

RA4000e Series

eSATA to Serial ATA Disk Array System

User Manual Ver1.0

Preface

Notice

Product features and specifications described in this manual are subject to change without notice.

The manufacturer shall not be liable for any damage, or for the loss of information resulting from the performance or use of the information contained herein.

Trademarks

This manual has been checked for accuracy, but no guarantee is given that the contents are correct. Information and specifications can change without notice. AVerMedia is not responsible for data loss or other consequences caused by the use of this manual.

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Manual version: 1.0



Caution

Before starting any kind of hardware installation, please ensure that all power switches have been turned off and all power cords disconnected to prevent personal injury and damage to the hardware.

Regulatory information



This equipment is in conformity with the EMC directive.

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

Those limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antennas.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circlet different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

Warning:

A shielded-type power cord is required in order to meet FCC emission limits and also to prevent interference to the nearby radio and television reception. It is essential that only the supplied power cord be used.

Use only shielded cables to connect I/O devices to this equipment.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

About this manual

Intended user

This manual is designed and written for users of the RA4000e Series. This is an entry level product suitable for most users.

Organization of the manual

This manual consists of the following sections:

- Chapter 1: **Introduction** provides an overview of the as well as details of key features and a list of specifications.
 - Chapter 2: **Before you begin** provides a detailed illustrated package list. This chapter also contains all the information you need to decide whether to set up a RAID 0, 0+1, 5 or RAID 5+spare array and lists important pre-installation notices.
 - Chapter 3: **Setting up the RA4000e Series** gives a detailed overview of the RA4000e Series' features and guides you through the process of installing hard disk drives into.
 - Chapter 4: **Setting up an array** explains how to set the RAID level, create an array and connect to a host computer.
 - Chapter 5: **Partitioning the array** tells you how partition the array in Windows, Linux or Mac OS X operating systems.
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- Appendix A: **FAQ** helps you deal with encountered problems in the form of Q&A.
 - Appendix B: **Glossary** defines relevant technical terms used in this manual.
 - Appendix C: **LCD Display Messages** lists all status and error messages that may be displayed on RA4000e Series' built-in display.
 - Appendix D: **Updating Firmware** explains how to install new or updated firmware on RA4000e Series.

Using this manual

This guide contains all the information you need to set up and start using your RA4000e Series and to monitor its performance in real time. The setup process will follow these steps:

Step 1

Prepare: Familiarize yourself with the features and capabilities of RA4000e Series (**Chapter 1**)
Decide whether to set up a RAID 0, 0+1, 5 or 5+spare array RA4000e Series (**Chapter 2**)

Step 2

Set up: Install drives into RA4000e Series (**Chapter 3**)
Set the RAID level (**Chapter 4**)

Step 3

Create: Create a RAID array and connect it to a host computer (**Chapter 4**)

Step 4

Partition: Partition the array using the host operating system (**Chapter 5**)

Guide to Conventions

Important information that users should be aware of is indicated with the following icons:



Caution

This icon indicates the existence of a potential hazard that could result in personal injury, damage to your equipment or loss of data if the safety instruction is not observed.



Note

This icon indicates useful tips on getting the most from your RA4000e Series.

Important terms, commands and programs are put in **Boldface** font.

Screen text is given in **screen** font.

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Chapter 1**Introduction**

This chapter introduces the features and capabilities of RA4000e Series.

You will find:

- ⇒ A full introduction to your RA4000e Series
- ⇒ Details of key features
- ⇒ A list of the product specifications

Overview

Congratulations on your selection of the RA4000e Series subsystem. The RA4000e Series is a high-performance and extremely flexible RAID system. RAID (Redundant Array of Independent/Inexpensive Disks) is a storage technology used to improve the processing capabilities of a storage system, providing a combination of reliability and performance. The RA4000e Series is ideally suited for integration with databases, e-mail, web servers and imaging systems.

The RA4000e Series is the ultimate approach to a flexible RAID solution. It can manage three different RAID levels (0, 0+1 and 5) and also offers the option of RAID 5+hot spare. You will find detailed explanation on the features and suggested uses of these RAID levels later in this chapter.

The RA4000e Series features a user-friendly drive carrier design that lets you easily install four drives. Each drive carrier supports a one-inch high 3.5-inch form factor drive.

Featuring intelligent online recovery, the RA4000e Series lets you hot swap a failed drive: data will automatically be rebuilt to the new drive without any system down time. The four drive design allows also one drive to be designated a hot spare: if one of other drives fails, the will seamlessly rebuild the failed drive's data on the hot spare.

Key features

The RA4000e Series supports the following features

- Automatic on-line rebuilding
- Drives are hot swappable
- Supports RAID levels 0, 0+1 and 5
- Optional hot spare setup for RAID 5 (5+spare)
- Hot swappable fan
- Supports four Serial ATA hard drives
- Requires no driver
- Audible alarm on drive failure & alarm mute function
- Supports eSATA host interfaces
- Disk auto shutdown when system over heat for protecting.
- Plug and play

Hot Spare

Hot Spare allows for the automatic replacement of a failed drive without requiring intervention from the administrator. If this option is selected and a drive fails, the will automatically replace the faulty drive with the hot spare drive.

Automatic drive rebuilding

If a member drive in a RAID 5 array is replaced on-line, the RA4000e Series will automatically start to rebuild data to the new drive.

Hard drive hot swapping

Hot swapping allows for the removal and installation of disk drives without the need to power down the system while the system is in use.

Auto disk shut down when over heat

The RA4000e Series will shut down disks automatically when temperature is over 55°C to prevent the damage of DISK and DATA loss.



Note

This manual contains the information necessary to set up each of the two available hardware configurations of the RA4000e Series . Where procedures for the configurations differ, they are described separately and clearly marked.

Warranty

Two years warranty

Specifications

Available host interfaces and transfer speeds

- eSATA 1.5Gb

Disk Interface Support

- Four SATA disk interfaces compatible with SATA2 3Gb disks

RAID Function Support

- Hardware RAID level 0, 5, 0+1, 5 + spare by switch setting
- Hot swappable disk
- Automatic on-line rebuilding

RA4000e Series Function Support

- Driverless
- Plug & Play
- Multiple operating system support:
 - ◆ Mac OS 9 / X (10.2.8 & 10.3)
 - ◆ Windows 2000/2003/XP
 - ◆ Windows Vista
 - ◆ Linux 7.3 and later
 - ◆ Fedora 6, 7
- GUI support for system status monitoring
- Support over 2TB RAID capacity (Windows Vista only)
- On board 2MB buffer cache size
- LCD panel for operation status display
- Event notification through audible alarm or e-mail
- Alarm mute switch
- Memory for RAID level status
- One RS-232 port for terminal or GUI connection
- Removable cooling fan module

Mechanical, Environmental and Safety Specifications

- Dimensions: 286.5(L) x 152.8(W) x 206.4(H) (mm)
- Host Connectors:
 - ◆ one eSATA connector
- Interface Connectors:
 - ◆ One RS-232 connector
- Operation temperature: 0 ~ 35°C
- Operation humidity: 5% ~ 95 %, non-condensing
- Storage humidity: 5%~95%, non-condensing
- 200 W power supply
 - ◆ Input: 100 ~ 250 AC
 - ◆ Output: +5V/10 A, +12V/10 A, +3.3V/5A



Note

Specifications are subject to change without notice.

Chapter 2

Before you begin

This chapter includes all the information you need to prepare for installation and to decide which RAID level to use. You will find:

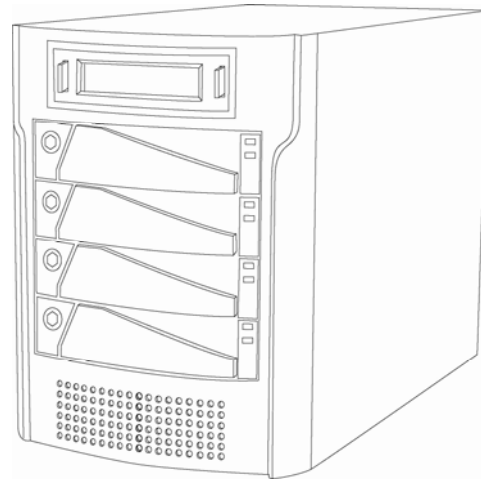
- ⇒ A checklist of what should be in the product package
- ⇒ A full introduction to and comparison of RAID levels 0, 0+1 and 5
- ⇒ Important notices on the safe operation and installation of

Making sure you have everything

What's in the box

Some vendors may ship certain components as standard, while other vendors treat the same component as optional. In its most basic configuration, your package should include the following:

- RA4000e Series system with four drive trays (Disk not included)



- The following cables:



Power cable



RS-232 cable



eSATA cable



SATA to eSATA bracket

- Screws pack
- AverMedia CD kit containing RA4000e Series User's Manual (this manual)

What else you need

In order to setup a working system, the following user-supplied items are required:

- Host computer system with eSATA interface
- Four disk drives



Caution

For non-proprietary accessories, such as cables, etc., ask your vendor to recommend compatible and reliable brands.

Pre-installation planning

Introduction to RAID levels

The RA4000e Series can support the following RAID levels: 0, 0+1 and 5 with the additional option of RAID 5 + hot spare. Which is the right level for you? The answer depends on the application it is used for.

RAID Level 0 offers high transfer rates, and is ideal for large blocks of data where speed is of importance. Computer Aided Design, Graphics, Scientific Computing, Image and Multimedia applications are all good examples. If one drive in a RAID 0 array fails however, the data on the whole array is lost.

RAID Level 0+1 combines mirroring and striping functions on a minimum of four hard disks. Mirroring provides full redundancy and protects data in case of multiple drive failure (providing that data on one of each mirrored pair of drives is intact).

