RAIDBANK5

By MicroNet

Owner's Guide

September 2010

MicroNet

Storage you can rely on

www.MicroNet.com

Welcome From MicroNet Technology

We are pleased that you have chosen the RAIDBank5. 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
> 20525 Manhattan Place
> Torrance, CA 90501
> info@micronet.com

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Two Year Limited Warranty

Micronet warrants this product (the "Product") against defects in material or workmanship as follows:

1. LABOR: For a period of two (2) year from the original date of purchase from Micronet or its authorized reseller, Micronet will repair defective Product (or, at its option, replace with a new or recertified product) at no charge. After this 2 year period, you must pay for all labor charges.

2. PARTS: For a period of two (2) year from the original date of purchase from Micronet or its authorized reseller, Micronet will supply, at no charge, new or rebuilt replacement parts in exchange for defective parts of this Product. Any replacement parts will be warranted for the remainder of the original warranty period or ninety (90) days from installation by Micronet. All exchanged parts replaced under this warranty will become the property of Micronet.

This warranty only covers the hardware components packaged with the Product. This warranty does not cover any software contained in, or included with, the Product; any such software is provided "AS IS". Please refer to any documentation included with the software for your rights and obligations with respect to the software.

This warranty extends only to you, the original purchaser. It is not transferable to any one who subsequently purchases the Product from you.

Proof of purchase in the form of a bill of sale (which is evidence that the Product is within the warranty period) must be presented to obtain warranty service.

To obtain warranty service you must take the Product, or deliver the Product freight prepaid, in either it's original packaging, or in a package that provides the Product with a degree of protection equivalent to that of the original packaging, to Micronet. Please contact Micronet at the number listed on the reverse side for further information.

Micronet is not responsible for any damage to, or loss of, any programs, data, or other information stored on any media or any part of any Product serviced hereunder. Be sure to remove all features, parts, options, alterations, and attachments not under warranty prior to returning the Product to Micronet. Micronet is not liable for any loss or damage to these items.

This limited warranty does not cover: (1) any consumables (such as batteries) supplied with this product; cosmetic damages; damage or loss to any software programs, data or removable storage media; or damage due to the Product such as but not limited to excessive heat or humidity, or modifications of this Product; (2) improper installation, operation, testing or maintenance of this Product; (3) power failure or connection to improper voltage supply; or; (4) attempted repair by any party other than Micronet. This Warranty does not apply when the malfunction results from the use of this Product in conjunction with accessories, products or ancillary or peripheral equipment, or where it is determined by Micronet that there is no fault with this Product itself. This Limited Warranty is invalid if the factory applied serial number has been altered or removed from the Product.

Repair or replacement as provided under this warranty is the exclusive remedy of the consumer. Micronet shall not be liable for any incidental or consequential damages for breach of any express or implied warranty, breach of contract, negligence, strict liability or any other legal theory related to this product. Such damage include, but are not limited to, loss of profit, loss of data, loss of use of the product or any associated equipment, down time and purchaser's time. Except to the extend prohibited by applicable law, any implied warranty of merchantability or fitness for a particular purpose on this product is limited in duration of this warranty.

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Limitations of 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.

Chapter 1. Getting Started

Thank you for purchasing The MicroNet RAIDBank5 storage solution. With speed, high capacity, ease of use, and support for numerous applications, RAIDBank5 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 RAIDBank5 Subsystem is a high-performance RAIDBank5 built around a powerful 64bit controller designed to meet or exceed the highest industry standards. Outstanding features include:
- SuperSpeed USB 3.0 (Compatible with USB 2.0), eSATA-300, FireWire 800, and FireWire 400 host connections for maximum host flexibility
- SATA II, NCQ enabled drive channels
- Configurable RAID engine for optimal performance and fault tolerance

Featuring high performance and availability RAID technology and advanced array management features, The RAIDBank5 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

Note: At the time of publication no Mac OS X drivers are available for USB 3.0. USB 2.0 is fully supported

System Requirements and Compatibility

The RAIDBank5 features USB 3.0 (Compatible with USB 2.0), eSATA-300, FireWire 800, and FireWire 400 host connections, providing nearly universal connectivity. While the RAIDBank5 can function with a variety of hardware and software combination, MicroNet has tested and approved the RAIDBank5 for compatibility with the following architectures:

Apple Hosts: G5/Intel Macintosh computers, OS 10.5 and newer
Windows Hosts: Pentium 4-2.8Ghz and newer, Windows revisions XP SP3 and newer

Unpacking the RAIDBank5

Please unpack your RAIDBank5 in a static free environment, carefully making sure not to damage or discard any of the packing material. If the RAIDBank5 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 RAIDBank5 for repair or upgrade, please use the original packing material to ensure safe transport.

What's Included

Your RAIDBank5 comes with the following items:

1x RAIDBank5 unit
5x Disk Drive Modules
1x SATA to eSATA cable Kit
1x eSATA to eSATA cable
1x USB3.0 Type A to B cable
1x 1394a to 1394a cable
1x 1394b to 1394b cable
1x Fan Module
1x User's Manual and software CD
1x Power Cord
1x Quick Installation Guide

Choosing a location for your RAIDBank5

When selecting a place to set up your RAIDBank5, be sure to follow these guidelines:

• Place on a flat and stable surface capable of supporting at least 25lbs
• Place the RAIDBank5 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 RAIDBank5
• 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**

Installing the Fan Module

Before turning on the RAIDBank5, make sure to unpack and install the fan module as illustrated right. Simply line up the fan with the power connector (bottom edge) and the securing clip slots (left and right,) and gently push the fan evenly until the securing clips click into place.
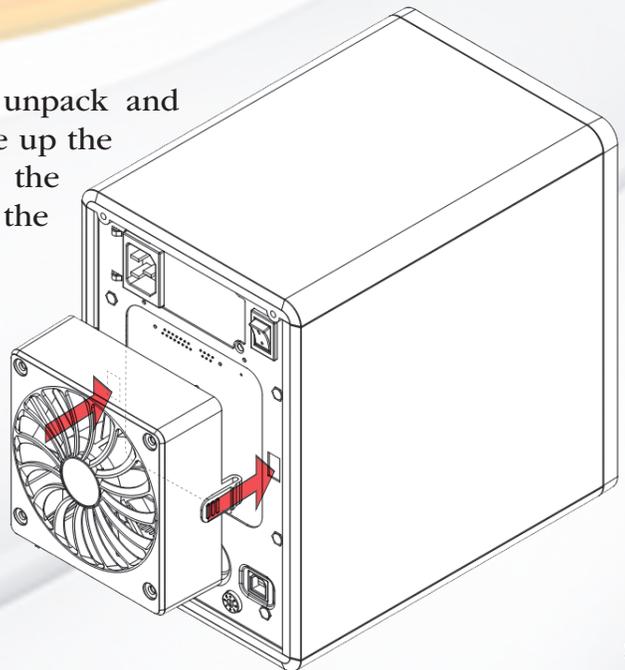
The RAIDBank5 interface components

The following figures illustrate the connector locations for the RAIDBank5.

FRONT VIEW

- Power Indicator
- Fault Indicator
- Host activity Indicator
- Front Display and control keypad
- Disk Activity LED
- Disk Power LED
- Canister Release Latch
- Disk Canisters

REAR VIEW

- AC Power Connector
- Master Power Switch
- Fan vents (DO NOT BLOCK!)
- Host eSATA Port
- Host FireWire 800 Ports
- Host FireWire 400 Port
- Host USB 3.0 Port
- Operating Mode Selector Switch
- Encryption Key Slot
- Settings/Mute/Backup Button
- Security Lock Slot

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 RAIDBank5's current operating status at a glance, as shown here:

Indicator	Normal Status	Problem Indication
Power LED (Front)	LED glows **blue**	Dark on power fault.
Fault LED	LED is dark	LED glows **red**
Host Activity LED	LED glows **blue** when system links to a host; blinks **blue** when data is accessed.	N/A
Disk Activity LED	LED glows **blue** on power on; blinks **blue** during hard drive read and write activity	N/A
Disk Fault LED	LED is dark	This LED will blink **red** on disk fault.

Hot plug Drive Replacement

In the event of a drive failure, the RAIDBank5 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.)

The disk fault light will illuminate red upon disk failure. To replace a drive, please follow these steps:

1. Press down on the **drive release latch** (see page 8, *"The RAIDBank5 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 module with the tray handle open. When the tray is slid all the way into the RAIDBank5, push the tray handle closed.
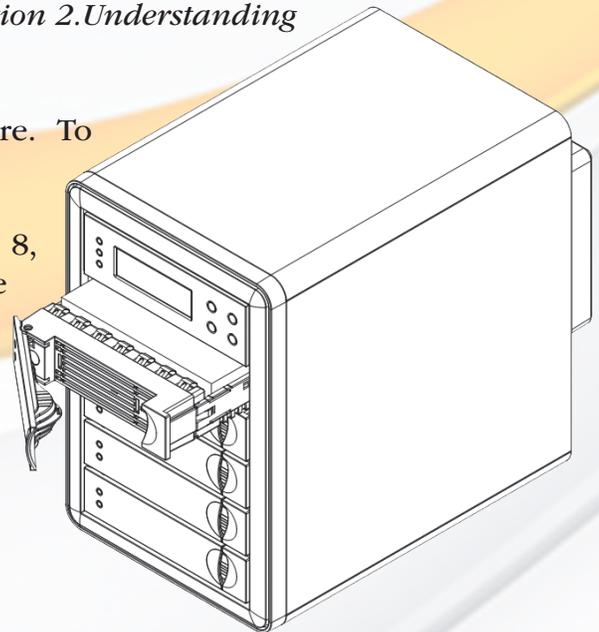
> ⚠ IMPORTANT: NEVER remove a drive tray without replacing it. Operating the RAID with a drive tray missing will disrupt airflow and may cause the RAIDBank5 to fail.

