

User Manual, MDA (Military Disk Array) OSS-MDA-T5



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1. Revision History

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Appendix

1. Unpacking and Inspection

1.a. Checking the Package Contents

The MDA-T5 is shipped with the components and cables indicated in the table below. Make sure that all components are included in the shipping carton. Notify One Stop Systems if components are missing.

Components Shipped with the MDA-T5

Description	Quantity
Serial Cable and DB9 Adapter	2 each
Drive pack, removable (some configurations have drive packs shipped separately)	2 each
Quick Start Guide, MDA -T5	1 each
Cable, power (for use in North America only)	1 each

1.b. Inspection

After unpacking the unit, examine the MDA-T5 for:

- Verify model and serial numbers on the barcode stickers match the information on the MDA -T5 invoice.
- Bent, scratched, or missing pins on the connectors.
- Rust, discoloration, or signs of corrosion or water, moisture, or chemical damage.
- Drive packs that are cracked, scratched, or dented, and which do not smoothly slide in and out of their drive ports.

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2. Component Identification

2.a. Description

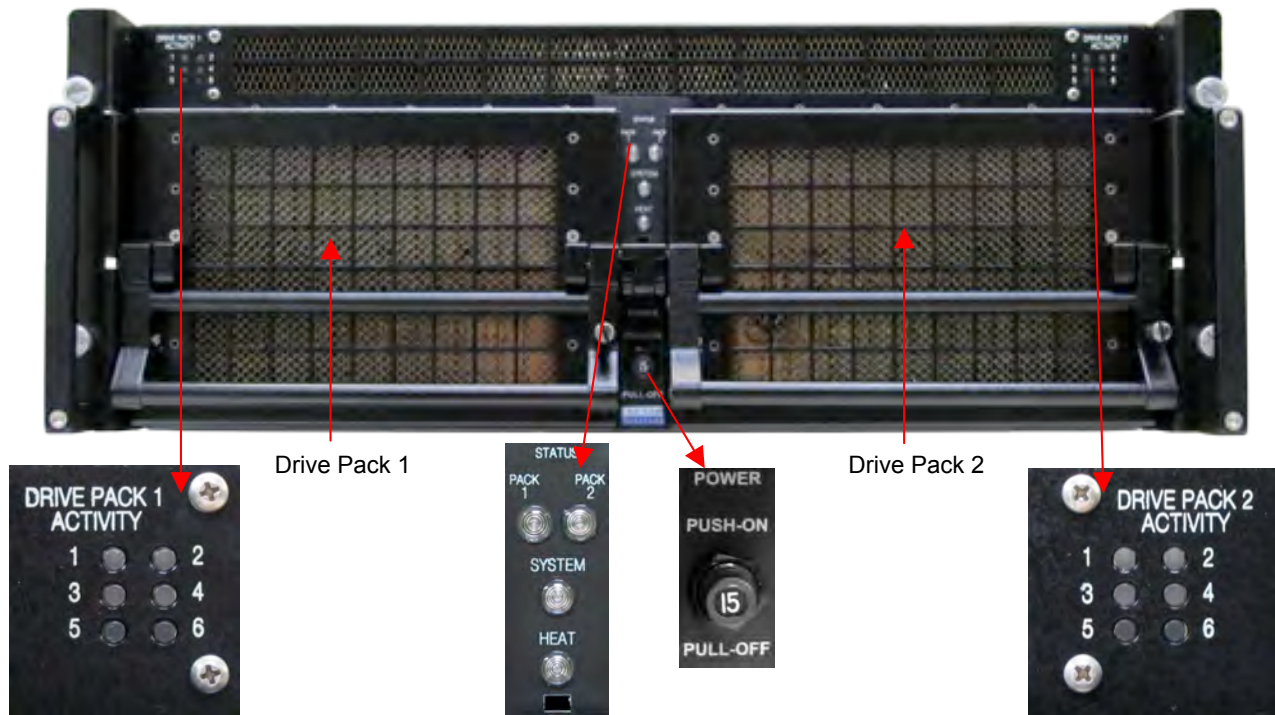
The MDA-T5 is a rugged, high-performance RAID storage chassis with two removable drive packs and dual Storage Bridge Bay (SBB) 2.0-compliant controllers.

Features

- Two easily removable drive packs, each pack holds six physical drives each capable of transporting up to 12TB of data for a total of up to 24TB.
- Optional 1.5TB solid state drives for a total of 18TB
- Hermetically sealed drive packs ensure operation to altitudes of 41,000 ft (12,496 m).
- Rugged and fully field deployable in harsh environments
- Sustained data transfer rates of over 300 MB/s per controller
- Powered by RAIDCore RAID software technology
- Two SBB 2.0 compliant RAID controllers
- Thermal monitoring and control protects against extreme temperatures
- Supports RAID levels 0,1,10 & 5

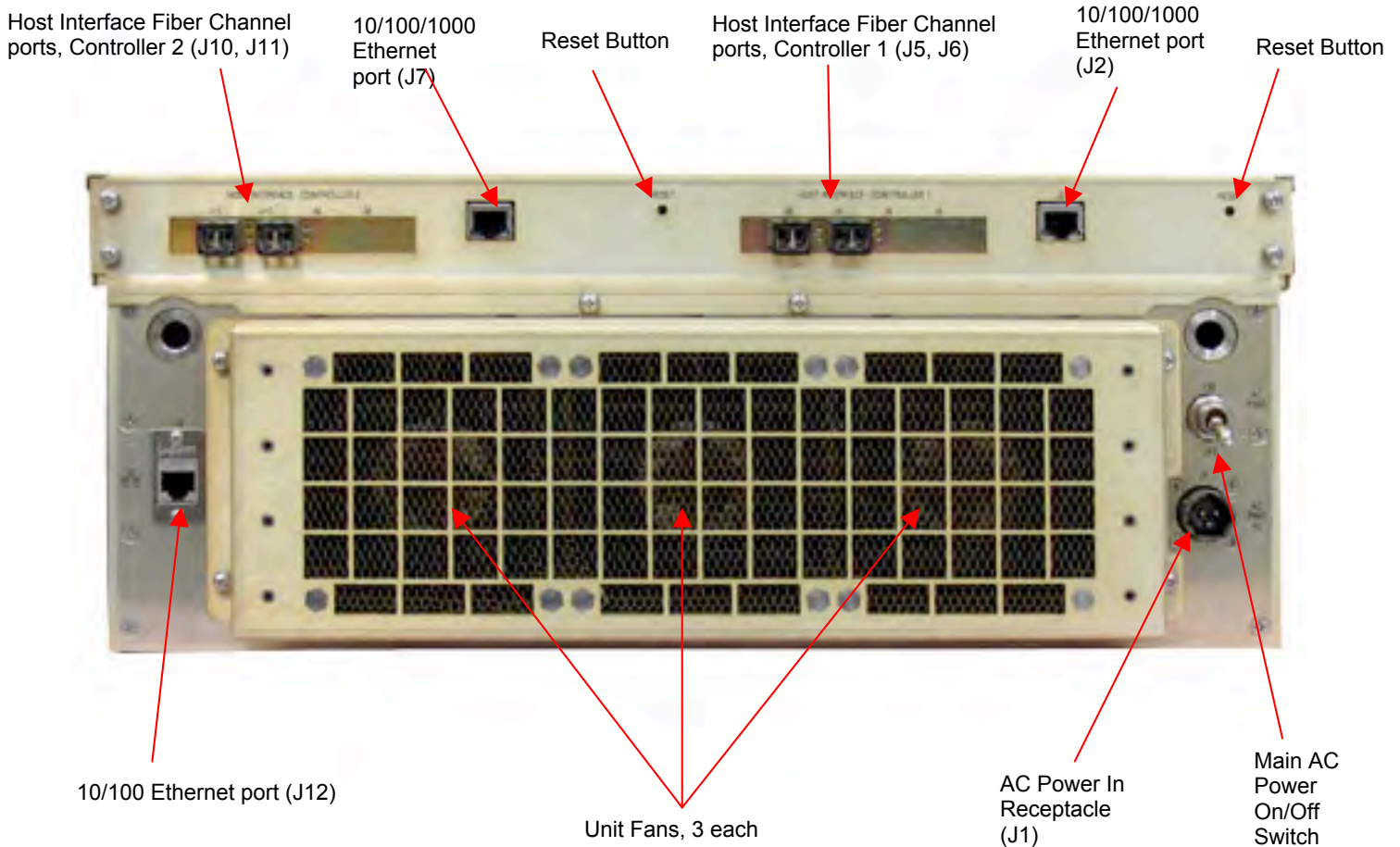


2.b. Front Panel Components



Descriptions of the Front Panel Components Table	
Component	Description
Drive Pack 1, Drive Pack 2	Each removable Drive Pack contains six disk drives or solid-state disks, a SATA/SAS backplane and a drive pack resistive heater. Each drive pack is controlled by a RAIDCore SBB 2.0 RAID controller installed in the rear of the enclosure.
DRIVE PACK 1 ACTIVITY 1-6	Each LED corresponds to disk drives 1 to 6 in Drive Pack 1. A disk drive's LED is illuminated when the disk drive is performing data I/O operations.
DRIVE PACK 2 ACTIVITY 1-6	Each LED corresponds to disk drives 1 to 6 in Drive Pack 2. A disk drive's LED is illuminated when the disk drive is performing data I/O operations.
STATUS - PACK 1	An illuminated LED indicates that the disk pack is installed, fully seated in the enclosure, powered-up and available for data I/O operations.
STATUS - PACK 2	An illuminated LED indicates that the disk pack is installed, fully seated in the enclosure, powered-up and available for data I/O operations.
SYSTEM	An illuminated LED indicates that the host computer is communicating with the MDA-T5.
HEAT	An illuminated LED is green when the system is powered and red when the heaters are on.
SECONDARY POWER	Front access power is a secondary push button breaker that can be pushed to turn on and pulled to turn off. Notice the white band when the power button is pulled off.

2.c. Rear Panel Components



Descriptions of the Rear Panel Components Table	
Component	Description
Host Interface Fibre Channel ports; J5, J6, J10 and J11	Accepts 8Gb Fibre Channel optical cables for connections between the MDA-T5 and a host computer. Uses a SFP to connect each port to an LC duplex optical cable. The Host Interface is a x8 PCIe personality module connected to each of the RAIDCore RC52xx SBB 2.0 RAID controllers. Other personality modules are available for SCSI, PCIe cable, 1Gb Ethernet, 10Gb Ethernet or Infiniband.
10/100/1000 Ethernet ports; J2 and J7	Provides access for 10 Mbps, 100 Mbps or 1000 Mbps data transfer speeds to each respective RAID controller via an RJ-45 connector
10/100 Ethernet port; J12	Provides access for 10 Mbps or 100 Mbps data transfer speeds to both RAID controllers via an RJ-45 connector
Unit Fans	Vents heat from the interior of the MDA-T5. The fan tray is removable to access the power supplies mounted inside the rear of the chassis.
AC Power On/Off Switch	Turns AC power on or off to the MDA-T5 power supply, raise to power the system on and lower to turn off.
AC Power In Receptacle; J1	Accepts cable for connection to a 100-240 VAC power source. WARNING: Prior to performing any maintenance on the MDA-T5, remove the AC power cable from its receptacle to ensure that all power is removed from the unit.

2.d. Set-up Requirements

To setup, configure, and use the MDA-T5, the equipment operator must perform the following five operations **in the order indicated** in the table.

Sequence of MDA-T5 Setup, Configuration and Usage Table	
Operation	What to Do...
1	Plan system configuration and usage (Type of RAID, size of arrays, ect.)
2	Connect cables and establish data transmission connections
3	Install a disk pack and perform other equipment setup
4	Set up RAID configuration options
5	Understand and use LED codes and functions

2.e. RAIDCore RAID Controller Information

RAIDCore RAID Controller Information							
Board type	Bus Type	Number of ports and type	+12V		Total Operating Power	Dimensions	Operating Temperature Range
MDA-T5 Controller	SBB 2.0	16 SATA/SAS	TBD A		TBD W	8-in (W) x10.7-in (L) x 1.6-in (H)	-18° to 45°C

SBB 2.0 compliant

- SATA1 or 2 compliant with Native Command Queuing
- SAS compliant
- >1GB/s Performance, up to 32 drives spanned
- Phoenix adapters support SAS expansion
- RAID levels 0,1,5,10,50
- RoHS Compliant
- Conformal coated

2.f. System Information

System Information	
Condition or Component	Value or Range
Controller	Single or dual RAID controllers, supporting RAID levels 0, 1, 10, and 5.
Performance	Sustained data rates of over 300 MB/s per controller port
Capacity	HDD: Up to 12TB per drive pack, and 24 TB per T5 system SSD: Up to 9 TB per drive pack and 18 TB per T5 system
Disk Drives	500 GB, 750 GB, 1 TB, 1.5 TB and 2TB SATA

Host Interface	8Gb FC, 1Gb Ethernet, 10Gb Ethernet, PCI Express, Infiniband*
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2.g. Physical Information

Physical Information	
Condition	Value or Range
System Dimensions	19"w x 6.97"h x 24"d (483 x 177 x 606mm)
Drive Pack Dimensions	8.2"w x 4.8"h x 11.2"d (208 x 122 x 285 mm)
System Weight	65 lbs. (29.5 kg.)
Weight per drive pack (with six drives)	15 lbs. (6.8 kg.)

2.h. Environmental Information

Environmental Information Table	
Condition	Value or Range
Temperature (operating)	-18C to +45C; 0F to +113F
Temperature (non-operating)	-55C to +71C; -67F to +160F
Altitude (operating)	MIL-STD 810F Method 500.4 0 to 41,000 Feet 0 to 12.496 Meters
Relative Humidity (operating)	6 to 95%
Relative Humidity (non-operating)	6 to 100%

2.i. Environmental Testing Compliance

Environmental Testing Compliance	
Condition	Designed to meet
Shock	MIL-STD 810F Method 516.5
Vibration	MIL-STD 810F, Method 514.5, Category 13, propeller aircraft
Temperature and Humidity	MIL-STD 810F Method 501-503.4
Salt Fog	MIL-STD 810F Method 509.4
Explosive Atmosphere	MIL-STD 810F Method 511.4
Emissions/Immunity	MIL-STD 461, CE101, CE102, CS114, RE101, RE102, RS103

2.j. Overview of RAID

RAID Minimum Disk Requirements

The following table lists the minimum number of disks required for each RAID level.

RAID Level	Minimum number of disks	Maximum number of disks
JBOD (Volume)	1	32
RAID0	2	32
RAID1	2	2
RAID1n	3	16
RAID10	4	32
RAID10n	6	32
RAID5	3	16
RAID50	6	32

3. Hardware Installation and Configuration

3.a. Overview

The MDA-T5 is shipped with 19-inch rack-mounting hardware and Jonathan Engineered Solutions rack slides installed. Attach the MDA to the rack by screwing the fixed portion of the rack slides into the rack using the supplied rack slide mounting hardware. Then slide the chassis mounted portion of the rack slides into the mounted fixed portion. The chassis can be further fixed to the rack to prevent unwanted extension of the rack slides during missions by screwing the four front panel captive screws on the chassis rack ears into the rack-mounting angle near the front of the rack. For more information on the available rack slides or special mounting slides, please refer to the Jonathan Engineered Solutions web site at <http://www.jonathanengr.com>.

3.b. Cabling the Unit

Connectors, Switches, and LEDs

Become familiar with the front and back of the MDA-T5.

Cabling the Unit

Cabling the MDA-T5 consists of making the following connections:

- Fibre Channel (or other personality module interface)
- Ethernet
- Electrical power
- Serial Port

3.c. Fibre Channel connections compatible Fibre Channel host adapters

Use only optical cables and associated SFPs. Do not use copper cables.

Compatible 4-Port Fibre Channel Host Adapters	
ATTO	Celerity series

Compatible 2-Port Fibre Channel Host Adapters	
ATTO	Celerity series
Qlogic	QLA Series

- The MDA-T5 communicates with your computer by using a 8Gb Fibre Channel LC Duplex optical interface. A compatible host adapter must be installed in your computer for the MDA-T5 to communicate with the host computer.
- To maximize the MDA-T5's 8Gb Fibre Channel interface, the host adapter in the computer should also be rated for 8Gb Fibre Channel. The 2Gb and 4Gb Fibre Channel host adapters will work, but at a lower transfer rate.
- Make sure the host adapter is installed correctly, and that the appropriate host adapter drivers are installed and functioning properly, before connecting the MDA-T5 to the computer system.

- Make sure the host adapter is installed correctly, and that the appropriate host adapter drivers are installed and functioning properly, before operating the unit.

3.d. Fibre Channel I/O Connections

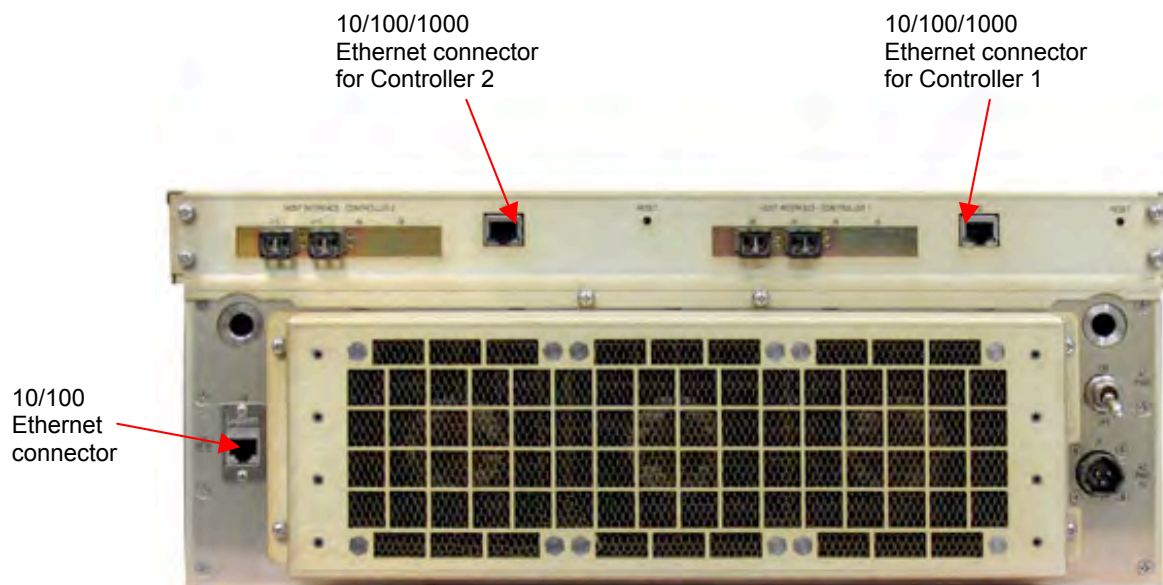
An MDA-T5 with a Fibre Channel interface is shipped with a 8Gb Fibre Channel SFP (Small Form-factor Pluggable) optical transceiver. There is an LC Duplex hookup on Side A or Side B. The SFP mates to up to four LC Duplex optical cables for data transfer to and from the host computer, server, etc.

