Dell™ CERC ATA100/4-channel RAID Controller

User's Guide

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SECTION 1

Overview

Documentation

CERC (Cost-Effective RAID Controller) is a half-sized PCI adapter card that provides a way to improve the performance and availability of your storage subsystems. An entry-level-to-mid-range RAID controller solution, CERC offers high transfer rates and fault-tolerant data redundancy by using low-cost Ultra ATA drives in desktops, workstations, or low-end servers.

You can connect one to four drives in Master mode to the CERC card and can configure these drives using a simple setup menu embedded in the CERC BIOS. The CERC card supports the following drive modes: PIO 0-4, Multiword DMA 0-2, and Ultra DMA 0-5. In addition, it supports RAID levels 0, 1, 5, and 10.

Documentation

The technical documentation set includes:

- *CERC User's Guide*
- *CERC Configuration Software Guide*
- *CERC Operating System Driver Installation Guide*

CERC User's Guide

The *CERC User's Guide* contains information about installing the RAID controller. It also contains general introductory information about RAID, RAID system planning, and configuration information. Read the *CERC User's Guide* before you read the *CERC Configuration Software Guide*.

CERC Configuration Software Guide

This manual provides information about CERC software utility programs. You will not need this manual until after you have planned your RAID system and have installed the RAID controller. RAID system planning, installation, and configuration information is provided in the *CERC User's Guide*. Read the *CERC User's Guide* before you read the *CERC Configuration Software Guide*.

CERC Operating System Driver Installation Guide

This manual provides all the information you will need to install the appropriate operating system software drivers.

SECTION 2

Features

CERC is a half-size, four-channel IDE RAID card built around this proven SCSI Dell™ PowerEdge™ RAID Controller (PERC) technology. The CERC RAID card supports all major operating systems.

This chapter discusses the following:

- Self-monitoring analysis and reporting technology (SMART)
- Configuration on Disk
- Hardware architecture
- Array performance
- RAID management
- Fault tolerance
- Utility programs
- Software drivers

SMART Technology

SMART technology detects predictable drive failures. SMART monitors the internal performance of all motors, heads, and drive electronics.

Configuration on Disk

Configuration on Disk (drive roaming) saves configuration information both in non-volatile random access memory (NVRAM) on the RAID controller and on the hard drives connected to the RAID controller. If the RAID controller is replaced, the new RAID controller can detect the actual RAID configuration, maintaining the integrity of the data on each drive, even if the drives have changed channels.

Compatibility

The RAID controller is compatible with the following:

- SNMP managers
- IDE hard drives
- All IDE backup and utility software

Hardware Requirements

The CERC RAID controller can be installed in a system that contains the following:

- Motherboard with 5 V/3.3 V PCI expansion slots
- Support for PCI version 2.1 or later
- An Intel® Pentium II®, Celeron®, or more powerful CPU
- A diskette drive
- A color monitor
- A VGA adapter card
- A mouse
- A keyboard.

CERC Specifications

Table 2-1. CERC Specifications contains the specifications for the CERC card.

Table 2-1. CERC Specifications

Parameter	Specification
Card size	6.877" x 4.178" (half-length PCI)
Processor	Intel i960RS™ 32-bit RISC processor @ 100 MHz
Bus type	PCI 2.2
Bus data transfer rate	Up to 132 MB/s

Table 2-1. CERC Specifications *(continued)*

Parameter	Specification
BIOS	AMIBIOS®
Cache configuration	16 MB ECC through a 66MHz 72-bit unbuffered 3.3V SDRAM soldered to the PCB.
Firmware	1 MB × 8 flash ROM
NVRAM	32 KB × 8 for storing RAID configuration
Operating voltage	5.00 V ± 0.25 V
IDE controller	Two IDE controllers for IDE support
IDE data transfer rate	Up to 100 MB/s
Devices per channel	One IDE device per channel. Up to four per CERC card.
RAID levels supported	0, 1, 5, and 10

PCI Bridge/CPU

The RAID card uses the Intel i960RS PCI bridge with an embedded 80960JT RISC processor running at 100 MHz. The RS bridge handles data transfers between the primary (host) PCI bus, the secondary PCI bus, and CPU. The DMA controller supports chaining and unaligned data transfers. The embedded 80960JT CPU directs all controller functions, including command processing, IDE data transfers, RAID processing, drive rebuilding, cache management, and error recovery.

Cache Memory

Cache memory for the RAID card resides in an unbuffered synchronous dynamic random access memory (SDRAM.) The maximum achievable memory bandwidth is 528 MB/s.

The RAID card supports write-through or write-back caching, selectable for each logical drive. The default write policy is write-through. The default read policy for the RAID card is adaptive read-ahead caching. The other options for the read policy are read-ahead, and no read-ahead.

NOTICE: Write-back caching is not recommended for the physical drives. When write cache is enabled, data can be lost when the power is interrupted.

CERC BIOS

The BIOS provides an extensive setup utility that can be accessed by pressing <Ctrl><M> at BIOS initialization. The BIOS Configuration Utility is described in the *CERC Configuration Software Guide*.

