(DO NOT USE, controller damage may occur!)**
J4	Fast/Wide SCSI Connector, 68-pin, Drive Channel 0
J5	Fast (Narrow)SCSI Connector, 50-pin, Drive Channel 0
J6	Jumpers, SCSI ID and Configuration
J7	Fast/Wide SCSI Connector, 68-pin, Drive Channel 1
J8	Fast (Narrow) SCSI Connector, 50-pin, Drive Channel 1
J9	Power Connector
J10	Fault Indication, Drive Channel 1
J11	Fault Indication, Drive Channel 0
J12	AEMI (Array Enclosure Management Interface) Port
J13	Power Connector
RP1, RP2, RP3	Differential termination resistor packs, Host Channel 0 (Installed = Termination Enabled; Removed = Disabled)

6-Channel Distribution Boards

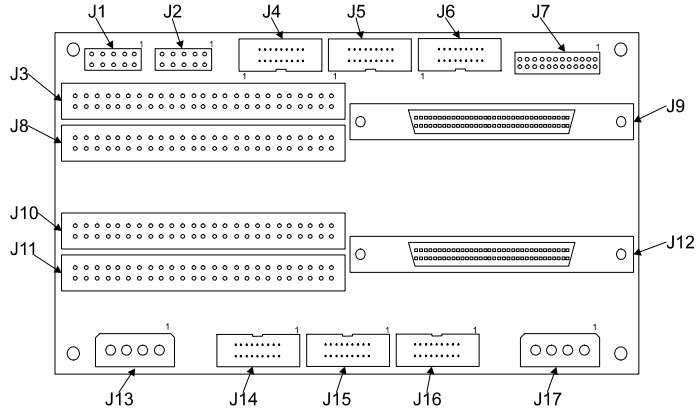

Figure 1-6. DAC960SI-5-*n* Fast SCSI Distribution Board

Table 1-5. Fast SCSI, 6-Ch. Distribution Board Connectors and Jumpers

Connector	Description
J1	Serial Port
J2	Reserved **(DO NOT USE, controller damage may occur!)**
J3	Fast (Narrow) SCSI Connector, Drive Channel 3*
J4	Fault Indication, Drive Channel 3*
J5	Fault Indication, Drive Channel 2*
J6	Fault Indication, Drive Channel 4*
J7	Jumpers, SCSI ID and Configuration
J8	Fast (Narrow) SCSI Connector, Drive Channel 2*
J9	Fast/Wide SCSI Connector, Host Channel 1/Drive Channel 4*
J10	Fast (Narrow) SCSI Connector, Drive Channel 1
J11	Fast (Narrow) SCSI Connector, Drive Channel 0
J12	Fast/Wide SCSI Connector, Host Channel 0
J13	Power Connector
J14	Fault Indication, Drive Channel 1
J15	Fault Indication, Drive Channel 0
J16	AEMI (Array Enclosure Management Interface) Port
J17	Power Connector

* Requires DBI960S-3 Daughter-board Option

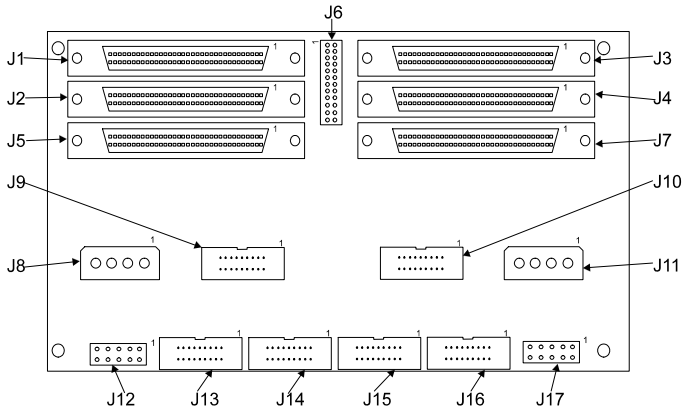

Figure 1-7. DAC960SI-5W-*n* Wide SCSI Distribution Board

Table 1-8. Wide SCSI Distribution Board Connectors and Jumpers

Connector	Description
J1	Fast/Wide SCSI Connector, Drive Channel 2*
J2	Fast/Wide SCSI Connector, Drive Channel 0
J3	Fast/Wide SCSI Connector, Drive Channel 3*
J4	Fast/Wide SCSI Connector, Drive Channel 1
J5	Fast/Wide SCSI Connector, Host Channel 1/Drive Channel 4*
J6	Jumpers, SCSI ID and Configuration
J7	Fast/Wide SCSI Connector, Host Channel 0
J8	Power Connector
J9	Fault Indication, Drive Channel 4*
J10	AEMI (Array Enclosure Management Interface) Port
J11	Power Connector
J12	Serial Port
J13	Fault Indication, Drive Channel 1
J14	Fault Indication, Drive Channel 0
J15	Fault Indication, Drive Channel 2*
J16	Fault Indication, Drive Channel 3*
J17	Reserved **(DO NOT USE, controller damage may occur!)**

* Requires DBI960S-3 Daughter-board Option

Operator Interface

Using the Front Panel Controls

The DAC960SI uses a keypad and a liquid crystal display (LCD) panel connected to the DAC960S controller board to access the built-in configuration and administration utility that resides in the controller's firmware. Complete control and management of the disk array(s) can be performed from the DAC960SI front panel, no additional hardware or software drivers are required.

The front panel keypad buttons provide the user interface to the controller's functions. The LCD screen displays up to three lines of menu items or status information. The fourth line of the display shows controller status in Monitor mode. In Menu mode, the fourth line is usually an instruction line which shows an abbreviated list of functions that can be accessed by pressing the corresponding keypad button below each one. These are described in detail later in this manual.

Using a VT100 Terminal

The DAC960SI serial port can be used to access the controller in either SLIP or VT100 mode. In SLIP mode, the serial port can be used with the supplied DOS-based configuration software utilities. In VT100 mode, the supplied utilities will not function on the serial port, instead, a VT100 compatible terminal may be used with the built in configuration/administration utility as well as message monitoring.

Note: The Front Panel keypad/LCD display and a VT100 terminal CANNOT be in the menus at the same time. The controller allows only one device at a time to access menus. A different device can be selected when both are in the initial screen (made available by pressing **Esc** from within the utility).

Using the DACCF Software Utilities

Controller configuration and array management can also be performed using the DOS-based DACCF software utilities provided with the DAC960SI. These utilities run from an SLIP or ASPI mode terminal and are described in detail in the *DACCF Utilities Installation Guide and User Manual.*

Specifications

Controller		**DAC960S**
	CPU	Intel i960®RISC 32-bit microprocessor
	Memory	
	Module Type	DRAM, 60ns, 72-pin SIMM, *n* x 36
	Size	Minimum : 4 MB (1 x 36) Optional: 8, 16, or 32 MB
	Cache	Write: Selectable, Write Through or Write Back Read: Always enabled
	Firmware	
	ROM Type	Flash EEPROM, 256K x 8
	SCSI	
	I/O Processors	NCR 53C720®one per channel
	Transfer Rate	Up to 20 MB/second (synchronous)
	Communications	
	Serial Port	One asynchronous, 10-pin, RS232
	Baud Rate	19,200
	Data bits	8
	Stop bits	2
	Parity	None
	Signals	Tx, Rx, CTS, RTS, DSR, DTR, DCD, RI
	Connection	Null-modem cable (user supplied)
RAID (Levels supported)		RAID 0, Striping RAID 1, Mirroring RAID 5, Parity RAID 0 + 1, Striping and Mirroring (Mylex RAID 6) JBOD, Single-drive control (Mylex RAID 7)

Specifications (continued)

Electrical requirements

Input Power	12V ± 5% @ 100 mA.
	5V ± 5% @ 2.5 Amp[1] (w/4MB memory)
	5V ± 5% @ 3.5 Amp[1] (w/16MB memory)
	[1] (Supply currents assume drives feeding term power)

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)

Chapter 2
Functional Description

Controller Functions

The Mylex DAC960SI is a high-performance SCSI-to-SCSI Disk Array Controller. When properly configured, the DAC960SI can provide non-stop service with a high degree of fault tolerance through the use of RAID technology and advanced array management features.

The DAC960S Disk Array Controller connects to the host system through an existing SCSI-2 (Small Computer System Interface) host bus adapter (HBA). The SCSI interface on the host may be located either on the system board, or on a plug-in adapter card.

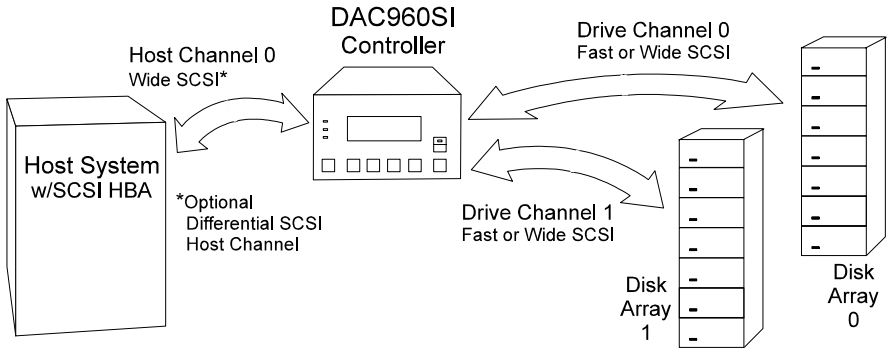

Figure 2-1. System Block Diagram

Controller Components

Key components of the DAC960SI controller (shown in Figure 2-2) include:

- i960 RISC processor
- Memory subsystem and DRAM cache
- SCSI and I/O subsystems

The i960 Processor

The DAC960SI CPU is a 32-bit Intel i960 RISC microprocessor. The CPU controls all functions of the controller including SCSI bus transfers, RAID processing, configuration, data striping, error recovery, and drive rebuild.

Memory Subsystem and DRAM Cache

The DAC960SI can be configured with up to 128 megabytes of DRAM cache, depending on the type of memory modules being used. A minimum of 4MB DRAM is required. The standard configuration DAC960SI is supplied with 4MB of DRAM.

A fast 32-bit interface between the i960 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 DAC960SI firmware contains the programs executed by the i960 CPU. The firmware resides in the on-board Flash EEPROM. This memory device retains information even after power is off. and can also be re-written, to allow the controller firmware to be upgraded without the need to replace any hardware chips.

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 configurations change (for example, when a drive fails), the NVRAM keeps a record of the changes.

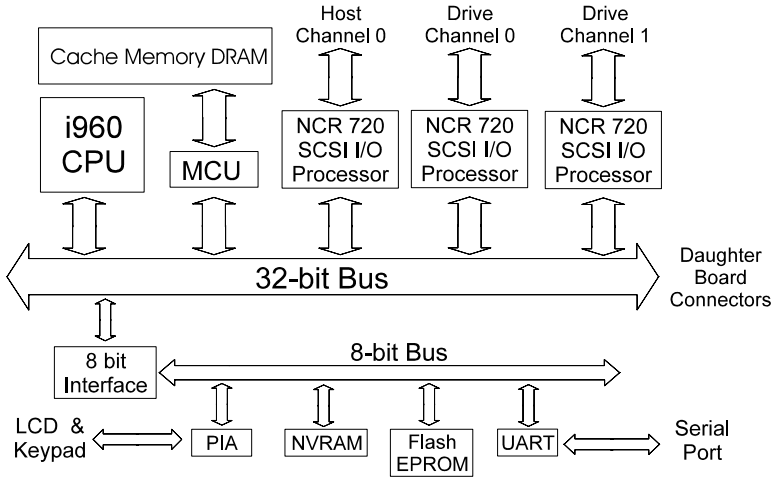

Figure 2-2. Controller Block Diagram

SCSI Bus Interface

The DAC960SI uses the NCR 53C720 SCSI I/O processor chip on each SCSI channel to allow the controller to simultaneously communicate with the host system, and read or write data on several drives. Up to seven disk drives can be connected to each SCSI channel controlled by the DAC960SI.

The DAC960SI supports the Fast/Wide SCSI-2 standard, which is backward compatible with earlier SCSI standards.

User Interface

The primary user interface to the DAC960SI is provided by the front panel keypad and LCD screen communicating through discrete components on the controller's main circuit board.

A second interface is available through the RS-232 serial communications port on the controller's back panel. The serial port can be used with either a VT100 compatible terminal or with a PC. The PC may operate in either SLIP mode or by using appropriate ASPI drivers and the DOS-based DACCF.EXE software utility.

SCSI Functions

The DAC960SI i960 RISC processor and SCSI I/O processors, provide intelligent, high-performance SCSI interface and control. The DAC960SI manages and controls the SCSI bus arbitration between the controller and its connected devices, and all SCSI activity of the connected devices.

Multiple SCSI Format Support

The DAC960SI provides at least two, and optionally up to five, SCSI channels for connecting disk drives. With the appropriate cabling, these devices may be any combination of standard Narrow, Fast, or Wide SCSI formats (see Table 2-1).

