StorageWorks™

RAID Array 230/Plus Subsystem RAID Configuration Utility

User's Guide

AA-R07GA-TE

Digital Equipment Corporation
Maynard, Massachusetts

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Revision Record

This Revision Record provides a concise publication history of this user's guide. It lists the guide's revision levels, release dates, and reasons for the revisions.

The following revision history lists all revisions of this publication and their effective dates. The publication part number is included in the Revision Level column, with the last entry denoting the latest revision. This publication supports StorageWorks RAID Array 230/Plus Subsystems.

Revision Level	**Date**	**Summary of Changes**
AA–R07GA–TE	November 1996	Original release

About This Guide

This section defines the audience of the guide and describes its contents and structure. In addition, this section identifies the conventions used in the guide and provides a list of related documents.

The StorageWorks RAID Array 230/Plus Subsystem RAID Configuration Utility User's Guide

This guide describes the *RAID Configuration Utility (RCU)* and how to use it to configure and maintain StorageWorks RAID Array 230/Plus Subsystems.

Intended Audience

This guide is for system administrators and users who need to configure and maintain RAID Array 230/Plus Subsystems with the *RCU*.

Organization

This guide contains the following:

Chapter 1: RAID Configuration Utility

The chapter provides:

- A procedure for energizing and de-energizing the host computer and storage enclosures,
- Procedures for invoking the *RCU* on Intel-Based, and Alpha-Based systems,
- The function of the *RCU's* command line options and how to use them,
- A procedure for selecting a specific StorageWorks RAID Array 230/Plus Subsystem controller, also known as a KZPAC controller, when the host system has multiple KZPAC controllers installed,
- General information for navigating through the *RCU* screens,
- A procedure for exiting the *RCU*,
- A brief description of the *RCU's* main menu selections, and
- Procedures for setting the KZPAC controller parameters.

Chapter 2: Configuring RAID Array

This chapter provides:

- Information on planning your disk configuration;
- A description of the automatic configuration method with the two requirements which must be satisfied to use it, and the three major steps required to implement it;
- A description of the interactive/manual configuration method with a listing of its four advantages over the automatic method, and a listing of the five major steps (two of them optional) used to implement it;
- The procedure for configuring automatically; and
- The procedure for configuring interactively/manually.

Chapter 3: Maintaining RAID Array

This chapter provides:

- A procedure for checking and repairing parity on logical drives with redundant RAID levels,
- Procedures for recreating (rebuilding) a failed drive's data on a replacement drive if the failed drive is part of a configuration with a redundant RAID level, and
- Procedures for using each of the eight options in the Tools window.

Appendix A: Downloading New Controller Firmware

This appendix documents the firmware downloading function.

NOTE

The *RCU* and this document use the term 'MB' or 'megabyte' to mean 2^{20} or 1,048,576 bytes. The *RCU* reports only the formatted capacity.

Conventions

This guide uses the following conventions:

Style	Meaning
`boldface mono-space type`	**To be input by the user**
`plain mono-space type`	**Screen text**
italic type	**For emphasis, manual titles, utilities, menus, screens, and filenames**

Special Notices

This guide uses the following to emphasize specific information.

WARNING

WARNING indicates the presence of a hazard that can cause personal injury if the hazard is not avoided.

CAUTION

CAUTION indicates the presence of a hazard that might damage hardware or corrupt software.

NOTE

Notes provide additional information.

Related Documentation

The table below identifies related documentation by title and order number.

Document Title	Order Number
RAID Array 230/Plus Subsystem Installation Guide	AA–R07FA–TE
RAID Array 230/Plus Subsystem RAID Configuration Utility User's Guide	AA–R07GA–TE
RAID Array 230/Plus Release Notes	AA–R0Ex–TE (x = latest revision letter)

1

RAID Configuration Utility

This chapter provides: a procedure for energizing and de-energizing the host computer and storage enclosures, procedures for invoking the RAID Configuration Utility (RCU) on Intel-Based, and Alpha-Based systems, the function of the RCU's command line options and how to use them, a procedure for selecting a specific StorageWorks RAID Array 230/Plus Subsystem controller, also known as a KZPAC controller, when the host system has multiple KZPAC controllers installed, general information for navigating through the RCU screens, a procedure for exiting the RCU, a brief description of the RCU's main menu selections, and procedures for setting the KZPAC controller parameters. The StorageWorks RAID Array 230/Plus Subsystem RAID Configuration Utility supports a maximum of four RAID Array 200 devices.

NOTE

Always read the Release Notes, supplied as hard copy with the KZPAC controller, to get information not included in other RAID Array 230/Plus documentation.

1.1 Energizing/De-Energizing Host System and Storage Enclosures

The order in which you turn-on and -off your computer and storage enclosures is critical. If the KZPAC controller can not access the drives in your storage enclosures, it marks the drives as failed, and the RAID array subsystem won't operate. To avoid the KZPAC controller trying to access the drives with the storage enclosure turned off, power-on and off your computer and storage enclosures in the following order:

Energizing

1. Storage enclosures *first*
2. System *second*

De-Energizing

1. System *first*
2. Storage enclosures *second*

If the RAID array subsystem fails because you make an error when energizing or de-energizing the computer or storage enclosures, you must change any drives that are in the failed (*FLD*) state into the optimal (*OPT*) state. (Use the *Make Optimal* selection in the *Tools* window.)

1.2 Invoking RAID Configuration Utility

1.2.1 Intel-Based Systems

To invoke the *RAID Configuration Utility* on an Intel system:

1. Insert StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Intel Systems diskette in your floppy drive.
2. Boot computer so it starts from floppy drive.
3. Take this opportunity to read the release notes.
   - At the following prompt:

     ```
     Press a key to read the RAID Array 230/Plus
     Utilities Release Notes
     Or type Ctrl–C to quit to the MS-DOS prompt
     Press any key to continue . . .
     ```
   - Press <space bar> (or any key) to read release notes. Or press Ctrl and C keys simultaneously to bypass release notes and continue with next step.
4. Screen displays prompt: `A:\RA200RCU>`
5. After prompt type: **`RA200RCU`**
6. Press Enter. *RCU* checks drives, then displays *Main Menu* as shown in Figure 1–1.

1.2.2 Alpha-Based Systems

> **NOTE**
>
> Take this opportunity to review the release notes for Alpha-Based systems, fully identified under Related Documentation in the About This Guide section.

To invoke the *RCU* on Alpha systems:

1. Invoke ARC console menu shown in Figure 1–2. Consult your Alpha-Based system documentation for this procedure.

Figure 1–1 Main Menu of RAID Configuration Utility

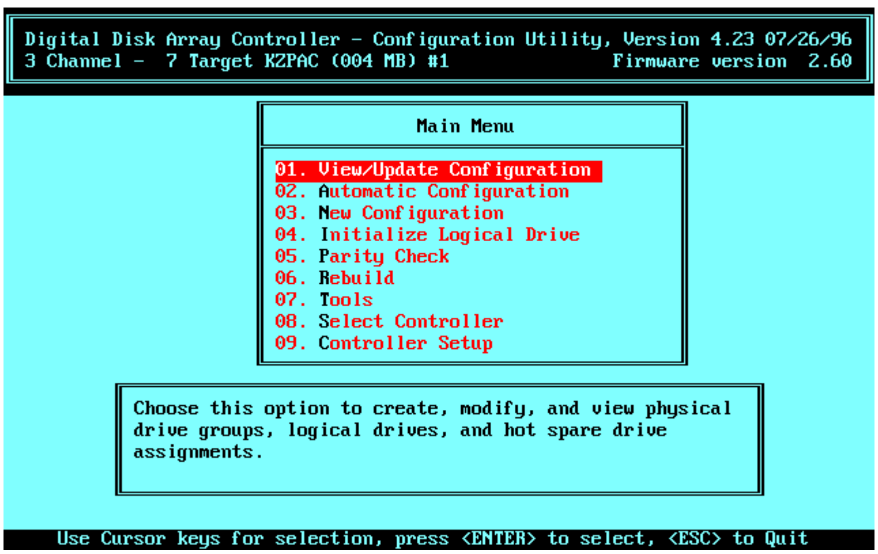


Figure 1–2 ARC Console for Alpha-Based System

```
ARC Multiboot Alpha AXP Version 4.31
Copyright (c) 1993–1995 Microsoft Corporation
Copyright (c) 1993–1995 Digital Equipment
Corporation

Boot Menu
      Boot Windows NT
      Boot an alternate operating system
      Run a program
      Supplementary menu ...

Use the arrow keys to select, then press Enter.
```

2. Insert StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Alpha Systems diskette into your floppy drive.

3. Select *Run a program* option from Alpha *Boot menu*. System displays *Program to run:* prompt.

4. After *Program to run:* type: **`A:RA200RCU`**
5. Press Enter. RCU checks drives, then displays Main Menu as shown in Figure 1–1.

1.3 Invoking Serial RCU on Alpha-Based Systems

If you have:

- A Vtxxx terminal, and
- A serial connection to the host system,

you can still run the *RAID Configuration Utility* from the ARC console. Prepare as follows:

- Set up your system for serial mode as explained in your system manual.
- Set to No Cursor mode.
- Set to Vtxxx Mode, 8-bit controls.

Then:

1. Invoke ARC console menu shown in Figure 1–2. Consult your Alpha-Based system documentation for this procedure.
2. Insert StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Alpha Systems diskette into your floppy drive.
3. Select *Run a program* option from Alpha *Boot menu*. System displays *Program to run:* prompt.

NOTE

When the *RCU* starts in the following steps, and prompts you to press the **`Esc`** key to continue, use **`Ctrl-[`** as a simultaneous, two-key combination, rather than **`Esc`**. That is, press **`Ctrl`** and **`[,`** at the same time, to invoke the escape function.

4. After *Program to run:* type: **`A:\RA200SRL.EXE`**
5. Press Enter. *RCU* checks drives, then displays *Main Menu* as shown in Figure 1–1, above.

1.4 Command Line Options

1.4.1 Configuration Override Option

The *RAID Configuration Utility* has an override option which allows the user to enter the utility without waiting for the drives to timeout in the event of either a dead logical drive or an unwanted configuration. To use the override option, type **`RA200RCU -o`** when starting the utility. You can then make failed drives OPT (optimal) or completely change your RAID configuration. This option should only be used when using the *Tools* or *New Configuration* menu options of the RAID configuration utility.

1.4.1.1 Intel-Based Systems

1. Insert StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Intel Systems diskette in your floppy drive.
2. Boot computer so it starts from floppy drive.
3. Screen displays prompt: `A:\RA200RCU>`
4. After prompt type: **RA200RCU -o**
5. Press Enter.

1.4.1.2 Alpha-Based Systems

1. Invoke ARC console menu shown in Figure 1–2. Consult your Alpha-Based system documentation for this procedure.
2. Insert StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Alpha Systems diskette into your floppy drive.
3. Select *Run a program* option from Alpha *Boot menu*. System displays *Program to run:* prompt.
4. After *Program to run:* type: **`A: RA200RCU -o`**
5. Press Enter.

1.5 Using RAID Configuration Utility

1.5.1 Selecting KZPAC Controller

> **NOTE**
>
> As explained in the paragraph below, the following KZPAC controller selection procedure applies only to RAID Array 230/Plus Subsystems with more than one RAID controller.

With one KZPAC controller installed in the host system, the *RCU* automatically selects that controller when the *RCU* is invoked as described above. If there are two or more KZPAC controllers installed, a controller selection screen displays when the *RCU* is invoked, and the user selects the desired controller before proceeding.

The *RCU* works with one KZPAC controller at a time. If you are using the *RCU* in a multiple controller subsystem and wish to select another controller:

- Press Esc successively as required to display *Main Menu* of *RCU.*
- Use arrow keys to highlight *Select Controller* from *Main Menu* as shown in Figure 1–3.
- Press Enter to display selection screen as shown in Figure 1–4.
- Use arrow keys to highlight desired KZPAC controller distinguished by slot number as shown in Figure 1–4.

> **NOTE**
>
> The screen in Figure 1–4 shows a subsystem with only one KZPAC controller and only one possible choice. With a multiple KZPAC controller subsystem, your screen shows two or more choices.

- Press Enter. *RCU* now works with new controller selection.

Figure 1–3 Select Controller Function

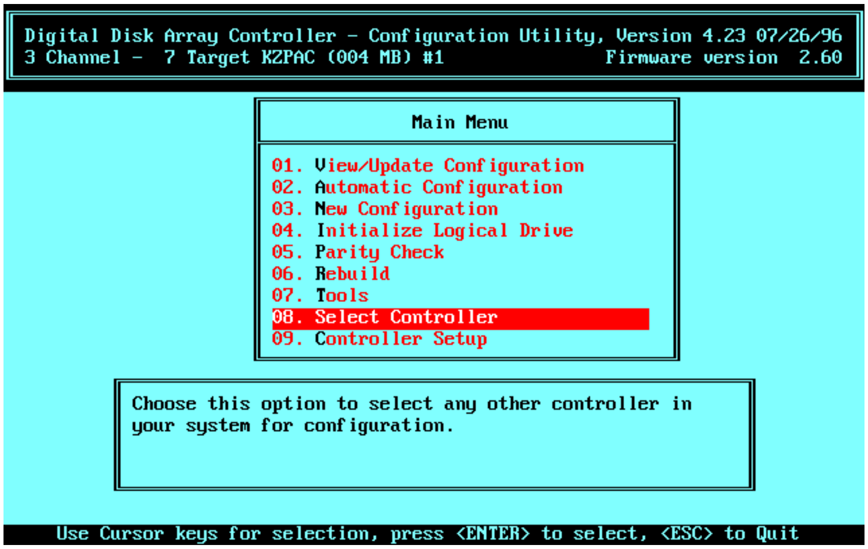
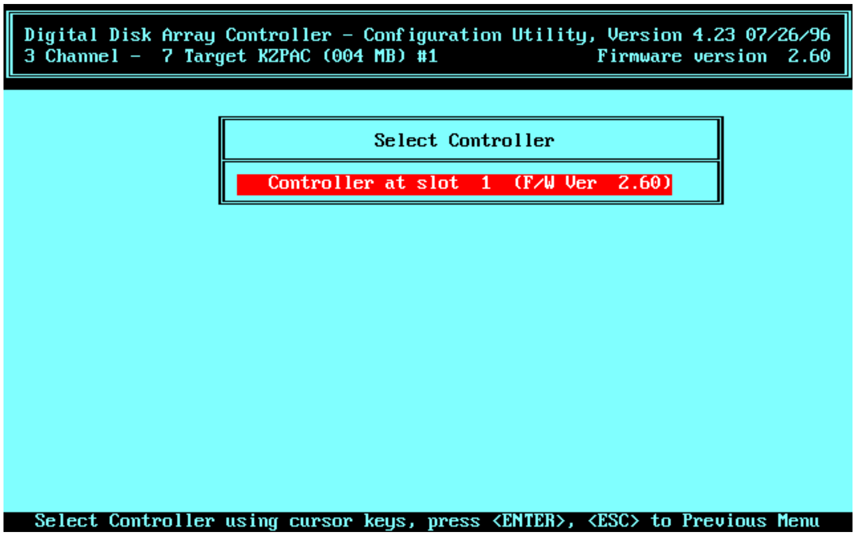


Figure 1–4 Selection Screen

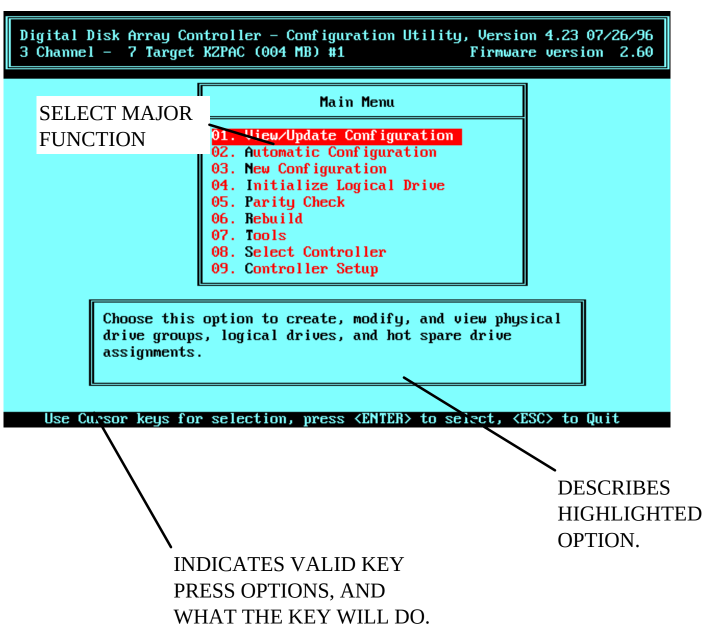


1.5.2 Navigating through RCU Screens

Figure 1–5 explains the elements of the utility screens. Notice that:

- With *RCU* started, and *Main Menu* screen displayed, *RCU* operation is similar on both Intel-Based, and Alpha-Based systems.
- You may use arrow keys to highlight desired selection, then press Enter/Return. Or, type first letter of desired selection, then press Enter/Return.
- Message window in lower part of screen displays brief description of highlighted option.

Figure 1–5 Elements of RCU Screens



1.5.3 How to Exit RCU

- From *Main Menu*, press Esc once.
- *RCU* prompts you to confirm you want to exit. Use arrow key to highlight *Yes*.
- Press Enter.

1.6 Main Menu Selections

Refer to Figure 1–5 for the *Main Menu* selections of the *RAID Configuration Utility* described below. The descriptions given are intended as an overview of functions you can perform with the *RCU*. Detailed procedures are given elsewhere in this guide.

1.6.1 View/Update Configuration

This selection lets you check the status of a selected KZPAC controller to find out whether any target SCSI disk drives are connected to it, and if so, whether those drives are configured into defined drive groups and logical drives. If the drives are configured, *View/Update Configuration* shows how the drive groups and logical drives are defined, and also other characteristics such as the RAID level of logical drives, caching in effect, and the status of each drive, namely: failed (FLD), formatting (FMT), hot spare (HSP), optimal (OPT), ready (RDY), unformatted (UNF), and write only (WOL).

In addition, *View/Update Configuration* permits you to modify the existing configuration, or create a new one if the drives connected to the KZPAC controller aren’t currently configured into drive groups and logical RAID drives. The *New Configuration* selection in Section 1.6.3, below, is more often used to create a new configuration than *View/Update Configuration*.

Compare the *View/Update Configuration* with the *New Configuration* selection in Section 1.6.3, below.

1.6.2 Automatic Configuration

The *Automatic Configuration* selection is a quick method of configuring an array of disk drives if the user is willing to:

- Configure one RAID level 5 logical RAID drive using not less than 3, or more than 8, drives of the same capacity, or
- Configure up to 8 Just a Bunch of Disks (JBODs) of any capacity.

1.6.3 New Configuration

The *New Configuration* selection is useful when you know there are target SCSI disk drives connected to the selected KZPAC controller and you wish to use the *RCU* to:

- Define drive groups and logical RAID drives when no configuration exists, or
- Eliminate an existing configuration and replace it with a new one by defining new drive groups and new logical RAID drives.

The *New Configuration* selection eliminates any existing configuration. Therefore, this selection does not permit you to view or modify an existing configuration, only eliminate the existing configuration and define a new one.

Compare the *New Configuration* selection with the *View/Update Configuration* selection in Section 1.6.1, above.

1.6.4 Initialize Logical Drive

CAUTION

To avoid data loss:

- Do not initialize a logical RAID drive if it has valid data. Initialization overwrites and destroys all data.
- After initializing a logical RAID drive, do not change, or rearrange, the physical drives or cables. These actions may destroy all data in the drive group.

The *Initialize Logical Drive* selection enables you to create a starting parity for a logical RAID drive which has parity, or starting data for a logical RAID drive which does not have parity. To do this, the *RCU* writes a pattern of zeros to the logical RAID drive.

1.6.5 Parity Check

Use the *Parity Check* selection to check parity on logical RAID drives having a redundant RAID level such as RAID 1, RAID 0+1, and RAID 5 to ensure the consistency of RAID parity information.

When you select *Parity Check*, the *RCU* reads the data from the logical RAID drives and computes the parity for each series of blocks. Any discrepancies between the computed parity and the parity stored on the drive are indicated.

The *RCU* repairs parity errors, at the option of the user, by regenerating the data.