To Install the SFP and Connect the LC Duplex Optical Cable

1. Remove the protective cover from the SFP.
2. With the gold contacts facing up, insert the SFP into FC Port 1. Gently push the SFP in until it clicks.
3. The tips of the LC Duplex cable are packaged with a protective covering. (The protector might be a cap over the white tips of the LC cable or a clipped-on shell). Remove the cover before use.
4. Insert one end of the LC Duplex cable into the SFP at FC Port 1.
5. Insert the other end of the LC Duplex cable into the Fibre Channel switch or Fibre Channel host base adapter of the host computer, server, etc.
6. Repeat steps 4 and 5 for each port of the MDA-T5.

Ethernet Connections

Plug the Ethernet cable into connector into respective Controller Ethernet port or into the 10/100 port at the rear of the unit.



Electrical Connections

1. Set the AC PWR switch to **OFF**. See Figure below.
2. Connect a power cable at the rear of the unit, at AC PWR IN

See Figure below **Power Cable Connection. Power cable connector, AC PWR switch**



3.e. Powering Up the Unit

1. Power up the MDA-T5 by setting the AC PWR switch to the ON position.
2. Push front panel breaker to ON position.
3. Verify that the fans are running in each power supply and in the fan module.

3.f. Scanning a SCSI Bus

When a drive pack is removed from the MDA-T5, system-generated SCSI time-outs might cause the system to stop looking for storage available via the Fibre Channel interface. To correct this situation, commands can be issued that prompt the system to “rediscover” the MDA-T5. The following examples illustrate the use of these commands on SGI IRIX systems and SUN Solaris Systems.

SGI Irix

On SGI IRIX systems, the SCSI bus can be scanned and the file system remounted, as shown in the following example:
[Need an updated example, if applicable at all].

Sun Solaris

On SUN Solaris systems, the SCSI bus may need to be rescanned and the file system remounted. To rescan the SCSI bus, refer to the following example: [need an updated example, if applicable at all]

Windows 2003 or XP

Microsoft Windows 2003 or XP host systems can rediscover disk devices. However, it is occasionally necessary to reboot. Windows can rediscover the MDA-T5 disk pack through either the Disk Administrator or Disk Part. To access the Disk Administrator:

1. Left-click on Start, then right-click on My Computer > Manage.
2. Choose "Disk Management" under the "Storage" heading in the left tree hierarchy.
3. From the Action menu, choose Rescan Disks. Windows updates the disks on the right side of the screen with information, including the recently inserted MDA-T5 device.

3.g. Obtaining an IP Address

There are two methods for obtaining the IP address of MDA-T5. The simplest is to have an IP supplied by the DHCP server on the network. The other requires assigning a static IP to the MDA-T5.

DHCP

MDA-T5 configures to an IP address from a DHCP/BOOTP server on a network. If the network has such a server, power up the MDA-T5 and use the following instructions to find the IP address.

1. Verify that the Ethernet cable is connected to MDA-T5 and to the network.
2. Power up the system and wait for the power-up cycle to finish.
3. Push the Display/Eject button. The status of the Ethernet connection appears: EnEt=uP, followed by the IP address, for example: Addr=172.20.110.11.

NOTE: It might take a few minutes to obtain the address from the DHCP server. Until then, the system displays: EnEt=dn. If this address appears, periodically recheck the address until a different address appears.

Creating a File System

During the initial installation of the MDA-T5 system or when installing a new disk pack for the first time to an existing MDA-T5, it might be necessary to create a file system on the disk pack.

Windows 2003 or XP Operating Systems

Microsoft Windows 2003 or XP host systems allow for two disk types, basic and dynamic. A basic disk comes online automatically; whereas a dynamic disk must be manually forced on-line each time a pack is removed and reinserted. The basic disk for use on the MDA-T5 is recommended. After creating a basic disk, create either an NTFS or FAT-32 file system. Refer to Microsoft documentation for creating a basic disk with an NTFS or FAT-32 file system.

Unix Operating Systems

On UNIX systems, create standard file systems as you would on any storage device.

- UFS for oracle Solaris® systems
- EXT-3 for Linux

Refer to oracle documentation for information about creating file systems

3.h. Starting the Disk Pack Heaters

The heat-phase data string appears when the disk pack temperature and user settings indicate that drives require heating before they spin up. This heating information is repeated during the course of the heat phase, which can last up to one hour. The heat phase default is 20 minutes. This information is not shown if a heat-phase is not required, or if the heater option is not installed.

The symbols for the heat phase display are:

Heat Phase Formula Legend	
Display	Indicates
[Beginning of data string.
H	Heating symbol.
w=	Current heating level is in use. The “w” value is between 1 - 8. MDA-T5 automatically adjusts the heating level in response to time and temperature conditions.
x	Remaining heating time in minutes. This is the maximum time remaining that the disk pack will continue to heat, unless the target temperature is achieved first.
t#=	Current temperature symbol. Identifier number (2 or 3) of the sensor reporting this temperature. The reading is from the warmer of the two disk pack sensors.
-yy0c	Current temperature is in Celsius. The minus sign (-) is shown only when negative temperatures are reported.
tt=	Target temperature symbol. The heating phase ends when either the current temperature is equal to or exceeds the target temperature, or the remaining heating time expires.
-yy0c	Target temperature is in Celsius. The minus sign (-) is shown only when negative temperatures are reported.
]	End of data string.

Expanding Disk Capacity Online

Online capacity expansion (OCE) allows:

- Adding any number of disks to an array at any time
- Accessing the array data while it is being redistributed.

To increase the size and organization of an array, transform the array. Use the transform function as part of the system backup and recover strategy, by using RAID1, RAID10, RAID1n, and RAID10n array types.

Migrating RAID Levels Online

Online RAID Level Migration (ORLM) allows the system to move from one RAID level to another. While the migration is taking place, the data is accessible and protected to the lowest protection of either the source RAID level or the destination RAID level. The transform feature can be used to increase the size and organization of an array. It can also be used as part of the system backup and recover strategy through the use of the RAID1, RAID10, RAID1n, and RAID10n array types.

Performance Considerations

With RAID, performance is based on four elements:

- The number and organization of disks in an array
- Caching attributes being used for the array
- The application workload
- PCI bus speed.

Disks

RAID increases performance by putting more disks to work and by buffering data for the host. Many disks can transfer data at greater than 50 Megabytes per second. RAIDCore RC5000 Series RAID controllers can aggregate this bandwidth in an almost linear fashion, as more of the same drives are included in an array.

Caching

The RAIDCore RAID controller software can also be configured to provide read and write-back caching, if desired.

Write-back caching has a large effect on most workloads, but should be used with caution.

Workload

When configuring an array, workload is probably the most important performance variable. Most applications do many more reads than writes, so the best performance will be obtained with array types like RAID0, RAID10, and RAID5.

PCI Bus Speed

Performance bottlenecks can be caused by the type of PCI bus you are using. The maximum theoretical performance of a PCI 32-bit 33-MHz bus is 132 Megabytes per second. Performance increases to 512 Megabytes per second with a PCI 64-bit 66-MHz bus. The best possible performance with the fewest bottlenecks on PCI-X systems can be obtained by using a PCI-X 64-bit 133-MHz bus. It offers 1024 Megabytes per second. For PCIe systems, RAIDCore adapters support a 4x link that offers 1024 Megabytes per second in each direction, for a theoretical throughput of 2048 Megabytes per second.

Reliability Considerations

Reliability is enhanced through data redundancy and backup.

Redundancy

RAID1, RAID10, RAID5, or RAID50 are necessary for redundancy. With redundancy, both capacity and performance are sacrificed for reliability. With RAIDCore RAID controllers, extremely high performance is obtained even with redundant-type arrays.

Backup

The controller's ability to transform arrays and split mirrors can be used as part of a backup strategy. For example, you can create a RAID1 or RAID10 array; yet periodically transform them into RAID1n and RAID10n arrays. The RAID1n and RAID10n arrays can

be split into the original array and a backup array. As part of a hot fallback strategy, the backup array can be kept online and hidden from the operating system or remain visible, or it can be removed and stored as a backup device. When a boot array is split, the original and the copy are exact copies with the same labels. When using the Linux operating system, One Stop Systems recommends that you keep the split copy hidden during boot time, to avoid boot-time issues with duplicate labels.

Flexibility and Expansion Considerations

Before configuring an array, consider the following points to enhance the flexibility of your RAID system.

Multiple Types

Most RAID controllers do not allow

- Changing a chosen array type
- Creating more than one type of array for each controller
- Creating more than one array per physical disk.

With the RAIDCore RAID controller, different types of arrays can be created on the same disk, to adapt each array to the I/O that it processes. Depending on the array capacity and redundancy level, an existing array can be transformed to another RAID type, if the type of array being used is not the optimal type for the application. Also, different arrays with different characteristics can be built for different applications.

Operating System Considerations

An important array planning consideration is whether to extend the RAID benefits to the system disk and operating system, as well as to the data disks. For example, if the operating system is installed on a RAID1 array (mirror), split the array into two volumes. Hide one of the resulting volumes. The operating system can be recovered easily if the system disk fails. Alternatively, improve operating system performance by installing the operating system on a RAID10 array. Split the array and hide one of the RAID0 arrays (like a hot spare).

3.i. Setting up array through serial port

1. The serial port is accessed through a RJ-11 connector that is located behind the connector panel on the back of the MDA-T5
2. The serial port on the client machine should be configured as: 115.200 8, N, 1.
3. Connector cover plate must be off of MDA T5.
4. Connect serial port.

DB9 connector to back of PC RJ11 connector to back of MDA T5 SBB

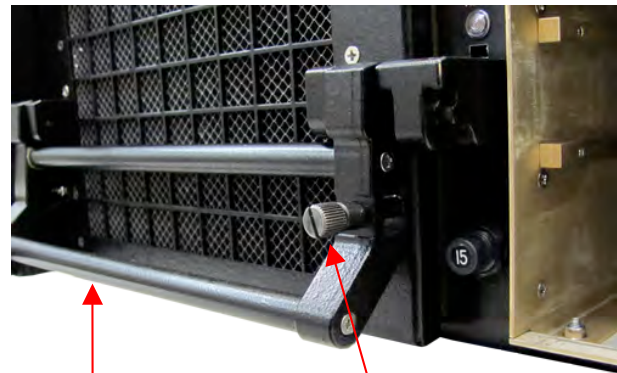
5. Power on MDA-T5. Bootup will take several minutes. The display will stop for about 3 minutes at the line: Bcraid:
bc_event_kthread thread started if the line above is not displayed within 2 minutes, reset the SBB.

6. At login: root

Password: t5

7. Use bcadm to configure and monitor arrays

3.j. Installing a Drive Pack



Drive pack handle

Thumbscrew

1. Align the mounting slides on the drive pack with the rails on each side of the disk rack compartment. Make sure the drive pack handle is in an upright position.
2. Carefully slide the drive pack straight back into its compartment.
3. When the drive pack slides into the enclosure and the front of the drive pack is approximately even with the front of the enclosure, lower the drive pack handle.
4. Tighten the thumbscrew.
5. Wait for the pack to perform a self-test and initialization.
6. When the individual drives are spun-up, the unit brings the RAID controllers online. Observe the Drive Pack 1 (or 2) Activity LEDs on the front of the MDA-T5. When the LEDs are illuminated the indicated drives are ready for operations.

3.k. Removing a Drive Pack

Stopping I/O Transactions

To remove a disk pack, you must first stop all I/O transactions between the host computer and the drive packs, in order to maintain data integrity between the remote host and the RAID Controller(s).

Unmount UNIX File Systems

If the disk pack has a mounted file system, unmount the file system to ensure that the data structures are properly closed down before removing the disk pack.

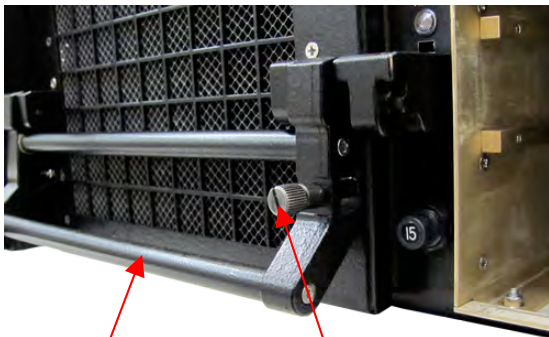
To unmount the UNIX file system:

1. Stop all I/O from going to the logical units that exist on the MDA-T5.
2. Verify that the file system is un-mounted.
 - List the file system with the df command.
 - Use flags after the command (such as -k) to format the output and make it easier to read and interpret.

NOTE: Only a superuser can unmount file systems and flush Windows data.

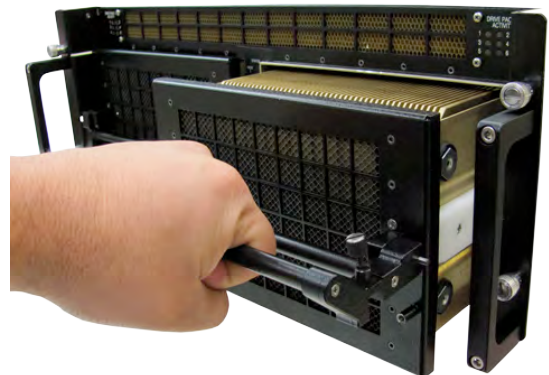
Remove a Drive Pack

1. Power down
2. Loosen the appropriate drive pack thumbscrew.
3. Grasp the front handle at the drive pack.
4. Lift the handle fully upright.

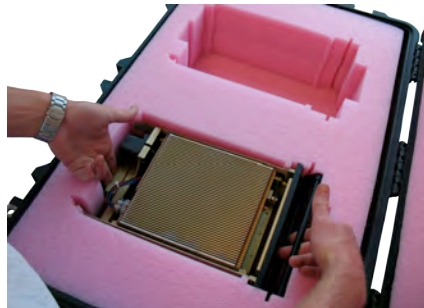


Drive pack handle

Thumbscrew

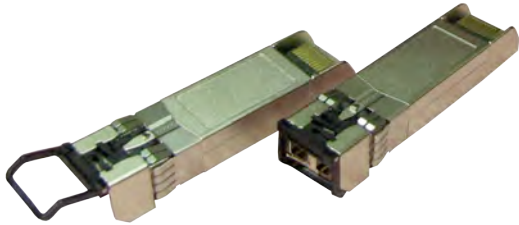


5. Carefully slide the drive pack out of its compartment.
6. Place the disk pack on a flat, stable surface or in an approved MDA-T5 drive pack transit case. NOTE: Drive pack will sit upside down in the transit case. Be sure to hold the unit only by the front handle and the metal tab on the back of the drive pack.

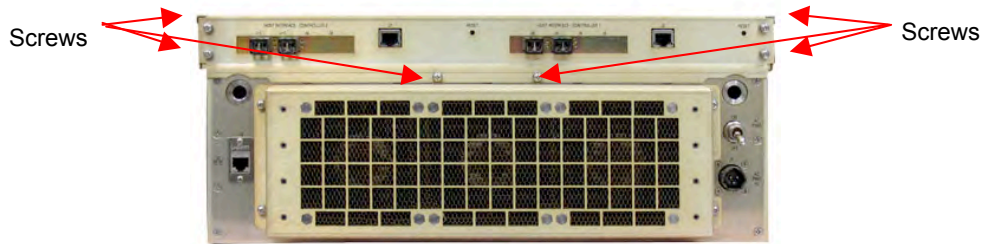


3.I. Removing/Replacing an SBB 2.0 RAID Controller

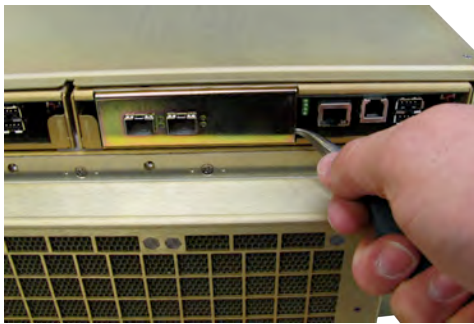
1. Turn off the unit using the power switch on the rear of the system.
2. Remove all of the Fibre cables from both controllers.



3. Remove all Fibre Channel Small Form Factor Pluggable (SFP) modules from both controllers by moving the wire release lever on each module downward then grasping the lever and gently pulling straight out.



4. Unscrew the six rear controller panel screws and remove the rear panel.



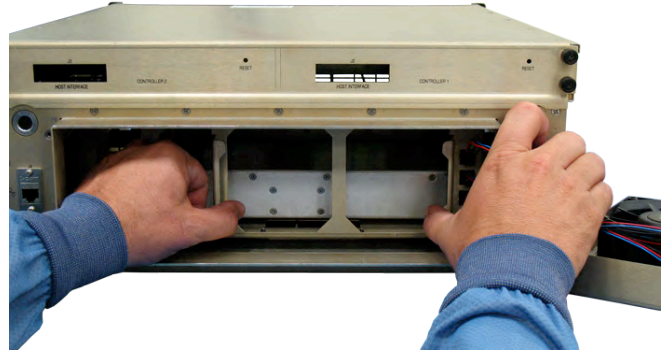
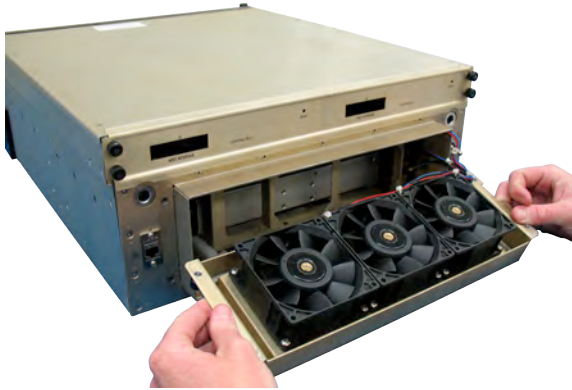
5. Grasp the metal tab on the front top corner of the controller module to be removed and FIRMLY pull straight out. A tool may be required to disengage the connectors. Place tool at bottom of bracket as seen in pictures and pull.