SCSI Cabling and Termination Conventions

Disk drives equipped with a SCSI interface should be connected to the DAC960SI controller distribution board (back panel) by means of cables that comply with standard SCSI pinout and cable-length conventions (no longer than 3 meters, including all internal wiring). Up to seven SCSI devices can be connected to each of the DAC960SI drive channels. The first and last device on each drive channel must be terminated.

SCSI Address (Target ID) Selection

Each drive on a specific SCSI channel(or bus) must be configured for a target address (target ID) that is different from all other devices on that channel. The target ID, a SCSI address number from 0 to 7, is assigned to each device attached to a SCSI channel during installation.

The default SCSI address for the DAC960SI controller is target ID 0. Subsequently, you must assign to each connected disk drive a different (unique) SCSI address, typically a target ID number from 1 to 6.

Table 2-1. Supported SCSI Formats

SCSI Type	Clock Rate	Data Rate	Connector	Cable Length
Wide SCSI-2 (16-bit)	10 Mhz 5 Mhz	20 MB/sec 10 MB/sec	68-pin	3 m 6 m
Narrow SCSI-2 (8-bit)	10 Mhz 5 Mhz	10 MB/sec 5 MB/sec	68-pin or 50-pin*	3 m 6 m
SCSI-1 (8-bit)	5 Mhz	5 MB/sec	50-pin*	6 m

* 50-pin to 68-pin adapter required

Drive Organization

The DAC960SI controller organizes the SCSI drives connected to it as physical drives and logical units.

Physical Drives (Drive Groups)

Using the DAC960SI, up to eight (8) individual disk drives can be used together to form a pack or *drive group* of physical drives that will comprise the array's logical unit capacity.

Note: If all of the disks in a drive group are not the same size, the drive group will effectively have the capacity of the multiple of the smallest drive.

To determine the total size of a drive group, multiply the size of the smallest disk in the drive group by the number of disks in the group.

For example, if there are four drives of 4 GB each, and one drive of 2 GB comprising a drive group, the effective capacity available for use is 10 GB (5 x 2), *not* 18 GB.

The DAC960SI supports up to eight (8) drive groups.

Logical Units (LUNs)

A logical unit (or 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 to the host by its logical unit number (LUN). The DAC960SI supports up to eight (8) LUNs per drive group.

For example, the third logical unit on a drive channel with a SCSI target ID of 1 will be seen by the host computer as ID 1, LUN 2 (since LUN numbering begins at 0, and continues 1, 2, 3, etc.).

Note: Use the DAC960SI LCD panel, or the VT100 utility, to configure the logical units from *one* drive group. Use only the DACCF software utility to configure the logical units that span *more than one* drive group (refer to the DACCF Utilities documentation).

RAID Management

RAID is an acronym for Redundant Array of Independent Disks. The DAC960SI controller implements several different versions of the Berkeley RAID technology, and two special versions that are specific only to the DAC960 family of RAID controllers. Each version (referred to as a RAID Level) supported by the DAC960SI controller is shown in Table 2-1.

An appropriate RAID level is selected when the logical units are defined or created. This decision is based on the following priorities:

- Disk capacity
- Data availability (fault tolerance or redundancy)
- Disk performance

The DAC960SI controller makes the RAID implementation and the disks' physical configuration transparent to the host operating system. This means that the host operating system drivers and software utilities are not affected, regardless of the RAID level selected.

Correct installation of the disk array and the DAC960SI controller requires a proper understanding of RAID technology and the concepts described in this chapter and in the DACCF Utilities documentation.

Table 2-1. Supported RAID Levels

RAID Level	Description	Drives/Chnl Min	Drives/Chnl Max
0	Block striping is provided, which yields higher performance than with individual drives. There is no redundancy.	2	8
1	Drives are paired and mirrored. All data is 100% duplicated on an equivalent drive (fully redundant).	2	2
5	Data is striped across several physical drives. Parity protection is used for data redundancy.	3	8
0+1	(Mylex RAID 6) Combination of RAID levels 0 and 1. This level provides striping and redundancy through mirroring.	3	8
JBOD	(Mylex RAID 7) "Just a Bunch of Drives." Each drive can operate independently like with a common host bus adapter; or multiple drives may be spanned and seen as a single very large drive. No redundancy is provided.	1	1

RAID Techniques

The techniques of disk striping, mirroring, and parity (redundancy) are fundamental elements of RAID technology performed by the DAC960SI. More detailed information on how to apply these techniques can be found in the *DACCF Utilities* manual.

Mirroring (RAID 1)

Mirroring refers to the 100% duplication of data from one disk drive onto another. Each disk contains the mirror image of the data on the other drive.

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 will be separated into blocks. 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 on. This method can significantly increase disk system throughput, particularly for transferring large, sequential data blocks.

Stripe Order

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

Stripe Width

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

Striping with Parity (RAID 5)

Striping with parity (rotated XOR redundancy) is a method of providing complete data redundancy that requires only a fraction of the storage capacity than mirroring for storing redundant information.

In a system configured under RAID-5 (which requires at least three SCSI 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).

Drive Management

The DAC960SI functions that monitor and control the operation of the physical 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: ONLINE, STANDBY, DEAD, or WRITE-ONLY.

The controller stores the state of the attached SCSI drives in its non-volatile memory. This information is retained even after power-off. If a SCSI disk is labeled DEAD in one session, it will stay in the dead state until a change is made either by using a system level utility or after a maintenance/rebuild procedure is performed.

The operational state of a disk drive may be indicated by a one-letter status code to the DAC960SI monitor screens or by a three-letter status code to the DACCF software utility screens.

Figure 2-3. Drives States on the *Show Drives* LCD Screen

On-line (O or ONL)

A SCSI drive (physical drive) is *on-line* if it:

1. Is powered on
2. Has been defined as a member of a drive group
3. Is operating properly.

Standby (S or SBY)

A SCSI disk drive is in a *standby* state if it:

1. Is powered on
2. Is able to operate properly
3. Has *not* been defined as part of any drive group.
4. Has been defined as a standby

Dead (D or DED)

A drive is *dead* if it:

1. Is not present
2. Is present, but not powered on
3. Failed to operate properly and was killed by the controller

When the controller detects a failure on a disk, it *kills* that disk by changing its state to dead. A SCSI drive that is in the dead state does not participate in any I/O activity. No commands are issued to dead drives.

Write-Only (W or WOL)

A SCSI drive is in a *write-only* state if it was in the process of being rebuilt, that is ...

- During a RAID 1 rebuild, data is being copied from the mirrored drive to the replacement drive, or
- During a RAID 5 or RAID 0+1 rebuild, data is being regenerated via the XOR redundancy algorithm and written to the replacement drive.

... and the rebuild was terminated abnormally before it completed.

Controlling Logical Unit States

The state of a DAC960SI logical unit can be ONLINE, CRITICAL, or OFF-LINE. Notice that the same term *on-line* is used for both physical drives and logical units.

Note: I/O operations can be performed only with logical units that are either *on-line* or *critical*.

On-line

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 failure of another of its physical drives may result in a loss of data.

A logical unit is *critical* if it meets both of the following conditions:

1. It is configured for RAID 1, RAID 5 or RAID 0+1
2. No more than one of its physical drives is *not* on-line.

Off-line

An *off-line* logical unit is one on which no data can be read or written. No operations can be performed on off-line logical units. System commands issued to off-line logical units are returned with an error status.

A logical unit can be off-line under one of two conditions:

1. It is configured with a redundant RAID level (1, 5, or 0+1) and two or more of its SCSI drives are *not* on-line
2. It is configured as RAID 0 or JBOD (or in a spanned set) and one or more of its SCSI drives are *not* on-line.

Controlling Standby Replacement Drives (Hot Spares)

The *standby replacement* drive, or *hot spare*, is one of the most important features the DAC960SI controller provides to achieve automatic, non-stop service with a high degree of fault-tolerance. With the standby rebuild function, the controller performs a rebuild operation automatically when a SCSI disk drive fails and both of the following conditions are true:

1. A standby SCSI disk drive of identical or larger size is found attached to the same controller;
2. All of the system drives that are dependent on the failed disk are redundant system drives, e.g., RAID 1, RAID 5, or RAID 0+1.

During the automatic rebuild process, system activity continues as normal. System performance may degrade slightly, however, during a rebuild.

Using Standby Rebuild

To use the automatic standby rebuild feature, it is necessary to always maintain a standby disk in the system.

A *standby* disk can be created in one of two ways.

1. A disk may be labeled as standby using the *Create Standby* option under the Configuration menu.
2. When the DAC960SI configuration is created or changed using the DACCF software utility, all disks attached to the controller that are not assigned to a drive group will be automatically labeled as standby disks.

Standby Replacement Table

A standby replacement table stores data on up to eight automatic replacement events in any session (from one power-on/reset to the next power-off/ reset). When the limit of eight is reached and a disk failure occurs, a standby replacement can take place but is not recorded in the replacement table.

The standby replacement table can be cleared from the DAC960SI by using the *Save Configuration* option under the Configuration menu.

Hot-Swap Drive Replacement

The DAC960SI supports the ability of certain drive enclosures to perform a *hot-swap* drive replacement while the system is on-line. A disk can be

disconnected, removed, or replaced with a different disk without taking the system off-line. The SCSI bus termination must be arranged so that a drive can be removed without disrupting the termination scheme.

Disk Failure Detection

The DAC960SI controller automatically detects SCSI disk failures. A monitoring process running on the controller checks, among other things, elapsed time on all commands issued to disks. A time-out will cause the disk to be reset and the command will be retried. If the command time-out occurs again, the disk could be killed by the controller (that is, its state changed to dead).

The DAC960SI 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 DAC960SI controller manages SCSI disk media errors in a manner transparent to the user.

Disks 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 5), and writes the data back to the disk that encountered the error. If the *write* fails, or the following *verify-of-data* fails, (media error on write), 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 a 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 Disk Parity

A parity check is a process that verifies the integrity of redundant data. For example, performing a parity 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 parity check reads all associated data blocks, computes parity, reads parity, and verifies that the computed parity matches the read parity.

Cache Management

The DAC960SI provides performance enhancement of data transfers through its on-board cache memory. The controller supports cache memory sizes from 4 MB (minimum) to 128 MB (maximum). 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 within specific applications.

Read Cache

Read cache is always enabled by the controller. Its operation is transparent and requires no user intervention.

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 data to be written. The target SCSI Drive will receive the data at a more appropriate time in order to increase controller performance.

Write-Through Cache

Write-Through Cache refers to a cache writing strategy whereby data is written to the SCSI Drive before a completion status is returned to the host operating system. This caching strategy is considered more secure, since a power failure will be less likely to cause loss of data. However, a Write-Through cache results in a slightly lower performance in most environments.

Cache Battery Backup

An optional cache battery backup is available that can be used to protect against cache data loss in the event of a power failure.

Chapter 3
User Interface

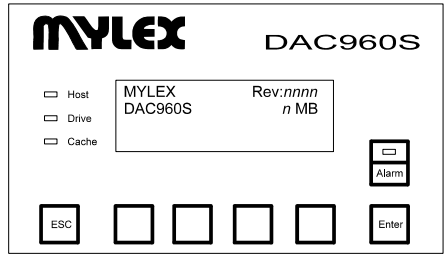

Figure 3-1. DAC960SI Front Panel Keypad and LCD

Overview

A touch-control keypad and a liquid crystal display (LCD) mounted on the front panel of the DAC960SI is the primary operational interface and monitor display for the disk array controller. This user interface controls all configuration and management functions for the DAC960SI controller and for all SCSI disk array subsystems to which it is properly connected.

A secondary operational interface is available through the DAC960SI serial port. By connecting a VT100 compatible terminal, or a PC operating in an equivalent terminal emulation mode, all controller monitoring, configuration and administration functions that are available from the DAC960SI front panel can instead be exercised from the VT100 terminal.

The DAC960SI front panel user interface, or the VT100 terminal, both access the built-in configuration and administration utility that resides in the controller's firmware. This utility provides complete control and management of the controller and disk arrays, eliminating the need for additional hardware or software drivers for that purpose.

User Interface Screen Modes

The DAC960SI controller's distinctive operating modes are represented by different displays on the front panel LCD or terminal monitor display. These modes are:

- Start-up
- Monitor mode
- Menu mode.

Note: The controller allows only one device at a time to access menus. The front panel keypad with LCD display and a VT100 terminal cannot be in the menus at the same time.

Navigating the LCD Screens

The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to three lines at a time of menu items or other information. The fourth line of the display shows controller status in Monitor mode. In Menu mode, the fourth line is usually an instruction line which shows an abbreviated list of functions that can be accessed by pressing the corresponding front panel keypad button below each abbreviation or prompt.

By pressing the keypad button, a command or menu function associated with that prompt is executed (if possible); otherwise, an error indication or status message is provided.

Start-up LCD Screen

The start-up title screen is displayed on the front panel LCD after the controller is powered-on. A built-in power-on self test (POST) diagnostic checks the controller functions during start-up. Any errors detected by the POST diagnostic are reported on the title screen. Otherwise, a successful start-up results in a title screen that displays: manufacturer identification, the on-board firmware release level, the controller board model number, the size of the on-board cache, and a status message that the startup was successful.

