RAIDBANK 4

Owner's Guide

September 2008

MicroNet

www.MicroNet.com

FCC Compliance Statement

Federal Communications Commission

Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio 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:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Only use shielded cables, certified to comply with FCC Class B limits, to attach this equipment. Failure to install this equipment as described in this manual could void the user's authority to operate the equipment.

Canadian Department of Communications Compliance: This equipment does not exceed Class B limits per radio noise emissions for digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications. Operation in a residential area may cause unacceptable interference to radio and TV reception requiring the owner or operator to take whatever steps are necessary to correct the interference.

Conformite aux regiements du Department Canadien de Communications: Cet equipement n'excede pas les limites de Classe B concernaut les bruits des emissions de radio pour le dispositif digital etablies par le Reglement d'Interference de Radio du Departement Canadien de Communications. L'operation de cet equipement dans un quartier residential peut occasionner des parasites inacceptables dans la reception de la radio ou de la television exigeant le proprietaire ou l'operateur de faire routes les necessaires pour corriger cet interference.

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Limitations of Warranty and Liability

MicroNet Technology has tested the hardware described in this manual and reviewed its contents. In no event will MicroNet or its resellers be liable for direct, indirect, incidental, or consequential damage resulting from any defect in the hardware or manual, even if they have been advised of the possibility of such damages. In particular, they shall have no liability for any program or data stored in or used with MicroNet products, including the costs of recovering or reproducing these programs or data.

During the specified warranty period, MicroNet guarantees that the product will perform according to specifications determined by the manufacturer, and will be free of defects. Parts and labor of the received product, and replacement parts and labor are guaranteed during the specified warranty period. The warranty covers defects encountered in normal use of the product, and does not apply when damage occurs due to improper use, abuse, mishandling, accidents, sand, dirt, excessive dust, water damage, or unauthorized service. The product must be packed in its original packing material when shipped, or the warranty will be void. In all cases, proof of purchase must be presented when a warranty claim is being made.

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Technical Support Policy

If you have a problem installing your system or suspect it is malfunctioning, please contact the Authorized MicroNet Reseller from whom you purchased the system. If the reseller fails to resolve the problem, please visit our support page at www.micronet.com/support, or call MicroNet's Help Desk for assistance at (310) 320-0772. Please have the model, serial number, date of purchase, and the reseller's name available before calling. If possible, call from a telephone near the system so we can more readily direct you to make any necessary system corrections, should they be required.

Returning Materials

If a reseller or MicroNet Technician finds it necessary to have the system returned for testing or servicing, a Return Materials Authorization (RMA) number will be issued. The RMA number must be placed on the outside of the carton in large, visible letters near the address label. Return the complete system including all cables and software. The system must be packed in the original packing materials and shipped prepaid. MicroNet will repair the system and return it prepaid by similar common carrier and priority. Please record the RMA number and make reference to it when inquiring on the status of the system. A returned unit found to be fault-free will carry a $65.00 charge for service and repackaging.

Welcome From MicroNet Technology

We are pleased that you have chosen the RAIDBank4. Our systems are designed for speed, reliability, compatibility, and performance. We think you will find the system easy to install, and a productive addition to your computer system.

This manual presumes that you are familiar with standard computer operations; this includes copying files, opening documents, clicking with the mouse, and organizing files or folders within other folders. If you are unfamiliar with these operations, please consult the User's Guide that was supplied with your computer system. Your computer dealer and local user's groups are also good sources of information. After you are comfortable with the operation of your computer, continue reading this manual which describes hardware installation and operation.

Your comments assist us in improving and updating our products. Please feel free to share them with us. Please send comments to:

MicroNet Technology
Attn: Customer Service
19260 Van Ness Ave
Torrance, CA 90501
info@micronet.com

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Chapter 1. Getting Started

Thank you for purchasing The MicroNet RAIDBank4 storage solution. With speed, high capacity, ease of use, and support for numerous applications, RAIDBank4 is the ideal solution for all of your data storage needs.

Please take advantage of the information contained within this manual to ensure easy setup and configuration. If at any time you require technical assistance, MicroNet's Help Desk is available at 310-320-0772 or at www.micronet.com/support

Features and Benefits

The RAIDBank4 Subsystem is a high-performance RAIDBank4 built around a powerful 64bit controller designed to meet or exceed the highest industry standards. Outstanding features include:
- eSATA-300 and USB 2.0 host connections for maximum host flexibility
- SATA II, NCQ enabled drive channels
- Configurable RAID engine for high data protection
- On-line volume expansion and migration with no system down-time

Featuring high performance and availability RAID technology and advanced array management features, The RAIDBank4 can serve in several applications:
- As a high speed local storage device for a dedicated workstation
- As a high-speed, fault tolerant server-attached storage device
- As a redundant backup station

System Requirements and Compatibility

The RAIDBank4 features a high speed eSATA 300 and a USB 2.0 connections, providing nearly universal connectivity. While the RAIDBank4 can function with a variety of hardware and software combination, MicroNet has tested and approved the RAIDBank4 for compatibility with the following architectures:

Apple Hosts:
- G4-733 and better, Mac OS-X revisions 10.4.8 and newer (eSATA utilizing MicroNet's eSATA PCI-X host bus adapter, MicroNet part number SATAPCIX4)
- G5 and Mac Pro desktops with a PCI Express Slots, OS 10.4.8 and newer (eSATA utilizing MicroNet's eSATA-PCIX host bus adapter, MicroNet part number SATAPCIE2)

Windows Hosts:
- Pentium 3-800 and better, Windows revisions 2000/XP/2003/Vista (eSATA utilizing MicroNet's eSATA-PCIX host bus adapter, MicroNet part number SATAPCIX4)
- Pentium D-2800 and better with PCI express ports, Windows revisions 2000/XP/2003/Vista (eSATA utilizing MicroNet's eSATA-PCIX host bus adapter, MicroNet part number SATAPCIE2)

Unpacking the RAIDBank4

Please unpack your RAIDBank4 in a static free environment, carefully making sure not to damage or discard any of the packing material. If the RAIDBank4 appears damaged, or if any items of the contents listed below are missing or damaged, please contact your dealer or distributor immediately.

In the unlikely event you may need to return the RAIDBank4 for repair or upgrade, please use the original packing material to ensure safe transport.

What's Included

Your RAIDBank4 comes with the following items:

1 RAIDBank4 unit
4 Disk Drive Modules
1 RAIDBank4 CD containing this manual in PDF format
1 Ethernet cord
1 RJ11-DB9 serial cord
1 power cord
1 eSATA cable
1 USB 2.0 cable

Choosing a location for your RAIDBank4

When selecting a place to set up your RAIDBank4, be sure to follow these guidelines:

• Place on a flat and stable surface capable of supporting at least 25lbs
• Place the RAIDBank4 close enough to the computer for the host connection cable to reach.
• Use a grounded wall outlet.
• Avoid an electrical outlet controlled by wall switches or automatic timers. Accidental disruption of the power source may wipe out data in the memory of your computer or RAIDBank4.
• Keep the entire system away from potential sources of electromagnetic interference, such as loudspeakers, cordless telephones, etc.

> ⚠ **CAUTION! Avoid direct sunlight, excessive heat, moisture, shock and vibration, or dust**

The RAIDBank4 interface components

The following figures illustrate the connector locations for the RAIDBank4.

FRONT VIEW

Disk Activity LED
Disk Power LED

Canister Release Latch

Disk Canisters

Power/Status Indicator Light

REAR VIEW

LCD Panel with Keypad

Fan vents (DO NOT BLOCK!)

RS232 Port (reserved)

LAN monitoring Port

Host USB Port

Host eSATA Port

Master Power Switch

AC Power Connector

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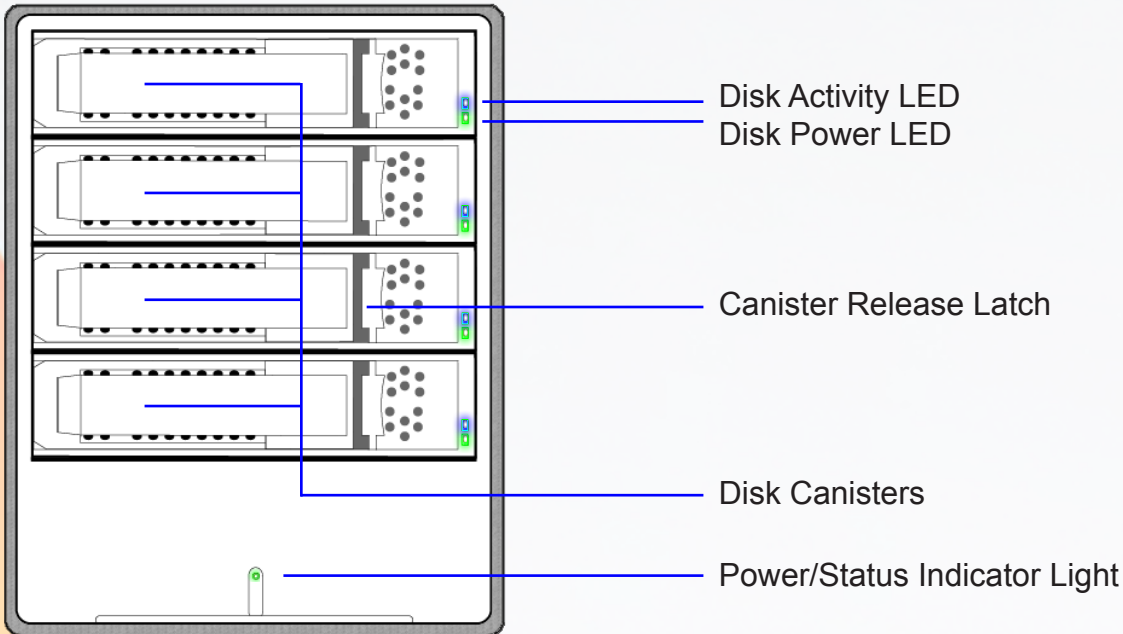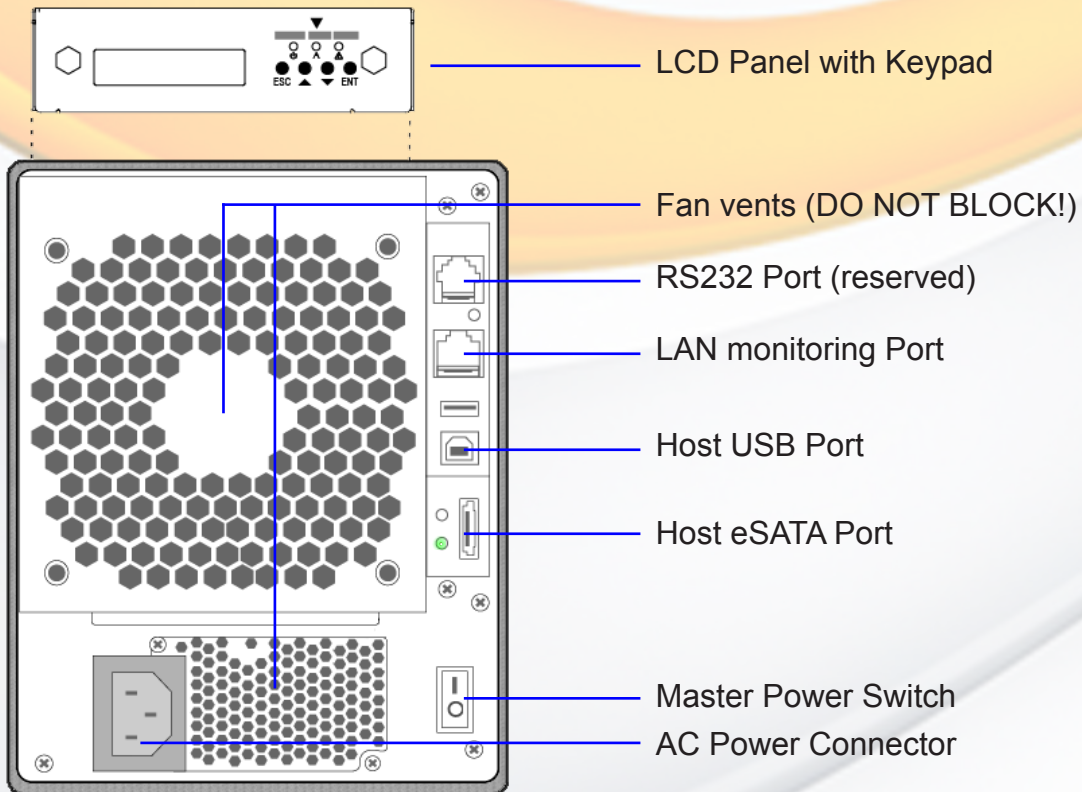
Communication and Control

RAID functions including creation, modification, and monitoring can be accomplished through the LCD Control panel or the web based administration user interface. The LCD status panel informs you of the RAIDBank4's current operating status at a glance, as shown here:

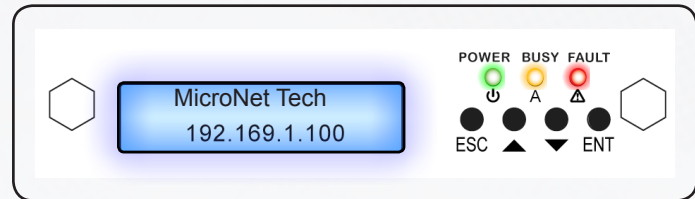| LED	Normal Status	Problem Indication
Power LED (Front)	LED glows **bright green**	Dark or **blinking red** on system error.
Power LED (LCD)	LED glows **bright green**	Dark on power-on
Busy LED	LED is dark	LED **blinks amber**
Disk Activity LED	LED **blinks blue** during hard drive read and write activity	N/A
Disk Power LED	LED glows **bright green**	This LED will **blink red** if there is a disk error.
System Fault LED	LED remains dark	This LED will **blink red** if there is a system error.

Hot plug Drive Replacement

In the event of a drive failure, the RAIDbank4 supports the ability to hot-swap drives without powering down the system. A data module can be removed and replaced without powering off the unit or taking the system off line. In a fault tolerant array, the RAID rebuilding will proceed automatically in the background (see *Section 2.Understanding RAID* for more information.)

A drive failure will illuminate amber the **drive indicator light** above the failed drive on the front of the RAIDBank4. To replace a drive, please follow these steps:

1. Press down on the **drive release latch** (see page 8, *"The RAIDBank4 Interface components"*) to release the drive tray
2. Gently pull out the disk drive tray handle and slide out the drive tray.
3. To replace: Slide in the replacement drive tray with the tray handle open. When the tray is slid all the way into the RAIDBank4, push the tray handle closed.

⚠️ **IMPORTANT: NEVER remove a drive tray without replacing it. Operating the RAID with a drive tray missing will disrupt airflow and may cause the RAIDBank4 to fail.**

Connecting the RAIDBank4

Connecting the RAIDBank4 requires an available power socket, and a host with one of the following interfaces:
• A USB 2.0 port
• An external SATA host bus connector with large LUN and port multiplier support
• The Ethernet remote management requires an available Ethernet jack to a hub or switch on your network.

1. Plug the AC adapter cord into the power port on the back of the drive. The plug should not require much effort to insert. If the plug will not go in, do not force it; the plug is probably upside down. Rotate the plug and try again. Incorrectly inserting the plug could damage the drive and void the warranty.
2. Plug the power cord into the power socket
3. Connect the appropriate cable to your host. USB and eSATA plugs are shaped so they can only be properly inserted one way. Be sure to insert the plugs properly or you may damage the drive and void the warranty.
   (USB) Connect the square USB 2.0 connector (type B) of the included USB cable to a the square USB plug on the RAIDBank4 (illustrated right in green), and the rectangular end to a free USB port on your computer.
   (eSATA) Connect the included eSATA cable to a free eSATA port on your computer (illustrated right in blue.) If your computer does not have eSATA ports, you may purchase an eSATA expansion card for your computer. Contact your authorized MicroNet reseller for further details.
4. Flip the power switch located on the back of the RAIDBank4 to the "ON" position (labelled "-".)
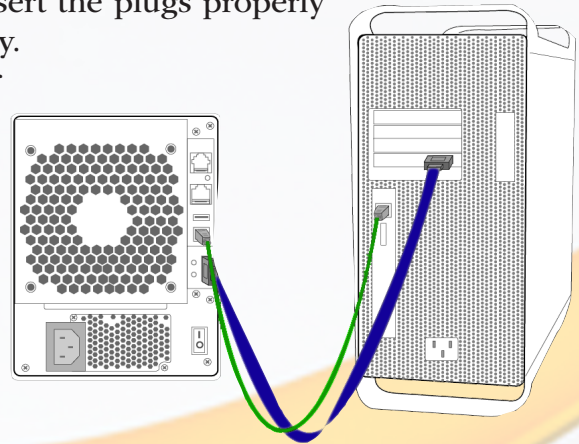
RAID System Management Controls

Following the hardware installation, the RAIDBank4 must be configured and the volume set units initialized before they are ready to use. This can be accomplished by one of the following methods:

- Front panel touch-control keypad
- Web browser-based RAID management

Note:
The RAIDBank4 allows only one method to access menus at a time.

These user interfaces can access the built-in configuration and administration functions that reside in the controller's firmware. They provide complete control and management of the controller and disk arrays, requiring no additional hardware or software.

Using the front panel touch-control keypad

The front panel keypad and liquid crystal display (LCD) are the primary user interface for the RAIDBank4. All configuration and management (with the exception of firmware upgrades) of the controller can be performed from this interface. The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

The four function keys at the button of the front panel perform the following functions:

Key	Function
Up Arrow	Use to scroll the cursor Upward / Rightward
Down Arrow	Use to scroll the cursor Downward / Leftward
ENT Key	Submit Selection Function (Confirm a selected item)
ESC Key	Return to Previous Screen (Exit a selection configuration)

The main menu can be activated by hitting the *ENT* key. Use the up and down arrow buttons to highlight a menu item. Press *ENT* to select the highlighted item. Press the *UP/ DOWN* to browse the selection. Press *ESC* to return to the previous screen.

Using the web browser-based RAID management

The RAIDBank4 controller firmware includes a complete HTML-based weblet application that allows all configuration and monitoring to be performed across any IP based network, and utilizes standard web browsers for interfacing.