Configuration Features

Table 2-2. Configuration Features displays the CERC configuration features.

Table 2-2. Configuration Features

Specification	Feature
RAID levels	0, 1, 5, and 10
IDE channels	Four
Maximum number of drives per channel	One
Array interface to host	PCI 2.2
Drive interface	Supports up to four ATA/UDMA 100 drives.
	Four internal IDE connectors (one drives per channel)
	Drive modes supported:
	• UDMA 5/4/3/2/1/0
	• MDMA 2/1/0
	• PIO 4/3/2/1/0
Cache size	16 MB of 32-bit, 66 MHz On-board ECC SDRAM Memory
Cache function	Write-through, write-back, adaptive read ahead, no read ahead, read ahead
Multiple logical drives/arrays per controller	Up to 40 logical drives per controller
Maximum number of CERC controllers per system	1
Online capacity expansion	Yes
Dedicated and pool hot spare	Yes

Table 2-2. Configuration Features *(continued)*

Specification	Feature
Flashable firmware	Yes
Hot swap devices supported	Yes
Non-disk devices supported	No
Mixed capacity hard drives	Yes
Number of 16-bit internal IDE connectors	Four
Support for hard drives with capacities of more than 8 GB	Yes
Clustering support (Failover control)	No
Online RAID level migration	Yes
RAID remapping	Yes
No reboot necessary after expansion	Yes
Hardware clustering support on the board	No
User-specified rebuild rate	Yes

Hardware Architecture Features

Table 2-3. Hardware Architecture Features displays the hardware architecture features.

Table 2-3. Hardware Architecture Features

Specification	Feature
Processor	Intel i960RS 100
IDE controller	AMI MG80649
Size of flash ROM	1 MB
Amount of NVRAM	32 KB
Direct I/O	Yes
Direct I/O bandwidth	132 MB/s

Array Performance Features

Table 2-4. Array Performance Features lists the array performance features.

Specification	Feature
Host data transfer rate	132 MB/s
Drive data transfer rate	100 MB/s
Maximum scatter/gathers	26 elements
Maximum size of I/O requests	6.4 MB in 64 KB stripes
Stripe sizes	2 KB, 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB
Maximum # of concurrent commands	255

RAID Management Features

Table 2-5. RAID Management Features lists the RAID management features.

Specification	Feature
Support for simple network management protocol (SNMP)	Yes
Performance monitor provided	Yes
Remote control and monitoring	Yes
Event broadcast and event alert	Yes
Hardware connector	I2C
Drive roaming	Yes
Support for concurrent multiple stripe sizes	Yes

Table 2-5. RAID Management Features

Specification	Feature
RAID management utilities: • BIOS Configuration Utility (operating system independent) • CERC Manager (Novell® NetWare®, Red Hat Linux) • WebBIOS Configuration Utility • Dell OpenManage™ Array Manager on Dell OpenManage Server Assistant® CD (Novell NetWare, Windows NT®, Windows® 2000)	Yes
Novell NetWare server support using a GUI client utility	Yes
Desktop management interface (DMI) support	Yes

Fault Tolerance Features

The RAID card fault-tolerance features are:

- Automatic failed drive detection
- Manual failed drive rebuild

Automatic Rebuild of Failed Drives

If you use hot spares, the firmware can automatically detect and rebuild failed drives using the hot spare. The RAID controller support automatic rebuild only on hot spare drives. The hot spare must have enough capacity to rebuild the data that was on the failed drive. See Creating Hot Spares in Configuring Arrays and Logical Drives.

Manual Rebuild of Failed Drives

The rebuild is not automatic under any of the following conditions:

- You don't use hot spares.
- The hot spares don't have enough capacity to rebuild the failed drive, and you replace the drive manually. You need to use the configuration utilities to perform the rebuild.

- IDE drive hot swap is not supported by the system or a hot swap is not performed even though the system supports hot swap.

Table 2-6. Fault Tolerance Features lists the CERC fault tolerance features.

Table 2-6. Fault Tolerance Features

Specification	Feature
Support for SMART	Yes
Drive failure detection	Automatic
Drive rebuild using hot spares	Automatic
Parity generation and checking	Software

Software Utilities

Table 2-7. Software Utility Features displays the software utility features.

Table 2-7. Software Utility Features

Specification	Feature
Graphical user interface	Yes
Management utility	Yes
Bootup configuration	Yes
Online read-, write-, and cache- policy switching	Yes
Internet and intranet support through transmission control protocol (TCP)/internet protocol (IP)	Yes

Operating System Software Drivers

The CERC RAID controller includes drivers for the following operating systems:

- Windows NT
- Windows 2000
- Novell NetWare 5.1, 6.x
- Red Hat Linux 7.1, 7.2, 7.3, 2.1 Advanced Server

For information about installing drivers for other operating systems, see the *CERC Operating System Driver Installation Guide*.

📝 **NOTE:** Be sure to use the latest Service Packs (updates) provided by the operating system manufacturer. Visit the Dell | Support web site at **support.dell.com** for the latest CERC operating system support information, including new operating systems, and the latest service packs and drivers.