3.m. Removing Power Supply units

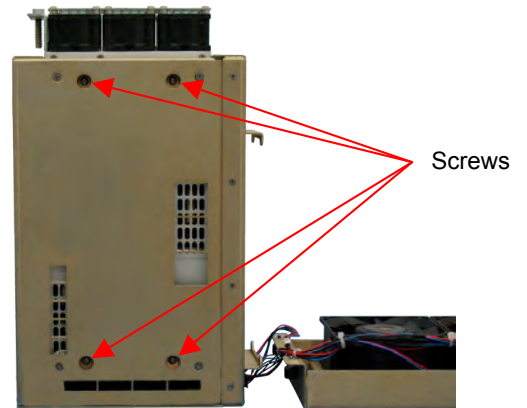
Overview

The procedure for removing and replacing an individual power supply in the MDA-T5 chassis involves removing the power supply rack from the main chassis.

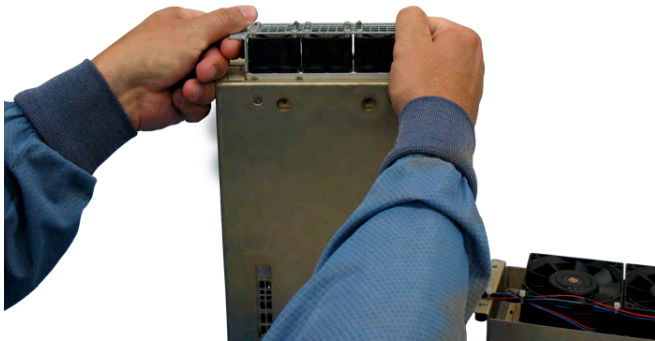
1. Loosen the four screws around the fan bay and gently remove the cover and set to the side being sure not to stress the fan wires.
2. Using thumb tabs, pull the power supply rack from the main chassis.



3. Unplug fans (Note the connector release tab)
4. Gently slide the power supply rack from the main chassis
5. Stand power supply rack vertically and remove the power supply from the rack.
6. Remove four screws to release power supply.



7. Remove power supply by lifting upward.



3.n. Replacing an individual disk drive

Overview

The procedure for removing and replacing an individual disk drive in the MDA-T5 chassis involves removing the drive box drawer from the main chassis. Once the drawer is removed the process to replace a disk drive takes approximately 20-40 minutes, depending mostly on the seal cleaning required. This time does not include the set time to re-check for any leaks or the time required to determine cause of leaks and repair time.

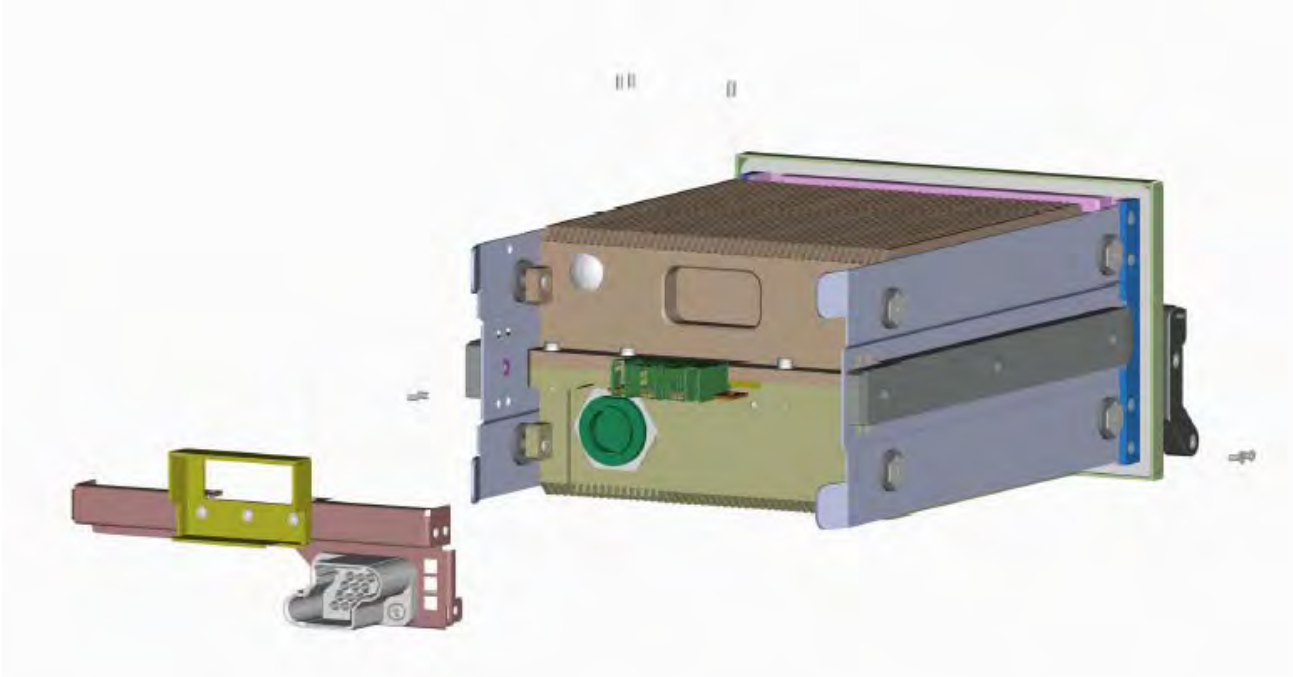
Materials

This is a description of equipment required to replace a drive and re-pressurize the drive box.

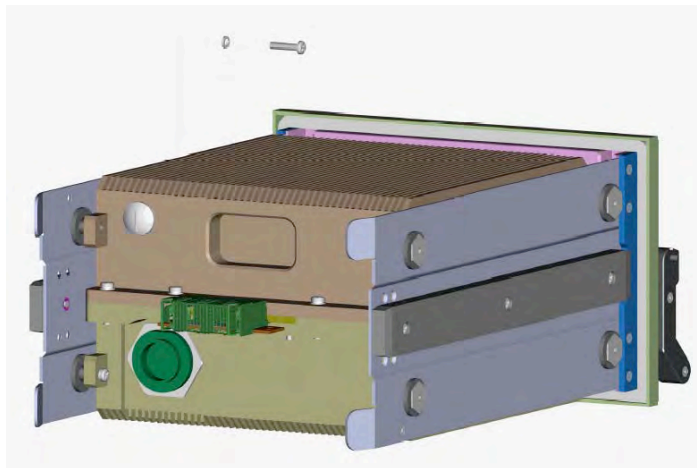
- Torque screwdriver with Phillips #1 and #2 bits
- Isopropyl Alcohol
- A tank of dry inert nitrogen compressed.
- Nitrogen purging regulator with a low pressure gauge of 5-60 psi, that will thread into the tank.
- A One Stop Systems drive bay refill parts kit (P/N: OSS-MDA-T5-PARTS-KIT) which includes:
 - An air filler tube, which screws into the flush mount valve stem fill valve that is on the drive box. The air filler tube is reusable (P/N: xxx-xxxxx-xxx)
 - One drive pack replacement sealing gaskets (P/N: xxx-xxxxx-xxx)
- An approximately 10 foot industrial air hose rated 250-300 psi, ¼ inside diameter.
- Nozzle fittings on the hose, quick-disconnect nose couplings one end male the other female.
- A standard air chuck that will attach to the hose. So one end of the hose is attached to the regulator gauges and the other end has the air chuck that will fit onto the air filler tube.
- A separate hand held air pressure gauge to check the pressure in the drive box after a set time period to see if it has any leaks.
 - Note that the gauges could vary some in what they read, however the goal is to hold nitrogen pressure in the drive box, exact psi is not as critical.

Procedure

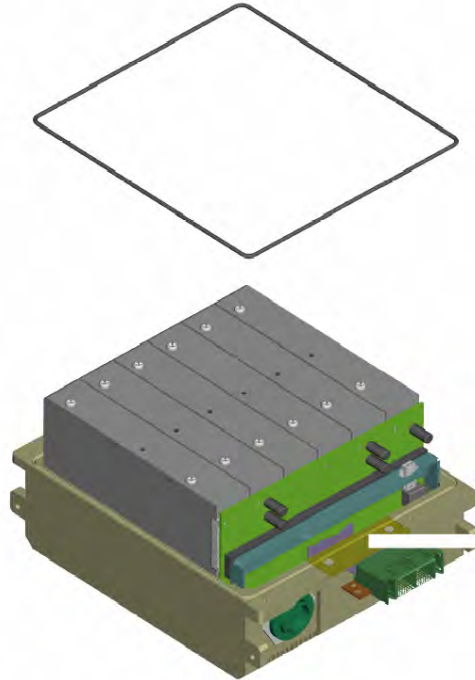
1. Purge nitrogen from drive enclosure by depressing the bleeder valve on the lower front, behind the air intake, until all nitrogen has escaped.
2. Remove a total of (9) screws holding drive signal connector bracket to the mounting plates with isolators, and the flex



3. Remove (8) screws holding drive box assembly to mounting plate isolators. Note that 1 screw also holds the ground wire.

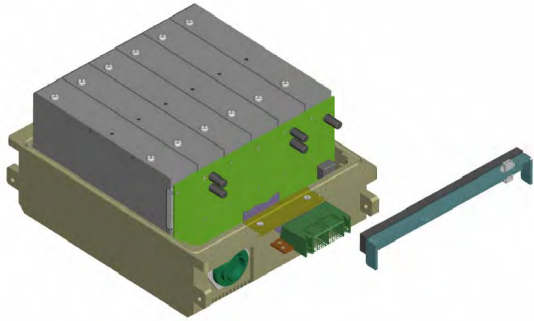


4. Remove (9) screws and washer assemblies holding top of drive box to bottom of drive box. (Note: do not mix the screws. The screws at the fill valve end are longer than the screws at the bleeder valve end. . Unplug heater connector if installed.

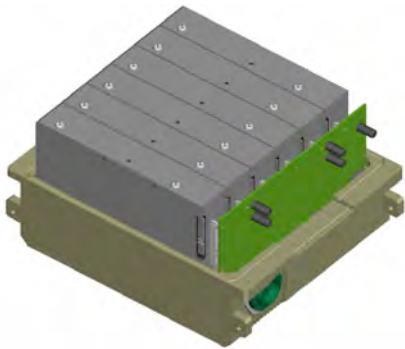


4. Inspect O-Ring (OSS p/n xxxxx) for cracks, splits, frays, etc. and replace if necessary. Usually replacement is suggested. If sealant is detected, it must be removed and the aluminum housing cleaned with Isopropyl alcohol. Be careful not to stretch o-ring gasket during installation.

5. Remove MUX cardholder bracket.



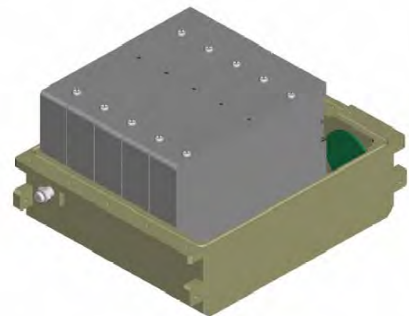
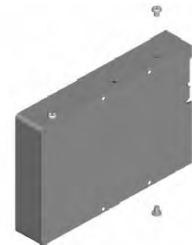
6. Pull MUX card back to release drive connections.



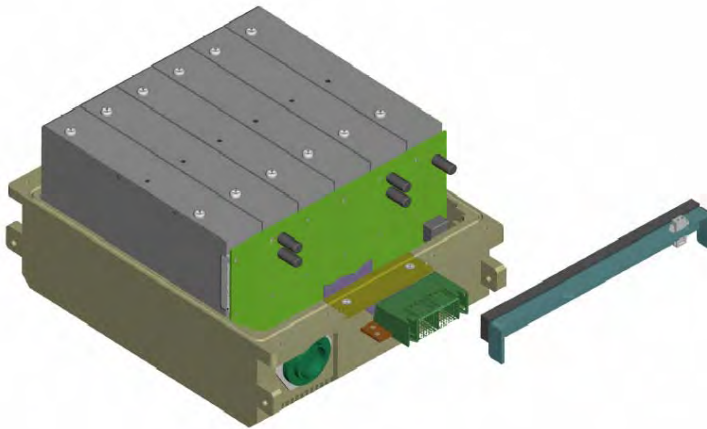
8. Remove selected disk drive.

9. Remove alignment screws from old disk drive and install in new disk drive.

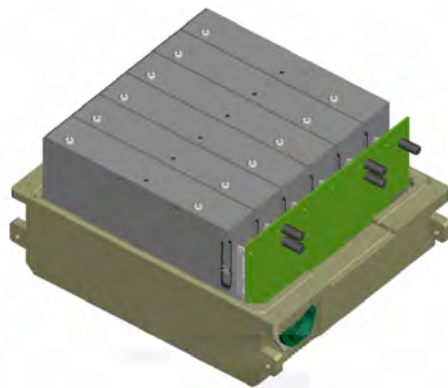
10. Insert new drive into drive box being sure that alignment screws are placed in alignment cores in bottom of drive enclosure.



11. Once new drive is properly installed, replace MUX card so that all disk drives are plugged into appropriate slots in card.

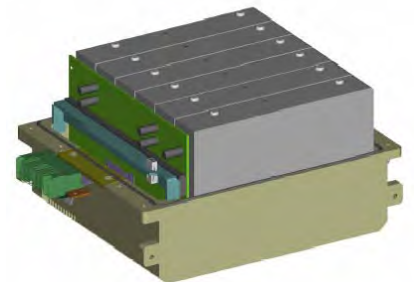


12. Replace MUX cardholder bracket



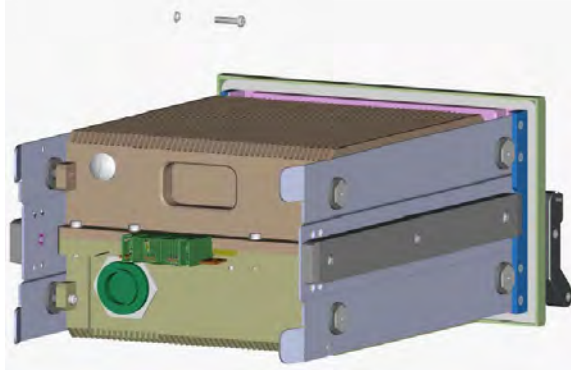
13. When MUX card and bracket is properly installed, replace drive enclosure top being sure that rubber o-ring is inspected and clean, mating surfaces are clean, and o-ring is secured properly in groove. Plug in heater connector.

14. Replace screws and washer assemblies holding drive enclosure halves together. Torque screws to 15 in-lbs. in a staggering pattern to maintain equal pressure throughout the drive enclosure.

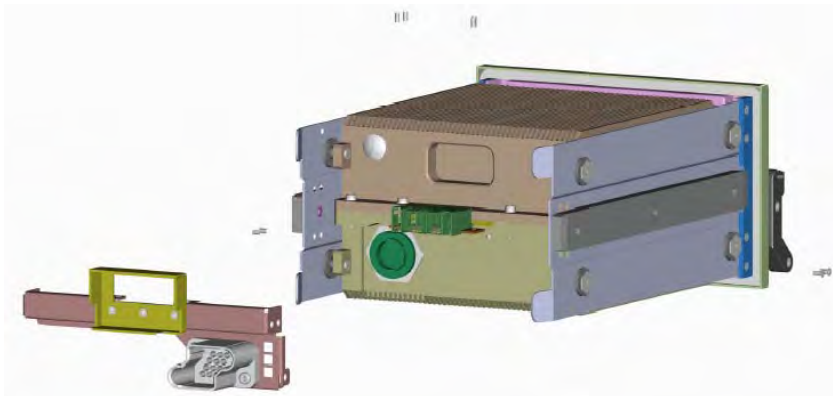


15. Apply dry nitrogen to drive box by removing the cover on the fill valve, upper rear of drive box, and installing the filler tube. Hold the bleeder valve in, on the lower front of the box behind the air intake, while simultaneously filling with nitrogen using the air chuck from the tank for approximately 1 minute or until all oxygen has been purged from inside of drive enclosure assembly. Release the bleeder valve and fill box with approximately 5-10 psi of dry nitrogen. Let drive box set for approximately 24 hr and check pressure with an air pressure gauge to determine if there are leaks.

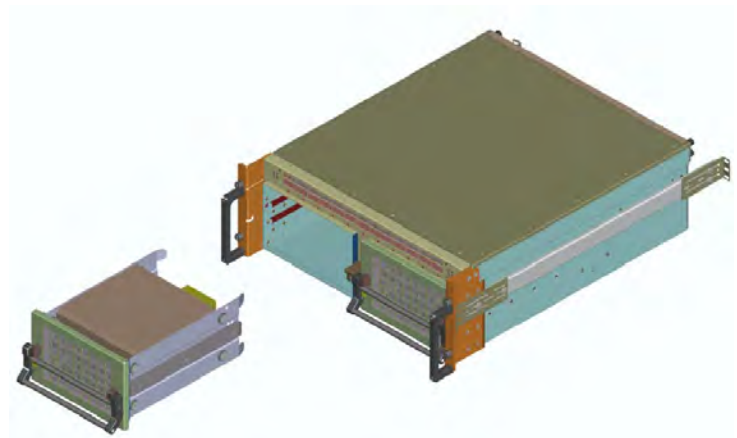
16. Re-assemble (8) screws and washers holding drive enclosure to mounting plate isolators. Note that 1 screw holds the ground wire.



17. Re-assemble drive signal connector bracket. Note: hand squeezes the flex connector so that the frame slides over it easily. Be careful not to pinch wires.



18. With handle in horizontal position, replace drawer into main chassis being sure that all connectors align correctly. Push handle down to lock drawer into correct position. (Note: do not use undue pressure to force handle into locked position. If handle does not go into locked position remove drawer and check connector alignment). The handle does not go into locked position remove drawer and check connector alignment).



4. Using the BIOS Configuration Utility

4.a. When to Use the BIOS Configuration Utility

The firmware component of the installation kit includes the BIOS Configuration Utility. Use this utility to:

Action	Description	Find More Information At...
Create the boot array	If the system is not booting off of the array, this utility does not need to be used to create an array, although it can. A non-bootable array can be created in the RAIDConsole management application	See "Creating Arrays Larger Than 2TB" in Chapter 8, Using the RAID Console. or See "Creating New Arrays: bcadm --create" in Appendix E, Using bcadm.
Swap in a copy of the boot array	In RAIDConsole, a copy of your boot array can be made by mirroring the array and then splitting it; by default, it is hidden from the operating system. If the system were to lose the boot array, the BIOS Configuration utility can be used to unhide the copy and swap it into the first position in the Arrays list.	
Initialize a new disk	When a new disk is being added, it can be initialized from the BIOS.	