Check the parity of all your logical RAID drives periodically, and after a power failure or an *RCU* crash, to ensure the integrity of parity and reduce the chance of data loss.

1.6.6 Rebuild

The *Rebuild* selection allows you to manually rebuild a failed drive's data onto a replacement drive after replacing the failed drive. You can rebuild a logical drive only for configurations with redundant RAID levels 0 + 1, 1, and 5. If a drive fails in a configuration without a redundant RAID level (RAID 0 or JBOD), you can't recover data from the failed drive using the *RCU*.

When you define a hot spare drive in a redundant RAID subsystem, and you have enabled StorageWorks Fault Management, the rebuilding process when a drive fails is entirely automatic. If you don't have a hot spare drive defined, rebuilding occurs automatically as soon as you replace the failed drive. In both cases, a manual rebuild is unnecessary.

Use the *Rebuild* selection on the *Main Menu* of the *RCU* to manually rebuild a logical drive if:

- Your storage enclosure doesn't have StorageWorks Fault Management and a drive fails.
- You manually fail a drive.

1.6.7 Tools

Selecting *Tools* from the *Main Menu* of the *RCU* displays the *Tools* window with eight available options:

1. *Bad Block Table*
2. *Error Counts*
3. *Format Drive*
4. *Make Optimal*
5. *Fail Drive*
6. *Backup/Restore conf* (configuration)
7. *Clear Configuration*
8. *Print Configuration*

Read the sections below for a brief functional summary of the options on the Tools menu.

1.6.7.1 Bad Block Table

The *Bad Block Table* selection helps you troubleshoot a failed rebuild when a disk drive fails in a redundant logical RAID drive.

1.6.7.2 Error Counts

The *Error Counts* selection tracks errors in four categories: parity, soft, hard, and miscellaneous, which occur on each of the drives. Use it to check the reliability of each drive by checking on the number, and type, of errors it makes. Replace unreliable drives.

1.6.7.3 Format Drive

The *Format Drive* selection permits you to perform a SCSI format of disk drives with a status of failed (FLD) and ready (RDY).

1.6.7.4 Make Optimal

Use the *Make Optimal* selection to change the status of a drive to optimal (OPT) when you want the controller to write information to it.

1.6.7.5 Fail Drive

Failing a drive in a RAID 0 or JBOD configuration will result in the loss of all data. You will need to restore the data from backup media.

Ensure optimal status for all drives in a RAID 1, RAID 0+1, or RAID 5 configuration before failing a drive. Failing a drive in a RAID 1, RAID 0+1, or RAID 5 configuration with a drive already failed will cause the loss of all data, and you will need to restore the data from backup media.

1.6.7.6 Backup/Restore Configuration

If your KZPAC controller fails, you will need to load the configuration information onto the replacement KZPAC controller from a backup copy stored on diskette. Use the *Backup/Restore conf* selection for this purpose.

1.6.7.7 Clear Configuration

Use the *Clear Configuration* selection to clear the existing RAID configuration without immediately creating a new one.

1.6.7.8 Print Configuration

Use the *Print Configuration* selection to print a hard copy summary of the existing RAID configuration easily understood by the user.

1.6.8 Select Controller

The *RCU* works with one KZPAC controller at a time. Choose *Select Controller* from the *Main Menu* of the *RCU* If you are using the *RCU* in a multiple controller subsystem and wish to select another KZPAC controller:

With one KZPAC controller installed in the host system, the *RCU* automatically selects that controller when the *RCU* is invoked as described above. If there are two or more KZPAC controllers installed, a controller selection screen displays when the *RCU* is invoked, and the user selects the desired controller before proceeding.

1.6.9 Controller Setup

Choose *Controller Setup* from the Main Menu of the *RCU* after installing your KZPAC controller, and prior to configuring your RAID array. When you highlight *Controller Setup* and press Enter, the *RCU* displays an *Edit/View Parameters* menu which allows you to set the RAID controller: hardware, data, SCSI transfer, and startup parameters.

1.7 Setting Controller Parameters

After installing your KZPAC controller, and prior to configuring your RAID array, you must perform a one-time setup to load parameters into the controller firmware. These parameters help define the controller interface with the disk drives in the StorageWorks storage pedestals or internal shelves. The controller parameters establish such characteristics as the speed of data movement (data transfer rate) between the controller and disk drives; how fast data on a failed disk drive is restored to a hot spare drive (rebuild rate); and various other one-time settings which must be selected before configuring the RAID array.

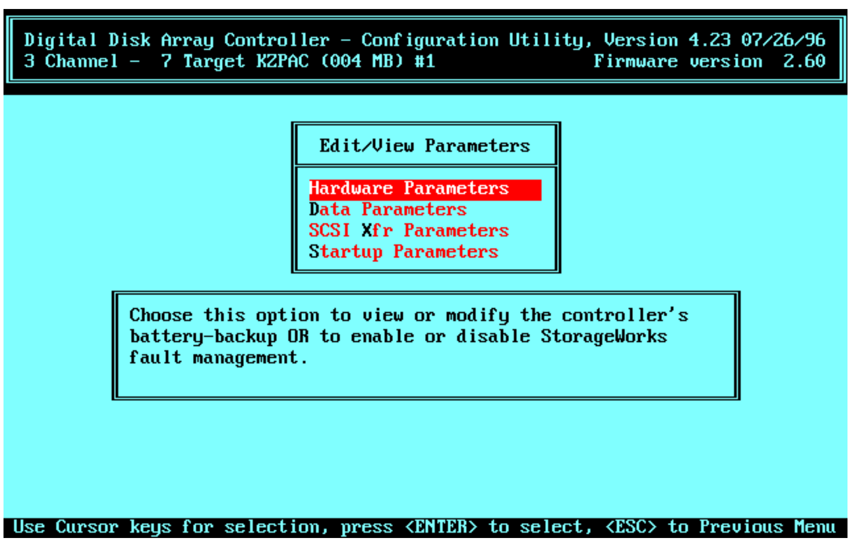
Start the *RAID Configuration Utility*, then set the controller parameters, beginning with the hardware parameters below.

1.7.1 Hardware Parameters

1. Use up and down arrow keys to highlight *Controller Setup* option on *Main Menu* (Figure 1–1), then press Enter.
2. System displays *Edit/View Parameters* menu shown in Figure 1–6.
3. If necessary, use arrow keys to highlight *Hardware Parameters*, then press Enter.

4. *Hardware Parameters* screen appears, similar to that shown in Figure 1–7, showing current status of *Battery-Backup* and *StorageWorks Fault Management* options.
5. If your KZPAC controller is equipped with battery backup, your *Battery-Backup* setting needs to be *Enabled*, if not, leave setting *Disabled*. If you need to change settings, use arrow keys to highlight *Battery-Backup*, then press Enter to change setting.

Figure 1–6 Edit/View Parameters Menu

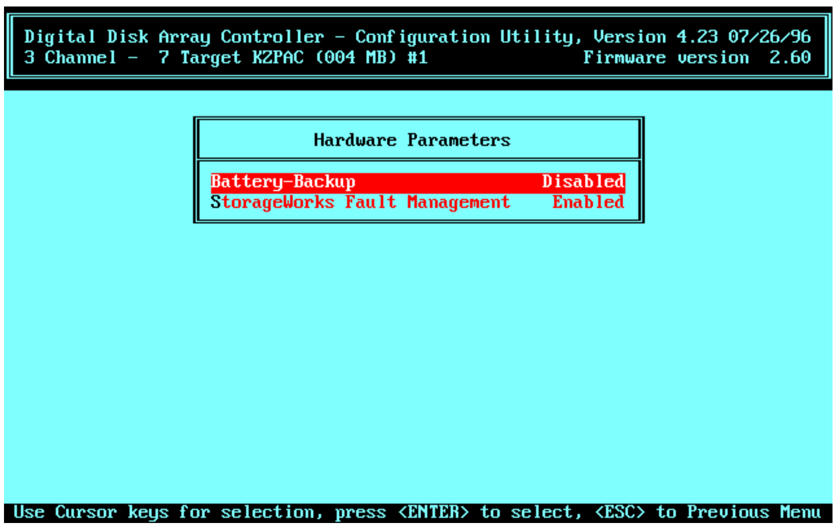


NOTE

If the KZPAC controller connects to a StorageWorks enclosure and StorageWorks Fault Management is enabled in the following step, the subsystem will support hot swapping for redundant RAID levels in case of a disk drive failure.

6. Check StorageWorks Fault Management setting on screen. If your KZPAC controller connects to StorageWorks enclosure, it supports fault management and this option should be Enabled. If setting needs to be changed, use arrow keys to highlight StorageWorks Fault Management, then press Enter to change setting.

Figure 1–7 Hardware Parameters Screen



7. Press Esc to return to Edit/View Parameters menu.
8. Continue with Section 1.7.2.

1.7.2 Data Parameters

1.7.2.1 Data Parameters KZPAC and KZPSC

Two *Data Parameters* must be set. You can no longer set the *Read-Ahead* option for the cache as you could with the previous utility. When saving the data parameters, *Read-Ahead* will be automatically disabled. The parameters are:

Default rebuild rate — The maximum percentage of time that the controller will spend on reconstructing data during a rebuild

Stripe size — The amount of data that the RAID controller writes to any drive before writing to the next drive in the RAID set

Set the data parameters as follows:

1. Use arrow keys to highlight *Data Parameters* option on *Edit/View Parameters* menu and press Enter key.

2. *Default rebuild rate* of 50 is fastest rate system will rebuild data from failed drive. If default setting is value you wish to use, continue with next step. If not, press Enter key and box appears at bottom right corner of screen in which you can type rebuild rate from 0 – 50. Type in desired value.
3. Use arrow keys to highlight *Stripe size (K bytes)* option.
4. Press Enter key to change *Stripe size* value.
5. Press Esc key to return to *Edit/View Parameters* menu.
6. Continue with Section 1.7.3.

1.7.2.2 Data Parameters KZESC

Three *Data Parameters* must be set. Parameters which may be set are:

Default rebuild rate — The maximum percentage of time that the controller will spend on reconstructing data during a rebuild

Stripe size — The amount of data that the RAID controller writes to any drive before writing to the next drive in the RAID set

Read-Ahead — When enabled, the firmware on the KZESC will pre-fetch data into the cache on the controller.

Set the *Data Parameters* as follows:

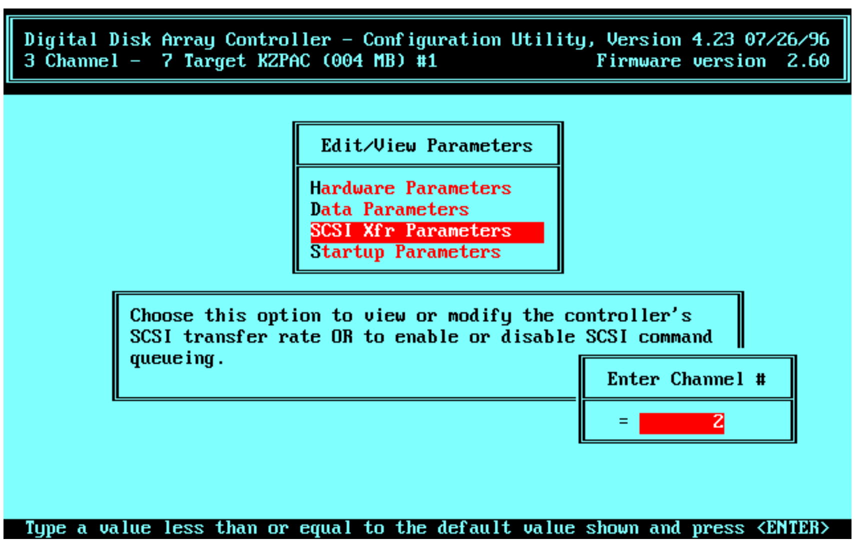
1. Use arrow keys to highlight *Data Parameters* option on *Edit/View Parameters* menu and press Enter key.
2. *Default rebuild rate* of 50 is fastest rate system will rebuild data from failed drive. If default setting is value you wish to use, continue with next step. If not, press Enter key. Box appears at bottom right corner of screen in which you can type rebuild rate from 0 to 50. Type in desired value.
3. Use arrow keys to highlight *Stripe size (K bytes)* option.
4. Press Enter key to change *Stripe size* value.
5. Use arrow keys to highlight *Read-Ahead* option.
6. Press Enter key to change *Read-Ahead* value.
7. Press Esc key to return to *Edit/View Parameters* menu.
8. Continue with Section 1.7.3.

1.7.3 SCSI Transfer Parameters

Under the *SCSI Xfr Parameters* menu, you will be able to change the data transfer rate and command tagging for each SCSI bus individually.

1. Use arrow keys to highlight *SCSI Xfr Parameters* option on *Edit/View Parameters* menu and press Enter. An *Enter Channel #* box appears, similar to that shown at bottom right of screen in Figure 1–8.

Figure 1–8 Enter Channel # Box at Bottom Right



NOTE

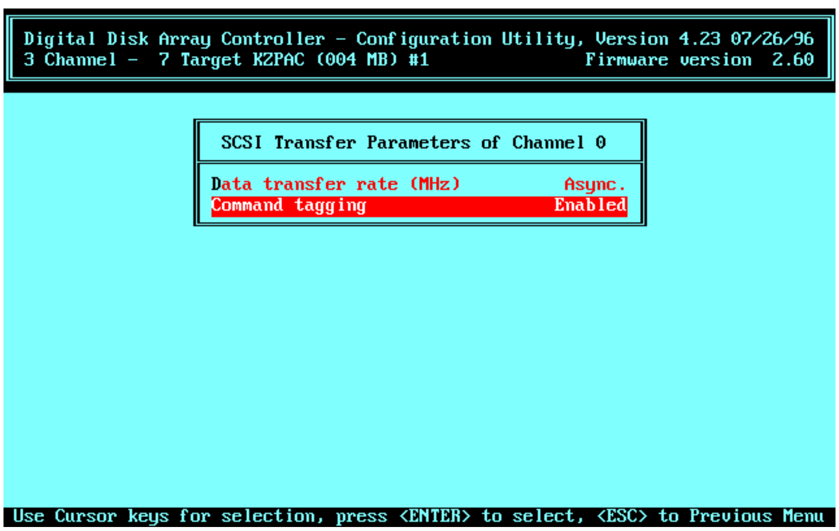
You will need to perform steps 1 through 5 for each SCSI channel that is used in the array.

2. Enter a channel number of attached controller and press Enter. *SCSI Transfer Parameters of Channel x* screen appears similar to that shown in Figure 1–9.

3. If necessary, use arrow keys to highlight *Data transfer rate (MHz)*. Press Enter to scroll through *Data transfer rate (MHz)* options. Default value is *10 Mhz*, which should be used only if you are not using longer than 3-meter SCSI cable. Select *5 Mhz* if you plan to use 6-meter SCSI cable. Select *Async* only if drives in your subsystem don't support synchronous operation.

4. Use arrow keys to highlight *Command tagging* option. Command tagging is *Enabled* by default. Command tagging allows controller to queue up to two commands to each drive. With *Command tagging Disabled*, controller queues only one command to each drive. Press Enter to disable *Command tagging* if required.
5. Press Esc to return to *Edit/View Parameters* menu.

Figure 1–9 SCSI Transfer Parameters of Channel Screen



6. Repeat steps 1 – 5 to set these parameters for each channel on your controller.
7. Continue with Section 1.7.4.

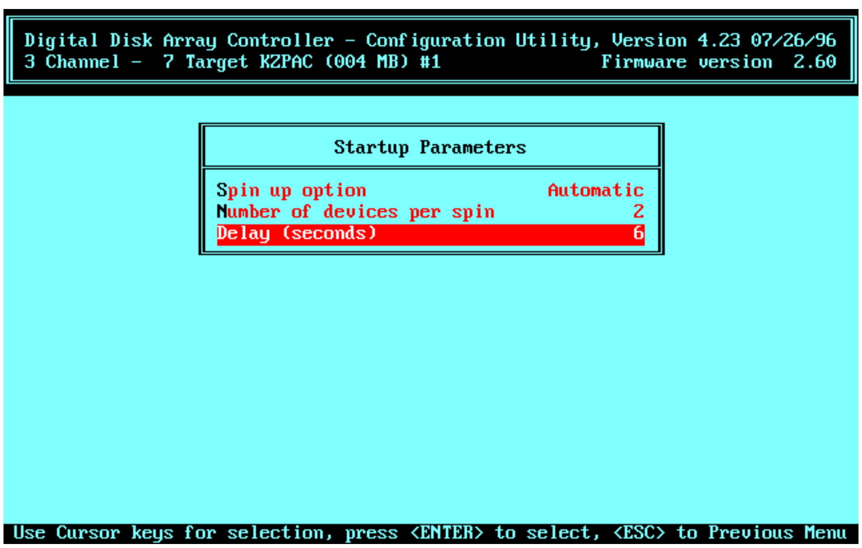
1.7.4 Startup Parameters

1. Use arrow keys to highlight *Startup Parameters* option on *Edit/View Parameters* menu and press Enter. *Start up Parameters* menu appears as shown in Figure 1–10.

2. *Spin up option* specifies whether controller starts drives at intervals, or drives spin up simultaneously on power up. *Spin up option* is set to *Automatic* by default, meaning controller starts drives. If you want drives to spin up on power up, go to step 3. If you want controller to start drives, continue with substeps below.

   a. Ensure that *Spin up option* setting is *Automatic*. If necessary, use arrow keys to highlight *Spin up option* and press Enter to change *On Power* to *Automatic*, then continue with next substep.

Figure 1–10 Startup Parameters Menu



   b. Use arrow keys to highlight *Number of devices per spin* and type number desired. Default value is 2.

   c. Use arrow keys to highlight *Delay (seconds)* and type number desired. Default value is 6.

   d. Go directly to step 4.

NOTE

In the following step, the remaining options, *Number of devices per spin* and *Delay (seconds)*, can't be set, and aren't required, because drives start immediately when power turns on.

3. Ensure that *Spin up option* setting on screen is *On Power*. If not, use arrow keys to highlight *Spin up option* and press Enter to change *Automatic* to *On Power*.
4. Press Esc to exit. *Edit/View Parameters* menu appears.
5. Press Esc again.
6. If you change settings, *RCU* prompts to save altered controller configuration. Use arrow keys to highlight *Yes*, then press Enter and *Main Menu* appears. If you make no parameter changes, *Main Menu* appears as soon as you press Esc.
7. Press Esc, then: *Press any key to continue*. Exit screen appears.
8. Use arrow keys to highlight *YES*, then press Enter.
9. When A: prompt (Intel-Based system) or Boot Menu (Alpha-Based system) appears, proceed to Chapter 2 to configure RAID array. Don't remove diskette from floppy diskette drive.

2

Configuring The RAID Array

This chapter provides: information on planning your disk configuration; a description of the automatic configuration method with the two requirements which must be satisfied to use it, and the three major steps required to implement it; a description of the interactive/manual configuration method with a listing of its advantages over the automatic method, and a listing of the major steps used to implement it; the procedure for configuring automatically; and the procedure for configuring interactively/manually.

2.1 Planning Disk Configuration

The first step in configuration is planning. When you configure your array, you allocate your disk drive resources into drive groups and hot spares. You then create logical RAID drives, which allow your computer to view the combined disk space of each of the disk drives in the group as a single drive. You determine how you want to store data on a logical RAID drive by selecting a RAID level (RAID 0, 1, 0+1, 5, or Just a Bunch of Disks [JBOD]) when you create it.

2.1.1 Planning Recovery from Disk Failure

One of the major benefits of RAID is the ability to maintain data availability even in the event of a disk failure. RAID configurations using redundant RAID levels (RAID 1, RAID 0 + 1, and RAID 5) can sustain the failure of one disk at any given time. Your RAID Array 230/Plus Series Subsystem recovers from the failure of a disk by rebuilding the failed disk's data onto a replacement disk. The RAID subsystem does this using any one of the following methods:

- Hot Spare
- Hot Swap
- Manually rebuilding

Read the following descriptions of the methods for recovering from a disk failure to help you decide whether to create one or more hot spare drives when you configure your array.

NOTE

You can't recover data from a drive that fails in a configuration with a non-redundant RAID level (RAID 0, JBOD).