To ensure proper communications between the RAIDBank4 and Web browser-based RAID management, Please connect a standard, Cat5 Ethernet cable to the RJ45 network jack on the back of your RAIDBank4 and attach to your existing network. In order to access the web administration utility please note the IP address displayed on the LCD screen. You may launch your firmware-embedded TCP/IP & Web Browser-based RAID manager by entering http://[IP Address] in your web browser. The RAIDBank4 controller default username is "admin" and there is no password assigned from the factory. Please refer to Chapter 6, section 6.2 for more information on proper network settings.

Chapter 2. Understanding RAID

The RAIDBank4 controller subsystem is a high-performance SATA2 drive bus disk array controller. When properly configured, the RAIDBank4 can provide non-stop service with a high degree of fault tolerance through the use of RAID technology and advanced array management features.

The RAIDBank4 can be configured to RAID levels 0, 1, 10, 3, and 5, as well as disk spans and direct mapping. RAID levels other than 0 are able to tolerate a hard disk failure without impact on the existing data, and failed drive data can be reconstructed from the remaining data and parity drives. RAID configuration and monitoring is accessible through the LCD front control panel or the built in web administration interface. The RAIDBank4 features the following high availability functions:

• RAID Levels 0,1,10,3,5, disk spans, and direct mapping Support
• Up to 4 discrete LUN support
• Online Capacity Expansion
• Online RAID Level Migration
• Logical Drive Capacity Extension
• Array Roaming
• Automatic Drive Failure Detection
• Automatic Failed Drive Rebuilding
• Hot Spare Disk Drives
• Instant Availability/Background Initialization.

> **FYI:**
> The Berkeley RAID levels are a family of disk array data protection and mapping techniques described by Garth Gibson, Randy Katz, and David Patterson in papers written while they were performing research into I/O subsystems at the University of California at Berkeley. There are six Berkeley RAID Levels, usually referred to by the names RAID Level 1, etc., through RAID Level 6.

This section will help you gain understanding of how these functions can serve your needs best.
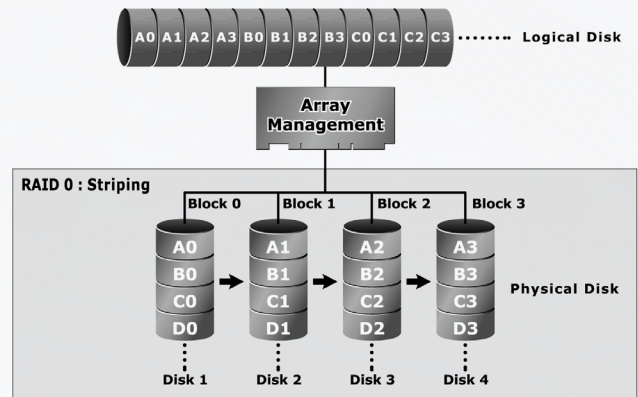
RAID

RAID is an acronym for Redundant Array of Independent Disks. It is an array of multiple independent hard disk drives that provide high performance and fault tolerance through support of several levels of the Berkeley RAID techniques. An appropriate RAID level is selected when the volume sets are defined or created, and is based on disk capacity, data availability (fault tolerance or redundancy), and disk performance considerations. The RAIDBank4 controller makes the RAID implementation and the disks' physical configuration transparent to the host operating system, which means that the host operating system drivers and software utilities are not affected regardless of the RAID level selected.

RAID 0 (Striping)

This RAID algorithm writes data across multiple disk drives instead of just one disk drive. RAID 0 does not provide any data redundancy, but does offer the best high-speed data throughput. RAID 0 breaks up data into smaller blocks and then writes a block to each drive in the array.

Pros: Disk striping enhances both read and write performance because multiple drives are accessed simultaneously,

Cons: The reliability of RAID Level 0 is less than any of its member disk drives due to its lack of redundancy.
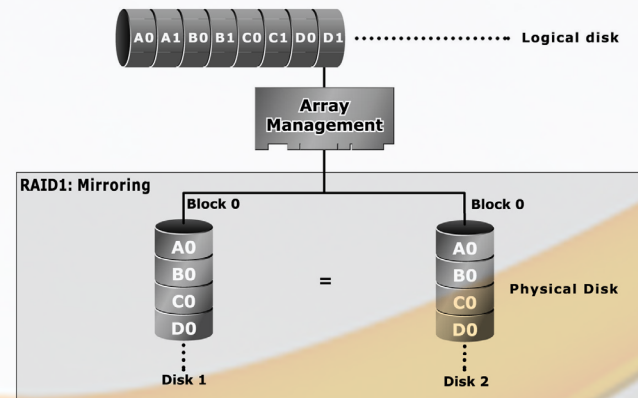
RAID 1 (Disk Mirroring)

RAID 1, also known as "disk mirroring", distributes duplicate data simultaneously to 2 disk drives.

Pros: RAID 1 offers extremely high data reliability as all the data is redundant. If one drive fails, all data (and software applications) are preserved on the other drive. Read performance may be enhanced as the array controller can access both members of a mirrored pair in parallel.

Cons: RAID 1 volume requires double the raw data storage capacity. During writes, there will be a minor performance penalty when compared to writing to a single disk.

RAID 10 (Striped Mirror)

RAID 10 is a combination of RAID 0 and RAID 1, combing striping with disk mirroring. RAID Level 10 combines the fast performance of Level 0 with the data redundancy of Leve1 1. In this configuration, data is distributed across several disk drives, similar to Level 0, which are then duplicated to another set of drive for data protection. RAID 10 provides the highest read/write performance of any of the Hybrid RAID levels, but at the cost of doubling the required data storage capacity.

Pros: Fastest read/write performance of any of the Hybrid RAID levels High data reliability as all the data is redundant.

Cons: Requires double the raw data storage capacity
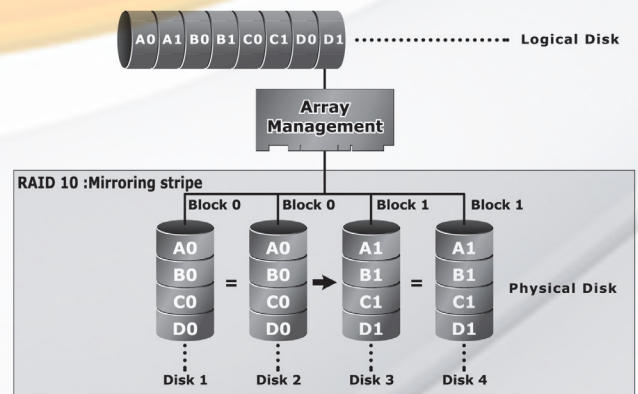
RAID 3

RAID 3 provides disk striping and complete data fault tolerance though a dedicated parity drive. RAID 3 breaks up data into smaller blocks, calculates parity on the blocks, and then writes the blocks to all but one drive in the array. The parity data created is then written to the last drive in the array. If a single drive fails, data is still available by computing the inverse operation on the data and parity of the contents corresponding strips of the surviving member disk. RAID 3 is best for applications that require very fast large block data transfer rates or long data blocks

Pros: Very good large file transfer performance. Fault tolerant.
Cons: Not well suited for transaction processing or other I/O request-intensive applications.
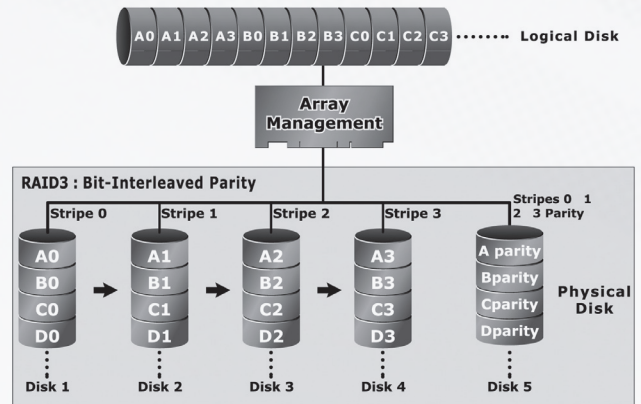
RAID 5

RAID 5 is sometimes called striping with parity at byte level. In RAID 5, the parity information is written to all of the drives in the subsystems rather than concentrated on a dedicated parity disk. If one drive in the system fails, the parity information can be used to reconstruct the data from that drive. All drives in the array system can be used to seek operation at the same time, greatly increasing the performance of the RAID system. RAID 5 is the most often implemented RAID algorithm in RAID arrays.

Pros: Very good general transfer performance.
        Fault tolerant.
Cons: Can be slower then RAID 3 at large size file transfers
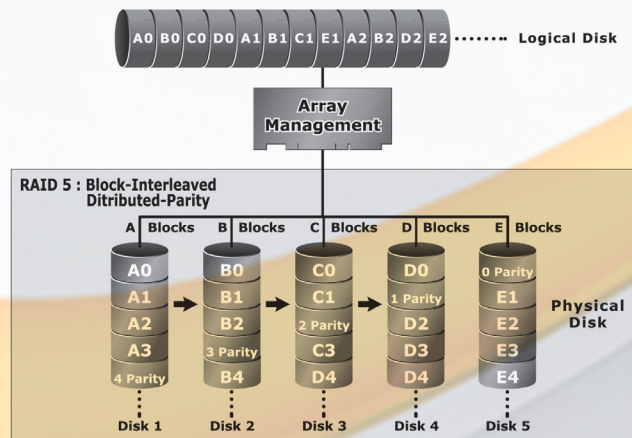
RAID Set

A RAID Set is a group of disks containing one or more volume sets. The MicroNet RAIDBank4 supports as follows:
  • Up to three RAID Sets are supported. Please note that multiple RAID Sets on the same disks are not supported.
  • From one to five drives can be included in an individual RAID Set.
  • A Volume Set must be created either on an existing RAID set or on a group of available individual disks (disks that are not yet a part of a RAID set). If there are pre-existing RAID sets with available capacity and enough disks for specified RAID level desired, then the volume set will be created in the existing RAID set of the user's choice.

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Volume Set

A Volume Set is seen by the host system as a single logical device. It is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a Volume Set. A Volume Set capacity can consume all or a portion of the disk capacity available in a RAID Set. Multiple Volume Sets can exist on a group of disks in a RAID Set. Additional Volume Sets created in a specified RAID Set will reside on all the physical disks in the RAID Set. Thus each Volume Set on the RAID Set will have its data spread evenly across all the disks in the RAID Set.
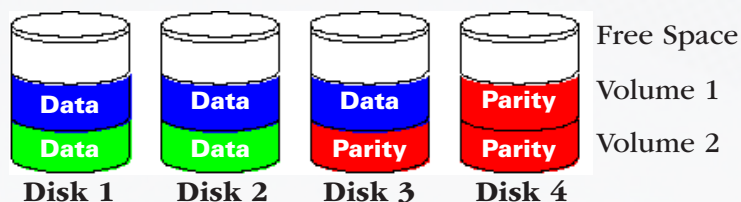
A 4 Disk RAIDset may contain two volumes. Volume 1 can be assigned a RAID 5 level of operation while Volume 2 might be assigned a RAID 0+1 level of operation.

- Volume Sets of different RAID levels may coexist on the same RAID Set.
- The maximum addressable size of a single volume set is 2 Terabytes.
- Up to eight volume sets can be created in a RAID set

Online Capacity Expansion

Online Capacity Expansion makes it possible to add one or more physical drives to a volume set, while the server is in operation, eliminating the need to store and restore after re-configuring the RAID set. When disks are added to a RAID set, unused capacity is added to the end of the RAID set. Data on the existing volume sets residing on that RAID set is redistributed evenly across all the disks. A contiguous block of unused capacity is made available on the RAID set. The unused capacity can create additional volume set. The expansion process is illustrated as following figure:

Before Expansion: Disk Array A, 600GB | After Disk Expansion: Disk Array A, 800GB
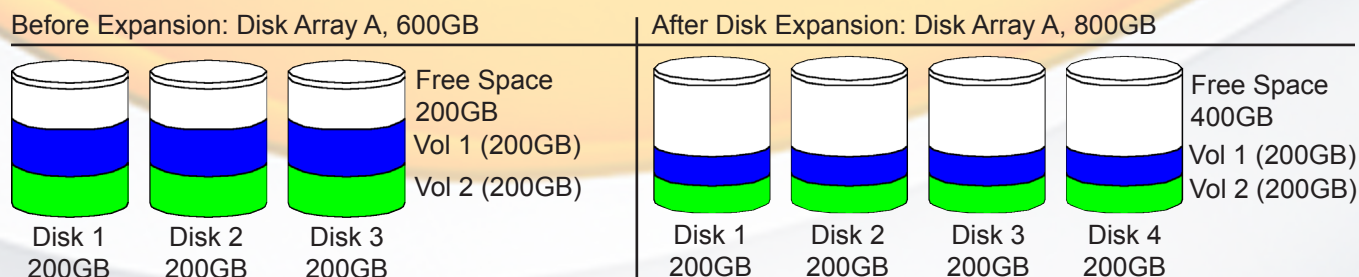
The RAIDBank4 controller redistributes the original volume set over the original and newly added disks, using the same fault-tolerance configuration. The unused capacity on the expanded RAID set can then be used to create additional volume sets, with a different fault tolerance setting if required.

Array Roaming

The RAIDbank4 stores configuration information both in NVRAM and on the disk drives, and can protect the configuration settings in the case of a disk drive or controller failure. Array roaming allows the administrator the ability to move a complete RAID set to another system without losing RAID configuration and data on that RAID set. Should the RAIDBank4 enclosure cease to function, the RAID set disk drives can be moved to another RAIDBank4, inserted in any order, and become instantly available.

Hot Swappable Disk support

Your RAIDBank4 has a built in protection circuit to support replacement of disk drives without having to shut down or reboot the RAID. In case of drive failure, the failed drive can be removed from the RAIDBank4 and replaced with a new drive without disrupting dataflow to the host computer.

Instant Availability/Background Initialization

RAID 0 and RAID 1 volume set can be used immediately after the creation, whereas RAID 3 and 5 volume sets must be initialized to generate parity information. RAIDBank4 features both foreground and background initialization modes for RAID 3 and RAID 5 volumes- In background mode, the initialization proceeds as a background task and the volume set is fully accessible for system reads and writes without requiring a reboot and waiting for the initialization completion. Furthermore, the RAID volume set is also protected against a single disk failure while initialing. Background initialization takes longer to complete and host disk access will be slower during the initialization process. Foreground Initialization must be completed before the volume set is ready for system accesses, but the RAID Initialization completes faster.

Online RAID Level and Stripe Size Migration

Users can migrate both the RAID level and stripe size of an existing volume set, while the RAIDBank4 is online and the volume set is in use. Online RAID level/stripe size migration can prove helpful during performance tuning activities as well as at the addition of physical disks to the RAIDBank4. For example, in a system using two drives in RAID level 1, you could add capacity and retain fault tolerance by adding one drive. With the addition of third disk, you have the option of adding this disk to your existing RAID logical drive by migrating from RAID level 1 to 5. The result would be parity fault tolerance and double the available capacity without taking the system offline.

Hot Spare Drives

A hot spare drive is an unused online available drive predesignated for replacing a failed disk drive. Any unused online available drive installed but not belonging to a RAID set can be defined as a hot spare drive. Hot spares permit you to replace failed drives automatically without powering down your RAIDBank4. When your RAIDBank4 detects a drive failure in a RAID 1,10,3 or 5 volume sets the system will automatically and transparently rebuild using any available hot spare drive(s). The volume set(s) will be reconfigured and rebuilt in background, while the RAIDBank4 continues to handle system requests. During the automatic rebuild process, system activity will continue as normal, but system performance will be reduced and the affected volume(s) will not be fault tolerant until the rebuild process is complete.

Hot-Swap Disk Rebuild

A Hot-Swap function can be used to rebuild disk drives in arrays with data redundancy such as RAID level 1, 10, 3, and 5. If a hot spare is not available at time of drive failure, the failed disk drive must be replaced with a new disk drive so that the data on the failed drive can be rebuilt. Upon insertion of a replacement disk, the RAIDBank4 automatically and transparently rebuilds failed drives in the background with user-definable rebuild rates. The RAIDBank4 will automatically restart the system and the rebuild if the system is shut down or powered off abnormally during a reconstruction procedure condition. Please note that the affected volume(s) will not be fault tolerant until the rebuild process is complete.

Chapter 3. RAID Controls- LCD Interface

This Chapter describes the menu and control structure for your RAIDBank4 using the front panel, serial port, or via Telnet. The RAIDBank4 configuration utility is firmware-based and its operation is independent of host computer type or operating system.
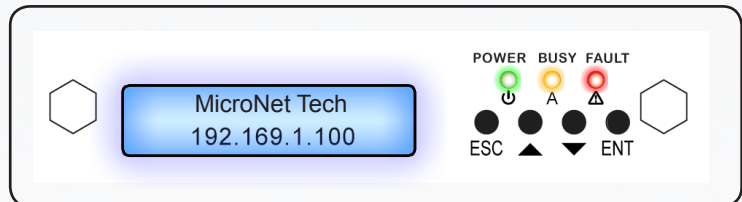
Conventions

In this chapter, menu navigation is described as follows:
UP/DOWN scrolling through options
ENT making selections
ESC Cancelling current menu choice

Login Procedure

By Default, The RAIDBank4 ships without a password defined (user changeable to protect the internal RAIDBank4 from unauthorized entry). The controller will check the password only when entering the main menu from the initial screen The RAIDBank4 will automatically go back to the initial screen when it does not receive any command in twenty seconds.

The Main Menu Configuration Tree

1. Quick Volume/RAID Setup	
2. RAID Set Function	2.1 Create RAID Set
	2.2 Delete RAID Set
	2.3 Expand RAID Set
	2.4 Offline RAID Set
	2.5 Activate RAID Set
	2.6 Create Hot Spare
	2.7 Delete Hot Spare
	2.8 RAID Set Information
3. Volume Set Function	3.1 Create Volume Set
	3.2 Delete Volume Set
	3.3 Modify Volume Set
	3.4 Check Volume Set Consistency
	3.5 Stop Volume Set Consistency
	3.6 Display Volume Info
4. Physical Drives	4.1 Display Drive Information
	4.2 Create Pass-Through Disk
	4.3 Modify Pass-Through Disk
	4.4 Delete Pass-Through Disk
	4.5 Identify Selected Drive
5. RAID System Controls	5.1 Mute The Alert Beeper
	5.2 Alert Beep Setting
	5.3 Change Password
	5.4 JBOD/RAID Operation
	5.5 RAID Rebuild Priority

> **! CONSIDERATIONS FOR RAID VOLUME CREATION**
> Your RAIDBank4 is capable of creating large logical volumes (LUNS) in excess of 2 Terabytes. Large LUNS (>2TB) must be supported by the host bus adapter and the host Operating System to be usable. Windows 2003, Vista, Windows 2008, Mac OS X >10.4.8, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB, and must use eSATA host bus adapters that have RAID support to be usable. MicroNet offers such host bus adapters- consult your MicroNet authorized reseller for more information.