NOTE: The first device in the Arrays list is the bootable array. The system can only boot from the first device in the list.

NOTE: Until the BIOS loads, the LEDs are not indicative of disk connectivity.

To enter the BIOS Configuration Utility

When booting the system, press **CTRL + R** when the BIOS banner displays. You have a minimum of three (3) seconds to enter the BIOS, using this key combination.

4.b. Understanding the Color Code in the BIOS

The following color codes are used to indicate the type or status of information displayed on the screen.

Color	Description
White text	Available option or information text.
Yellow highlighting	Current option on which you may choose to take action.
Green text	Item has been selected.
Light blue text	Item is not available for selection
Yellow text	Informational text, describes an option
Magenta text	Spare options and boot options.
Red text	Failed drive or other warning to user. For example, informational text might be red if the option is not available.

4.c. Initializing Disks from the BIOS

Before new disks are used, they must be initialized. At the very least the boot array must be created using RAIDCore BIOS Array Configuration utility. Initialization writes the RAIDCore configuration information to disk. This process is the same whether there is one controller or multiple controllers. The BIOS utility can be used to create and manage arrays, so that an operating system can be installed on an array. The system is booted from this array.

To initialize disks from the BIOS

1. Power-up the computer to start booting.

2. When prompted, press the **CTRL + R** keys, to access the RAIDCore BIOS Array Configuration utility.

The RAIDCore Array Configuration menu is displayed (see “Understanding the Color Code in the BIOS” on page 6-3).

NOTE: If the BIOS is not displayed, contact OSS support.

3. Use the arrow keys to select **INITIALIZE DISK(S)** from the Main menu.

4. Press **ENTER**.

5. Use the arrow keys to highlight a disk, and then press the **Insert** key to select the disk or choose all selectable disks by pressing the **A** key.

NOTE: Multiple disks can be selected; there is no need to initialize one disk at a time.

6i. Press **ENTER** to initialize the selected disks.

7. Press the **C** key to continue with initialization.

Initialization takes 10–15 seconds per disk. A status indicator shows which disk is being initialized. When the initialization is complete, the status indicator goes away. A complete rescan of all channels is done automatically.

CAUTION: If a disk has a RAIDCore array on it, the disk cannot be selected. To initialize this disk anyway, delete the array. Be sure this is what you want to do, because the data on the disk will be deleted.

4.d. Creating Arrays from the BIOS

After your disks are initialized, you can create arrays. See “Understanding Arrays” in Appendix B, Overview of RAID Concepts, if you have not yet decided what type of arrays you need.

Before You Begin...

- In some circumstances, more than eight arrays are possible. They might appear to function properly, but are not supported by OSS.
- For redundant arrays, the creation process is not finished until after the operating system and controller drivers have been installed and the system has been booted into the operating system context. However, the arrays are immediately available to use for either a boot or data array.
- Array numbers are valid only for a given boot, and might be different in the BIOS and drivers. If a permanent label is required, use the labeling feature.
- When a disk is highlighted from the disk list, the LEDs on the controller or a properly cabled disk enclosure light up to identify that disk.
- At any point in this procedure, return to a prior window by pressing **ESC**.

To create an array

1. From the Main menu of the Array Configuration screen, use the arrow keys to select "Create Array". Press **ENTER**.
2. Select the disks on which to create the array:
 - a. Highlight the disk by using the arrow keys.
 - b. For each disk, press **INSERT** to select the disk. You can insert the disks in the order of your choice.
 - c. After selecting the disks to be included in the array, press **ENTER**.
3. In the "User Input" area, use the arrow keys to select an array type. Press **ENTER**. (Only array types that can be created with the selected disks are available).
4. If spares are applicable:
 - a. In the "User Input" area, use the arrow keys to highlight a spare type.
 - b. If applicable, in the "Disks" area, highlight the disk(s) to use as a spare. Press **INSERT** to select them.
 - c. Press **ENTER** to add the spare disk(s).

To select an array size

NOTE: Use the Page Up and Page Down keys to increase or decrease the array size in large increments. Use the up arrow and down arrow keys to increase or decrease the array size in small increments.

1. Use the Page Up/Page Down keys or the arrow keys to select a size. Press **ENTER**. (By default all available space up to 2.199 TB is selected).

or

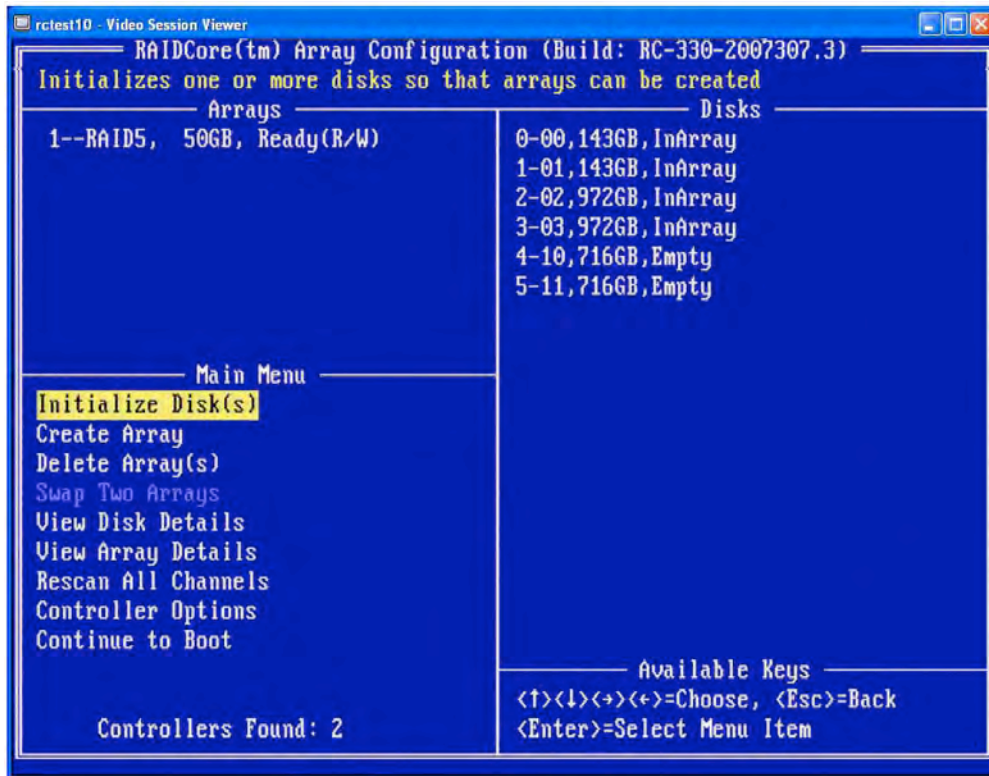
2. Create an array that is greater than 2.199 TB (the maximum allowed by some operating systems):

NOTE: 32-bit operating system do not support arrays larger than 2TB. See "Creating and Formatting Arrays" in Chapter 5, Using the RAIDConsole.

- Press **PAGE UP** or the up arrow to increase the array size. You are asked if you want to limit the size of the array to the 2TB maximum.
 - Press **ESC** to create a larger array.
 - Press **PAGE UP** or the up arrow until you have reached either the desired size or the maximum available.
 - Press **ENTER**.
3. Select a caching level using the arrow keys. Press **ENTER**.
 4. Press **C** to confirm that you want to create the array.

NOTE: The array is marked “Ready” for use. The text at the top of the Array Configuration screen returns to a description of the menu items.

5. When you are finished creating arrays, resume the boot process:
 - a. From the Main menu, highlight “Continue to Boot”.
 - b. Press **ENTER**. No reboot is required.
6. See Figure 6-1 for an example of a configured 4-drive RAID5 array.



4.e. Deleting Arrays from the BIOS

CAUTION: Deleting an array permanently destroys all data that was on the array. This action cannot be undone; all data will be lost.

To Delete an Array

1. Highlight “Delete Array(s)” from the Main menu. Press **ENTER**.
 2. Do one of the following:
 - Highlight each array to delete. Press **INSERT** to select it.
- or**
- Type **A** to select all arrays for deletion.
3. Press **ENTER**.
 4. Press **C** to continue.

4.f. Swapping Arrays from the BIOS

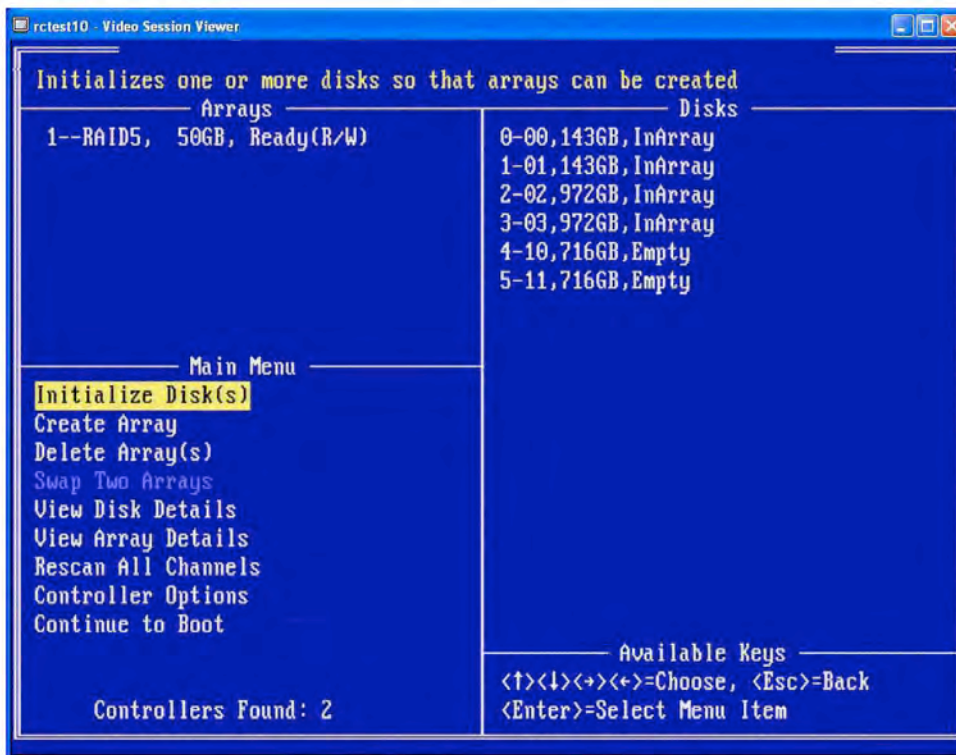
Using the “Swap Two Arrays” option, arrays can be arranged in a different order.

Before you begin...

- If more than one array is created, install the operating system to any of them. However, a small amount of boot information is always written to a disk in the first array on the array list, regardless on which array the operating system is installed. If anything happens to the disk in Array 1, the system cannot be booted. OSS recommends installing on a redundant array-type—such as RAID1 or RAID5—and swapping that array into the first position, if it is not already Array 1.
- This swap feature is only available from the BIOS.

To swap arrays

1. Highlight “Swap Two Arrays” in the *Main* menu. Press **ENTER**.
2. Use the arrow keys to highlight an array. Press **INSERT** to select an array.
3. Use the arrow keys to highlight another array. Press **INSERT** to select the array.
4. Press **ENTER** to swap the arrays.



In this example, the RAID10 array was the first array created. However, to boot from the RAID5 array, the arrays were swapped so that the RAID5 array is the first device listed.

4.g. Hiding or Un-hiding Arrays from the BIOS

The “Hide/Unhide” array option allows you to hide or unhide an array or arrays from the operating system. If an array is hidden it will not be visible through INT13 or to the operating system when booted. This is a useful feature for hiding hot backups of the system.

NOTE: A legacy array cannot be hidden from the BIOS. A legacy array can be hidden from the operating system (using RAIDConsole or bcadm), as long as the system is not booted off the legacy array and another non-legacy disk is attached to the controller.

To hide or unhide an array

1. Select the “Hide/Unhide” option.
2. Use the arrow keys to highlight the array to be hidden or un-hidden.
3. Press **INSERT** to select an array.
4. Press **ENTER** to commit the selection. The hidden array turns blue in the “BIOS Configuration Utility”. The status of the array displays as “Hidden”.

4.h. Viewing Disk Details from the BIOS

This option allows you to view details about the disk. Nothing can be changed from this menu option. It is for informational purposes only.

To view disk details

1. From the Main menu, select “View Disk Details”.
2. Use the arrow keys to choose a disk.
3. Information about the disk is displayed in the “Information” field across the top:
 - Disk Number
 - Controller Number
 - Channel Number
 - Disk Size
 - New/Legacy/Empty/InArray
 - Free space
 - Disk Model Number

4.i. Viewing Array Details from the BIOS

This option allows the details of the array to be viewed. Nothing can be changed from this menu option. It is for informational purposes only.

To view array details

1. From the Main menu, select “View Array Details”.
2. Use the arrow keys to choose an array.
3. The full details of the array are displayed in both the Information field across the top:

- Array Number
- Type
- Size
- State
- Name
- Cache Setting
- DOS Size

NOTE: The disks list shows the disks in the array, as selected (green).

4.j. Rescanning All Channels from the BIOS

This option allows you to rescan all channels to detect new or removed disks and arrays.

1. To perform a rescan, select “Rescan All Channels” from the Main menu. (The activity indicator in the “Information” field spins while the disks are being polled).
2. The “Rescan All Channels” option rescans all the channels, searching for new or removed disks, and rereads the configuration information from each disk.

NOTE: Sometimes when a disk is offline, it can be brought online through a rescan. Rescan also stops, and then automatically resumes, all tasks

4.k. Changing Controller Options from the BIOS

Selecting Controller Options allows you to configure whether RAIDCore arrays might be bootable, as well as other aspects of the boot process. The default is to configure an array. An operating system can boot from the RAIDCore RC5000/BC4000 Series RAID controller. If an error occurs, an error message is displayed. However, you might be booting from the motherboard IDE or another SCSI device in your system. If this is the case, do not install INT13 (without INT13, DOS cannot see the array).

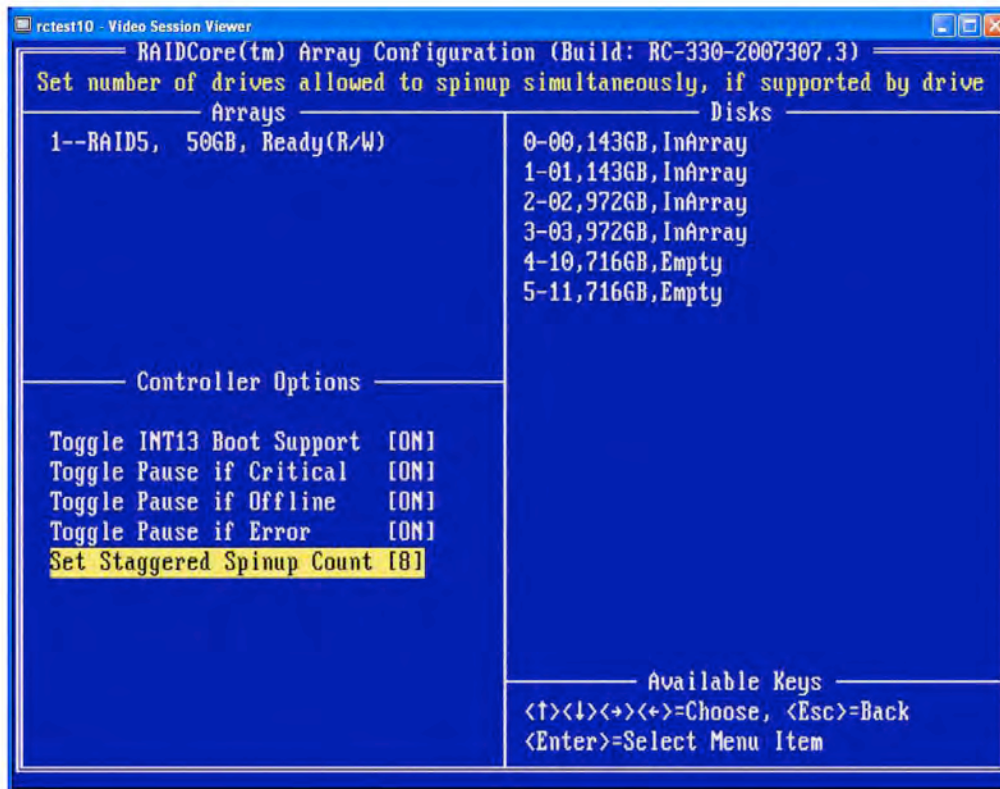
NOTE: If “Boot Mode” is configured to install INT13 and never display an error message, you will not know during the boot process if an array is degraded or if other problems have occurred.

One symptom of having too much memory used by the option ROMs is a blank screen, with the message “Couldn’t initialize memory” appearing in the top left hand corner. No additional information is given. This message is coming from the NT Boot Loader, which requires 512 KB of memory free below 640 K. This menu also sets whether the boot process will pause when an error occurs. When the “Pause” feature is enabled and an array goes critical or offline, or there is a controller configuration error, the boot process stops. Press **ENTER** to continue booting. View the error message on the window. If the “Pause” feature is disabled, the error message is displayed briefly, but the system continues to boot.

To select a boot option

1. From the Main menu, select “Controller Options”.

NOTE: The “Controller Options” area is displayed in the BIOS Array Configuration utility window, as shown in Figure 6-3, in the Controller Options area of the BIOS Array Configuration screen. The current settings display in magenta text above the white selectable options.



2. Use the arrow keys to select a boot option.

NOTE: By default, all options are turned on. OSS recommends that options remain enabled.

To Accomplish This...	Do This...	Notes
Not boot from an array	<ol style="list-style-type: none"> 1. Highlight "Toggle INT13 Installation," using the arrow keys. 2. Press ENTER to change the setting to "Disabled" 	OSS recommends disabling INT13 only if you want to boot from another device and Leaving the rest of the options enabled.)
Turn off critical arrays while booting	<ol style="list-style-type: none"> 1. Highlight "Toggle Pause if Critical". 2. Press ENTER to change the setting to "Disabled". 	
Turn off warnings due to offline arrays when booting	<ol style="list-style-type: none"> 1. Highlight "Toggle Pause if Offline". 2. Press ENTER to change the setting to "Disabled". 	
Turn off warnings due to controller configuration errors when booting	<ol style="list-style-type: none"> 1. Highlight "Toggle Pause if Error". 2. Press ENTER to change the setting to "Disabled". 	These warnings include errors generated when the license key is not found or is Corrupted, or when the license level does not match on all controllers in the system and the lowest level found is used.
Allow the RAIDCore RAID controller to work with newer Linux kernels that load the libata driver.	<ol style="list-style-type: none"> 1. Highlight "Toggle Legacy Board ID". 2. Press ENTER to change the setting to "Disabled". 	