2.1.1.1 Hot Spare

A hot spare drive is a drive in your storage enclosure that you do not incorporate into a drive group, but designate as a hot spare. The drive remains unused and available in your storage enclosure until a disk fails in a drive group on which you configured a redundant logical RAID drive. Then, the StorageWorks RAID Array 230/Plus Subsystem controller, also known as a KZPAC controller, automatically starts to rebuild the failed drive's data onto the hot spare disk.

You can define a hot spare drive when you configure your array for the first time, or at another time. This drive must have a capacity equal to, or greater than, the drives in the drive groups on which you will configure redundant logical RAID drives. Section 2.4.4 has the procedure for defining a hot spare drive.

2.1.1.2 Hot Swap

Enable the StorageWorks Fault Management option as described in Section 1.6.1, Hardware Parameters, and you can perform a hot swap if a drive fails. (Your storage enclosure must support *StorageWorks Fault Management*.) You perform a hot swap by removing the failed drive, a drive to which the KZPAC controller assigned a status of failed (FLD), from the storage enclosure. You then insert a working drive into the same slot of the storage enclosure from which you removed the failed drive. Shortly after you insert the replacement drive, the KZPAC controller automatically starts to rebuild the failed drive's data onto the replacement drive.

NOTE

It may take minutes for a rebuild to begin on a hot spare or after a hot swap, depending upon the rebuild rate and activity of the subsystem.

2.1.1.3 Manually Rebuilding

If a drive fails, and you did not define a hot spare drive, or do not have hot swap capability, you can manually issue a command to get the controller to rebuild the data from a failed drive onto a replacement drive. See Section 3.2, for the rebuilding procedure.

Now go on to Section 2.1.2 to continue planning the configuration.

2.1.2 Planning Configuration

You started planning your configuration when you selected what to purchase for your StorageWorks RAID Array 230/Plus Subsystem. Prior to configuring the subsystem, you need to plan how to maximize the resources you purchased. This section includes two sample configurations which illustrate ways to maximize the potential of a subsystem.

The following samples demonstrate:

- High data availability (redundancy) and
- Low cost with high performance

2.1.2.1 Sample Configuration for High Data Availability

The configuration shown in this example provides high data availability (redundancy) in case of a drive or channel failure. Drive redundancy is achieved by using RAID 5 logical RAID drives. Channel redundancy is achieved by locating all the drives in a drive group on separate channels. If a channel fails, the subsystem continues to function in degraded mode.

This sample is shown in Table 2–1, we configured 21, 1-GB capacity disk drives into 7 drive groups, then created 7, RAID 5 logical RAID drives with 1 logical RAID drive on each drive group. For information on the number of drives you can use in a drive group with each RAID level, and how the capacity of individual drives affects the capacity of a drive group, see Section 2.4.2, Defining Drive Groups.

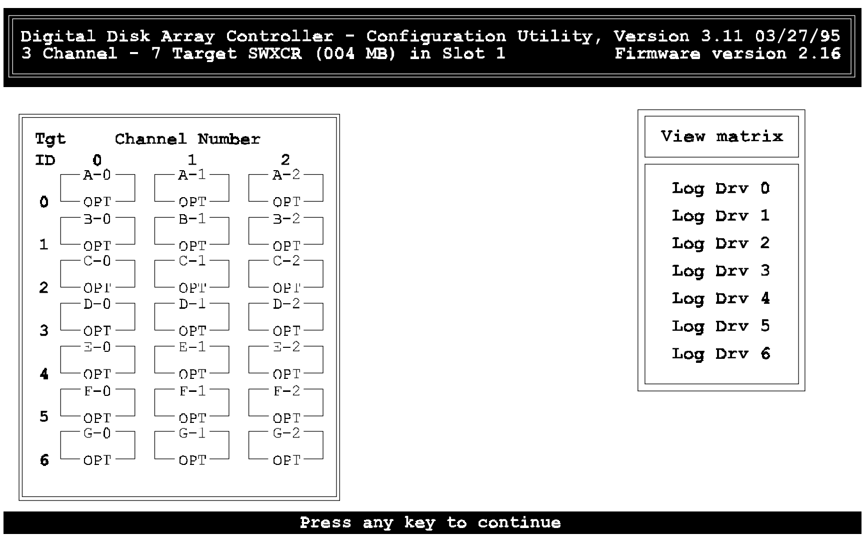
Figure 2–1 shows the *View matrix* screen of the *RAID Configuration Utility (RCU)* when the configuration in Table 2–1 is implemented with a 3-channel KZPAC controller connected to 3 storage enclosures. Each controller channel (0, 1, and 2) of the KZPAC controller connects to a storage enclosure through a SCSI cable as shown in Figure 2–2. For more information on viewing the logical drive matrix, refer to Section 2.4.5, Viewing Logical Drive Matrix.

Table 2–1 Data Availability Configuration Using RAID 5

Drive Group	**Number of Drives in Group**	**Drive Location**	**Group Type**	**Usable Capacity**
A	3	Drive 1 = Ch 0, SCSI ID 0	RAID 5	2GB
		Drive 2 = Ch 1, SCSI ID 0		
		Drive 3 = Ch 2, SCSI ID 0		
B	3	Drive 1 = Ch 0, SCSI ID 1	RAID 5	2GB
		Drive 2 = Ch 1, SCSI ID 1		
		Drive 3 = Ch 2, SCSI ID 1		
G	3	Drive 1 = Ch 0, SCSI ID 6	RAID 5	2GB
		Drive 2 = Ch 1, SCSI ID 6		
		Drive 3 = Ch 2, SCSI ID 6		
Total	**Total**		**Total**	**Total**
7	21 drives		7 RAID 5	14 GB

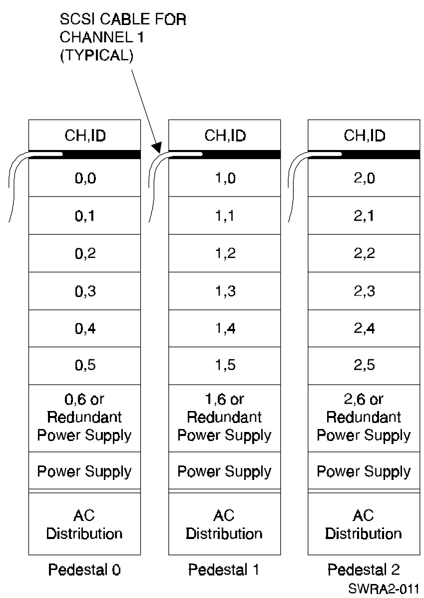
The Table 2–1 sample shows all of the 21 drives in the subsystem being used in drive groups; however, you may want to create fewer drive groups and use some of the 21 drives as hot spare drives. When hot spares are used, if a drive fails in one of the redundant logical RAID drives, the controller will automatically begin to rebuild the failed drive's data onto one of the hot spares.

Figure 2–1 View Matrix Screen Showing Configuration of Table 2–1



SWRA2-010

Figure 2–2 Storage Enclosures Required for Configuration of Table 2–1



2.1.2.2 Sample Configuration for Low Cost with High Performance

The configuration shown in this example maximizes low cost and high performance in the event that you want to configure the same number of drives used in Table 2–1, and maximize their usable capacity. This configuration provides high performance and good use of disk media at the expense of data redundancy. A loss of any disk in a RAID 0 configuration results in a complete loss of data in the affected logical drives. Backups of your data are the only possibility of data recovery.

In the configuration example shown in Table 2–2, we configured 21, 1-GB capacity disk drives into 7 drive groups. We created 7, RAID 0 logical RAID drives, one on each drive group. For information on the number of drives you can use in a drive group with each RAID level, and how the capacity of individual drives affects the capacity of a drive group, see Section 2.4.2, Defining Drive Groups.

Table 2–2 Low Cost and High Performance Using RAID 0

Drive Group	Number of Drives in Group	Drive Location	Group Type	Usable Capacity
A	3	Drive 1 = Ch 0, SCSI ID 0	RAID 0	3GB
		Drive 2 = Ch 1, SCSI ID 0		
		Drive 3 = Ch 2, SCSI ID 0		
B	3	Drive 1 = Ch 0, SCSI ID 1	RAID 0	3GB
		Drive 2 = Ch 1, SCSI ID 1		
		Drive 3 = Ch 2, SCSI ID 1		
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
G	3	Drive 1 = Ch 0, SCSI ID 6	RAID 0	3GB
		Drive 2 = Ch 1, SCSI ID 6		
		Drive 3 = Ch 2, SCSI ID 6		
Total	**Total**		**Total**	**Total**
7	21 drives		7 RAID 0	21 GB

2.2 Understanding Configuration Methods

You can configure your array either automatically or by using the interactive/manual method. Though configuring automatically is quicker than configuring interactively, manual configuration provides more flexibility in creating the array. Table 2–3 compares available options with both methods.

Table 2–3 Configuration Methods, Automatic Verus Interactive

Feature	Automatic Method	Interactive/Manual Method
Available RAID levels	Either RAID 5 or JBOD (not both)	0, 0 +1, 1, 5, and JBOD
Drive group limit	One with RAID 5, or up to 8 with JBOD	Up to 8
Logical RAID drive limit	One with RAID 5 or up to 8 with JBOD	Up to 8, total, with choice of RAID levels
Capability to define spare drives	No	Yes

2.2.1 Automatic Method

2.2.1.1 Restrictions

You can configure automatically only if:

- You want to configure one RAID 5 logical RAID drive (requires between three and eight drives of same capacity)
- You want to configure up to eight JBODs of any capacity

2.2.1.2 Major Steps

To configure automatically you must:

- Select the *Automatic Configuration* option.
- Initialize the logical RAID drive.
- We also recommend that you save your configuration to diskette.

2.2.1.3 Menu Selection

Automatic Configuration is a selection available on the *Main Menu* of the *RCU*.

2.2.2 Interactive/Manual Method

2.2.2.1 Advantages

Configuring interactively provides four options not available with automatic configuration. Configure interactively if you want to:

- Create more than one drive group.
- Create more than one logical RAID drive.
- Specify RAID levels 0 + 1 and 1, in addition to RAID level 5 and JBOD.
- Define one or more hot spare drives.

2.2.2.2 Major Steps

To configure interactively you will:

- Create one or more drive groups. A drive group defines the drives that you want to work together as the available space for the logical RAID drives that you will create.
- Create logical RAID drives. A logical RAID drive allows your system to see and respond to a drive group as a single drive and defines how your system will store data in that space, based on the RAID level selected.
- Add hot spares (optional). A hot spare drive is a drive available in your subsystem that the KZPAC controller can automatically begin to use to store the data of a failed drive when a redundant logical RAID drive fails.
- Initialize the logical RAID drives. Initialize a logical RAID drive before you use it to ensure consistent RAID parity information.
- Save your configuration to diskette. Your RAID subsystem stores the new configuration information on flash EEPROM/NVRAM on the KZPAC controller. In the event that your KZPAC controller fails, you can restore your configuration from a backup copy of the NVRAM configuration on floppy disk, created by the *Backup/Restore conf* option of the *RAID Configuration Utility*.

2.2.2.3 Menu Choices

You can configure interactively with one of two menu choices. These choices are selections on the *Main Menu* of the *RCU*. Use:

- *New Configuration* to cancel an existing configuration and create a new one, and
- *View/Update Configuration* to look at, and possibly modify, an existing configuration.

Differences between these two menu choices are explained in Section 2.4.1.1.

2.3 Configuring Automatically

The two requirements for configuring automatically are:

- You want to configure one RAID 5 logical RAID drive. This requires between three and eight drives of the same capacity.
- You want to configure up to eight JBODs of any capacity.

2.3.1 Selecting Automatic Configuration Option

To configure automatically:

1. Start *RCU* and display *Main Menu* on your monitor. Refer to Section 1.2, Invoking RAID Configuration Utility, if necessary.
2. Use arrow keys to highlight *Automatic Configuration,* then press Enter key. One of two things happens depending upon whether, or not, any configuration currently exists.

   If current configuration exists, *RCU* displays warning message explaining that valid configuration exists and that if you proceed, you will destroy it. Confirmation window also appears. See Step 3.

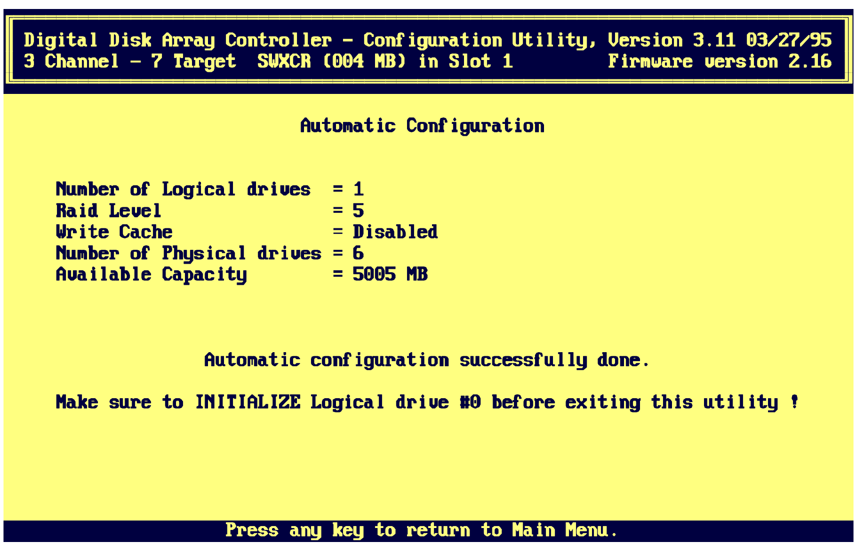
   If there is no current configuration, *Automatic Configuration* screen appears. Go to Step 4.
3. Select *Yes* to delete current configuration. (Select *No* to quit without changing configuration and return to *Main Menu*.) *Automatic Configuration* screen appears.
4. Use arrow keys to highlight RAID 5 or JBOD and press Enter key to select that configuration. *RCU* displays window with this message:

   Do you want to have Write Cache enabled?

5. If you want the recommended *Write Through* caching, press the Enter key to select *No*. This sets cache to the recommended *Write Through* policy. (See Section 2.4.3.2, Choose Caching Policy, for description of caching options.)
6. *RCU* displays window with *Automatic Configuration* at top of screen and message, *Saving configuration, please wait ...*, at bottom of screen. *RCU* then displays screen with your system configuration information, similar to Figure 2–3.
7. Press any key to return to *Main Menu*.

Now go to the next section to initialize the logical RAID drive(s).

Figure 2–3 Automatic Configuration Screen



2.3.2 Initializing Logical RAID Drive

Initialize a logical RAID drive before you use it. The *RCU* initializes the logical drive by writing a pattern of consistent data and parity to it. This creates a starting parity for a logical RAID drive with parity.

CAUTION

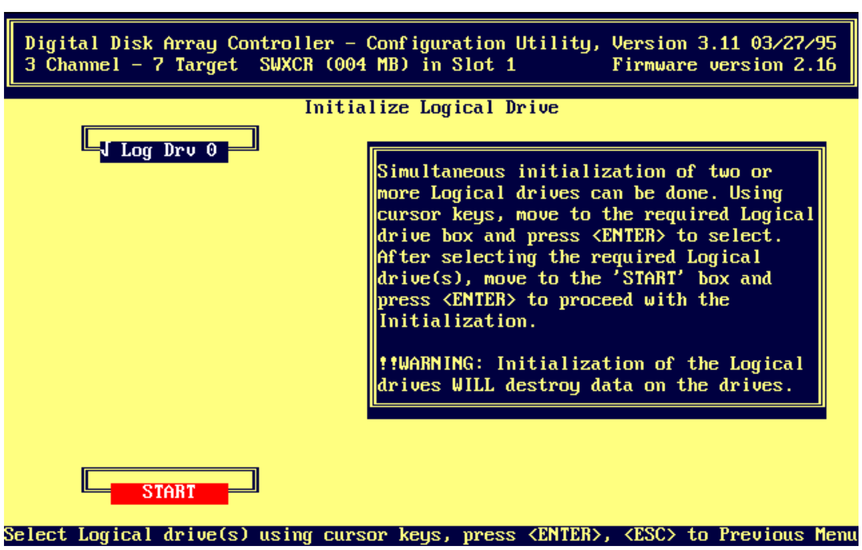
Do not initialize a logical RAID drive if it has valid data. Initialization overwrites and destroys all data.

Also, after you initialize a logical RAID drive, do not change or rearrange the physical drives or cables. Otherwise, all data in the drive group can be lost.

To initialize a logical RAID drive:

1. From *Main Menu*, use arrow keys to highlight *Initialize Logical Drive,* then press Enter key. *RCU* displays *Initialize Logical Drive* screen, with
2. *Log Drv 0*, as shown in Figure 2–4.

Figure 2–4 Initialize Logical Drive Screen



1. If necessary, use arrow keys to move to *Log Drv 0* and press Enter key to select it. Check mark appears in front of *Log Drv 0*. Select any additional JBOD logical RAID drives that were created automatically, that you wish to initialize. *RCU* automatically highlights *Start* button after you select all logical RAID drives.
2. Press Enter key. Confirmation window appears, as shown in Figure 2–5, displaying:
3. *Do you want to proceed with initialization?*
4. Select *Yes*. *Initialize Logical Drive* status bar appears at top of screen, as shown in Figure 2–6, indicating percent of initialization completed. Bar gradually fills as initialization process completes. When done initializing, *RCU* prompts you to press any key to continue.
5. Press any key. *RCU* displays message indicating that it is saving configuration, then *Main Menu* appears.

Go to Section 2.3.3 to continue with the next step of the automatic configuration, saving the configuration to a diskette.

Figure 2–5 Proceed with Initialization Confirmation Message

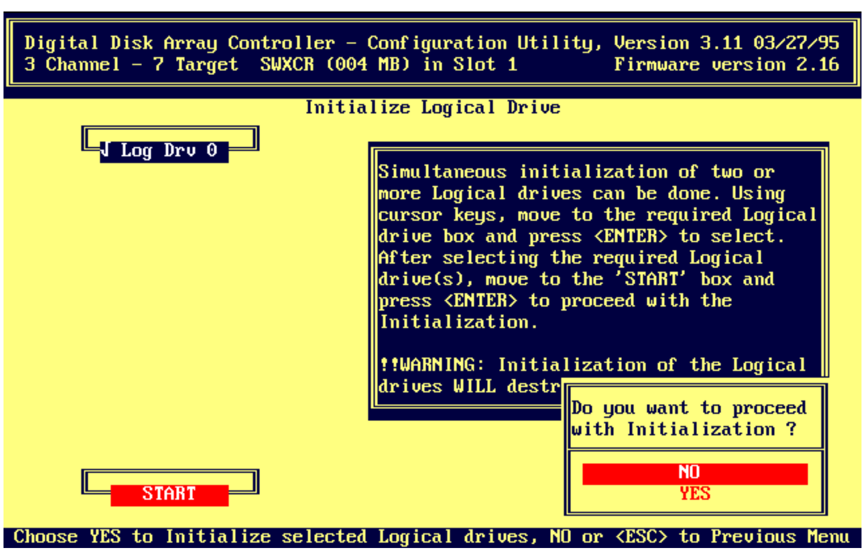
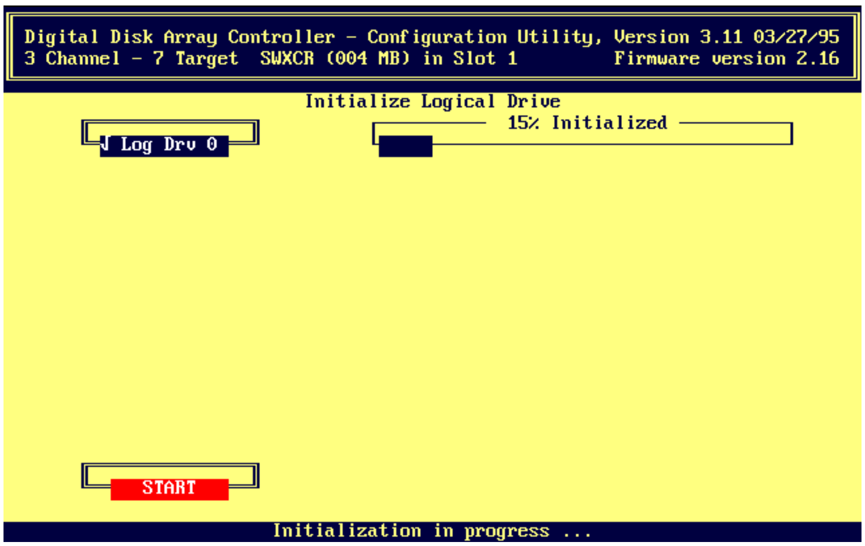


Figure 2–6 Progress Bar Displays Status of Initialization



2.3.3 Saving Controller Configuration to Diskette

CAUTION

If you replace a failed KZPAC controller with a new one, and restore an outdated configuration to it from diskette, data will be lost. Since the KZPAC controller must have a current configuration to locate data on the logical drives, it's important to have a current version of the configuration on diskette. All configuration changes, however small, must be reflected. For example, if a logical drive rebuilds using a hot spare drive, you need to update the new configuration on diskette.

