Highly Reliable SYSTEMS

BNAS 400/450 and RAIDFrame BNAS with 2 Bay AMT

Combined Operating Manual V1.3

1 Terminology.

The definition of some simple terms as they are used here will help in understanding the remainder of this document:

- Hard Disk – The actual hard disk drive where data is stored.

- Tray – The removable cartridge which holds the hard disk.

- Media – The assembly of the hard disk in the tray. Often times, the term "Drive" refers to media.

- HRC Media – High-Rely Classic media, contains a single 3.5" hard disk.

- RAIDPac – The media for RAIDFrame which is a self-contained hot-pluggable RAID system cartridge and contains (3) 3.5" drives and a RAID controller.

- Receiver – Also referred to as the bay. The slot where the Media is inserted.

- AMT – Automatic Mirror Technology is the term and technology Highly Reliable Sysytems, Inc. uses to describe the use of automatic drive duplication in order to create a backup for which the host knows nothing of.

- RAID 1 – Is the RAID type designator for Mirror (see Mirror below). Sometimes RAID 1 and Mirror are used interchangeably throughout this document.

- Mirror – A byte for byte (exact data) copy. Usually a hard drive mirror means that one hard drive is an exact duplicate of another. This is primarily used in the event that one hard drive fails, the other can resume operations. However, High-Rely often uses mirroring to create backups without software intervention or necessity. We may use the terms Mirror, AMT or RAID 1 throughout this document, all terms essentially mean the same thing for these purposes.

- Re-sync, re-syncing, mirroring, rebuilding - maybe used interchangeably and is meant to be the process of the hardware RAID controller duplicating the good drive of the mirror set to the drive that is not yet up to date.

- Synced, mirrored - maybe used interchangeably and is the term used for when both drives in the mirror are exactly the same.

- Swapping, swap – usually considered the action of removing one media and inserting another.

- JBOD – An acronym for Just a Bunch (or Box) Of Drives (or Disks). This term is often used when referring to a more than one hard drive in a physical grouping of drives where each hard drive is an independent storage entity and is in no way bound to any of the other drives. An example of a hard drive bound to another drive is like what occurs in a Mirror (see definition above).

Important!
This is a NAS (Network Attached Storage) device for the purpose of fulfilling part of your system back-up strategy. It is provided by us (the factory) in a Vanilla configuration with only minimal software installed. The software, configurations operation and back-up strategy are to be determined by your IT service provider. The discussion of such is not within the scope of this document nor something otherwise provided by Highly Reliable Systems. Be aware, the administrator password has not been set.

2 READ THIS FIRST

Important Quick Start Information for your High-Rely drives

- YOUR MACHINE IS SET TO OPERATE AT 115 VOLTS A/C. IF THE OPERATING VOLT-AGE YOU INTEND TO USE IT ON IS HIGHER SUCH AS 220/240 VOLTS A/C, BE SURE TO MOVE THE VOLTAGE SELECTOR SWITCH ON THE BACK OF THE UNIT TO YOUR OPERATING VOLTAGE RANGE. FAILURE TO DO THIS COULD RESULT IN SE-RIOUS DAMAGE TO YOUR UNIT! Some units may be "auto-switching" which do not require this so there is no selector switch on the back of units with this feature.

- WE HIGHLY RECOMMEND that the BNAS$^{(R)}$ is placed on a UPS of 750VA capacity or better. This will insure stable operation and product life during unstable power situations.

- High-Rely Media contain SATA hard disks which are extremely sensitive to shock. Please handle with care when transporting off-site or removing and use our padded carrying cases to avoid data loss through physical damage.

- DO NOT ATTEMPT TO REMOVE High-Rely Classic media from their media bays without "unlocking" the media with the key first! Forced removal of the media will void your warranty. The key has a mechanical interlock that blocks the media from being removed. Do not attempt to remove RAIDPac media without pressing the release lever 10 seconds prior to pulling the media out.

- We recommend telling all operating systems to "safely remove" the drive prior to removing drive to avoid removing drive during a write. If you are sure the drive is not being used, you may skip this step at your own discretion.

- High-Rely Classic media will not "power up" until the key lock, on the front of the drive, is turned to the locked and on position. This is by design and prevents accidental media removal.

- The latest Service Packs are important! Microsoft has continued to Debug removable drives on all Windows product lines.

● If you are using multiple trays in the single bay of your High-Rely in PM/JBOD mode, you may have a drive letter problem as you change your media. Windows will assign drive letters randomly, which may cause your backup software to fail. You can use the High-Rely Drive Manager utility HRDM2 to solve this problem. HRDM2 allows you to set particular drive letters and shares to particular drives and then makes sure those letters stay the same after removal and insertion.

● Particular photos in this manual may not be your exact unit.

The information in this manual primarily documents Windows OS. Although the High-Rely may work with Windows NT, Linux, Mac OS X and other operating systems, at this time, our tech support can assist with Windows platforms only.

3 Introduction.

The BNAS 400/450 and RAIDFrame BNAS (RFBNAS) integrate High-Rely's 2 Bay AMT products as well as few other features into a Rack Mount chassis with its own significant computing power for many purposes - see the functional block diagram below. The BNAS product is quite useful as a standalone device but also leverages the power of many other High-Rely products.

High-Rely's 2 Bay AMT products like that integrated into the BNAS are unique backup products which provide your backup strategy with a large, reliable, redundant means of near-line storage as well as a removable means of storing data for off-site backups. With our 2 Bay AMTs, your backup can be both near-line and off-site without the addition of any software or configuration. This is because the 2 Bay AMTs have a built-in hardware RAID controller which can mirror (copy) the media in your unit automatically. Thus, you're free to remove one of the media for off-site storage while the other remains on-line to your hosts.

Removal and replacement of the off-site media will not interfere or even alert the host that anything has changed because the volume will never go off-line during a drive change. As far as your host computer is concerned, the 2 Bay AMT device is a single stand-alone drive (when set to RAID 1 - mirror). Thus, special software drivers or backup software configuration is unnecessary making a 2 Bay AMT very portable from host to host. In this case of the BNAS, the 2 Bay AMT has been built into the BNAS and thus the BNAS is the host. In addition to this powerful storage feature, the BNAS 400/50 has a third bay which is independent of the 2 Bay with AMT function. This allows for your media to be accessible to the system without the interference of the 2 Bay AMT. The RAIDFrame BNAS (RFBNAS) has 2 bay which are not connected to the AMT portion.