RAID Level 5 arrays offer high I/O transaction rates, and are the ideal choice when used with on-line transaction processing applications, such as those used in banks, insurance companies, hospitals, and all manner of office environments. These applications typically perform large numbers of concurrent requests, each of which makes a small number of disk accesses. If one drive in a RAID 5 array fails, the lost data can be rebuilt from data on the functioning disks. The RA4000e Series allows users to set one disk as a **hot-spare** that will be activated automatically to replace a failed disk.

RAID 0

RAID 0 links each drive in the array as one huge drive. Storage capacity is determined by the smallest drive in the array. That capacity is then applied to format all other drives in the array. If using a 40 GB, 50GB, 60 GB, and 70 GB drive in a RAID 0 array, your system will see one huge drive of 160 GB (40 GB×4).

RAID 0 offers double or more performance under sustained data transfers when one drive per is used. But RAID 0 without fault tolerance, if one of disks in RAID 0 array fails, the RAID crashed.

RAID 0: *Striped disk array without fault tolerance*

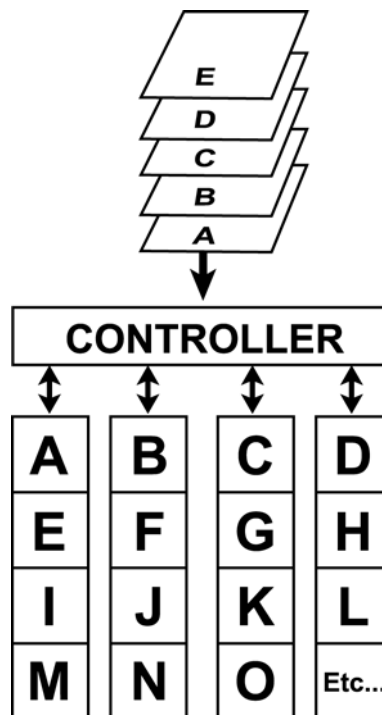
Characteristics:

- RAID 0 implements a striped disk array, the data is broken down into blocks and each block is written to a separate disk drive.
- I/O performance is greatly improved by spreading the I/O load across many channels and drives.
- Fastest and most efficient array type but offers no fault-tolerance.
- **Storage capacity = (No. of disks) × (capacity of smallest disk)**
- If installed 40 GB, 50 GB, 60 GB and 70 GB, configured as RAID 0, the RAID capacity will be 160 GB.

Recommended use:

- Video production and editing
- Image editing
- Pre-press applications
- Any application requiring high bandwidth

The diagram below represents the writing of data on a RAID 0 array composed of four DISKS connected to the controller. Data blocks are distributed across all disks in the array.



Arrangement of data blocks saved on a Level 0 RAID

RAID 0+1

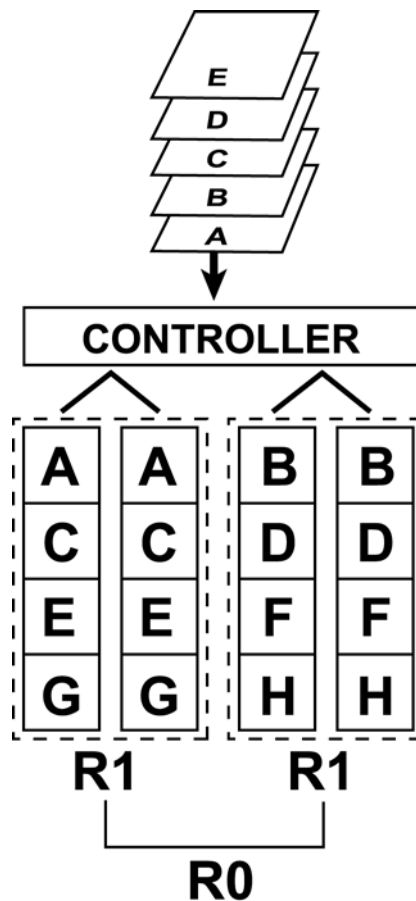
RAID 0+1 combines mirroring and striping functions on a minimum of four hard disks. Mirroring provides full redundancy and protects data in case of multiple drive failure (providing that data on one of each mirrored pair of drives is intact).

RAID 0+1: *Combination of mirroring and striping*

Characteristics:

- This configuration provides optimal speed and reliability.
- Requires even number of disks (minimum 4 disks)
- **Storage capacity = 2 x capacity of smallest of disk**
- If installed four drives each are 40 GB, 50 GB, 60 GB and 70 GB, configured as RAID 0+1, the RAID capacity will be 80 GB.

The diagram below represents the writing of data on a RAID 0+1 array composed of four DISKS connected to the controller. The controller creates two matching RAID 0 arrays on four DISKS.



Arrangement of data blocks saved on a Level 0+1 array

RAID 5 and RAID 5+hot spare

RAID 5 uses a mathematical expression that compares data from three drives and calculates a fourth piece of data called “parity” which is saved on a fourth drive. Should one of the drives fail, parity data can be used to rebuild the failed data. Under RAID 5, parity data is stored across all drives in the array. This maximizes the amount of storage capacity available from all drives in the array while still providing data redundancy. RAID 5 requires at least three drives. The allows users to set RAID 5 with three drives and the fourth drive as a “hot spare” ready to be used for rebuilding data in case one of the other drives fails. This is RAID 5 +hot spare function.

RAID 5: *Independent data disks with distributed parity blocks*

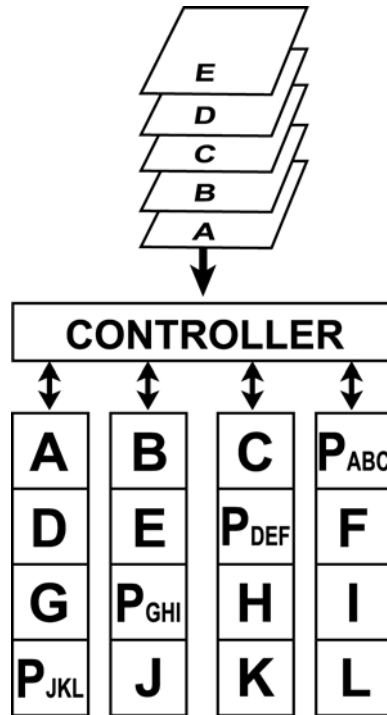
Characteristics:

- Each entire data block is written on a data disk. Parity for blocks in the same rank is generated on Writes, recorded in a distributed location and checked on Reads.
- Highest Read data transaction, medium Write data transaction rate.
- Relatively low ratio of ECC (Parity) disks to data disks means high efficiency (compared to other RAID levels).
- Good aggregate transfer rate.
- **Storage capacity = (No. of disks – 1) × (capacity of smallest disk)**
- In RAID 5, installed drives each are 40 GB, 50 GB, 60 GB, 70 GB, the RAID capacity will be 120 GB.
- In RAID 5 + hot spare, installed 40 GB, 50 GB, 60 GB each in disk 2, 3, 4 and installed 70 GB in disk 1 as hot spare disk, the RAID capacity will be 80 GB.

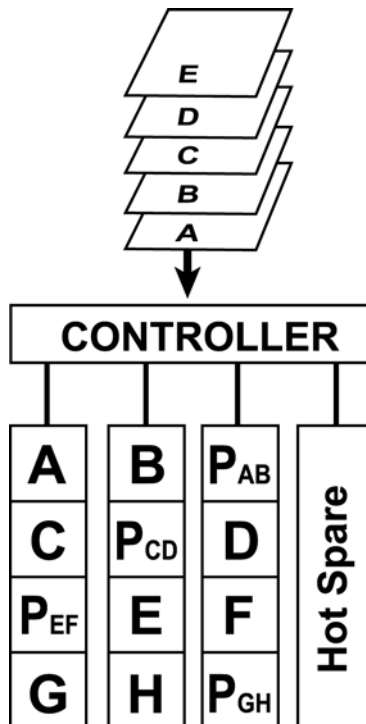
Recommended use:

- File and application servers
- Database servers
- WWW, E-mail and News servers
- Intranet servers
- Most versatile Raid level

The diagram below represents the writing of data on a RAID 5 array composed of four DISKS connected to the controller. Parity blocks are represented by the letter P.



The diagram below represents the writing of data on a RAID 5+hot spare array composed of four DISKS connected to the controller. Parity blocks are represented by the letter P.



Arrangement of data and parity blocks saved on a Level 5+hot spare RAID

Pre-installation notices



Caution

Before starting any kind of hardware installation, please ensure that all power switches have been turned off and all power cords disconnected to prevent personal injury and damage to the hardware.



Caution

To avoid overheating, should be installed in a well-ventilated area and in such a way that sufficient airflow is maintained across the controller chips.



Caution

Static electricity can damage electronic components. To guard against such damage:

Work in a static-free environment

Wear a grounded anti-static wrist strap

Store uninstalled components in anti-static bags



Caution

Environmental requirements: Temperature: 0-35°C

Operation humidity: 5-95%, non-condensing

Storage humidity: 5-95%, non-condensing

Chapter 3

Setting up the RA4000e Series

This chapter gives an overview of the and explains how to:

- ⇒ Remove the drive carriers from the RA4000e Series
- ⇒ Load hard drives into the drive carriers
- ⇒ Install the drive carriers in

Familiarizing yourself with RA4000e Series



Note

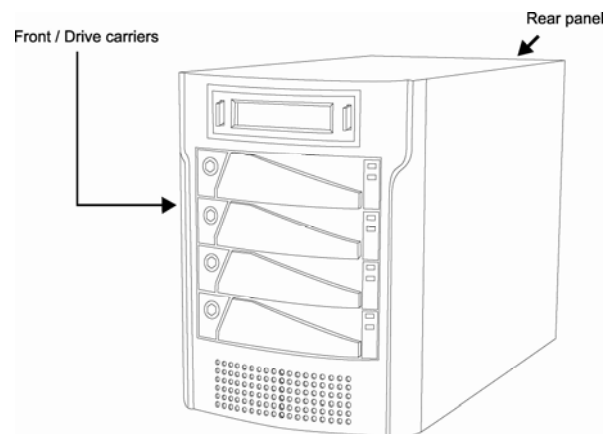
The RA4000e Series is available in one hardware configurations with eSATA host interfaces:

This manual contains the information necessary to set up the available hardware configurations. Where procedures for the configurations differ, they are described separately and clearly marked.