Connecting the RAIDBank5

Connecting the RAIDBank5 requires an available power socket, an operating system capable of addressing volumes larger then 2TB, and a host with one of the following interfaces:
• An available USB 3.0 or 2.0 port
• An external SATA host bus connector with **large LUN and port multiplier support**
• An available FireWire 800 or FireWire 400 port

⚠ **IMPORTANT: The RAIDBank5 can only use one connection at a time. Host plugs are shaped so they can only be properly inserted one way; be sure to insert the plugs properly or you may damage the system and void the warranty.**

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) Connect the square USB 3.0 connector (type B) of the included USB 3.0 cable to a the square USB plug on the RAIDBank5 (illustrated right in blue), and the rectangular end to a free USB port on your computer. The USB 3.0 ports are backwards compatible with USB 2.0.

   (eSATA) Connect the included eSATA cable to a free eSATA port on your computer (illustrated right in green.) 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.
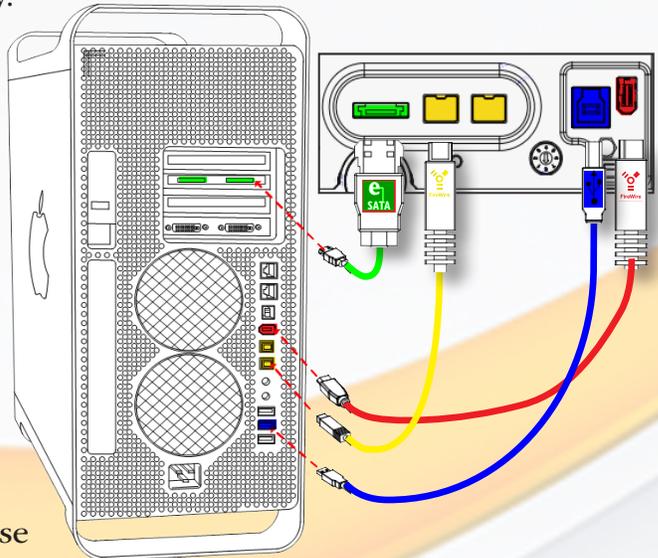
📓 **Note:** The RAIDBank5 requires an eSATA host connection with the following features:
   • Port Multiplier Support
   • Large LUN Support
   • AHCI Mode Enabled and Active
   Please consult your eSATA host bus manufacturer for more information.

   (FireWire 400) Connect the FireWire 400 connector of the included FireWire cable to a FireWire 400 port on the RAIDBank5, and the other end to a FireWire port on your computer (illustrated in red).
   (FireWire 800) Connect the FireWire 800 connector of the included FireWire 800 cable to a FireWire 800 port on the RAIDBank5, and the other end to a FireWire port on your computer (illustrated in yellow).

📓 **Note:** All three FireWire ports are members of the same bus. You may daisy chain additional FireWire devices from a single host connection.

4. Flip the power switch located on the back of the RAIDBank5 to the "ON" position (labelled "-".)

Installing the Included host bus adapter

1. Turn your computer off and any peripherals connected to the computer (ie. printers, external hard drives, etc.). Unplug the power cable from the rear of the power supply on the back of the computer.
2. Remove the cover or door to access your computer's expansion slots. For more information on how to access your computer's expansion slots consult your computer's user manual.
3. Locate an open PCI Express slot and remove the metal cover plate on the rear of the computer case (1X ~ 16X lane slots supported).
4. Insert the card into the open PCI Express slot and fasten the bracket to the rear of the case, per your computer's documentation.
5. Connect an LP4 molex power connector from the computer's power supply to the LP4 connector on the card.
6. Replace your computer cover and reconnect power.
7. Power on your computer. Windows machines should automatically identify the new hardware and install drivers. If driver installation is not successful, insert the provided Driver CD into the computer's CD/DVD drive. Autorun should start the installation program, (If Autorun does not start, Go into "My Computer" and access the CD/DVD drive that the CD is in, and run the "setup.exe" file located on the CD.) Follow the instructions onscreen to complete the driver installation.

> **Note:**
> At the time of publication no Mac OS X drivers are available for USB 3.0

RAID System Management Controls

Following the hardware installation, the RAIDBank5 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:

- RAID Mode Selector Switch
- Front panel touch-control keypad
- RAIDBank management Software

These user interfaces can access the built-in configuration and administration functions that reside in the controller's firmware. Advanced features such as multiple volume support, remote notification, firmware updates, etc are accessible via the RAIDBank Management software.

Configuration via RAID Mode Selector Switch

> ⚠ **IMPORTANT: Changing the mode of operation will destroy all existing data! Please use care when changing operating modes!**

There are 7 Modes of operation addressable by the rotary switch, listed as follows:

- Stripe (RAID 0)- Position 0
- Mirror (RAID 10)- Position 1
- Cloned Mirror (RAID 1)- Position 2
- RAID 3 (Fixed Parity)- Position 3
- Graphic User Interface (GUI) Control- Position 4
- RAID 5 (Distributed Parity)- Position 5
- Large Mode (Span)- Position 6
- Port Multiplier (JBOD)- Position 7
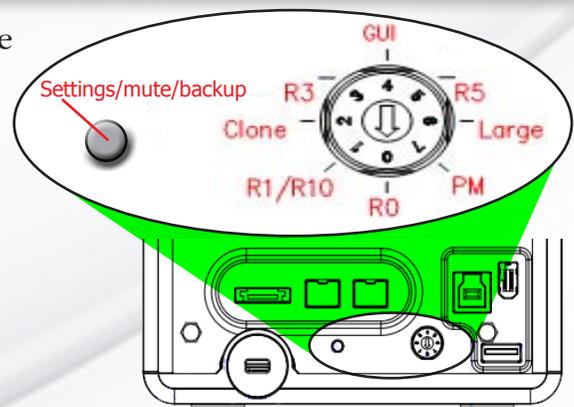
To set or change a RAID operating mode please follow the procedure herein:

1. Turn off the RAIDBank5

2. Use a small flathead screwdriver to turn the rotary mode selector switch to the operating mode desired.

3. Press and hold the multifunction button "setting/mute/backup" button illustrated above and power on the RAIDBank5. Release the button about 5 seconds after power on.

The RAIDBank5 will utilize all available hard drives to create a single RAID volume. For more information regarding RAID technology and operating modes, please see *Chapter 2: Understanding RAID*.

Using the front panel touch-control keypad

The Micronet RAIDBank5 has a front panel keypad and liquid crystal display (LCD) that may be used for system configuration. 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. Refer to *Chapter 4: RAIDBank5 Front Panel* for more information.

Using the RAID management Application

The MicroNet RAIDBank5 has a software configuration manager for users to administrate one or multiple RAIDBank5 RAID subsystems attached to the host computer. Users need to install the RaidBank5 Manager on the PC or MAC which the RAIDBank5 is connected to. The RAIDBank5 Manager provides a simple graphic user interface that users can easily create volumes, monitor hardware status, check event logs and upgrading the firmware, etc. There are two modes in RAIDBank5 Manager: Basic Mode and Advanced Mode. In Basic Mode, some basic functions are available, such as hard disk information, viewing event logs, creating a RAID volume and setting one button backup. Advanced mode allows administration of email notification, upgrading firmware and System information, etc. Refer to *Chapter 4: RAIDBank5 Manager* for more information.

Chapter 2. Understanding RAID

The RAIDBank5 controller subsystem is a high-performance SATA2 drive bus disk array controller. When properly configured, the RAIDBank5 can provide non-stop service with a high degree of fault tolerance through the use of RAID technology and advanced array management features.

The RAIDBank5 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 RAIDBank5 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 RAIDBank5 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.
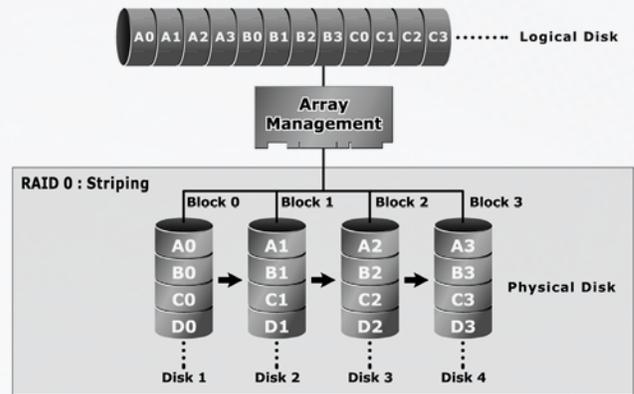
Disk Spanning

This RAID algorithm writes data to multiple disk drives sequentially. Spanning does not provide any data redundancy, and is only as fast as a single disk drive.