4.I. Linux Kernel Issues and Recommendations

Issues

When the libata driver is loaded by these newer Linux kernels (beginning with some errata kernels for Fedora Core 2, and all kernels for Fedora Core 3) the RAIDCore RAID controller is recognized as a simple SATA controller and is taken over by the operating system. If this problem occurs on your system, any previously created arrays do not appear as arrays, but only as a group of individual disks.

Recommendations

By turning off the "legacy" ID used by all RAIDCore RAID controllers, the newer Linux kernels can recognize the MDA-T5 as a RAID controller. A RAIDCore driver that is version 1.4 or later must be used (drivers that are version 1.3 or earlier will not be able to recognize the RAIDCore controller). All Linux systems will work properly with the legacy board ID disabled. It can be enabled and disabled as needed. If any problems are encountered after disabling the legacy ID, re enable it to get back to a working system.

Limiting Disks Numbers and Reducing Power Demands

To limit the number of disks that can spin up at the same time and reduce power demands by the system, perform the following:

1. Highlight "Set Staggered Spinup Count".
2. Press **ENTER**.
3. Using the arrow keys, specify the number of disks that should be allowed to simultaneously spin up.
4. Press **ENTER** again.

Continue Booting from the BIOS

After you have created arrays, you can continue booting the system from the point where the RAIDCore BIOS was entered. To resume the boot, highlight "Continue to Boot" in the Main menu. Press **ENTER**. No reboot is required.

5. Using the RAIDConsole

5.a. To start RAIDConsole under Linux

1. Open a command prompt and type `/usr/bin/bc_winraid`.

NOTE: For most Linux systems, this starts RAIDConsole and also starts the `bc_service` application that logs events in the system. It also starts the `bcapiservice` application that enables remote management.

2. If these applications do not auto start, start them manually. Auto start them next time.

3. Alternatively, stop them and keep them from autostarting next time by changing to the `/etc/init.d/` directory from a console window.

Type the following:

- For `bc_service`: `bcserviced start | stop`

- For `bcapiservice`: `bcapid start | stop`

4. If you want a pop-up message to appear on the desktop when an event is detected by `bc_service` and reported to the log, run the `bcpopup` application. Open a command prompt and type `/usr/bin/bcpopup`.

5. Open the Security Level Configuration window by clicking Desktop from the menu bar.

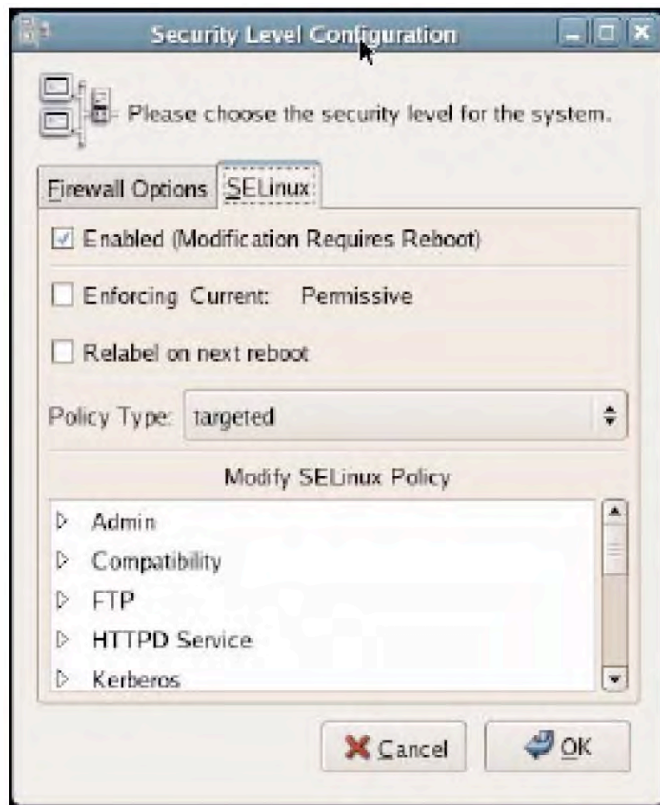
6. Click **SYSTEM SETTINGS**.

7. Click **SECURITY LEVEL**.

8. At the Security Level Configuration screen, select the “SELinux” tab.

9. Disable SELinux by un-clicking the first option. Or, change the policy from “Enforcing” to “Permissive” by clicking the second option. See Figure 7-1.

10. When RAIDConsole starts, the First Time Run window opens and inquires whether password protection for the application is needed. See “Using Password Protection” on page 7-4 for information and instructions.



5.b. Using Password Protection

OSS strongly recommends that the RAIDConsole management application be protected by a password. Misuse of the application could easily result in destroyed data. Password protection for the application can be enabled or disabled the first time it is started, using the First Time Run dialog, as shown in Figure 7-2. If you choose not to protect the application with a password at this time, you can do it later from the Options menu.



Things to Know About Passwords

- If you forget your password you will not be able to run the application. Select a password that you will remember.
- The password must be at least six characters long.
- The password is case sensitive.
- Four chances are given to enter the password correctly. If you fail to type the password correctly, the application will close after the fourth try. To try again, reopen the application.
- The application does not keep track of passwords that have been previously used.

To set Password Protection from First Time Run

1. Type a password in the "Password" box.
2. Confirm the password by typing it again in the **CONFIRM** box.
3. Click **CONTINUE**. The *Array Status* window opens.

To disable Password Protection from First Time Run

1. Select "Disable Password Protection".
2. Click **CONTINUE**. The Array Status window displays.

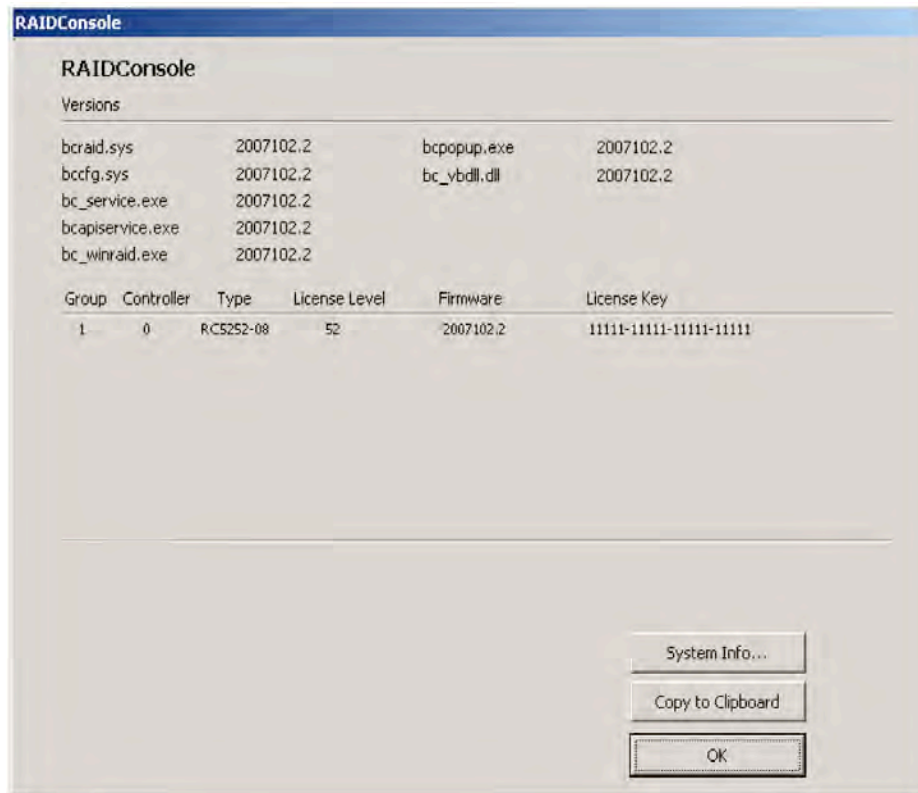
To set Password Protection later from the Options menu

1. On the Options menu, select **PASSWORD**.
2. Check "Enable Password Protection".
3. Enter a password.
4. Confirm the password by typing it again.
5. Click **OK**.

5.c. Using the Help Menu

The Help menu on the Array Status screen provides access to the following:

- Click on the "Help" tab and then do one of the following:
- Click **CONTENTS & INDEX** to view the web-based online help system
- Click **ABOUT** to view the version information. The following information is provided (see Figure 7-3):
- Version information is provided for the RAIDCore miniport driver (bcraid.sys)
- The configuration driver (bccfg.sys)
- The array maintenance service (bc_service)
- The remote management service (bcapiservice)
- RAIDConsole (bc_winraid)
- The pop-up message utility (bcpopup)
- The dynamic link library (bc_vbdll.dll).



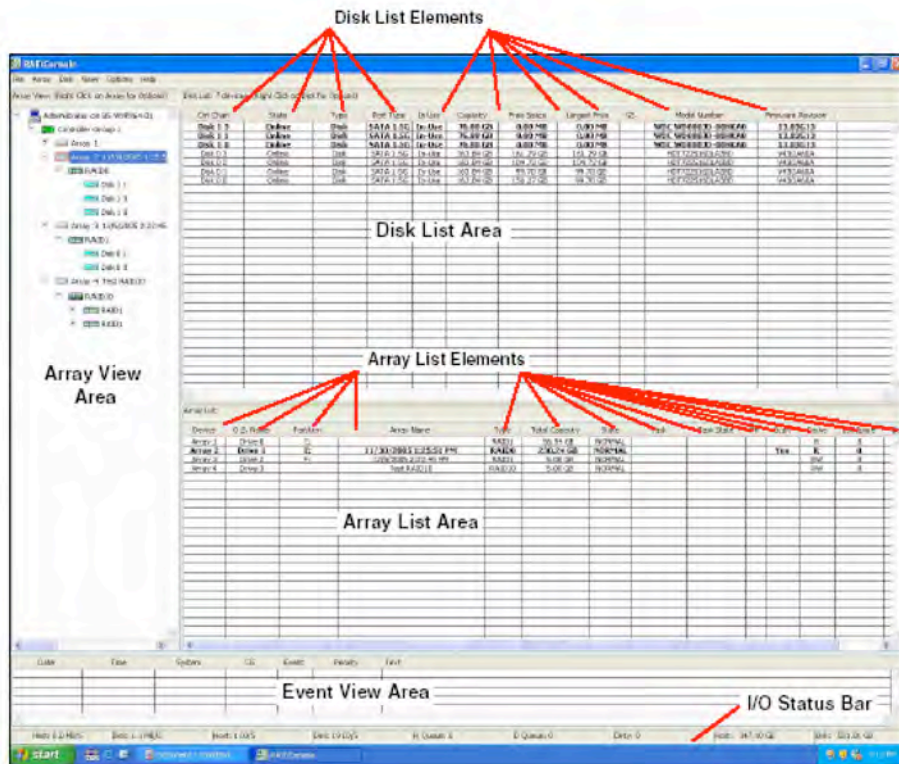
To copy the version or license information, click **COPY TO CLIPBOARD**. Paste the information into a text editor, such as Notepad. This method captures the serial numbers of the disk drives in the system, which are listed by the designation Disk x: y, where x is the controller number and y is the port number.

5.d. Reviewing the Interface

The Array Status Window

The Array Status window is the main window within RAIDConsole. From here you can view configuration information such as physical disk status, logical array status, and task information. It also provides the main function menus for managing arrays. As shown in Figure 7-4, the Array Status window includes:

- An “Array View” area
- A “Disk List” area
- An “Array List” area
- An “I/O Status” bar.



NOTE: Certain languages do not display correctly in the “Array View” area. The source of this problem is not within RAIDConsole itself. English, other English variants, and many other languages do display properly. If desired, use the Control Panel to set the regional language to English or another language. **NOTE:** To refresh the array and disk information displayed in the Array Status window, click View, and then click Refresh. This command rereads configuration information from the driver, but does not poll the disks.

5.e. Array View Elements

Array View Area of the Screen

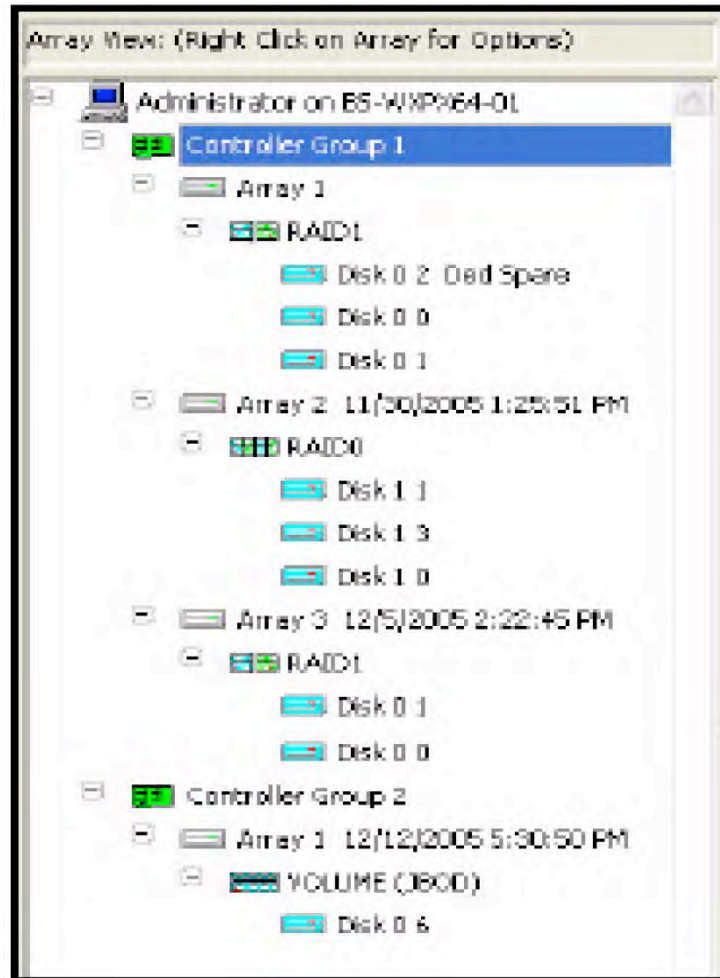
The “Array View” area on the left side of the Array Status window presents a graphical view of array properties during and after the creation of the array.

Elements at the Array View Section of the Array Status Screen.

Array	The array number assigned to created or creating arrays.
Array name	The name assigned to an array.
Task Percent Complete and ETA	The progress of a current array task, such as a create or transform, shown as percent complete and estimated time left to completion (hours: minutes: seconds).
Task type	The nature of a current task, such as a create or transform.
Source array	The original array to be transformed.
Destination array	The array to which the source array is being transformed.

5.f. Array View Icons

The icons in the “Array View” area reflect the type of array (RAID0, RAID1, etc.) and which controller it appears on. An example configuration of icons is shown in Figure 7-5.



5.g. Disk List Elements

The “Disk List” area on the Array Status screen provides information about all disks assigned or available to arrays. See Table 7-2.

Ctrl Chan	Disk controller and channel number
State	State of the disk (ONLINE, FAILED, UNKNOWN)
Type	Disk type (DISK, Legacy, NEW)
Port Type	Type of port (SATA, SATA II, SAS) and its port speed; this is the speed the controller negotiates, not the speed of the port type.
Capacity	Disk capacity: 1 MB = 1,000,000 bytes 1 GB = 1,000,000,000 bytes NOTE: Because the ATA storage industry has standardized the meanings of MB as 1,000,000 bytes and GB as 1,000,000,000 bytes, the RAIDCore software reports the same units.
Free Space	Total amount of space unused on the disk
Largest Free	Largest contiguous unused space on the disk
GS	Indicates if disk is assigned as a global spare
Model Number	Disk manufacturer’s model number
Firmware Revision	Disk manufacturer’s firmware version

NOTE: If there are any disk drives missing from the Disk List, the most likely cause is a loose cable. Ensure that all disk cables are connected and then rescan the disks.

5.h. Array List Elements

The “Array List” area of the Array Status screen provides information about the arrays.

Array List Area of the Array Status Screen.

Device	The array number
O.S. Name	Name assigned by the operating system to the array. The name appears as “Hidden” if the array is hidden from the operating system. The name appear as “??” if the array is OFFLINE.
Partition Mount Point	Drive letter or letters than have been assigned to this array. NOTE: If a dynamic volume is created on an array, RAIDConsole cannot retrieve the volume’s drive letter.
Array Name	User-supplied name for the array
Type	RAID type
Total Capacity	Total capacity: 1MB = 1,000,000 bytes, 1GB = 1,000,000,000 bytes
State	State of the array (NORMAL, CRITICAL, OFFLINE)
Task	Task type if in progress (TRANSFORM, COPY, CHECK, CHECK_BITMAP, NOT_ACTIVE, CREATE, RESTORE)
Task State	The state of the task (STARTED, PAUSED, COMPLETED); the progress of the task is given in the “Array View” area.
Priority	Task priority if a task is in progress.
Scan	Background Array Scan enabled? (Yes/No)
Cache	Current cache setting (NC=No Cache, R=Read Cache, W=Write- Back Cache, RW=Read/Write Cache)
Dst Spare	Indicates whether the distributed spare option is being used.
Dsd Spare	Indicates the number of dedicated spares assigned to the array.

5.i. I/O Status Bar Elements

The “I/O Status” bar in the Array Status screen provides the following information:

I/O Status Bar Elements, Array Status Screen.

Host x.x MB/s	Host traffic in megabytes per sec.
Disk x.x MB/s	Disk traffic in megabytes per sec.
Host x I/O's	Host I/Os per second.
Disk x I/O's	Disk I/Os per second.
Host Queue	Number of Host I/O requests currently in progress.
Disk Queue	Number of Disk I/O requests currently in progress.
Dirty	Number of dirty cache buffers if write caching has been enabled (or, the number of buffers not actually written out to the drives). This is informational only and not an error condition.
Host	Total amount of data transferred to or from the host since last boot.
Disk	Total amount of data transferred to or from the disks since last boot.

NOTE: The I/O status indicators are approximate in nature, especially when the system is experiencing a high volume of I/O traffic.

5.j. Working with Disks

Initializing Disks

When disks are initialized, the RAIDCore configuration information is written to the disks. If the disks are new and have not been used before, they must be initialized before they can be used in RAIDCore arrays. After a disk is initialized, it shows as a “Disk” type in the Disk List.