Overview

The RA4000e Series has four **drive carriers**, accessed from the front.

The **connectors** and **power switch** are located on the rear panel.



Front view

Drive carriers

Each drive carrier can hold a one-inch high 3.5-inch form factor SATA disk drive.

LCD Display

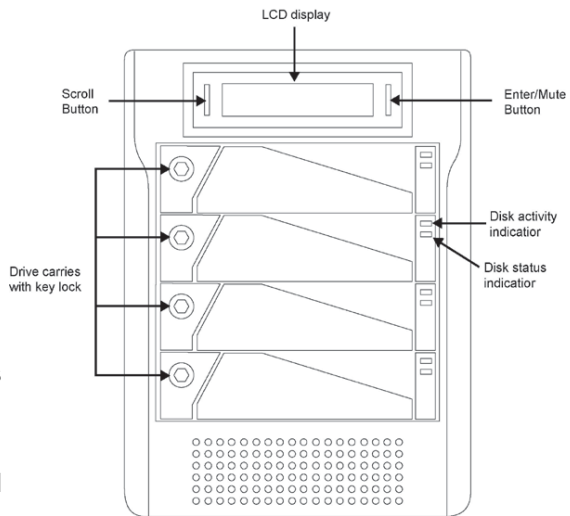
The LCD displays status and configuration information for the RA4000e Series and arrays. A full list of LCD display messages is given in Appendix C.

Scroll button

The scroll button is used to scroll through information on the display and to select settings for the date and time.

Enter / Mute button

The Enter / Mute button is used to set date and time and to mute the buzzer.



Rear view

Power switch

The power switch is the main on/off switch of the RA4000e Series.

Fan vent

The fan vent should be kept unobstructed.

RAID level selector

The RAID level selector consists of two switches which together are used to set the RAID level. See Setting RAID level in Chapter 4.

eSATA port

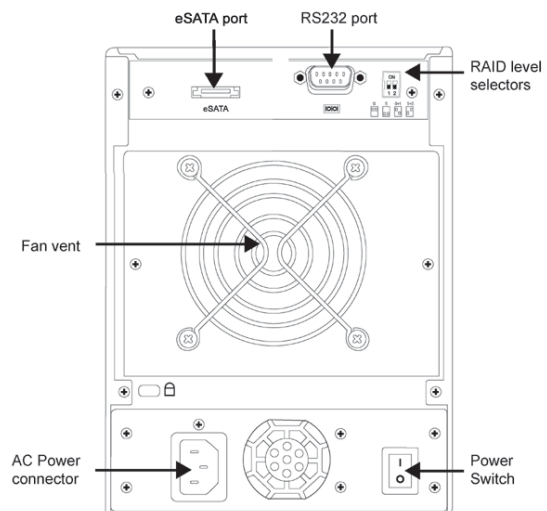
The eSATA port is used to connect your RA4000e Series to host computer.

AC power connector

To connect to AC power code.

RS232 port

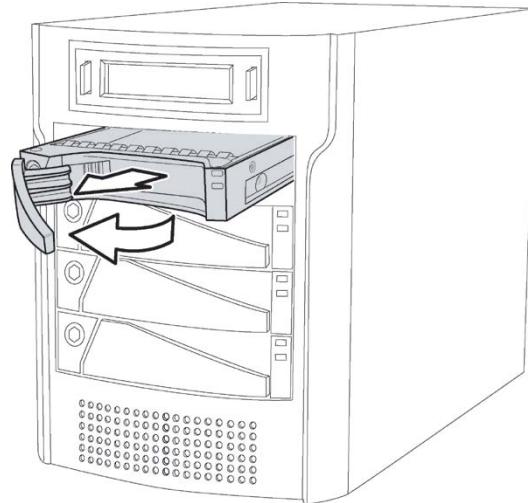
The RS232 port is used for data transmission for firmware update and GUI interface.



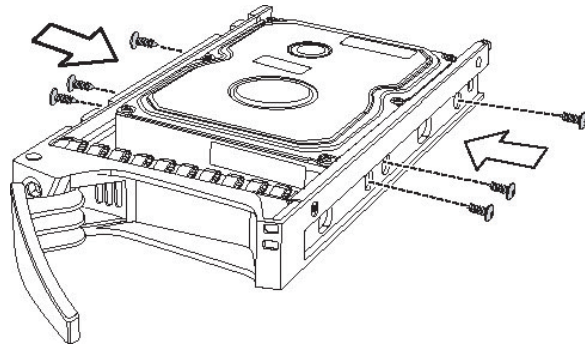
Loading drives into RA4000e Series

The RA4000e Series should be fitted with four hard disk drives. Load each drive into a drive carrier as follows:

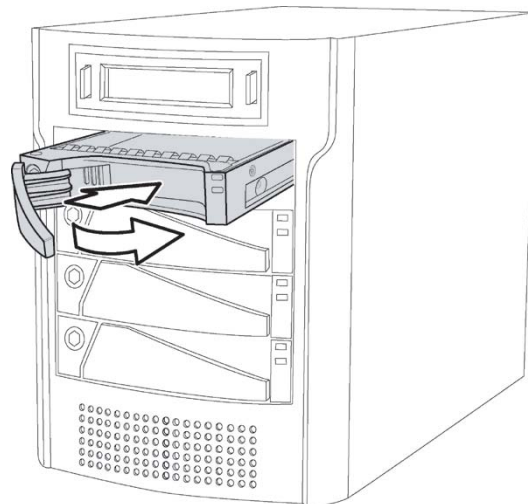
1. Pull the drive carrier handle to release the latch.
2. Slide the drive carrier out of the RA4000e Series.



3. Place the disk drive in the drive carrier and secure the disk in the carrier



4. Slide the loaded disk drive carrier into the RA4000e Series and push flat the carrier handle to lock the carrier in position.



Chapter 4

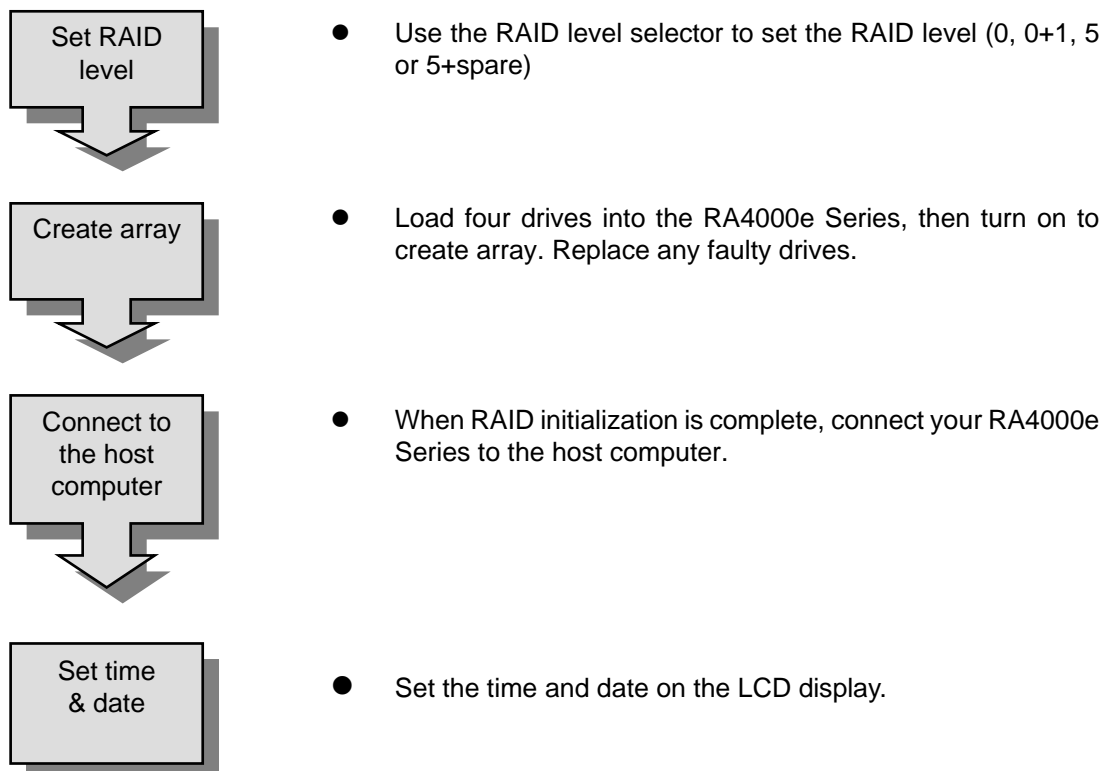
Setting up an array

This chapter explains how to:

- ⇒ Set RAID level on the RA4000e Series
- ⇒ Create an array
- ⇒ Remove and replace drives from an array
- ⇒ Connect RA4000e Series to the host computer
- ⇒ Set the time and date on

Array creation flowchart

Setting up an array on is simple. This chapter will lead you through the following steps:

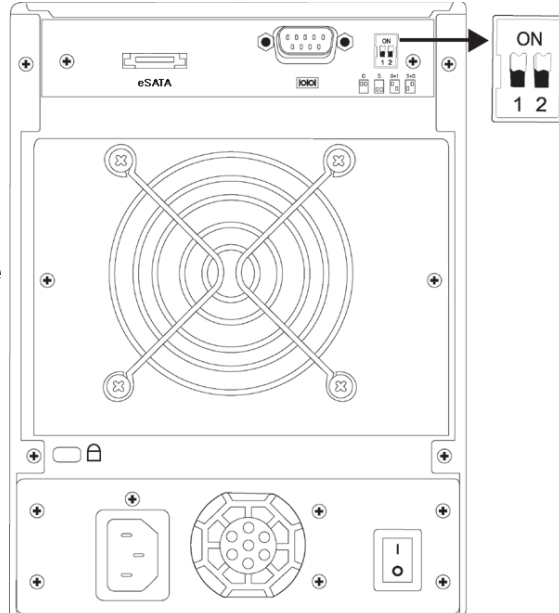


Setting RAID level

RAID level is set using the RAID level selector on the rear panel of the RA4000e Series. The RAID level selector consists of two switches. The four possible combinations of switch position correspond to the four available RAID settings: 0, 0+1, 5 and 5+spare.