Figure 3-2. Title Screen Display

Monitor Mode LCD Screen

In Monitor Mode, the main title screen displays the STARTUP COMPLETE status message on the front panel LCD until:

1. Controller operations generate a new status message in its place.
2. Someone logs-on the controller, putting it into Menu Mode.

Menu Mode LCD Screen

Menu mode is reached by logging-on the controller, which causes the main menu screen to appear. Holding the Enter key for at least five seconds when the title screen is displayed will invoke the log-on sequence.

The main menu screen lists three sub-menu choices for Configuration, Administration, and Toolkit (utility) functions. The nxt prompt is also displayed, but its button does not control a function on this screen.

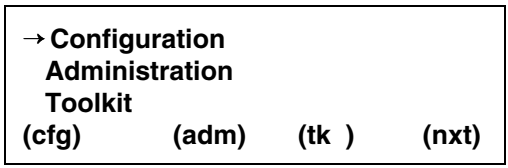

Figure 3-3. Main Menu Display

Each of the three menu choices that can be selected from the main menu screen will produce subordinate screens that invoke different functions for configuring and managing the SCSI disk array. These functions produce additional screens, and most of those screens also invoke commands associated with their specific functions.

The principal main menu command selections and the sub-menu commands that invoke additional subgenus or command functions are shown in Table 3-1 and are described throughout the subsequent chapters of this manual.

Navigating the VT100 Terminal Screens

Access to the DAC960SI built-in utility screens is achieved by sending a Break character from the VT100 terminal keyboard. On some terminals, this is achieved by pressing the <Ctrl> and <Break> keys together; and some terminal emulation modes may also require you to press the <Enter> or <Return> key (refer to the documentation for your specific terminal or terminal emulation software).

Start-up VT100 Screen

To start-up the controller's VT100 utility, power-on the terminal, the drives and the DAC960SI. From the VT100 terminal, start the DAC960SI Configuration/ Administration utility by issuing the ***Break*** command.

The Break command will cause a password prompt to appear on the monitor screen. Since password support is not implemented in this version of the DAC960SI, the prompt can be cleared by pressing the <Enter> or <Return> key to display the DAC960SI main monitor mode screen.

After you press the <Enter> or <Return> key to clear the password prompt. The terminal will display the Monitor Mode panel header (**`MESSAGE:`**).

Monitor Mode VT100 Screen

In Monitor Mode, the terminal monitor screen displays the status messages in the panel below the screen prompt indicated by the **`MESSAGE:`** header.

Any status message displayed in this panel will remain on screen until:

1. Controller operations generate a new status message in its place.
2. Someone presses the <Enter> or <Return> key, putting the controller into Menu Mode.
3. Someone presses the <Esc> key, causing the controller into exit the utility and return to the main terminal screen.

Menu Mode VT100 Screen

Press the <Enter> or <Return> key to display the Menu Mode screen. Menu Mode causes additional prompts and panels to be displayed on the screen below the Monitor Mode screen's **`MESSAGE:`** panel.

Up to three menu items at a time will display in the panel below the prompt **OPTIONS:** Respond to the on-screen prompts to select the desired configuration, administration or diagnostic functions.

Typing the number associated with a menu item in the **OPTIONS:** panel (such as **1**) causes the number to appear next to the prompt labeled **ENTER PARAMETER:**

When a menu item is selected, its number appears next to the **OPTIONS:** prompt to verify its selection.

Pressing the <Enter> key activates the selected function or sub-menu.

Pressing the < n > key accesses the next page of a menu when there are more than three items to list.

The panel below the **INSTRUCTIONS:** prompt shows an abbreviated list of other functions and the corresponding key to press for accessing each one.

Pressing the <Esc> key allows you to go back to the previous screen at nearly any point in the menus.

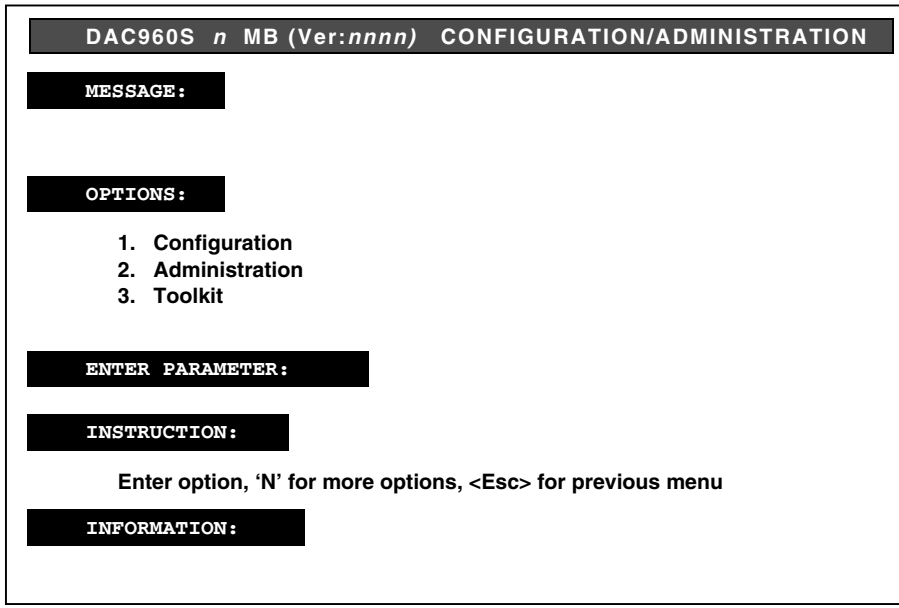

Figure 3-4. Menu Mode VT100 Utility Screen

Controller Screen Descriptions

The sections that follow show the principle LCD screens of the DAC960SI controller front panel user interface. They provide tabular descriptions of the controllers main features and functions.

Except for the title screen and the log-on screen, the screens are presented in the order in which they appear as subordinate command screens of the main menu selections. Some sub-menu screens have further subordinate screens, and these are shown and described immediately following their associated parent screen.

Descriptions for the Menu Mode screens and their subordinate screens are provided in the chapters that follow this one.

Screens for the VT100 utility are NOT shown in this manual for the sake of brevity. The functionality of each of the menu selections found on both the LCD panel and the VT100 screens is identical. To understand the basic principles underlying the functionality of one method of user interface is to understand the other's.

Descriptions of the LCD screens, however, contain additional prompts and messages relating to operating the DAC960SI controller's front panel keypad. Of course, these descriptions of the keypad operations do not apply to operating the VT100 terminal keyboard, but we have faith in you to be able to make the adjustment.

Menu Screen Locator

Table 3-1 provides a quick-reference guide to menu screen locations.

Table 3-1. Controller Menu Screen Locator

Main Menu Selection	Submenu Locator	Submenu Title
Configuration	Screen 1	Get Configuration
		Show Configuration
		Create Array
	Screen 2	Delete Last Array
		Create Standby
		Save Configuration
	Screen 3	Start Initialize
		Change Write Policy
Administration	Screen 1	Rebuild/Check Rate
		Start Rebuild
		Start Parity Check
	Screen 2	LUN Statistics
		Enclosure Status
Toolkit	Screen1	Show Drives
		Drive Information
		Change Drive State
	Screen 2	Format Drives
		Controller Parameters
		Controller Diagnostics
	Screen 3	AEMI Scan

Monitor Mode, Main Title Screen

Figure 3-5. Title Screen Display

Table 3-2. Title Screen Description

Indication/Key	Description
MYLEX	Manufacturer identification
Rev:*nnnn*	Controller firmware revision level
DAC960S	Controller model number
***n* MB**	Controller cache memory size
STARTUP COMPLETE	Status message indicates successful completion of power-on-self-test (POST) diagnostics
ESC	Not used
K1 - K4	Not used
Enter	Invokes menu access log-on procedure, when held for at least five seconds
Alarm	Resets audible alarm in all screens

Menu Mode, Log-in Password Prompt

Figure 3-6. Password Prompt Display

Table 3-3. Password Screen Description

Indication/Key	Description
PASSWORD	The password feature is not implemented in this version of the DAC960SI
ESC	Cancels the menu access routine and returns the display to the monitor mode main title screen
Enter	Clears the password prompt and launches the main menu screen

Menu Mode, Main Menu Screen

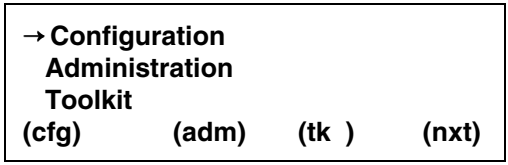

Figure 3-7. Main Menu Display

Table 3-4. Main Menu Description

Indication/Key	Description
Configuration	Menu selection that allows arrays to be created, configured, saved, or deleted
Administration	Menu selection that allows management of array resources
Toolkit	Menu selection for drive and controller utilities
→	Indicator arrow marks active selection
ESC	Displays the previous screen (title screen)
K1 (cfg)	Selects the Configuration menu screens
K2 (adm)	Selects the Administration menu screens
K3 (tk)	Selects the Toolkit menu screens
K4 (nxt)	Key not used on this screen
Enter	Invokes the menu selection indicated by the selection arrow

Chapter 4
Configuration Menu

Configuration Menu, Page One

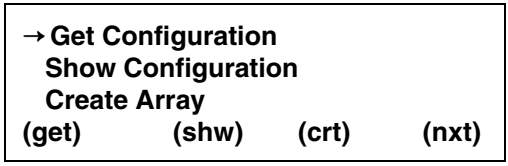

Figure 4-1. Configuration Menu, Page One

Table 4-1. Configuration Menu, Page One Description

Indication/Key	Description
Get Configuration	Function that loads the current saved configuration data into the controller temporary work space
Show Configuration	Menu selection that allows user to review the current configuration data
Create Array	Menu selection that allows user to define the configuration parameters for a new array drive group
→	Indicator arrow marks active selection
ESC	Displays the previous screen (main menu)
K1 (cfg)	Selects the Get Configuration function
K2 (adm)	Selects the Show Configuration function
K3 (tk)	Selects the Create Array function
K4 (nxt)	Selects the next page of Configuration menu selections
Enter	Invokes the submenu selection or function indicated by the selection arrow

Get Configuration Screen

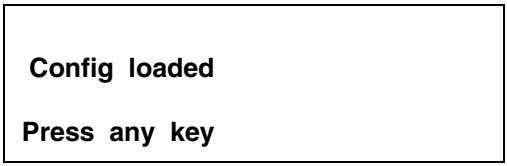

Figure 4-2. Get Configuration Screen

Table 4-2. Get Configuration Description

Indication/Key	Description
Config loaded	Indicates that current data is loaded into the controller's temporary work space
Press any key	Prompt to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous screen

Note: Always invoke the **Get Configuration** function before performing any array management task from the Configuration submenu. The Get Configuration command assures that the DAC960SI controller temporary work space contains the current configuration data.

Show Configuration, Page One

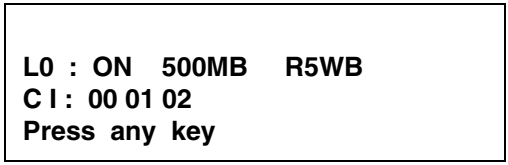

Figure 4-3. Show Configuration, Page One

Table 4-3. Show Configuration, Page One Description

Indication/Key	Description
L ***n***	Number indicates the currently displayed logical unit number (LUN)
ON OF CR	Indicates the status of the current logical unit. ON = on-line CR = critical OF = off-line
n **MB**	Number indicates the capacity (in megabytes) of the currently displayed logical drive
R ***n*** **(0 , 1 , 5 , 6 , 7)**	Number indicates the RAID level of the logical unit
W ***x*** **(WT , WB)**	Indicates the setting of the on-board write cache WT = Write Through (no write cache) WB = Write Back (write cache enabled)
C I : ***nn nn nn*** (etc.)	Number pairs indicate the SCSI address of each drive that comprise the logical unit. The first digit in each pair is the SCSI channel number. The second digit in each pair is the SCSI drive identification number (SCSI ID).
Press any key	Prompt to clear this status screen
ESC	Displays the previous menu screen
K1 - K4 , Enter	Displays the configuration data for the next logical drive or hot spare until all are shown, then displays the previous menu

Show Standby *(Show Configuration, Page Two)*

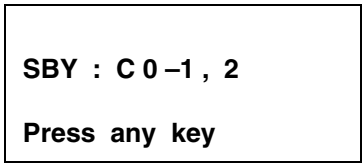

Figure 4-4. Show Configuration, Page Two

Table 4-4. Show Configuration, Page Two Description

Indication/Key	Description
SBY :	Indicates that information on this screen is for standby (hot spare) drives in the currently displayed configuration
C *n*	Number indicates the SCSI channel number of the standby drives
– *n*, *n*	Number indicates SCSI ID number of each standby drive on this channel
Press any key	Prompt to clear this status screen
ESC	Displays the previous menu screen
K1 - K4 , Enter	Displays the configuration data for the next channel with standby drives until all are shown, then displays the previous menu

Create Array Function

The Create Array function combines selected drives into a Drive Group. The Drive Group may be divided into multiple logical units, each with its own RAID level, cache policy, and capacity. Logical units may be added until the maximum capacity of the Drive Group is fully used.