CAUTION: Normally, do not attempt to initialize disks that are part of an array. However, it is possible to do so, unless the disk is part of the boot array. (If the disk is part of multiple arrays, it cannot be initialized).

To initialize disks

1. On the “Disk” menu, select **INITIALIZE**. “Initialize Disk” is displayed.
2. Select the disk(s) to be initialized, by clicking on the box next to the disk(s).
3. Click **INITIALIZE SELECTED**.

5.k. Rescanning Disks

The “Rescan Disks” option:

- Rescans the serial ATA (SATA) channels that search for new or removed disks
 - Rereads the configuration information from each disk. Sometimes when a disk is offline, it can be brought online through a rescan.
- Rescan also stops and then automatically resumes all tasks. To rescan disks, select “Rescan” at the on Disk menu.

CAUTION: Normally, do not attempt to initialize disks that are part of an array. However, it is possible to do so, unless the disk is part of the boot array. (If the disk is part of multiple arrays, it cannot be initialized).

5.I. Changing Cache Settings for Disks

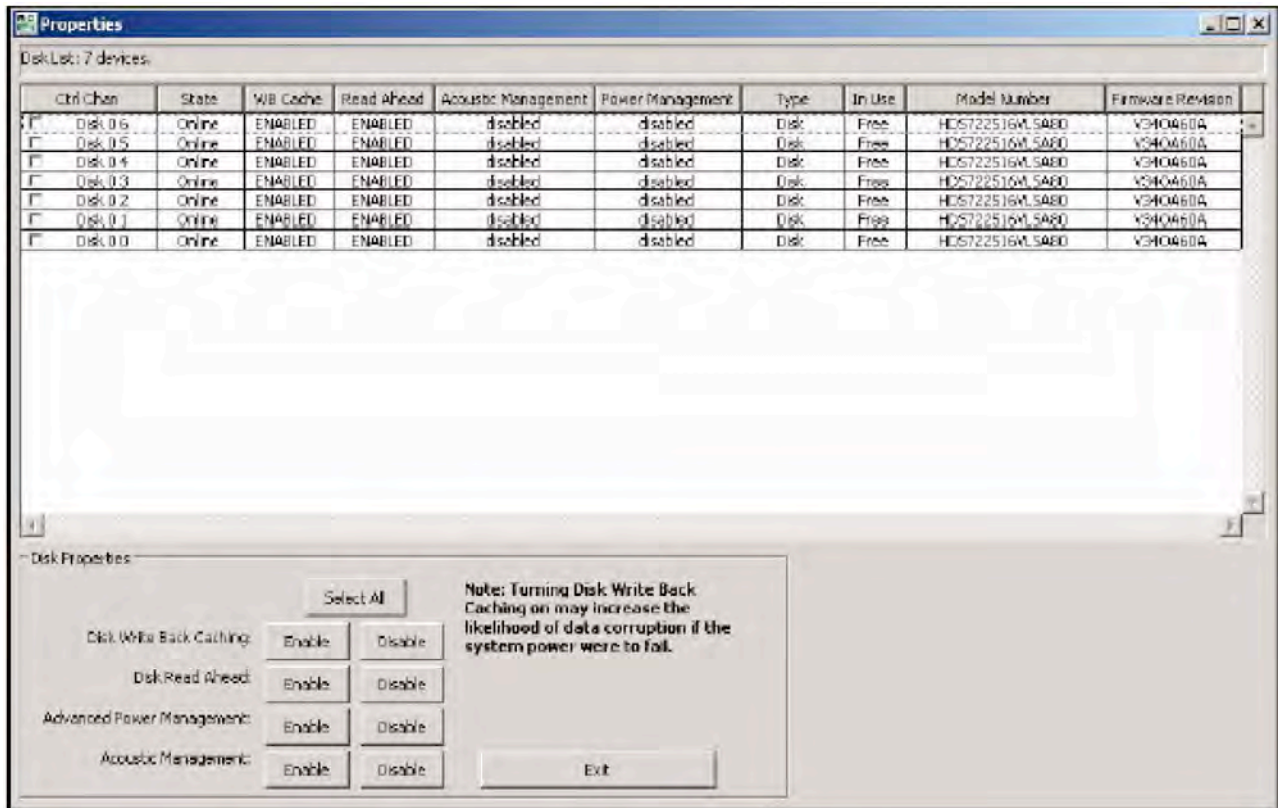
If the disks support this option, “read ahead” and “write cache” properties can be changed. The default settings are to have “read ahead” and “write back caching” enabled.

CAUTION: Leaving “write back caching” enabled might increase the likelihood of data being corrupted, if the system experiences a power interruption or unexpected shutdown.

NOTE: The disk cache settings cannot be changed if any tasks are active on the arrays. The option is enabled when the tasks are complete.

To change disk caching properties

1. From the Disk menu, select “Properties”.



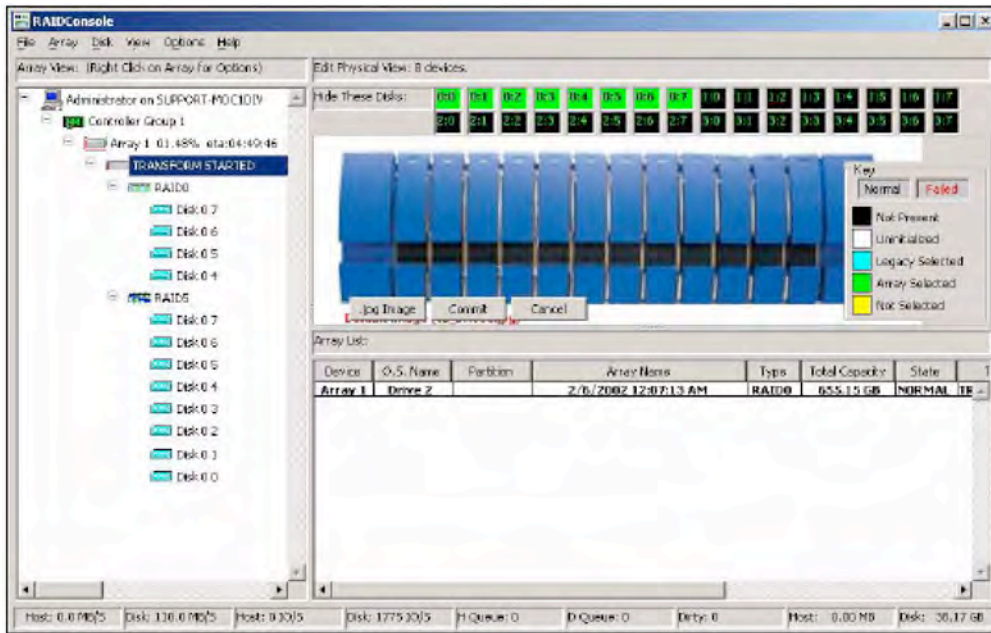
2. Select the disks. See Figure 7-6.
3. Under “Disk Properties,” click the **ENABLE** or **DISABLE FOR THE DISK WRITE BACK CACHING** and **DISK READ AHEAD** settings.
4. Click **EXIT**.

5.m. Changing Disk View Settings

At the View menu click either **DISK LIST VIEW** or **PHYSICAL VIEW**. The “Disk List View” is a view of the disks in a list format (as described in “Disk List Elements”). It is the default view. In this view, you can:

- Right-click on a disk in the “Ctrl Chan” column to add or remove a dedicated or global spare.
- View information such as disk capacity and amount of free space, which do not display in the physical view. The “Physical View” is a graphical representation of the disks and their status. A default picture is provided, but any JPEG (*.jpg) format image can be inserted and edited to match the configuration of your disks.

An example “Physical View: is shown in Figure with the default *.jpg image supplied with the application.



If a new controller is added to the system, the physical view must be edited. The disk information in this view is not updated automatically.

Operations at Physical View

The following operations can be performed at the “Physical View”:

Creating a Dedicated Spare

Right-click on a disk-identifying box to assign it as a dedicated spare (if available), or to assign it as a global spare.

Identifying a Disk

Right-click on a disk-identifying box to use LEDs to identify that disk on a controller or in an enclosure.

Seeing Disk Status

See disk status as conveyed by the font and background color of the disk identifying boxes.

Editing the Physical View

Use “Edit Physical View” on the Options menu to:

- Add your own *.jpg file,
- To show or hide a disk in the view.
- To change the positions of the disk identifying boxes, in order to match the configuration of your actual disks in their enclosure(s).

Operations at Physical View

The following operations can be performed at the “Physical View”:

Creating a Dedicated Spare

Right-click on a disk-identifying box to assign it as a dedicated spare (if available), or to assign it as a global spare.

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See disk status as conveyed by the font and background color of the disk identifying boxes.

Editing the Physical View

Use “Edit Physical View” on the Options menu to:

- Add your own *.jpg file,
- To show or hide a disk in the view.
- To change the positions of the disk identifying boxes, in order to match the configuration of your actual disks in their enclosure(s).

5.n. Using LEDs to Identify Disks

The “Identify Disk” option can be used within RAIDConsole to physically identify a disk. By selecting a disk within RAIDConsole and using this feature, the LED on the controller or a disk enclosure blinks for that disk. If a disk fails, this feature can be used to physically identify which disk in the enclosure has failed.

NOTE: If the LED cables between a disk enclosure and the controller are not properly connected, the wrong disks might be identified.

To use LEDs to identify a disk

1. In the “Disk List” area, right-click the disk that you want to identify.
2. When the Options window is displayed, click **IDENTIFY DISK USING LEDS**. Click **OK**. When the Identify window is displayed, the LED for that disk begins to blink.
3. To stop the LEDs from blinking, click **STOP IDENTIFY**.

5.o. Working with Arrays

Creating and Formatting Arrays

Unlike many RAID controllers, the RAIDCore RC5000/BC4000 Series RAID controllers allow the partitioning and creation of as many as eight arrays across all disks. Portions of disks can be used to create arrays, while other arrays are using different portions of the same disks. A maximum of eight arrays can be created.

Before You Begin...

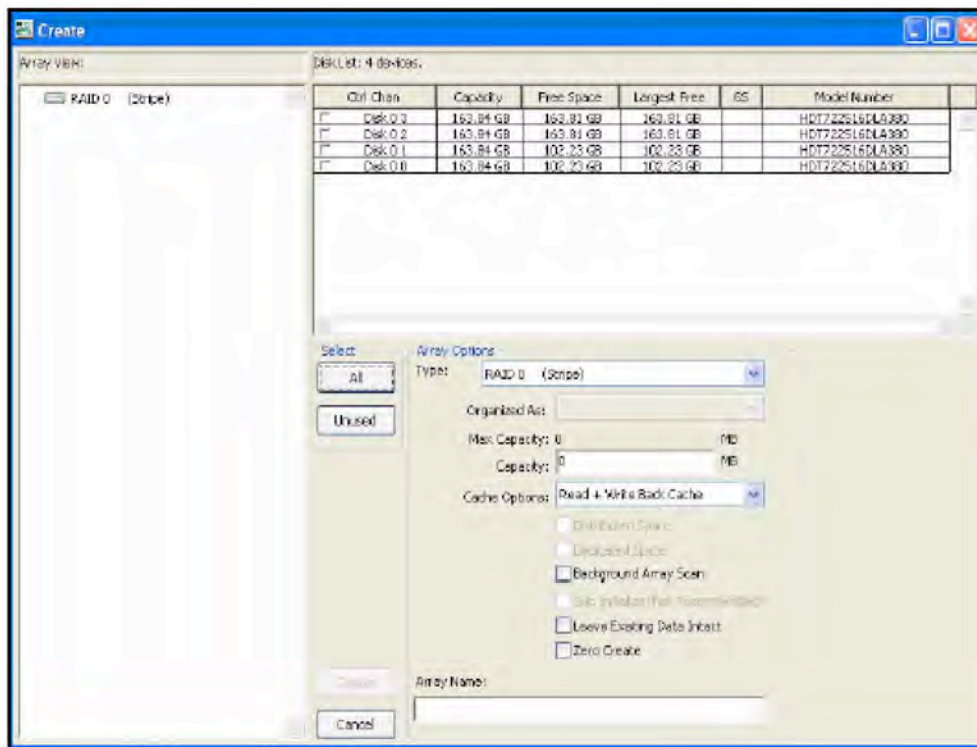
Issues and Recommendations for Creating and Formatting Arrays.

Issues	Recommendations
Access to arrays	The creation of arrays, even redundant arrays, allows users immediate access to the arrays, unless the zero option is used during the create.
Array numbers	Array numbers are valid only for a given boot, and can be different in the BIOS and drivers. If a permanent label is required, use the labeling feature described in "Naming Arrays" on page 7-43.
Array size	The array size of the new array is limited to 2.199 TB on some versions of Windows and Linux. Refer to your operating system documentation for details on maximum array sizes.
Number of arrays	In some circumstances, more than eight arrays are possible. They might appear to function properly, but are not supported by OSS.
System reboot	If the system reboots, the creation process continues where it left off.

5.p. To create an array

Select an Array and Cache

1. From the Array menu, select **CREATE**.



The Create Screen, with the Disk List.

2. In the “Disk List,” select the disks to include in the array by checking the box next to the desired disks.

NOTE: Click the ALL button to select all disks, or click the UNUSED button to select those disks that have yet to be used in an array.

3. Select an array type from the “Type” list.

4. Enter the capacity in the “Capacity” field.

NOTE: The maximum available capacity changes with the disks selected, array type, and the sparing options chosen.

Select a cache option for the array. The default is **Read + Write Back Cache**.

Select Options and Configurations

1. Select whether to configure distributed and/or dedicated spares by clicking the appropriate option.

NOTE: See “Working with Spares” in Appendix D, General Concepts for Managing Arrays and Disks, to determine what type of spare or spares to assign.

Select whether to enable background array scanning by clicking the Background Array Scan option.

3. Choose whether to skip initialization by clicking the Skip Initialization option.

NOTE: Arrays can be created instantly by skipping the background consistency check usually performed when initializing the array. For certain types of redundant arrays this is a viable option and has no data integrity drawbacks. A consistency check can be performed at a later time. For RAID5 and RAID50 sets, if the initialization is skipped, the arrays are not redundant until a consistency check is performed. Creating a RAID 5 array with this option selected, and a cache option of “No Cache,” can in some situations result in data corruption.

4. If the configuration information for an array is lost and you want to leave data that was on the disks untouched when writing new configuration information, check the option to “Leave Existing Data Intact”.

NOTE: This option can be used to try and recover user data when an array has been accidentally deleted or when the configuration information is lost but the data is still intact. When an array is created with this option enabled, new configuration information is written while trying to use exactly the same disk space that was used before. Generally this option is used as a last resort. The likelihood of recovering data with this method is very low, unless it is performed immediately after the array was deleted and no other tasks have been performed on the array.

5. Choose whether to use the “Zero Create” option, which writes the created array with zeros. If the “Zero Create” option is used, the array is not immediately available.

6. Name the array, if desired.

NOTE: Names can be up to 30 characters long. However, the BIOS will display only 17 of those characters.

Click **CREATE** to create the array. A 4-disk RAID0 array is created in the Create window.

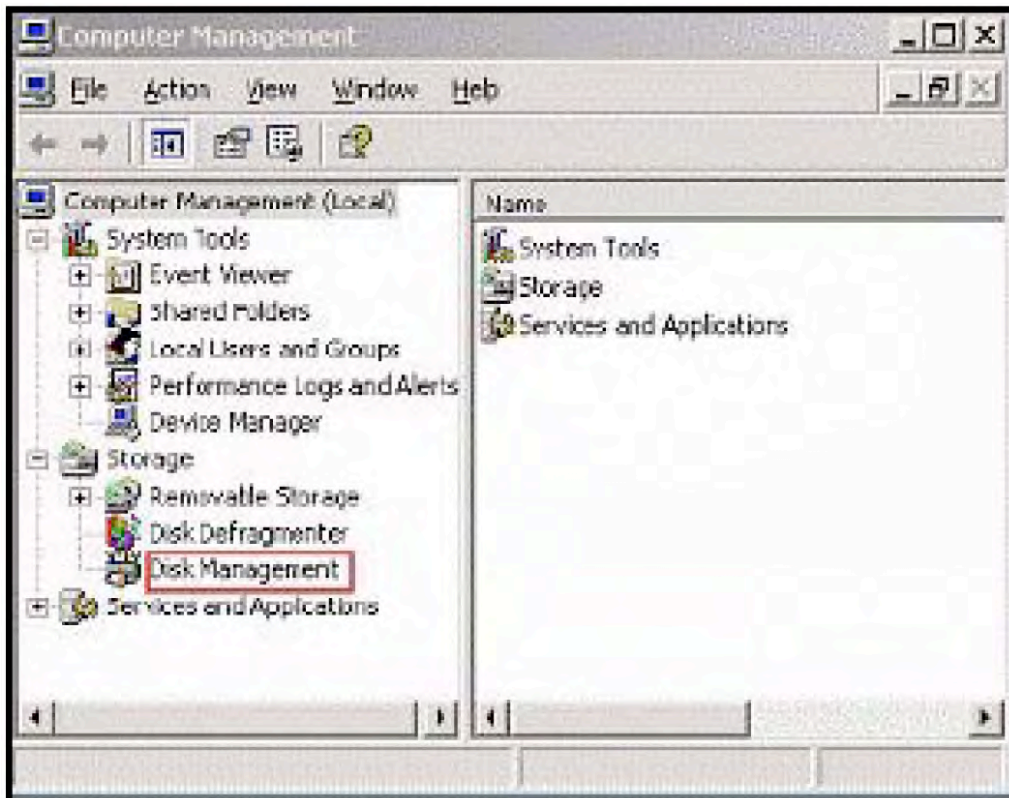
To partition an array for use with Windows

Use the standard operating system format procedure to format an array. If you are unfamiliar with this procedure, use the following procedure for Windows 2003:

1. From the desktop, right click **MY COMPUTER**.
2. Select "Manage".

FIGURE 7-9. Computer Management Screen, Showing the Disk Management Selection.