Additionally, the RAID 1 (mirror) configuration will tolerate a single media failure without loss of data (provided the media failure does not occur during a rebuild/copying process).
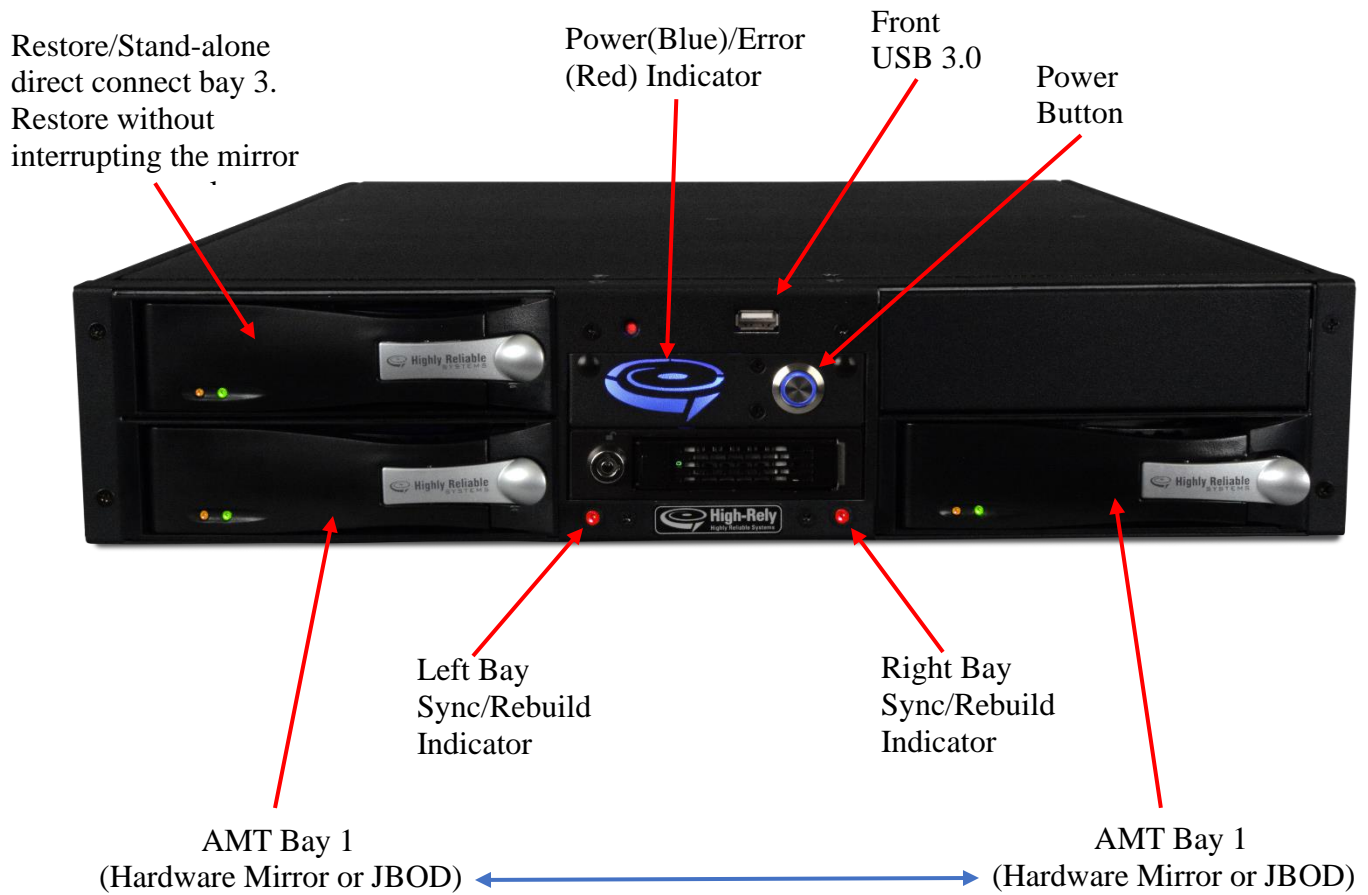
There is no information written to either media by the RAID controller which interferes with the media being read by another computer without special hardware or software – if your media is all you have; your data can still be retrieved.

4 BNAS 400/50 Specifications

- Dimensions (2U Rack-mount)

  23" L X 17" W X 3" (2U) H

- Weight (unit alone, with no media installed)

  26 lbs

- Typical Power Consumption

  Idle (booted windows, but no other activity): 80 Watts

  Working (performing tasks on internal drive and drives on 3 bays): 130 Watts

- Typical Thermal output

  Idle: 270 BTUs

  Working: 440 BTUs

- Ports

  (2) 1GPS NIC connections (RJ45)

  (5) USB 3.0 – 4 rear, 1 front

  (2) USB 2.0 – rear

  (2) USB 3.1 Type C - rear

  VGA, DVI, HDMI, Audio

- Internal Storage

  250 GB SSD

- External Storage

  1 HRC Bay, 2 more HRC Bays via AMT controller. Each HRC bay can hold up to 16TB. At the time of this writing, 16TB is the largest 3.5" SATA HDD available.

- CPU

  i5 8500 (400), i7 8700 (450)

- RAM

  16 GB (400), 32GB (450)

- Typical Hardware RAID Performance

  Mirror duplicates 300 – 500 Gigabytes per hour, depending on drives and load.

Page 8

5 BNAS 400/50 Front Panel Controls and Indicators.

Restore/Stand-alone
direct connect bay 3.
Restore without
interrupting the mirror

Power(Blue)/Error
(Red) Indicator

Front
USB 3.0

Power
Button

Left Bay
Sync/Rebuild
Indicator

Right Bay
Sync/Rebuild
Indicator

AMT Bay 1
(Hardware Mirror or JBOD)

AMT Bay 1
(Hardware Mirror or JBOD)