Pros: Disk spanning provides a large logical volume from multiple smaller disks. The entire disk capacity is available for user access.

Cons: No fault tolerance, speed equivalent to a single disk.
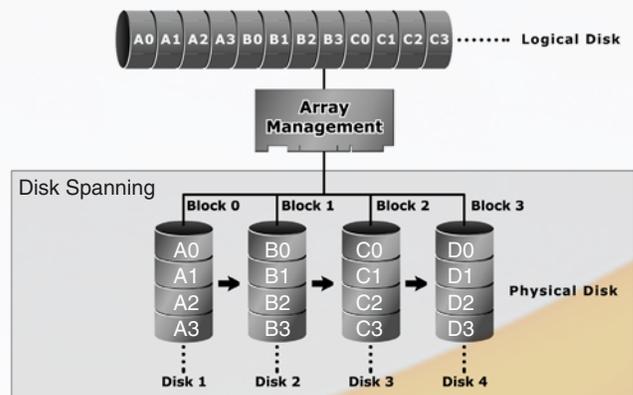

RAID 1 (Disk Mirroring, Cloning)

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.
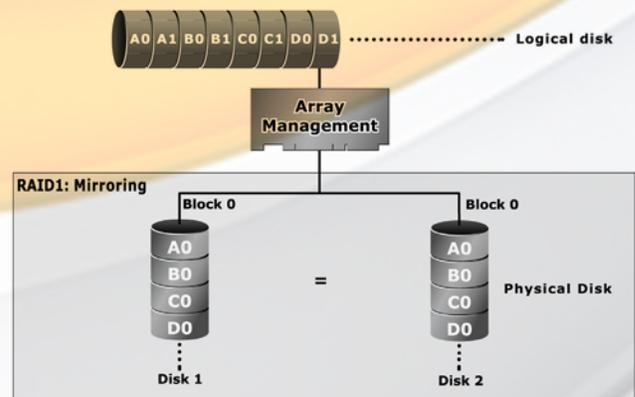
RAID 10 (Striped Mirror)

RAID 10 combines 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.
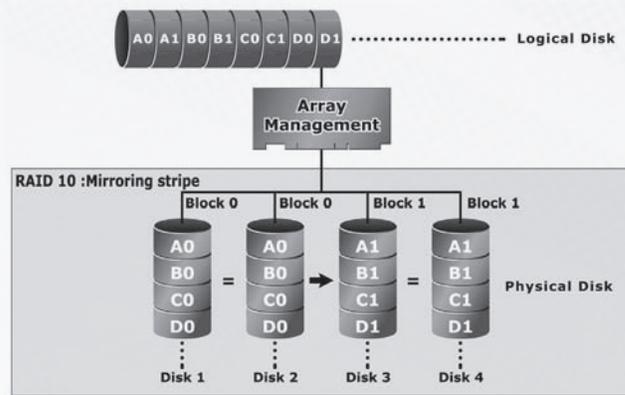
Pros: Fastest read/write performance of any of the Hybrid RAID levels. Fault tolerant
Cons: Requires double the raw data storage capacity

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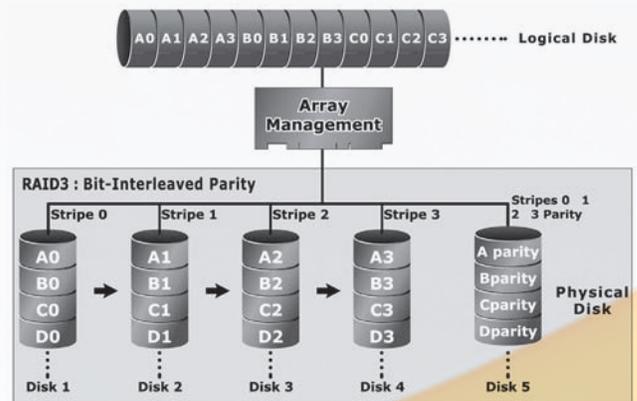
Pros: Very good large file transfer performance. Fault tolerant.
Cons: Not well suited for transaction processing or other I/O request-intensive applications.

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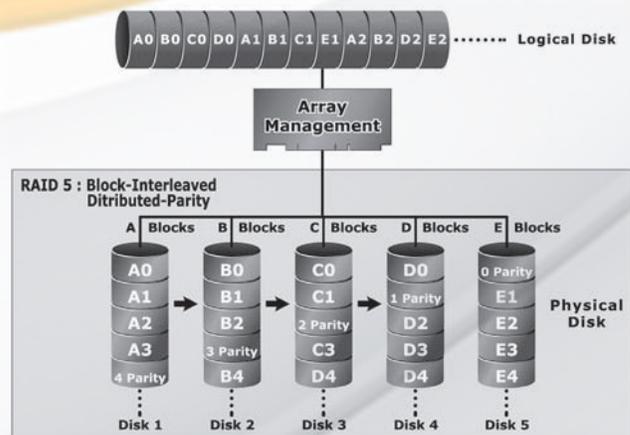
Pros: Very good general transfer performance. Fault tolerant.
Cons: Can be slower then RAID 3 at large size file transfers

Direct Mapping

The RAIDBank5 can simply pass through individual disks to the host operating system. In this mode, all 5 disks are individually accessible to the host operating system. No RAID functions are performed.

Hot Swappable Disk support

Your RAIDBank5 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 RAIDBank5 and replaced with a new drive without disrupting dataflow to the host computer.

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 RAIDBank5. When your RAIDBank5 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 RAIDBank5 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 RAIDBank5 automatically and transparently rebuilds failed drives in the background with user-definable rebuild rates. The RAIDBank5 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 RAIDBank5 using the front panel. The RAIDBank5 LCD configuration 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

Access Procedure

To access control functions from the front panel, press any button to enter Main Menu. The main menu contains four sub-menus, and navigation utilizes *UP/DOWN* to move forward and backward, *ENT* to select , and *ESC* to return to previous menu item.
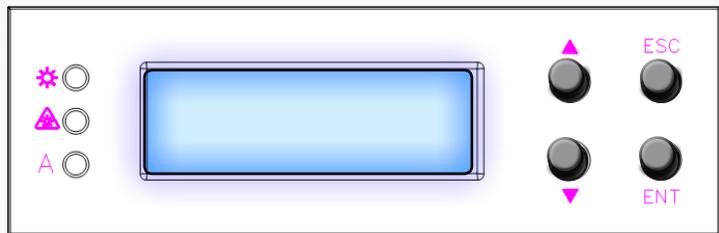
1. Quick Volume/RAID Setup
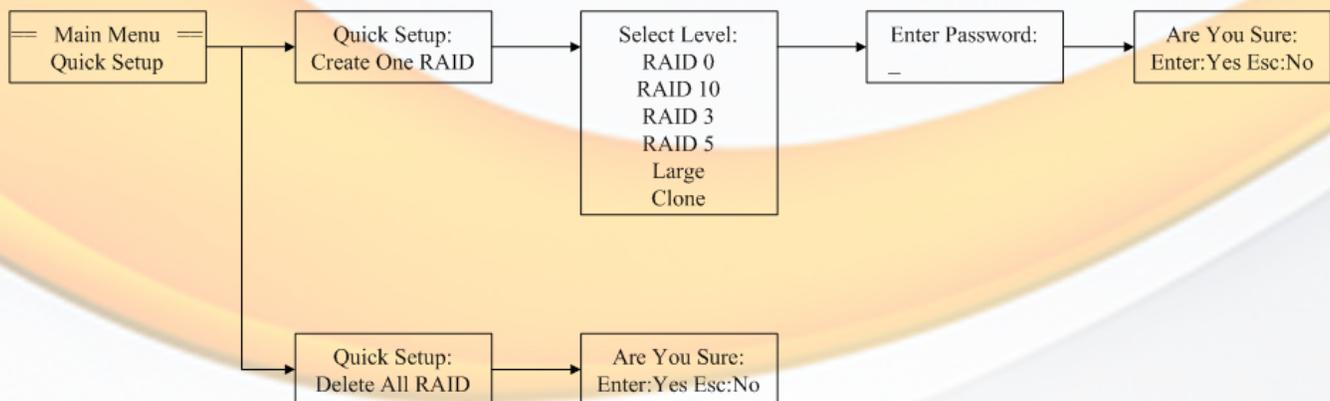

⚠ **CONSIDERATIONS FOR RAID VOLUME CREATION**
Your RAIDBank5 is capable of creating large logical volumes (LUNS) in excess of 2 Terabytes. Large LUNS (>2TB) must be supported by the host bus adapter and the host Operating System to be usable. Windows 2003 and newer, Mac OS X 10.4.8 and newer, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB or FireWire, 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.