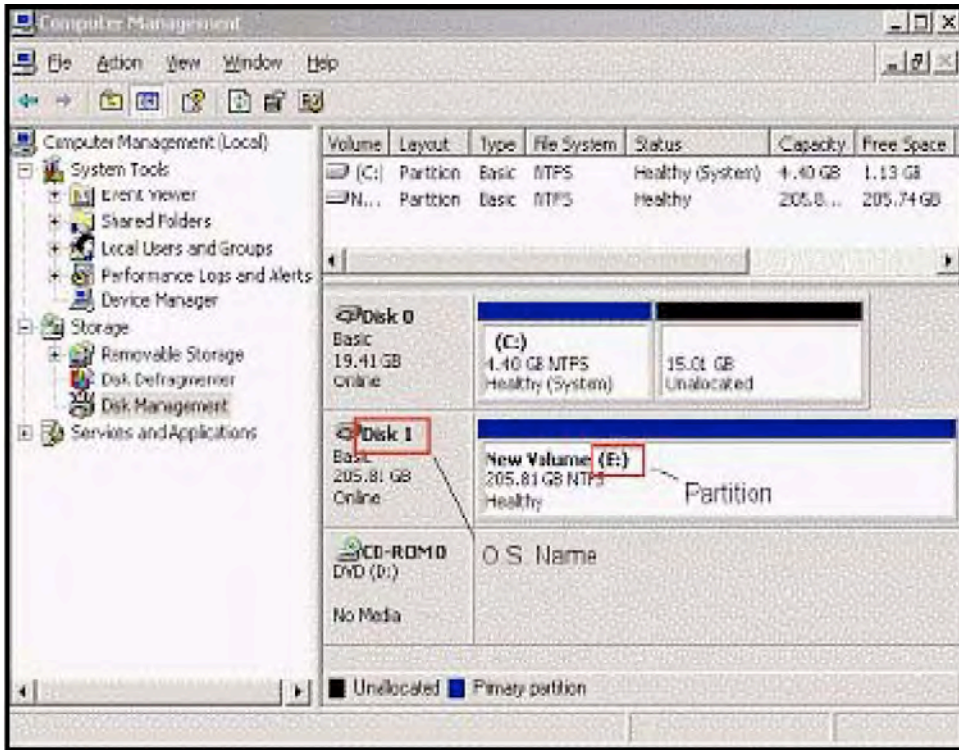
3. Click **DISK MANAGEMENT**.



Computer Management Screen, Showing the Disk Management Selection.

3. Click **DISK MANAGEMENT**.

4. Follow the instructions provided by the “Write Signature and Upgrade Disk Wizard” to write a signature on the drive. When you close the wizard, the Computer Management window reappears.



Computer Management Screen, Showing the Disk Volume and Partition Information.

The “O.S. Name” is the same name found in the Array Status window. This is the array that needs to be formatted before it can be used.

To format the array

1. Right click in the white area surrounding the new partition and select **Create Volume**.
2. Follow the instructions provided by the Create Volume Wizard to format the disk.

NOTE: Expansion is easiest if the array is formatted with NTFS.

Creating Arrays Larger Than 2TB

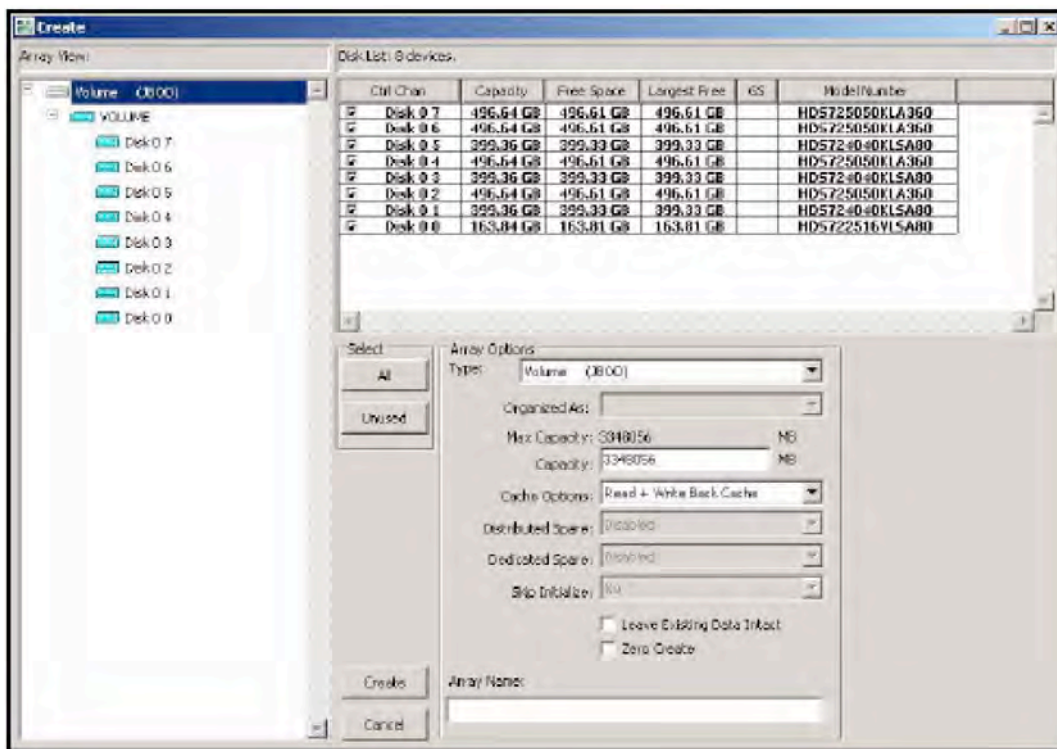
In the SCSI miniport architecture, there is a limit of approximately 2 Terabytes (TB) per array. Arrays larger than this do not operate properly. This means that RAIDConsole does not allow you to create an array larger than this limit. Windows addresses this problem in two different ways.

Creating Arrays Larger Than 2 TB.

Operating System	Description	Notes
Windows 2003 and 64-bit Windows XP	Disks greater than 2 TB are converted to the GUID Partition Table (GPT) format. This format supports very large array sizes (up to 18 Exabytes) and has no artificial constraints on the number of partitions.	See Chapter 16 of the Extensible Firmware Interface (EFI) specification for details on GPT disks.
32-bit Windows XP and 2003	Disks greater than 2 TB are created from groups of smaller arrays through the use of dynamic volumes. Dynamic volumes can be striped together using the Windows Disk Management utility to create arrays larger than 2 TB from groups of smaller arrays.	

To create volumes larger than 2 TB on Windows 2003 and 64-bit XP

1. Create an array using the “Create” command. Specify the size of the array.
2. For the “Type” field, select a desired array type.



NOTE: To create arrays larger than 2 TB on 32-bit Windows 2003, make sure that Service Pack 1 has been installed in the system.

3. From the desktop, right-click **MY COMPUTER**. Click **MANAGE**.

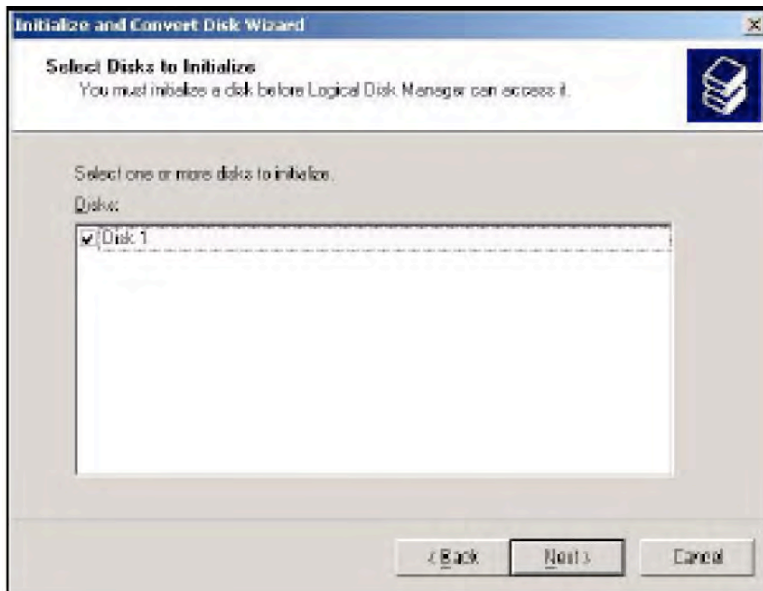
4. Under “Computer Management (Local),” click **STORAGE/DISK MANAGEMENT**. The Initialize and Convert Disk Wizard window opens.

Initialize and Convert Disk Wizard Screen.



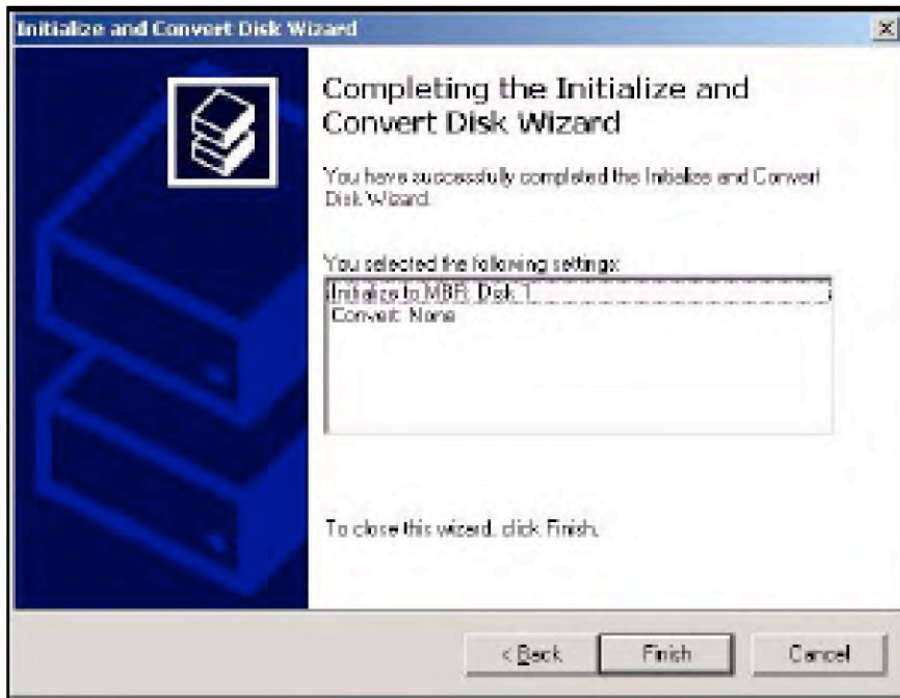
Initialize and Convert Disk Wizard Screen.

5. Click **NEXT**.



Initialize and Convert Disk Wizard Screen, Showing the Selected Disk.

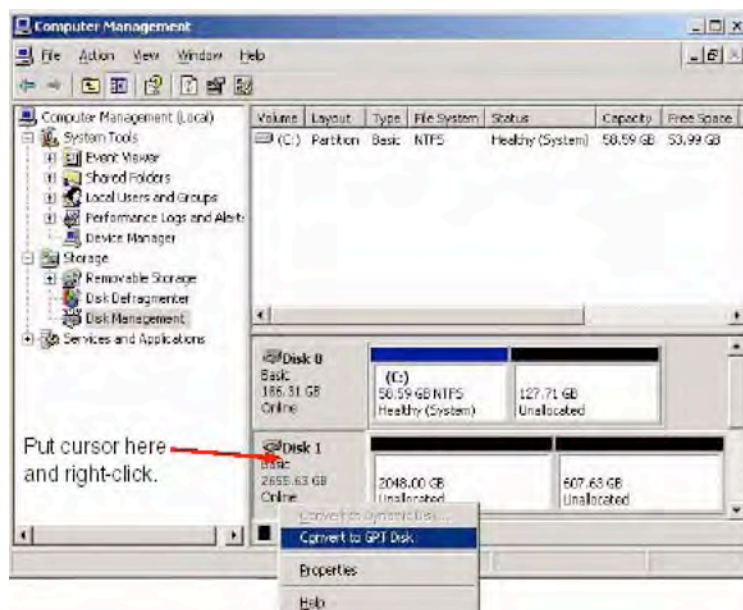
4. Select Disk 1, or the disk number of the new array. Click **NEXT** to initialize the array.



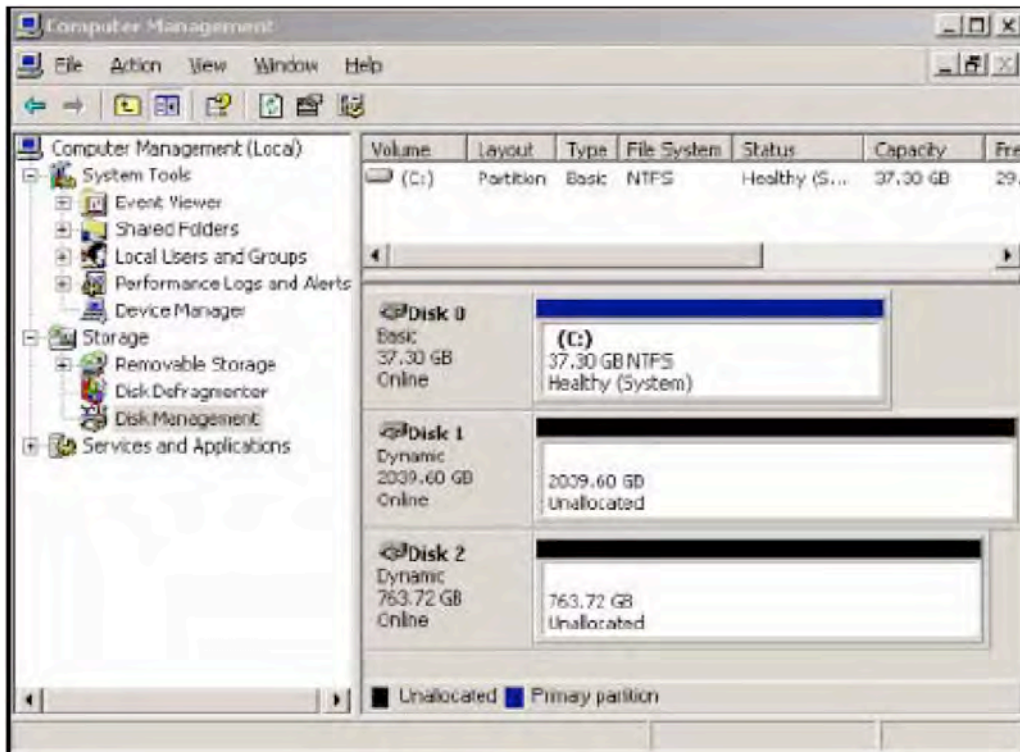
Initialize and Convert Disk Wizard Screen, Showing the Initialize to MBR Disk.

7. Close the Initialize and Convert Disk Wizard by clicking **FINISH**.
8. In the Computer Management window, position the cursor over the Disk 1 icon. Right-click and select the “Convert to GPT Disk” option.

NOTE: The two sections of the disk now are merged into one.

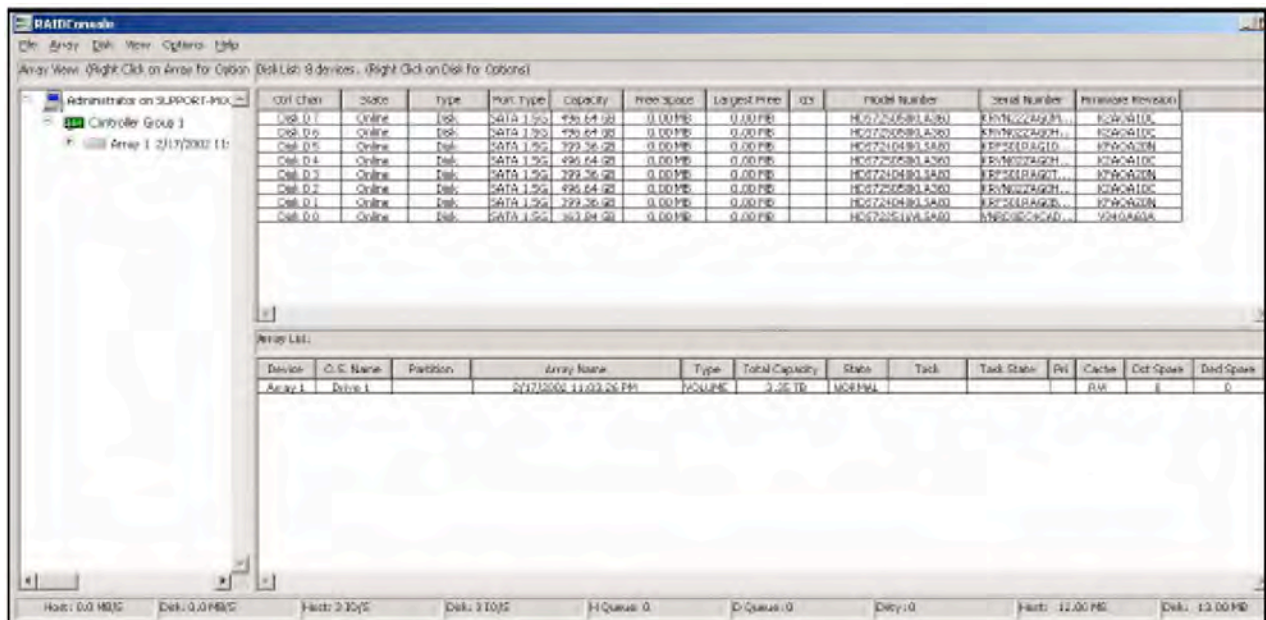


Computer Management Screen, Showing the “Convert to GPT Disk” Option.



Computer Management Screen, Showing the Merged Sections of Disk 1.

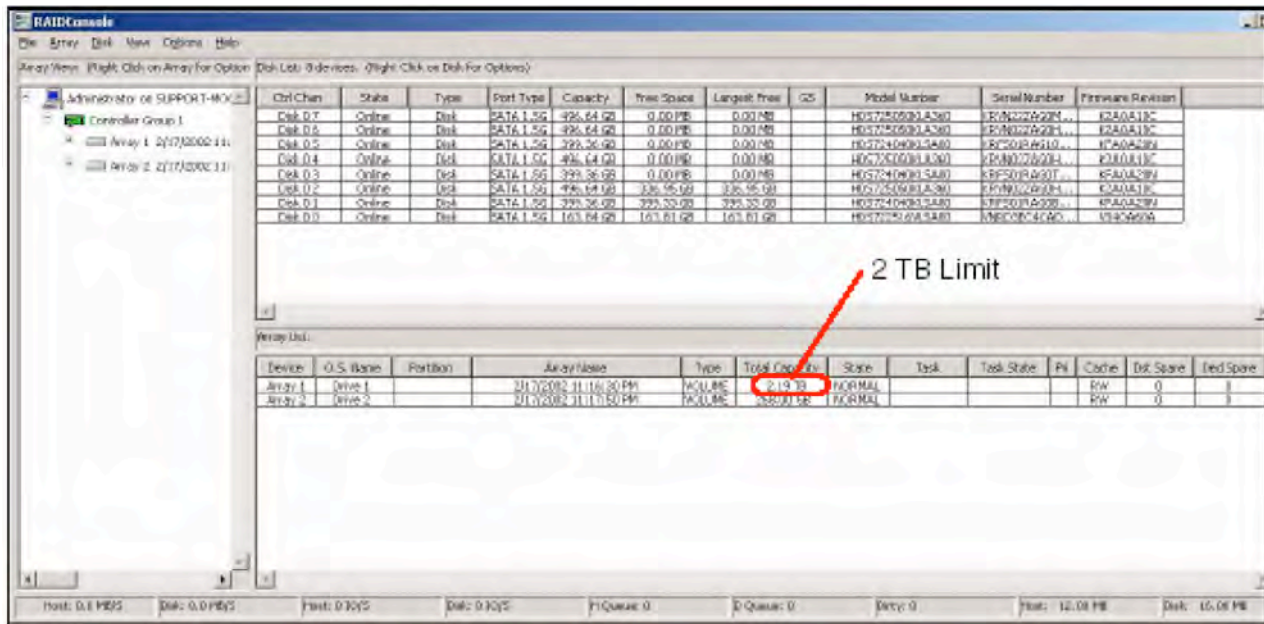
6. Close the Computer Management window.
7. The new array appear in the "Array List" area at its specified size.