Onboard Speaker

The RAID card has an onboard speaker that generates audible warnings when system errors occur.

RAID Management Utilities

Software utilities enable you to manage and configure the RAID system and CERC, create and manage multiple disk arrays, control and monitor multiple RAID servers, provide error statistics logging, and provide online maintenance. The utilities include:

- BIOS Configuration Utility
- Dell Manager
- WebBIOS Configuration Utility
- Dell OpenManage™ Array Manager

BIOS Configuration Utility

The BIOS Configuration Utility configures and maintains RAID arrays, formats hard drives, and manages the RAID system. It is independent of any operating system. See the *CERC Configuration Software Guide* for additional information.

Dell Manager

Dell Manager is a character-based utility that works in DOS, Red Hat Linux 7.1, 7.2, and 7.3, and Novell NetWare 5.1 and 6.*x*. See the *CERC Configuration Software Guide* for additional information.

WebBIOS Configuration Utility

WebBIOS is an HTML-based utility used to configure and manage a RAID system on a server. See the *CERC Configuration Software Guide* for additional information.

Dell OpenManage Array Manager

Dell OpenManage Array Manager is used to configure and manage a storage system that is connected to a server, while the server is active and continues to handle requests. Array Manager runs under Novell NetWare, Windows NT, and Windows 2000. Refer to Dell documentation at the Dell | Support web site at **support.dell.com** for more information.

SECTION 3

Hardware Installation

Requirements

Hardware Installation Steps

Migrating Existing Non-RAID Data to a CERC System

Requirements

You must have the following items to install the RAID controller:

- A CERC RAID controller
- A host computer with an available PCI expansion slot
- The CERC RAID controller installation CD
- The necessary IDE cables
- An uninterruptible power supply (UPS) for the entire system
- IDE hard drives

Hardware Installation Steps

The following is an overview about installing the controller. These steps are described in detail in the rest of this section.

1 Unpack the RAID controller and inspect for damage.

   Make sure all items are in the package. If damaged, call your Dell™ Support.

2 Turn the computer off, remove the power cord, then remove the cover.

3 Check the jumper settings on the RAID controller.

   The jumper J2 should not be shorted.

4 Install the RAID card.

5 Set the IDE devices to master or cable select (CS).

6 Connect the IDE cables to IDE devices.

7 Replace the cover, connect the power cord, then turn the power on.

8 Run the BIOS Configuration Utility to configure arrays and logical drives.

9 Install software drivers for the desired operating systems.

Perform the following steps to install the RAID card and configure the arrays and logical drives.

Step 1: Unpack

Unpack and install the hardware in a static-free environment. The RAID controller is packed in an anti-static bag between two sponge sheets. Remove the card and inspect it for damage. If the card appears damaged, or if any item listed below is missing, contact Dell support. The RAID card is accompanied by the following items:

*   The *CERC Configuration Software Guide* (on CD)
*   The *CERC Operating System Driver Installation Guide* (on CD)
    *   The *CERC User's Guide* (on CD)

🖉 **NOTE:** If ordered, you will receive hard-copy documentation for the controller.

*   Dell OpenManage™ Array Manager on the *Dell OpenManage Server Assistant*® CD.

Step 2: Power Down

Turn off the computer and physically remove the power cord from the back of the power supply. Remove the cover from the chassis. Make sure the computer is disconnected from any networks before installing the controller card.

Step 3: Set Jumpers

Make sure the jumper settings on the CERC RAID card are correct. Table 5-1. Jumpers and Connectors displays the jumpers and connectors.

🖉 **NOTE:** Make sure that J2, J3, and J13 are unconnected.

Table 5-1. Jumpers and Connectors

Connector	Description	Type
J2	Force BIOS enable	2-pin header
J3	Reserved	4-pin header
J13	Reserved	2-pin header

RAID Card Layout

Figure 5-1. RAID Card Layout shows the location of the channels, jumpers, flash BIOS, and other features on the RAID card.

Figure 5-1. RAID Card Layout
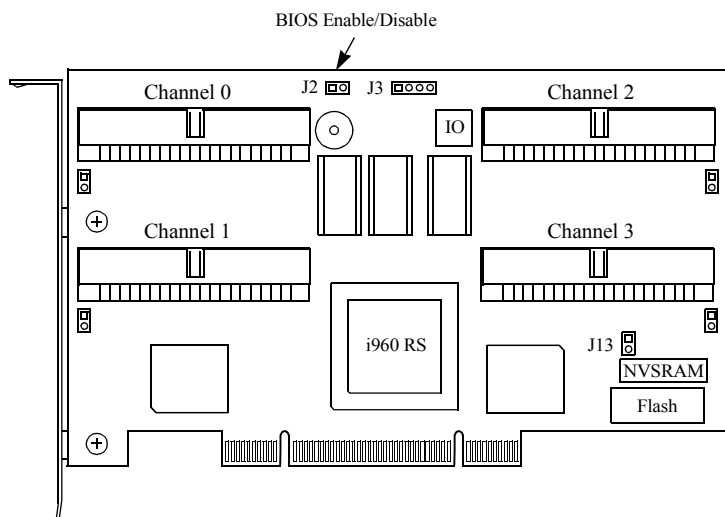
Step 4: Install the RAID Controller

Select a 3.3 V or 5 V PCI slot and align the RAID card bus connector to the slot, as shown in Figure 5-3. Installation of RAID Card. Press down gently, but firmly to make sure that the card is properly seated in the slot. The bottom edge of the controller card should be flush with the slot. Figure 5-2. 3.3 V and 5 V PCI Slots for RAID Controller displays the PCI slots on the motherboard.