If the RAID level is not matched between the disk setting and the RAID level selector setting, the LCD will display the following two messages alternatively:

- (1) "RAID level"
"Unmatched"
- (2) "Current: Rx"
"Original: Rx"



Note: **Current Rx** means the RAID level setting of RAID level selector

Original Rx means the RAID level setting of current disks

For example:

Supposed the RAID level selector is R0, but the disk setting detected from disks is R5, the LCD will display the following two messages alternatively:

- (1) "RAID Level"
"Unmatched"
- (2) "Current : R0"
"Original : R5"

Solution: At this situation, RAID cannot work, users should choose one of the following options :

- (1) Shut down the RA4000e Series and tune the RAID level selectors to R5.

OR

- (2) Re-plug the four disks and re-create the Array to R0 (But data in the R5 disks will be lost due to the destructive initialization)



Note

The RA4000e Series must be powered off to change RAID level.

To change RAID level:

- 1. Power off*
- 2. Set the new RAID level using the RAID level selector*
- 3. Remove all four disks*
- 4. Power on*
- 5. Install the four disks to start RAID initialization*

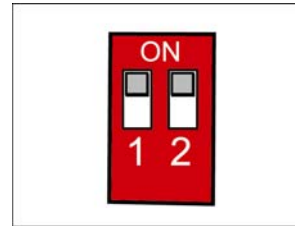


Caution

Changing RAID level may lead to the loss of all data on the array.

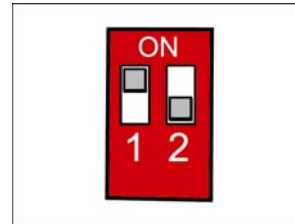
Setting RAID 0

1. Ensure the RA4000e Series is turned off.
2. Move both selector switches 1 and 2 to **ON** as shown.



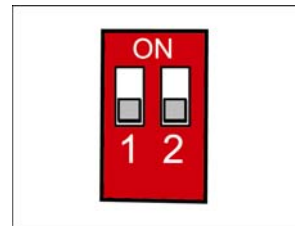
Setting RAID 0+1

1. Ensure the RA4000e Series is turned off.
2. Move selector switch 1 to **ON** and 2 to **OFF** as shown



Setting RAID 5

1. Ensure the RA4000e Series is turned off.
2. Move both selector switch 1 and 2 to **OFF**.



Setting RAID 5+spare

1. Ensure the RA4000e Series is turned off.
2. Move selector switch 1 to **OFF** and 2 to **ON**.



Note

Initially, in a R5+spare array, the drive in the bottom drive carrier is the hot spare and its status indicator will be shown amber for notification.



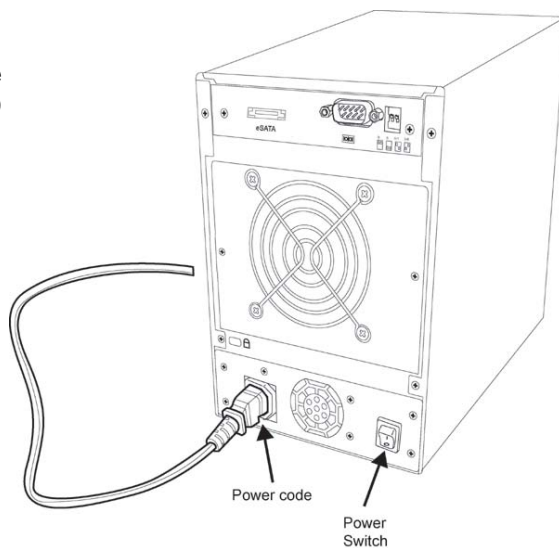
Note

In a RAID 0+1 array, disk 1, 2 and disk 3, 4 are two independent RAID 1 group. This allows one disk from each separate R1 group to fail simultaneously.

Creating an array

Create a new RAID

1. Ensure that four drives are installed.
2. Ensure that the RAID level selectors are correctly positioned for the desired RAID level.
3. Connect a power cable.
4. Turn on the power switch.
5. Install drives to begin initialization.



The RA4000e Series will check the status of the installed drives. If all of four drives are brand new or never been used in RA4000e Series then the initialization of the desired RAID level array will begin automatically.

If any one of disks you installed has been used in RA4000e Series before, then RA4000e Series will have a notification on LCD to remind if you really want to initialize a new RAID with previously used DISK to prevent wrong operation caused data loss.

The RA4000e Series confirms with you that “Create New RAID” and you can select “Yes” by button to re-create new RAID or “No” to retrieve existing RAID according to current drives



Note

Four drives should usually be installed for initialization to begin. If four drives are not installed when the power is turned on, the alarm will sound. A “RAID Fail” message will also display unless:

- ⇒ RAID 5+hot spare has been set
- ⇒ The bottom three drive carriers have drives installed.

In this case, the initialization of a RAID 5 array will take place.



Note

The RAID capacity determined on the RAID level and the capacity of drives you installed in , for an example:

If configuring as R5 and install 4 drives each of them are 10 GB, 20 GB, 30 GB, 40 GB to create an array then the total RAID capacity will be 30 GB.

If a red disk status indicator shows, check to make sure the appropriate drive is:

- Locked
- Installed correctly
- Not faulty (if necessary, the drive should be replaced).

**Note**

The alarm will sound in case of RAID failure. Press the Enter / Mute button to the right of the display to silence the alarm.

Over 2TB capacity

The RA4000e Series supports over 2TB capacity. If your operation system (e.g. Windows Vista) that supports a SATA device with over 2TB capacity. After create the array, you can have the setting to enable over 2TB capacity by the scroll button. The below steps will guide you to enable over 2TB capacity.

1. Create a new RAID.
2. Select scroll button to find the capacity setting item 「**Enable over 2T**」 on LCD panel. Press ENT button to continue.
3. Select **YES** to enable over 2TB capacity.

**Note**

*The device over 2TB capacity should be supported by Operation System (e.g. Windows Vista). Please refer to **Chapter 5. Partitioning the array with over 2TB capacity** to partition the device.*

**Note**

If system power is turned off midway through array initialization, the process will continue from its point of interruption when power returns.

Checking the status of RA4000e Series

The status of the RA4000e Series is given by the LCD display. Press the scroll button to the left of the display to scroll through information about the array. The following information is available:

- ⇒ RAID level and Capacity
- ⇒ Disk model
- ⇒ Disk DMA mode and capacity
- ⇒ Firmware Version
- ⇒ Serial Number
- ⇒ Fan Status and Temperature Status



Note

A full list of LCD display messages is given in Appendix C

Removing / replacing a drive

What if a disk fails?

If a disk drive fails, the disk status indicator of the disk carrier will light red and the alarm will sound. When this happens, you should replace the failed disk.



Note

*The failure or removal of a single drive in a **R5** array will not lead to failure of the array. The failure or removal of a single drive in a **R0** array will lead to loss of all data on the array and the entire array must be re-initialized.*



Note

There is no need to immediately replace a failed disk in a R5+spare array. The hot spare disk will be brought on line automatically.



Note

The alarm can be silenced by pressing the Enter / Mute button to the right of the display.

Swapping drives

The hot swap function for R5 arrays enables failed disks to be swapped while the array is powered on. RAID rebuilding will be processed automatically in the background and the RA4000e Series will record its progress. If the host system is shut down or powered off abnormally, the RA4000e Series will continue the disk rebuilding process after power is turned on again.

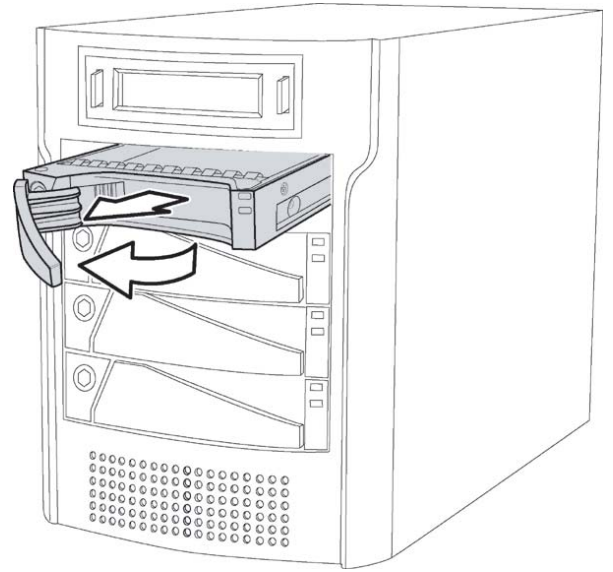


Note

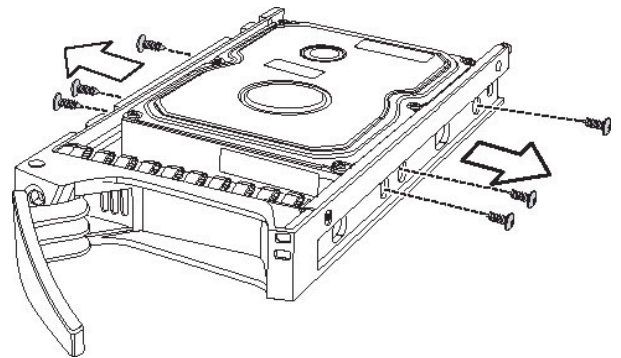
A hard disk in a R5 array should not be replaced when the system is turned off. Doing so may leads to loss of data. Always hot swap disks in a R5 array.