Refer to Section 3.4.6, Backup/Restore Configuration, for this procedure.

2.4 Configuring Interactively/Manually

2.4.1 Introduction

A user configures interactively using one of two *Main Menu* choices in the *RAID Configuration Utility*. These choices are *New Configuration* and *View/Update Configuration*. Decide which choice is best for your situation by reading Sections 2.4.1.1 and 2.4.1.2.

2.4.1.1 New Configuration and View/Update Configuration: Differences

If a valid configuration already exists, selecting *New Configuration* from the *Main Menu* on the *RCU* displays a *WARNING* which explains that a configuration exists and that proceeding further may destroy it. There is also a prompt asking if you want to proceed. Selecting *NO* returns you to the Main Menu. Selecting *YES* displays the *New Configuration* screen. If no configuration exists, the *WARNING* and *NO/YES* prompt do not appear, and the *New Configuration* screen displays directly when selected. The *New Configuration* screen has three selections:

- *Define Drive Group*
- *Define Logical Drive*
- *Define Spare*

Selecting *View/Update Configuration* from the *Main Menu* on the *RCU* displays the *View/Update Configuration* screen with four selections:

- *View/Define Drive Group*
- *Define Logical Drive*
- *Define Spare*
- *View Logical Drive matrix*

Table 2–4 summarizes the differences between the *New Configuration* and *View/Update Configuration* screens.

Table 2–4 New Configuration and View/Update Configuration Screens: Differences

Feature/ Selection	New Configuration Screen	View/Update Configuration Screen
Major differences	If configuration already exists, displays WARNING when *New Configuration* selected that existing configuration may be voided if you proceed.	If configuration already exists, selecting *View/Update Configuration* displays *View/Update Configuration* screen with no WARNING because existing configuration is left in place.
	All selections made from *New Configuration* screen below show no configuration until you create new one.	All selections made from *View/Update Configuration* screen show previously defined configuration if one exists.
	If no configuration exists, selecting *New Configuration* displays *New Configuration* screen directly with no advance WARNING.	If no configuration exists, or old configuration has been canceled, selections below become similar to *New Configuration* screen selections.
1st selection	*Define Drive Group* — Displays *Group Definition* screen allowing you to create, and then arrange, drive groups as well as cancel drive group and obtain device information.	*View/Define Drive Group* — Displays same *Group Definition* screen as originated from *New Configuration* screen. Difference is that screen displays any existing configuration.

Table 2–4 New Configuration and View/Update Configuration Screens: Differences (Cont)

Feature/ Selection	New Configuration Screen	View/Update Configuration Screen
2nd selection	*Define Logical Drive* — Displays *Logical Drive Definition* screen, allowing you to define logical drives if you've defined and arranged drive groups. Making this selection without creating and arranging drive groups, displays message explaining that drive groups must be created and arranged before defining logical drives.	*Define Logical Drive* — Displays same *Logical Drive Definition* screen as originated from *New Configuration* screen. Difference is that screen displays any drive groups and logical drives already defined in existing configuration.
3rd selection	*Define Spare* — Displays *Define Spare* screen, allowing you to designate any drive with ready (*RDY*) status as hot spare (*HSP*).	*Define Spare* — Displays same *Define Spare* screen as originated from *New Configuration* screen. Difference is that screen displays any previously defined hot spare drive in existing configuration as *HSP*.
4th selection	(This selection is unavailable on *New Configuration* screen.)	*View Logical Drive matrix* — Displays *View matrix* screen with list of logical drives currently defined.

2.4.1.2 Using New, or View/Update, Configuration Screen to Configure Subsystem or Check Configuration

Use *New Configuration* screen selections for configuring when:

- No configuration exists and you want to create one.
- An unwanted configuration exists and you want to replace it with an entirely different one.

The *New Configuration* screen is a good choice when you know there is no existing configuration and you want to create one. In this case, you start with unconfigured drives connected to the KZPAC controller and configure them.

For example, you install a new RAID array subsystem and use the *New Configuration* screen to configure it.

The *New Configuration* screen is also a good choice when an unwanted configuration exists, and you want to create a different one. In this case, the data on the RAID subsystem may be from a completed project and is no longer needed. The new project has different data requirements than the old one, and requires an entirely different configuration, not just a change that can be handled by a slight modification of the old configuration.

For example, your original project requires you to maximize storage space using six, 1-GB drives. Available space is more important than redundancy. You configure six drives in six drive groups as JBODs on a 1-channel KZPAC controller to maximize available storage space.

In your next project your storage space requirements are small, but reliability is important. You use the *New Configuration* screen to cancel the existing configuration and configure four of the six, 1-GB drives in two drive groups of two drives each, defining logical RAID drives using RAID level 1 for maximum reliability. You define the remaining drives as hot spares.

Use *View/Update Configuration* screen selections when:

- You want to find out whether a configuration exists, and if so, determine its characteristics.
- You want to modify an existing, known configuration.

The *View/Update Configuration* screen is a good choice when you don’t know whether a subsystem has been configured, or you know it’s configured, but have forgotten the arrangement.

For example, you know a configuration exists with two logical RAID drives, but you don't know what RAID level was specified. Select the *View/Update Configuration* screen, then choose *Define Logical Drive* from the screen that appears. The *Logical Drive Definition* screen displays, showing that logical drives 0 and 1 are defined using RAID level 1 in two drive groups with two physical drives each.

The *View/Update Configuration* screen is also a good choice when you want to modify a known configuration.

For example, you have the configuration described above with six, 1-GB drives in two drive groups of two drives each, with two logical RAID drives defined, using RAID level 1 for maximum reliability. Two remaining drives are hot spares. Because you need more space for data storage, you decide to create an identical third drive group using the two hot spares. You select the *Define Spare* screen from the *View/Update Configuration* screen to change the status of the two hot spares from HSP to RDY, then use the *View/Define Drive Group* from the *View/Update Configuration* screen to create and arrange the drive group. Next, you use the *Define Logical Drive* screen to define the logical drive. Finally, you save the configuration before you return to the *Main Menu* of the *RCU*.

2.4.2 Defining Drive Groups

Read Section 2.4.1.2 before choosing the *View/Update Configuration* screen used for working with drive groups as in the procedure below. Depending on the situation, the *New Configuration* screen may be a better choice than the *View/Update Configuration* screen.

2.4.2.1 Introduction

A drive group consists of from one to eight physical drives that you want to work together.

You can define a drive group at any time. After you initially configure the subsystem, you can define a drive group with drives that you did not previously configure into drive groups, or with new drives you add to the subsystem. You can also define new drive groups with drives that you previously configured into drive groups by first canceling the existing drive groups that you want to re-organize.

Determine how many drives to use for each drive group based on the following:

- The RAID levels of the logical RAID drives you will create.

  See Table 2–5 to see the minimum and maximum number of drives allowed for each RAID level. (You can create multiple logical RAID drives of varying RAID levels on a drive group.)

Table 2–5 Number of Drives per Drive Group for Each RAID Level

RAID Level	Number of Drives in Drive Group	Amount of Storage Available for User Data	Data Redundancy
0	2 to 8	100%	No
1	2	50%	Yes
0 + 1	3 to 8	50%	Yes
5	3 to 8	66% — 87%	Yes
JBOD	1	100%	No

- The amount of disk space you need

  Table 2–5 shows the amount of storage available for user data for each of the RAID levels.

  Also, consider the capacities of each of the individual disks. The capacity of each disk is affected by the other disks in the group. As shown in Table 2–6, disk drives of varying capacities are limited to the capacity of the smallest drive in the drive group. To maximize your space resources, use drives of the same capacity in each drive group.

Table 2–6 How Capacity of Each Individual Drive Affects Capacity of Drive Group — Example Only

Drive Group	Drives	Drive's Capacity	Drive's Usable Capacity in This Group	Drive Group's Total Capacity
A	0 1 2	1 gigabyte 2 gigabyte 2 gigabyte	1 gigabyte 1 gigabyte 1 gigabyte	3 gigabytes (due to drive 0's capacity being 1 gigabyte)
B	0 1 2	2 gigabytes 2 gigabytes 2 gigabytes	2 gigabytes 2 gigabytes 2 gigabytes	6 gigabytes

In defining drive groups, remember:

- Each physical disk will belong to only one drive group at a time.
- You can define a maximum of eight drive groups per KZPAC controller.
- After you create drive groups, you must arrange them in the order in which you want to use them. Arranging drive groups determines the order that the operating system sees the logical drives you create in each drive group. The logical drive(s) on the first group arranged is (are) presented to the operating system before all subsequently arranged drive groups.
- You must use all the available space on a drive group before you can use another drive group. Consider what data you want to put on which drive group before arranging your drives because you can only delete drive groups in the reverse order in which they were arranged. For example, if you create drive groups A, B, and C, and arrange them in that order, then you must delete drive groups C and B before you can delete drive group A.

Defining drive groups is a two-step procedure.

- Creating drive groups and
- Arranging drive groups.

2.4.2.2 Create Drive Group

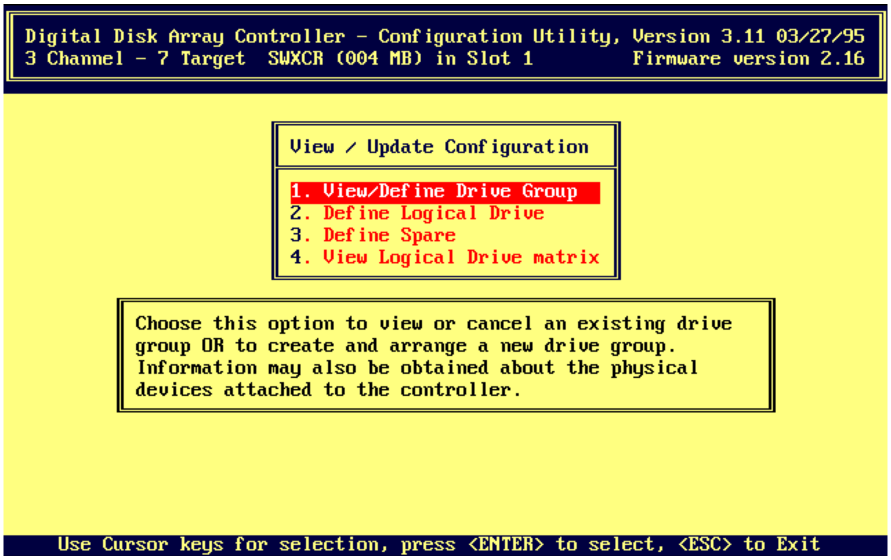
This procedure creates a drive group. In the example given, we create a group with 2 disk drives, and add it to an existing group of 3 disk drives.

We use the *View/Update Configuration* screen, rather than the *New Configuration* screen, because we are adding to an existing configuration.

> **NOTE**
>
> You may create a maximum of eight drive groups per KZPAC controller. Version 2.xx firmware supports the creation of a maximum of eight logical drives spread in any combination on the drive groups defined on the controller.

1. Use arrow keys to highlight *View/Update Configuration* option from *Main Menu* and press Enter key to select it. *View/Update Configuration* screen appears with *View/Define Drive Group* option highlighted, as shown in Figure 2–7.

Figure 2–7 View/Update Configuration Screen

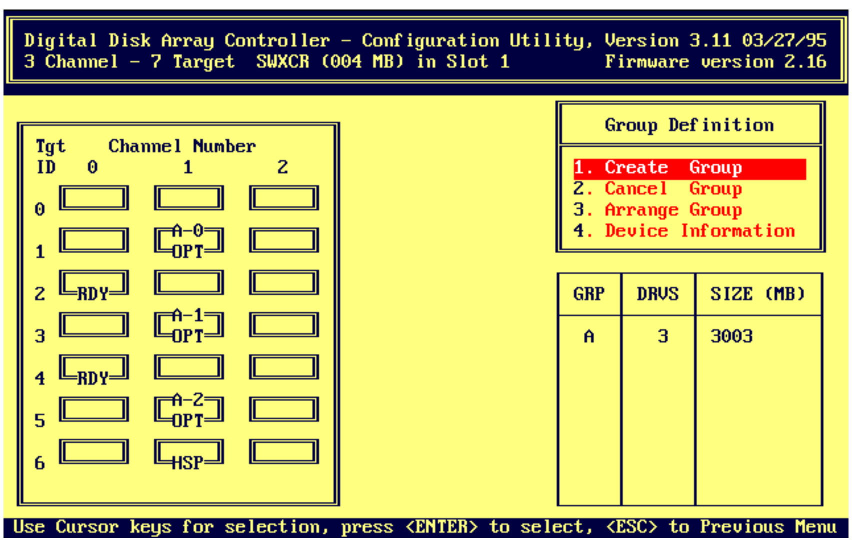


2. Press Enter key to select *View/Define Drive Group* option. *RCU* displays *Group Definition* screen with drive matrix showing drives connected to adapter (KZPAC controller). Screen indicates status of each drive, as shown in Figure 2–8. *Create Group* selection appears highlighted.

NOTE

The Group Definition screen below is the same whether originated from the View/Update Configuration screen by selecting View/Define Drive Group, or from the New Configuration screen by selecting Define Drive Group.

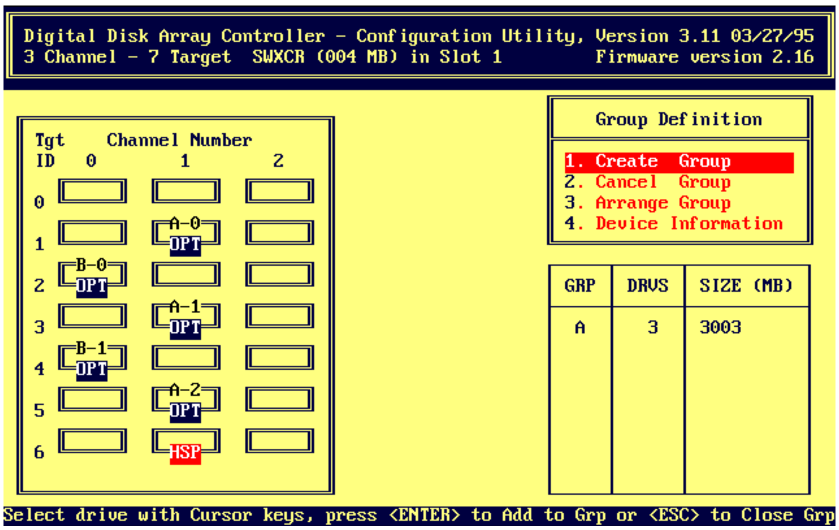
Figure 2–8 Group Definition Screen



3. Press Enter key to select *Create Group* option. Cursor moves to drive matrix.

4. Use arrow keys to position cursor on each drive you want to add to drive group, one at a time, and press Enter key. *RCU* adds that drive to drive group, changing its status from RDY (ready) to OPT (optimal), and assigning group letter and sequence number to drive as shown in Figure 2-9.

Figure 2–9 Adding New Drive Group



5. Press Esc key after you add all drives you want for this drive group.

> **NOTE**
>
> The hot spare drive mentioned in the following step must have capacity equal to, or greater than, capacity of drives you used in drive groups.

1. Repeat Steps 3 through 5 of this procedure to create additional drive groups. If you plan to define a hot spare, leave at least one drive with RDY (ready) status.
2. If you assign all physical drives to drive groups, *RCU* automatically highlights *Arrange Group* option. To leave some drives unassigned, press Esc key and cursor returns to *Group Definition* menu.
3. If you mistakenly select incorrect drive for drive group, cancel drive group as explained in Section 2.4.2.3. Otherwise, go directly to Section 2.4.2.4 to arrange drive groups.

> **NOTE**
>
> Check the drive groups you defined to make sure you want them. Make changes now. You cannot cancel a drive group once you select the *Arrange Group* option.

2.4.2.3 Cancel Drive Group

If you select a drive for a drive group incorrectly, or you want to redefine a drive group for any other reason, cancel the group as follows:

1. See Section 2.4.2.1 for restrictions in canceling drive groups.
2. If necessary, display *Group Definition* screen by performing steps 1 and 2 in Section 2.4.2.2, Create Group.
3. Use arrow keys to highlight *Cancel Group* and press Enter key to select it.
4. Cursor highlights first drive in drive group. If this is not drive group you wish to cancel, use arrow keys to highlight first drive in desired group.
5. Press Enter key to cancel drive group.

2.4.2.4 Arrange Drive Group

Before you define a logical RAID drive on any drive group, you must arrange the drive groups to specify the order in which you want to use them.

1. If *Arrange Group* option is not already highlighted, use arrow keys to highlight it, then press Enter key. Cursor moves to first defined drive group.

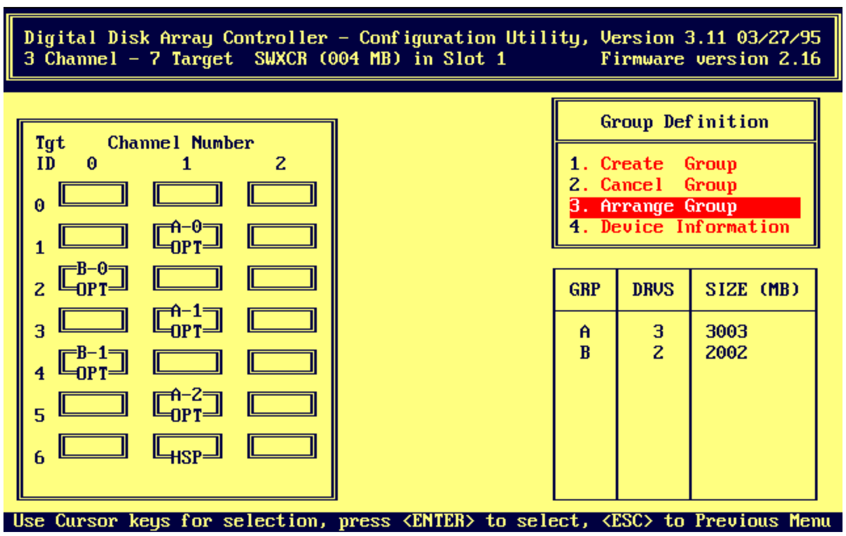
> **NOTE**
>
> If you press the ESC key while arranging groups, you lose the assigned drive groups and must recreate them.

2. Use arrow keys to move cursor to drive in drive group you want to arrange. Press Enter key. Drive group and size information for arranged drive group appears in table at lower-right side of screen, as shown in Figure 2–10. If you defined only one drive group, *View/Update Configuration* menu appears with the *Define Logical Drive* option highlighted.

   Otherwise, repeat this for each drive group that you defined. When you arrange last drive group, *View/Update Configuration* screen appears with *Define Logical Drive* option highlighted.

This completes the creation and arrangement of your drive groups. If you want device information on the drives, continue with Section 2.4.2.5, Obtaining Device Information; otherwise, go to Section 2.4.3, Creating Logical Drive and Choosing Caching Policy.

Figure 2–10 Arrange Group Screen



2.4.2.5 Obtaining Device Information

Use the *Device Information* selection to obtain the vendor, model number, revision, size (in MB), channel number, and target identification number of any drive attached to the KZPAC controller:

1. If necessary, display *Group Definition* screen by performing steps 1 and 2 in Section 2.4.2.2, Create Group.
2. Use arrow keys to highlight *Device Information* and press Enter key.
3. Cursor moves to drive matrix to highlight first drive in first drive group (A-0) as shown in Figure 2–11.
4. Use arrow keys to highlight desired drive; that is, drive you want information on.
5. When desired drive is highlighted, press Enter key.
6. Monitor displays *Device Information* for highlighted drive (A–0) at lower right corner of screen. See Figure 2–12.