Select SCSI Channel *(Create Array, Page One)*

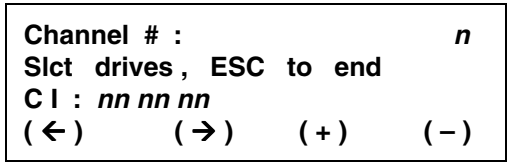

Figure 4-5. Select SCSI Channel; Create Array, Page One

Table 4-5. Create Array, Page One Description

Indication/Key	Description
Channel # *n*	Number indicates the channel identification for the drive to be used in the array
Slct drives, ESC to end	Prompt indicates user response options
C I : *nn nn nn*	Number pairs indicate the SCSI address of each drive that comprise the array. The first digit in each pair is the SCSI channel number. The second digit in each pair is the SCSI ID number. **Note:** No "CI" information is displayed until the first physical drive is selected.
ESC	1. Cancels the function (no array is created) and displays the previous menu screen when no drives are selected for the array. 2. Completes the SCSI channel selection function and displays the next page
K1 (←) , K2 (→)	Not used
K3 (+)	Increments channel number
K4 (–)	Decrements channel number
Enter	Invokes the channel number selection and displays the next page

Select Drives *(Create Array, Page Two)*

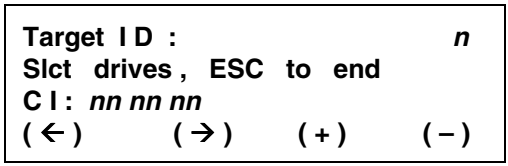

Figure 4-6. Select Drives, Create Array, Page Two

Table 4-6. Create Array, Page Two Description

Indication/Key	Description
Target ID : *n*	Number indicates the SCSI ID of a drive to add to the array being created
Slct drives, ESC to end	Prompt indicating user response options
C I : *nn nn nn* (etc.)	Number pairs indicate the SCSI address of each drive that comprise the array. The first digit in each pair is the SCSI channel number. The second digit in each pair is the SCSI ID number.
ESC	Completes the drive selection function and displays the next page
K1 (←)	Not used
K2 (→)	Not used
K3 (+)	Increments Target ID number
K4 (–)	Decrements Target ID number
Enter	Checks the drive selected, adds the drive to the array, and displays the prompt for the next selection

Notes:
1. Only unused or hot spare (standby) drives may be selected.
2. Drives must be physically connected to be used.
3. If an error message appears, wait 10 seconds for the drive to spin-up, then try again.

RAID Level *(Create Array, Page Three**)***

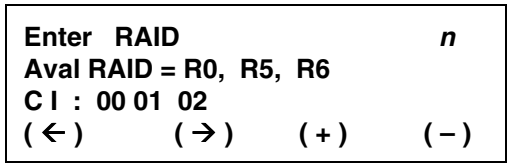

Figure 4-7. RAID Level; Create Array, Page Three

Table 4-7. Create Array, Page Three Description

Indication/Key	Description
Enter RAID *n*	Number indicates the RAID level to be assigned to the array being created. Only numbers for valid RAID levels are accepted
Aval RAID = R*n*	Prompt indicates the possible RAID level(s) that may be assigned to the logical unit
C I : *nn nn nn* (etc.)	Number pairs indicate the SCSI address of each drive that comprise the array. The first digit in each pair is the SCSI channel number. The second digit in each pair is the SCSI ID number.
ESC	Quits the function before the array is created. A prompt screen to Exit or Continue is displayed.
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the RAID level number
K4 (–)	Decrements the RAID level number
Enter	Invokes the function and displays the next page

LUN Size *(Create Array, Page Four)*

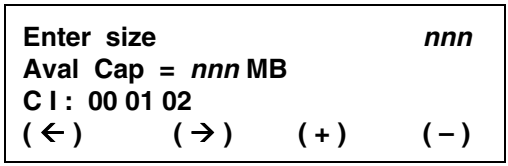

Figure 4-8. LUN Size; Create Array, Page Four

Table 4-8. Create Array, Page Four Description

Indication/Key	Description
Enter size *nnn*	Number sets the usable capacity (in megabytes) for the logical unit being created
Aval Cap = *nnn* MB	Indicates maximum drive capacity (in megabytes) available for the logical unit being created
C I : *nn nn nn* (etc.)	Number pairs indicate the SCSI identification of each drive that comprise the array. The first digit in each pair is the SCSI channel number. The second digit in each pair is the drive SCSI ID number.
ESC	Quits the function before the array is created. A prompt screen to Exit or Continue is displayed.
K1 (←)	Moves cursor to the left (below the drive capacity numbers)
K2 (→)	Moves cursor to the right (below the drive capacity numbers)
K3 (+)	Increments number above the cursor position
K4 (–)	Decrements number above the cursor position
Enter	Completes the size selection for this LUN and displays the next page

Note: All available capacity must be used when configuring the DAC960SI with the LCD panel or VT100 terminal. It is not necessary to initialize unneeded LUNs, however. To define an array *without* configuring all available capacity, use the DACCF software utility.

Write Cache Mode *(Create Array, Page Five)*

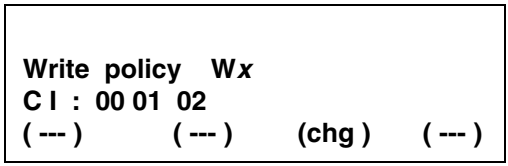

Figure 4-9. Write Cache Mode; Create Array, Page Five

Table 4-9. Create Array, Page Five Description

Indication/Key	Description
Write policy Wx	Indicates the setting of the on-board write cache for the logical unit being defined WT = Write Through (no write cache) WB = Write Back (write cache enabled)
C I : *nn nn nn*	Number pairs indicate the SCSI address of each drive that comprise the array. The first digit in each pair is the SCSI channel number. The second digit in each pair is the SCSI ID number.
K3 (chg)	Toggles the cache policy mode between WT and WB
ESC, K1, K2, K4, Enter	Invokes the cache mode selection and displays the next page

Confirm Logical Unit *(Create Array, Page Six)*

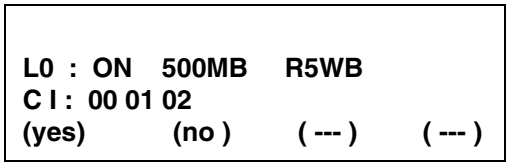

Figure 4-10. Logical Unit Confirmation; Create Array, Page Six

Table 4-10. Create Array, Page Six Description

Indication/Key	Description
L *n*	Number indicates the logical unit number (LUN)
ON OF CR	Indicates the status of the logical unit ON = on-line CR = critical OF = off-line
***nnn* MB**	Number indicates the size of the logical unit defined
R *n*	Number indicates the RAID level of the logical unit (RAID 0 , 1 , 5 , 6 = 0+1, 7 = JBOD)
WT WB	Indicates the write cache mode for the logical unit WT = Write Through WB = Write Back
C I : *nn nn nn* (etc.)	Number pairs indicate the SCSI address of each drive that will comprise the array. The first digit in each pair is the SCSI channel address. The second digit is the SCSI ID number.
K1 (yes)	Selection creates a logical unit with the configuration settings shown on this screen. If full capacity is used, the next page displays, otherwise, the RAID level page is displayed for the next logical unit until the full capacity is used.
K2 (no)	Selection cancels the creation of this logical unit and abandons the configuration data entered for this LUN (RAID level and LUN size). The user is returned to the screen shown in *Create Array, Page Three*.
ESC, K3, K4, Enter	Not used

Array Configuration *(Create Array, Page Seven)*

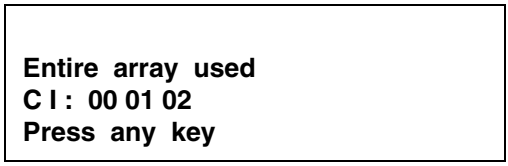

Figure 4-11. Array Configuration; Create Array, Page Seven

Table 4-11. Create Array, Page Seven Description

Indication/Key	Description
Entire array used	Message indicates that all available capacity on the drive group is assigned to one or more logical units
C I : ***nn nn nn***	Number pairs indicate the SCSI identification of each drive that will comprise the array. The first digit in each pair is the SCSI channel number. The second digit is the SCSI ID number.
Press any key	Prompt to clear this status screen
ESC, K1 - K4, Enter	Selection clears this message screen and displays the previous menu

Exit/Continue Configuration *(Create Array, Alternate Screen)*

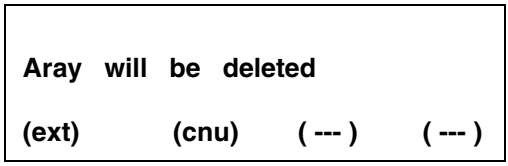

Figure 4-12. Exit/Continue Configuration; Create Array, Alternate Screen

Table 4-12. Exit/Continue, Alternate Screen Description

Indication/Key	Description
Aray will be deleted	Message indicates that all target ID, size and RAID level configuration data for all LUNs defined during this *Create Array* session will be deleted
K1 (ext)	Selection exits the function, deletes the LUNs and displays the previous menu. No array is created.
K1 (cnu)	Selection continues the Create Array function so that LUN definitions may be modified or saved
ESC, K3, K4, Enter	Not used

Configuration Menu, Page Two

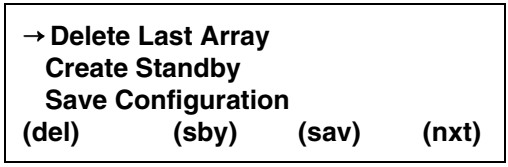

Figure 4-13. Configuration Menu, Page Two

Table 4-13. Configuration Menu, Page Two Description

Indication/Key	Description
Delete Last Array	Menu selection that allows user to remove the last drive group from the configuration
Create Standby	Menu selection that allows user to specify drive that will serve as a “hot spare” or standby drive
Save Configuration	Function saves new or modified configuration data to the controller non-volatile memory
→	Indicator arrow marks active selection
ESC	Displays the previous screen (main menu)
K1 (del)	Selects the Delete Last Array function
K2 (sby)	Selects the Create Standby function
K3 (sav)	Selects the Save Configuration function
K4 (nxt)	Selects the next page of Configuration menu selections
Enter	Invokes the submenu or function indicated by the arrow

Delete Last Array Function

The Delete Last Array function displays the logical unit numbers comprising the last Drive Group created, and deletes that Drive Group and all of its associated logical units.

WARNING

Data on the drives will be lost when the array is deleted.

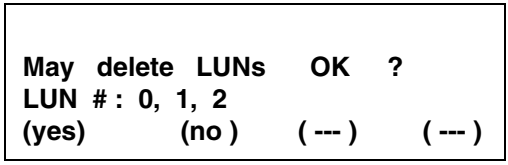

Figure 4-14. Delete Last Array Screen

Table 4-14. Delete Last Array Description

Indication/Key	Description
May delete LUNs OK?	Prompt indicates that the function will delete all logical units of the last Drive Group created
LUN # : *n*, *n*	Number identifies the LUNs that make up the last Drive Group created
ESC	Cancels the function (no array is deleted) and displays the previous menu screen
K1 (yes)	Selection deletes the last Drive Group created
K2 (no)	Cancels the function (no array is deleted) and displays the previous menu screen
K3, K4, Enter	Not used

Create Standby Function

The Create Standby function is used to designate a drive that will be a standby replacement or "hot spare" drive for a redundant array (e.g., RAID 1, RAID 5, or RAID 0+1).

Note: A standby drive must be created for the DAC960SI Automatic Rebuild function to operate properly with a redundant array.

Caution

A Standby Drive must have at least as much capacity as the largest drive in the array or the rebuild may not start.