2. Disk Management


3. RAID Function Control

| RAID Manager: Delete RAID | → | Select RAID: RAID Set 0 RAID Set 1 | → | Delete The RAID: Enter:Yes Esc:No | → | Waiting System Re-initialize... |

| RAID Manager: RAID Information | → | Select RAID: RAID Set 0 RAID Set 1 | → | RAID Name: RAID Level: RAID Capacity: Member Count: RAID State: |

| RAID Manager: Change RAID Pwd. | → | Select RAID: RAID Set 0 RAID Set 1 | → | Enter New Pwd.: _ |

| RAID Manager: Rebuild Priority | → | Select RAID: RAID Set 0 RAID Set 1 | → | Select Priority: Lowest Level Low Level Medium Level High Level Highest Level | → | Are You Sure: Enter:Yes Esc:No |

| Disk Manager: Standby Timer | → | Select RAID: RAID Set 0 RAID Set 1 | → | Standby Timer: xx minutes | → | Are You Sure: Enter:Yes Esc:No |

4. System Functions

| Main Menu System Manager | → | System Manager: System Info. | → | Firmware Version: Controller Num.: |

| System Manager: Change Password | → | Enter New Pwd.: _ |

| System Manager: Logout From Menu | → | Are You Sure: Enter:Yes Esc:No |

| System Manager: Alarm Control | → | Mute The Buzzer: Enter:Yes Esc:No |

| System Manager: Hardware Monitor | → | Hardware Monitor: Voltage Monitor Temp. Monitor FAN Monitor |

## Chapter 4. RAID Manager Software

Introduction

The RAIDBank5 includes RAID Manager, a management utility for users to administrate one or multiple RAIDBank5 RAID subsystems attached to the host computer. The RAIDBank5 Manager provides a simple graphic user interface to create volumes, monitor hardware status, check event logs, upgrade firmware, etc. This Chapter describes the menu and control structure for your RAIDBank5 using the web interface. The RAIDBank5 configuration utility is firmware based and its operation is independent of host computer type or operating system.

1. Installation

The RAIDBank RAID manager software is available on the CD that came with your RAIDBank5, located under /raid manager. For Windows systems, navigate to /raid manager/windows on the product CD and click on setup.exe. Follow the on screen instructions. For MacOS X Systems, navigate to /raid manager/mac on the product CD, and copy the contained directory to your /Applications directory on your system volume.

2. The User Interface
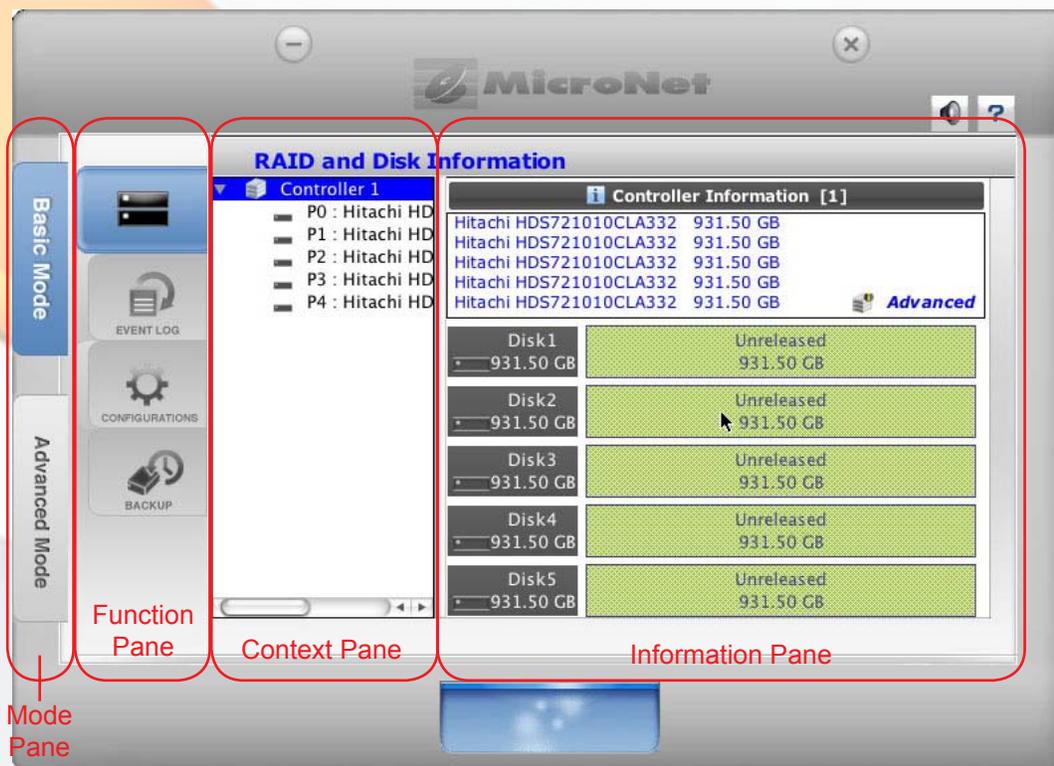
The RAIDBank RAID Manager Interface is divided into 4 sections, or panes. The Pane functions are dependent on operating mode, selected in the Mode Pane. The two operating modes are "Basic" and "Advanced" modes. At the top right of the interface, the ◀ button will toggle muting the system buzzer, and the ? button will display application copyright information.

3. Basic Mode

Basic mode allows simpler and quicker access to system administration. In basic mode, there are four function tags in the function pane: RAID and Disk Information, Event Log Viewer, Basic RAID Configuration and One Button Backup Settings. The current system configuration is displayed in the Information Pane.

3.1 RAID and Disk Information
RAID and Disk Information provides users the information about RAIDBank5 controller, physical disks and RAID volumes. To identify the controllers, RAID volumes and hard disks, click the information bar ( ) at top and the related disk power LED would flash. To display system vitals including temperature, fan speed, and voltages, select the RAID controller from the context pane and click (Illustrated right). Encrypted RAID sets will show a "key" icon (P0 : Hardware RAID), and non encrypted sets will display a "normal" icon (P0 : Hardware RAID). Selecting a RAID set or disk drive below the controller will display the disk information including disk model, capacity, raid membership, etc. To display the disk's SMART (Self-Monitoring, Analysis, and Reporting Technology) status, click for the disk selected in the context pane.
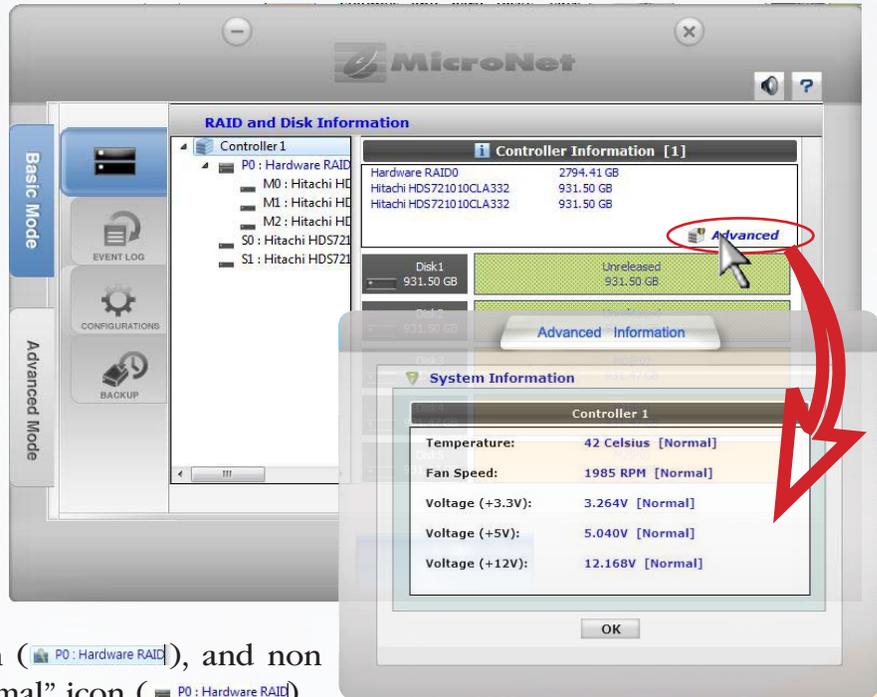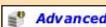
3.2 Event Log
The RAIDBank5 records all notable events the system experiences. To view the event log, click the "Event Log" button in the function pane. Logs include issuing module, date, event type and detailed message. You may save to file or clear the event log from this interface.

3.3 RAID Configuration (Basic Mode)

The simplest and most common configuration for the RAIDBank5 is a single volume RAID set. With that in mind, RAID configuration in basic mode are limited to a single volume, single RAID configurations.

3.3.1 Creating RAID set

Select the desired RAID level in the context pane and the unit will prepare a single RAID volume of the requested RAID Level, and utilize all available disks in the subsystem. If the AES USB Key has been initialized and is plugged in, the volume will be encrypted.
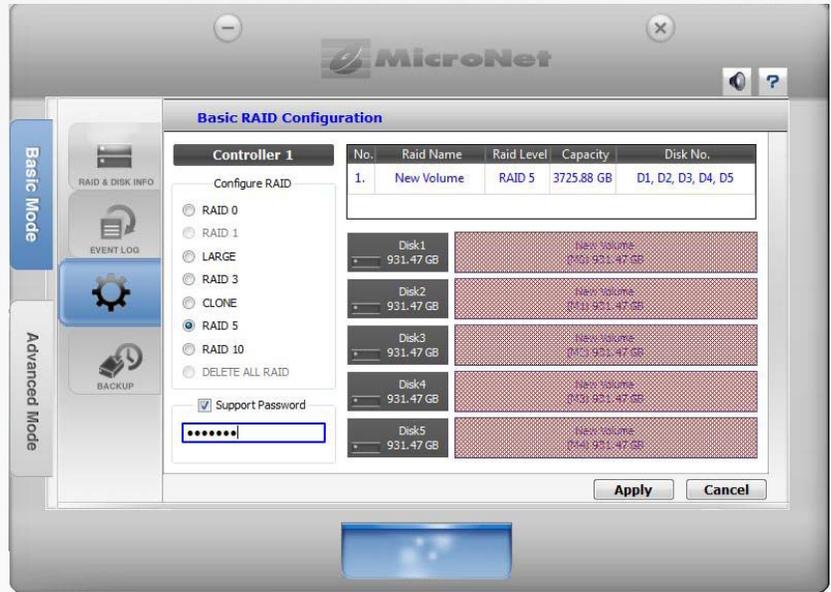
The RAIDBank5 can enforce password protection to avoid inadvertent or unauthorized deletion and modification of RAID sets. To assign an authorization password, check "Support Password" in the bottom of the context pane to enable RAID volume protection, and enter the desired password. The password supports up to 8 characters.