Figure 5-2. 3.3 V and 5 V PCI Slots for RAID Controller
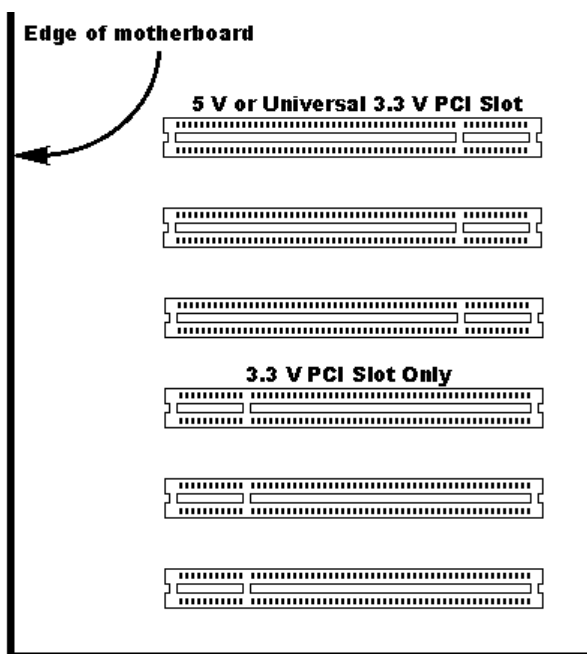
Screw the bracket to the computer frame.

Figure 5-3. Installation of RAID Card
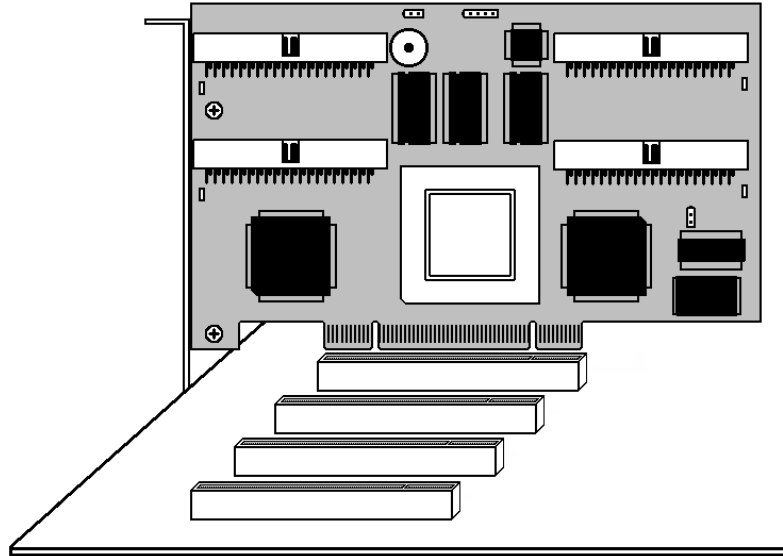
Step 5: Set Up the IDE Devices

Before you install the IDE devices, you must set the drive as a master or cable select (CS). To do this, see the documentation for the IDE drive.

Step 6: Connect IDE Cables

Connect the IDE cables to IDE devices. The RAID card provides four ATA100 IDE cables. Match pin 1 on the cable to pin 1 on the IDE channel connector.

Step 7: Start the System

Replace the cover and reconnect the AC power cords. Turn power on to the computer.

During boot, the CERC BIOS message appears:

```
CERC ATA100/4ch RAID Controller BIOS Version x.xx date

Copyright (c) LSI Logic Corporation

Firmware Initializing... [ Scanning IDE Device ...(etc.)... ]
```

The firmware takes several seconds to initialize. During this time the adapter scans the IDE channels. When ready, the following appears:

```
CERC Adapter-1 Firmware Version x.xx DRAM Size 16 MB

0 Logical Drives found on the Host Adapter

0 Logical Drives handled by BIOS

Press <Ctrl><M> to run CERC BIOS Configuration Utility
```

The <Ctrl><M> utility prompt times out after several seconds. The RAID host card number, firmware version, and cache DRAM size are displayed in the second portion of the BIOS message. The numbering of the cards follows the PCI slot scanning order used by the system's motherboard.

Step 8: Run the BIOS Configuration Utility

Press <Ctrl><M> when prompted during the boot process to run the BIOS Configuration Utility. See the *CERC Configuration Software Guide* for information about running the BIOS Configuration Utility.

Step 9: Install the Operating System Software Driver

Operating system drivers are provided on the Dell OpenManage Server Assistant® CD that accompanies your controller.