Figure 2–11 Selecting Device Information

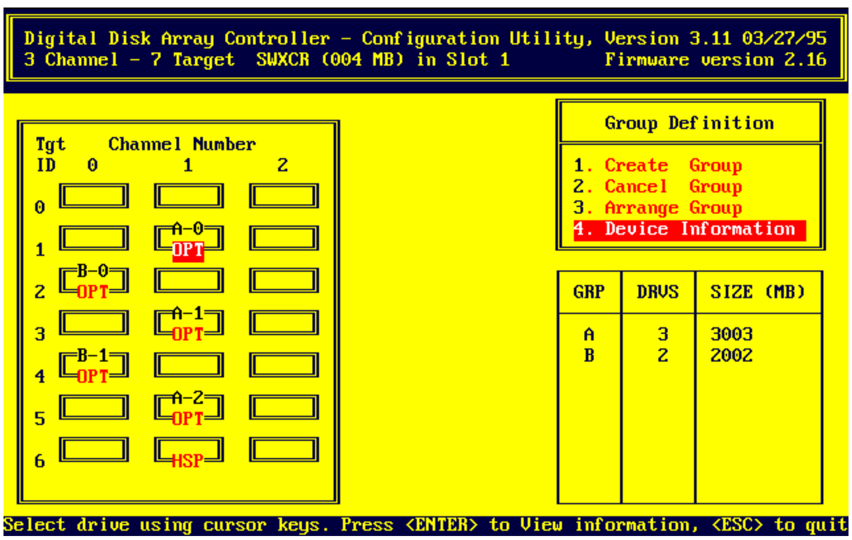
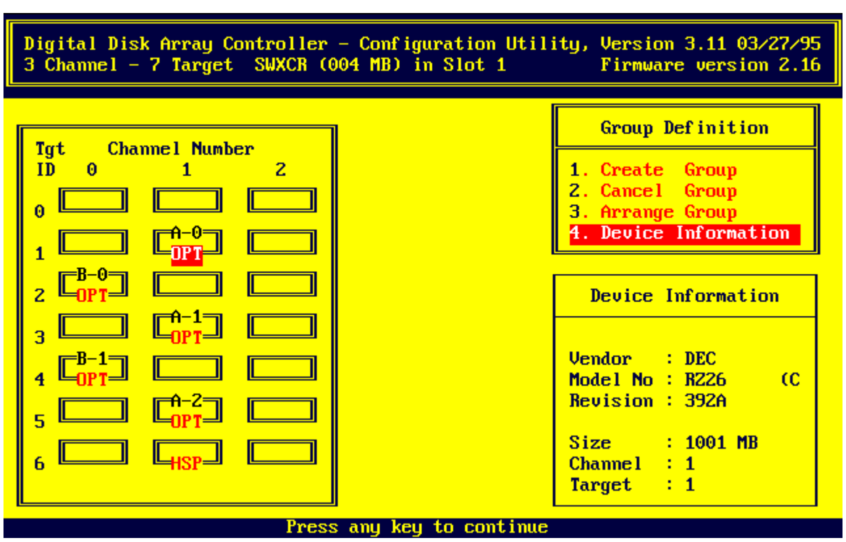


Figure 2–12 Device Information Window



2.4.3 Creating Logical Drive and Choosing Caching Policy

You create a logical RAID drive with part, or all of the space available on a drive group. The logical RAID drive allows your operating system to see and respond to the selected space of the drive group as one physical drive. The logical RAID drive also defines how your system will store data on that disk space, based on the RAID level selected. To the operating system, there is no difference between a logical RAID drive and a single physical drive on a conventional disk controller.

You can create a maximum of 8 logical RAID drives per controller.

NOTE

For redundant RAID configurations, the controller must use some of the space to support redundancy. See Table 2–5 for information on how much space is available on which you can store unique data for each RAID level.

Creating a logical drive is a three-step procedure:

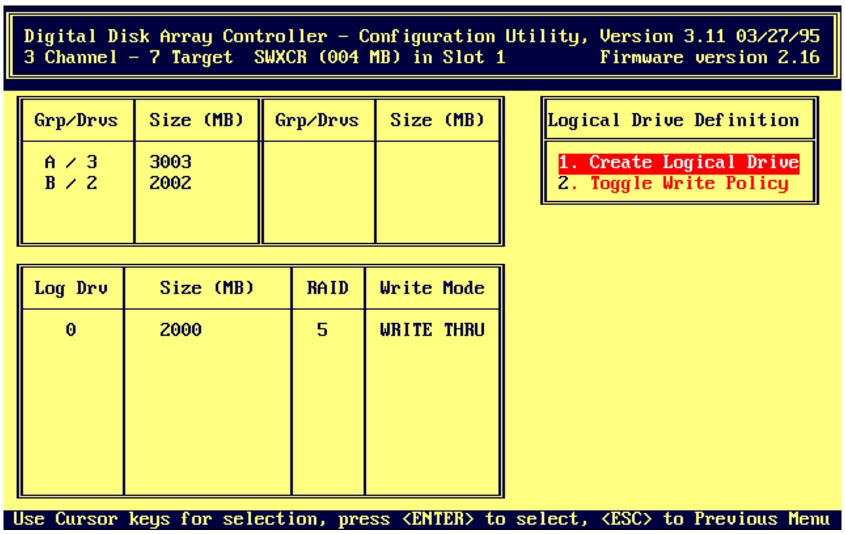
- Defining a logical drive
- Choosing a write caching policy
- Saving the logical drive configuration

2.4.3.1 Define Logical Drive

To define a logical drive:

1. Press Enter key to select *Define Logical Drive* option from *View/Update Configuration* menu. *Logical Drive Definition* screen appears as shown in Figure 2–13. *Logical Drive Definition* screen displays option menu, table of drive groups available for selection as logical drives, and table of existing logical drives.

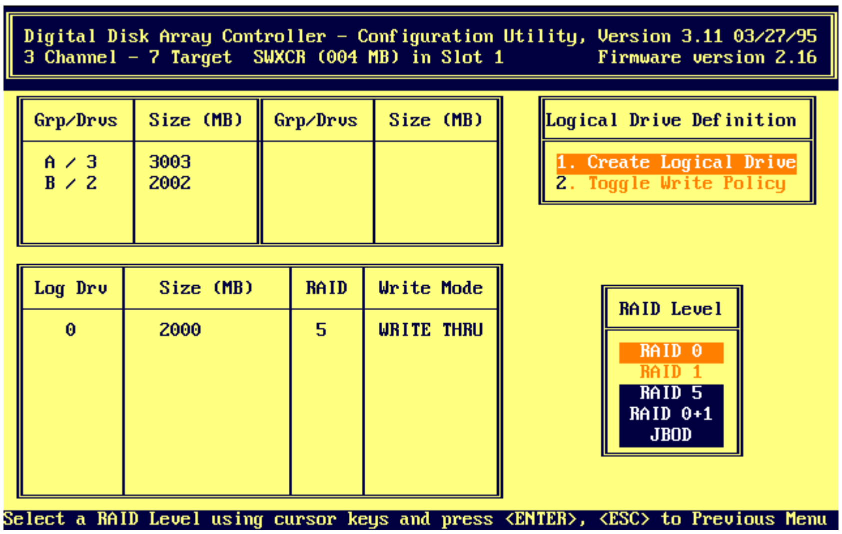
Figure 2–13 Logical Drive Definition Screen



2. Press Enter key to select *Create Logical Drive* option. A pop-up window, similar to that shown in Figure 2–14, displays RAID levels available for that logical drive. Unavailable levels appear black in this guide, gray on your monitor. You cannot select them.

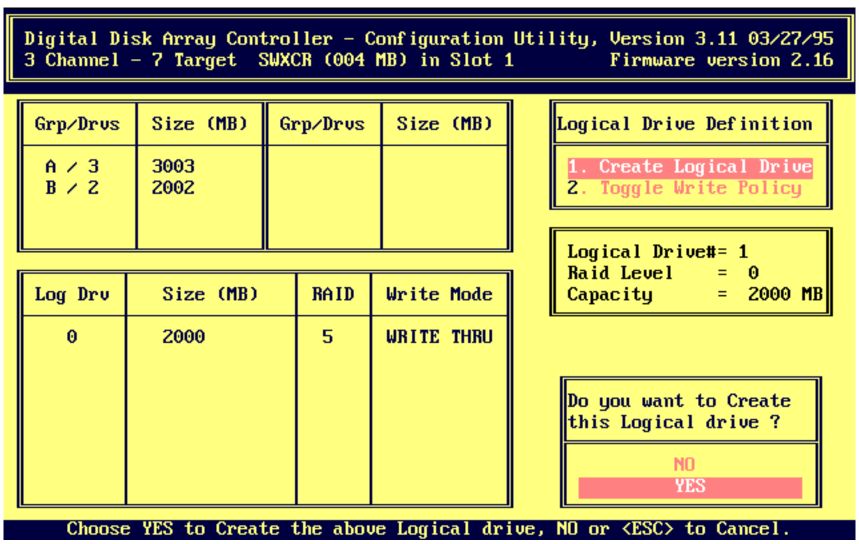
   You can create logical drives on one drive group at a time, and must use all space on each drive group before you can go on to the next one. You can only create logical RAID drives on drive groups in the order in which groups appear in Group Drives (*Grp/Drvs*) list.

Figure 2–14 RAID Level Window



3. Use up and down arrow keys to move to RAID level valid for number of drives in this drive group. (See Table 2–5 for description of number of drives required for each RAID level.) Press Enter key to select. Pop-up window appears, displaying available space for this RAID level.
4. Type amount of space you want to use for this logical drive and press Enter key, or press Enter key to select all available space in this drive group. Two boxes appear, similar to those shown in Figure 2–15, displaying number of new logical drive, its RAID level, and capacity. Another box prompts you to create this logical drive.

Figure 2–15 Create Logical Drive Confirmation

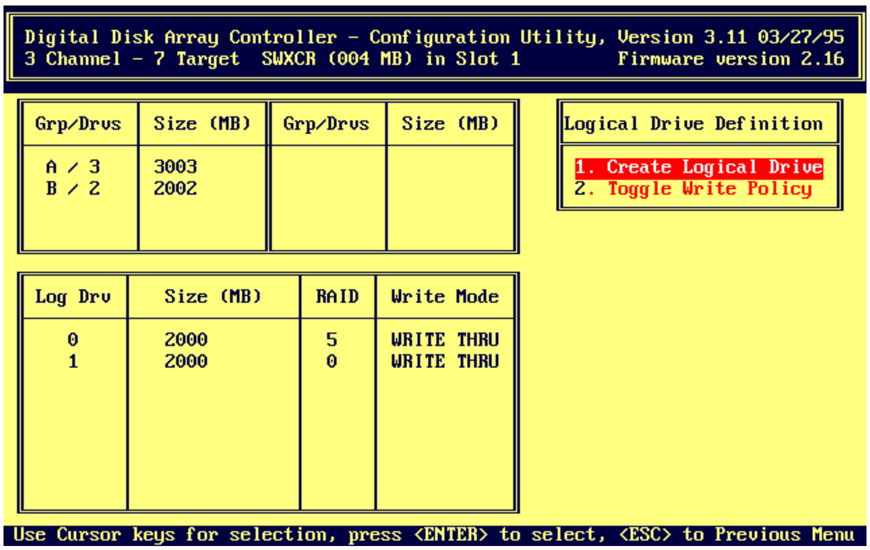


5. Select *YES* to create this logical drive. *RCU* adds logical drive to Logical Drive (*Log Drv*) list at lower-left of screen, similar to screen shown in Figure 2–16.

   Or,

   Select *NO* if you don't want to create this logical drive. Confirmation box disappears.

Figure 2–16 Displaying New Logical Drive



6. Repeat steps 1–5 for up to eight logical RAID drives, or until you use full capacity of all available drive groups, whichever comes first. You can only create logical drives on one drive group at a time and must use all space on drive group before you can go on to next one. *RCU* displays each logical drive in list at lower-left of screen.
7. When you finish creating logical drives, see Section 2.4.3.2, Choose Caching Policy, to select caching policy for logical drives you created.

   Or, if you do not want to use logical drives you just created, press Esc key. *View/Update Configuration* screen appears. Press Esc key again. *Save Configuration* screen appears. Highlight *NO* and press Enter key. *Main Menu* appears.

2.4.3.2 Choose Caching Policy

The caching policy determines what procedure the KZPAC controller uses to write data to the logical drives. You can choose one of the following caching policies:

- *WRITE BACK* caching: A caching policy in which the controller acknowledges that a write operation has completed successfully before data is written to the disks. If you choose this option, you may increase the I/O performance of your RAID subsystem.

  We recommend that you select this caching policy only if your cache has battery backup and you have enabled the battery backup. Without a battery backup, if there is a power failure, you lose data in cache that is not yet written to the disks.

- *WRITE THRU* caching: A caching policy in which the data is written to disk before the controller acknowledges that a write operation has completed successfully. If you choose this option, and there is a power failure, you minimize the chance of data loss. This is the StorageWorks RAID Array 200 subsystem default caching policy.

NOTE

If you do not have the battery backup option installed and enabled, we strongly recommend a *WRITE-THRU* caching policy to eliminate the chance of data loss due to a power failure.

To change the caching policy:

1. Use up and down arrow keys to highlight *Toggle Write Policy* option in *Logical Drive Definition* box (Figure 2–16) and press Enter key. Cursor moves to *Write Mode* column of Logical Drives (*Log Drv*) list and highlights write mode of first logical drive.
2. Press Enter key to toggle caching policy to *WRITE BACK.*
3. Use arrow keys to move to another logical drive and repeat step 2, as necessary.
4. When you finish selecting cache policy for your logical drives, press Esc key. *Write Mode* column is no longer highlighted.
5. Press Esc key again. *View/Update Configuration* screen, or *New Configuration* screen, appears.

If you plan to use one of your drives as a hot spare, go on to section 2.4.4 to define a hot spare drive. If you want to view the logical drive matrix, go to section 2.4.5. Otherwise, go to section 2.4.6 to save your array configuration.

2.4.4 Defining Hot Spare Drive

Optionally, you may define a hot spare drive to keep a drive available in your subsystem on which the KZPAC controller can automatically rebuild information from a drive that fails. The hot spare drive must have a capacity equal to, or greater than, the failed drive.

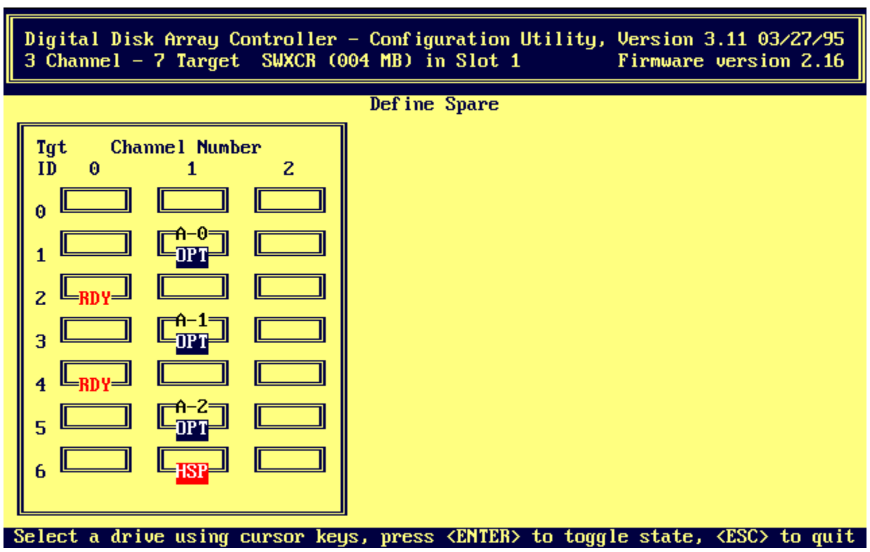
CAUTION

To maintain high availability in the array when hot spare devices are used, always ensure that your hot spare disk capacity is equal to, or larger than, any prospective configured disk the hot spare might replace. This is particularly important after an initial failure to a hot spare disk has occurred, and the KZPAC controller automatically designates a replacement drive as a new hot spare.

To define a hot spare drive:

1. Use up and down arrow keys to highlight *Define Spare* option on *View/Update Configuration* screen and press Enter key. *RCU* displays *Define Spare* screen as shown in Figure 2–17.

Figure 2–17 Define Spare Screen



2. Use arrow keys to select drive with status of RDY that you want to define as spare, and press Enter key. *RCU* changes drive status to HSP (hot spare).

   If you select wrong drive or decide you do not want hot spare drive, press Enter key again. Status of drive returns to its previous status.

Unless you want to view the logical drive matrix as described in section 2.4.5, go to section 2.4.6 to save the configuration of your array.

2.4.5 Viewing Logical Drive Matrix

> **NOTE**
>
> *View Logical Drive matrix* cannot be originated from the *New Configuration* screen.

To view disk drive and logical drive information:

1. Use up and down arrow keys to select *View/Update Configuration* option from *Main Menu* and press Enter key. *RCU* displays *View/Update Configuration* screen (Figure 2–7).

2. Use up and down arrow keys to highlight *View Logical Drive matrix* option from *View/Update Configuration* screen and press Enter key. *View matrix* screen appears with drive matrix as shown in Figure 2–18.

   View matrix list displays all logical drives configured onto disk drives in your subsystem.

3. Use up and down arrow keys to highlight any logical drive and press Enter key. Cursor moves to drive matrix. Cursor appears at disk drive 0 of drive group associated with selected logical drive. Drive matrix displays:

   - Target Identification *(Tgt ID)*
   - *Channel Number*
   - Drive group designator, if any, which allows you to see which disks belong to which drive groups, and how many disks belong to group based on numbers assigned to drives 0 through 7. For example, drive A-2 is one of three drives in drive group A.
   - Status for each drive in subsystem (Table 2–7 describes each status that a drive can have.)

Figure 2–18 View Matrix Screen

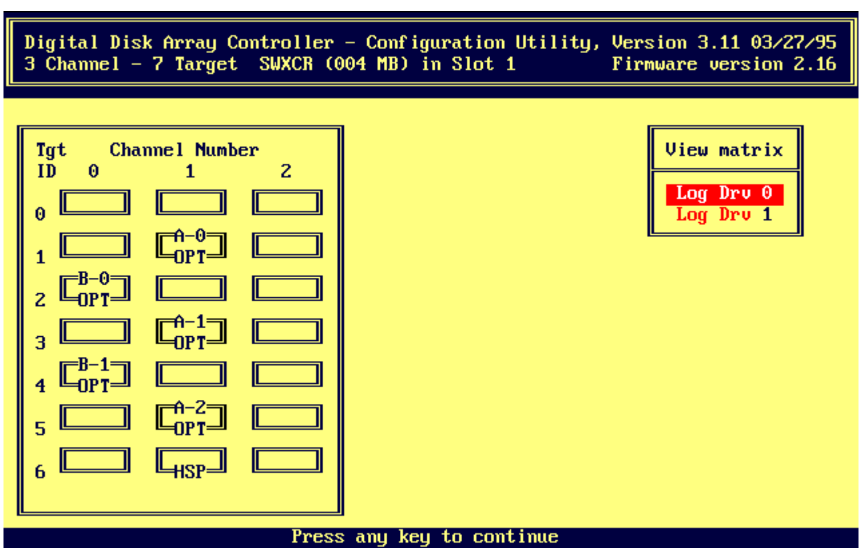


Table 2–7 Drive Status

Display	Drive Status	Meaning
FLD	Failed	The device failed due to errors, or you manually failed it.
FMT	Formatting	The device is undergoing SCSI device format.
HSP	Hot spare	The device is configured as a hot spare for use in an automatic rebuild in the event of a disk failure in a redundant RAID configuration.
OPT	Optimal	The device is on-line and configured for use. Drives associated with a drive group appear with this status.
RDY	Ready	The device is spun up and ready to be used by the controller, but it is not configured. Drives which are not associated with a drive group appear with this status.
UNF	Unformatted	The controller could not properly talk to the device on the SCSI bus, or a SCSI format to the device was halted in the middle.
WOL	Write Only	The device is being rebuilt and is in write-only mode, or the rebuild has failed, leaving the RAID set in degraded mode.