6 BNAS 400/50 Back Panel Connection Features

A/C Power Cord
Connector

(Optional)
eSATA PCIe card

Gigabit Ethernet

Main Power
Switch

Back I/O
PS2, VGA, DVI, HDMI,
USB 3.0, USB 2.0, audio
connectors

(Optional) 10GBs
NIC PCIe card
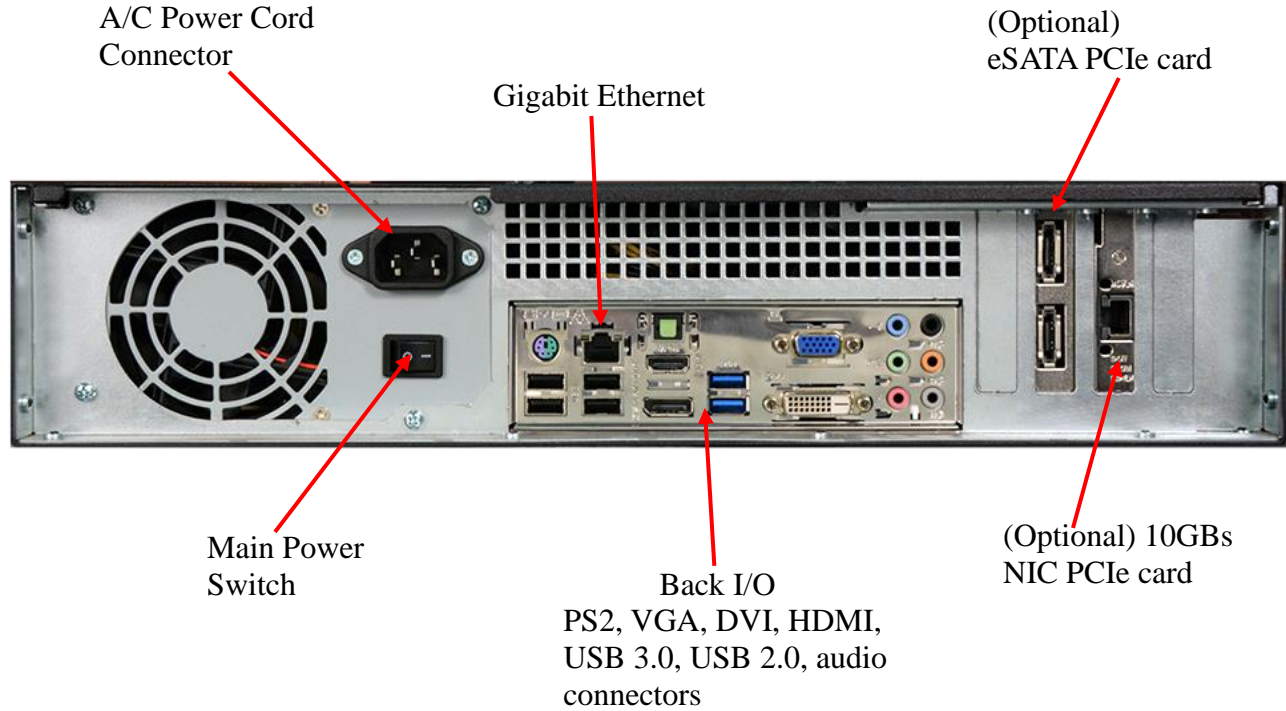
7 RAIDFrame BNAS Specifications

- Dimensions (4U Rack-mount)

23.5" L X 17.25" W X 7" (4U) H (with rack ears, 19" W)

- Weight (unit alone, with no media installed)

45 lbs

- Typical Power Consumption (*4 RAIDPacs installed, booted windows, but no other activity):*

140 Watts

- *Working (performing tasks, 4 RAIDPacs installed):*

160 Watts

- Typical Thermal output

Idle: 480 BTUs

Working: 550 BTUs

- Ports

(2) 1GPS NIC connections (RJ45)

(5) USB 2.0 – 4 rear, 1 front

(2) USB 3.0 – rear

(2) eSATA 3GPS

VGA, DVI, Audio

(2)PS2 - Keyboard, Mouse

- Internal Storage

120GB

- External Storage

2 RAIDPac bays, 2 more RAIDPac bays via AMT controller, more through USB and eSATA connections (HRC, RAIDFrame, Mpac or others). Each RAIDPac bay can hold up to 48TB. At the time of this writing, 16TB is the largest 3.5" SATA HDD available.

- CPU

Xeon E3 3.1

- RAM

32GB

- Typical Hardware RAID Performance *Mirror duplicates 200 – 300 Gigabytes per hour, depending on drives and load.*

8 Choosing Media sizes.

Depending on your use, the media size should be considered in the design of your application. In fact, it will probably be the determining factor of which BNAS class you choose. Obviously, the RAID-Frame BNAS has much more capacity, both total and per media and a whole extra bay as each RAID-Pac can store up to 3 times as much as the HRC media. But the 2U HRC model is less costly.

For both units, two of the bays can work as a hardware mirror or JBOD. If used in JBOD, the sizes and mixing of media is not critical other than what is required for your application.

However, if you chose to use the hardware mirror (AMT function) the media in the media pool should be the same size across the whole set of media. For example, all media is 1 TB in size. The 2 Bay AMT portion of the BNAS will not mirror data from a larger media to a smaller media which may limit some of your backup options. And while it can mirror from a smaller to a larger, the difference in size is lost on the larger media as unused. Keeping all media the same size avoids this road block or waste.

For the case when you would mirror from a smaller hard drive to a larger one, this allows for larger re-placement media in the future if the current size is no longer available.

The media family the BNAS400/50 supports is the HRC media which houses a single 3.5" SATA drive. Thus sizes are limited by what is available in this format currently. The media family the RAIDFrame BNAS supports is RAIIDPac, which houses (3) 3.5" SATA drives – thus up to 3 times the capacity of the HRC media.

9 Applications of the BNAS 400/50 and RFBNAS

In today's world of network servers and virtual machines, Direct Attached Storage (DAS) can have physical connection limitations. As makers of advanced DAS mobile storage, we began to incorporate networkable front ends with our mobile storage systems. The BNAS 400/50 and RFBNAS are the 4th generation of these solutions offered by Highly Reliable Systems.

Although the BNAS's were built with the intention of being part of a back-up solution, the alternative uses are many. But with a focus on back-up applications, below are some popular uses:

1) A dedicated Backup Appliance.
2) Multiple integrated removable disk trays to allow rapid data backup or recovery of large data sets without the need to wait for internet restore during a disaster. The removable drive system includes the ability to utilize a hardware mirror of the primary data repository hard drives facilitating "softwareless" backup.
3) A powerful 64 bit Windows based server to host one or more "Virtual machines" during a disaster and virtual servers can use previously stored backup images.
4) Archival to removable storage.
5) A Network Attached Storage (NAS) device.

The BNAS 400/450 and RFBNAS integrate some of the functionality of our NetSwap 1 Bay, and 2 Bay AMT product. They also have the ability to drive other HR devices such as the RAIDFrame, Mpac or HRC products. If so configured, the integrated AMT feature found in our 2 Bay AMT and FirstRAID G4 models can be used to make a softwareless backup of the primary storage drive via the AMT bays 1 and 2. The third bay (and 4th for the RAIDFrame BNAS), among other things, can be used for restoring purposes without taking the 2 Bay AMT off-line. In the case of the RFBNAS, it can actually be configured to boot from a RAIDPac lending itself to quite a large and removable system drive if so desired.