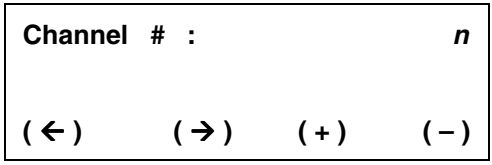

Figure 4-15. Select Channel; Create Standby, Page One

Table 4-15. Create Standby, Page One Description

Indication/Key	Description
Channel # *n*	Number indicates the SCSI channel number of the drive to be made a standby "hot spare"
ESC	Cancels the function (no standby drive is created) and displays the previous menu screen
K1 (←)	Not used
K2 (→)	Not used
K3 (+)	Increments channel number
K4 (–)	Decrements channel number
Enter	Selects the channel number indicated and displays the next page

Select Drive *(Create Standby, Page Two)*

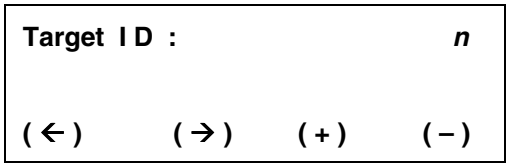

Figure 4-16. Select Drive; Create Standby, Page Two

Table 4-16. Create Standby, Page Two Description

Indication/Key	Description
Target ID : *n*	Number indicates the SCSI identification of a drive to be made a standby “hot spare”
ESC	Cancels the function (no standby drive is created) and displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the Target ID number
K4 (–)	Decrements the Target ID number
Enter	Invokes the standby drive selection and displays the next screen

Confirm Standby Drive *(Create Standby, Page Three)*

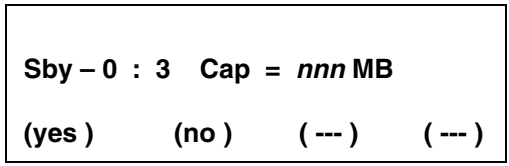

Figure 4-17. Standby Drive Confirmation; Create Standby, Page Three

Table 4-17. Create Standby, Page Three Description

Indication/Key	Description
Sby – *n*	Number indicates the SCSI channel number of the drive to be made a standby “hot spare”
: *n*	Number indicates the SCSI identification of a drive to be made a standby “hot spare”
Cap = *nnn* MB	Indicates maximum drive capacity (in megabytes) available for the standby drive being created
SBY size too small	Prompt notifies the user if the capacity of the standby drive is too small to be used in the existing configuration. If a drive failure were to occur, the Standby drive may not take over
ESC	Cancels the drive SCSI channel and Target ID selection and displays the first page of the Create Standby menu
K1 (yes)	Confirms the standby drive selection and displays the previous menu screen
K2 (no)	Cancels the drive SCSI channel and Target ID selection and displays the first page of the Create Standby menu
K3 , K4, Enter	Not used

Save Configuration Function

The Save Configuration function must be invoked whenever a configuration is created or changed in order for the configuration parameters to take effect.

Caution

Data may be lost if the configuration is changed on an active array.

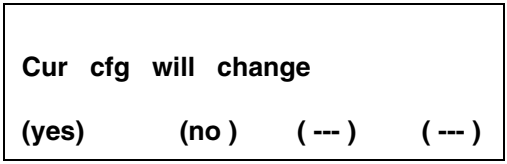

Figure 4-18. Save Configuration Screen

Table 4-18. Save Configuration Description

Indication/Key	Description
Cur cfg will change	Prompt notifies the user that the function will change the current configuration
K1 (yes)	Selection saves the current configuration and returns the display to the previous menu
K2 (no)	Cancels the function (no configuration is saved) and displays the previous menu screen
ESC, K3, K4, Enter	Not used

Configuration Menu, Page Three

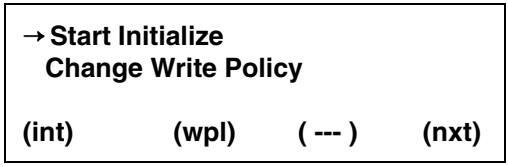

Figure 4-19. Configuration Menu, Page Three

Table 4-19. Configuration Menu, Page Three Description

Indication/Key	Description
Start Initialize	Menu selection that allows user to initialize the logical units
Change Write Policy	Menu selection that allows user to select the cache write policy (Write Through or Write Back) that will provide the best performance for the array
→	Indicator arrow marks active selection
ESC	Displays the previous screen (main menu)
K1 (int)	Selects the Start Initialize function
K2 (wpl)	Selects the Change Write Policy function
K3 (--)	Not used
K4 (nxt)	Selects the next page of Configuration menu selections
Enter	Invokes the submenu or function indicated by the arrow

Start Initialize

The Initialize function should be used on all logical units immediately after they are created and before data is written. Initialization clears all data on the logical unit and synchronizes the parity and mirror information with the data.

WARNING

Failure to initialize a newly created logical unit can result in loss of data.

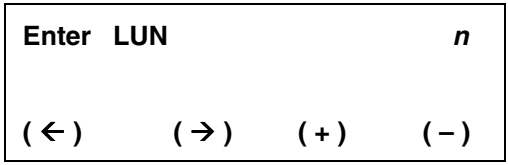

Figure 4-20. Start Initialize, Page One

Table 4-20. Start Initialize, Page One Description

Indication/Key	Description
Enter LUN ***n***	Number indicates the logical unit number of the logical unit to be initialized
ESC	Cancels the function (nological unit is initialized) and displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the logical unit number
K4 (–)	Decrements the logical unit number
Enter	Invokes the Initialization function and displays the prompt for the next message screen

Initialize Confirmation *(Start Initialize, Page Two)*

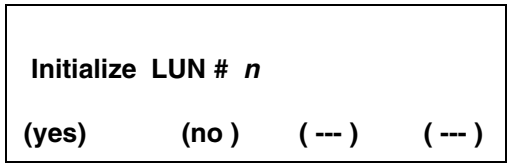

Figure 4-21. Start Initialize, Page Two

Table 4-21. Start Initialize, Page Two Description

Indication/Key	Description
Initialize LUN # *n*	Prompt notifies the user that the function will initialize the LUN identified by the number shown
K1 (yes)	Selection starts the initialization process and returns the display to the previous menu
K2 (no)	Cancels the function (no initialization is performed) and displays the previous menu screen
ESC, K3, K4, Enter	Not used

Caution

Pressing Yes will immediately begin the initialization function. Initializing the wrong logical units can result in data loss.

Initialize Status *(Start Initialize, Page Three)*

Figure 4-22. Start Initialize, Page Three

Table 4-22. Start Initialize, Page Three Description

Indication/Key	Description
Initialize started	Message indicates the initialization process is started
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu, initialization process continues in background mode until completed

Note: Pressing the ESC key several times will display the monitor mode main screen:

1. An audible alarm (beep) sounds periodically until the initialization process is complete
2. Status indication showing the completion percentage of the initialization process displays on the monitor mode main title screen

Change Write Policy

The Change Write Policy function

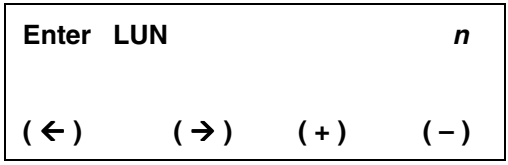

Figure 4-23. Start Initialize, Page One

Table 4-23. Start Initialize, Page One Description

Indication/Key	Description
Enter LUN *n*	Number indicates the logical unit identification of the logical unit on which to Change Write Policy
ESC	Cancels the function (no change is made) and displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the logical unit number
K4 (–)	Decrements the logical unit number
Enter	Invokes the Initialization function and displays the prompt for the next message screen

Write Policy Confirmation *(Change Write Policy, Page Two)*

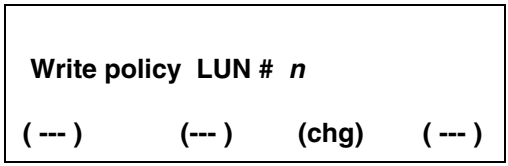

Figure 4-24. Change Write Policy, Page Two

Table 4-24. Change Write Policy, Page Two Description

Indication/Key	Description
Write policy LUN #*n* -W*x*	Prompt notifies the user that the function will change the cache write policy for the LUN identified by the number shown to W*x* (WB or WT)
K3 (chg)	Selection toggles the write policy between WB (Write Back) and WT (Write Through)
ESC, K1, K2, K4	Not used
Enter	Invokes the function (the change is made) and displays a prompt to return to the previous menu

Save Configuration Prompt
(Configuration Menu, Alternate Screen)

The Save Configuration Prompt will display if the user has not saved a new or modified configuration before attempting to initialize the array or exit the Configuration Menu.

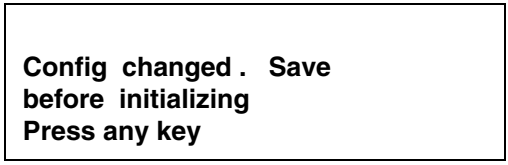

Figure 4-25. Save Configuration Prompt; Configuration Menu, Alternate Screen

Table 4-25. Save Configuration Prompt, Alternate Screen Description

Indication/Key	Description
Config changed. Save before initializing	Prompt notifies the user that a change to the current configuration was made but not saved
Press any key	Prompt to clear this status screen
ESC, K1 - K4, Enter	Selection clears this message screen and displays the previous menu

Initialize Locial Unit Prompt

(Configuration Menu, Alternate Screen)

The Initialize Logical Unit Prompt will display if the user has not initialized a new or modified configuration before attempting exit the Configuration Menu.

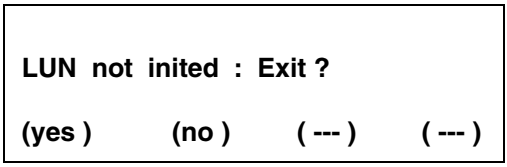

Figure 4-26. Initialize LUN Prompt; Configuration Menu, Alternate Screen

Table 4-26. Initialize LUN Prompt, Alternate Screen Description

Indication/Key	Description
LUN not inited: Exit?	Prompt notifies the user that a change to the current configuration was made and saved but the new logical units are not initialized
K1 (yes)	Selection exits theConfiguration Menu and returns the display to the previous menu. The new or changed configuration is not initialized.
K2 (no)	Selection returns the user to the Configuration Menu, where the Start Initialize function may be selected.
ESC, K3, K4, Enter	Not used

Chapter 5
Administration Menu

Administration Menu, Page One

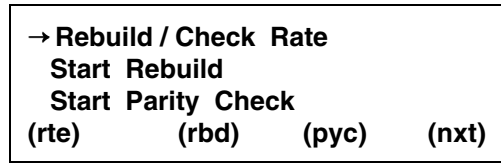

Figure 5-1. Administration Menu, Page One

Table 5-1. Administration Menu, Page One Description

Indication/Key	Description
Rebuild / Check Rate	Menu selection that allows user to specifiy the controller rebuild and parity check priority rate
Start Rebuild	Menu selection that allows user to start a rebuild process
Start Parity Check	Menu selection that allows user to start a parity check on a logical unit
→	Indicator arrow marks active selection
ESC	Displays the previous screen (main menu)
K1 (rte)	Selects the Rebuild / Check Rate function
K2 (rbd)	Selects the Start Rebuild function
K3 (pyc)	Selects the Start Parity Check function
K4 (nxt)	Selects the next page of Administration menu selections
Enter	Invokes the submenu selection or function indicated by the selection arrow

Rebuild/Check Rate

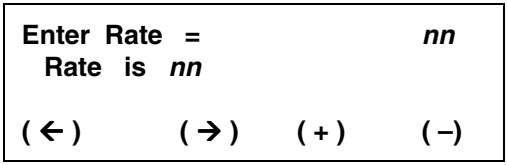

Figure 5-2. Rebuild/Check Rate, Page One

Table 5-2. Rebuild/Check Rate, Page One Description

Indication/Key	Description
Enter Rate = *nn*	Number indicates the amount of background activity the controller allocates to the Rebuild/Parity Check operation Lowest priority setting = 0 Highest priority setting = 50
Rate is *nn*	Number indicates the existing rate setting
ESC	Cancels the Rebuild/Parity Check Rate entered on this screen and displays the next page
K1 (←)	Moves cursor below number to the left
K2 (→)	Moves cursor below number to the right
K3 (+)	Increments Rate number
K4 (–)	Decrements Rate number
Enter	Invokes the selection, sets the working Rebuild/Parity Check Rate, and displays the next page

Rate Setting *(Rebuild/Check Rate, Page Two)*

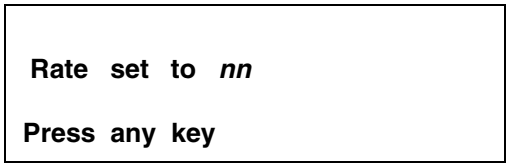

Figure 5-3. Rate Setting, Rebuild/Check Rate, Page Two

Table 5-3. Rebuild/Check Rate, Page Two Description

Indication/Key	Description
Rate set to *nn*	Indicates the current Rebuild/Parity Check Rate
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu

Start Rebuild Function

The Rebuild function is used after a drive has failed. It restores the original information on a replacement drive.

Note: Rebuilding a drive may impact controller performance. Use the Rebuild Rate function to vary the priority that the controller allocates to the Rebuild process.