1. Quick Volume/RAID Setup

Quick Volume And RAID Setup is the fastest way to prepare a RAID and volume set, and needs few keystrokes to complete. This function creates a single RAIDset and one volume set, and you can modify the RAID level, stripe size, capacity, and designating drives as Hot Spares. The created RAIDset will have the following properties (default setting values can be changed after configuration is completed):

Parameter	Setting
Volume Name	Volume Set#00
Host Channel/ Drive Select	SATA/0
Cache Mode	Write Back
SATA Xfer Mode	SATA300+NCQ

1.1 Specify desired RAID level and spare configuration
1.2 Select volume set capacity size. When choosing >2TB support, make sure the host operating system can support the volume (see "Consideration for RAID volume creation" above)
1.3 Select stripe sizes for the current volume set. This parameter specifies the size of the stripes written to each disk in a RAID 0, 1, 10, or 5 volume set. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size provides better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random read requests more often, choose a small stripe size.
1.4 Specify foreground or background initialization. Background initialization will make the volume immediately available to host access, but initialization will complete slower. Foreground Initialization must be completed before the volume set ready for system accesses, but will complete quicker.

2. RAID Set Functions

Select the RAID Set Function to manually configure the RAID set for the first time or delete/ reconfigure existing RAID sets. The RAID Set function allows more complete control over the RAID creation process, but requires more interaction then the Quick Volume/RAID Setup option. To enter a RAID Set Functions, press *ENT* to enter the Main menu. Scroll to select the *"RAID Set Functions"* option and press *ENT* to enter further submenus. All the RAID set submenus will be displayed.

2.1 Create A New RAID Set

Choose "RAID Set Function" from the main menu. Select the "Create RAID Set" and press *ENT.* Select the drives to be used in the RAIDSet. Press *UP/DOWN* buttons to select specific physical drives, and press the *ENT* key to associate the selected physical drive with the current RAID set. When all required drives are added press *ENT* to commit. The RAIDSet is now ready for volume creation (See *Section 3.1 "Create a Volume Set"*)

> **Note:**
>   The numbers of physical drives in a specific RAID set determine the RAID levels that can be implemented with the RAID set.
> RAID 0 requires 1 or more physical drives per RAID set.
> RAID 1 requires at least 2 physical drives per RAID set.
> RAID 1 + Spare requires at least 3 physical drives per RAID set.
> RAID 3/5 requires at least 3 physical drives per RAID set.
> RAID 3/5 + Spare requires at least 4 physical drives per RAID set.

2.2 Delete Existing RAID Set

Once this option is selected, scroll to select the RAID set number to delete and press *ENT*. A Confirmation screen appears, and press *ENT* to delete the existing RAID set. A second confirmation screen will appear, and choose "Yes" to complete the deletion.

2.3 Expand Existing RAID Set

The Expand existing RAID Set function allows the user to add disk drives to the RAID set that already exists. To expand an existing RAID set, scroll to choose the *"Expand Existing RAID Set"* option. Scroll to select the RAID set number to be expanded and then press *ENT*. If there is an available disk, then the Select Drive Channel x appears. Scroll to select the target disk and then press *ENT* to select it. Press *ENT* to start the expansion process. The new added capacity will be available for new volume sets. To define one or more volume sets, follow the instruction presented in the Volume Set Function to create the volume sets. When RAID migration is in progress, migration status is displayed in the RAID and volume status areas of the RAID Set information.

> **Note:**
> If a disk drive fails during RAID set expansion and a hot spare is available, an auto rebuild operation will occur after the RAID set expansion completes.

> ⚠ **IMPORTANT:** Once the RAID Set expansion process has started it cannot be stopped. The process must complete before any other RAID functions will be available.

2.4 Offline RAID set

You can selectively offline RAID Sets to limit access or for diagnostics. Select the RAIDset to bring offline and press *ENT*. Following confirmations, all Hdds of the selected RAIDset will be put into offline state, spun down and fault LED will be in fast blinking mode.

2.5 Activate RAID set

Following a drive failure, the affected Parity or mirrored RAIDset will operate in degraded mode, and will continue to function until the unit is reset. Following a reset, in order for a degraded RAIDset to be available to the host it must be activated. Select *"Activate RAID Set"* option. Scroll to select the RAID set number to be activated and then press *ENT*.

> ⚠ **ACTIVATING AN INCOMPLETE RAIDSET**
> When one of the disk drives is removed and the RAID rebooted, the RAID set state will change to Incomplete and will not be available at first boot. To force the RAIDset to be available, use the Activate RAIDSet (2.5) option. The RAIDset will become available in degraded state.

2.6 Create Hot Spare Disk

Hot spare disks are disks predesignated to be available for parity or mirrored volumes to rebuild volume data upon a RAID member disk failure. To designate a disk as a hot spare, select the "Create Hot Spare", select the disk and press *ENT* to set.

2.7 Delete Hot Spare Disk

To delete hot spare, choose the *"Delete Hot Spare Disk"* option. Select the hot spare to delete and then press *ENT* to select it. The confirmation screen appears, and press *ENT* to delete the hot spare.

2.8 Display RAID Set Information

Scroll to the Display RAID Set Information option and press *ENT*. Select the RAID set desired, and the RAID set information will be displayed. Scroll through the available options to see RAID Set Name, Total Capacity, Free Capacity, Number of Member Disks, Min. Member Disk Capacity and RAIDSet State.

3. Volume Set Function

A volume set is seen by the host system as a single logical device, and is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a Volume Set. The RAIDBank4 supports up to 4 simultaneous volume sets in varying RAID level configurations. Creating volume sets require that a RAIDset is already defined- to create a RAIDset please see *section 2.1 "Create RAIDset"* of this chapter. A Volume Set capacity can consume all or a portion of the disk capacity available in a RAID Set, and multiple Volume Sets can exist on a group of disks in a RAID Set. All Volume Sets created in a specified RAID Set will reside on all the physical disks in the RAID Set, and the data spread evenly across all the disks in the RAID Set. To enter a Volume Set Function, press *ENT* to enter the main menu. Scroll to select the Volume Set Functions option and then press *ENT* to enter further submenus.

3.1 Create RAID Volume Set

3.1.1 To create a new volume set, choose "Volume Set Functions" from the Main menu. Select the "Create Volume Set" and press *ENT*.

3.1.2 select the desired RAIDset from the screen and Press *ENT*. The volume set attributes screen will appear.

3.1.3 Select wether large LUN support is to be used. Large LUNS (>2TB) must be supported by the

host bus adapter and the host Operating System to be usable. Windows 2003, Vista, Windows 2008, Mac OS X >10.4.8, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB, and must use eSATA host bus adapters that have RAID support to be usable. MicroNet offers such host bus adapters- consult your MicroNet authorized reseller for more information.

3.1.4 The volume set attributes screen shows the volume set default configuration value that is currently being configured. The volume set attributes are:

Volume Name	Default name is RAIDbank-VOL#nn. You can rename the volume set name providing it does not exceed 15 characters.
RAID Level	RAID level 0,1, 0+1 (10), 3 and 5.
Stripe Size	This parameter sets the size of the segment written to each disk in a RAID 0, 1, 3, or 5 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces better-read performance for mostly sequential reads. For better random reads performance, select a smaller stripe size.
Write Cache Mode	RAIDBank4 supports Write-Through and Write-Back Caching algo-rithms. In the Write-Back caching method, modifications to data in the cache aren't copied to the cache source until absolutely neces-sary, whereas Write-Through cache data is written to the storage and the cache memory simultaneously. Write-back caching yields better performance than write-through caching because it reduces the num-ber of write operations to disk, but is also more prone to data loss due to service interruptions.
HOST Channel (SATA/USB)	RAIDBank4 supports two host channels. Host Channel 0 is the host eSATA interface, and Channel 1 is the USB 2.0 host interface.
Drive Number (LUN 0-4)	RAIDBank4 supports 4 logical units. Any Volume Set may be mapped to eSATA and/or USB host channels independently.
Host SATA Transfer Mode.	SATA150, SATA150+NCQ, SATA300, SATA300+NCQ (default.)

SIMULTANEOUS HOST CHANNEL VOLUME MAPPING
The RAIDBank4 can map a Volumeset to both host channels simultaneously for clustering environment. Never attempt to mount the same volume on both channels without proper clustering software.

Mounting the same volume on both channels without proper software can result in data corruption or loss!

Press the **UP/DOWN** buttons to select the attributes. Press the **ENT** to modify each attribute of the default value. Using **UP/DOWN** buttons to select attribute value or press **ENT** to accept the default value. To complete the attribute definition, press **ESC**

3.1.5 Enter the appropriate volume size to fit your application. Each volume set must have a selected capacity which is less than or equal to the total capacity of the RAID set on which it resides.

3.1.6 Press **ENT** to select foreground initialization or **ESC** to select background initialization. Background initialization allows immediate access to the new volume but at an increase volume creation time. Foreground initialization does not allow access to the host until completion but at a faster completion rate.

3.2 Delete Volume Set

Scroll to choose the Delete Existing Volume Set option. Select the RAID set number and volume set to delete and press **ENT**. At the subsequent confirmation screen, press **ENT** to confirm deletion.

3.3 Modify Volume Set

Use this option to modify an existing volume set attributes as described in the above section. To modify volume set attributes scroll to choose the *"Modify Volume Set Attribute option"* from the *"RAID set system"* function. Select the RAID set number to modify and press **ENT**. Select the volume set number that user want to modify and press **ENT**. The volume set attributes screen shows the volume set setting configuration attributes that was currently being configured. Select attribute to change and Press the **ENT** to modify the default value. Select attribute value and press the **ENT** to accept the selection value. Choose this option to display the properties of the selected Volume Set; you can modify all values except the capacity.

> **Note:**
> When a volume set is migrating from one RAID level to another, a volume set stripe size changes, or when a disk is added to a RAID set the volume state will change to migrating. During migration. The migration status will be displayed in the volume state area of the LCD display. No additional volume changes can be performed until migration completes.

3.4 Check Volume Set Consistency

To check volume set consistency from volume set system function, scroll to choose the *"Check Volume Set Consistency"* option. Select the RAID set number to check and press **ENT**. Select the volume set number to check and press **ENT**. At the subsequent confirmation screen, press **ENT** to start the volume set consistency check.

3.5 Stop Volume Set Consistency Check

To stop volume set consistency check from volume set system function, scroll to choose the *"Stop Volume Set Consistency Check"* and then press **ENT**.

3.6 Display Volume Set Information

To display volume set information, scroll to choose the *"Display Volume Information"* option and then press **ENT**. Select the RAID set number that user wants to show and press **ENT**. Select the volume set number to display and press **ENT**. The volume set attributes screen shows the volume set setting configuration value that was currently being configured. See this chapter, section 3.1-*"Create RAID Volume Set"* for the various RAID attribute descriptions.

4. Physical Drive Functions

Choose this option from the Main Menu to select a physical disk and to perform the operations listed below. To enter a Physical Drive Functions, press **ENT** to enter the main menu. Scroll to select the Physical Drive Functions option and then press **ENT** to enter further submenus. All physical drive submenus will be displayed.

4.1 Display Drive Information

Select the View Drive Information option and press **ENT**. Select the drive to display. The drive information screen shows the Model Name, Serial Number, Firmware Rev., Device Capacity, Current SATA Transfer mode, Supported SATA Transfer mode, and Device State.

4.2 Create a Pass-Through Disk

A Pass-through disk can be defined to dedicate a single disk as not controlled by the RAIDBank4 firmware and thus cannot be a part of a RAID set. Instead, the disk is available to the operating system as an individual disk. To create a Pass-Through disk, select the Create Pass-Through Disk option and press **ENT**. Select the drive number to create, and the drive attributes will be displayed. Select attribute to modify and then press **ENT**. Select attribute value and press the **ENT** to accept the selection value.

4.3 Modify Pass-Through Disk

To modify Pass-Through Disk attributes, scroll to choose the *"Modify Pass-Through Drive"* option, and then press **ENT**. The Select Drive Function menu will show all Pass-Through Drive number items. Select the Pass-Through Disk to modify and press **ENT**. The attributes screen shows the Pass-Through Disk setting value currently configured. Select the desired attribute to modify and Press **ENT** to modify the default value. Select attribute value and press **ENT** to accept the selection. After completing the modification, press **ESC** to enter the confirmation screen and then press **ENT** to accept.

4.4 Delete Pass-Through Disk

To delete pass-through drive from the pass-through drive pool, scroll to choose the *"Delete Pass-Through Drive option"*, and then press **ENT**. The Select Drive Function menu will show all Pass-Through Drive number items. Select the Pass-Through Disk to delete and press **ENT**. The Delete Pass-Through confirmation screen will appear. Press **ENT** to confirm deletion.

4.5 Identify Selected Drive

This function is designed to prevent removing the wrong drive by illuminating the selected disk HDD LED Indicator. To identify the selected drive from the physical drive pool, scroll to choose the *"Identify Selected Drive"* option and press **ENT**. Select the Disk to identify and press **ENT**. The selected disk HDD LED indicator will flash.

5. RAID System Functions

To control the RAID System, Select the *"RAID System Function"* option and then press **ENT** to enter further submenus. Scroll to select the submenus and then press **ENT** to enter the specified function.

5.1 Mute The Alert Beeper
Select the *"Mute The Alert Beeper"* function to mute the RAIDBank4 alert buzzer. Press **ENT** in the dialog box to turn the beeper off temporarily. The buzzer will still activate on any subsequent fault.

5.2 Alert Beeper Setting
The Alert Beeper setting function item is used to enable or disable the RAIDBank4 controller alarm tone generator. Scroll to the *"Alert Beeper Setting"* selection and press **ENT.** Press **ENT** at the confirmation screen to accept the function.

5.3 Change Password
The RAIDBank4's administrative functions can be protected with a password. To set or change the RAIDBank4 password, scroll to the *"Change Password"* selection and press **ENT.** The New Password: screen appears, and a new password may be entered. If the LCD front panel is used, use the **UP/DOWN** keys to select the letters and **ENT** to move to the next letter; When done, Press **ENT** repeatedly until the confirmation screen will be displayed. To disable the password, press **ENT** repeatedly in the password field and **ENT** in the confirmation screen. The existing password will be cleared.

5.4 JBOD/RAID Configuration
The RAIDBank4 controller can be used in JBOD (Just a Bunch Of Drives) mode, which allows each drive to be presented separately to the host. To use this mode, make sure to erase any existing RAID sets.

5.5 RAID Rebuild Priority
The RAID Rebuild Priority is a relative indication of how much processor time the controller devotes to a rebuild operation. The RAIDBank4 allows user to choose the rebuild priority (low, normal, high) to balance volume set access and rebuild tasks appropriately.
To set or change the RAIDBank4 RAID Rebuild Priority, Select *"RAID Rebuild Priority"* option and press **ENT**. Set the rebuild value at the rebuild priority selection screen that appears, and press **ENT** at the confirmation screen.

5.6 Maximum SATA Mode
The RAIDBank4 uses 4 discrete SATA busses for its disk channels. These drive channels can support up to SATA300 and NCQ (Native Command Queuing,) A SATA function controlling dynamic rearranging of data fetching commands for maximum performance. Please do not change this setting unless instructed by MicroNet's technical support.

5.7 Host Channel NCQ Setting
The RAIDBank4 supports Native Command Queuing (NCQ) over the eSATA host connection. The NCQ algorithms allow I/O operations to be performed out of order to optimize performance. Since different host bus adapters have some compatibility differences in NCQ implementation, The default setting on this option is Disable for better compatibility. To enable NCQ, choose the option that matches your eSATA host bus adapter:
- ESB2/MACPro/Siliconlimage: Intel ESB2, MACPro, MicroNet, and Silicon Image based adapters
- ICH: Intel ICH series based adapters
- Marvell6145: Marvell 6145 based adapters
- nVidia: Nvidia nForce based adapters

5.8 HDD Read Ahead Cache
Enabled by default. Please do not change this setting unless instructed by MicroNet's Technical Support.

5.9 Staggered HDD Spinup control
The RAIDBank4 employs a staggered disk mechanism startup sequence to minimize power supply strain. Please do not change this setting unless instructed by MicroNet's Technical Support.

5.10 HDD Idle Spindown Control
The RAIDBank4 can automatically spin down disks that haven't been accessed for a certain amount of time to reduce power consumption. This value is used to determine idle time before spinning down the disk(s).

5.11 Empty tray LED Control
(ON or OFF) If this option is selected, the disk error LED will light on a slot without a disk.

5.12 HDD SMART Status Polling
The RAIDBank4 reads and reports the SMART (Self-Monitoring, Analysis, and Reporting Technology) status of each disk drive mechanism. This option is enabled by default, and should not be disabled unless instructed by MicroNet's Technical Support.

5.13 Disk Capacity Truncation Mode
Disk Truncation is used to decrease disk usable space for compatibility purposes. Please do not change this setting unless instructed by MicroNet's Technical Support.

5.14 Serial Port Configuration
The RAIDBank4 has provisions for an RS232 host management connection. In order to use the RS232, a special cable has to be used (not included)- consult your authorized Micronet reseller for more information. To set or change the RAIDBank4 communications port configuration, Scroll to the *"Terminal Port Configuration"* selection and press **ENT**. The communications port configuration defaults are 115200 Baud., 1 Stop bit operation. The baud rate (1200-115200) and stop bits (1,2) are user selectable. Handshaking and parity are fixed at none.

5.15 Reset Controller
To reset the RAIDBank4, select *"Reset Controller"* and then press **ENT**. Press **ENT** at the confirmation screen to reset the controller.