> **NOTE:** Be sure to use the latest Service Packs (updates) provided by the operating system manufacturer. Also, see the readme file that comes with the driver for any updated information.

See the *CERC Operating System Driver Installation Guide* for instructions for installing the operating system drivers.

📝 **NOTE:** When booting the system from a drive connected to a CERC card and using EMM386.EXE, MEGASPI.SYS must be loaded in CONFIG.SYS before EMM386.EXE is loaded. If you do not do this, you cannot access the boot drive after EMM386 is loaded. The MEGASPI.SYS file is provided on the CD that comes with your CERC card..

ASPI® Driver

The ASPI driver can be used under DOS. The MEGASPI.SYS ASPI driver supports hard drives. You can use it to run software that requires an ASPI driver.

Copy MEGASPI.SYS to your hard disk drive. *MEGASPI.SYS must be loaded in CONFIG.SYS before EMM386.EXE is loaded.* Add the following line to CONFIG.SYS:

```
device=<path>\MEGASPI.SYS /v
```

The MEGASPI.SYS parameters are shown in Table 5-2. MEGASPI.SYS Parameters.

Table 5-2. MEGASPI.SYS Parameters

Parameter	Description
/h	INT 13h support is not provided.
/v	Verbose mode. All messages display on the screen.
/a	Physical drive access mode. Permits access to physical drives.
/q	Quiet mode. All messages except error messages are suppressed.

Migrating Existing Non-RAID Data to a CERC System

When you add a CERC card and several IDE hard drives to a server, you may want to keep the existing data that is stored on the hard drives connected to the integrated IDE controller. In addition, you may want to migrate the data to the new CERC RAID system. There are two methods for data migration, as described in the following procedures.

NOTICE: You should not connect the existing data drives directly to the RAID card without backing up the data first. When you set up RAID configuration, the existing file system and data on these hard drives may be destroyed. You should always back up useful data before connecting the drives to the RAID card.

Migrating Data with a Data Backup Device

Perform the following steps if you have a data backup device, such as a tape drive:

1 Make a complete backup of the data you want to migrate.

2 Disconnect the existing hard drives from the integrated IDE controller.

   Either remove the drives or use them to connect to the RAID card.

3 Insert the RAID card in one of the PCI slots.

4 Add extra IDE hard drives as needed.

5 Connect all of the hard drives to the RAID card using the Ultra ATA100 cables included with the card.

6 Start the system.

7 Press <F2> during system boot to enter the System Setup program.

8 Disable the integrated IDE controller.

   For details on disabling integrated IDE controller in the System Setup program, see your system User's Guide.

9 Save the setting and exit.

10 Insert the *Dell OpenManage Server Assistant* CD (included with the RAID card) into the CD drive and reboot the system.

11 Follow the prompts from the *Server Assistant* to set up RAID and install the operating system.

12 Restore the backed-up data.

Migrating Data Without a Data Backup Device

Perform the following steps if you do not have a data backup device:

1 Insert the RAID card in one of the PCI slots

2 Add extra IDE hard drives as needed.

3 Connect the added drives to the RAID card using the Ultra ATA100 cables included with the card.

🖉 **NOTE:** The CERC card may show up as a PERC controller in some System Setup programs. If so, select the PERC controller as the boot device controller.

4 Start the system.

5 Press <F2> during system bootup to enter the System Setup program.

6 Set the add-in CERC card as the boot device controller.

7 Save the setting and exit.

For more details on how to set up the boot device controller in System Setup, see your system User's Guide.

8 Insert the *Dell OpenManage Server Assistant* CD (included with the RAID controller) into the CD drive and reboot the system.

9 Follow the prompts from the *Server Assistant* to set up RAID and install the operating system.

The hard drives connected to the integrated IDE controller and the existing data display in the new file system.

10 Copy the data that you want to migrate to the new hard drives connected to the RAID card.

11 Turn off the system.

12 Disconnect the existing hard drives from the integrated IDE controller.

Either remove the drives or use them to connect to the RAID controller.

13 Boot the system.

14 Press <F2> during system boot to enter System Setup.

15 Disable the integrated IDE controller.

For more details on disabling an integrated IDE controller in the System Setup program, see your system User's Guide.

If you connect the existing hard drives to the RAID card, you can use them by either expanding the existing array on the RAID card or creating a new virtual disk on the RAID controller. For details on array expansion or creating new virtual disk, see Configuring Arrays and Logical Drives.

4

Configuring Arrays and Logical Drives

Physical Drives

Configuring Arrays

Planning the Array Configuration

Random Array Deletion

You can install IDE hard drives in the system, then use the configuration utilties, such as the BIOS Configuration Utility, to organize the hard drives into arrays, or groups of drives. You can then make the arrays part of a logical drive or drives. In addition, you can span the arrays. The arrays and logical drives that you construct must be able to support the RAID level that you select.