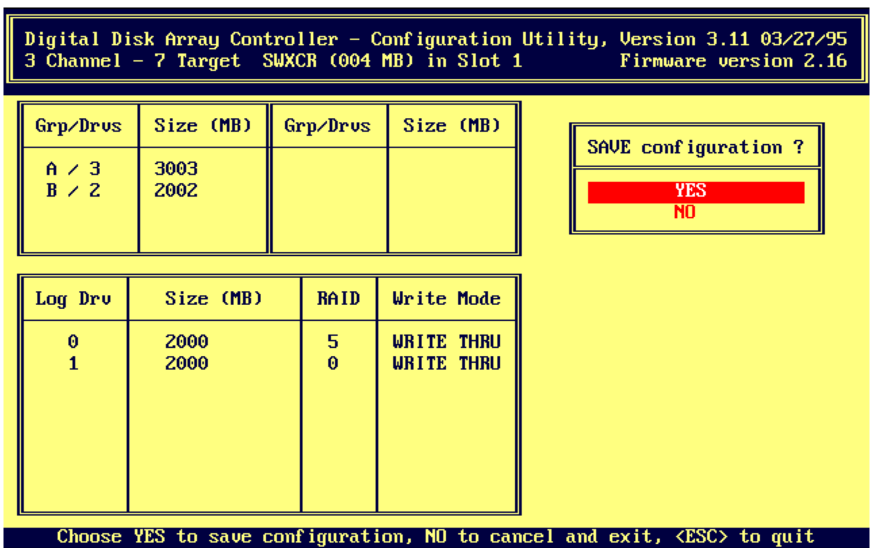
4. Press Enter key to return to *View Matrix* list.
5. Press Esc key to return to *View/Update Configuration* screen when you finish viewing drive groups associated with logical drives.

2.4.6 Saving Logical Drive Configuration

To save the logical drive configuration that you created:

1. Press Esc key from View/*Update Configuration, New Configuration,* or *Define Spare* screens. *RCU* displays *SAVE configuration?* window, as shown in Figure 2–19.
2. Select Yes to save logical drive configuration. *RCU* saves configuration to flash EEPROM/NVRAM and *Main Menu* appears.

Figure 2–19 Save Configuration Window



The *RCU* saves the configuration that you created by storing it on flash EEPROM/NVRAM. Thereafter, your controller will expect to see this configuration.

If you created a new logical drive, go to section 2.4.7 to initialize it.

2.4.7 Initializing Logical Drive

Initialize a logical RAID drive before you use it. The *RCU* initializes the logical drive by writing a pattern of consistent data and parity to it. This creates a starting parity for a logical RAID drive with parity.

CAUTION

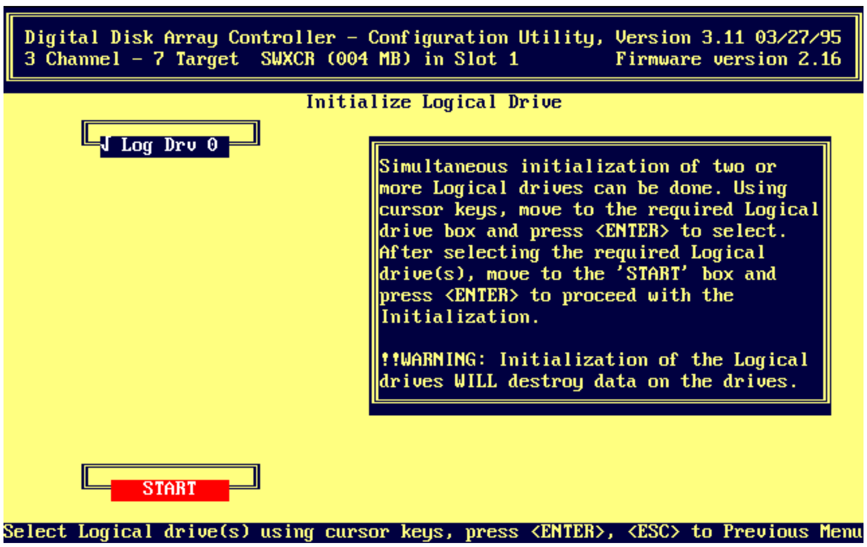
Do not initialize a logical drive if it has valid data. Initialization overwrites and destroys all data.

After you initialize a logical drive, do not change or rearrange the physical drives or cables. Otherwise, all data in the drive group can be lost.

To initialize a logical drive:

1. From *Main Menu*, select *Initialize Logical Drive* option. *RCU* displays *Initialize Logical Drive* screen, with logical drive 0 (*Log Drv 0*), as shown in Figure 2–20.

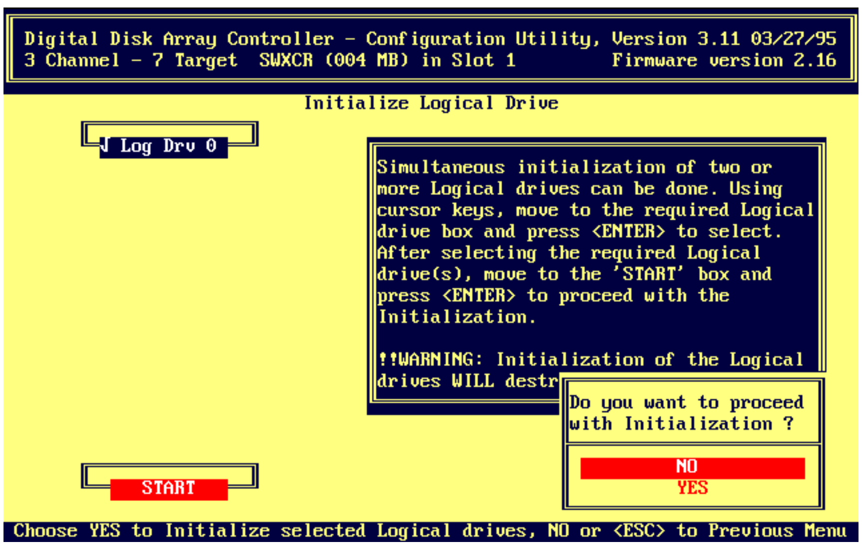
Figure 2–20 Initialize Logical Drive Screen



2. Use arrow keys to move to each logical drive you want to initialize, and press Enter key to select it. Check mark appears beside each logical drive you selected. Once you select all available logical drives, *RCU* automatically highlights *START* button. Otherwise use arrow keys to move to *START* button.
3. Press Enter key. Confirmation window appears as shown in Figure 2–21, displaying message as follows:

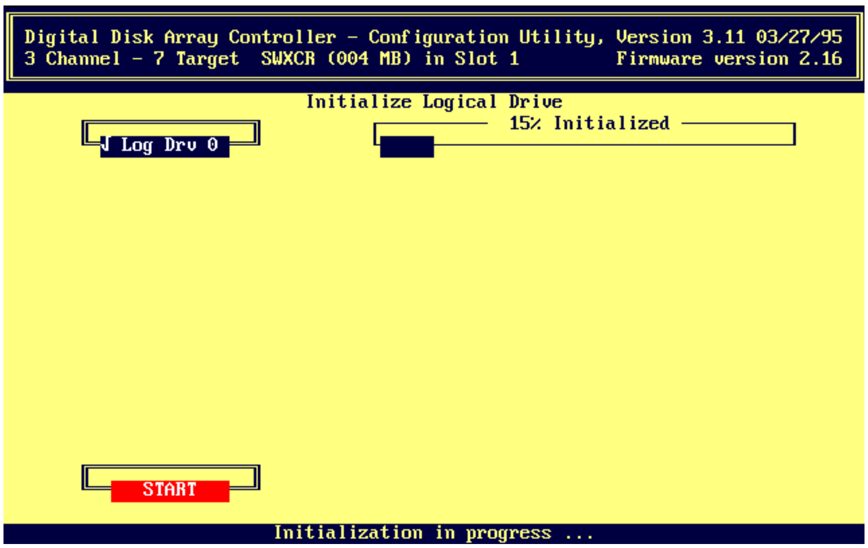
Do you want to proceed with Initialization?

Figure 2–21 Confirmation Window



4. Use arrow keys to select *YES,* then press Enter key. *Initialize Logical Drive* status bar appears at top of screen, as shown in Figure 2–22, indicating percent of initialization completed. Bar gradually fills as initialization completes. When done initializing, *RCU* prompts you to press any key to continue.
5. Press any key. *RCU* displays message indicating that it is saving configuration, then *Main Menu* appears.

Figure 2–22 Percent Initialized Screen



2.4.8 Saving KZPAC Controller Configuration to Diskette

CAUTION

To avoid the chance of data loss due to a KZPAC controller failure, save the configuration to diskette any time the configuration changes. Then, If the controller fails and is replaced, the current configuration will be available to load onto the replacement controller. For example, if a physical drive fails, and the logical RAID drive incorporating it rebuilds the contents of the physical drive onto a hot spare, the changed configuration must be updated on diskette.

Refer to Section 3.4.6, Backup/Restore Configuration, for this procedure.

3

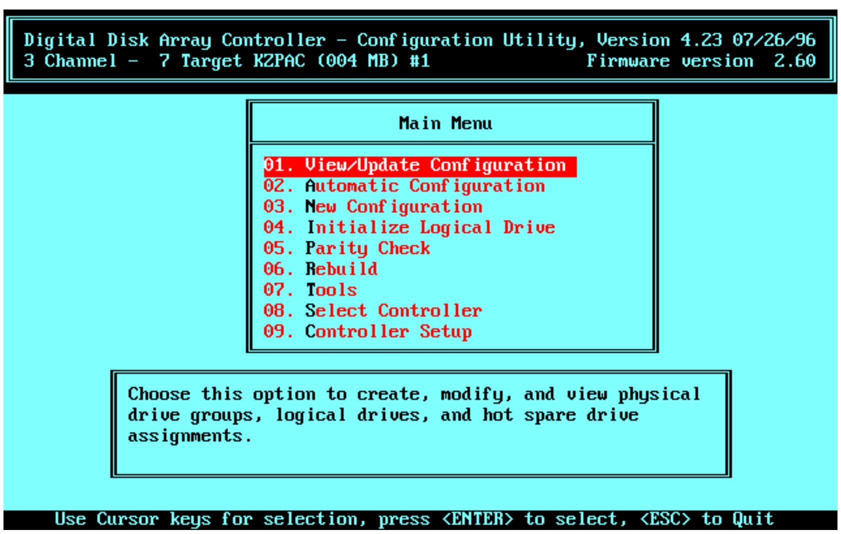
Maintaining The RAID Array

This chapter provides: a Parity Check procedure for checking and repairing parity on logical drives with redundant RAID levels, a Rebuild procedure for recreating (rebuilding) a failed drive's data on a replacement drive if the failed drive is part of a configuration with a redundant RAID level, and Tools procedures for using each of the eight options in the Tools window.

3.1 Introduction

As stated in the summary above, this chapter provides procedures for the *Parity Check, Rebuild,* and *Tools* selections. These choices are shown on the *Main Menu* of the *RAID Configuration Utility* (*RCU*). See Figure 3–1.

Figure 3–1 Main Menu of RCU



3.2 Running Parity Check/Repair

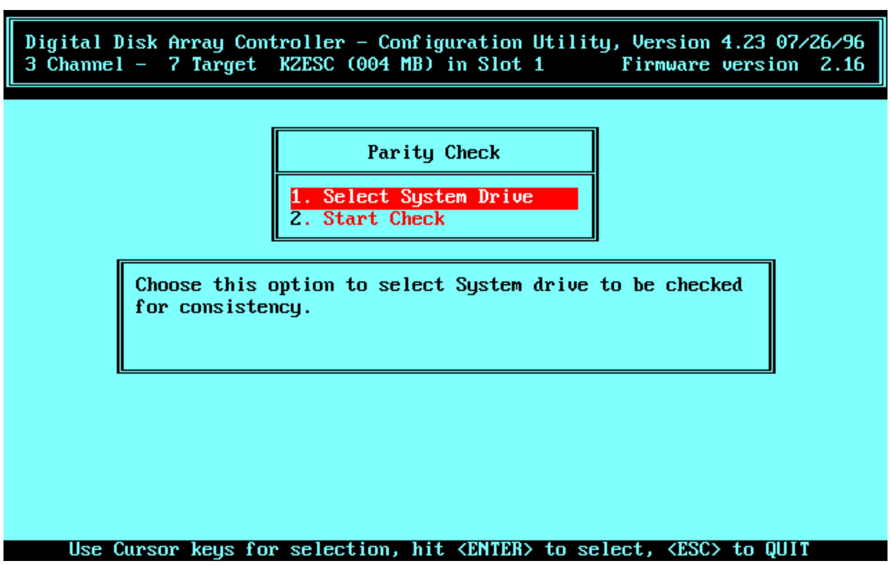
Perform a parity check on logical drives with a redundant RAID level (RAID 1, RAID 0 + 1, and RAID 5) to check the consistency of the RAID parity information. When you select *Parity Check* from the *Main Menu*, the *RCU* reads the data from the logical drive and computes the parity for each series of blocks. Any discrepancies between the computed parity and the parity stored on the drive are indicated. The *RCU* repairs parity inconsistencies by regenerating the data.

Check the parity of all of your logical drives at regular intervals, and after a power failure, or an *RCU* crash to ensure the integrity of parity and reduce the chance of data loss.

To check the consistency of a logical drive, follow these steps:

1. Use up and down arrow keys to highlight *Parity Check* on *Main Menu*, and press Enter. *RCU* displays *Parity Check* menu as shown in Figure 3–2.

Figure 3–2 Parity Check Menu

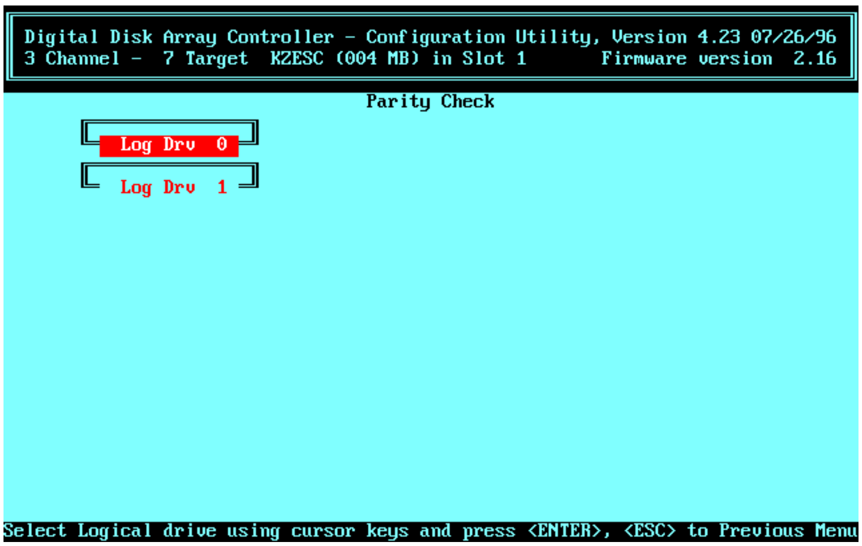


2. If necessary, use up and down arrow keys to highlight:

```
1.  Select System Drive
```

3. Press Enter key. *RCU* displays *Parity Check* screen as shown in Figure 3–3.

Figure 3–3 Parity Check Screen



4. Use up and down arrow keys to highlight logical drive you wish to check.
5. Press Enter key to select logical drive, then press Esc key to return to *Parity Check* menu (Figure 3–2).
6. Use up and down arrow keys to highlight:

```
2.  Start Check
```

7. Press Enter key. *RCU* displays *Parity Check* progress screen as shown in Figure 3–4.
8. If check is successful, as shown in Figure 3–5, press any key to return to *Main Menu*.
9. If check fails, as shown in Figure 3–6, press any key to restore parity. Screen similar to Figure 3–7 appears. Press any key again to restore parity. *RCU* displays results of parity restoration on screen similar to that shown in Figure 3–8.

Figure 3–4 Parity Check Progress Screen

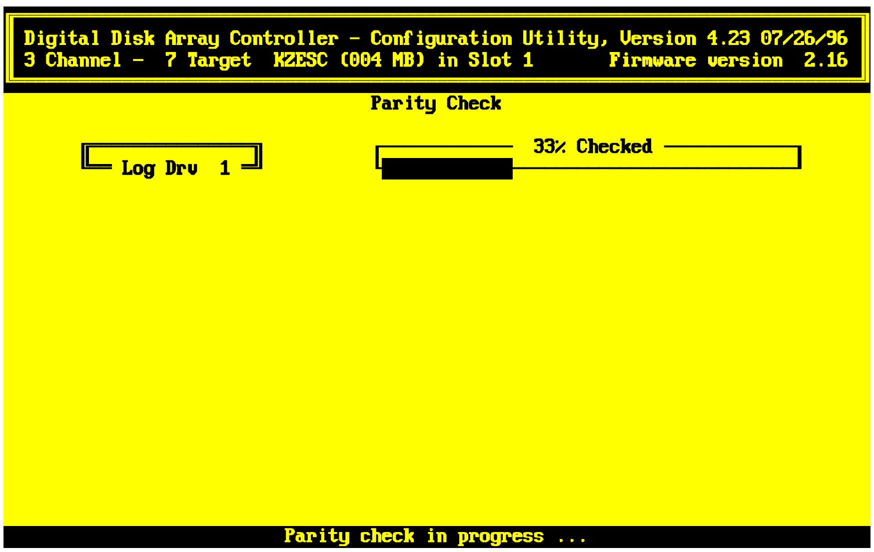


Figure 3–5 Parity Check Passed Screen

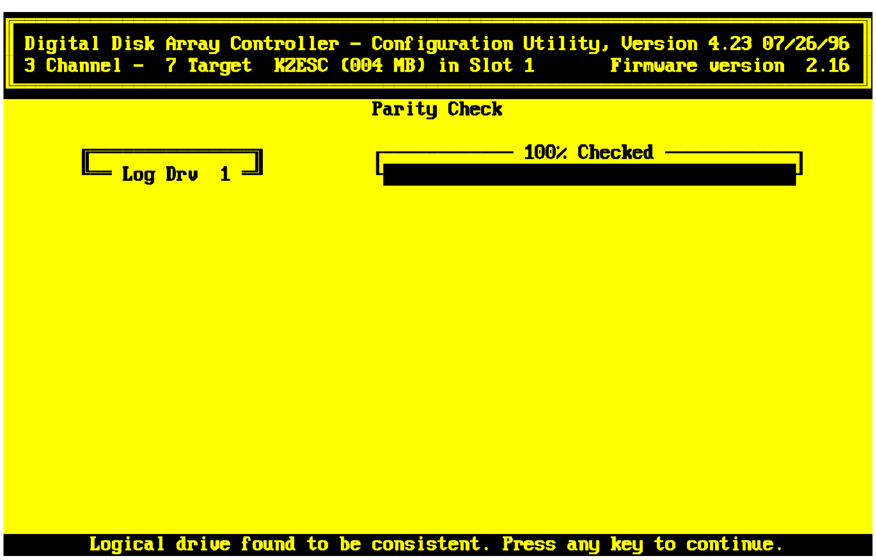
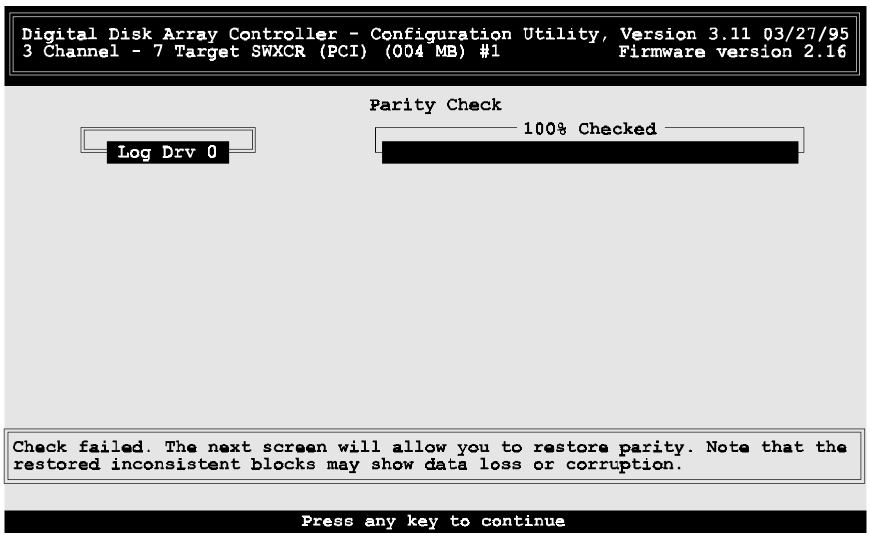
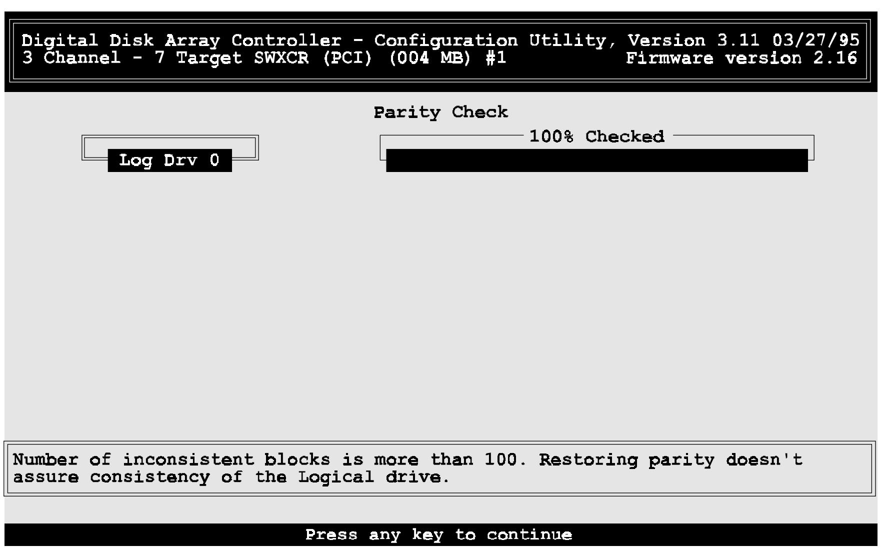