10 Typical Backup Usage and Tips for the BNAS400/50 and RFBNAS:

Examine the functional diagram in the pages above. There are three storage systems:

- **BNAS 400/50** :
  1. The system drive is an internal 250GB, of which 200GB is left usable for storage.
  2. Storage drives: 1) direct attached HRC Receiver (can accommodate HRC media which uses a single 3.5" SATA hard drive). Current capacities up to 16TB per Media.
  3. (2) External HRC Receivers (AMT function), like the other, however, these two are managed separately by a hardware mirror controller. The management and settings of this RAID are controlled through a desktop application called JM RAID Manager. The JM RAID Manager is currently only available as a Windows Application and not supported yet for other operating systems.

- **RAIDFrame BNAS**: The system drive is a 120GB SSD. An extra 2.5" SATA drive service bay is provided.
  1. The system drive: 120GB Intel SSD.
  2. (2) direct attached and (bootable) bays (1 and 2), current capacities up to 12TB each.
  3. (2) more External RAIDPac bays (AMT function), like the others, however, these two are managed separately by a hardware mirror controller. The management and settings of this RAID are controlled through a desktop application called JM RAID Manager. The JM RAID Manager is currently only available as a Windows Application and not supported yet for other operating systems.

In most applications, it is recommended that the mirrored drive volume (bay 1 and 2 for BNAS 400/50 and bays 3 & 4 for the RAIDFrame BNAS) be considered as the main data repository to be used for depositing backup images of machines (servers) onto. It is also recommended that 3rd (BNAS 400/50) or 1st or 2nd (RAIDFrame BNAS) bays be left open so that if a Restore must be done, it can be done from that bay without interfering with the Mirror set. This allows for a restore directly to the mirror set. However, it is not uncommon to use this these bays as another back-up destination – particularly if you want to backup the BNAS itself outside of whatever server back ups are being hosted. It is not necessary for the direct attached bays to have the same size media in it as the media pool used in the mirror. See the scenarios below for how this operates.

11 Operating Scenarios:

11.1 Stand alone, No Server – self backing NAS

In this instance, the BNAS is actually the file server for a small office. The mirror is the shared volume from which everyone's workstation retrieves and stores data to during the day. When they all leave at night, there is no more activity on the unit. Thus, nighttime proves to be the best time to re-sync because that is when the unit will be the least busy. So the unit starts the day with steady green lights because it's drives are synced up. When the office closes, the manager swaps a media out. The swapped media then begins to get copied to and synced with the remaining drive installed. This leaves a 15 hour window (5:00pm to 8:00am) before the unit will have activity again. 15 hours is more than

enough time to mirror up to 3 TB. When the office opens at 8:00 am, the flashing red has turned solid green, and is safe to remove and swap again. This is a truly softwareless backup configuration as there is no backup software running.

11.2 Backup Software writes to Mirror

In this scenario, backup software such as Backup Exec, Acronis or Shadow Protect, Windows backup, etc. is used to write backups to the mirror via a network share. In the case of multiple servers, multiple folders maybe setup as targets for each server's backup.

The typical set up is such that the backup job(s) should complete as close to before the time the media is swapped as possible. This allows the maximum time between when the media was swapped, and the backup job is started, for the syncing to complete. If the backup job starts before the syncing operation completes, things will slow down considerably thus stretching the backup window out and the sync window out and possibly never allowing a complete or proper sync to occur before the next media swap.

For this example, the office opens at 8:00am and closes at 5:00 pm. The backup job(s) takes 4 hours to run. Allowing an additional four hours for anyone working late, the backup job(s) have been set to start at 10:00pm. That leaves plenty of time for the backup job complete and to grow in length or to handle exceptions. At 8:00am, the office opens and the secretary checks to see that the swap bay's sync indicators are steady green indicating the drives are synced and either maybe removed without damaging the volume. If so, she swaps out one of the media. Once swapped, the new media's sync indicator will flash red and green indicating that it is rebuilding. Also, the Power/Error indicator will flash blue and red. The newly installed media begins to rebuild. Then throughout the day, between 3 and 12 hours later (depending on media size), the swapped media will finish syncing up and the blinking red light turns solid green and blue again. Then at 10:00pm the unit is takes backup sets from the server(s), writing the back up data to the mirror again. Both drives receive the backup data at the same time and remain in sync. At 8:00am, the cycle starts over again.

If the red light was still blinking when the secretary came in to change the media, then something bad happened (sync not complete or disk error) and the media is not ready to remove. If she removes the one that is blinking still, the copy she keeps will not be complete and thus is corrupted. If she removes the other with the steady light, she will disconnect the mirror. Thus, if either bay's light was steady red, she should call IT.

11.3 Backup in JBOD mode with up to three servers:

In this situation, the RAID configuration is disable (JBOD) and three drive volumes appear, J:, K: and L:. These drives are each shared out. Each of the servers is attached to its own drive and performs a traditional backup. Thus, share J goes to server 1, share K goes to server 2, share L goes to server 3. The backup software is loaded onto each of the servers and is set to do a full backup once a week and incrementals for the rest of the week. HRDM2 is used as in the examples above to keep windows from confusing drive letters. Also, the feature in HRDM2 to reactivate shares once a drive has changed is

also enable. Without this feature, each drive would have to be re-shared after it was changed. The media pool consists of a total of 12 drives. 3 for daily incrementals for week 1. 3 for full backups of week 1. Then again for week two.

The set of 3 media is changed once a week before the day of the full backups. Also, the backup start time of each server are set to start well after the backup of the previous server has ended so that multiple servers are not trying to backup at the same time, otherwise, the network connection to the machine can become swamped and the jobs may not complete or connection problems could occur. However, the BNAS does have 2 network connections to help in situations like this through separation, bonding or load balancing (talk to your IT person).

11.4 Combinations of the above scenarios:

Because the third bay is independent, it allows you configure a system that combines the functions of the above scenarios. Also, the expansion eSATA and USB 3.0 ports on the back of the machine will work with more High-Rely DAS devices like a rack mount 10 bay providing a total of 13 or more possible bays! Cross media types can be used as well. RAIDFrame and Mpac media type systems can work harmoniously with the BNAS.

12 Connecting and Turning on your BNAS.

YOUR MACHINE IS SET TO OPERATE AT 115 VOLTS A/C. IF THE OPERATING VOLTAGE YOU INTEND TO USE IT ON IS HIGHER SUCH AS 220/240 VOLTS A/C, BE SURE TO MOVE THE VOLTAGE SELECTOR SWITCH ON THE BACK OF THE UNIT TO YOUR OPERATING VOLTAGE RANGE. FAILURE TO DO THIS COULD RESULT IN SERIOUS DAMAGE TO YOUR UNIT! Some units may be "auto-switching" which do not require this so there is no selector switch on the back of units with this feature.

WE HIGHLY RECOMMEND that the BNAS[R] is powered through a UPS of 750VA capacity or better. This will insure stable operation and product life during unstable power situations.