Click Apply to start creating the RAID volume Cancel to undo.

> Note: To create non-encrypted volumes, make sure to boot the RAIDBank5 without the AES USB Key attached.

> ⚠ **CONSIDERATIONS FOR RAID VOLUME CREATION**
> Your RAIDBank5 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 and newer, Mac OS X 10.4.8 and newer, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB or FireWire, 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.

Once the RAID volume is created successfully, an information message will appear including the resulting RAID level, capacity and member disks.

3.3.2 Deleting an existing RAID Set

To delete RAID volumes, select "DELETE ALL RAID" in the context pane. The RAID volume information will turn red with an X mark. If the volume was password protected, enter the password in the bottom of the context pane. Click Apply to delete the RAID set, or click Cancel to abort.
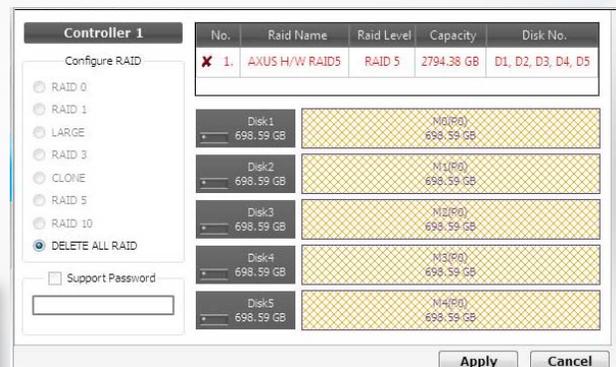
> ⚠ **WARNING: This procedure will erase all data on the RAID system! To delete individual RAID sets selectively, see the Advanced RAID procedure (section 4.2.2, page 27)**

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3.4 Button Backup

The Micronet RAIDBank5 RAID subsystem supports user triggered backup, triggered by the "Set/Mute/Backup" button on the back of the unit (see page 9 for button location illustration.) Once configured, the button will trigger the configured task.

Your RAIDBank5 may arrive with bundled backup software. If you'd like to use the button to trigger this software (or another program of your choosing) make sure it is installed before configuring the button task. In the button configuration screen, enter the program filename including full path (you may use the [Browse] button to locate the program) and the command line arguments as applicable in the "Program Arguments" field.
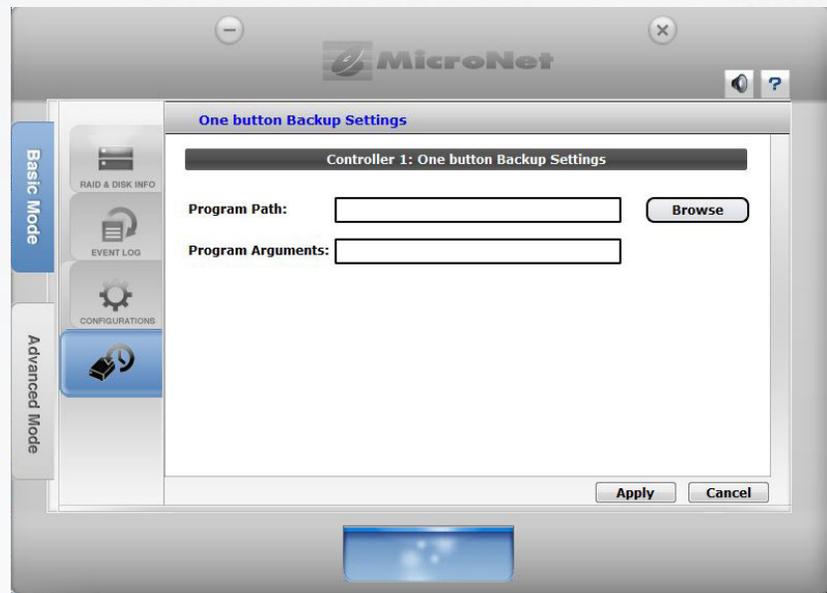
> PCClone EX utilizes a simple syntax for command line arguments. The argument "**/filesbackup:X**" (where "X" is the drive letter of the target drive) will launch a backup to the specified target volume.

4. Advanced Mode

Advanced mode provides interface to the more advanced features of the RAID subsystem. In this mode there are five function tags in the function pane: Email Notification and Event Settings, Advanced RAID Configuration, Firmware Control, RAID power and rebuild settings, and Encryption Control.

4.1 Remote Notification

The RAIDBank5 features an SMTP manager, and can send email notifications for various RAIDBank5 conditions. The following subsections discuss each attribute's descriptions. When all desired options are entered, click [Apply] to finalize or [Cancel] to undo selection.

4.1.1 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 and port in these fields. If you do not know your SMTP server's IP address or server port, consult your network administrator.
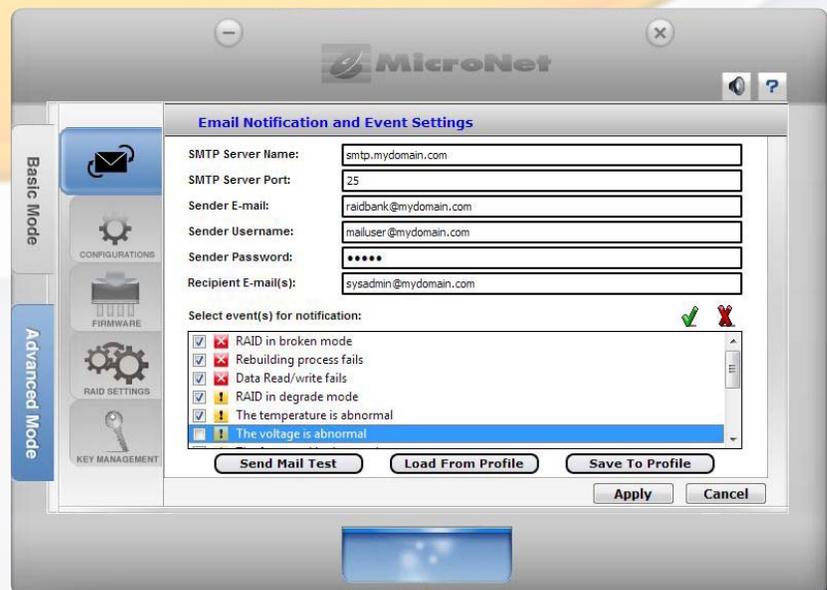
4.1.2 Sender Name and Credentials

In the sender name field, enter a name that will identify the RAIDBank5 as the sender of the email. "RAIDBank5" or the attached host name would be most appropriate. The mail address is not important, but should be used to validate the RAIDBank5 as the sender. The user Account and password fields may be required to authenticate the RAIDBank5 to the SMTP server- consult your network administrator for more information.

4.1.3 Recipients

The RAIDBank5 can send notifications to up to 4 recipients. Enter the respective names and email addresses in this section.

4.1.4 Event Notification Configuration

The entry box at the bottom of the window contains all the events that the RAIDBank5 is designed to trap. Check the event(s) for monitoring (Click ✔ to select all events, or ✘ to deselect all.)

4.1.5 Testing SMTP Settings

When all settings are entered you may wish to verify that the settings are correct and functioning. To send a test email, click Send Mail Test.

**4.1.6 Saving and Loading Notification Profiles**

Once notification settings are complete and functioning, it is recommended that you save the settings for safekeeping. To save remote notification settings, click Save To Profile. To retrieve previously saved settings, click Load From Profile.

4.2 Advanced RAID Configuration

RAIDBank5 RAID subsystem supports up to 5 volumes. Advanced RAID Configuration allows for creating and controlling multiple volumes and RAID sets. Users can also modify the capacity size when creating each RAID volume. Any unassigned hard disk will be used as hot spare.