Figure 3–6 Parity Check Failed Screen



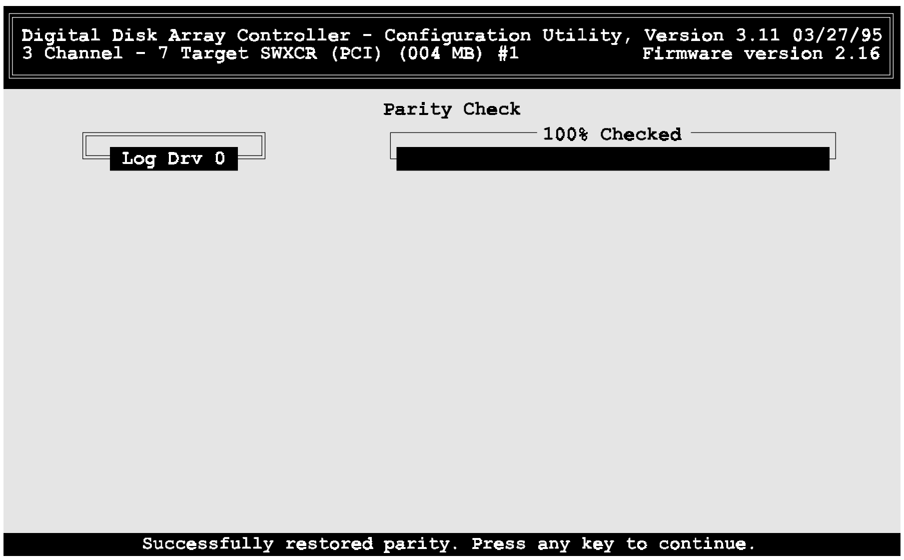
R07GA-001

Figure 3–7 Restore Parity Screen



R07GA-002

Figure 3–8 Parity Successfully Restored Screen



R07GA-003

3.3 Rebuild

Rebuilding a drive recreates a failed drive's data onto a replacement drive. You can rebuild a drive only for configurations with redundant RAID levels (RAID 1, RAID 0 + 1, and RAID 5). If a drive fails in a configuration without a redundant RAID level (RAID 0, JBOD), you can not recover data from the failed drive using the *RCU*.

NOTE

Upon detection of a drive failure, replace the drive as soon as possible to minimize the chance of data loss because of a second drive failure.

If your storage enclosure has StorageWorks Fault Management support, then the StorageWorks RAID Array 230/Plus Subsystem controller, also known as a KZPAC controller, will automatically start to rebuild the logical drive when you replace a failed drive in a redundant RAID set. If a hot spare drive exists in the shelf, then you do not have to manually rebuild the failed drive. In this case, a rebuild will automatically start on a hot spare device in the event of a drive failure in a redundant RAID set.

In addition, the KZPAC controller supports queuing rebuilds. If a rebuild is in process and a drive should fail in another drive group, the controller will start a rebuild of that second logical drive group after completing the first rebuild, assuming you replace the second failed drive, or another hot spare is present in the shelf.

Use the *Rebuild* selection on the *Main Menu* of the *RCU* to manually rebuild a logical drive if:

- Your storage enclosure doesn't have StorageWorks Fault Management and a drive fails.
- You have manually failed a drive because it was reporting excessive errors, and you wish to return the replaced drive to the optimal state.

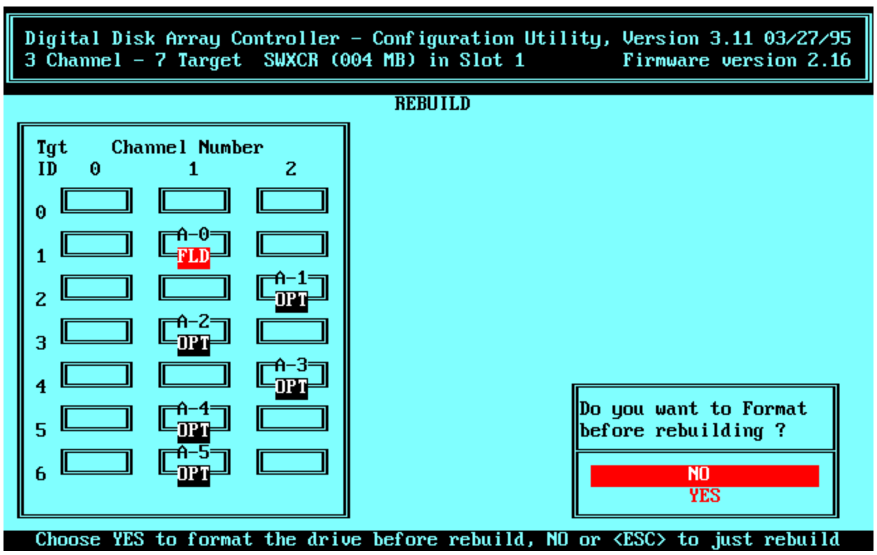
To manually rebuild a drive:

1. Replace failed drive with a working drive.
2. Use up and down arrow keys to highlight *Rebuild* selection on *Main Menu* and press Enter key to select it. *RCU* displays drive matrix, showing drives and status of each.
3. Use up and down arrow keys to highlight drive with FLD (failed) status and press Enter key to select it.
4. Pop-up window appears, similar to screen shown in Figure 3–9. *RCU* provides option of formatting replacement drive prior to rebuilding information from failed drive. Press Enter key to select *NO* to rebuild drive without formatting, or highlight *YES* and press Enter key to rebuild drive after formatting. Status bar appears, indicating either formatting or rebuilding. After formatting, *RCU* automatically begins rebuilding drive.
5. When the rebuild progress bar displays 100%, press any key to continue. *Main Menu* appears.

3.3.1 Rebuild Fails

A rebuild will fail if the power on the system is lost during the time the controller is doing the rebuild, or data can not be reconstructed correctly from the other drives in the RAID set. The drive being reconstructed will be in the WOL state if the rebuild fails. If the rebuild fails due to a power cycle, the user can recover by reseating the WOL drive and restarting a manual rebuild.

Figure 3–9 Choose whether to Format before Rebuilding



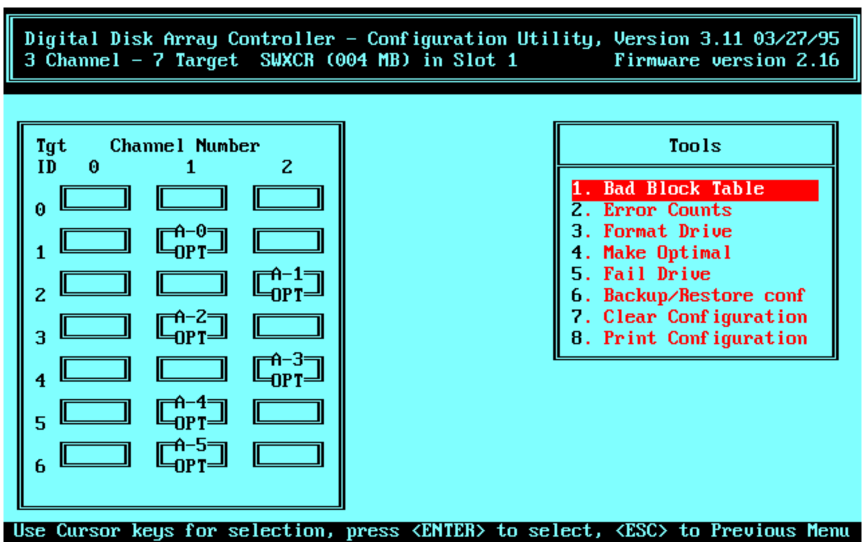
3.4 Tools

Selecting *Tools* from the *Main Menu* of the *RCU* (Figure 3–1) displays the *Tools* window with eight available options as shown in Figure 3–10:

1. *Bad Block Table*
2. *Error Counts*
3. *Format Drive*
4. *Make Optimal*
5. *Fail Drive*
6. *Backup/Restore conf* (configuration)
7. *Clear Configuration*
8. *Print Configuration*

The remaining sections of this chapter explain how to use each of the *Tools* options.

Figure 3–10 Tools Window



3.4.1 Bad Block Table

The *Bad Block Table* selection helps you troubleshoot a failed rebuild when a disk drive fails in a redundant logical RAID drive.

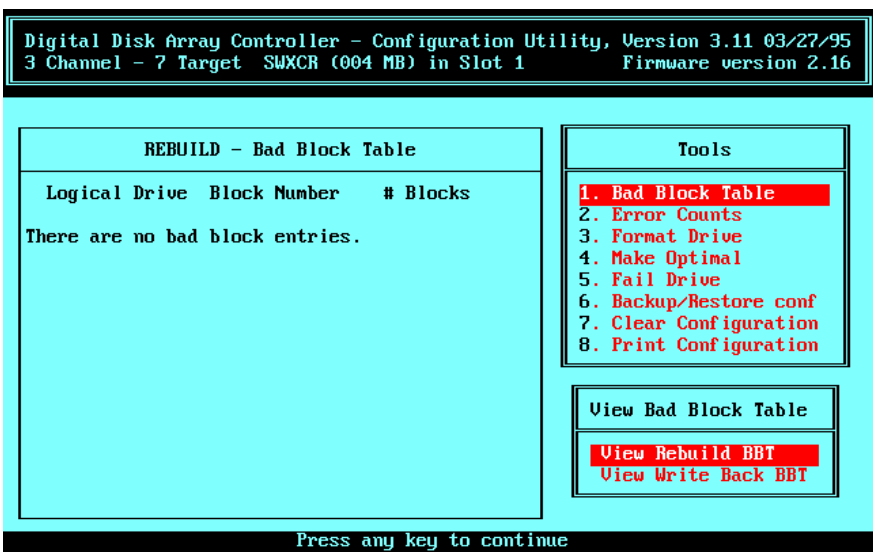
Sometimes the *RCU* fails to rebuild data onto a replacement disk. A rebuild failure occurs because of errors with one of the disks from which the *RCU* tries to rebuild the data.

You will know that a rebuild failed when the status of the replacement drive remains WOL (write only). After a successful rebuild, the status of the replacement drive changes to OPT (optimal).

To view the *Bad Block Table*, invoke the *RAID Configuration Utility*, then:

1. Use up and down arrow keys to highlight *Tools* option from *Main Menu* and press Enter key to select it. *RCU* displays *Tools* window.
2. Use up and down arrow keys to highlight *Bad Block Table* option from *Tools* window, and press Enter key to select it. *RCU* displays *View Bad Block Table* window as shown in Figure 3–11. You can select:
   - *View Rebuild BBT*, or
   - *View Write Back BBT*

Figure 3–11 Bad Block Table Screen



3. Press any key to return to *Tools* window. *RCU* clears *REBUILD — Bad Block Table* once you exit it.
4. Press Esc key to return to *Main Menu*.

If the *REBUILD — Bad Block Table* contains error entries, it indicates some internal error with one of the drives which the *RCU* used to rebuild data. If no entries appear in the *REBUILD — Bad Block Table*, check for physical problems, such as improperly seated drives, or loose connecting cables.

Attempt to rebuild the data onto the replacement drive again. If the rebuild fails a second time, and bad block entries appear in the *REBUILD — Bad Block Table*, restore the data from backup media.

3.4.2 Error Counts

The *RAID Configuration Utility* keeps a count of errors that occur while the *RCU* is running. You can view the number of device error occurrences and the type of error in a table. View the table to see the number and nature of errors being produced. Use this information to determine the reliability of a drive and whether to replace it.

The Error Counts Table displays a maximum of 127 errors.

To view the error count for a drive:

1. Use up and down arrow keys to highlight *Tools* option on *Main Menu* and press Enter key to select it. *Tools* window appears.
2. Use up and down arrow keys to highlight *Error Counts* option in *Tools* window and press Enter key to select it. Cursor appears in drive matrix.
3. Use arrow keys to select drive you want to check for errors, and press Enter key. *RCU* displays error count window similar to Figure 3–12.
4. After viewing error count window, press any key to return to *Tools* window.
5. Press Esc key and drive no longer appears highlighted.
6. Press Esc key again to return to *Main Menu*.

The types of *Error Counts* shown in the error count window in Figure 3–12 are described below:

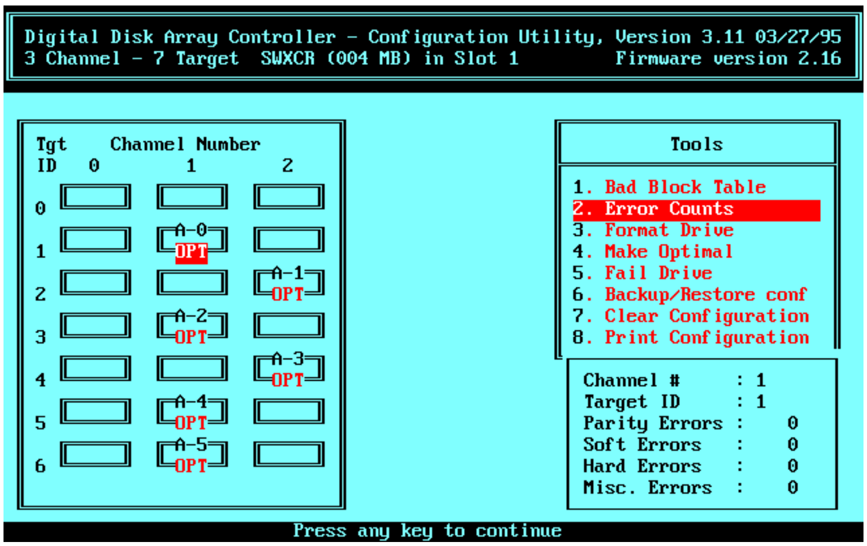
Parity Errors — A count of SCSI bus parity errors that occurred while transferring information on the SCSI bus

Soft Errors — “Check-Condition” errors from the device, indicating a bad sector was encountered on the device

Hard Errors — A count of hardware-related error on the RAID controller

Misc. Error — All other errors not listed otherwise

Figure 3–12 Error Count Window



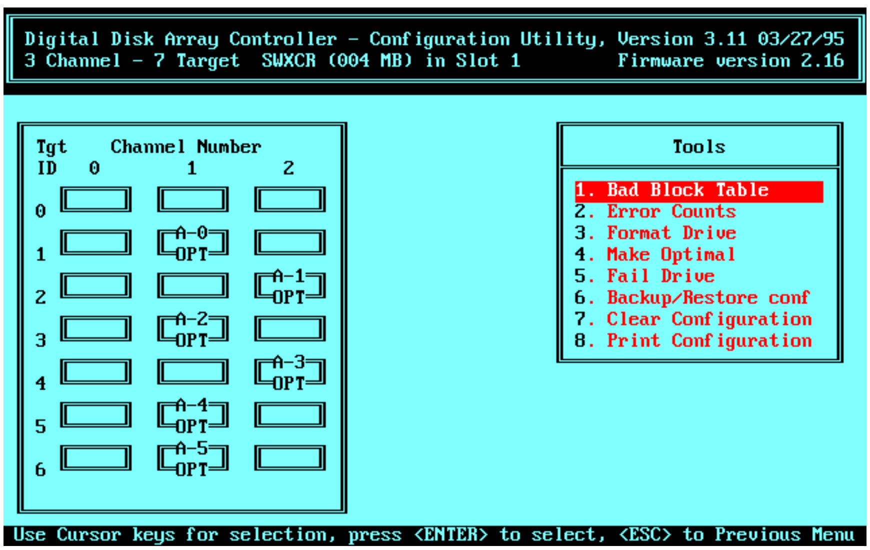
3.4.3 Format Drive

You can use the *RCU* to perform a SCSI format of any drive with a RDY (ready) state, prior to using it in a drive group. It takes approximately 30 to 45 minutes for the *RCU* to format a drive.

To format a disk drive:

1. Use up and down arrow keys to highlight *Tools* option on *Main Menu,* and press Enter key to select it. *RCU* displays *Tools* window as shown in Figure 3–13.
2. Use up and down arrow keys to highlight *Format Drive* option and press Enter key to select it.
3. Cursor moves to first available drive in matrix. Drives that you can format appear in blue, and drives that you cannot appear in gray.
4. Use up and down arrow keys to highlight drive you want to format, then press Enter key. *RCU* displays warning message indicating all data will be lost.
5. Use up and down arrow keys to highlight *YES*, then press Enter key to confirm selection. Drive status changes to FMT (formatting).
6. Press Esc key. *RCU* prompts you to decide whether to continue.

Figure 3–13 Tools Window



7. Use up and down arrow keys to highlight *YES*, then press Enter key to confirm selection. *RCU* begins to format drive. When formatting completes, drive status changes from FMT to RDY.

   Or, highlight *NO* and press Enter key. *RCU* returns drive status to its previous state and cursor appears in *Tools* window.

8. When formatting completes, press any key to continue, then press Esc key. *Main Menu* appears.

3.4.4 Make Drive Optimal

Use the *Make Optimal* selection in the *Tools* window to change the status of a *FLD* (failed) drive to *OPT* (optimal). Normally, the only time you would want to change a failed drive to the optimal state is if you energized or de-energized the components in the wrong order. Changing a failed drive to optimal at any other time may cause increased potential for data loss.

Do not use *Make Optimal* to change the status of a drive which replaces a disk drive that failed. Use the *Rebuild* option to properly replace a disk drive that has failed. Otherwise, the drive may contain faulty data.