This section describes configuration for physical drives, arrays, and logical drives, and contains tables you can complete to list the configuration for the physical drives and logical drives. This section covers the following topics:

- Guidelines for connecting and configuring IDE devices
- Array creation
- Hot spares
- Configuration strategies
- Logical drive configuration
- Array configuration planner
- Random array deletion

Physical Drives

You should observe the following guidelines when connecting and configuring IDE devices in a RAID array:

- Attach hard drives as masters on each IDE channel.
- You can place up to four physical drives in an array, depending on the RAID level.
- It is recommended that you include all drives that have the same capacity in the same array.
- Make sure any hot spare has a capacity that is at least as large as the largest drive that may be replaced by the hot spare.
- When replacing a failed drive, make sure that the replacement drive has a capacity that is at least as large as the drive being replaced.

Physical Device Layout

Use Table 4-1. Physical Device Layout to record your physical device layout.

Table 4-1. Physical Device Layout

	Channel 1	Channel 2	Channel 3	Channel 4
Master				
Device Type				
Logical Drive Number				
Drive Number				
Manufacturer				
Model Number				
Firmware Level				

Configuring Arrays

Organize the physical drives into arrays (groups of drives) after the drives are connected to the RAID card, formatted, and initialized. An array can consist of up to four physical drives, depending on the RAID level.

The RAID card supports up to four arrays. The number of drives in an array determines the RAID levels that can be supported.

Arranging Arrays

You must arrange the arrays to organize the data on the drives and allow you to create system drives that can function as boot devices.

You can sequentially arrange arrays with an identical number of drives so that the drives in the group are spanned. Spanned drives can be treated as one large drive. Data can be striped across multiple arrays as one logical drive. You can create spanned drives using the RAID management utilities:

*   BIOS Configuration Utility
*   Dell Manager
*   WebBIOS
*   Dell™ OpenManage™ Array Manager.

Creating Hot Spares

Any drive that is present, formatted, and initialized, but not included in an array or logical drive can be designated as a hot spare. Hot spares replace drives that fail. You can use the RAID management utilities to create hot spares.

✍ NOTE: For more information about using these utilities to create hot spares, refer to the *CERC Configuration Software Guide*.

Creating Logical Drives

Logical drives are arrays or spanned arrays that are presented to the operating system. You must create one or more logical drives.

The logical drive capacity can include all or any portion of an array. The logical drive capacity can also be larger than an array by using spanning. The CERC card supports up to 40 logical drives.

Configuration Strategies

The most important factors in RAID array configuration are drive capacity, drive availability (fault tolerance), and drive performance. You cannot configure a logical drive that optimizes all three factors, but it is easy to select a logical drive configuration that maximizes one factor at the expense of the other two factors.

Configuring Logical Drives

After you have installed the RAID controller in the server and have attached all physical drives, perform the following actions to prepare a RAID disk array. See the *CERC Configuration Software Guide* for more information.

1 Optimize the RAID controller options for your system.

2 Format the IDE drives to include in the array and the drives to use as hot spares.

3 Press <Ctrl> <M> to run the BIOS Configuration Utility.

   The **Management Menu** displays.

4 Select **Easy Configuration** or **New Configuration** to define and configure one or more logical drives.

5 Create and configure one or more system drives (logical drives.)

6   Select the RAID level, cache policy, read policy, and write policy.

7   Save the configuration.

8   Initialize the logical drives.

    After you initialize the logical drives, you can install the operating
    system.

Logical Drive Configuration

Use Table 4-2. Logical Drive Configuration to record your logical drive
configuration.

Table 4-2. Logical Drive Configuration

Logical Drive	Raid Level	Stripe Size	Logical Drive Size	Cache Policy	Read Policy	Write Policy	# of Physical Drives
LD0							
LD1							
LD2							
LD3							
LD4							
LD5							
LD6							
LD7							
LD8							
LD9							
LD10							
LD11							
LD12							
LD13							
LD14							
LD15							
LD16							
LD17							
LD18							

Table 4-2. Logical Drive Configuration *(continued)*

Logical Drive	Raid Level	Stripe Size	Logical Drive Size	Cache Policy	Read Policy	Write Policy	# of Physical Drives
LD19							
LD20							
LD21							
LD22							
LD23							
LD24							
LD25							
LD26							
LD27							
LD28							
LD29							
LD30							
LD31							
LD32							
LD33							
LD34							
LD35							
LD36							
LD37							
LD38							
LD39							

Optimizing Data Storage

Data Access Requirements

Each type of data stored in the disk subsystem has a different frequency of read and write activity. If you know the data access requirements, you can more successfully determine a strategy for optimizing the disk subsystem capacity, availability, and performance.

Servers that support Video on Demand typically read the data often, but write data infrequently. Both the read and write operations tend to be long. Data stored on a general-purpose file server involves relatively short read and write operations with relatively small files.

Array Functions

You must first define the major purpose of the disk array. Will this disk array increase the system storage capacity for general-purpose file and print servers? Does this disk array support any software system that must be available 24 hours per day? Will the information stored in this disk array contains large audio or video files that must be available on demand? Will this disk array contain data from an imaging system?