IMPORTANT: Controller Reset can only be performed if no host or drive activity is present.
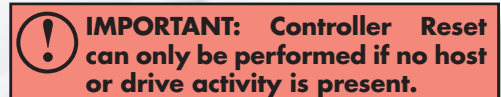
6. Additional System Functions

The following system functions are located in the main menu and control miscellaneous system functions.

6.1 Ethernet Configuration

The RAIDBank4's Ethernet port is preconfigured for DHCP operation. This menu option allows the user to reconfigure IP functionality for static IP address or custom MAC address.

#### 6.1.1 DHCP (enabled by default)

DHCP (Dynamic Host Configuration Protocol) is a protocol that lets network administrators manage centrally and automate the assignment of IP (Internet Protocol) configurations on a computer network. Select this option if you wish to use the DHCP address services in your network. Move the cursor bar to DHCP Function item, then press **ENT** to show the DHCP setting. Select the "Disabled' or 'Enabled" option to enable or disable the DHCP function.

6.1.2 Manual (Static) IP Address

Select this option to manually configure the IP address of the controller. Make sure that the assigned IP address is in the same range of your default router address and that it is unique to your private network. To set a static IP address, move the cursor bar to the Main menu Ethernet Configuration Function item and then press **ENT**. The Ethernet Configuration menu appears on the screen. Move the cursor bar to Local IP Address item, then press **ENT** to show the default address setting in the RAID controller. You can reassign the IP address of the controller (use the **UP/DOWN** keys on the front panel for each digit.)

6.1.3 HTTP Port Number

The HTTP port number is the TCP Port used for the web user interface. The default port is 80, and can be changed per user specification. To access the web UI with a port other then 80, point your browser to http://<IPADDRESS>:<HTTP PORT>

> **Note:**
> The RAIDBank4 cannot use ports 7168-8191 for IP services.
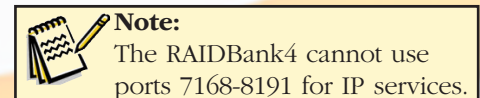
6.1.4 Telnet Port Number

The Default Telnet TCP port is 23, and can be changed per user specification.

6.1.5 SMTP Port Number

The Default Telnet TCP port is 25, and can be changed per user specification.

6.1.6 Ethernet Address

A MAC address stands for Media Access Control address and is your computer's unique hardware number. This option should not normally be modified.

6.2 View System Events

To view the RAIDBank4 events, select the *"Show System Events"* option and press **ENT**. The system events logged will be displayed. System events are logged chronologically, and may be scrolled through.

6.3 Clear all Event Buffers

To clear all events in the system log, scroll to select the *"Clear all Event Buffers"* option and press *ENT*. The confirmation message will be displayed and press the *ENT* to clear all event buffers or *ESC* to abort the action.

6.4 Hardware Information

To view the RAIDBank4 controller's hardware monitor information, Scroll to select the *"Hardware Information"* option and press *ENT*. All hardware information will be displayed. Scroll to browse all the hardware information. The Hardware Monitor Information provides the temperature, fan speed (chassis fan) and voltage of the internal RAIDBank4. The temperature items list the current states of the controller board and backplane.

The Platinum RAID has an audiovisual alert system to inform the user of environmental failure. The warning messages will indicate through the LCD, LED and alarm buzzer. The following is a table of monitoring threshhold values:

Monitored Item	Warning Condition
Controller Board Temperature	> 60° Celsius
Controller Fan Speed	< 1900 RPM
Power Supply +12V	< 10.5V or > 13.5V
Power Supply +5V	< 4.7V or > 5.3V
Power Supply +3.3V	< 3.0V or > 3.6V
CPU Core Voltage +1.2V	< 1.08V or > 1.32V

6.5 System Information

Choose this option to display Main processor, CPU Instruction cache/ and data cache size, firmware version, serial number, controller model name, and the cache memory size. To check the system information, press *ENT* to enter the main menu. Scroll to select the Show System Information option, and then press *ENT*. All major controller system information will be displayed. Scroll to browse all the system information.

Chapter 4. RAID Controls- Web Interface

Introduction

The RAIDBank4 controller firmware includes a complete HTML-based application that allows all configuration and monitoring to be performed across any IP based network, and utilizes standard web browsers for interfacing. This Chapter describes the menu and control structure for your RAIDBank4 using the web interface. The RAIDBank4 configuration utility is firmware based and its operation is independent of host computer type or operating system.

Preparation

To ensure proper communications between the RAIDBank4 and Web browser-based RAID management, Please connect a standard, Cat5 Ethernet cable to the RJ45 network jack on the back of your RAIDBank4 and atach to your existing network. In order to access the web administration utility please note the IP address displayed on the LCD screen. Launch your firmware-embedded TCP/IP & Web Browser-based RAID manager by entering http:// [IP Address] in your web browser. The RAIDBank4 controller default User Name is "admin" and there is no password assigned from the factory. Please refer to section 6.2 for more information regarding security.

Login Procedure

The controller will prompt for user ID and password when initially logging in. The default user ID is "admin" and no password (leave the password field blank). The RAIDBank4 ships without a password defined, but is user changeable to protect the internal RAIDBank4 from unauthorized entry.) Upon login, the unit will display the user interface and system information as illustrated:

> **Note:**
> The Default User ID is
> **admin**
> There is no password by default; leave the password blank when logging in.

> **Note:**
> RAIDBank4's web control applet has been tested for use with Microsoft Internet Explorer >6.x and Netscape 4.7/Gecko based browsers or newer, and Apple Safari. Other browsers may be compatible, please check www.micronet.com/support for the latest information.

The Main Menu Configuration Tree

1. Quick Volume/RAID Setup
2. RAID Set Functions
      2.1 Create RAID Set
      2.2 Delete RAID Set
      2.3 Expand RAID Set
      2.4 Offline RAID Set
      2.5 Activate RAID Set
      2.6 Create Hot Spare
      2.7 Delete Hot Spare
      2.8 Rescure RAID Set
3. Volume Set Functions
      3.1 Create Volume Set
      3.2 Delete Volume Set
      3.3 Modify Volume Set
      3.4 Check Volume Set Consistency
      3.5 Stop Volume Set Consistency
4. Physical Drives
      4.1 Create Pass Through Disk
      4.2 Modify Pass-Through Disk
      4.3 Delete Pass-Through Disk
      4.4 Identify Selected Drive
5. RAID System Controls
      5.1 System Configuration
      5.2 EtherNet Configuration
      5.3 eMail Notification Configuration
      5.4 SNMP Configuration
      5.5 NTP Configuration
      5.6 View Events/Mute buzzer
      5.7 Generate Test Event
      5.8 Clear Event Buffer
      5.9 Change Password
      5.10 Upgrade Firmware
      5.11 Restart Controller
6. System Information
      6.1 RAIDset Hierarchy
      6.2 System Information
      6.3 Hardware Monitor

1. Quick Volume/RAID Setup

> ⚠️ **CONSIDERATIONS FOR RAID VOLUME CREATION**
> Your RAIDBank4 is capable of creating large logical volumes (LUNS) in excess of 2 Terabytes. Large LUNS (>2TB) must be supported by the host bus adapter and the host Operating System to be usable. Windows 2003, Vista, Windows 2008, Mac OS X 10.4.8, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB, and must use eSATA host bus adapters that have RAID support to be usable. MicroNet offers such host bus adapters- consult your MicroNet authorized reseller for more information.

Quick Volume And RAID Setup is the fastest way to prepare a RAID and volume set, and needs few keystrokes to complete. This function creates a single RAIDset and one volume set, and you can modify the RAID level, stripe size, capacity, and designating drives as Hot Spares. The created RAIDset will have the following properties (default setting values can be changed after configuration is completed):

| Parameter	Setting
Volume Name	Volume Set#00
Host Channel/ Drive Select	SATA/0
Cache Mode	Write Back
SATA Xfer Mode	SATA300+NCQ

1.1 Specify desired RAID level and spare configuration

1.2 Select volume set capacity size. When choosing >2TB support, make sure the host operating system can support the volume (see "Consideration for RAID volume creation" above)

1.3 Select stripe sizes for the current volume set. This parameter specifies the size of the stripes written to each disk in a RAID 0, 1, 10, or 5 volume set. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size provides better-read performance, especially if your computer does mostly sequential reads. However, if you are sure that your computer does random read requests more often, choose a small stripe size.

1.4 Specify foreground or background initialization. Background initialization will make the volume immediately available to host access, but initialization will complete slower. Foreground Initialization must be completed before the volume set ready for system accesses, but will complete quicker.

1.5 When all selections have been made, check the "Confirm The Operation" checkbox and click Submit to commit or Reset to revert all options to default.
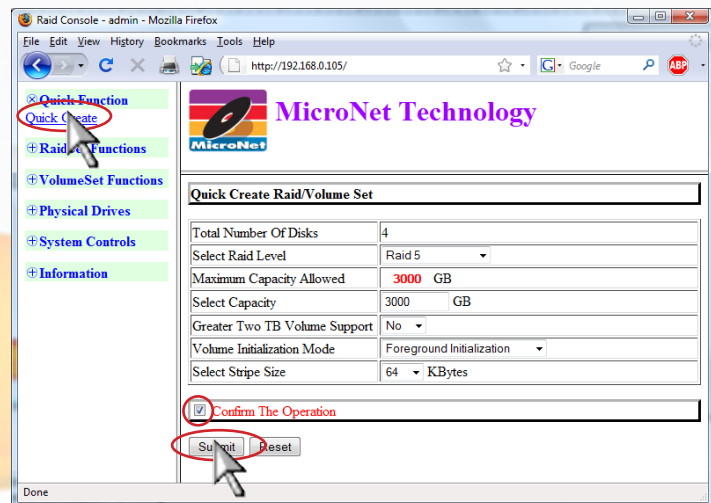
2. RAID Set Functions

Select the RAID Set Function to manually configure the RAID set for the first time or delete/ reconfigure existing RAID sets. The RAID Set functions allows more complete control over the RAID creation process, but requires more interaction then the Quick Volume/RAID Setup option. To enter a RAID Set Functions, Click on the *"RAID Set Functions"* menu, and the RAID set submenus will be displayed.

2.1 Create A New RAID Set

> **Note:**
> The numbers of physical drives in a specific RAID set determine the RAID levels that can be implemented with the RAID set.
> RAID 0 requires 1 or more physical drives per RAID set.
> RAID 1 requires at least 2 physical drives per RAID set.
> RAID 1 + Spare requires at least 3 physical drives per RAID set.
> RAID 3/5 requires at least 3 physical drives per RAID set.
> RAID 3/5 + Spare requires at least 4 physical drives per RAID set.

Choose "RAID Set Function" from the main menu. clink on the "Create RAID Set" menu option. Check the checkbox corresponding to the disks to be used in the RAIDSet. Yoy may also name the resulting RAIDset (optional.) When all selections have been made, check the "Confirm The Operation" checkbox and click [Submit] to commit or [Reset] to revert all options to default. The RAIDSet is now ready for volume creation (See *Section 3.1 "Create a Volume Set"*)
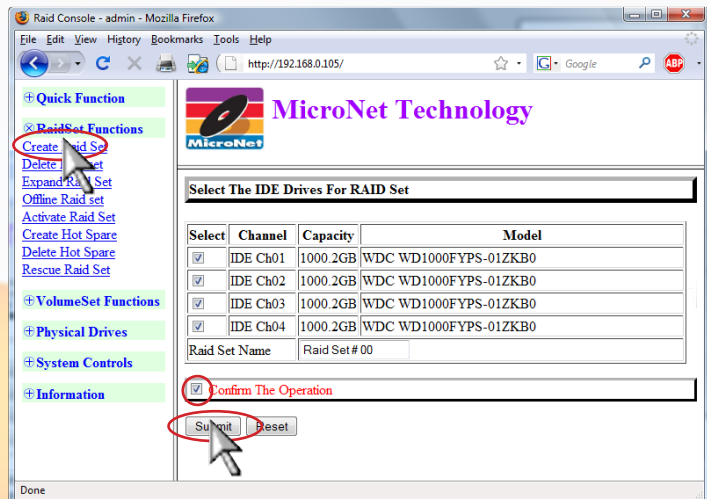
2.2 Delete Existing RAID Set

Once this option is selected, a table will appear with the available RAID set(s).
Check the radio button next to the RAIDset(s) to be deleted, check the "Confirm The Operation" checkbox and click [Submit] to commit or [Reset] to revert all options to default. A Confirmation screen appears prior to the deletion.

2.3 Expand Existing RAID Set

Instead of deleting a RAID set and recreating it with additional disk drives, the Expand existing RAID Set function allows the user to add disk drives to the RAID set that already exists.
When this option is selected, a table will appear with the available RAID set(s). Check the radio button next to the RAIDset(s) to be expanded, and click the [Submit] Button. if spare disks are available, they will be listed. Check the radio button next to the drive(s) to add, check the "Confirm The Operation" checkbox and click [Submit] to commit or [Reset] to revert all options to default. A Confirmation screen appears prior to the expansion. The new added capacity will be available for new volume sets. To define one or more volume sets, follow the instruction

presented in the Volume Set Function to create the volume sets. While RAID migration is in progress, migration status will be displayed in the RAID and volume status areas of the RAID Set information.

> ⚠ **IMPORTANT: Once the RAID Set expansion process has started it cannot be stopped. The process must complete before any other RAID functions will be available.**

2.4 Offline RAID set

You can selectively offline RAID Sets to limit access or for diagnostics. Check the radio button next to the RAIDset(s) to be brought offline, check the "Confirm The Operation" checkbox and click [Submit] to commit or [Reset] to revert all options to default. Following confirmations, all Hdds of the selected RAIDset will be put into offline state, spun down and fault LED will be in fast blinking mode. Offline RAIDSets will be online on the next reboot.

2.5 Activate RAID set

Following a drive failure, the affected RAID set will operate in degraded mode, and will continue to function until the unit is reset. Following a reset, in order for a degraded RAID set to be available to the host it must be activated. Select "Activate RAID Set" option. A table will appear with the available RAID set(s). Check the radio button next to the RAID set to be activated, check the "Confirm The Operation" checkbox and click [Submit] to commit or [Reset] to revert all options to default. A Confirmation screen appears prior to the activation.

> ⚠ **ACTIVATING AN INCOMPLETE RAIDSET**
> **When one of the disk drives is removed and the RAID rebooted, the RAID set state will change to Incomplete and will not be available at first boot. To force the RAIDset to be available, use the Activate RAIDSet (2.5) option. The RAIDset will become available in degraded state.**

2.6 Create Hot Spare Disk

Hot spare disks are disks predesignated to be available for parity or mirrored volumes to rebuild volume data upon a RAID member disk failure. To designate a disk as a hot spare, select "Create Hot Spare", Check the radio button next to the disk from the list of available drives, check the "Confirm The Operation" checkbox and click [Submit] to commit or [Reset] to revert all options to default. A Confirmation screen appears prior to the operation conclusion.

2.7 Delete Hot Spare Disk

To delete hot spare, choose the "Delete Hot Spare Disk" option. Check the radio button next to the disk from the list of hot spare designated devices, check the "Confirm The Operation" checkbox and click [Submit] to commit or [Reset] to revert all options to default. A Confirmation screen appears prior to the operation conclusion.

2.8 Rescue RAID Set

In rare cases, It may be possible to recover a failed RAIDset by using this feature. Please make sure that any failed disk drives have been replaced prior to attempting this procedure. When this choice is selected, a command prompt will appear. The two command choices available are 'RESCUE' and 'SIGNAT'. It is strongly recommended you contact MicroNet support prior to using this function.

2.8.1 If the replaced disk was a member of the RAIDset and is simply out of synchronization, you may attempt signature recovery by typing 'SIGNAT' in the command box, and checking the "Confirm the operation" checkbox. Click [Submit] to commit or [Reset] to revert all options to default. A Confirmation screen appears prior to the operation conclusion.

2.8.2 If the replaced disk is new, you may attempt to force RAID rebuild by typing 'RESCUE' in the command box, and checking the "Confirm the operation" checkbox. Click [Submit] to commit or [Reset] to revert all options to default. A Confirmation screen appears prior to the operation conclusion.

3. Volume Set Function

A volume set is seen by the host system as a single logical device, and is organized in a RAID level with one or more physical disks. RAID level refers to the level of data performance and protection of a Volume Set. The RAIDBank4 supports up to 4 simultaneous volume sets in varying RAID level configurations. Creating volume sets require that a RAIDset is already defined- to create a RAIDset please see *Section 2.1 "Create RAIDset"* of this chapter. A Volume Set capacity can consume all or a portion of the disk capacity available in a RAID Set, and multiple Volume Sets can exist on a group of disks in a RAID Set. All Volume Sets created in a specified RAID Set will reside on all the physical disks in the RAID Set, and the data spread evenly across all the disks in the RAID Set. To access volume set functions, click on the "Volume Set Functions" Option the main menu (illustrated right) and click to select desired menu option.
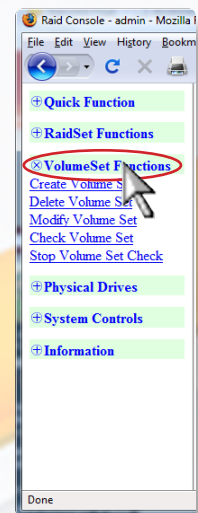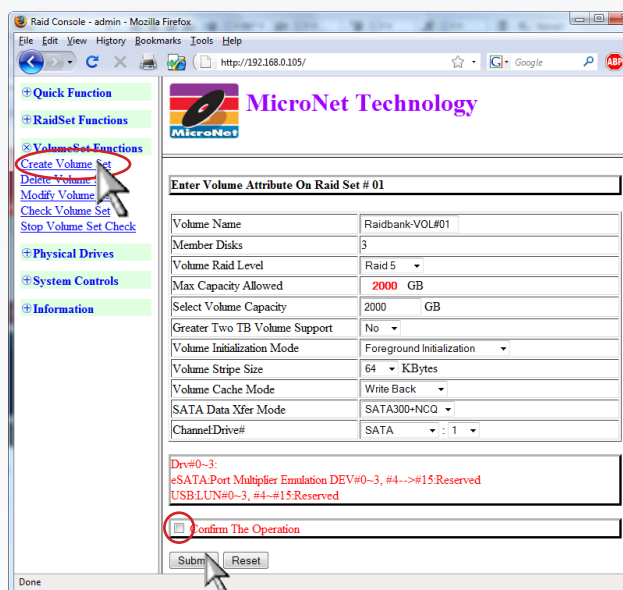

3.1 Create RAID Volume Set

> **⚠ CONSIDERATIONS FOR RAID VOLUME CREATION**
> Your RAIDBank4 is capable of creating large logical volumes (LUNS) in excess of 2 Terabytes. Large LUNS (>2TB) must be supported by the host bus adapter and the host Operating System to be usable. Windows 2003, Vista, Windows 2008, Mac OS X 10.4.8, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB, and must use eSATA host bus adapters that have RAID support to be usable. MicroNet offers such host bus adapters- consult your MicroNet authorized reseller for more information.