Removing a drive

1. Pull the drive carrier handle.
2. Slide the drive carrier out of the RA4000e Series.



3. Remove four screws from the tray and lift out the disk drive.



Connecting to a host computer

Once the array is initialized, you can connect the RA4000e Series to your host computer.

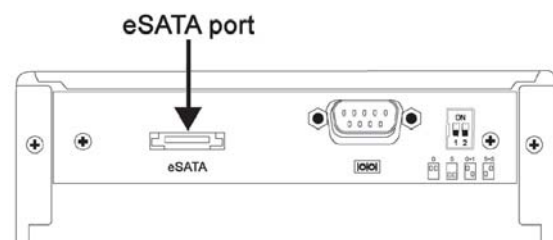


Note

The RAID cannot be recognized by Operating System before initialization complete.

To connect to the host:

1. Power on RA4000e Series and follow the instructions earlier in this chapter to establish a RAID array.
2. Connect one end of the supplied eSATA cable to the eSATA port and the other end to a spare eSATA port on your host computer.
3. The host computer should detect the presence of the RA4000e Series. Turn to the next chapter for instructions on formatting your array.



Note

Advanced users wishing to remotely monitor the status of their array should connect RA4000e Series via an RS-232 cable to a terminal or computer hosting a terminal emulation program.

Setting the Display Time & Date

Press down the right hand (Enter) button for over five seconds to enter or change the time and date displayed on the display. When you release the button, the date and time setting screen will show:

1. First enter the year. Change the displayed value by pressing the left hand (Scroll) button. When the correct value is displayed, press the Enter button to move to the next field.
2. Enter the month in the same way then move to and enter the date.
3. Press the Enter button to move to the hour field. Enter the time in the 24-hour clock format.
4. Press Enter when you have entered the correct minute value to complete time and date entry.

YY/MM/DD HH: MM
03/11/23 19: 27

Chapter 5

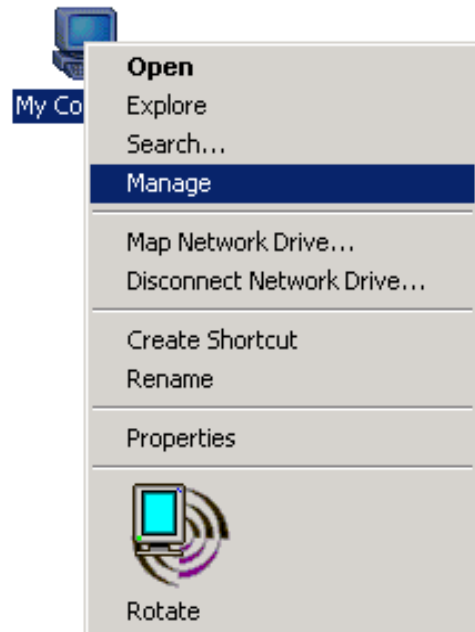
Partitioning the array

This chapter explains how to partition the array in Windows 2000/2003/XP/ME, Windows Vista, Linux, Mac operating systems.

Partitioning the array - Windows

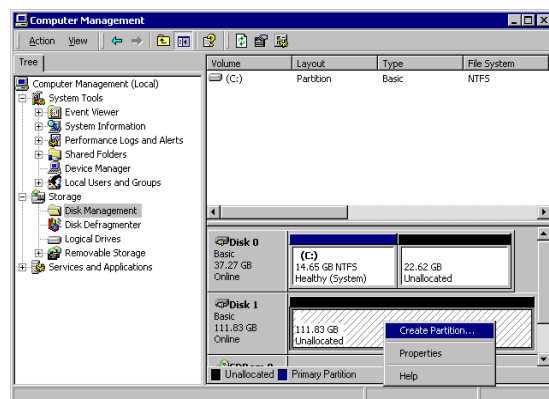
The array must be partitioned before it can be used. To do this on a Windows operating system:

1. Establish the array and connect to the host computer following the instructions in the preceding chapter. Make sure no error messages are showing on the LCD display.
2. Turn on the host computer.
3. On the desktop, right click the **My Computer** icon.
4. Select **Manage**. The Computer Management dialog box will appear.

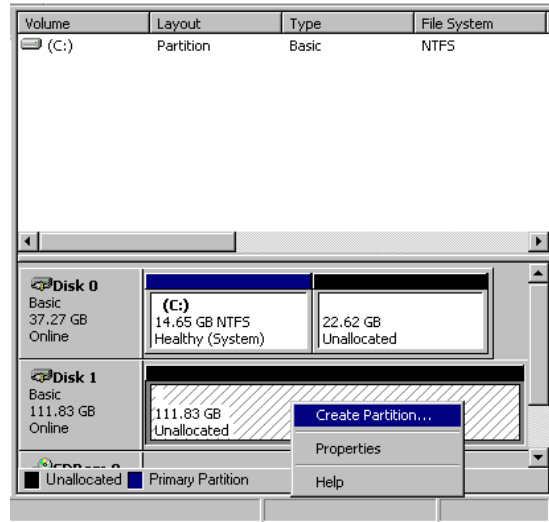


5. In the Computer Management dialog box, select Disk Management from the left hand menu. The array will appear in the lower right section of the dialog box as a disk marked unallocated.

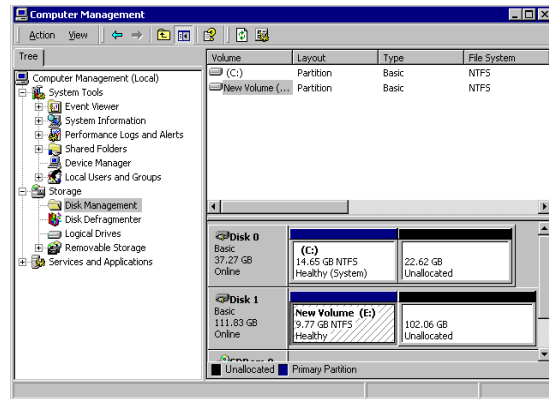
Other disks attached to the host machine, such as the main drive of the machine, will have an assigned letter (e.g. C:) for the parts of the disk (partitions) that are accessible to the operating system. These are listed in the upper right part of the dialog box. You must partition the disk and make it accessible to the operating system.



- Right click on the disk representing the array and select **Create Partition**. Follow the wizard to create one or more partitions on the array.



- When you have completed creating a partition, the array will appear as a disk in the disk management section of the Computer Management dialog box.



Partitioning the array - Linux

The array must be partitioned before it can be used. To do this on a Linux operating system:

1. Establish the array and connect to the host computer following the instructions in the preceding chapter. Make sure no error messages are showing on the LCD display.
2. Turn on the host computer.
3. Check to confirm the operating system has detected the array: type “**df**”

The array will be listed as shown at a temporary location (**/tmp**). The code given the array depends on the host interface type. Arrays connected through a USB or IEEE 1394 interface will be assigned a code **sda** (**sdb**, **sdc** etc.). Arrays connected through a serial ATA interface will be assigned a code **hde** (**hdf**, **hdg** etc.) as in the example shown.

```
[root@localhost tmp]# df
Filesystem      1K-blocks      Used Available Use% Mounted on
/dev/hda2       78163044    4979204 69213376   7% /
/dev/hda1       101089      9399      86471   10% /boot
none            127652        0    127652    0% /dev/shm
/dev/hde        35584272     20    33776656   1% /tmp
```

When you have confirmed that the array has been detected:

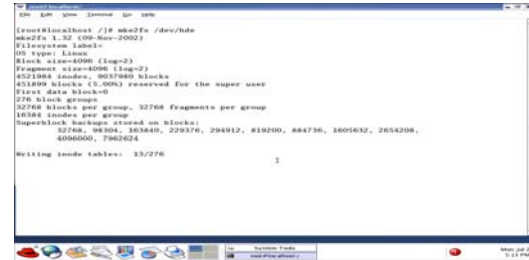
4. Enter the command to format the disk (array): **fdisk /directory/device name** (e.g. **fdisk /dev/hde**).
5. When the disk is formatted, you should partition the disk. Call up the help screen as shown to identify the correct command to add a partition.
6. Enter the command to add a partition (in the example given, the command is “**n**.”)
7. Enter the command to create a primary partition then enter the number of primary partitions you wish to create.

```
[root@localhost /]# fdisk /dev/hde
The number of cylinders for this disk is set to 4500.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
 1) software that runs at boot time (e.g., old versions of LILO)
 2) booting and partitioning software from other OSs
   (e.g., DOS FDISK, OS/2 FDISK)

Command (m for help): m
Command action
 a toggle a bootable flag
 b edit bsd disklabel
 c toggle the dos compatibility flag
 d delete a partition
 l list known partition types
 m print this menu
 n add a new partition
 o create a new empty DOS partition table
 p print the partition table
 q quit without saving changes
 s create a new empty Sun disklabel
 t change a partition's system id
 u change display/entry units
 v verify the partition table
 w write table to disk and exit
 x extra functionality (experts only)

Command (m for help): n
Command action
 e extended
 p primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-4500, default 1): 1
Last cylinder or +size or +sizeM or +sizeK (1-4500, default 4500): 4500
```

8. Enter the command to create a Linux second extended file system on the array. In the example, the command is **mke2fs /directory/device (mke2fs /dev/hde)**.
9. Assign the array a location: Enter **mount /directory/device /location (mount /dev/hde /tmp)**.



```
root@localhost:~# mke2fs /dev/hde
mke2fs 1.23 (10-Nov-2002)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
4521984 inodes, 9037980 blocks
4521989 blocks (10.00%) reserved for the super user
First data block=0
176 block groups
32768 blocks per group, 32768 fragments per group
10284 inodes per group
Superblock backups stored on blocks:
32768, 98304, 183840, 279376, 294912, 819200, 884736, 1605632, 2654208,
4096000, 7962424

Writing inode tables: 33/276      1
```