You must identify the purpose of the data to be stored in the disk subsystem before you can confidently select a RAID level and a RAID configuration.

Planning the Array Configuration

Fill out the following form in Table 4-3. Planning the Array Configuration when planning an array configuration.

Table 4-3. Planning the Array Configuration

Question	Answer
Number of physical drives in the array	
Purpose of this array. Rank the following factors:	
• Maximize drive capacity	
• Maximize the safety of the data (fault tolerance)	
• Maximize hard drive performance and throughput	
Number of hot spares	
Amount of cache memory installed on the RAID controller	
Are all hard drives and the server protected by an uninterruptible power supply (UPS)?	

Random Array Deletion

The CERC controller supports random array deletion, which is the ability to delete any unwanted logical drives and use that space for a new logical drive.

NOTE: Refer to the *CERC Configuration Software Guide* for the procedures for random array deletion.

NOTE: When a 'delete' request reaches the operating system driver, the driver stops all the running input/output (I/O) for other logical drives and processes the delete request first. Normal read/write operation starts after the delete request is completed.

After you delete a logical drive, you can create a new one. You can use the configuration utilities to create the next logical drive from the non-contiguous free space ('holes'), and from the newly created arrays.

NOTICE: The deletion of the logical drive can fail under certain conditions. You cannot delete a logical drive during a reconstruction. Deletion can fail during a rebuild, initialization or check consistency of a logical drive, if that drive has a higher logical drive number than the drive you want to delete.

The main benefit of random array deletion on the configuration module is that you are not restricted to sequential or contiguous logical drives when you create logical drives. You can use non-contiguous segments to create logical drives.

You can still create sequential logical drives, without using the non-contiguous segments. The utilities provide information about sequential segments, non-contiguous segments and physical drives that have not been configured. You can use this information when you create logical drives.

5

SECTION 5

Troubleshooting

General Problems and Solutions

Table 5-1. General Problems describes general problems you might encounter and suggests solutions.

Table 5-1. General Problems

Problem	Suggested Solution
The system hangs during the boot process after installation.	Make sure the CERC card is installed in the proper PCI expansion slot.
Some operating systems do not load in a computer with a RAID adapter.	Check the system BIOS configuration for PCI interrupt assignments. Make sure some interrupts are assigned for PCI.
	Initialize the logical drive before installing the operating system.
One of the hard drives in the array fails often.	Check the drive error counts using the BIOS Configuration Utility. Select **Objects—> Physical Drive**. After the **Physical Drive Selection Menu** displays, press <F2> to view the drive errors.
	Format the drive.
	Rebuild the drive.
	If the drive continues to fail, replace it with another drive of the same capacity.
After pressing <Ctrl><M>, running Megaconf.exe, and trying to make a new configuration, the system hangs when scanning devices.	Check the drive's master/slave settings on each channel to make sure each device is set to Master or cable select (CS).
	Replace the drive cable.
Pressing <Ctrl> <M> or running megaconf.exe does not display the Management Menu.	These utilities require a color monitor.
Cannot flash or update the CERC card.	Call Dell™ Support for assistance.
`Firmware Initializing...` appears and remains on the screen.	Make sure that the RAID controller is properly seated in the PCI slot.

BIOS Boot Error Messages

displays the error messages that can display when there is an error during bootup.

Table 5-2. BIOS Boot Error Messages

Message	Problem	Suggested Solution
Adapter BIOS Disabled. No Logical Drives Handled by BIOS	The CERC BIOS is disabled. Sometimes the BIOS is disabled to prevent booting from the BIOS.	Enable the CERC BIOS using the BIOS Configuration Utility.
Host Adapter at Baseport xxxx Not Responding	The BIOS cannot communicate with the firmware on the RAID card.	Make sure the RAID card is properly installed.
No CERC Adapter	The BIOS cannot communicate with the firmware on the RAID card.	Make sure the RAID card is properly installed.
Configuration of NVRAM and drives mismatch. Run View/Add Configuration option of Configuration Utility. Press any key to run the Configuration Utility.	The configuration stored on the RAID card does not match the configuration stored on the drives.	When prompted, press a key to run the BIOS Configuration Utility. Select **Configure—> View/Add Configuration** from the **Management Menu**. Use **View/Add Configuration** to examine both the configuration in the non-volatile random access memory (NVRAM), and the configuration stored on the hard drives. Resolve the problem by selecting one of the configurations.

Table 5-2. BIOS Boot Error Messages *(continued)*

Message	Problem	Suggested Solution
`1 Logical Drive Failed`	A logical drive failed to sign on.	Make sure all physical drives are properly connected and are powered on.
		Run the BIOS Configuration Utility to find out whether any physical drives are not responding. Reconnect or replace any drive that is not responding.
`X Logical Drives Degraded`	x number of logical drives signed on in a degraded state.	Make sure all physical drives are properly connected and are powered on.
		Run the BIOS Configuration Utility to find if any physical drives are not responding. Reconnect, replace, or rebuild any drive that is not responding.
`1 Logical Drive Degraded`	A logical drive signed on in a degraded state.	Make sure all physical drives are properly connected and are powered on.
		Run the BIOS Configuration Utility to find out if any physical drives are not responding. Reconnect, replace, or rebuild any drive that is not responding.