CAUTION

When you use this option, ensure the integrity of the data stored on all logical RAID drive(s) that use the failed drive. For example, do the following:

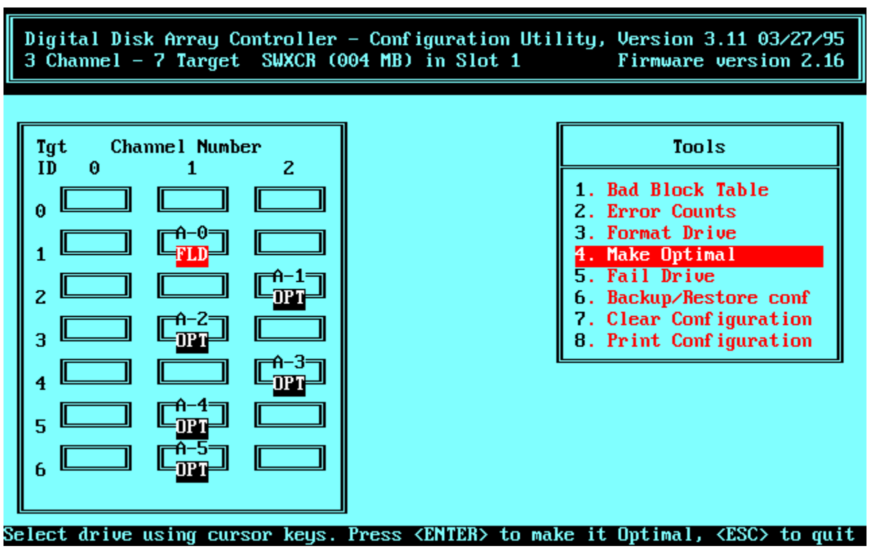
- For drives with a redundant RAID level (RAID 1, 0+1, or 5), use the *Parity Check* option from the *Tools* window.
- Run an operating system file integrity check.
- Run a data integrity check of your files (application-specific).

If you detect corrupted files, you need to restore data from backups.

To change the status of a drive to optimal, follow these steps:

1. Use up and down arrow keys to highlight *Tools* option from *Main Menu*, then press Enter key. *RCU* displays *Tools* window similar to that shown in Figure 3–13, above.
2. Use up and down arrow keys to highlight *Make Optimal* selection from *Tools* window and press Enter key. Cursor moves to first drive in matrix available for you to make optimal, as shown in Figure 3–14.
3. Use arrow keys to move cursor to drive you want to change to OPT status and press Enter key. *RCU* displays warning message. Press any key to continue.
4. Confirmation window appears. Use up and down arrow keys to highlight *YES*, then press Enter key. *RCU* starts drives and changes state of selected drive to OPT.
5. Press Esc key to return to *Main Menu*.

Figure 3–14 Make Drive Optimal



3.4.5 Fail Drive

Use the *Fail Drive* option to change the status of a drive to failed when you want to prevent the KZPAC controller from writing information to it. You would do this, for example, if you wanted to remove the drive from the storage enclosure because you believed it was not operating properly.

Failing a drive in a RAID 0 or JBOD configuration will result in the loss of all data, and you will need to backup the data before putting the drive in the FLD (failed) state.

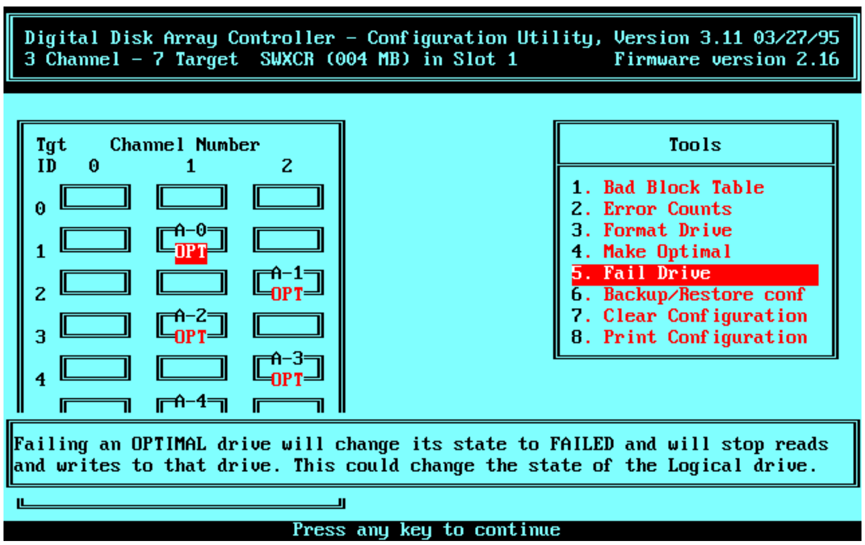
Ensure OPT (optimal) status for all drives in a RAID 1, RAID 0+1, or RAID 5 configuration before failing a drive. Failing a drive in a RAID 1, RAID 0+1, or RAID 5 configuration with a drive already failed will result in the loss of all data, and you will need to restore the data from backup media.

To fail a drive:

1. Use up and down arrow keys to highlight *Tools* option from *Main Menu* and press Enter key to select it. *RCU* displays *Tools* window similar to Figure 3-13, above.
2. Use up and down arrow key to highlight *Fail Drive* option, and press Enter key. Cursor appears in drive matrix. Drives you can fail appear in blue. Drives you cannot fail appear in gray.

3. Use up and down arrow keys to highlight drive you want to fail and press Enter key. *RCU* displays message similar to that shown in Figure 3–15.

Figure 3–15 Message Displayed When You Select Drive to Fail



4. Press any key. *RCU* displays confirmation window as shown in Figure 3–16.
5. Use up and down arrow keys to highlight *YES*, then press Enter key. *RCU* spins down selected drive. Status of drive changes to FLD (failed), similar to screen shown in Figure 3–17.

Figure 3–16 Fail Drive Confirmation Message

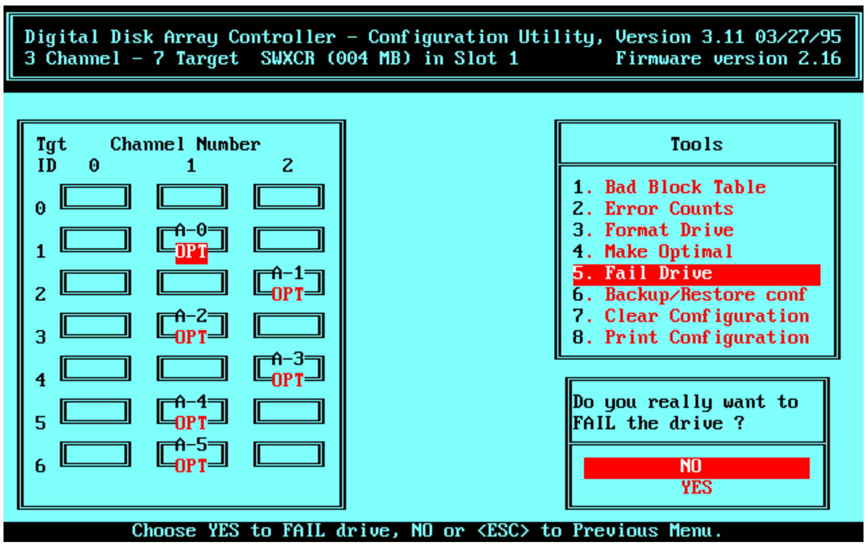
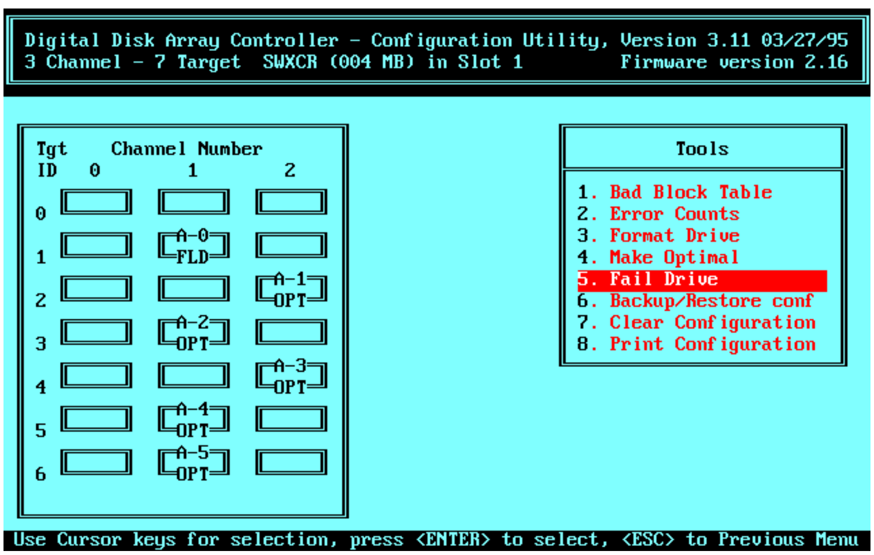


Figure 3–17 RCU Changes Drive Status to FLD



3.4.6 Backup/Restore Configuration

3.4.6.1 Saving Copy of RAID Configuration on Diskette

CAUTION

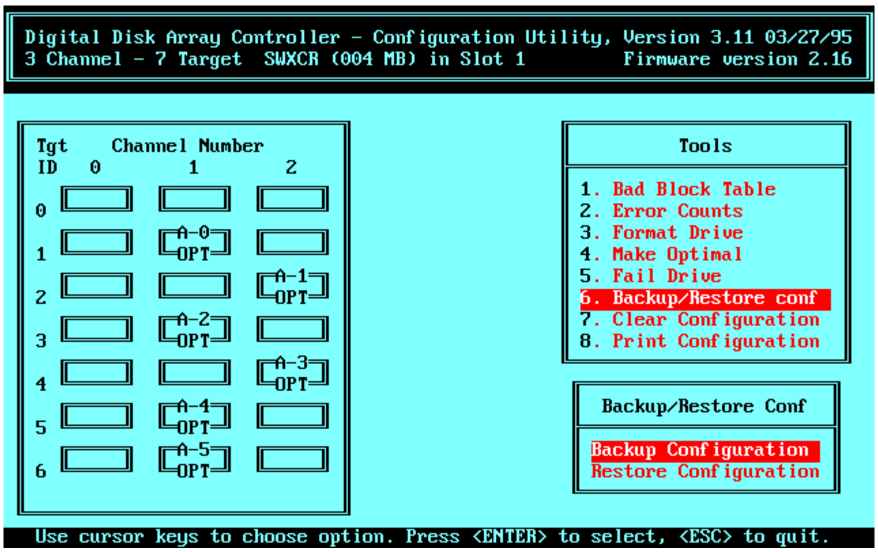
If you replace a failed KZPAC controller with a new one, and restore an outdated configuration to it from diskette, data will be lost. Since the KZPAC controller must have a current configuration to locate data on the logical drives, it's important to have a current version of the configuration on diskette. All configuration changes, however small, must be reflected. For example, if you rebuild a logical drive to incorporate a hot spare drive, you need to update the new configuration on diskette.

Save a copy of your KZPAC controller configuration on a diskette. Because the *RCU* stores the configuration on EEPROM/NVRAM on the KZPAC controller board, if your controller ever fails, you will need to restore the configuration from diskette after you install a new controller.

To save the configuration:

1. Insert formatted diskette in your system's floppy drive.
2. Use arrow keys to highlight *Tools* option from *Main Menu*, and press Enter key to select it. *RCU* displays *Tools* window as shown in Figure 3–13, above.
3. Use up and down arrow keys to highlight *Backup/Restore conf* option. Press Enter key to select it. Brief message appears explaining this option.
4. Press any key to continue. *Backup/Restore Conf* window appears as shown in Figure 3–18.
5. Use up and down arrow keys to highlight *Backup Configuration* from *Backup/Restore Conf* option, and press Enter key to select it. *RCU* prompts you to enter name for file.
6. On Intel-Based systems enter path, for example, **`a:\`**, and appropriate file name with up to eight characters, not including file extension. On Alpha-Based systems enter only eight-character filename and character extension. Then press Enter key. *RCU* displays message asking whether it should overwrite existing file.

Figure 3–18 Backup/Restore Configuration Window



7. Use up and down arrow keys to highlight *YES*, then press Enter key to overwrite existing file. Message appears, indicating that *RCU* is saving configuration. *Backup/Restore Conf* window appears when *RCU* finishes saving configuration.

   Or,

   Use up and down arrow keys to highlight *NO*, then press Enter key to return to *Backup/Restore Conf* window without saving file.
8. Press any key, then press Esc key to exit. *Main Menu* appears.

3.4.6.2 Restoring RAID Configuration onto New Controller

If your RAID controller fails, you will need to restore the configuration information onto the new KZPAC controller. You can restore the RAID configuration information if you saved a copy of the configuration on a diskette.

To restore the configuration:

1. Insert diskette with previously saved configuration into floppy drive.
2. Use up and down arrow keys to highlight *Tools* option from *Main Menu* and press Enter key to select it.

3. Use up and down arrow keys to highlight *Backup/Restore conf* option from *Tools* window, then press Enter key to select it. *Backup/Restore Conf* window appears with *Backup Configuration* option highlighted as shown in Figure 3-18, above. *RCU* prompts you to use caution. Press any key to continue.
4. Use up and down arrow keys to highlight *Restore Configuration*, then press Enter key to select *Restore Configuration* option. *RCU* prompts you for file name.
5. On Intel-Based systems, enter path, for example, **`a:\`**, and name of saved configuration file. On Alpha-Based systems, enter name of saved configuration. Then press Enter key. *RCU* prompts you to confirm that you want to restore.
6. Use up and down arrow keys to select *YES*, then press Enter key. *RCU* begins reading file and prompts you again to confirm that you want to restore configuration.
7. Use up and down arrow keys to select *YES,* then press Enter key. *RCU* writes configuration to Flash EEPROM/NVRAM and indicates when it has successfully restored configuration.
8. Press any key to continue.
9. Press Esc key to return to *Main Menu*.

3.4.7 Clear Configuration

This option provides you with a quick way to delete the existing RAID configuration when you want to delete it without immediately creating a new one. You may want to use this option when moving the controller to another system without moving the attached hardware. Otherwise, use the *New Configuration* option, which clears the configuration and then prompts you to create a new one.

To clear the configuration:

1. Use normal procedures to back up information stored on your array prior to clearing configuration.
2. Use up and down arrow keys to highlight *Tools* option on *Main Menu*, then press Enter key. *Tools* window appears.
3. Use up and down arrow keys to highlight *Clear Configuration* option in *Tools* window, then press Enter key.

3.4.8 Print Configuration, Intel-Based

You can view your configuration by printing out a hard copy representation of it. To print a representation of your configuration:

1. Use up and down arrow keys to select *Tools* option from *Main Menu*, then press Enter key. *Tools* window appears as shown in Figure 3–13, above.
2. Use up and down arrow keys to highlight *Print Configuration* option from *Tools* window, then press Enter key. Prompt appears:

Enter File Name

3. To create configuration save file in current directory, enter a file name with up to 8 characters plus extension. For example, type:

`config.sav`

To create configuration save file in root directory of C: drive, type:

`c:\config.sav`

Press Enter key. Prompt appears:

Existing File, if any will be overwritten!

4. Use up and down arrow keys to highlight *YES*, then press Enter key if you want to create file with name that you specified. If file with same name already exists, *RCU* will write over it. Use up and down arrow keys to highlight *NO*, then press Enter key to return to previous menu without creating file. If you select *YES*, prompt appears:

Saved configuration print file. Press any key to continue.

5. Press any key and *Tools* window appears. Press Esc key to return to *Main Menu.*
6. Press Esc key again. *RCU* prompts you to confirm that you want to exit utilities.
7. Use up and down arrow keys to highlight *YES,* then press Enter key to exit *RCU*. MS-DOS prompt appears.

8. At MS-DOS prompt type:

print filename

where filename is name you specified for print configuration file, including path, if any. For example, type:

print c:\config.sav

File similar to the following prints on printer attached to your computer:

```
************************************************************
Digital Disk Array Controller - Configuration Utility*
•Version 4.27*
************************************************************

CONFIGURATION INFORMATION OF :
==============================
1 Channel - 7 Target  KZPAC  in Slot 3  Firmware version 2.40
DRIVE GROUP INFORMATION :
===========================
Number of drive groups = 1
Group 0 : [0:0]

LOGICAL RAID DRIVE INFORMATION :
=================================
Number of Logical RAID Drives = 1
Log. Drv #   Phy. Size    Raid Level   Eff. Size    Write Policy
========     ========     =========    ========    ============
    0        4004 MB          5        3003 MB      Write Thru
```

3.4.9 Print Configuration, Alpha-Based

You can view your configuration by printing out a hard copy representation of it. To print a representation of your configuration:

1. Use up and down arrow keys to select *Tools* option from *Main Menu*, then press Enter key. *Tools* window appears as shown in Figure 3–13, above.
2. Use up and down arrow keys to highlight *Print Configuration* option from *Tools* window, then press Enter key. Prompt appears:

Enter File Name

3. To create configuration save file in current directory, enter a file name with up to 8 characters plus extension. For example, type:

`config.sav`

Press Enter key. Prompt appears:

Existing File, if any will be overwritten!

4. Use up and down arrow keys to highlight *YES*, then press Enter key if you want to create file with name that you specified. If file with same name already exists, *RCU* will write over it. Use up and down arrow keys to highlight *NO,* then press Enter key to return to previous menu without creating file. If you select *YES*, prompt appears:

Saved configuration print file. Press any key to continue.

5. Press any key and *Tools* window appears. Press Esc key to return to *Main Menu.*
6. Press Esc key again. *RCU* prompts you to confirm that you want to exit utilities.
7. Print `config.sav` (or name you specified) from any machine that can read a MS-DOS based file.

A

Downloading New Controller Firmware

This appendix documents the firmware downloading function.

CAUTION

Please read the current release notes for the latest instructions on downloading firmware.

A.1 Firmware Downloader Description

There are two ways to specify command line parameters for the firmware download utility: an explicit name for the download image for each controller in the system, up to four, and the -v option where the same image is used for each controller in the system.

If you have a mix of different types of RA200 RAID controllers, then you must explicitly specify the firmware for each controller.

A.1.1 Intel-Based Systems

A.1.1.1 Explicit Image Name

1. Insert diskette labeled StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Intel Systems into floppy drive and boot system from it.
2. Screen displays prompt: `A:\RA200RCU>`
3. After prompt type:

   `A:\RA200RCU>` **`RA200FL.EXE xxxx yyyy zzzz aaaa`**

   where **`xxxx, yyyy, zzzz, aaaa`** are firmware image names; for example, **`SWXCRFWP.240`**

Dummy parameters can be specified if you do not wish to load firmware for a specific controller. Leaving **`yyyy`** in the command above would cause the second controller's firmware not to be changed.

The order in which you specify the image name depends on the machine and the order in which the boards are identified. Usually, any EISA boards will be identified first.

4. Press Enter key. Firmware loads onto controllers.

A.1.1.2 -v Option

1. Insert diskette labeled StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Intel Systems into floppy drive and boot system from it.
2. Screen displays prompt: `A:\RA200RCU>`
3. After prompt type:

   `RA200FL.EXE -v xxxx`

   where **`xxxx`** is version of firmware; for example, **`240`**
4. Press Enter key. Firmware loads onto controllers.

A.1.2 Alpha-Based Systems

A.1.2.1 Explicit Image Name

1. Invoke ARC console menu shown in Figure A–1. Consult your Alpha-Based system documentation for this procedure.
2. Insert diskette labeled StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Alpha Systems into floppy drive.
3. Select *Run a program* option from Alpha *Boot menu*. System displays *Program to run:* prompt.
4. After prompt type:

   `RA200FL.EXE xxxx yyyy zzzz aaaa`

   where **`xxxx yyyy zzzz aaaa`** are firmware image names; for example, **`SWXCRFWP.240`**

   Dummy parameters can be specified if you do not wish to load firmware for a specific controller. Leaving **`yyyy`** in the command above would cause the second controller's firmware not to be changed.

The order in which you specify the image name depends on the machine, and the order in which the boards are identified. Usually, any EISA boards will be identified first.

Figure A–1 ARC Console for Alpha-Based System

```
ARC Multiboot Alpha AXP Version 4.31
Copyright (c) 1993–1995 Microsoft Corporation
Copyright (c) 1993–1995 Digital Equipment Corporation

Boot Menu
      Boot Windows NT
      Boot an alternate operating system
      Run a program
      Supplementary menu ...

Use the arrow keys to select, then press Enter.
```

5. Press Enter key. Firmware loads onto controllers.

A.1.2.2 -v Option

1. Invoke ARC console menu shown in Figure A–1. Consult your Alpha-Based system documentation for this procedure.
2. Insert diskette labeled StorageWorks RAID Array 230/Plus Software RAID Configuration Utility for Alpha Systems into floppy drive.
3. Select *Run a program* option from Alpha *Boot menu*. System displays *Program to run:* prompt.
4. After prompt type:

   `RA200FL.EXE -v xxxx`

   where **`xxxx`** is version of firmware; for example, **`240`**
5. Press Enter key. Firmware loads onto controllers.

CAUTION

Please read the current release notes for the latest instructions on downloading firmware.

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