The BNAS is expected to be installed and connected by an IT professional, the following instructions may not be understood by and are not intended for the layman.

1. Install into your rack as required.
2. Establish your power connection to the rear of unit.
3. Connect your network RJ-45. Both ports are 1Gig capable.
4. Connect your monitor, keyboard and mouse.
5. Press the round power button on the front and boot the unit.
6. Your administrator password is "High-Rely". Your unit is already activated with the product code on the rear of the machine. Once changed, High-Rely can not assist your if you lose of forget your administrator password. Your only recourse through us in this case is an out of warranty service call.

13 Status indicators and changing backup drives (media) in a Mirror (RAID1) configuration

The factory default configuration for the AMT bays is JBOD (also called PM). This means every new media inserted will appear as an independent volume. In order to make use of the AMT function, at least two media must be configured as a mirror. After that, each sync up to a new media will transfer over the Mirror settings as well and mark that media as part of the mirror (RAID) group pool of media.

Page 18

13.1 Starting a mirror (RAID 1) with AMT using JM RAID Manager.

To do this, you must install two media in the AMT bays (for BNAS 400/50, bays 1 & 2. For RFBNAS, bays 3 & 4). WARNING! Following this process will erase all data on both drives!

In order to make this change, you must first run the desktop application, JM RAID Manager. This should already be installed on your BNAS (<Start<Programs<JMicron HW RAID Manager - <= left click, > = right click). If for some reason it is not on your particular unit, it can be downloaded from our website www.high-rely.com.

When you run it, it may look similar to this:

RAID 1 (Mirror). In this mode, the 2 Bay AMT will prepare off-site duplicates of your backup media (drive) automatically. Your master drive can be in either bay, but we suggest you choose one for consistency and to avoid confusion. Occasionally, you should swap out the other bay to keep the media cycling. Once the media has been synchronized by the AMT, it assumes that whichever media is left after you remove one is the master.

NOTE: Highly Reliable Systems is not the author or owner of this software, thus support for this program is limited.
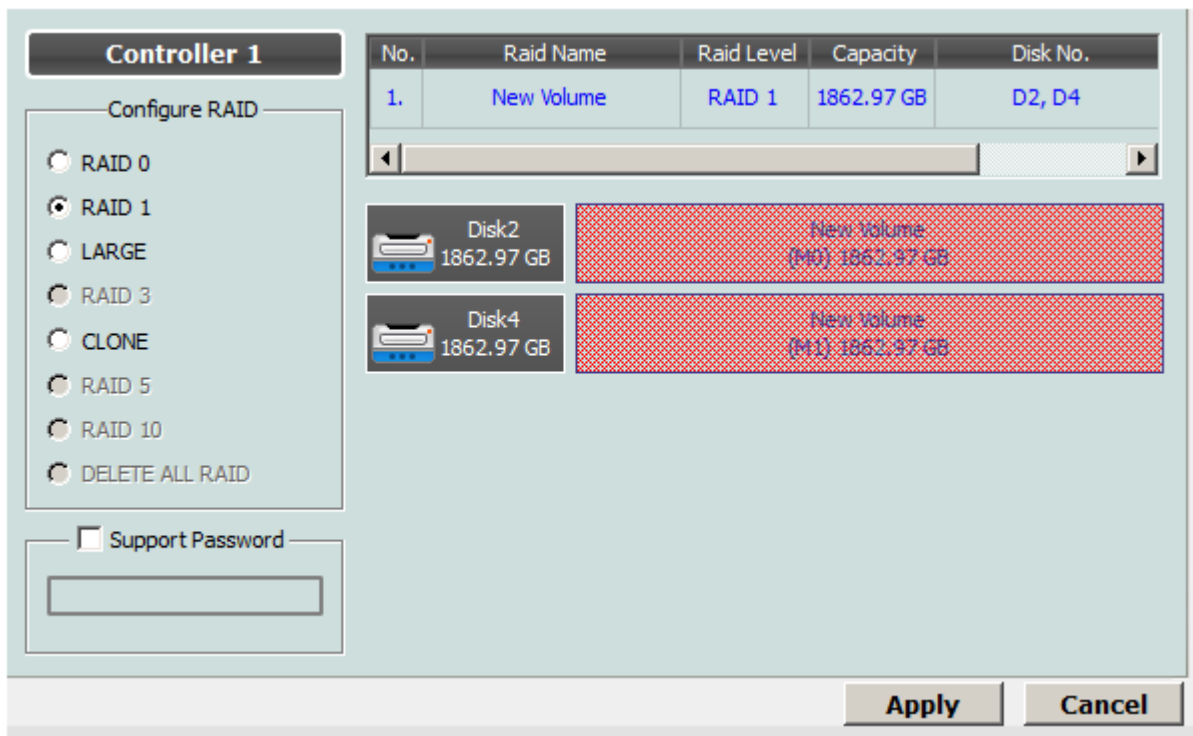
There are two menu tab columns, Basic/Advanced Mode and the iconic sub tabs under those. Staying in the basic mode, click the settings icon:
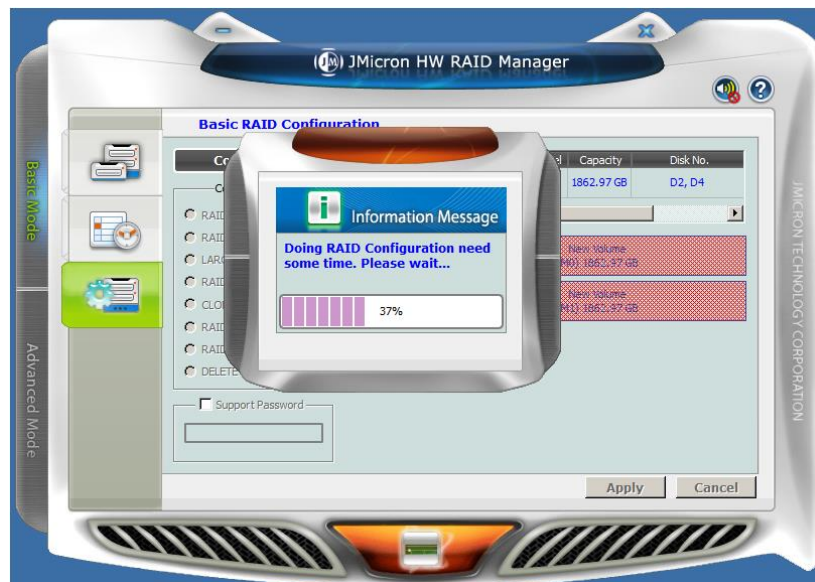