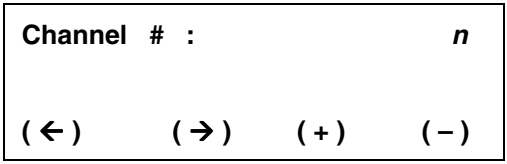

Figure 5-4 Start Rebuild, Page One

Table 5-4. Start Rebuild, Page One Description

Indication/Key	Description
Channel # : *n*	Number indicates the SCSI channel of the drive to rebuild
ESC	Displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments channel number
K4 (–)	Decrements channel number
Enter	Selects the drive channel for the drive to be rebuilt and displays the next screen

Select Target Drive *(Start Rebuild, Page Two)*

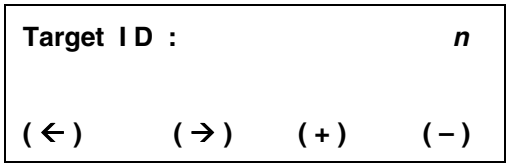

Figure 5-5. Select Target Drive, Start Rebuild, Page Two

Table 5-5. Start Rebuild, Page Two Description

Indication/Key	Description
Target ID : *n*	Number indicates the SCSI ID of the drive to rebuild
ESC	Displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the drive SCSI ID number
K4 (–)	Decrements the drive SCSI ID number
Enter	Selects the drive to rebuild, invokes the Rebuild process, and displays the next screen

Rebuild Status *(Start Rebuild, Page Three)*

Figure 5-6. Rebuild Status, Start Rebuild, Page Three

Table 5-6. Start Rebuild, Page Three Description

Indication/Key	Description
Rebuild started	Message indicates that the Rebuild process is started
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu, rebuild process continues in background mode until completed

Notes:
1. An audible alarm (beep) sounds periodically until the Rebuild process is complete.
2. Status indication showing the completion percentage of the Rebuild is displayed on the monitor mode main title screen.

Start Parity Check

The Parity Check function is used to verify the integrity of data on a logical drive (LUN). It verifies that mirror or parity information matches the stored data on the LUNs that are redundant (RAID 1, RAID 5. or RAID 1+0).

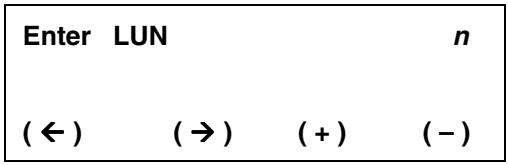

Figure 5-7. Start Parity Check, Page One

Table 5-7. Start Parity Check, Page One Description

Indication/Key	Description
Enter LUN *n*	Number indicates the logical unit number (LUN) of the logical unit to be checked
ESC	Cancels the function (no logical unit is checked) and displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the logical unit number
K4 (–)	Decrements the logical unit number
Enter	Selects the logical unit to check, invokes the Parity Check function, and displays the next message screen

Parity Check Confirmation *(Start Parity Check, Page Two)*

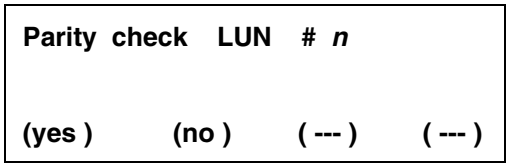

Figure 5-8. Parity Check Confirmation; Start Parity Check, Page Two

Table 5-8. Parity Check Confirmation, Page Two Description

Indication/Key	Description
Parity check LUN # – *n*	Number indicates the logical unit number (LUN) of the logical unit selected to parity check
ESC	Cancels the parity check and displays the first page of the Administration menu
K1 (yes)	Invokes the Start Parity Check function and displays the previous menu screen
K2 (no)	Cancels the parity check and displays the first page of the Administration menu
K3 , K4, Enter	Not used

Parity Check Status *(Start Parity Check, Page Three)*

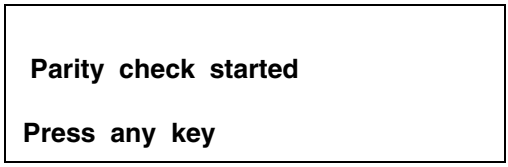

Figure 5-9. Parity Check Status, Start Parity Check, Page Three

Table 5-9. Start Parity Check, Page Three Description

Indication/Key	Description
Parity check started	Message indicates that the Parity Check process is started
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu, parity check process continues in background mode until completed

Notes:
1. An audible alarm (beep) sounds periodically until the parity check process is complete.
2. Status indication showing the completion percentage of the parity check displays on the monitor mode main title screen.

Administration Menu, Page Two

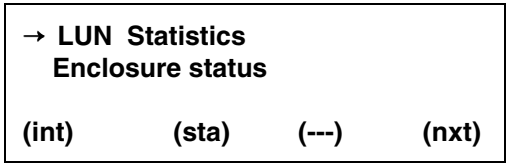

Figure 5-10. Administration Menu, Page Two

Table 5-10. Administration Menu, Page Two Description

Indication/Key	Description
LUN Statistics	Menu selection that provides statistical data about the logical units
Enclosure status	Menu selection that displays status of the fan, power supply, and temperature in an AEMI-compliant array enclosure
→	Indicator arrow marks active selection
ESC	Displays the previous screen (main menu)
K1 (int)	Selects the Start Initialize function
K2 (sta)	Selects the LUN Statistics function
K3 (---)	Not used
K4 (nxt)	Selects the next page of Administration menu selections
Enter	Invokes the submenu or function indicated by the arrow

LUN Statistics

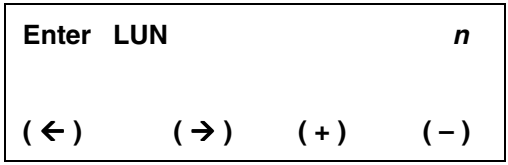

Figure 5-11. LUN Statistics, Page One

Table 5-11. LUN Statistics, Page One Description

Indication/Key	Description
Enter LUN ***n***	Number indicates the logical unit number (LUN) of the logical unit from which to view statistics
ESC	Cancels the function and displays the previous menu screen
K1, K2	Not used
K3 (+)	Increments the logical unit number
K4 (–)	Decrements the logical unit number
Enter	Invokes the LUN Statistics function and displays the next page

Statistics Display *(LUN Statistics, Page Two)*

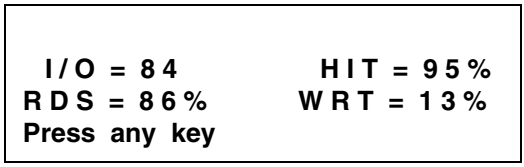

Figure 5-12. LUN Statistics, Page Two

Table 5-12. LUN Statistics, Page Two Description

Indication/Key	Description
I/O = *n* %	Number indicates the I/O transfers per second since the last time this function was invoked
HIT = *n* %	Number indicates percentage of cache read hits since the last time this function was invoked
RDS = *n* %	Number indicates percentage of LUN I/Os that were reads since the last time this function was invoked
WRT = *n* %	Number indicates percentage of LUN I/Os that were writes since the last time this function was invoked
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu

Note: The 99% total percentage number, achieved by adding I/O reads and I/O writes, is due to the rounding down of the third decimal place of the two numbers.

Enclosure Status

The DAC960SI includes cabinet fault reporting for AEMI-compatible enclosures. Status is reported on up to three fans, three power supply units (PSUs), and one enclosure temperature sensor. The status messages (pass/fail) report only the fault signals input from the enclosure.

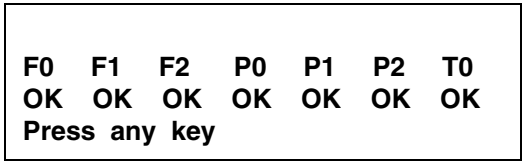

Figure 5-13. Enclosure Status

Table 5-13. Enclosure Status

Indication/Key	Description
F *n* **=** Fan	Number indicates the enclosure fan identification
P *n* **=** Power unit	Number indicates the enclosure power supply unit identification
T0 **=** Temperature	Indicates the enclosure temperature sensor status
message	OK = operating within specified parameters ! F = failure, or operating out of specification
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu

Chapter 6
Toolkit Menu

Toolkit Menu, Page One

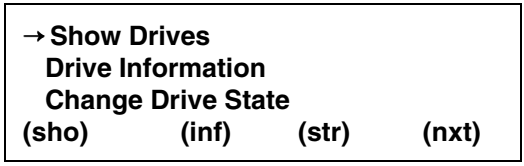

Figure 6-1. Toolkit Menu, Page One

Table 6-1. Toolkit Menu, Page One Description

Indication/Key	Description
Show Drives	Function that displays the operational state of drives in the array (online, dead, standby, write-only), and the first logical unit number associated with each drive
Drive Information	Menu selection that allows user to get specific information about an individual drive
Change Drive State	Menu selection that allows user to set a drive operational state to online, dead, or standby
→	Indicator arrow marks active selection
ESC	Displays the previous screen (main menu)
K1 (sho)	Invokes the Show Drives function
K2 (inf)	Selects the Drive Information function
K3 (str)	Selects the Change Drive State function
K4 (nxt)	Selects the next page of Toolkit menu selections
Enter	Invokes the submenu selection or function indicated by the selection arrow

Show Drives Function

The Show Drives function provides drive status information at-a-glance.

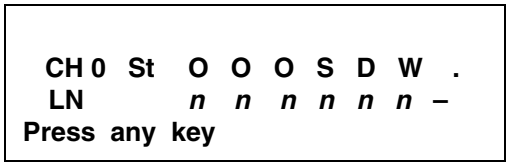

Figure 6-2. Show Drives Screen

Table 6-2. Show Drives Description

Indication/Key	Description
CH ***n***	Number indicates which SCSI channel is displayed
St ***x x x***	Indication shows the state of each SCSI drive on the channel. SCSI ID 0 = First position SCSI ID 1 = Second position . . . . . SCSI ID 6 = Last position O = Online S = Spare D = Dead W = Write-Only **.** = Unconfigured drive
LN ***n n n***	Numbers indicate the first logical unit associated with each drive represented directly above
Press any key	Prompt for user action to clear this screen
ESC	Displays the previous screen
K1-K4, Enter	Displays the screen for the next SCSI channel until all are shown

Drive Information

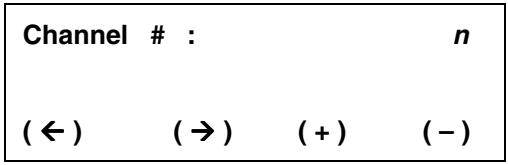

Figure 6-3. Drive Information, Page One

Table 6-3. Drive Information, Page One Description

Indication/Key	Description
Channel # : *n*	Number indicates the SCSI channel of the drive about which to display information
ESC	Displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the channel number
K4 (–)	Decrements the channel number
Enter	Selects the drive channel of the drive about which to display information and displays the next screen

Select Drive *(Drive Information, Page Two)*

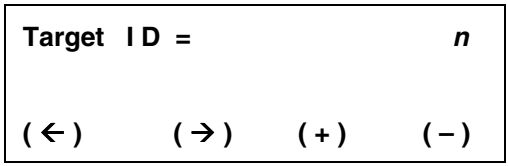

Figure 6-4. Drive Information, Page Two

Table 6-4. Drive Information, Page Two Description

Indication/Key	Description
Target ID = *n*	Number indicates the SCSI ID of the drive about which to show information
ESC	Displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the drive Target ID number
K4 (–)	Decrements the drive Target ID number
Enter	Selects the drive information function and displays the next screen

Information Display *(Drive Information, Page Three)*

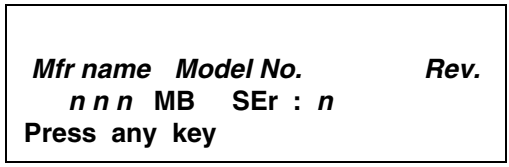

Figure 6-5. Drive Information, Page Three

Table 6-5. Drive Information, Page Three Description

Indication/Key	Description
Mfr name	Name of the drive manufacturer
Model No.	Manufacturer's model number for the drive
Rev.	Manufacturer's revision number for the drive
nnn **MB**	Numbers indicate the capacity (in megabytes) of the drive
Ser : *n*	Number indicates the number of soft errors attributed to this drive
Press any key	Prompt for user action to clear this screen
ESC, K1-K4, Enter	Displays the previous screen

Change Drive State

The Change Drive State function is used to recover from accidental drive state changes. If a user changes a failed drive to an Online state by mistake, data integrity may be compromised.

WARNING

Changing the state of a drive can result in data loss.