Partitioning the array – Mac OS X

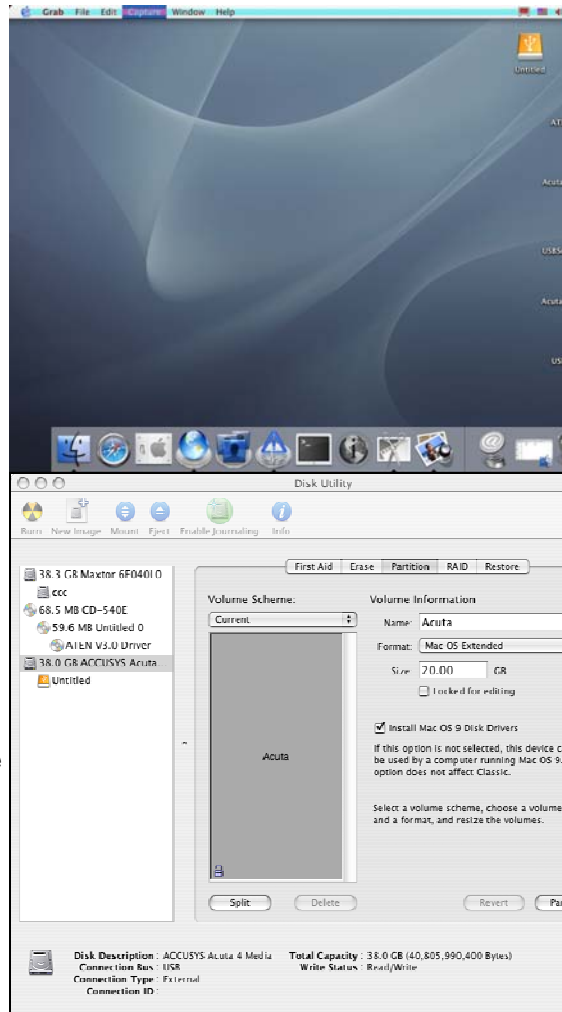
The array must be partitioned before it can be used. To do this on a Mac operating system:

1. Establish the array and connect to the host computer following the instructions in the preceding chapter. Make sure no error messages are showing on the LCD display.
2. Turn on the host computer.
3. When the array is detected by system, it will be shown as an untitled device on desktop.

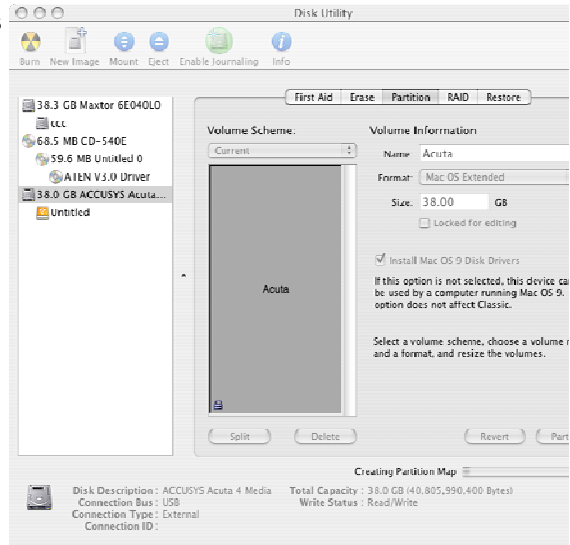
4. Executing **Disk utility** to begin partitioning array, (**Disk utility** is located **Applications/Utilities**). The **Disk utility** dialog box appears, and the array will appear in the left menu of window as an untitled disk.

Other disks attached to the host machine, such as main drive of the machine, will have an assigned name for the parts of the disk (partition) that are accessible to the operating system. These are listed in the left hand menu of dialog box. You must partition the disk and make it accessible to the operating system.

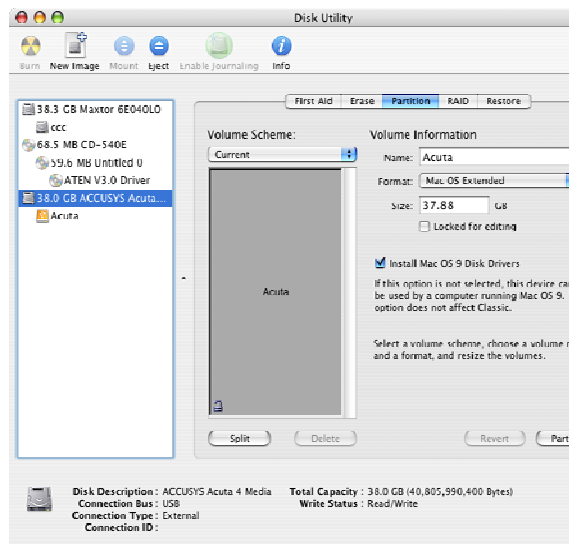
5. Choosing by click in left menu and click on tag "**partition**" to fill the **name** and **size** of the array. The array could be created to be a single volume or several volumes, determined by intention of user. Then click **Partition**, which located lower right corner of dialog box.
6. The confirmation dialog will be pop out to confirm again. Click **Partition** to continue procedure.



- The partition will then begin, and process is been showing as **creating partition map** in lower right corner of dialog box.




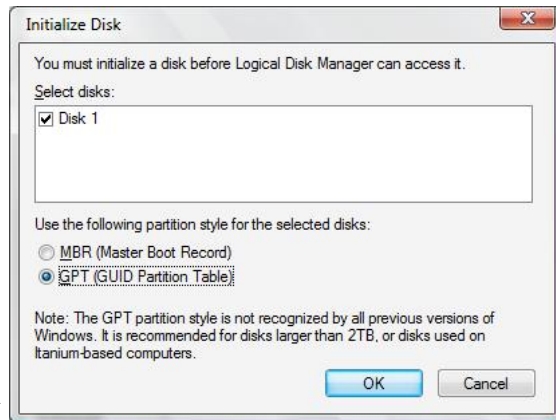
- When you have completed creating a partition, the array will appear as a disk in storage list in left menu, and be put on desktop as shortcut.



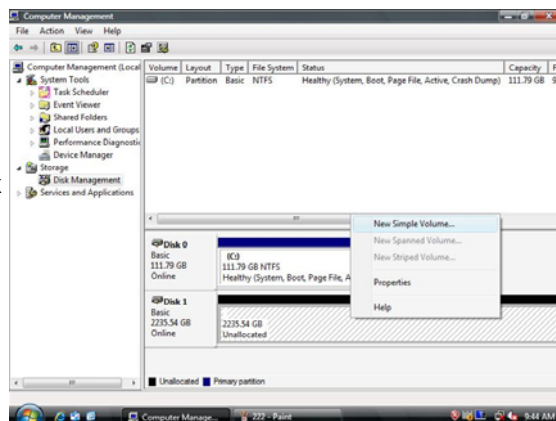
Partitioning the array – Vista

The array must be partitioned before it can be used. To do this on a Windows Vista operating system:

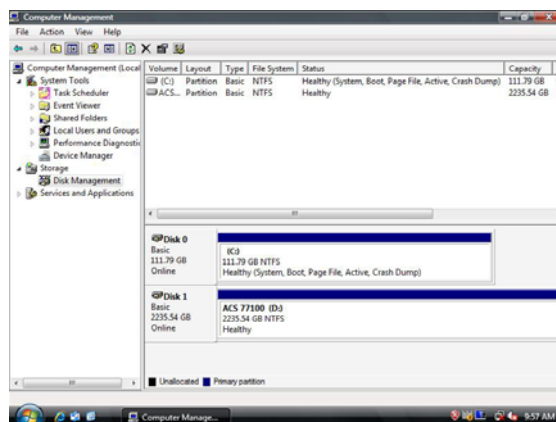
1. Right click **Computer** and click **Manage**.
2. From the **Computer Management** window, select **Disk Management**.
3. Windows operation system will list all the hard drives that are installed on the system. Locate the RA4000e Series drive that is represented by the  icon. Right click the icon and select **Initialize Disk**.
4. The **Initialize Disk** dialog box will appear, select the disk number and select the **MBR (Master Boot Record)** partition style. Click **OK** to partition.
If over 2TB capacity is needed, please choose **GPT (GUID Partition Table)** to partition.



5. In the drive box to the right shows **Unallocated**, right click and select **New Simple Volume**.
6. The **New Simple Volume Wizard** dialog box will appear, click **Next** to continue.
7. After selecting the partition type, specify the partition size, and assign a drive letter, the **Format Partition** dialog box will appear. In addition to regular formatting, you can also choose **Quick Format**, which allows faster formatting by skipping the scan of all disk sectors. Click **Next** to start the format process.



8. Your drive should now appear in your **Computer** and ready for use.



Appendix A

FAQ

If you encounter a problem while using the RA4000e Series, check this section for help.

1. My Operating System is Linux. I have enabled the over 2TB capacity setting, but I still cannot partition a device over 2TB in OS. Why?

⇒ The RA4000e Series is over 2TB available, but most OS still cannot support SATA device to over 2TB capacity. Please refer to the below list for choosing the OS.

a) Microsoft Windows Vista

2. I have connected the RA4000e Series, but it does not appear in the motherboard BIOS. Why?

⇒ Ensure that an array is initialized completely.

3. How should I react to disk failure?

⇒ For a R5/R0+1 array, you should replace the failed disk. Data rebuilding will then begin.

⇒ For a R5+hot spare array, data will be rebuilt automatically to the hot spare disk. There is no need to immediately replace the failed drive.

⇒ The capacity of new DISK you installed must equal or larger than the smallest disk in the RA4000e Series. Otherwise, it will be rejected by the RA4000e Series, though it has no any damage.