4.2.1 Creating RAID set

Check the radio button corresponding to "Create RAID" at the top of the context pane to begin. Select the desired RAID level in the bottom of the context pane. Select the disk(s) desired to add to the RAID set (only "unreleased" disks will be available). If the AES USB Key has been initialized and is plugged in, the volume will be encrypted. The RAIDBank5 can enforce password protection to avoid inadvertent or unauthorized deletion and modification of RAID sets. To assign an authorization password, check "Support Password" in the bottom
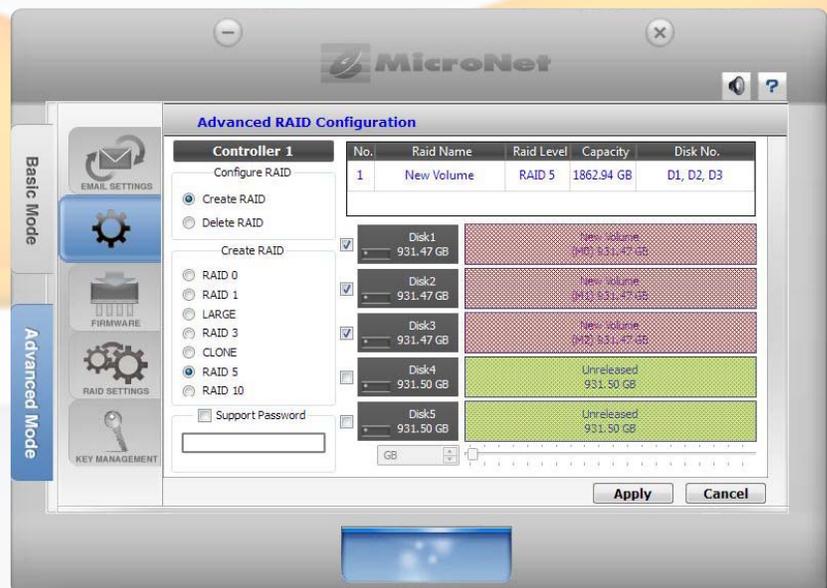
of the context pane to enable RAID volume protection, and enter the desired password. The password supports up to 8 characters.

Click [Apply] to start creating the RAID volume [Cancel] to undo.

⚠ **CONSIDERATIONS FOR RAID VOLUME CREATION**
Your RAIDBank5 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 and newer, Mac OS X 10.4.8 and newer, and Linux distributions with appropriate kernels all support large LUNS. Windows XP and prior cannot address large LUNS natively over USB or FireWire, 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.

Once the RAID volume is created successfully, an information message will appear including the resulting RAID level, capacity and member disks.

4.2.2 Deleting an existing RAID Set
To delete RAID volumes, check the radio button corresponding to "Delete RAID" at the top of the context pane. Select the desired RAID volume in the bottom of the context pane. If the volume was password protected, enter the password in the bottom of the context pane. Click [Apply] to delete the RAID set, or click [Cancel] to abort.
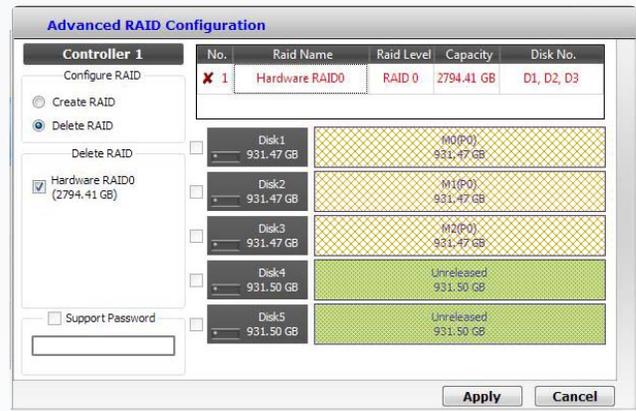
4.3 Firmware
The Firmware information page will display the current Product information and firmware revision. The RAIDBank5's firmware (operating control software) can be field upgraded; MicroNet Support may direct you as to the operation of this option.
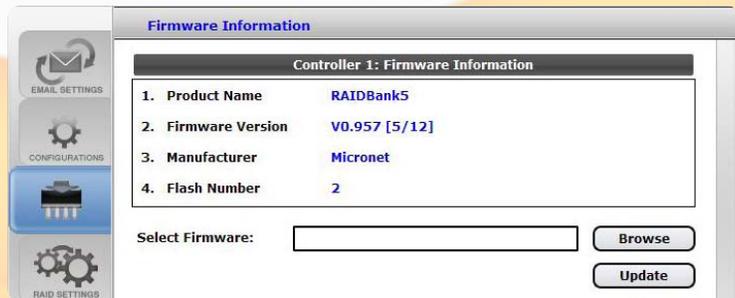
4.4 RAID Standby and Rebuild Priority
This Section contains subsystem option settings for power savings and RAID Rebuild Priority. When desired values are entered, click [Apply] to apply changes or [Cancel] to abort.

4.4.1 Stand By Power Down
The RAIDBank5 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 disks.
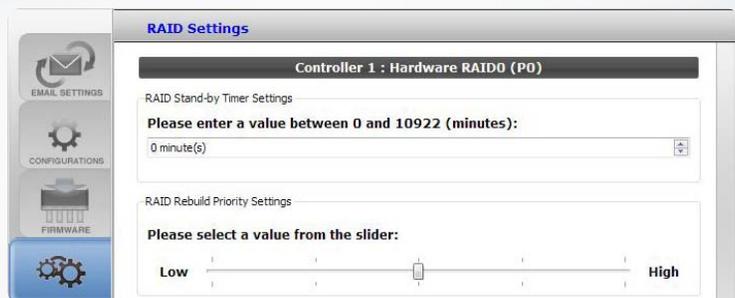
📝 Note: The RAIDBank5 requires the RAIDBank Manager task to be inactive in the tray in order for the powerdown feature to function.

4.4.2 Rebuilding Priority Setting

When the unit is building or rebuilding a RAID set, the RAIDBank5 processor will be shared between the building task and host I/O. This option specifies the relative priority of data I/O and background rebuilding task of RAIDBank5 RAID subsystem. This value has no effect under normal operation but will dictate the length of RAID creation or rebuilding process and the available processor time to service host I/O. The lower the rebuild priority, the longer the rebuild process will take but the impact on host will be lessened. Conversely, the higher the rebuild priority the quicker the rebuild process will take but the impact on host I/O performance will be greater.

4.5 Encryption Management

The RAIDBank5 RAID subsystem integrates real-time data encryption/decryption function. The encryption algorithm implemented by the RAIDBank5 is based on AES (Advanced Encryption Standard) with a key length of 256-bit. The encryption key saved in AES USB key fob can be copied to another AES USB key fob or saved as a file for backup. Your RAIDBank5 comes with a blank AES USB key fob for this purpose. Before creating AES-RAID volumes, The AES USB Key fob will need to be initialized.
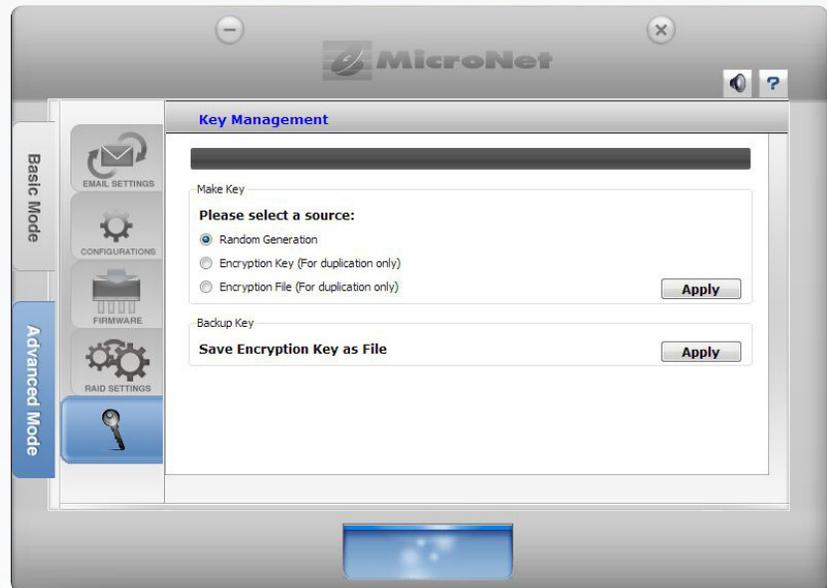
4.5.1 New Key Generation

The included non-encrypted AES USB key fob will need to be initialized before first time use. To initialize a AES USB key fob, insert the key into the RAIDBank5, select the radio button labelled "Random Generation" and click the corresponding Apply. A series of dialog boxes will confirm that the key generation was successful and prompt you to reboot the RAIDBank5 to activate. If the AES USB key fob is encrypted already, a warning message would pop up. Click Yes to overwrite the original AES key or click No to abort.

> ⚠ **WARNING!** Initializing a AES USB key will erase any previous key definition. Any prior encrypted RAID sets will no longer be able to use the AES USB key for decryption!

Once key generation is complete, the RAIDBank5 Manager will prompt you to save a local backup of the key to a file. Micronet advises customers to keep a backup file at all times.

> ⚠ **IMPORTANT!** Encrypted AES-RAID volumes are inaccessible without the AES USB Key. Micronet recommends keeping a backup AES key at all times to allow recovery in case of a lost or overwritten AES USB key.

4- RAID Manager Software

4.5.2 Duplicating Keys
For a variety of reasons, customers may wish to have multiple AES USB key fobs, especially if the RAIDBank5 is to be transported. To duplicate an existing encrypted AES Key, plug in the original AES USB key fob, select the radio button labelled "Encryption Key (for duplication only)" and click the corresponding ![Apply]. A dialog box will prompt you to remove the original key fob and replace it with a new AES USB key fob. If the new AES USB key fob is encrypted already, a warning message would pop up. Click ![Yes] to overwrite the original AES key or click ![No] to abort.

> 📓 Note: Additional AES USB key fobs are available for purchase. Consult your authorized Micronet/Fantom Drives reseller for more information.