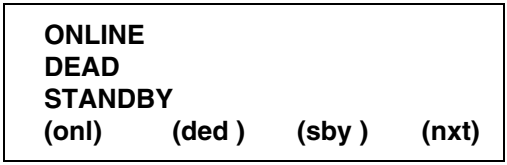

Figure 6-6. Change Drive State, Page One

Table 6-6. Change Drive State Page One Description

Indication/Key	Description
ONLINE	Menu selection that allows the user to change a drive state to Online
DEAD	Menu selection that allows the user to change a drive state to Dead
STANDBY	Menu selection that allows the user to change a drive state to Standby
→	Indicator arrow will appear and mark the active selection
ESC	Displays the previous menu screen
K1 (onl)	Invokes the change drive state function to make the drive Online
K2 (ded)	Invokes the change drive state function to make the drive Dead
K3 (sby)	Invokes the change drive state function to make the drive Standby
K4 (nxt)	Not used
Enter	Invokes the function indicated by the arrow

Select Channel *(Change Drive State, Page Two)*

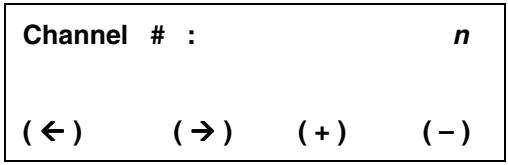

Figure 6-7. Select Channel, Change Drive State, Page Two

Table 6-7. Select Channel, Change Drive State, Page Two Description

Indication/Key	Description
Channel # : *n*	Number indicates the SCSI channel of the drive that will change state
ESC	Displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments channel number
K4 (–)	Decrements channel number
Enter	Selects the drive channel for the drive that will change state and displays the next screen

Select Target Drive *(Change Drive State, Page Three)*

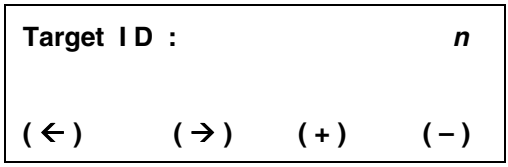

Figure 6-8. Select Drive, Change Drive State, Page Three

Table 6-8. Select Drive Change Drive State, Page Three Description

Indication/Key	Description
Target ID : *n*	Number indicates the SCSI ID of the drive that will change state
ESC	Displays the previous menu screen
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the drive SCSI ID number
K4 (–)	Decrements the drive SCSI ID number
Enter	Selects the drive to change state, invokes the Change Drive State process, and displays the next screen

Status of Change *(Change Drive State, Page Four)*

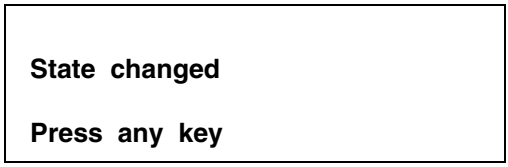

Figure 6-9. Status, Change Drive State, Page Three

Table 6-9. Status, Change Drive State, Page Three Description

Indication/Key	Description
State changed	Message indicates that the selected drive has changed state
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu

Note: An audible alarm sounds when a drive state is changed to Dead

Toolkit Menu, Page Two

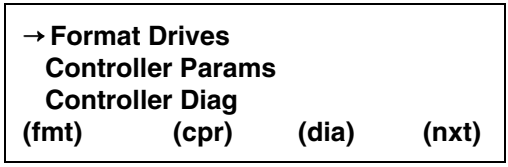

Figure 6-10. Toolkit Menu, Page Two

Table 6-10. Toolkit Menu, Page Two Description

Indication/Key	Description
Format Drives	Menu selection that allows user to perform a low-level format on drives not yet in an array
Controller Params	Menu selection that allows user to change specific operating parameters for the controller, drives, and SCSI channels
Controller Diag	Menu selection that allows user to run a self-test diagnostic on the controller
→	Indicator arrow marks the active selection
ESC	Displays the previous screen (main menu)
K1 (fmt)	Selects the Format Drives function
K2 (cpr)	Selects the Controller Parameters function
K3 (dia)	Selects the Controller Diagnostics function
K4 (nxt)	Selects the next page of Toolkit menu selections
Enter	Invokes the submenu selection or function indicated by the selection arrow

Format Drives Function

The Format Drives function performs a low level format on selected drives.

WARNING

Formatting a drive will result in loss of all data on that drive. Make sure that the correct drives are selected before starting the Format Drives function.

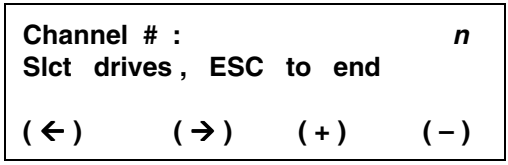

Figure 6-11. Select Channel, Format Drives, Page One

Table 6-11. Select Channel, Format Drives, Page One Description

Indication/Key	Description
Channel # : *n*	Number indicates the SCSI channel of the drive to be formatted
Slct drives, ESC to end	Prompt for user action
ESC	Cancels the function and displays the previous menu screen if no drive is selected
K1 (←) . K2 (→)	Not used
K3 (+)	Increments the drive channel number
K4 (–)	Decrements the drive channel number
Enter	Selects the drive channel containing the drives to be formatted and displays the next screen

Select Drive *(Format Drives, Page Two)*

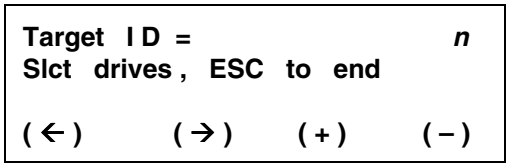

Figure 6-12. Select Drive Screen, Format Drives, Page Two

Table 6-12. Format Drives, Page Two Description

Indication/Key	Description
Target ID : *n*	Number indicates the SCSI ID of the drive to be formatted
Slct drives, ESC to end	Prompt for user action
ESC	1. Cancels the Format Drives function and displays the previous menu if no drives were selected for formatting by pressing the Enter key. 2. Completes the drive selection function and displays the next page
K1 (←), K2 (→)	Not used
K3 (+)	Increments the drive SCSI ID number
K4 (–)	Decrements the drive SCSI ID number
Enter	Invokes the Select Drive function and displays another Select Channel page to allow selection of another drive for formatting

Format Confirmation *(Format Drives, Page Three)*

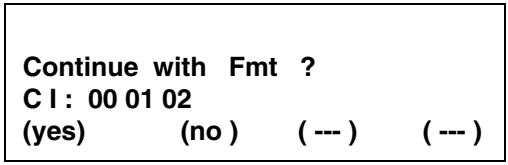

Figure 6-13. Confirm Format, Format Drives, Page Three

Table 6-13. Format Confirmation, Format Drives, Page Three Description

Indication/Key	Description
Continue with Fmt ?	Prompt indicates that the function will start the Format Drives process on all drives listed on the next line
C I : ***nn nn nn***	Number pairs indicate the SCSI identification of each drive that will be formatted. The first digit in each pair is the SCSI channel number. The second digit is the SCSI ID number.
ESC	Cancels the function (no drives are formatted) and displays the previous menu screen
K1 (yes)	Selection formats all drives listed
K2 (no)	Cancels the function (no drives are formatted) and displays the previous menu screen
K3, K4, Enter	Not used

WARNING

Selecting YES will immediately start the Format Drives process. ALL DATA WILL BE LOST on the drive(s) being formatted.

Format in Progress *(Format Drives, Page Four)*

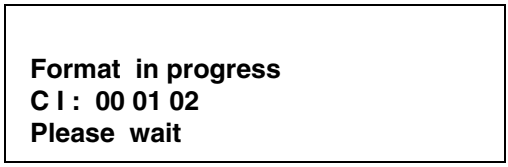

Figure 6-14. Format in Progress Screen, Format Drives, Page Four

Table 6-14. Format Drives, Page Four Description

Indication/Key	Description
Format in progress	Message line indicates that the drive formatting is in process on the selected drive's listed on the next line
C I : 00 01 02	Number pairs indicate the SCSI ID of each drive that is being formatted
Message	Message line will prompt for user action when all drive formatting is complete and it is time to clear this status screen
ESC , K1 - K4 , Enter	No function until drive formatting is complete. Displays previous menu screen after Format Drives process is complete for all selected drives

Format Status *(Format Drives, Page Five)*

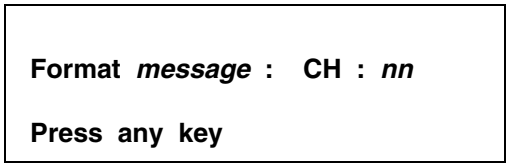

Figure 6-15. Format Status Screen, Format Drives, Page Five

Table 6-15. Format Drives, Page Five Description

Indication/Key	Description
Format *message*	Message indicates the status of the formatting process on the listed drive Format complete = Drive formated successfully Format failed = Drive did not format correctly
C H : *nn*	Number pairs indicate the SCSI ID of the drive about which format status is being reported
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu

Controller Parameters

The Controller Parameters function displays the current state of various controller settings. It allows the user to change these settings with predefined optional settings.

WARNING

Saving parameter changes causes the controller's working parameters to change. This can produce unpredictable results if it occurs during host/drive activity. All activity to the controller should be stopped before saving parameter changes.

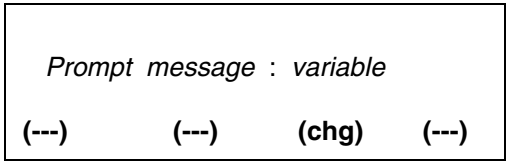

Figure 6-16. Controller Parameters Screen

Table 6-16. Controller Parameters Description

Indication/Key	Description
Prompt :	Message indicates controller parameter to be displayed
variable	Message indicates the current parameter state
ESC	Cancels the function. If changes were made, it displays the save parameters screen, otherwise it displays the previous menu screen
K1, K2, K4	Not used
K3 (chg)	Changes the current parameter selection
Enter	Records the current parameter selection to the controller's temporary working space and displays the next parameter until all have been shown

Save Changes *(Controller Parameters)*

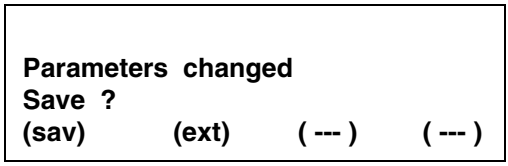

Figure 6-17. Save Controller Parameters

Table 6-17. Save Controller Parameters Description

Indication/Key	Description
Parameters changed	Message indicates that some controller parameter settings have changed from their previous value
Save ?	Prompt for user action to clear this message screen
K1 (sav)	Selection changes the controller's working parameters and saves the new settings to the controller's non-volatile memory
K2 (ext)	Selection exits the function without saving any changes
ESC , K1 - K4 , Enter	Not used

Controller Parameter Settings

The default settings for the DAC960SI controller parameters are shown in Table 6-18. These settings will provide optimum performance for most applications and usually will not need to be changed. In some applications, it may become necessary to change one or more of the default settings. Before making any changes to the default parameter settings, please read the provided descriptions of the parameter settings and fully understand the implications of the change that is about to be made.

WARNING

Inappropriate changes to the controller parameter settings can result in degraded performance or, possibly, data loss.

Table 6-18. Controller Parameter Variable Settings

Prompt	Description	Selection
Auto Rbld Mgmt	Automatic Rebuild Management function	Enable*/Disable
Fault Mgmt	Fault Management function	Enable* / Disable
SCSI Active Neg	SCSI Active Negation function	Enable/Disable*
Ctl Read Ahd	Controller Read Ahead function	Enable* / Disable
Super Read Ahd	Super Read Ahead function	Enable* / Disable
Cmd Tag, Chn# *n*	Command Tag, channel number	Enable* / Disable
Force 8 Bit, Ch *n*	Fast SCSI mode, channel number	Enable / Disable*
SCSI Xfr, Chn# *n*	SCSI Transfer rate, channel number	10MB*, Asyn , 8MB, 5MB
Spinup	SCSI device spin-up method	Automatic*, On Power, On Command
Stripe Size (KB)	Sequential data (Stripe) transfer size	8*, 16, 32, 64 KB
Blk Size (Bytes)	Block size in bytes	512* (Not changable)

* Indicates default setting

Automatic Rebuild Management

The Automatic Rebuild Management function works in conjunction with features in AEMI certified disk array enclosures. It detects the removal of a failed drive and performs an automatic rebuild after a replacement drive is installed into a redundant (fault tolerant) array (RAID 1, RAID 5, and RAID 0+1).

Automatic Rebuild Management requires hardware compatibility with disk array enclosures that are certified AEMI (Array Enclosure Management Interface) compliant.

Fault Management

The Fault Management function monitors and reports drive failures, background activity completion status, enclosure events, etc. This function should remain enabled during normal controller operation. Do not disable this function unless specifically instructed to do so as part of a trouble-shooting diagnostic activity.

SCSI Active Negation

The SCSI Active Negation function controls the negation of SCSI signals. When using the faster transfer rates associated with future technologies such as Ultra-SCSI (which is not supported on the DAC960SI at this time), this feature may have to be enabled. Active Negation provides faster negation of SCSI signals than negation with pull-up drivers, which is currently the default negation method (Active Negation Disabled).

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 encorporates 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 operation.

Command Tag (Drive Channel)

The Command Tag (Drive Channel) function controls the SCSI command tag queuing support for each drive channel. This function should normally remain enabled. Disable this function only when using older SCSI drives that do not support command tag queuing.

Force 8bit (Drive Channel)

The Force 8bit (Drive Channel) function allows the controller to communicate with Wide SCSI (16 bit) devices connected to it through a Narrow SCSI (8 bit) data cable on the specified drive channel.

The default setting for the Force 8bit function is *disabled*. Enabling this option prevents the controller from negotiating for wide SCSI transfers. This function should be enabled only when connecting Wide SCSI (16 bit) drives or devices to the controller using a Narrow SCSI (8 bit) cable.

SCSI Transfer

The SCSI Transfer function sets the maximum transfer rate for each drive channel. The default setting is 10MB. This setting produces 10 MB/sec transfers for Fast SCSI and 20 MB/sec transfers for Fast and Wide SCSI. The default setting should be changed only if problems are encountered in communicating with a drive. Do not change the default setting unless you are doing so as part of a trouble-shooting activity.

Note: Problems communicating with a drive can be caused by several conditions; e.g.: improper termination, wrong drive ID setting, SCSI cable is too long, faulty equipment, etc.