3.1.1 To create a new volume set, choose "Volume Set Functions" from the Main menu. Select the "Create Volume Set."

3.1.2 Check the radio button next to the appropriate RAIDset and click Submit to commit or Reset to revert all options to default. The volume set attributes screen will appear.

The volume set attributes screen shows the volume set default configuration value that is currently being configured. The volume set attributes are:

Volume Name	Default name is RAIDbank-VOL#nn. You can rename the volume set name providing it does not exceed 15 characters.
RAID Level	RAID level 0,1, 0+1 (10), 3 and 5.
Volume Capacitty	Capacity in GB up to the maximum allowed by RAIDset capacity and RAID Level
Large LUN support (>2TB)	Large LUNS (>2TB) must be supported by the host bus adapter and the host Operating System to be usable. Windows 2003, Vista, Windows 2008, Mac OS X >10.4.8, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB, and must use eSATA host bus adapters that have RAID support to be usable. MicroNet offers such host bus adapters- consult your MicroNet authorized reseller for more information.
Stripe Size	This parameter sets the size of the segment written to each disk in a RAID 0, 1, 3, or 5 logical drive. You can set the stripe size to 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB. A larger stripe size produces better-read performance for mostly sequential reads. For better random reads performance, select a smaller stripe size.
Volume Cache Mode	RAIDBank4 supports Write-Through and Write-Back Caching algorithms. In the Write-Back caching method, modifications to data in the cache aren't copied to the cache source until absolutely necessary, whereas Write-Through cache data is written to the storage and the cache memory simultaneously. Write-back caching yields better performance than write-through caching because it reduces the number of write operations to disk, but is also more prone to data loss due to service interruptions.

Host eSATA channel Transfer Mode	SATA150, SATA150+NCQ, SATA300, SATA300+NCQ (default.)
HOST Channel (SATA/USB)	RAIDBank4 supports two host channels. Host Channel 0 is the host eSATA interface, and Channel 1 is the USB 2.0 host interface.
Drive Number (LUN 0-4)	RAIDBank4 supports 4 logical units. Any Volume Set may be mapped to eSATA and/or USB host channels independently.

> ⚠ **SIMULTANEOUS HOST CHANNEL VOLUME MAPPING**
> **The RAIDBank4 can map a Volumeset to both host channels simultaneously for clustering environment. Never attempt to mount the same volume on both channels without proper clustering software.**
>
> **Mounting the same volume on both channels without proper software can result in data corruption or loss!**

When all options are set, check the "Confirm The Operation" checkbox and click Submit to commit or Reset to revert all options to default. A Confirmation screen appears prior to the operation conclusion.

3.2 Delete Volume Set
To delete a Volume Set, choose the "Delete Volume Set" option. A table will appear with the available Volume Sets. Check the radio button next to the Volume Set to be deleted, and check the box labelled "Confirm the operation." Click the Submit Button.

3.3 Modify Volume Set
To modify a Volume Set, choose the "modify Volume Set" option. A table will appear with the available Volume Sets. Check the radio button next to the Volume Set to be modifed, and click the Submit Button. A table will appear with the modifiable attributes (refer to section 3.1 in this chapter for attribute descriptions.) You can modify all values except the capacity.

> 📝 **Note:**
> When a volume set is migrating from one RAID level to another, a volume set stripe size changes, or when a disk is added to a RAID set the volume state will change to migrating. During migration. The migration status will be displayed in the volume state area of the LCD display. No additional volume changes can be performed until migration completes.

3.4 Check Volume Set Consistency
To check the internal integrity of a Volume Set, choose the "Check Volume Set" option. A table will appear with the available Volume Sets. Check the radio button next to the Volume Set to be checked, and check the box labelled "Confirm the operation." Click the Submit Button.

3.5 Stop Volume Set Consistency Check
To stop a consistency check already in progress, choose the "Stop Volume Set Check" option. A table will appear with the available Volume Sets. check the radio button next to the Volume Set to be aborted, and check the box labelled "Confirm the operation." Click the Submit Button.

4. Physical Drive Functions

4.1 Create a Pass-Through Disk

A Pass-through disk can be defined to dedicate a single disk as not controlled by the RAIDBank4 firmware and thus cannot be a part of a RAID set. Instead, the disk is available to the operating system as an individual disk. To create a Pass-Through disk, select the "Create Pass-Through" Disk option. A table will appear with available disks that are not already mapped to a RAIDset, hot spare, or existing passthroughs. Check the radio button next to the desired disk, and enter the values for the volume cache mode, host eSATA transfer rate, host channel and LUN number (for more information on these attributes please see *section 3.1- Create Volume Set* in this chapter.) When all fields are finalized, check the box labelled "Confirm the operation" and Click click Submit to commit or Reset to revert all options to default.
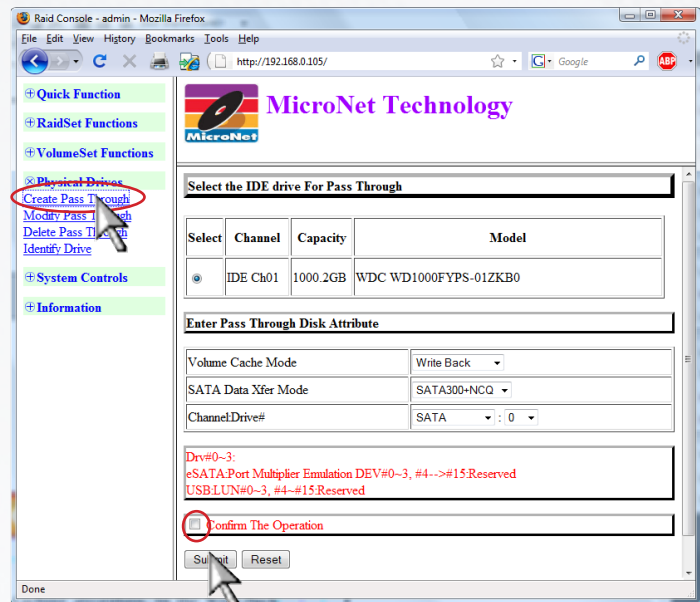
> ⚠ **SIMULTANEOUS HOST CHANNEL VOLUME MAPPING**
> The RAIDBank4 can map a Volumeset to both host channels simultaneously for clustering environment. Never attempt to mount the same volume on both channels without proper clustering software.
>
> **Mounting the same volume on both channels without proper software can result in data corruption or loss!**

4.2 Modify Pass Through Disk

To modify the attributes of a pass through disk, choose the "modify Pass Through" option. A table will appear with the available pass through disks. Check the radio button next to the disk to be modified, and modify the desired attributes in the below table (refer to section *section 3.1- Create Volume Set* in this chapter for attribute descriptions.) Click the Submit Button to finalize or Reset to revert all options to default.

4.3 Delete Volume Set

To delete a Pass through disk, choose the "Delete Pass Through" option. A table will appear with the available pass through disks. Check the radio button next to the disk to be deleted, and check the box labelled "Confirm the operation." Click the Submit Button to finalize or Reset to revert all options to default.

4.4 Identify Selected Drive

This function is designed to prevent removing the wrong drive by illuminating the selected disk HDD LED Indicator. To identify selected drive from the physical drive pool, choose the "Identify Drive" option. A table will appear with the available disks. Check the radio button next to the disk to be identified, and click the Submit button. Click the Reset button when done.

5. System Controls

5.1 System Configuration Functions

This menu contains various feature and environmental options of the RAIDBank4. The following subsections discuss each attribute's descriptions (bold denotes default value.) When all desired options are entered, check the box labelled "Confirm the operation" and Click the Submit Button to finalize or Reset to revert all options to default.
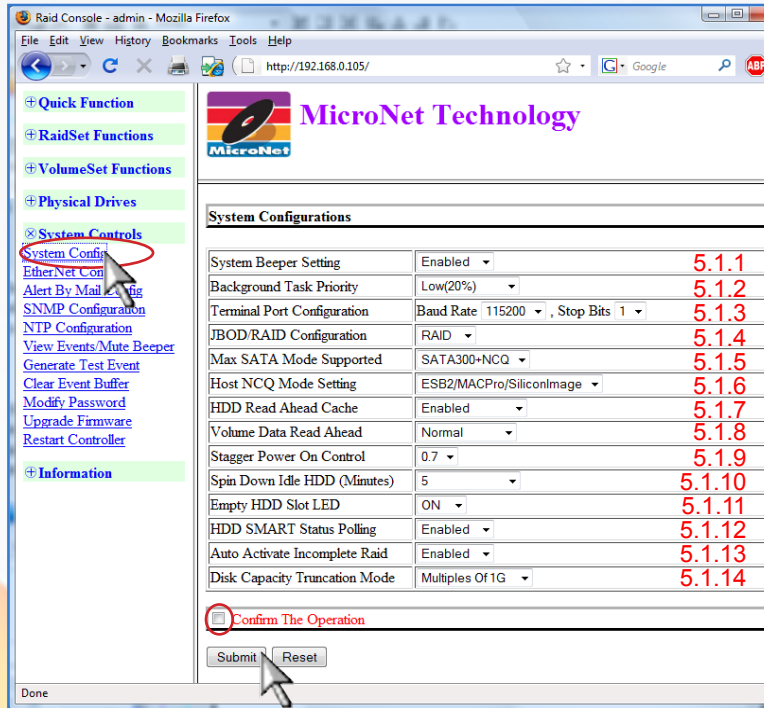
5.1.1 System Beeper Setting (**enabled**/disabled)

This function enables or disables the RAIDBank4 alert buzzer. It is not recommended to turn the buzzer off as it will not provide audible cues when faults occur.

5.1.2 Background Task Priority (ultralow, **low**, normal, high)

The Background Task Priority is a relative indication of how much time the controller devotes to a background initialization or rebuild operations. The RAIDBank4 allows user to choose the rebuild priority (ultralow, low, normal, high) to balance volume set access and rebuild tasks appropriately. The lower the priority, the greater the responsiveness of the RAID to host activity, but at a cost of longer background task completion.

5.1.3 Terminal Port Configuration

The RAIDBank4 has provisions for an RS232 host management connection. In order to use the RS232, a special cable has to be used (not included)- consult your authorized Micronet reseller for more information. The communications port configuration defaults are 115200 Baud., 1 Stop bit operation. The baud rate (1200-115200) and stop bits (1,2) are user selectable. Handshaking and parity are fixed at none

5.1.4 JBOD/RAID Configuration (**RAID**/JBOD)
The RAIDBank4 controller can be used in JBOD (Just a Bunch Of Drives) mode, which allows each drive to be presented separately to the host. To use this mode, make sure to erase any existing RAID sets.

5.1.5 Maximum SATA Mode (SATA150, SATA150+NCQ, SATA300, **SATA300+NCQ**)
The RAIDBank4 uses 5 discrete SATA busses for its disk channels. These drive channels can support up to SATA320 and support NCQ (Native Command Queuing,) A SATA function controlling dynamic rearranging of data fetching commands for maximum performance. Please do not change this setting unless instructed by Micronet's Technical Support.

5.1.6 Host Channel NCQ Setting (**ESB2/MACPro/Siliconlimage**)
The RAIDBank4 supports Native Command Queuing (NCQ) over the eSATA host connection. The NCQ algorithms allow I/O operations to be performed out of order to optimize performance. Since different host bus adapters have some compatibility differences in NCQ implementation, The default setting on this option is Disable for better compatibility. To enable NCQ, choose the option that matches your eSATA host bus adapter:
• ESB2/MACPro/Siliconlimage: Intel ESB2, MACPro, MicroNet, and Silicon Image based adapters
• ICH: Intel ICH series based adapters
• Marvell6145: Marvell 6145 based adapters
• nVidia: Nvidia nForce based adapters

5.1.7 HDD Read Ahead Cache (**Enabled**/Disabled)
Enabled by default. Please don't change this setting unless instructed by MicroNet Technical Support.

5.1.8 Volume Read Ahead Cache (**Normal**/Aggressive/Conservative/Disabled)
Controls the volume read cache algorithm. Depending on the type of data, a more aggressive or less aggressive caching algorithm will yield better performance.

5.1.9 Staggered HDD Spinup control (**0.7S**)
The RAIDBank4 employs a staggered disk mechanism startup sequence to minimize power supply strain. Please do not change this setting unless instructed by Micronet's Technical Support.

5.1.10 HDD Spindown Control (**5 Minutes**)
The RAIDBank4 can automatically spin down disks that haven't been accessed for a certain amount of time to reduce power consumption. This value is used to determine idle time before spinning down the disk(s).

5.1.11 HDD Empty slot LED (**ON**/OFF)
This option lights the disk error LED on a slot without a disk.

5.1.12 HDD SMART Status Polling (**enabled**/disabled)
The RAIDBank4 reads and reports the SMART (Self-Monitoring, Analysis, and Reporting Technology) status of each disk drive mechanism. This option is enabled by default, and should not be disabled unless instructed by Micronet's Technical Support.

5.1.13 Auto Activate Incomplete RAID (enabled/disabled)
This option determines the default behavior of the RAIDBank4 when booting up with a degraded Volume set. When enabled, the RAIDBank4 will attempt to activate a degraded volume on boot.

5.1.14 Disk Capacity Truncation Mode
Disk Truncation is used to decrease disk usable space for compatibility purposes. Please do not change this setting unless instructed by Micronet's Technical Support.

5.2 Ethernet Configuration
This menu contains The Ethernet specific functions of the RAIDBank4. The following subsections discuss each attribute's descriptions. When all desired options are entered, check the box labelled "Confirm the operation" and Click the [Submit] Button to finalize or [Reset] to revert all options to default.

5.2.1 DHCP Function (enable/disable)
DHCP (Dynamic Host Configuration Protocol) is a protocol that lets network administrators manage centrally and automate the assignment of IP (Internet Protocol) configurations on a computer network. Select this option if you wish to use the DHCP address services in your network. DHCP may be "Disabled' or 'Enabled."

MicroNet

Ether Net Configurations

DHCP Function	Enabled ⬍
Local IP Address (Used If DHCP Disabled)	192 . 168 . 1 . 100
Gateway IP Address (Used If DHCP Disabled)	192 . 168 . 1 . 1
Subnet Mask (Used If DHCP Disabled)	255 . 255 . 255 . 0
HTTP Port Number (7168..8191 Is Reserved)	80
Telnet Port Number (7168..8191 Is Reserved)	23
SMTP Port Number (7168..8191 Is Reserved)	25
Current IP Address	192.168.20.164
Current Gateway IP Address	192.168.20.1
Current Subnet Mask	255.255.255.0
Ether Net MAC Address	00.04.D9.60.84.7A

☐ Confirm The Operation

[Submit] [Reset]

5.2.2 Manual (Static) IP Address
Select this option to manually configure the IP address of the controller. Make sure that the assigned IP address is in the same range of your default router address and that it is unique to your private network.

5.2.3 Gateway IP address
If a static IP address is assigned, Enter the router address of your network in this field.

5.2.4 Subnet Mask
If a static IP address is assigned, enter your network subnet mask in this field. If you don't know your network's subnet mask, consult your network administrator.

5.2.5 HTTP Port Number (80)
The HTTP port number is the TCP Port used for the web user interface. The default port is 80, and can be changed per user specification. To access the web UI with a port other then 80, point your browser to http://<IPADDRESS>:<HTTP PORT>

> **Note:**
> The RAIDBank4 cannot use ports 7168-8191 for IP services.

5.2.6 Telnet Port Number (23)
The Default Telnet TCP port is 23, and can be changed per user specification.

5.2.7 SMTP Port Number (25)
The Default Telnet TCP port is 25, and can be changed per user specification.

5.2.8 Ethernet MAC Address
A MAC (Media Access Control) address is your computer's unique hardware number. This option should not normally be modified.

5.3 Alert by Mail Configuration
The RAIDBank4 features an SMTP manager, and can send email notifications for various RAIDBank4 conditions. The following subsections discuss each attribute's descriptions. When all desired options are entered, check the box labelled "Confirm the operation" and Click the [Submit] Button to finalize or [Reset] to revert all options to default.

5.3.1 SMTP Server IP address
The SMTP (Simple Mail Transport Protocol) server is an external server that relays your network's outgoing mail. Enter your network's SMTP server's network IP address in this field. If you do not know your SMTP server's IP address, consult your network administrator.

5.3.2 Sender Name and Credentials
In the sender name field, enter a name that will identify the RAIDBank4 as the sender of the email. "RAIDBank4" or the attached host name would be most appropriate. The mail address is not important, but should be used to validate the RAIDBank4 as the sender. The user Account and password fields may be required to authenticate the RAIDBank4 to the SMTP server- consult your network administrator for more information.

5.3.3 Recipients
The RAIDBank4 can send notifications to up to 4 recipients. Enter the respective names and email addresses in this section.

5.3.4 Event Notification Configuration

This table allows the administrator to specify the level of notification provided by the RAIDBank4. Check the radio button next to the desired notification leve. The available choices are:

Notification Level	Description
Disable Event Notification	No Event Notification Will Be Sent
Urgent Error Notification	Send Only Urgent Event
Serious Error Notification	Send Urgent And Serious Event
Warning Error Notification	Send Urgent, Serious And Warning Event
Information Notification	Send All Event

5.3.5 Notification for No Event

Check the box next to *"Notification for no event"* to receive periodic emails when no event occurs. This option is beneficial for remote assurance of continuous proper operation.