4. How should I react to a disk failure while creating a RAID5?

⇒ Replace the failed DISK with another of equal or larger capacity. The array will re-initialize from starting.

5. If I only have two or three disks, can I create a RAID?

⇒ 2 disks: No. need at least 3 disks to configure R5+hot spare

⇒ 3 disks: Yes, but you can only choose R5+hot spare. The three disks must be installed in the bottom three disk carriers with the top layer – the hot spare location, left empty.

6. Why does the display read “unmatched”?

- ⇒ The RAID level selector is not set to the level of the existing array. Please choose one of the following options :

Supposed the RAID level selector is R0, but the disk setting detected from disks is R5.

(1) Shut down and tune the RAID level selector to R5.

or (2) Re-plug the four disks and re-create the Array to R0 (But data in the R5 disks will be lost due to the destructive init)

7. If I really want to re-create a new RAID. How should I do?

- ⇒ Remove all disks.
- ⇒ Power off the RA4000e Series, set up RAID level by selector switch than power on the RA4000e Series.
- ⇒ Plug in all of disks to initialize new RAID.
- ⇒ If you use previous disks, will show a message “Create New RAID?” to confirm with you if you really want to create a new RAID. Please choose “Yes” by right button, the initialization will then begin.
- ⇒ Please notice that the procedure will erase all data of the four disks.

8. The host computer cannot detect the RA4000e Series. What should I do?

- ⇒ Make sure the host interface connection cable is attached securely to ports on and the host and is not damaged.
- ⇒ Check the display for error messages.

9. A disk has failed. What should I do?

- ⇒ Swap the failed disk with one of the other three disks and turn on. If the same disk fails, replace the disk. If the failure reappears at the same drive carrier, either the drive carrier or is faulty. Perform the next step.
- ⇒ Swap the position of the drive carrier that failed twice and turn on. If the same drive carrier fails, replace it. If the failure reappears at the same drive carrier slot, the RA4000e Series is faulty. Perform the next step.
- ⇒ The RA4000e Series appears to have an internal malfunction. Consults your dealer.

10. Two disks have failed. What should I do?

- ⇒ Swap the positions of the failed disks with the remaining two disks. If the same disks fail, replace them. If the failures reappear at the same drive carriers, either the drive carriers or is faulty. Perform the next step.
- ⇒ Swap the position of the drive carriers that failed twice with the working drive carriers and turn on. If the same drive carriers fail, replace them. If the failures reappear at the same drive carrier slots, the RA4000e Series is faulty. Perform the next step.
- ⇒ The RA4000e Series appears to have an internal malfunction. Consult your dealer.

11. Three disks have failed. What should I do?

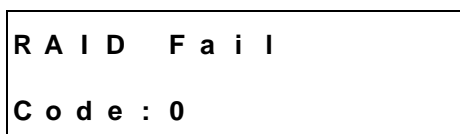
- ⇒ Swap the single functioning disks with each of the failed disks in turn. If the functioning disk continues to function at its new location, the original disk was faulty and should be replaced. If the functioning disk does not function at any of the three other locations, the drive carriers for those location or the RA4000e Series is faulty. Perform the next step.
- ⇒ Swap the functioning drive carrier in the same way to find out if the drive carriers or the RA4000e Series. Replace any malfunctioning drive carriers.
- ⇒ Consult your dealer if the RA4000e Series appears to be faulty.

12. Four disks have failed. What should I do?

- ⇒ If four disks have failed, you will need to use another disk that you know is functioning. Use this disk in the same way as outlined in the previous answer to find out if the malfunction is with the original disks, the drive carriers or RA4000e.

13. What should I do when I see below error message on LCD?

- ⇒ Condition 1



Note: not enough number of function disks for a RAID to operate

Solution: Install all of 4 disks to conform to create a new RAID.

⇒ Condition 2

```
RAID Fail
Code : 1 <xxxx>
```

Note: Represents disk sequence is wrong, and the current sequence displayed within <>

Solution: Replace the sequence of disk as original.

Example:

<2134>: disk 2 and disk 1 sequence is reversed.

<13x4>: the original disk 3 is put into tray 2 and the original disk 2 is not plugged or failed.

⇒ Condition 3

```
RAID Fail
Code : 2
```

Solution: To create a new RAID or you should call AVerMedia product support center to try to save the data from system.

⇒ Condition 4

```
Battery Failed
```

Note: Battery is low, missing, or failed.

Solution: Please contact with your distributor or vendor to change a new battery

⇒ Condition 5

```
Fan Failed
```

Note: Fan is low, missing, or failed.

Solution: Please contact with your distributor or vendor to change a new Fan.

Appendix B

Glossary

Array

See Disk Array.

Array Management Software

The body of software, that provides common control and management for a disk array. Array Management Software most often executes in a disk controller or intelligent host bus adapter, but may also execute in a host computer. When it executes in a disk controller or adapter, Array Management Software is often referred to as Firmware.

Cache

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

Disk Array

A collection of disks from one or more commonly accessible disk controllers, combined with a body of Array Management Software. Array Management Software controls the disks and presents them to the array operating environment as one or more virtual disks.

Firmware

See Array Management Software.

Host Computer

Any computer system to which disks are directly attached and accessible for I/O. Mainframes, and servers, as well as workstations and personal computers, can all be considered host computers in the context of this manual, as long as they have disks attached to them.

Parity

Parity information is redundancy information calculated from actual data values. If any single piece of data is lost, the data remaining and the parity information can be used together to compute the lost data. Parity information can either be stored on a separate, dedicated drive, or be mixed with the data across all the drives in the array.

RAID (Redundant Array of Independent / Inexpensive Disks)

A disk array in which part of the storage capacity is used to store redundant information about user data stored on the remainder of the storage capacity. The redundant information enables regeneration of user data in the event that one of the array member disks or the access path to it fails. See Parity. Different RAID level offer different data throughput speeds and fault tolerance (data redundancy). RAID 0 does not feature redundant information but is nonetheless considered a special type of RAID.

Serial ATA (Serial Advanced Technology Attachment)

Serial ATA (often abbreviated as SATA or S-ATA) is an advance on the commonly used Parallel ATA interface for data storage devices. Serial ATA allows data transfer up to 1.5 Gbps. It has an additional advantage parallel ATA in that cables are thinner, so airflow within computer cases is less impeded, and can extend to one meter in length (against only 40 cm for parallel ATA).

Appendix C

LCD Display Messages

When the system power is turned on, the following message will be always first displayed:

			A	V	e	r	M	e	d	i	a				
					B	o	o	t	.	.	.				

If the system installs 4 disks with a RAID level, this message will be next.

			A	V	e	r	M	e	d	i	a				
I	n	i	t	i	a	l	i	z	e		D	i	s	k	s

Over 2TB capacity setting

E	n	a	b	l	e		o	v	e	r		2	T		
P	r	e	s	s		E	N	T		s	e	l	e	c	t

If you would like to enable the function of support over 2TB capacity, press the button “ENT” to select this function, the next message will be displayed.

At this condition user presses the scroll buttons, the below messages will be displayed:

E	n	a	b	l	e		o	v	e	r		2	T		
(	Y	E	S)											

E	n	a	b	l	e		o	v	e	r		2	T		
(	N	O)												

When use presses “ENT” after the new condition select, the RA4000e Series will reboot.

RAID initialization

- Create new RAID

When the system is powered on and it's ready, replace 4 disks, the following message will be displayed to ask user to confirm the initialization process.

C	r	e	a	t	e		N	e	W		R	A	I	D	?
(	N	O	)								(	Y	E	S)

User can press the MENU or ENTER button to select NO or YES to confirm your selection

and move to the next operation.

- RAID initialization started

After select YES, system will automatically enter the RAID initialization state by showing the disk initialization progress on the LCD display.

R	A	I	D		I	N	I	T		x	x	.	x	%	
	T	o	t	a	I	:		x	x	x	x		G	B	

Where xx.x % represents the percentage of RAID capacity being initialized.

- RAID initialization completed without error

If there is no error during initialization, LCD panel will display the following message upon finish the initialization stage.

R	A	I	D		I	N	I	T		1	0	0	%		
x	x	x	x		G	B		I	N	I	T		O	K	!

■ RAID initialization failed

If there is any disk error happens on one of the 4 disks, for example disk 2, the LCD will display one of the following two messages respectively for disk failure or bad sectors detected:

R	A	I	D		I	N	I	T		F	a	i	l	e	d
D	2			o	f	f	l	i	n	e					

R	A	I	D		I	N	I	T		F	a	i	l	e	d
D	2			B	a	d		s	e	c	t	o	r	s	

System ready

After the system is powered on with all 4 disks successfully initialized, it will display the following message:

			A	V	e	r	M	e	d	i	a				
R	e	a	d	y							h	h	:	m	m

Where hh:mm represents the hour and minutes of current time if being correctly set.

RAID and disk status messages

Under system ready condition, if user presses the MENU button one by one, the LCD will display message in the following sequence:

RAID level Setting and Total RAID Capacity:

L	e	v	e	l		5									
1	2	0			G	B									

Disk information: Vendor, model # (for example: Western Digital Caviar 7200rpm 120G)

D	i	S	k		1										
W	D	1	2	0	0	B	B								

Disk information: mode, Capacity

S	e	r	i	a	l		A	T	A						
1	2	0				G	B								

Repeat messages 6.2.5.1 to 6.2.5.3 until all 4 disks information being displayed

System firmware version:

F	i	r	m	w	a	r	e								
V	e	r	:	1	.	0	0								

System serial number:

S	e	r	i	a	l		N	u	m	b	e	r			
0	0	0	9	7	6	1	0	0	0	0	0	2	3	8	0

System fan speed and temperature:

F	a	n	:	3	6	0	0		r	p	m				
T	e	m	p	e	r	a	t	u	r	e	:	4	0	°	C

Error and failure messages

Error or failure messages will be displayed on LCD panel under the following conditions:

Disk failure message: if one of the 4 disks fails in the operation

D	I	S	K	x		F	a	i	l	u	r	e			

Disk bad sector messages

D	I	S	K		x		b	a	d	:	Y				
T	o	t	a	l		b	a	d	:	x	x				

“DISK x bad Y”: It means disk x has Y bad sector. “Total bad xx”: it means total xx bad sectors had done. If the DISK has remapped more than 8 sector, the RA4000e Series will beep to let the user know how bad of the drive.