4.5.3 Restoring an AES Key from file
To restore an AES key from backup, insert a new AES USB key fob into the RAIDBank5, select the radio button labelled "Encryption File (for duplication only)" and click the corresponding ![Apply]. A File location dialog box will appear. Navigate and select your backup AES file (normally with the extension *.key). A series of dialog boxes will confirm that the key generation was successful and prompt you to reboot the RAIDBank5 to activate. If the new AES key is encrypted already, a warning message would pop up. Click ![Yes] to overwrite the original AES key or click ![No] to abort.

4.5.4 Saving a backup of your AES Key to a file
To save an AES key backup, insert your AES USB key fob into the RAIDBank5, and click ![Apply] corresponding to the "Save Encryption Key as File" option. A File location dialog box will appear. Navigate and select your backup AES file (normally with the extension *.key). A series of dialog boxes will confirm that the key generation was successful.

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 10.5 or greater, and any of the following:
•   Compatible eSATA Host Bus Adapter
•   A USB 2.0 port
•   A FireWire 400 or 800 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 "GUID Partition Table" in the dialog box and click "OK"
1.6 Click "Apply." Your RAIDBank5 is ready to use!

2. Volume Setup on Microsoft Windows 2000/XP/2003

Installation on a Windows system requires a Windows Installation with a properly installed and configured host bus.

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 RAIDBank5 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 RAIDBank5 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.
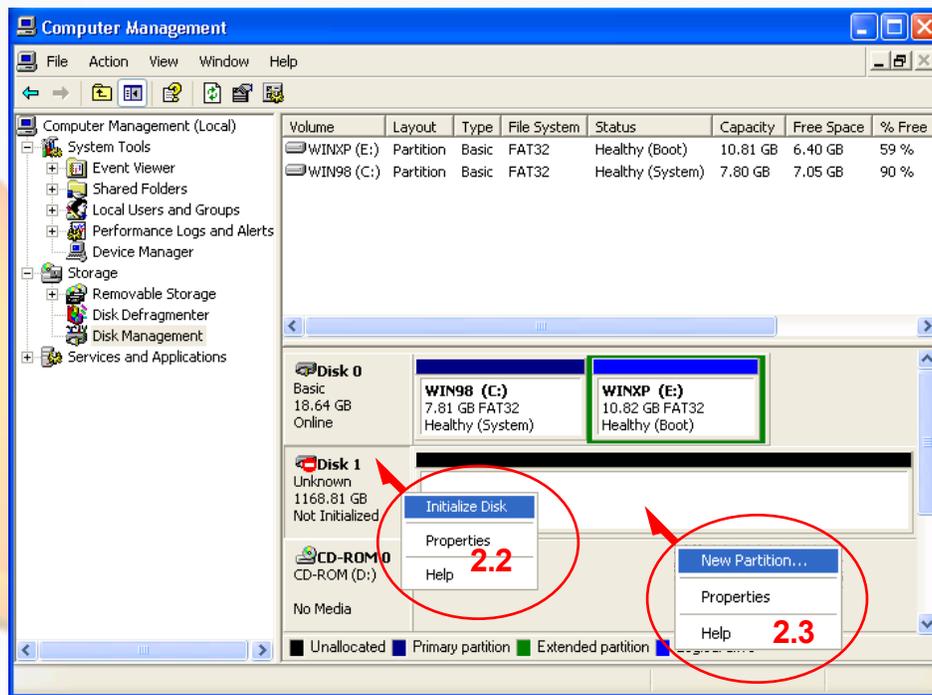
2.3 Right click the initialized volume (The area right of the disk icon.) In the context menu, select "New Partition." Follow the on screen instructions. In the File System pop-up menu, select NTFS. The default formatting option is Full format, which will take about 30-90 minutes. A Quick format will 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 RAIDBank5 is ready to use.

3. Volume Setup on Microsoft Windows Vista/7/2008

Installation on a Windows system requires a Windows Installation with a properly installed and configured respective host bus.

3.1 Open the disk management console. To open Disk Management, click the Windows Start menu orb. In the search box type diskmgmt.msc, and press enter.

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 RAIDBank5 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.
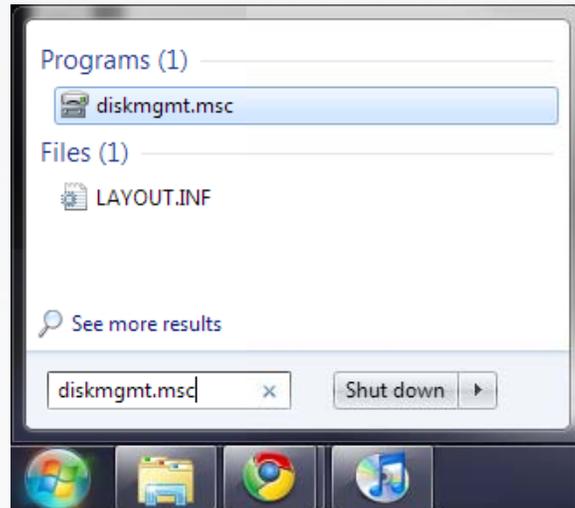
3.2 Right-click on a RAIDBank5 volume. If it's not initialized for use in your system, it will be denoted by a red down arrow on its disk icon. Right click on the disk and select "Initialize Disk." Windows will prompt you to choose a partition style. Choose GPT for volumes larger then 2TB, or MBR for smaller volumes.

> **Note:** The GPT Partition style is not recognized by all previous versions of Windows, and is required for proper addressing of volumes larger than 2TB. If you intend to use a volume on older versions of Windows, consider creating multiple smaller volumes partitioned in the MBR partition style.

3.3 Right click the initialized volume (The area right of the disk icon.) In the context menu, select "New Simple Volume." Follow the on screen instructions. In the File System pop-up menu, select NTFS. The default formatting option is quick format, which will take just a few minutes, but will do less verifying of the Drive than a Full format. A Full format will take about 30-90 minutes. Once the format process is complete, your RAIDBank5 is ready to use.
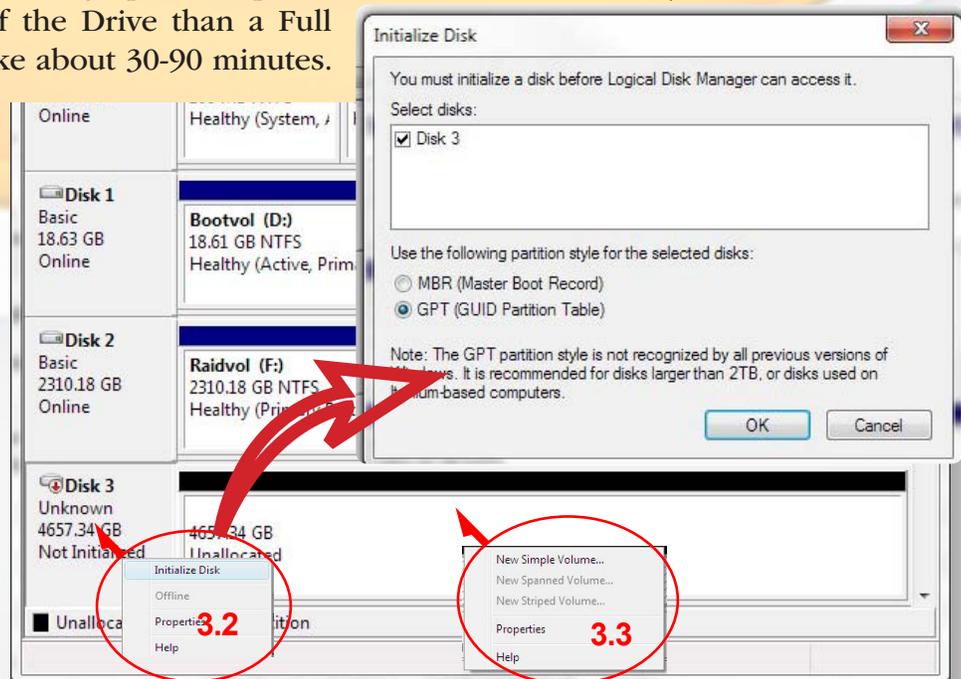
4. Optimizing Windows Caching Algorithm

By default, Windows XP optimizes caching for performance on external drives. Vista and Windows 7 optimize caching for quick removal. As a result, Windows XP appears to have faster access to external disks but at a greater risk of data corruption and loss. To change Windows' caching policy, open the disk management console. A list of the attached drives and their respective volumes will appear. Right-click on the RAIDBank5 volume in the disk list and select properties. Select the Policies Tab near the top left of the window, and check the radio button corresponding to your desired optimization level. Click [OK] when finished, and you may close the disk management applet.