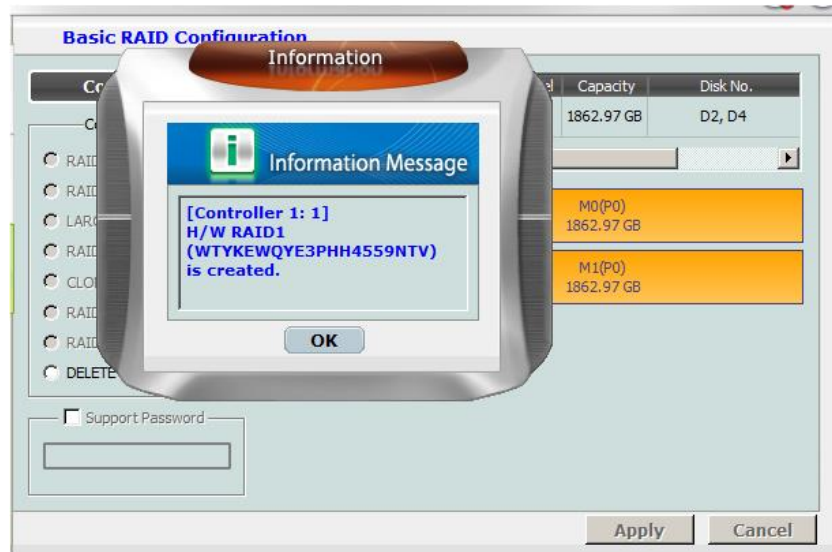Doing this should bring up the next screen:
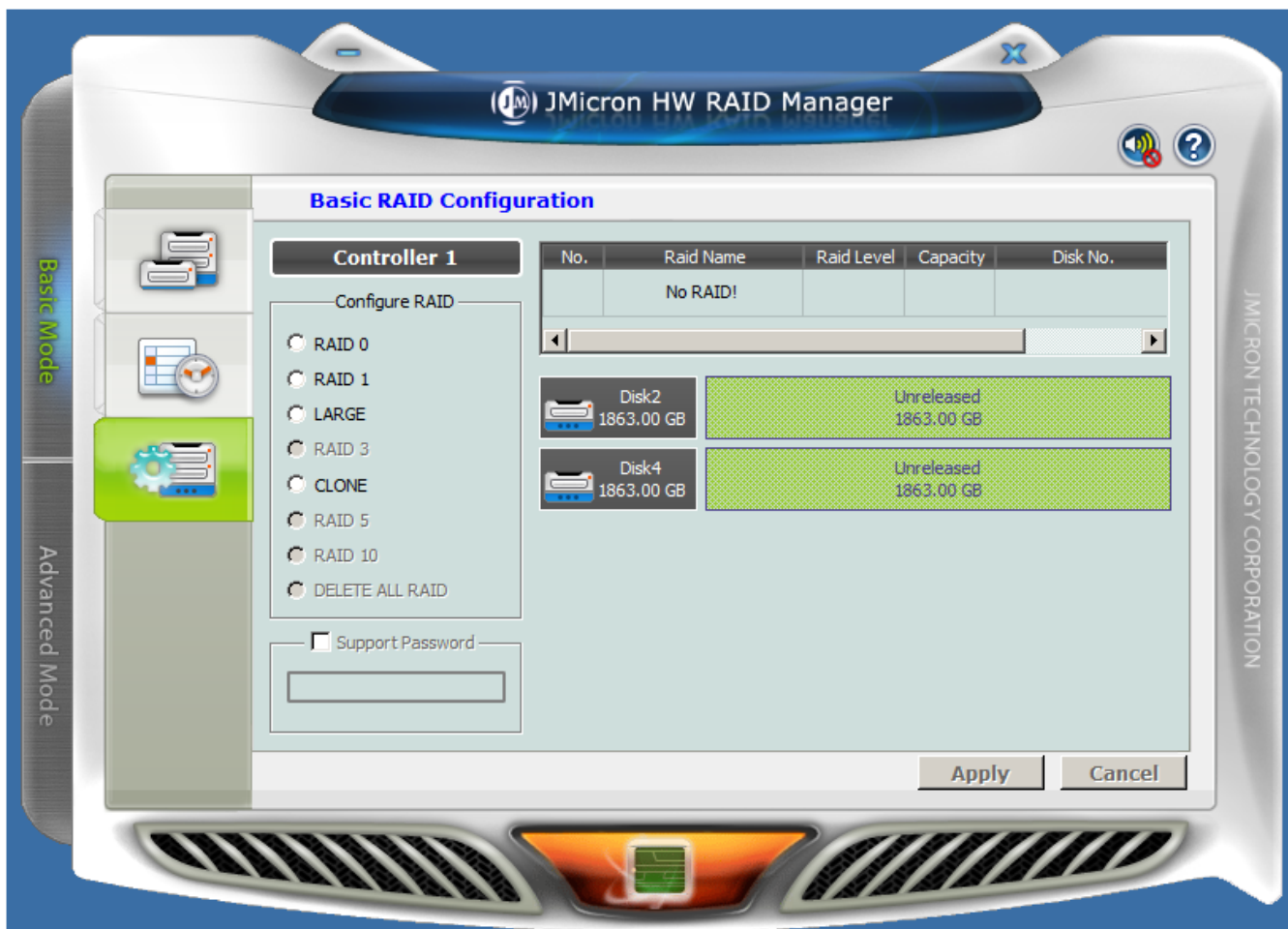
Click the RAID 1 setting:

Then click Apply and then Yes:

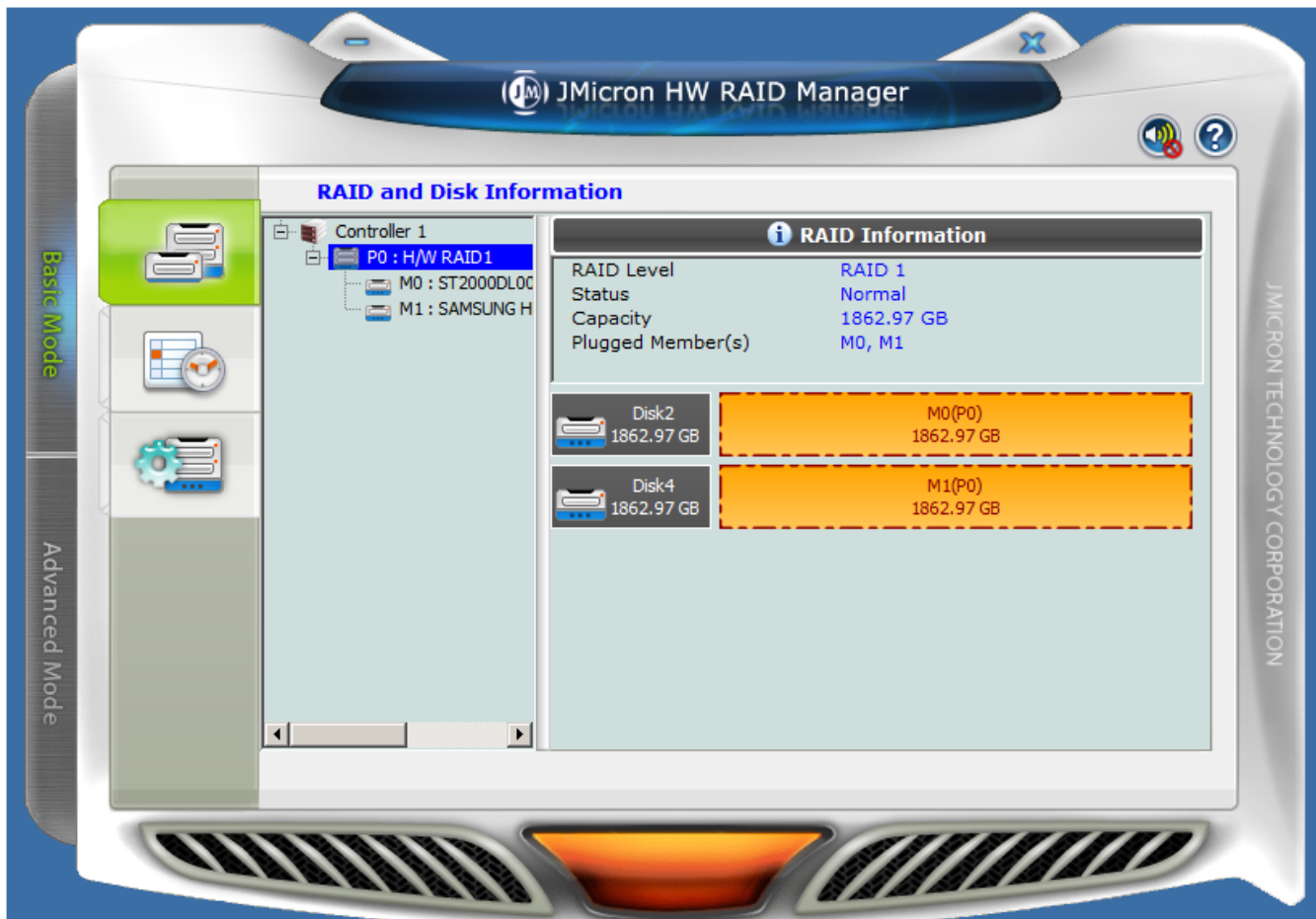After the RAID 1 setup completes, you should see something like this:

And click "Ok":

Click the RAID and Disk Information icon:
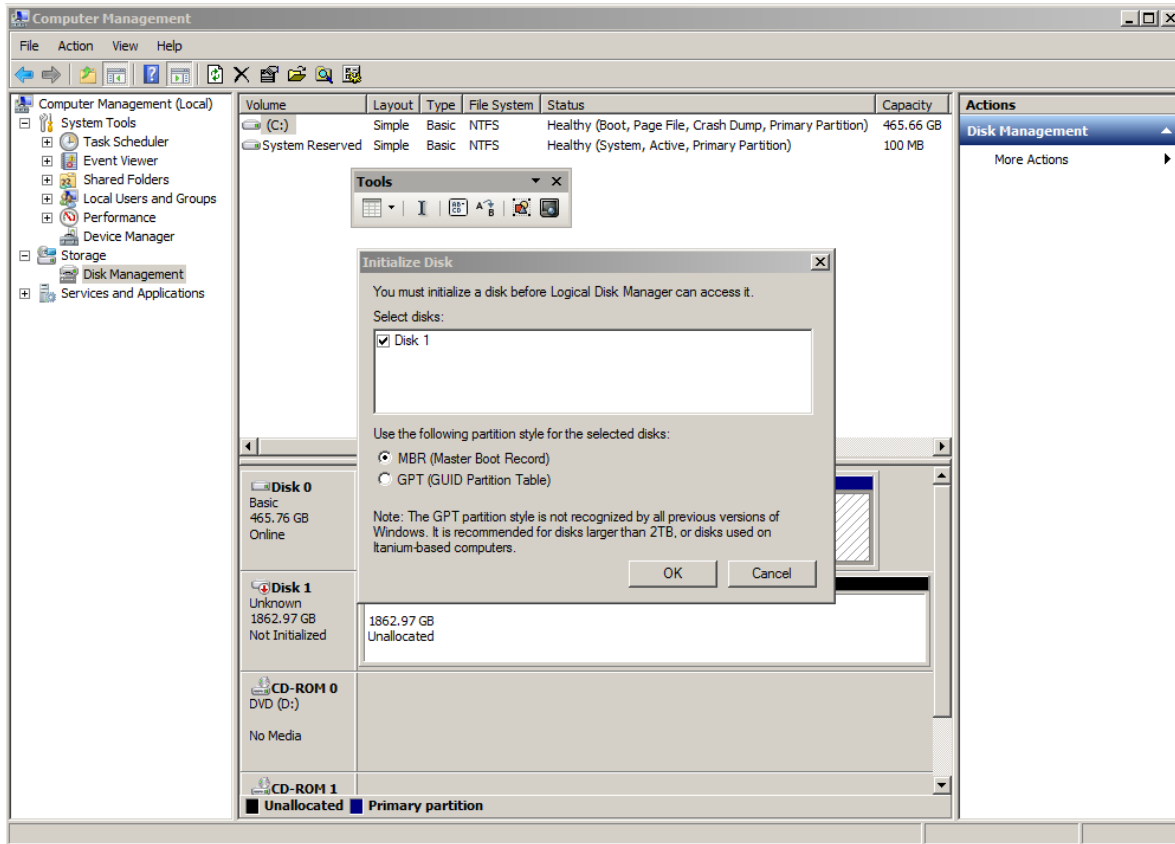