5.4 SNMP Configuration

The RAIDBank4 supports Simple Network Management Protocol (SNMP) agent for monitoring by an SNMP-based management application (also known as an SNMP manager) can monitor the disk array. If you are already running an SNMP management application at your site, it can monitor the RAIDBank4. Consult your SNMP management software documentation before entering the relevant information into the fields. When all desired options are entered, check the box labelled "Confirm the operation" and Click the [Submit] Button to finalize or [Reset] to revert all options to default.

5.5 NTP (Network Time Protocol) Configuration

The RAIDBank4 can synchronize its internal clock to an outside Network Time (NTP) server. This option allows for configuration of the NTP service. To obtain an NTP server, check with your network administrator or for a list of public servers refer to the NTP Public Services Project at http://ntp.isc.org. Enter the NTP server IP addresses and select your time zone. When all desired options are entered, check the box labelled "Confirm the operation" and Click the [Submit] Button to finalize or [Reset] to revert all options to default.

5.6 View Events/Mute Beeper

Use this entry to view events. If the buzzer is active, you may temporarily mute it using this option.

5.7 Generate Test Event
The RAIDBank4 can generate test events to confirm remote notifications are properly working. To generate a test event, select "Generate Test Event," check the box labelled "Confirm the operation" and click the [Submit] Button.

5.8 Clear Event Buffer
Select "Clear Event Buffer" to clear the event log. Check the box labelled "Confirm the operation" and Click the [Submit] Button to finalize or [Reset] to revert all options to default.

5.9 Modify Password
The RAIDBank4's administrative functions can be protected with a password. To set or change the RAIDBank4 password, select "Modify Password". The following screen has three fields- Enter original password, Enter New Password, and Confirm (Re-Enter) New Password. Type the current password in the "Enter Original Password" field (leave blank if no current password defined.) Enter and reenter the new password in the next two fields (the entries are case sensitive) to set a new password. To complete the operation, check the box labelled "Confirm the operation" and Click the [Submit] Button to finalize or [Reset] to revert all options to default.

5.10 Upgrade Firmware
The RAIDBank4's firmware (operating control software) can be field upgradable. MicroNet Support may direct you as to the operation of this option.

5.11 Restart Controller
To reset the RAIDBank4, select "Reset Controller" , check the box labelled "Confirm the operation" and Click the [Submit] Button to finalize or [Reset] to revert all options to default.

6. Information Functions

6.1 RAIDSet Hierarchy

This option will display the current physical and logical configuration of the RAIDBank4. The RAIDset(s), disk channels, and Volume Set(s) are each clickable, and will pull up the respective information about each object.
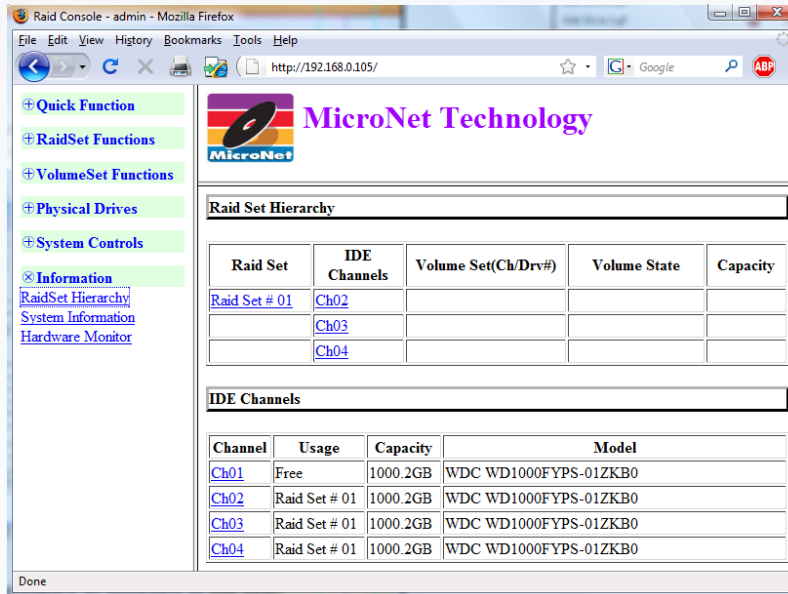
6.2 System Information

Choose this option to display various components of the RAIDBank4, as illustrated in this table:

Component	Value
Controller Name	RAIDBank4
Firmware Version	V1.45 2008-04-29
BOOT ROM Version	V1.45 2008-3-14
Serial Number	xxx
Unit Serial #	
Main Processor	400MHz 88F5182
CPU ICache Size	32KBytes
CPU DCache Size	32KBytes / Write Back
System Memory	128MB / 400MHz
Current IP Address	192.168.1.100

6.3 Hardware Information

To view the RAIDBank4 controller's hardware monitor information, select the *"Hardware Information"* option. All hardware environmental information will be displayed. Scroll to browse all the hardware information. The Hardware Monitor Information provides the temperature, fan speed (chassis fan) and voltage of the internal RAIDBank4. The temperature items list the current states of the controller board, backplane, and disk drives.

Chapter 5 - Host Computer Setup

This chapter is an overview of setting up storage volumes on Macintosh and Windows based computers. To ensure complete installation and ease of use, take a few minutes to read this chapter before installation.

1. Volume Setup on Apple Macintosh

Installation on a MacOS system requires MacOS X or greater, and any of the following:
1. Compatible SATA Host Bus Adapter with external ports.
2. USB 2.0 port

⚠ **Before you begin, please make sure you are logged in with administrative privileges. If you are unsure about your privilege level, please consult your Macintosh OS-X user manual or with your system administrator.**

1.1 Launch the "Disk Utility" application located under Applications/Utilities folder.
1.2 Highlight your new drive and select the "Partition" tab
1.3 Select the new partition map type.
1.4 For each partition in the volume scheme, select the desired file system format and volume name (optional)
1.5 Click the "Options" button. Select "Apple Partition Map" in the dialog box and click "OK".
1.6 Click "Apply." Your RAIDBank4 is ready to use!
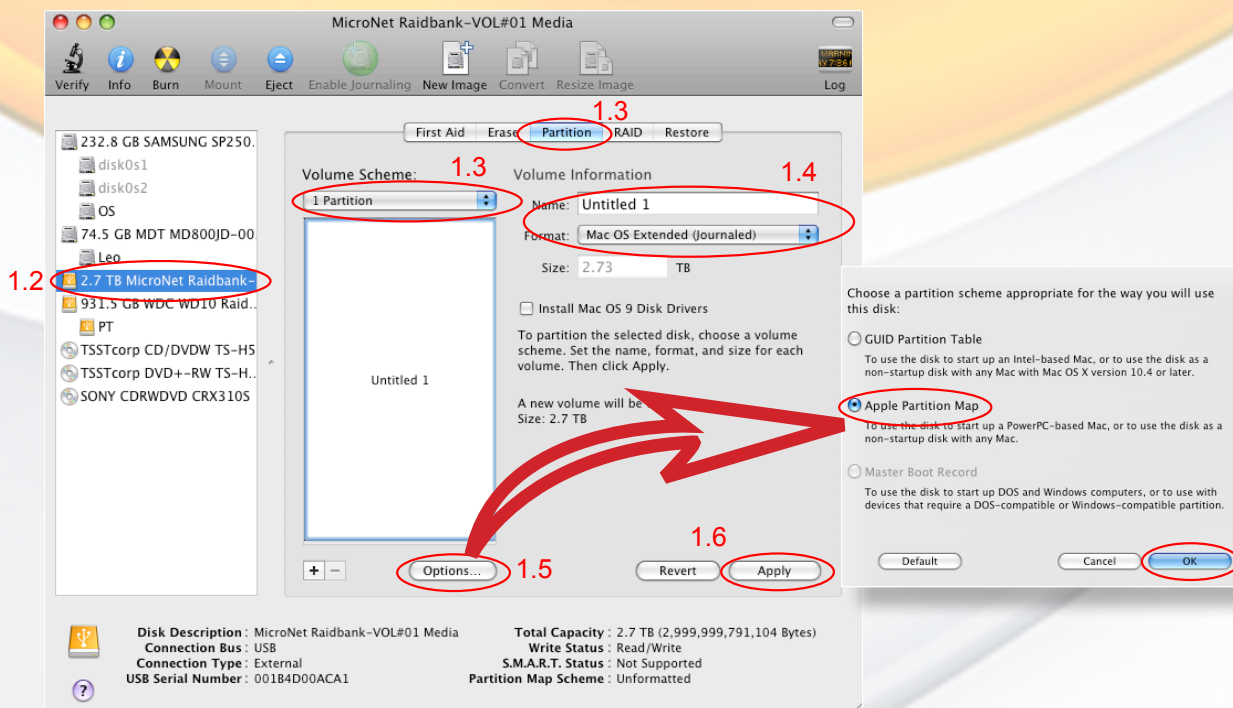
2. Volume Setup on Microsoft Windows 2000/XP/2003/Vista

Installation on a Windows system requires a Windows Installation with a properly installed and configured SCSI host bus. Please verify that your assigned SCSI ID is unique among the host SCSI chain, and verify that the terminator is attached and lit at the end of the chain.

2.1 Open the disk management console. A list of the attached drives and their respective volumes will appear. Each Volume set will appear as an individual disk in the management console. Upon the first time the RAIDBank4 is connected, a "Initialize and Convert Disk Wizard" should appear when the disk management console is run. You may use the Wizard to set up the volume, or follow the next steps for manual configuration.

> **Note:**
> The Disk Management Console can be found under \Windows\System32\diskmgmt.msc on your system drive. For an illustrated guide, please see http://www.fantomdrives.com/support/faqs/hdfaqpc.php4#8

2.2 Right-click on a RAIDBank4 volume. If it's not initialized, a red "No Entry" logo will cover the disk icon. Right click on the disk and select "Initialize Disk." Follow the on-screen instructions.
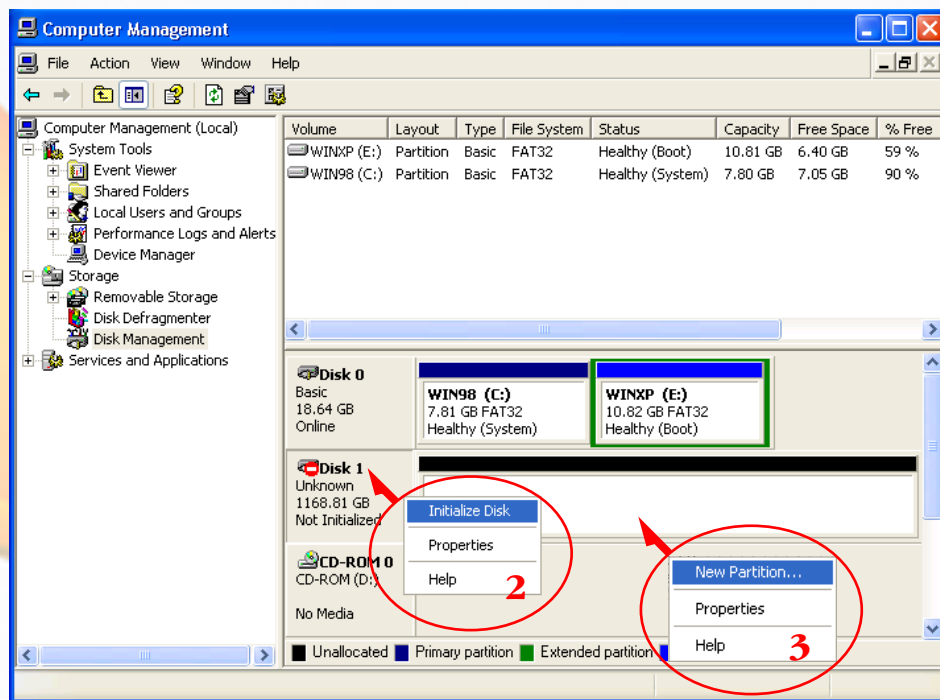
2.3 Right click the initialized volume (The area right of the disk icon.) In the context menu, select "New Partition." Follow the on screen instructions. In the File System pop-up menu, select NTFS. The default formatting option is Full format. A Full format will take about 30-90 minutes. A Quick format will take just a few minutes, but will do less verifying of the Drive than a Full format. Click Start. Once the format process is complete, your RAIDBank4 is ready to use.

Chapter 6 - Troubleshooting

Daily Use Tips

- Read this User's Guide carefully. Follow the correct procedure when setting up the device.
- Additional application software may have been included with your drive. Please review the documentation included with this software for information on the operation and support of this software. The documentation can usually be found in an electronic format on the installation CD.
- Always operate your drive on a steady, level surface. Do not move the unit while it's turned on.
- Plug your drive into a grounded electrical outlet. The use of "ground-defeating" adapters will cause damage not covered by your warranty.
- Do not open your hard drive or attempt to disassemble or modify it. Never insert any metallic object into the drive to avoid any risk of electrical shock, fire, short-circuiting or dangerous emissions. Your drive contains no user serviceable parts. If it appears to be malfunctioning, contact MicroNet Support.
- RAIDBank4 is compatible with the leading hard disk repair and defragmentation software. We recommend using this software to maintain peak performance and data-integrity of your drive. Contact your local software retailer for more information about the software best suited for your computer.

General Use Precautions

- Do not expose the hard drive to temperatures outside the range of 5°C (41°F) to 45°C (104°F). Doing so may damage the drive or disfigure its casing. Avoid placing your drive near a source of heat or exposing it to sunlight (even through a window.)
- Never expose your device to rain, or use it near water, or in damp or wet conditions. Doing so increases the risk of electrical shock, short-circuiting, fire or personal injury.
- Always unplug the hard drive from the electrical outlet if there is a risk of lightning or if it will be unused for an extended period of time.
- Do not place the drive near sources of magnetic interference, such as computer displays, televisions or speakers. Magnetic interference can affect the operation and stability of your RAIDBank4.
- Do not place heavy objects on top of the drive or use excessive force on it.
- Never use benzene, paint thinners, detergent or other chemical products to clean the outside of the RAIDBank4. Instead, use a soft, dry cloth to wipe the device.

Frequently Asked Questions

General FAQ

Q: Can I leave my RAIDBank4 on all the time, or should I turn it off when not in use?

A: The RAIDBank4 is meant to be left on, but does not add any limitations on being turned off. Drive reliability is definitely affected by repeated power cycles, and the RAIDBank4 cannot alleviate this. In addition, Micronet recommends that the drive's power supply is connected through a UPS or surge protector; In the case of a power surge, or brown/black out, the hard drive's sensitive electrical components will not be damaged. Lastly, as long as the RAIDBank4 is configured as a parity or mirrored RAID, you will be able to sustain a disk failure without losing access to your data.

Q: The green LEDs keep blinking on some or all the disk modules. Is something wrong?

A: The blinking disk activity light means that the disk is not being used for a RAIDset, spare, or disk passthrough and is available to use. Refer to sections 2.1 and 3.1 of chapters 3 or 4 for more information.

Q: The WebUI/LCD Front panel is not responding!

A: The RAIDBank4 can only be accessed for management through one method at any time. Make sure no other management connections are active, and retry to access the unit.

Q: Can I increase my RAIDBank4's volume capacity?

A: Larger drive modules may be available for your Model. Consult your MicroNet reseller for more information.

Q: Can I have more than one RAIDBank4 on my computer?

A: Yes! Please call MicroNet Help Desk if you have questions about your particular configuration.

Q: What is the warranty period for RAIDBank4?

A: RAIDBank4's standard warranty is One-year limited. Optional extended warranty and overnight exchange programs are available, consult your Micronet dealer or www.MicroNet. com for information.

Q: The RAIDBank4 reports Disk capacity is '1250GB', But when I connect it to the computer, The OS reports the disk capacity as 1165GB. Where is the missing capacity?

A: Disk drive manufacturers use the base 10 gigabyte measurement, , which defines a GByte as 1000 x 1000 x 1000. Some operating systems report disk capacity using Base 2 nomenclature, which define a GByte as 1024 x 1024 x 1024. Regardless of which scheme is used, there is exactly the same amount of usable capacity.

Q: I'm trying to access the RAIDBank4 using the front panel. When I push enter, it asks me to verify the password. I defined a password, and I enter it, but then the **ENT** key just moves the cursor over another space and the arrow keys change the characters to use and the **ESC** take me back to the IP Address screen.

A: Please press the **ENT** key to move the cursor over another space until the end of the password line is reached (16 character including space) to confirm the password.

Q: Can I boot from my RAIDBank4?

A: Yes! As long as your host hardware and operating system support booting from eSATA or USB. Refer to your computer's documentation for more information

Q: Files are missing or corrupted

A: Run your computer's disk repair utility.

Macintosh related FAQ

Q: Disk Utility does not display my drives (Mac)

A: If the options in Disk Utility are dimmed, you are not logged in as administrator. If you know the name and password for an administrator, click the lock icon (Tiger and prior) and enter the information. If the RAIDBank4 volumes are still not appearing, turn off the RAIDBank4, check all cable connections, wait 10 seconds and re-power on the RAIDBank4. You may need to reboot your Macintosh for the drives to be seen.

Q: Why is my Drive asking me to format it? It was already formatted and it contains data.

A1: Run a disk repair utility on the drive.

A2: Perform permission repair on your system drive. Open the disk utility (located in /Applications/Utilities/Disk Utility.app.) Select your system drive (usually the first disk listed) and click "Repair Disk Permissions" in the "First Aid" Tab.

A3: Restart your computer. As soon as the bootup chime sounds, press and hold down the option-command-p-r key combination to reset the PRAM. Release the keys when the chime sounds a second time.

Please refer to your Mac manual for more information on these procedures

Q: My computer does not recognize the Drive.

A: First, check to make sure that all of your connections are secure, and that the power switch is in the "ON" position. Then check if your RAIDBank4 is listed in the Apple System Profiler. If the problem persists, verify that the port used is functioning.

Q: I'm trying to copy files to/from FAT32 volumes or network shares, and it keeps failing.

A: FAT32, HFS+, and other file system formats allow different standards of filename length or use of special characters. Rename the offending file(s) and try the operation again.

Q: I have a FAT32 disk, and when I try to copy a large file I get an error saying there is not enough room on the drive-- I have lots of free space!

A: FAT32 only allows files up to 4GB in size. To copy larger files, please reformat the volume using MacOS Extended Format.