D	I	S	K		x		F	a	i	l	u	r	e		
B	a	d		s	e	c	t	o	r	:	1	0			

“DISK x Fail” “Bad sector: 10”: It means if the bad sector count of DISK has more than 10 or equal 10 sectors, the RA4000e Series will kick the DISK out.

D	I	S	K		x		F	a	i	l	u	r	e		
B	a	d		s	e	c	t	o	r	:	Y	Y	/	1	5

“DISK x Fail” “Bad sector:yy/15”: It means DISK x has Y bad sectors and the number 15 means the total remapped area. In the RA4000e Series remap policy, when the total bad count to 15, the controller will start to compare each DISK of bad sectors count to determine which DISK has the maximum bad sectors and then the controller will kicked it out.

RAID failure message: if the RAID crashes and the data cannot be recovered

R	A	I	D		F	a	i	l							
C	o	d	e		0										

“Code 0” represents not enough number of function disks for a RAID to operate

R	A	I	D		F	a	i	l							
C	o	d	e		1		<	1	3	X	4	>			

“Code 1” represents the disk sequence is wrong with current sequence displayed within <>. Examples:

- <2134>: disk 2 and disk 1 sequence is reversed.
- <13x4>: the original disk 3 is put into tray 2 and the original disk 2 is not plugged or failed.
- <423s>: the spare disk is put in the tray 4 and original disk 4 is put in the tray 1

R	A	I	D		F	a	i	l							
C	o	d	e		2										

“Code 2” represents the array has been failed but of 4 disk exist.

RAID configuration error message:

The following two messages will be displayed alternatively when the setting of RAID level selectors does not match the existing disk RAID level setting:

		R	A	I	D		L	e	v	e	I				
		U	n	m	a	t	c	h	e	d					

C	u	r	r	e	n	t	:	R	5						
O	r	i	g	i	n	a	l	:	R	0					

The system will stop working until users choose one of the following options:

- Shut down RA4000e Series and tune the RAID level selectors to R5
- Re-plug the four disks and re-create the RAID to R0 (but data in the R5 disks will be lost)

Fan failure message: fan can not function normally

F	A	N		F	a	i	I								
1	0	0		r	p	m									

Where the speed of failed fan is 100 rpm

Overheat message: will be displayed when temperature > 50°C

T	e	m	p	e	r	a	t	u	r	e	!	!			
	5	1	°	C		>		5	0	°	C				

- Disk shut down message: will be displayed when temperature > 55oC

O	v	e	r		T	e	m	p	e	r	a	t	u	r	e
	D	i	s	k		S	h	u	t	d	o	w	n	!	

Disk rebuilding messages

The system will display the disk rebuilding progress when a failed disk is replaced by a new one.

D	x		R	e	b	u	i	l	d		x	x	.	x	%
	T	o	t	a	l	:		x	x	x		G	B		

Where xx.x represents the percentage of RAID capacity is being rebuilt.

If there is no disk error during rebuilding, the LCD panel will display the following message upon finishing the initialization stage.

D	x		R	e	b	u	i	l	d			1	0	0	%
x	x	x		G	B		O	K	!						

- If the capacity of newly installed disk (diskx, 80GB, in the example below) is less than the minimum capacity required for rebuild, the LCD panel will display the following message.

D	x		R	e	b	u	i	l	d		F	a	i	l	
8	0		G	B		<	1	2	0		G	B			

- If there are too many bad sectors detected in the newly installed disk during rebuilding process, the LCD panel will display the following message.

D	x		R	e	b	u	i	l	d		F	a	i	l	
D	x		B	a	d		s	e	c	t	o	r	s		

- If the newly installed disk can not be accessed (and thus fails), the LCD panel will display the following message.

D	x		R	e	b	u	i	l	d		F	a	i	l	
D	x		O	f	f	l	i	n	e						

Time setting

After the Enter button is pushed for over five seconds and released, the following message will be displayed for users to change the time and date.

Y	Y	/	M	M	/	D	D		H	H	:	M	M		
x	x	/	x	x	/	x	x		x	x	:	x	x		

To press the MENU button to select between 0 to 9, and press the Enter button to confirm your selection and move to the next operation.

Start by adjusting the year (YY), then move to the month (MM), the day (DD), and finally the hour (HH) and minute (MM) (the time is measured in the 24-hour clock format).

Pressing the Enter button on the final selection will set the time and date.

Appendix D

Updating Firmware

The RA4000e Series is shipped with firmware installed. You may however wish to install new or upgraded editions of the firmware. Ask your vendor about the latest firmware edition or refer to the AVerMedia website <http://www.avermedia.com>

Once new or updated firmware has been obtained, it can be downloaded to from a host PC with third party communication software, such as HyperTerminal, that supports ANSI terminal emulation. Other terminal programs may be used in place of HyperTerminal to communicate with the RA4000e Series. However, the setup process for other terminal software may differ from that outlined in this chapter.



Note

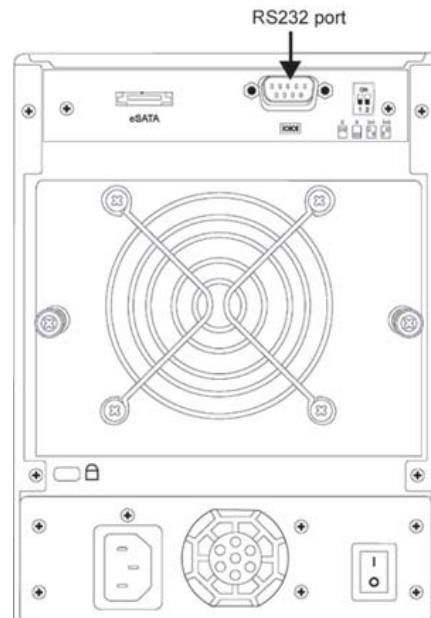
Array data and configurations are not affected by updating of firmware.



Note

HyperTerminal is bundled as standard with Microsoft Windows operating systems. It will be found in the Communications folder. The program can also be downloaded from Hilgraeve Software at <http://www.hilgraeve.com/hipe/>

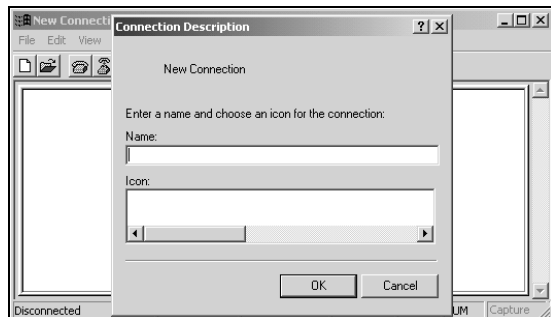
1. Ensure the RA4000e Series is turned off.
2. Connect one end of the supplied RS-232 cable to the RS-232 port on the rear of and connect the other end to one of the host computer's COM ports.



3. Launch HyperTerminal from the desktop of the host computer (**Start > Programs > Accessories > Communications > HyperTerminal**).



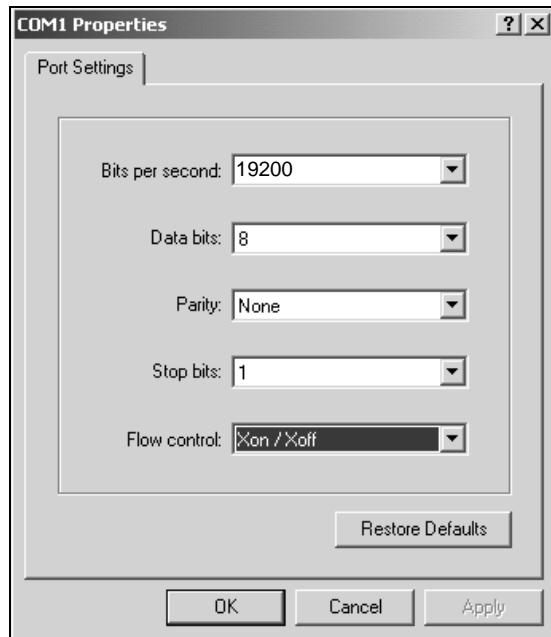
4. The **Connection Description** dialog box will appear (if this is the first time you have run HyperTerminal, you will first be prompted to enter information about your location). Enter a name to identify the connection (e.g.) and select an icon to represent the connection. Press **OK**.



5. The **Connect to** dialog box appears. Select **COM1** or **COM2** from the **Connect using:** dropdown menu, depending on which port is linked to . Click **OK**.



6. The **COM Properties** dialog box will appear. Set the following values:
 Bits per second: 19,200
 Data bits: 8
 Parity: None
 Stop bits: 1
 Flow Control: Xon/Xoff
7. Click **OK**. The HyperTerminal connection to is now established.



8. Turn on and press Esc on the host computer keyboard. The >>>> prompt will appear.
9. Type in the command "download".
10. When prompted **Enter '1' to Download Code** type "1".
11. Locate the updated firmware file to send. If using HyperTerminal, go to the **Transfer** menu and select **Send Text File...**
12. Send the firmware file as a text file. The file will start to download.
13. When the file has downloaded, After restarted, the firmware updating is finished, and you can check it on LCD panel.

```
===      Download      Mode      =====
*****Choose "1" to download firmware.

Enter '1'      to Download Firmware
      'ESC'    exit
      'r'      reset

- Version: Boot--- 01 (a)--- 04
Downloading Code!
```