Optimizing for performance can greatly enhance the throughput of your disk but is much more vulnerable to data loss! Make sure to have appropriate backup.
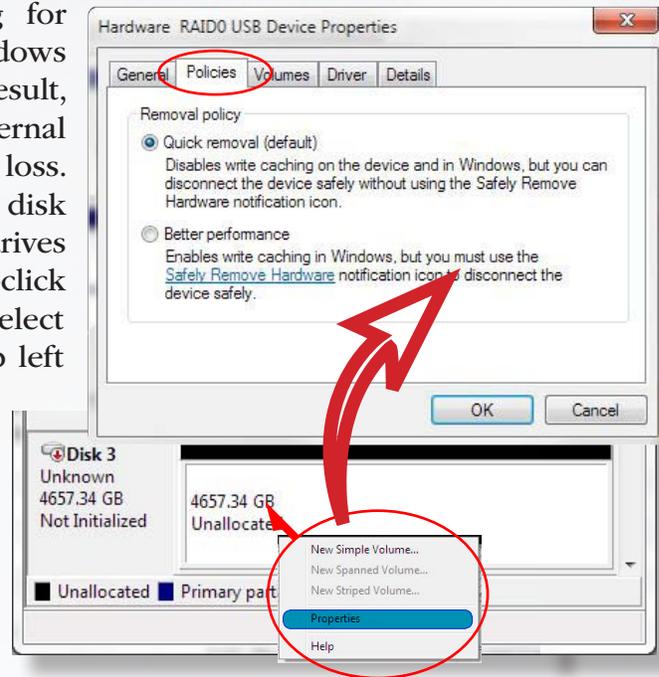
5. Safe Dismounting

When a device such as a hard drive is mounted, that means the computer 'sees' the device and is able to communicate with it. When you dismount a device, the computer no longer sees it. The device may still be running but the computer cannot access it, as though the device no longer exists.

⚠️ **Never turn off or unplug a hard drive without dismounting it first! Doing so could cause data on the drive to be lost or damaged!**

5.1 How to safely dismount- Mac
Drag the icon(s) for the RAIDBank5 volume(s) to the Trash. The drive will dismount and you can then safely disconnect and/or turn it off.

5.2 How to safely dismount- Windows
1. Locate the System Tray. The System Tray includes the time display in the bottom right, and icons to the left of the time. One of the icons will be an hot plug icon (🔌✓).
2. Left-click on (🔌✓). In the dialog box select the volume drive description and drive letter for the device.
3. Left-click on the appropriate device (with the drive letter matching the one used by the RAIDBank5 volume). After a few seconds, Windows will give you a message that it is safe to remove the device.
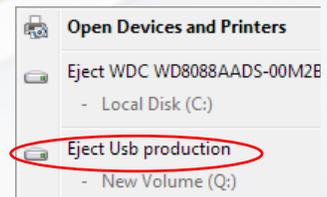
📝 Microsoft Windows may not automatically distinguish between SATA and eSATA disks. To facilitate proper disconnection, we recommend using HotSwap! by Kazuyuki Nakayama. HotSwap! provides the friendly user interface as the built in "safely remove hardware" icon in the notification area, and ensures that data is written and flushed to the disk before the device is marked safe to remove. HotSwap can be obtain from the author's site at http://mt-naka.com/hotswap/index_enu.htm

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.
- RAIDBank5 is compatible with the leading hard disk repair and defragmentation software. 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 RAIDBank5.
- 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 RAIDBank5. Instead, use a soft, dry cloth to wipe the device.

Frequently Asked Questions

General FAQ

Q: Can I leave my RAIDBank5 on all the time, or should I turn it off when not in use?

A: The RAIDBank5 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 RAIDBank5 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 RAIDBank5 is configured as a parity or mirrored RAID, you will be able to sustain a disk failure without losing access to your data.

Q: Can I increase my RAIDBank5'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 RAIDBank5 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 RAIDBank5?

A: RAIDBank5's standard warranty is Two-year limited. Optional extended warranty and overnight exchange programs are available, consult your Micronet dealer or www.MicroNet. com for information.

Q: The RAIDBank5 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: Can I boot from my RAIDBank5?

A: Yes! As long as your host hardware and operating system support booting from eSATA, USB, or FireWire. 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 RAIDBank5 volumes are still not appearing, turn off the RAIDBank5, check all cable connections, wait 10 seconds and re-power on the RAIDBank5. 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 RAIDBank5 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 RAIDBank5 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. USB 3.0 drivers for the optional adapter are included with the adapter.

Q: Do you have "DOS Driver" for the RAIDBank5? How about Windows 98 or NT 4?
A: No. Micronet does not support these operating systems.

Q: Does the RAIDBank5 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 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 RAIDBank5, 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.
20525 Manhattan Place
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	5	(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	5	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 disks. Parity must be equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	4	5	(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 disks. Parity must be equal to the smallest disk capacity in the array. Parity information normally stored on a dedicated parity disk.	3	5	(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 disks. Parity must be equal to the smallest disk capacity in the array. Parity information is distributed across member disks.	3	5	(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- Glossary

ATA Acronym for "**AT** Bus **A**ttachment" - a standard interface to IDE hard disks.

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.

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.

eSATA Standardized in 2004, eSATA (e=external) provides a variant of SATA meant for external connectivity. It has revised electrical requirements in addition to incompatible cables and connectors to standard SATA.

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.

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.

FireWire (IEEE 1394) is a serial bus interface standard for high-speed communications and isochronous real-time data transfer, frequently used by personal computers, as well as in digital audio, digital video, automotive, and aeronautics applications. FireWire can connect up to 63 peripherals in a tree chain topology (as opposed to Parallel SCSI's electrical bus topology). It is designed to support Plug and play and hot swapping. The copper cable it uses (1394's most common implementation) can be up to 4.5 metres (15 ft) long. FireWire 400 is the most common computer application of the technology, and is capable of 400Mbit gross bandwidth. FireWire 800 is backwards compatible with FireWire 400, but has a gross bandwidth of 800Mbit/Sec.

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 (**I**ntegrated **D**evice **E**lectronics) A hard disk drive interface standard developed by Western Digital. Also known 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 "**P**eripheral **C**omponent **I**nterconnect". 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 Express (Peripheral Component Interconnect Express), officially abbreviated as PCIe (or PCI-E, as it is commonly called), is a computer expansion card standard designed to replace the older PCI, PCI-X, and AGP standards. PCIe 2.1 is the latest standard for expansion cards that is available on mainstream personal computers. PCIe, unlike previous PC expansion standards, is structured around point-to-point serial links, a pair of which (one in each direction) make

up a lane. The lanes are designed for multiplexing, and PCIe devices that utilize multiple lanes in this configuration are designated with an "x" multiple to denote the number of lanes they can address simultaneously. The slots are modular- multiple lane slots (such as 16x) can accommodate devices of smaller lane count (such as 1x, 4x, 8x) but usually not the other way.

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 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 Level 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 or simple striping. Data is distributed across two or more disks. No data redundancy is provided. **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. **Disadvantage:** this RAID type does not provide any data redundancy, and a single disk failure would damage the entire volume.

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 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.

Read Ahead Cache 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 Through Cache 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.

RAID 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.

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.

Universal Serial Bus (USB) is a specification created in 1996 by a consortium of companies led by Intel to simplify the connection between host computer and peripheral devices. The original USB 1.x specification was capable of 12 Mbit/sec. USB 2.0 is the most common port at time of publication, and is capable of 480Mbit/sec gross bandwidth. USB 3.0 was ratified in November of 2008, and is capable of 5Gbit/sec gross bandwidth.

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 D: Product Specifications

Disk Bus Interface

   5 hot swappable, SATA2-NCQ enabled 3.5" disk drive mechanisms
   5 discrete SATA2 drive channels
   48-bit LBA support allows disks exceeding 2TB

RAID Features

   RAID level 0, 1 (0+1), 3, 5, Span, JBOD, disk passthrough
   Multiple RAID selection
   Hardware AES Data Encryption
   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
   RAID Control via rotary switch/front panel/host software
   Hot swappable fan module

Host Bus Channels

   External SATA-300 channel; Transfer rate up to 300MB/sec with Native Command Queuing
      support
   USB 3.0 host channel, 5gbit XHCI transfers enabled, backwards compatible with USB 2.0
   FireWire 800/400 Host Channels

Monitors / Indicators

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

RAIDBank5 Dimensions:

   Width: 5.5" (140mm)   **Weight:**
   Depth: 9.5" (242mm)   7 lbs empty
   Height: 8.1" (208mm)   16 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 220W power supply (90-240vac) (47-62Hz)

Operating Environmental Specifications:

   Temperature 5°C - 35°C (41°F - 95°F)
   Humidity 20% -80% RH (Non-condensing)

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.

FTZ/BTZ German Postal Service Notice: We hereby certify that the ADV, SB, SBS, SS, SBX, SBT, MO, MS, MR, MT, MD, CPK, CPKT, CPKD, DD and DDW products are in compliance with Postal Regulation 1046/1984 and are RFI suppressed. The marketing and sale of the equipment was reported to the German Postal Service. The right to retest this equipment to verify compliance with the regulation was given to the German Postal Service.

Bescheinigung des Herstellers/Importeurs: Hiermit wird bescheinigt, daB der/die/das: SB, SBS, SS, SBX, SBT, MO, MS, MR, MT, MD, CPK, CPKT, CPKD, DD, DDW in Ubereinstimmung mit den Bestimmungen der: VFG1046, VFG243 funk-enstort ist. Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerates angezeigt and die Berechtigung zur Uberprdfung der Serie auf Einhaltung der Bestimmungen eingeraumt MicroNet Technology, Inc.
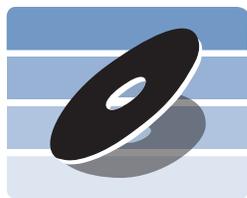
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