Windows related FAQ:

Q: I do not see my Drive listed in the My Computer window, but it does appear in the Device Manager list.

A: Right-click on My Computer. Select Manage in the pop-up menu. In the Computer Management window, select Storage, then select Disk Management. In the Disk Management window, you should see a list of available storage devices. Look for the Disk that has a capacity closest to your RAIDBank4 volume(s). Right-click on the right-hand box; in the pop-up menu select Delete Partition. Once you do this, it will say "Online" & "Unallocated". Right-click on the box and select Create New Partition in the pop-up menu. When the Partition Wizard appears, select Primary Partition and click on Next. You will see a default value for the Drive; click Next. You will then see a drive letter (you can change this drive letter if you wish); click Next. You will then be asked to format the Drive.

Q: My Drive was working fine yesterday but now its gone!

A: The disk may have been shut down without being dismounted, or may have failed. If you do not hear and feel the drive spin up when you connect the power, the drive will need to be replaced. Also, if you verify that the computer input and the drive data cable are working, and the computer still does not detect the drive by showing you the system tray icon or by listing the drive in the Device Manager after you plug in the drive, the drive is bad and needs to be replaced. If data recovery is desired, please contact an established professional data recovery firm. For a checklist of what qualities you might seek, see www.drivesavers.com/why_drivesavers/index.html or www.ontrack.com/services.

Some software applications may be helpful in situations where the drive hardware is seen, but the volume is simply corrupt. A couple examples are www.stellarinfo.com, www.binarybiz.com, and www.prosofteng.com. There are many companies that provide these services, it is best to be selective. Micronet does not refer or recommend any data recovery service as we are not affiliated with these companies in any way.

If the computer does detect the volumes, you may be able to repair or recover the data with your computer's disk repair utility or a third party utility.

Q: Where are the drivers for Microsoft Windows 2000/XP/2003/Vista?

A: Windows 2000 and newer already include all the necessary drivers! No additional drivers are necessary.

Q: Do you have "DOS Driver" for the RAIDBank4? How about Windows 98 or NT 4?

A: No.

Q: Does the RAIDBank4 work with Norton Ghost?

A: Yes. Norton Ghost 2003 or newer support USB drives. Micronet does not provide any additional drivers.

Q: When I leave my computer idle for a while, my Drive won't work properly.

A: The most likely cause is that your computer is going into sleep mode. The immediate solution is to shut down your computer and turn off the Drive, and then restart your computer. Once your computer is completely booted up, turn on the Drive. You should see the drive in the Windows Explorer. To prevent this problem from recurring, open the "Power Settings/Energy Saver" and set it to never go into sleep mode.

Q: After I connected the Drive to my PC, I got the following alert message: HI-SPEED USB Device Plugged into non-HI-SPEED USB Hub." What does this mean?

A: Windows 2000 and XP users will get this alert message if you plugged the Drive into a USB port that only supports USB 1.1. This can work but will not support larger then 2TB volumes, and only the first logical unit mapped to USB (disk 0). Additionally, the volume will operate USB 1.1 speeds.

If an issue cannot resolved by using our FAQ, please contact Technical Support via the Micronet support site at http://www.micronet.com/support

Appendix A- Getting Help

If you experience problems with your RAIDBank4, please contact your Authorized MicroNet Reseller for assistance. If the reseller is unable to resolve your issue, please contact MicroNet's Help Desk for assistance. Please have the model, serial number, date of purchase, and reseller's name available before making contact. If possible, call from a telephone near the system so we can direct you in any necessary system corrections.

How To Contact MicroNet Technology, Inc.

MicroNet Technology, Inc.
19260 Van Ness Avenue
Torrance, CA 90501

(310) 320-7272 Sales
(310) 328-0202 Sales Fax
(310) 320-0772 Help Desk & Customer Service

http://www.MicroNet.com

MicroNet Technology can also be reached via email at the following addresses:
Sales: sales@micronet.com
Help Desk: support@micronet.com

Appendix B: RAID Level Comparison Table

RAID Level	Description	Min. Drives	Max. Drives	Capacity	Fault Tolerance	Data Transfer Rate	I/O Request Rates
0	Also known as striping. Data distributed across multiple drives in the array. There is no data protection	1	4	(N) Disks	No fault tolerance	Very High	Very High for Both Reads and Writes
1	Also known as mirroring. All data replicated on 2 Separate disks. This is a high availability Solution,	2	2	1 Disk	Greater than RAID 3,5	Reads are higher Than a single disk; Writes similar to a single disk	Reads are twice faster than a single disk; Write are similar to a single disk.
10	Also known as Block-Interleaved Parity. Data and parity information is subdivided and distributed across all disk. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	4	4	(N / 2) Disks	Greater than RAID 3,5	Transfer rates more similar to RAID 1 than RAID 0	Reads are twice faster than a single disk; Writes are similar to a single disk.
3	Also known as Bit-Interleaved Parity. Data and parity information is subdivided and distributed across all disk. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	3	4	(N - 1) Disks	Lower than RAID 1, 10 greater than a single drive	Reads are similar to RAID 0; Writes are slower than a single disk	Reads are approximately twice as fast as a single disk; Writes are similar to a single disk.
5	Also known Block-Interleaved Distributed Parity. Data and parity information is subdivided and distributed across all disk. Parity must be the equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	3	4	(N - 1) Disks	Lower than RAID 1, 10 greater than a single drive	Reads are similar to RAID 0; Writes are slower than a single disk	Reads are similar to RAID 0; Writes are slower than a single disk.

Appendix C- Terminal Session Setup

The RAIDBank4 has provisions for an RS232 host management connection. In order to use the RS232, a special cable has to be used (not included)- consult your authorized Micronet reseller for more information. The communications port configuration defaults are 115200 Baud, 1 Stop bit operation, no handshaking and no parity. For changing these settings, please see section 5 of chapters 3 or 4.

Serial host management requires a VT100 compatible terminal, or a PC operating in an equivalent terminal emulation mode. All RAIDBank4 monitoring, configuration and administration functions can be exercised from the terminal session.

There are a wide variety of Terminal Emulation packages, but for the most part they should be very similar. The following setup procedure is a sample VT100 Terminal session utilizing Hyper Terminal use Version 3.0 or higher.

Step 1: Most versions of Windows include HyperTerminal, Typically located in Start menu -> Programs -> Accessories -> Communications -> Hyper Terminal. Please see your Microsoft Windows™ Documentation for more information about HyperTerminal.
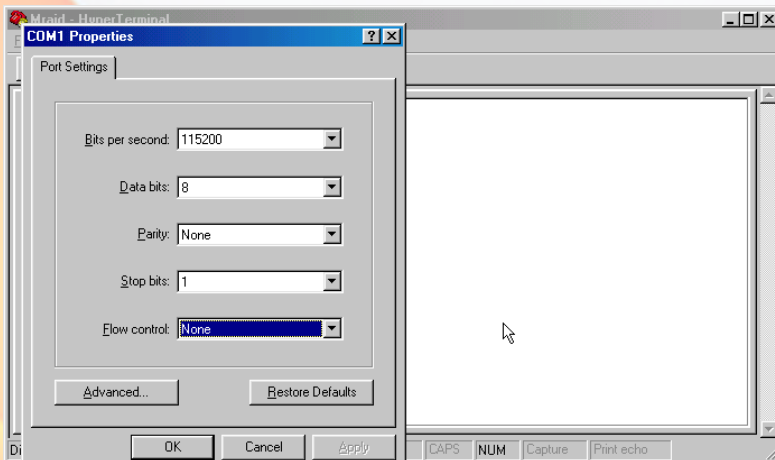
Step 2: Open HYPERTRM.EXE.

Step 3: Enter a name for your Terminal Session and Click OK.
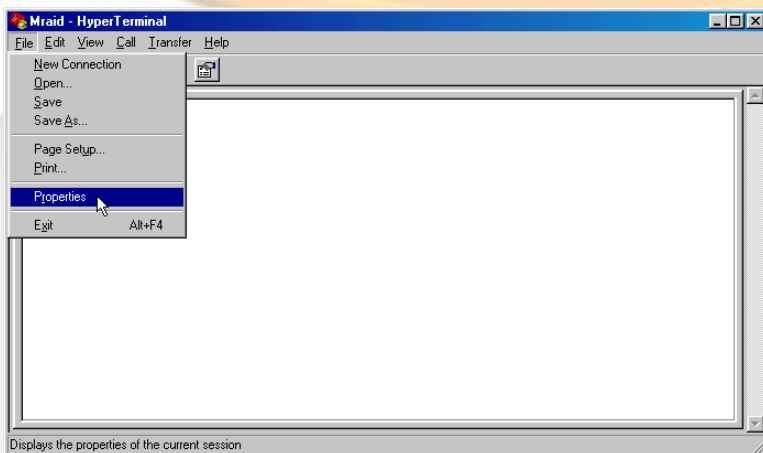

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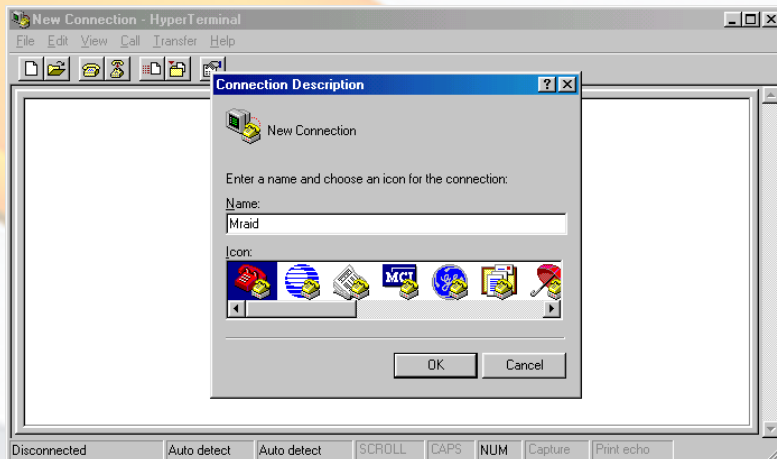
Step 4. Select an appropriate connecting port in your Terminal. Click OK
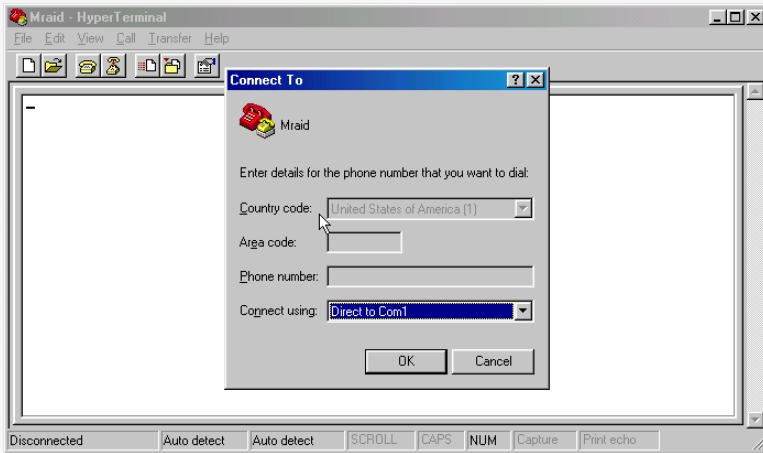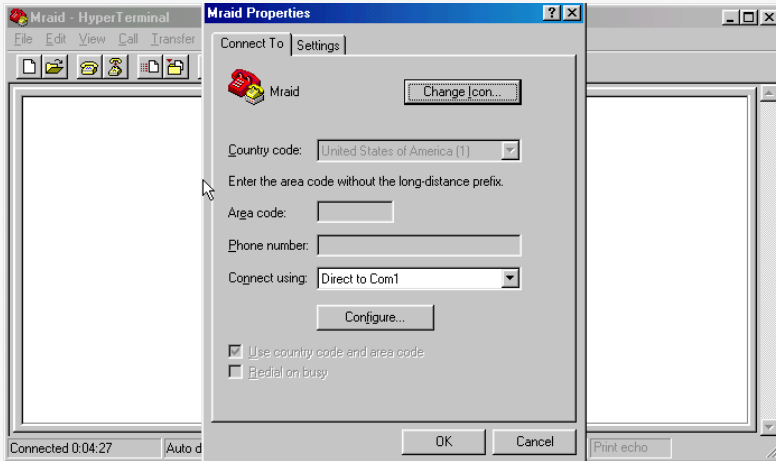

Step 5: Configure the port parameter settings. Bits per second: "115200", Data bits: "8", Parity: "None", Stop bits: "1", Flow control: "None". Click OK

Step 6: Open the File menu, and then open Properties.

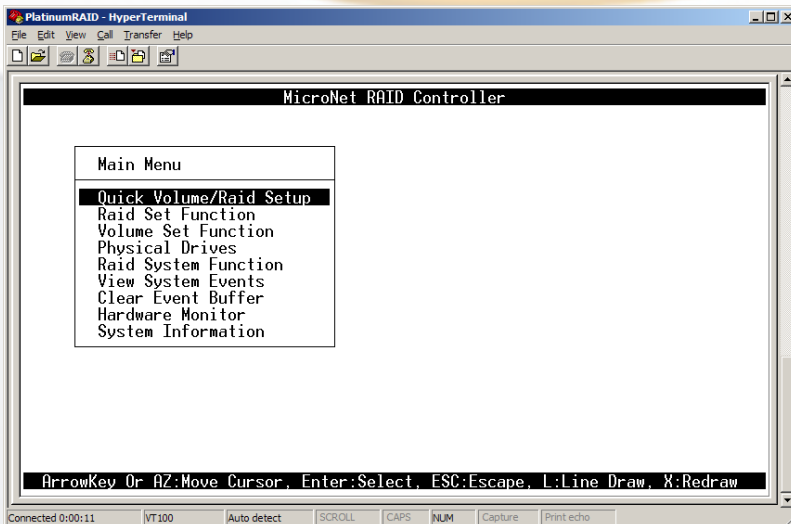Step 7: Open the Settings Tab.

Step 8. Open the Settings Tab. Function, arrow and ctrl keys act as: Terminal Keys, Backspace key sends: Crtl+H, Emulation: VT100, Telnet terminal: VT100, and Click OK.
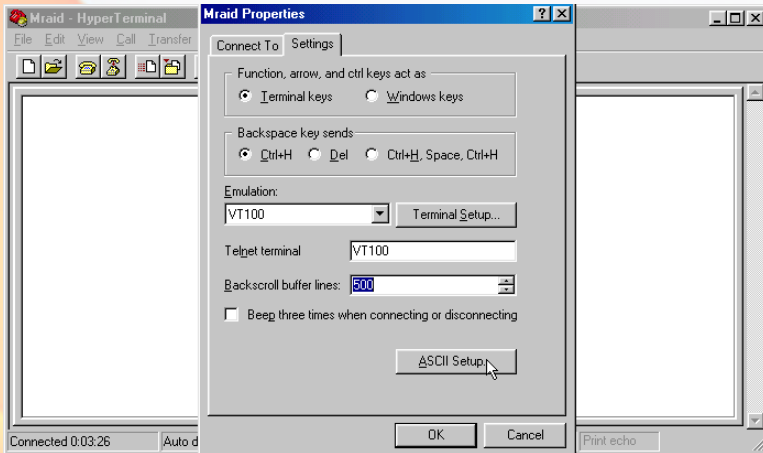
The VT-100 session is now configured. Press "X" key to display the disk array Monitor Utility screen on your VT100 Terminal.

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Appendix D- Glossary

ATA Acronym for "**AT** Bus **A**ttachment" - a standard interface to IDE hard disks. Western Digital's IDE disk interface was standardized by ANSI to form the ATA specification using a 16-bit ISA bus.

Cache cache is a fast-access memory bank that serves as an intermediate storage for data that is read from or written to secondary storage. Typically, high-speed caches are implemented in RAM, though they can also be implemented on disk when speed is not a critical requirement. Caches generally improve the efficiency of read operations due to the principles of "spatial and temporal locality of data". They can also improve the efficiency of write operations. **See also: Write Back Cache, Write Through Cache**

Degraded Mode/Status All arrays, with the exception of **RAID** 0, are designed to handle disk failures. However, there is limit on the number of hard disks that can fail before the array is rendered inoperative. For instance, this limit value is 1 for **RAID** 1, 3, and 5. In the case of **RAID** 10 or 50, the upper bound is equal to the number of parity groups. When the number of disk failures occurring in an array are less than or equal to this upper bound, the array is denoted to be in a degraded state. The failure of the disks does not impair reading from or writing to the array. However, it impairs the efficiency of throughput in all RAID types (with the exception of RAID 1) since data requested by read operations may have to be "reconstructed" using parity. In the case of RAID 1 the throughput of read operations is cut in half if a drive fails. Operating in degraded mode is considered an acceptable alternative only for short durations. Generally this duration should span no more time than that required to inform the user of the failures and to replace the failed disks with suitable spares.

Dirty Data Dirty data is data that has been written to a cache but has not been "flushed," or written to its final destination, typically some secondary storage device.

Disk Array A Disk Array is a logical disk comprised of multiple physical hard disks. The number of hard disks in an disk array is dictated by the type of the array and the number of spares that may be assigned to it. Furthermore, whether a disk array can be built using part of the space on a disk (as opposed to being forced to use the whole disk) depends upon the implementation. Disk Arrays are typically used to provide data redundancy and/or enhanced I/O performance.

Disk Block Data is stored on disks in blocks that are generally of a predefined size. This size is typically a value such as 512 bytes, 1 KB, 2 KB, etc. When a record is written to a disk, the blocks used for that record are dedicated to storing the data for that record only. In other words two records are not permitted to share a block. Consequently, a block may be only partially used. For instance, assume a disk has a block size of 1 KB and a user record written to it has a size of 3148 bytes. This implies that the user record will be written into 4 blocks, with the contents of one of the blocks being only partially filled with (3148 – 3072) 76 bytes of data.

Driver A piece of software that controls a hardware device. Typically drivers provide an interface by which applications can use the device in a uniform and hardware-independent manner.

DHCP (Dynamic Host Configuration Protocol) a protocol that lets network administrators manage centrally and automate the assignment of IP (Internet Protocol) configurations on a computer network. When using the Internet's set of protocols (TCP/IP), in order for a computer system to communicate to another computer system it needs a unique IP address. Without DHCP, the IP address must be entered manually at each computer system. DHCP lets a network administrator supervise and distribute IP addresses from a central point. The purpose of DHCP is to provide the automatic (dynamic) allocation of IP client configurations for a specific time period (called a lease period) and to eliminate the work necessary to administer a large IP network.