Spin-up

The Spin-up function controls how the SCSI drives in the array are started (spun-up). There are three different Spin-up modes that may be selected by the user. The default mode setting is Automatic.

Automatic This spin-up mode causes the controller to spin-up all connected drives, two-at-a-time at six second intervals, until every drive in the array is spinning. The controller then interrogates each drive, one-at-a-time at six second intervals, and confirms that the drive is ready for use. The interrogation process repeats until all drives have been verified.

On Power This spin-up mode assumes that all drives are already spinning and proceeds to interrogate the drives in the same manner as is described for Automatic mode.

On Command This spin-up mode causes the controller to wait for a spin-up command from the host. It then proceeds to spin-up the drives in the same manner as is described for Automatic mode.

Stripe Size

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, or OLTP processing)
- Larger stripe sizes provide better performance for sequential transfers (e.g., RAID 0, RAID 0+1; digital video, etc.).

The default setting is 8K (optimum random I/O performance and reduced sequential throughput). Changing the stripe size to 16K, 32K, or 64K alters the way data is written on the drives connected to the DAC960SI controller.

WARNING

1. **DATA LOSS will occur after changing the stripe size on a controller with existing logical units. Always back-up all data before making a stripe size change.**
2. **Always reconfigure and initialize the logical units after a new stripe size is saved.**

Block Size

The Block Size parameter indicates that the logical block sizes of the LUNs are 512 bytes. This firmware release supports only the default setting of 512 bytes and cannot be changed.

Caution

Data corruption may occur if a block size different than 512 bytes is used with controller firmware release versions 1.14 or earlier.

Controller Diag

The Controller Diag function allows the user to start the built-in self-test diagnostic program. This is the same diagnostic program that runs automatically when the controller is first powered-on. The only response reported by the diagnostic program is either *pass* of *fail*.

Since there are no user-serviceable parts in the controller, a *failure* message usually means the controller must be returned to a factory-authorized service center for repair.

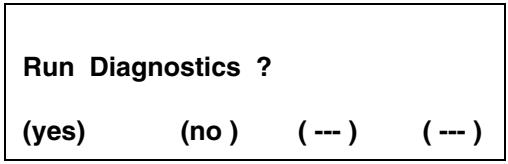

Figure 6-18. Run Diagnostics Confirmation, Controller Diag, Page One

Table 6-19. Run Diagnostics Confirmation, Page One Description

Indication/Key	Description
Run Diagnostics?	Prompt indicates that the function will start the Controller Diagnostics program
K1 (yes)	Selection runs the diagnostic program
K2 (no)	Cancels the function (no diagnostics are run) and displays the previous menu screen
ESC, K3, K4, Enter	Not used

Diagnostics Status *(Controller Diag, Page Two)*

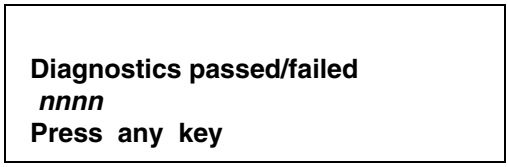

Figure 6-19. Diagnostics Status, Controller Diag, Page Two

Table 6-20. Diagnostics Status, Controller Diag, Page Two Description

Indication/Key	Description
Diagnostics *message*	Message indicates the results of the controller diagnostics check. **Passed** indicates all parameters tested were within specified norms **Failed** indicates the parameter identified by the error code is out of tolerance
nnnn	Error code identifies out of tolerance condition found by the diagnostic program
Press any key	Prompt for user action to clear this status screen
ESC , K1 - K4 , Enter	Displays the previous menu

Toolkit Menu, Page Three

The AEMI Scan function is a diagnostic utility that is used to scan the SCSI drive channels to detect the removal or insertion of a drive.

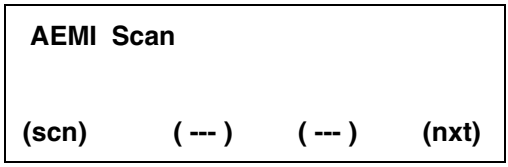

Figure 6-20. AEMI Scan, Page One

Table 6-21. AEMI Scan, Page One Description

Indication/Key	Description
AEMI scan	Function that will start the controller's built-in utility AEMI Scan diagnostic program
K1 (scn)	Selects the AEMI Scan diagnostic program utility
K4 (nxt)	Cancels the function (no scan is run) and displays the previous menu screen
ESC	Cancels the function, exits the Toolkit Menu and displays the Main Menu screen
K2, K3	Not used
Enter	Invokes the AEMI Scan function and displays the next screen

Select Channel *(AEMI Scan, Page Two)*

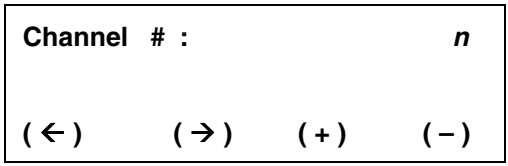

Figure 6-21. Select Channel Screen, AEMI Scan, Page Two

Table 6-22. AEMI Scan, Page Two Description

Indication/Key	Description
Channel # : *n*	Number indicates the SCSI channel to be scanned
ESC	Cancels the AEMI Scan function and displays the previous menu
K1 (←) , K2 (→)	Not used
K3 (+)	Increments the SCSI drive channel number
K4 (–)	Decrements the SCSI drive channel number
Enter	Invokes the AEMI Scan function and displays the next screen

AEMI Scan Started *(AEMI Scan, Page Three)*

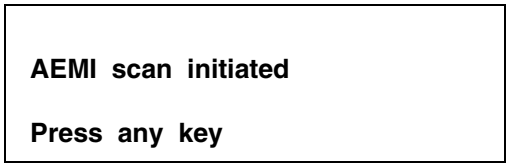

Figure 6-22. AEMI Scan Started, AEMI Scan, Page Three

Table 6-23. AEMI Scan Started, AEMI Scan, Page Three Description

Indication/Key	Description
AEMI scan initiated	Message indicates the AEMI Scan diagnostics program is loaded and ready to be run
Press any key	Prompt for user action to run the scan on the selected SCSI channel
Alarm (Tone)	Audible alarm tone indicates that the AEMI Scan detected a change in the number of drives present on the tested SCSI channel
ESC , K1 - K4 , Enter	Invokes the AEMI Scan function and displays the previous menu

Reference

Appendices

Appendix A

Error Messages

Glossary

Manual No. 771941

Appendix A
Error Messages

Table A-1. DAC960SI Error Messages

Error Message	Description	Menu/Function
Cannot Format Drive	Invalid choice of drive	Format Drives
Cannot use drive	Invalid choice of drive	Create Array
Controller Busy	Diagnostics could not be run because controller is busy	Controller Diag
Cur cfg will change	Current configuration will change if Save is invoked	Save Configuration
Diagnostics Failed	Controller diagnostics failed	Controller Diag
Entire array used	No space remains in current array to create additional logical units	Create Array
Error Code : *nnnn*	Diagnostics failed, number indicates type of failure	Controller Diag
Fail:Chk/Rbl in Prog	Failure due to a parity check or rebuild already in progress	LUN operation
Failed: Bad EEPROM	Failure in saving the configuration to EPROM	Save Configuration
Failed: Bad NVRAM	Failure in saving the configuration to Non-volatile RAM	Save Configuration
Failed: Channel Busy	Drive channel is busy	Drive Information Change Drive State
Failed: Check in Prog	A parity check is is progress on the addressed LUN	LUN operation
Failed: Disk failed	New disk failure	Start Rebuild
Failed: Drive Dead	Failure due to a dead dependent drive	LUN operation
Failed: Drv Not Ready	Unable to start drive	Drive Information Change Drive State

Table A-1. DAC960SI Error Messages (continued)

Error Message	Description	Menu/Function
Failed: Init in prog	Failed because an initialization is in progress	LUN operation
Failed: Invalid Dev	Failure due to an invalid device	Rebuild Drive Drive Information Change Drive State
Failed: Invalid LUN	Failure due a non-redundant logical unit or because a LUN does not exist	LUN operation
Failed: No Device	Drive or other device not available	Drive Information Change Drive State
Fail: Rbl/Chk in Prog	Rebuild failed because another rebuild or parity check is already in progress	Start Rebuild
Failed: Start failed	Rebuild failed because drive could not start or was Online	Start Rebuild
Failed: State Changed	A change of state has occurred	Save Configuration
Format Failed	Failure on Format function	Format Drives
Invalid drive	Invalid choice of drive	Create Standby
Invalid Device #	Invalid device address	All menus requiring a device address
Max LUNs created	Maximum number of logical units have been created	Create Array
No arrays defined	There are no LUNs to delete	Delete Array
No LUNs defined	Invalid configuration	Create Standby Show Configuration
No Stat Avail	No LUN statistics are available	LUN operation
Saving failed	Unable to save configuration changes to controller parameters	Controller Params
SEr: *n*	The number of drive soft errors	Drive Information
Undefined LUN	Invalid LUN selection	LUN operation

Table A-2. DAC960SI Warning Messages

Warning Message	Description	Menu/Function
Aray will be deleted	Attempt to quit before array is created will cause configuration entries made in this Create Array session to be lost	Create Array
LUN not inited: Exit?	Attempt to exit menu before initializing a LUN that was created	Configuration Menu
SBY size too small	The size of the Standby Drive is too small to use in the existing configuration	Create Standby

Glossary

Cache
Controller memory used to speed up data transfer to and from a disk.

Channel
A path for the transfer of data and control information between drives and the drive controller. Disk array controllers often have multiple channels and each channel supports multiple drives.

Data transfer capacity
The amount of data moved between devices. Generally measured in Megabytes/sec.

Disk striping
The controller divides data into blocks and writes them across multiple drives for increased performance.

Hot spare
A physical drive not part of a logical unit that the controller can use to automatically rebuild a logical unit that goes critical.

I/O
Input/Output. Refers to disk read and writes.

Logical Unit
Disk storage space on one or more physical drives which appears to the computer as one drive. (Sometimes referred to as a system drive or a logical drive.)

RAID levels
The disk array controllers monitored by this utility support three standard (RAID 0, RAID 1, RAID 5) and two special RAID levels (RAID 0+1, and JBOD).

RAID 0
The controller stripes data across multiple drives.

- Benefits: Very high data throughput, especially for large files.
- Drawbacks: Does not deliver any fault tolerance. All data is lost if any drive in the array fails.
- Uses: Intended for non-critical data requiring high performance.

RAID 1

Disk mirroring -- controller duplicates data from one drive to another.

- Benefits: Provides 100% data redundancy. Should one drive fail, the controller simply switches reads and writes to the other drive.
- Drawbacks: Requires two drives for the storage space of one drive. While a controller is rebuilding a drive, users will experience reduced performance if they try to read or write data to the logical unit.
- Uses: When data availability is most important.

RAID 5

Stripes blocks of data and parity information across all drives.

- Benefits: Uses a fraction of the disk space required by RAID 1 to achieve data redundancy. 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 on the failed drive by regenerating the missing information. The controller can recreate lost data on a replacement drive without interrupting access by users. The controller will do so automatically if a Hot Spare is available or the administrator can manually initiate a rebuild.
- Drawbacks: Cannot match RAID 0 in write performance because of the processing required to compute and write error-correction data. While the controller is rebuilding a drive, users will experience reduced performance if they try to read or write data to the logical unit.

RAID 0+1

Combines the benefits of disk mirroring (RAID 1) and data striping (RAID 0).

- Benefits: Optimizes for both fault tolerance and performance. Provides excellent performance for all data needs.
- Drawbacks: Requires half the available disk space for data redundancy just like RAID 1.

JBOD (Just a Bunch Of Drives)

The controller treats a single drive as a standalone disk and provides a high-performance cache.

- Benefits: Cache reduces the amount of time the computer has to wait for a disk to get to the right place to read or write data.
- Drawbacks: Does not provide data redundancy and does not use striping for performance enhancements.

MYLEX DAC960 Problem Report

Customer Identification	DAC960 Identification
Name: _____	Date: _____ Purchase Date:_____
Company: _____	Model_____
Address: _____	Invoice Number: _____
_____	Serial Number: _____
_____	# Chnls:_____ Cache:_____
Country: _____	Firmware Ver:_____ BIOS Ver: _____
	Make/Model/Size/Type of
Phone Number: _____	Drives:_____
Fax Number: _____	Disk: _____
	Non-Disk: _____

System Information

Motherboard:_____ CPU Speed: _____ BIOS Ver: _____
Video Adapter: _____ Network Card: _____ MB Memory:_____
Operating Sys:_____ Other Disk Ctrl: _____ Other Cards: _____

Pack Configuration

Indicate in matrix below 1, 2... for member of pack 1, pack 2... respectively. Indicate S, T, C, or O for Standby, Tape, CDROM and other drives.

Channel	SCSI ID						
	0	1	2	3	4	5	6
0							
1							
2							
3							
4							

System Drive Configuration

System Drive	Size	RAID Level	Write Back/ Thru
0			
1			
2			
3			
4			
5			
6			
7			

Problem Description

_____
_____
_____
_____
_____
_____
_____
_____

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