RAID Controller Screen, Showing the Array List.

To create volumes larger than 2 TB on 32-bit XP:

1. Decide how many maximum-sized (2.199 TB) arrays are needed. To do this, take the whole-number result of dividing the desired total array size by 2.199 TB. For example: Desired array size = 2.46 TB. Maximum-sized arrays needed = $(2.46 / 2.199) = 1$ 258 GB is the remainder.
2. If any space is left over (e.g., 258 GB in the above example), create one more array the size of the remainder.

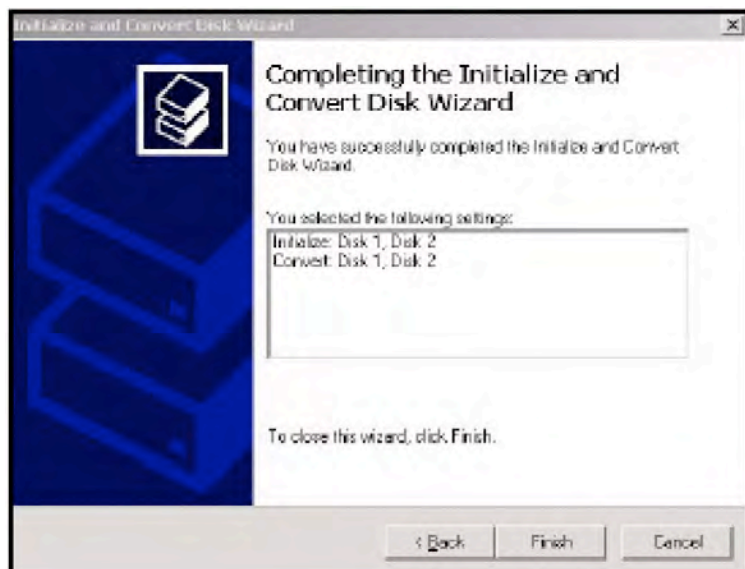


RAIDConsole Screen, Showing the Array Limit in the “Array List”.

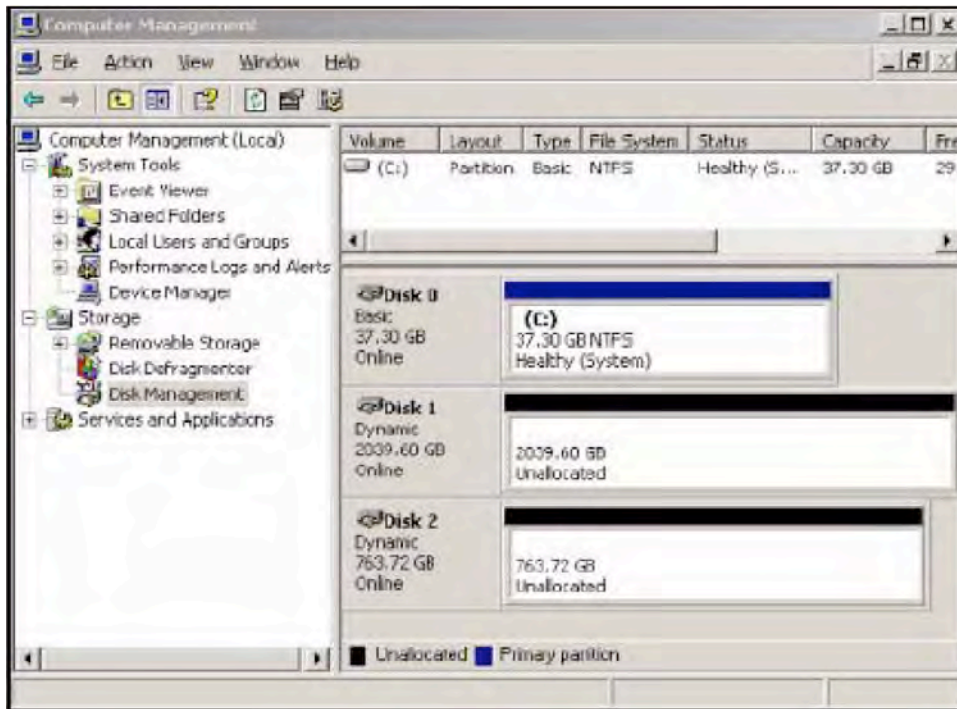
3. From the desktop, right-click **MY COMPUTER**.
4. Click **MANAGE**.
5. At the Computer Management screen, click **DISK MANAGEMENT**. (The Initialize and Convert Disk Wizard window opens).
6. Select both disks. Click **NEXT** to initialize both arrays.

NOTE: Normally, do not convert disks to dynamic disks. The file system cannot be expanded on a dynamic disk. In this case it is required.

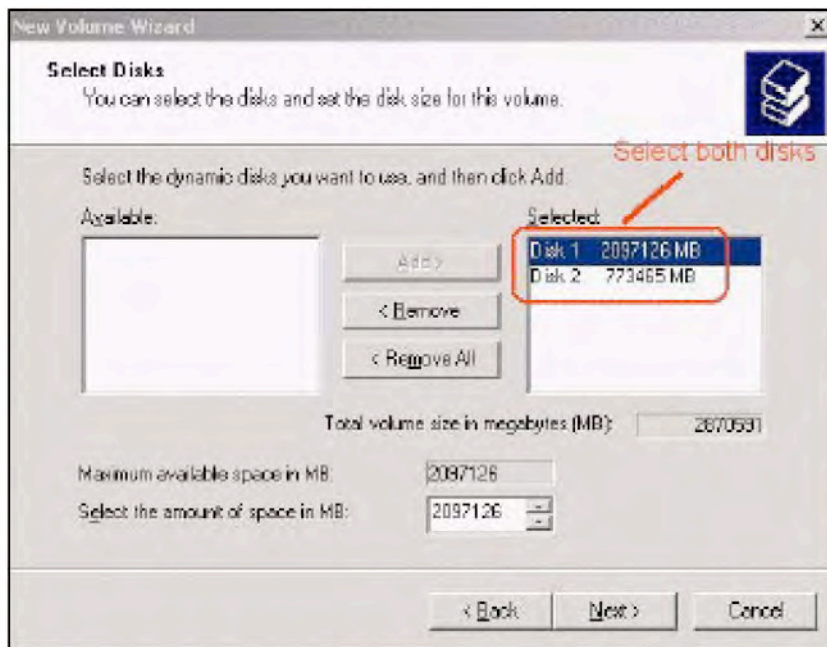
7. After selecting both disks, click **NEXT**.



8. Click **FINISH**. The arrays are displayed in the Computer Management screen.

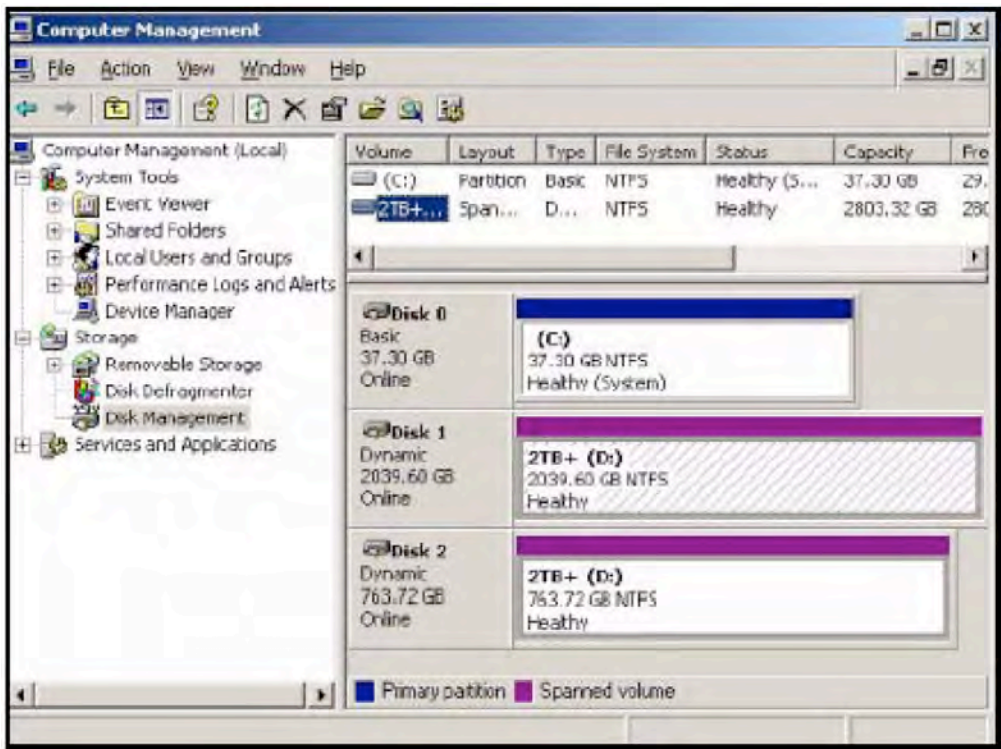


9. Right-click the first disk. Click **NEW VOLUME**.
10. Click **NEXT** when the New Volume Wizard opens.
11. Click **SPANNED**. (This type of volume concatenates the two disks together).
12. Click **NEXT**.
13. The **NEW VOLUME WIZARD** opens. Choose the desired disks and the size of the resulting volume.



14. Click **NEXT**. Follow the normal formatting procedure for a disk.

15. After the array initializes, it is displayed at the Computer Management screen.



Naming Arrays

Naming an array can be a useful practice, particularly when using RAID1n and RAID10n to perform backups. It allows an array in the BIOS to be easily identified.

To name an array

1. In the "Array View" area of the Computer Management screen, click on the array to select it.
2. Right-click on the array to view the Array menu. Click **NAME**.
3. Type the desired name in the Array Name window.

NOTE: The specified name appears in the "Array List" and in the BIOS.

NOTE: Names can be up to 30 characters long. However, the BIOS will display only 17 of those characters.

NOTE: Characters not allowed in the array name are as follows:

- (
- ^
-)
- ,
- |
- =
- "
- .

Using LEDs to Identify Arrays

You can use the “Identify Array” option within RAIDConsole to physically identify the disks that are part of an array. By selecting an array within RAIDConsole and using this feature, the LEDs on the controller or a disk enclosure blink for each disk within that array. If an array fails, this feature can be used to physically identify the disks that are associated with the failed array.

Before You Begin...

Issues and Recommendations for Using LEDs to Identify Arrays.

Issues	Recommendations
LED cables	If the LED cables between a disk enclosure and the controller are not properly connected, the wrong disks might be identified.
Dedicated spares	The LEDs for disks that are assigned as dedicated spares for an array do not blink.
Source and destination arrays	If the system is actively transforming or restoring an array, the disks associated with both the source array and the destination array blink.

To use LEDs to identify the disks in an array

1. In the “Array View” area of the Array Status window, select the desired array.
2. Right-click the array to access the Array menu. Select “Identify Array”. (When the Identify window is displayed, the LEDs for the disks associated with that array begin to blink).
3. To stop the LEDs from blinking, click **STOP IDENTIFY**.

Transforming Arrays

With the “Transform” option on the Array menu, an array can be transformed from one RAID level to almost any other RAID level. The array can be expanded dynamically, even under I/O load. In addition, with a 52-level license the Online Capacity Expansion (OCE) and Online RAID Level Migration (ORLM) features can be used to increase the size and organization of an array. These features can also be used as part of system backup and recover, by using the RAID1, RAID10, RAID1n, and RAID10n array types.

Before You Begin...

Issues and Recommendations for Transforming Arrays.

Issue	Recommendation
Array size	An array cannot be transformed to a smaller-sized array. New arrays must be either the same capacity or larger.
Array size limits	The array size of the transformed array is limited to 2.199 TB on some versions of Windows and Linux. Refer to your operating system documentation for details on maximum array sizes.
Array failure	If a drive fails while the transform is in progress, no data is lost as long as the source and destination array types are redundant. If a spare has been assigned to the destination array, a fail-over task will start as soon as the transform completes, provided the spare is available after the transform.
Multiple arrays	If there are multiple arrays on the controller, it might not be possible to transform some of the arrays to a larger size. If, in the future, an array needs to be expanded in size, it is best to configure the available space as a single array.
Task control commands	When using task control commands, a transform can only be paused/resumed but not removed. To end a transform task, pause and delete it. NOTE: If a task is paused and then deleted, the array will be deleted. Deleting a task is the same as deleting an array. Data loss will occur when the task is deleted. Please ensure you have your data backed up prior to deleting a task involving a transform or restore.
System reboot during transformation	If the system reboots during a transform, the transform continues where it left off.

To transform an array

One Stop Systems

OSS-MDA-T5

1. In the “Array View” area of the Array Status window, select the array to be transformed.

2. Right-click the array to access the Array menu. Select “Transform”.

NOTE: If the computer screen is not wide enough, only the “Destination View” is displayed.

3. Select the RAID type to be transformed.

4. Select all the disks that you want in the array (including disks that might already be in the array) by clicking on the box next to the drive in the “Disk List” area.

5. Do one of the following:

- To expand the array, enter the size of the new array.

or

- Accept the default size.

NOTE: An array can be transformed to an equal sized or larger array. It cannot be transformed to a smaller array size.

NOTE: If a transform is not possible, the “Commit” option is not enabled. A common reason preventing a transform is insufficient available space.

6. Click **COMMIT**.

NOTE: If a transformation is selected for which you are not licensed, the “License Issue” message displays.

NOTE: Unless the transform is instantaneous, the Array Status window updates to show the source and destination arrays, along with the progress of the transformation.

6. Ordering Information

OSS-MDA-T5-6TB

Ultra-rugged, high-performance RAID storage with innovative dual removable drive packs and dual SBB 2.0 compliant high-speed controllers each with two Fibre Channel 8Gb/s inputs. Includes 12 x 500GB SATA-II HDD (6 HDD per drive pack).

OSS-MDA-T5-12TB

Ultra-rugged, high-performance RAID storage with innovative dual removable drive packs and dual SBB 2.0 compliant high-speed controllers each with two Fibre Channel 8Gb/s inputs. Includes 12 x 1TB SATA-II HDD (6 HDD per drive pack).

OSS-MDA-T5-18TB

Ultra rugged, high-performance RAID storage with innovative dual removable drive packs and dual SBB 2.0 compliant high-speed controllers each with two Fibre channel 8Gb/s inputs. Includes 12 x 1.5TB SATA-II SSD (6 SSD per drive pack).

OSS-MDA-T5-24TB

Ultra rugged, high-performance RAID storage with innovative dual removable drive packs and dual SBB 2.0 compliant high-speed controllers each with two Fibre channel 8Gb/s inputs. Includes 12 x 2TB SATA-II SSD (6 SSD per drive pack).

Appendix

What is bcdm?

The bcdm program is a command line tool for managing the MDA-T5 controllers.

The bcdm program initiates RAID operations, such as:

- Creating and transforming arrays
- Deleting arrays
- Adding and removing disks
- Splitting mirrored arrays.

It also provides information on drive and array states. In --follow mode, it logs events and notifies the administrator of any changes in disk or array status.

The bcdm program has eight primary modes, with most primary modes having additional optional arguments. The eight modes of operation are:

Modes for the bcdm Program.

Mode	Usage
Manage	Uses the bcdm --manage command to manage and query controllers, arrays, and disks.
Create	Uses the bcdm --create command to create a new array.
Delete	Uses the bcdm --delete command to delete arrays.
Transform	Uses the bcdm --transform command to transform an array.
Create Copy	Uses the bcdm --create copy command to create a copy of an existing array.
Split	Uses the bcdm --split command to split a mirrored array.
Follow	Uses the bcdm --follow command to follow or monitor arrays and disks.

Example of bcdm Usage

The following example steps you through a series of bcdm commands. The examples are shown in logical progression with the resulting output of each command. Reviewing this information will give you an idea of what to expect while working with the bcdm program. This scenario illustrates most of the major modes of operation and some of the more commonly used options—including initializing disks, creating arrays, querying for information, transforming arrays, and splitting a mirrored array.

bcadm Command Sequence and Their Location in This Chapter.

Command Number	Action Performed	Page Location
1	Query the status of all controllers, disks, and arrays.	E-54
2	Initialize all eight disks.	E-55
3	Query again to see the status of all controllers, disks, and arrays.	E-56
4	Create a RAID1 set the size of 1 GB using three disks,	E-57
5	Query the status of array 1 in verbose mode to get all details.	E-58
6	Query the status of the controller.	E-59
7	Create a new RAID5 set with a size of 1GB using all disks, while also enabling distributed sparing.	E-60
8	Query the status of array 2.	E-60
9	Check the activity status of array 2 and its task type.	E-61
10	Query the status of all controllers, disks, and arrays.	E-62
11	Query information on the arrays only.	E-63
12	Split array 1 using the default settings.	E-64
13	Query the status of all arrays.	E-64
14	Assign array 1 the label "old mirror."	E-65
15	Assign array 3 the label "new split."	E-65
16	Query again the status of all arrays.	E-65
17	Un-hide array 3.	E-66
18	Query the status of array 3.	E-66
19	Print the maximum possible size, if array 3 is transformed from a Volume to a RAID5 set, using all disks.	E-67
20	Transform array 3 to a RAID5 set using all disks, with a size of 2 GB.	E-67
21	Query the status of all arrays.	E-68
22	Query the status of all arrays.	E-69