Ethernet A local-area network standard that is currently the most prevalent with an estimated 80% of desktops connected using this standard. It was developed jointly by Xerox, DEC and Intel and employs a bus or star topology.

Fibre Channel A high-speed, full duplex serial communication scheme permitting data transfer rates of up to 4 Gigabit per second with a roadmap extending up to 10 Gigabit per second. The actual transfer rates and the distance over which they apply vary depending on the physical media used such as video coaxial, shielded twisted pair, single/multi mode optical fiber etc.

File System A file system is a layer between applications and the disks to which their I/O is directed. File systems serve to hide the details of the physical layout of files on the disk, allowing applications to address files as a contiguous logical area on disk accessible by a name regardless of their physical location on the storage device.

Hot Spare One or more disks in a RAID array may fail at any given time. In fact, all RAID types with the exception of RAID 0 provide methods to reconstruct the array in the event of such an occurrence. A commonly used tactic is to earmark a hard disk that is not being used by any RAID array as a backup. In the event a hard disk in a RAID array fails, this backup is automatically mobilized by the RAID controller to step in place of the failed hard disk. The data in the failed hard disk is "reconstructed" and written into the new hard disk. In the case of a RAID 1, data is reconstructed by simply copying the contents of the surviving disk into the spare. In the case of all other RAID types, reconstruction is performed using parity information in the working hard disks of that RAID array. This backup hard disk is known as a "hot" spare since the fail-over process is performed dynamically on a server within the same session i.e., without the necessity for re-booting or powering down.

IDE Acronym for "**I**ntegrated **D**evice **E**lectronics". A hard disk drive interface standard developed by Western Digital and introduced. Also knows as Parallel ATA.

Logical Drive A logical drive is comprised of spaces from one or more physical disks and presented to the operating system as if it were one disk.

Logical Unit (LUN) a SCSI protocol entity which may be addressed by the actual input/output (I/O) operations of a Logical Drive. Each SCSI-type target provides one or more logical units.

Native Command Queuing (NCQ) a technology designed to increase performance of SATA hard disks by allowing the disk firmware to internally optimise the order in which read and write commands are executed. This can result in increased performance for workloads where multiple simultaneous read/write requests are outstanding, which occurs most often in server-type applications.

Online Capacity Expansion The ability to add space to an existing RAID array within a session while preserving the RAID type and data within the array is known as online capacity expansion. The availability of this feature enables the user to add space to a RAID array as and when required without rebooting, thereby obviating the need for precise forecasts of capacity requirements for the future.

Parity A mathematical function that serves as a method for error verification and correction. In strict technical terms the parity of a group is set to 1 if the number of bits in the group that are set to 1 is odd, and 0 otherwise. For instance, the parity of N bytes of data is obtained by determining the number of ith bits in the N bytes that are set to 1. If that number is odd, then the ith bit of the result is set to 1. This may sound complicated, but in reality the result can be obtained by simply evaluating the XOR of the N bytes. Parity allows one error in a group (of bytes) to be corrected.

Parity Group Complex RAID types such as RAID 10 or RAID 50 are built using two levels of hierarchy. For instance, consider a RAID 50. A RAID 50 array is comprised of a group of RAID 5 arrays at the first tier. Each RAID 5 array in the first tier is used just like a hard disk in creating a RAID 0 at the next tier. The result is a RAID 50. In this example, each RAID 5 array at the first tier is denoted as a parity group. Each parity group is self-contained in the sense that it is capable of withstanding a disk failure within its group and reconstructing the data in the failed disk from parity information contained within that group.

Partition The space contributed to each array on a physical drive is referred to as a partition.

PCI An acronym for "Peripheral Component Interconnect". It is Intel's local bus standard that supports up to four plug-in PCI cards per bus. Since PCs can have two or more PCI buses, the number of PCI cards they can support are a multiple of four. The current PCI bus implementation (version 2.2) incorporates two 64-bit slots at 66 MHz. Consequently, the highest throughput achievable using such a bus is 528 MB/sec.

PCI-X An enhanced version of PCI version 2.2. It supports one PCI slot per bus when running at 133 MHz, two slots when running at 100 MHz and four slots when running at 66 MHz. It is intended to provide throughputs in excess of 1 GB/sec using a 64-bit wide 133 MHz implementation.

Performance Performance is an important criterion on which a customer judges a RAID controller. There are a number of popular benchmarking utilities that are available to measure the I/O performance of a controller. Some of these utilities simulate specific real-life applications and provide the user a score indicating the controller's overall performance in that niche. Others allow the user to specify tests with specific I/O characteristics and generate throughput numbers corresponding to each specification. The nature of the tests a user may wish to conduct on a controller depends on the application space in which that controller is anticipated to be deployed.

Physical Drive A single tangible drive is referred to as a physical drive.

Primary Storage Main memory i.e., RAM is frequently referred to as primary storage.

RAID Abbreviation of Redundant array of independent disks. It is a set of disk array architectures that provides fault-tolerance and improved performance.

RAID Type There are a number of RAID formats that are widely used. Some of the well-known uni-level types are RAID 0, RAID 1, RAID 3, RAID 5 and RAID 6. The prevalent complex types are RAID 10 and RAID 50. ,

RAID 0 RAID 0 utilizes simple striping, with the data being distributed across two or more disks. No data redundancy is provided. The figure below illustrates a purely hypothetical RAID 0 array comprised of three disks – disks A, B, and C – with four stripes – each uniquely colored – across those disks. **Advantage:** Striping can improve the I/O throughput by allowing concurrent I/O operations to be performed on multiple disks comprising the RAID 0 array. However, this RAID type does not provide any data redundancy.

RAID 1 An array that uses a single pair of disks. Both disks in the pair contain the same data It provides the best data protection but can't improve system performance. And storage space for the same data capacity should be double than in general cases. Hence storage cost doubles. The capacity of RAID 1 will be the size of the smaller HDD, so we suggest you connect HDDs of the same sizes to save HDD space. **Advantage:** RAID 1 ensures that if one of the disks fails, its contents can be retrieved from the duplicate disk. Furthermore, a RAID 1 array can also improve the throughput of read operations by allowing separate reads to be performed concurrently on the two disks.

RAID 3 RAID 3 utilizes a striped set of three or more disks with the parity of the strips (or chunks) comprising each stripe written to a disk. Note that parity is not required to be written to the same disk. Furthermore, RAID 3 requires data to be distributed across all disks in the array in bit or byte-sized chunks. Assuming that a RAID 3 array has N drives, this ensures that when data is read, the sum of the data-bandwidth of N – 1 drives is realized. The figure below illustrates an example of a RAID 3 array comprised of three disks. Disks A, B and C comprise the striped set with the strips on disk C dedicated to storing the parity for the strips of the corresponding stripe. For instance, the strip on disk C marked as P(1A,1B) contains the parity for the strips 1A and 1B. Similarly the strip on disk C marked as P(2A,2B) contains the parity for the strips 2A and 2B. **Advantage:** RAID 3 ensures that if one of the disks in the striped set (other than the parity disk) fails, its contents can be recalculated using the information

on the parity disk and the remaining functioning disks. Consequently read operations can be time-consuming when the array is operating in degraded mode. If the parity disk itself fails, then the RAID array is not affected in terms of I/O throughput but it no longer has protection from additional disk failures. Also, a RAID 3 array can improve the throughput of read operations by allowing reads to be performed concurrently on multiple disks in the set. **Disadvantage:** Due to the restriction of having to write to all disks, the amount of actual disk space consumed is always a multiple of the disks' block size times the number of disks in the array. This can lead to wastage of space.

RAID 5 A RAID 5 array is similar to a RAID 4 array in that, it utilizes a striped set of three or more disks with parity of the strips (or chunks) comprising a stripe being assigned to the disks in the set in a round robin fashion. The figure below illustrates an example of a RAID 5 array comprised of three disks – disks A, B and C. For instance, the strip on disk C marked as P(1A,1B) contains the parity for the strips 1A and 1B. Similarly the strip on disk A marked as P(2B,2C) contains the parity for the strips 2B and 2C. **Advantage:** RAID 5 ensures that if one of the disks in the striped set fails, its contents can be extracted using the information on the remaining functioning disks. It has a distinct advantage over RAID 4 when writing since (unlike RAID 4 where the parity data is written to a single drive) the parity data is distributed across all drives. Also, a RAID 5 array can improve the throughput of read operations by allowing reads to be performed concurrently on multiple disks in the set.

RAID 10 A RAID 10 array is formed using a two-layer hierarchy of RAID types. At the lowest level of the hierarchy are a set of RAID 1 arrays i.e., mirrored sets. These RAID 1 arrays in turn are then striped to form a RAID 0 array at the upper level of the hierarchy. The collective result is a RAID 10 array. The figure below demonstrates a RAID 10 comprised of two RAID 1 arrays at the lower level of the hierarchy – arrays A and B. These two arrays in turn are striped using 4 stripes (comprised of the strips 1A, 1B, 2A, 2B etc.) to form a RAID 0 at the upper level of the hierarchy. The result is a RAID 10. **Advantage:** RAID 10 ensures that if one of the disks in any parity group fails, its contents can be extracted using the information on the remaining functioning disks in its parity group. Thus it offers better data redundancy than the simple RAID types such as RAID 1, 3, and 5. Also, a RAID 10 array can improve the throughput of read operations by allowing reads to be performed concurrently on multiple disks in the set.

RAID 50 A RAID 50 array is formed using a two-layer hierarchy of RAID types. At the lowest level of the hierarchy is a set of RAID 5 arrays. These RAID 5 arrays in turn are then striped to form a RAID 0 array at the upper level of the hierarchy. The collective result is a RAID 50 array. The figure below demonstrates a RAID 50 comprised of two RAID 5 arrays at the lower level of the hierarchy – arrays X and Y. These two arrays in turn are striped using 4 stripes (comprised of the strips 1X, 1Y, 2X, 2Y, etc.) to form a RAID 0 at the upper level of the hierarchy. The result is a RAID 50. **Advantage:** RAID 50 ensures that if one of the disks in any parity group fails, its contents can be extracted using the information on the remaining functioning disks in its parity group. Thus it offers better data redundancy than the simple RAID types, i.e., RAID 1, 3, and 5. Also, a RAID 50 array can improve the throughput of read operations by allowing reads to be performed concurrently on multiple disks in the set.

Read Ahead Motivated by the principle of "spatial locality", many RAID controllers read blocks of data from secondary storage ahead of time, i.e., before an application actually requests those blocks. The number of data blocks that are read ahead of time is typically governed by some heuristic that observes the pattern of requests. The read-ahead technique is particularly efficient when the spatial distribution of an application's requests follows a sequential pattern.

Read-Modify-Write This is a term used to characterize an efficient methodology using which parity is calculated and written into a RAID array. However, before we describe this methodology, let us briefly touch upon the most obvious and brute-force way of determining and writing parity (in response to a write operation) into a RAID array. Assume that data is being written into a strip on the RAID array that supports redundancy by the use of parity. Let us denote this as the target strip. Also assume that there are N strips per stripe including the parity strip and the target strip. Then to recalculate parity for that stripe, the following steps may be taken. First the contents of the N − 2 non-parity strips (belonging to the same stripe as the target strip) have to be read. This is followed by N − 2 XOR operations on the contents of the N − 2 strips that were just read plus the new contents of the target strip. This is followed by 1 operation to write the new data into the target strip and 1 operation to update the value of the parity strip. In all the total number of read, XOR and write operations are N − 2, N − 2, and 2 respectively adding up to a grand total of 2N − 2. Let us now discuss the "read-modify-write" method for calculating and writing parity. It is based on simple algebra, and is more efficient than the method described earlier when the value of N is large. Suppose d1, d2,… dt,… dN-1 are the data contents of the N − 1 non-parity strips with dt being the contents of the target strip. Let, p = d1 ^ d2 ^ … dt ^ …^ dN-1 Now suppose that the new data to be written into the target strip is d't.We wish to determine the value of p' = d1 ^ d2 ^ … d't ^ …^ dN-1. Now, p ^ p' = (d1 ^ d2 ^ … dt ^ …^ dN-1) ^ (d1 ^ d2 ^ … d't ^ …^ dN-1) p ^ p' = dt ^ d't, since ^ operation is commutative and associative p' = dt ^ d't ^ p In other words, the new parity can be evaluated by calculating the XOR of the old data in the target strip, the new data for the target strip and the old parity. Clearly this requires only 2 reads – one for the old data and the old parity – followed by 2 XOR operations with 2 writes – one for writing the new data into the target strip and the new parity, giving us a grand total of 6 operations. Why is this better? When the value of N is large, i.e., the size of the parity group is large; the brute-force method utilizes far more operations!

Read Through Using this methodology, a read operation not only reads data from secondary storage into system memory but also places the data into the cache such that future need for the same data can be addressed expeditiously by directing a read operation for that data into the cache only.

Rebuild When a RAID array enters into a degraded mode, it is advisable to rebuild the array and return it to its original configuration (in terms of the number and state of working disks) to ensure against operation in degraded mode

SATA Acronym for "**Serial ATA**". A hard disk drive interface standard developed to enhance connectivity and speed over the IDE, or Parallel ATA disk interface. Current generation SATAII supports speeds up to 300MB/S.

SCSI acronym for "**S**mall **C**omputer **S**ystem **I**nterface", SCSI is a set of standards for physically connecting and transferring data between computers and peripheral devices. The SCSI standards define commands, protocols, and electrical and optical interfaces. SCSI is most commonly used for hard disks and tape drives, but it can connect a wide range of other devices, including scanners and CD drives. Most modern storage protocols are based on the SCSI Block Protocol.

Secondary Storage Mass storage devices such as hard disks, magneto-optical disks, floppy disks and tapes are frequently referred to as secondary storage.

Stripe A stripe is a logical space that spans across multiple hard disks with each constituent hard disk contributing equal strips (or chunks) of space to the stripe. In the figure below, strips 1, 2, and 3 from hard disk 1, 2, and 3 respectively comprise a (purple colored) stripe. **Synonym:** major stripe

Stripe Set A stripe set is a set of stripes that spans across multiple hard disks. In the figure below, the displayed stripe set has 4 stripes, with strip number 1 comprised of the purple strips 1A, 1B and 1C. Stripe number 2 is comprised of the green strips 2A, 2B and 2C etc.

Stripe Size This is the size of the strips that constitute each stripe. This term is a misnomer – though prevalent – since it should appropriately be called strip size or chunk size.

TCP/IP This is an acronym for "**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol". It is comprised of two parts TCP and IP. The former, i.e., TCP is a peer-to-peer connection oriented protocol that guarantees the delivery of data packets in the correct sequence between two peers. The latter, i.e., IP is the protocol that defines and governs addressing, fragmentation, reassembly and time-to-live parameters for packets.

Volume Set A volume set is a concatenation of storage elements that may be RAID arrays, JBODs, or simply areas of disks that are not part of RAID arrays.

Write-back Cache a caching scheme that acknowledges the write request as complete before data is written to the final storage location. This methodology can improve the efficiency of write operations under favorable circumstances, but is at risk of data incoherencies in a system that is not protected from power fluctuations or failures.

Write-through Cache When a cache is operating in write-through mode, data written into the cache is also written to the destination secondary storage devices. Essentially write completion does not occur until the data is written to secondary storage. Thus the contents of the cache and the secondary storage are always consistent. The advantage is that the possibility of data corruption is greatly reduced. The disadvantage is that write-through operations are more time consuming

XOR Function All RAID arrays (with the exception of RAID 0, RAID 1 and RAID 10) require parity to be calculated and written to the array in conjunction with data. Typically the parity is a simple XOR on the bytes comprising a stripe. This is a computationally intensive operation that many modern RAID controllers perform using a dedicated ASIC often referred to as a XOR-engine.

Appendix E: Product Specifications

System Architecture
Marvell Orion advanced I/O processor
PCI Express Interconnect
Dual XOR DMA engines capable of reading from up to eight sources, perform bitwise XOR
between the eight sources, and writes the result to a destination.
128MB on-board DDR2-400 SDRAM with ECC protection
Marvell SATA ll drive channel controller
NVRAM for RAID configuration & transaction log
Write-through or write-back cache support
Firmware in Flash ROM for easy upgrades

Disk Bus Interface
4 hot swappable, SATA2-NCQ, 7200 RPM Disk Drives
4 discrete SATA2 drive channels
48-bit LBA support allows disk exceeding 137GB
Staggered Spin-Up of Individual Disk to minimize Power-on Surge

RAID Features
RAID level 0, 1 (0+1), 3, 5, Span, JBOD, disk passthrough
Multiple RAID selection
Array roaming
Online RAID level/ stripe size migration
Online capacity expansion and RAID level migration simultaneously
Automatically and transparently rebuilds hot spare drives
Hot swappable disk drives
Instant availability and background initialization
Automatic drive insertion / removal detection and rebuilding
Field-upgradeable firmware in flash ROM
Firmware-embedded management via Front Panel, web browser-based RAID management,
RS232 Terminal session, and/or telnet Session

Dual Concurrent Host Bus Channels
External SATA-300 channel; Transfer rate up to 300MB/sec with Native Command Queuing
support
USB 2.0 host channel, 480mbit EHCI transfers enabled

Monitors / Indicators
LCD Display and Control Panel for setup, alarm mute and configuration
4 drive LED indicators and 3 environment LED indicators
Environment and drive failure indication through LCD, LED and alarm buzzer

RAIDBank4 Dimensions:
Width: 4.85"
Depth: 6.5"
Height: 9.1"

RAIDBank4 Owner's Manual

Weight:

    9 lbs empty

    15 lbs with drives.

Power Consumption:

    Normal operation: 2.3 AC Amps @ 115 Volts

    Spin up (peak): 3.70 AC Amps @ 115 Volts

Power Requirements:

    Internal Auto-sensing 180W power supply (90-240vac) (47-62Hz)

Operating Environmental Specifications:

    Temperature 5ºC - 55ºC (41ºF - 131ºF)

    Humidity 10% - 90% RH (Non-condensing)

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