Other BIOS Error Messages

Table 5-3. Other BIOS Error Messages displays the other BIOS error messages that can display.

Table 5-3. Other BIOS Error Messages

Message	Problem	Suggested Solution
Following disk not found and no empty slot available for mapping it	The physical disk roaming feature did not find the physical disk with the displayed drive ID. No slot is available to map the physical drive, and the RAID controller cannot resolve the physical drives into the current configuration.	Resolve the mismatch between controllers and drives.
Unresolved configuration mismatch between disks and NVRAM on the adapter	The configuration stored in the NVRAM of the RAID controller does not match the configuration stored on the drives.	Press a key to run the BIOS Configuration Utility. Select **Configure—> View/Add Configuration** from the **Management Menu**. Use **View/Add Configuration** to examine both the configuration in NVRAM and the configuration stored on the hard drives. Select one of the configurations.

DOS ASPI Driver Error Messages

Table 5-4. DOS ASPI Driver Error Messages displays the error messages that can display when there is a problem with the DOS ASPI® driver.

Table 5-4. DOS ASPI Driver Error Messages

Message	Corrective Action
DOS ASPI has NOT been loaded.	The ASPI manager is not loaded. One of the failure codes listed below is displayed next.
Controller setup FAILED error code= [0xab]	Correct the condition that caused the failure. The failure codes are: • 0x40 No RAID adapters found. • 0x80 Timed out waiting for interrupt to be posted. • 0x81 Timed out waiting for CERC response command. • 0x82 Invalid command completion count. • 0x83 Invalid completion status received. • 0x84 Invalid command ID received. • 0x85 No RAID adapters found or no PCI BIOS support. • 0x90 Unknown setup completion error.
'ERROR: VDS support is *INACTIVE* for CERC logical drives	The /h option is appended to driver in CONFIG.SYS or this driver is used with a BIOS that is earlier than v1.10, or no logical drives are configured.

Other Potential Problems

Table 5-5. Other Potential Problems displays other items that might cause problems.

Table 5-5. Other Potential Problems

Topic	Information
DOS ASPI	MEGASPI.SYS, the CERC DOS ASPI manager, uses 6 KB of system memory once it is loaded.
CD drives under DOS	At this time, copied CDs are not accessible from DOS even after loading MEGASPI.SYS and AMICDROM.SYS.
Physical drive errors	To display the **Media Error and Other Error** options, select a physical drive under the **Objects—> Physical Drive** menu and press <F2>. A **Media Error** is an error that occurred while actually transferring data. An **Other Error** is an error that occurs at the hardware level because of a device failure, poor cabling, bad termination, signal loss, and so on.
Virtual sizing	The virtual sizing option enables RAID expansion. Virtual sizing must be enabled to increase the size of a logical drive or add a physical drive to an existing logical drive. Press <Ctrl><M> to run the BIOS Configuration Utility to enable virtual sizing. Select **Objects—> Logical Drive**, then select **View/Update Parameters**. Set **Virtual Sizing** to **Enabled**.
BSD Unix	No BSDI Unix driver is provided. The RAID controller does not support BSDI Unix.
Multiple LUNs	The RAID controller supports one logical unit number (LUN) per target ID. No multiple LUN devices are supported.
CERC Power Requirements	The maximum CERC power requirements are 5.25 - 7.875 watts at 5.25 V and 1 - 1.5 amps.

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Appendix A: Regulatory - LSI Logic Adapters

FCC Compliance Statement

Canadian Compliance (Industry Canada)

Manufacturer Declaration

MIC

VCCI Class B Statement

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NOTE: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesire operation.

CAUTION: If the device is changed or modified without permission of LSI Logic, the user may void his or her authority to operate the equipment.

Canadian Compliance (Industry Canada)

Canadian Regulatory Information (Canada Only)

This digitial apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications. Note that the Canadian Department of Communications (DOC) regulations provide, that changes or modifications not expressly approved by Intel could void your authority to operate the equipment. This Class B digital apparatus meets all the requirements of the Canadian Interference -Causing Equipment Regulations.

Cet appareil numerique de la classe B respecte toutes les exigences du Reglement sur la material brouilleur du Canada.

Manufacturer Declaration

This certifies that this product is in compliance with EU Directive 89/336/EEC, using the EMC standards EN55022;1988 (Class B) and EN55024;1988. This product also meets or exceeds EN60950;1992 safety requirements. This product has been tested and certified to meet CISPR Class B requirements.

LSI Logic Corporation

6145-D Northbelt Parkway

Norcross, GA 30071

MIC

B Class Device

기종별	사용자 안내문
B급 기기 정용 정보통신기기)	이 기기는 가정용으로 전자파적합등록을 한 기기로서 주거지역에서는 물론 모든 지역에서 사용할 수 있습니다.

Please note that this device has been approved for non-business purposes and may be used in any environment, including residential areas.

VCCI Class B Statement

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＢ情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
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