And you should see something like this:
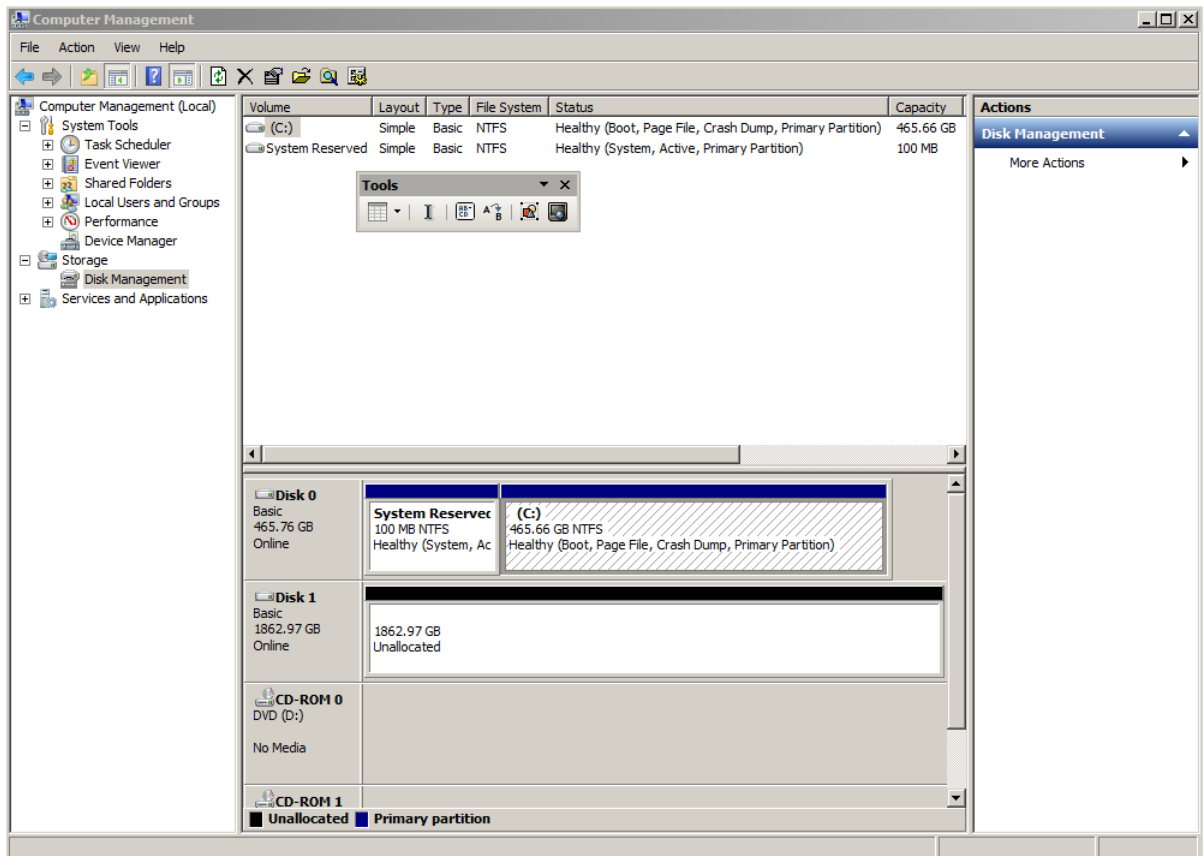
Then under Disk management (<Start>My Computer<Manage<Disk Management - <= left click, > = right click), you should see something like this:

If

your volume is larger than 2TB, you should select the GPT option in the Initialize Disk dialog box before clicking OK. Otherwise, click OK, and you should see this:

Right click in the disk volume specification box:

and select new simple volume, and follow the formatting specifications as you desire. NOTE: High-Rely factory formats Backup media with 32K Allocation unit sizes. Once the volume is formatted, you see it under explorer.

Notice that after the HW Raid manager program initialized the RAID, both green lights stayed lit steady. That is because after initialization, the drives are already in sync. Any writing to the volume is duplicated on both drives simultaneously. And, safely removing (making sure the BNAS is not writing to the drive) either drive should immediately provide a backup copy.

At this point, you can remove either drive and install another. Once you place the other in, you will note the sync indicator for that bay will blink green and red. That means the the that drive is not up to date but is in the process of being updated. Once the light is steady again, a drive maybe swapped again.

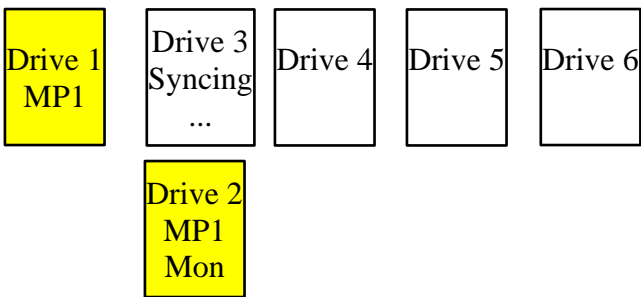## 13.2 Understanding Mirror Pools (RAID groups) and handling mirror troubles.

IMPORTANT! Once you create a RAID 1 (Mirror), every drive that was part of that mirror is marked as such and can not be overwritten by another mirror until the RAID stamp on the drive is removed. Drives which work with that mirror are part of that "mirror pool". Thus, if you have 8 drives, you start a mirror as described above, then swap the drives out twice more, at that point, you will have 4 drives total that are part of that mirror pool. If you removed both drives from bay 1 and 2 and installed new ones, you would have to create another RAID 1 like in the process above because there would be no master drive left to copy the current RAID/mirror configuration to. And, if you did create another RAID 1, that would start the creation of a different mirror pool. And, drives from one pool will not mirror with drives from another pool. The only way to get a drive from one pool to accept the mirror of another pool is to delete the RAID on that drive. A good indication that this has happened is if when you swap media, the Power/Error indicator stays lit RED, and you don't see any re-syncing occurring.

To illustrate this, below is a diagram of the propagation of data and RAID marks of a mirror pool of 6 drives from creation, in a simple 5 day backup system (NOTE: The term "Drive" means Media in this illustration):

Mirror is created – RAID mark MP1.

Drive 1 MP1	Drive 2 MP1	Drive 3	Drive 4	Drive 5	Drive 6
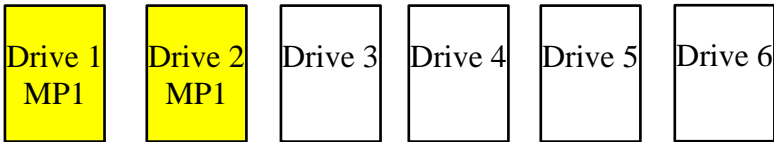
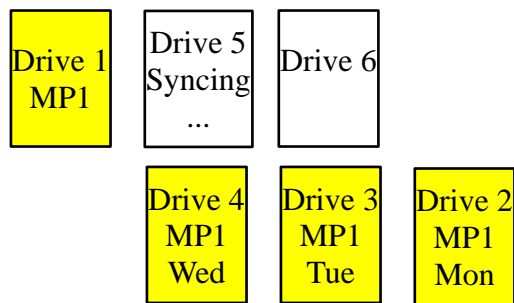Monday, Drive 2 is swapped out. NOTE: As soon as a drive is swapped, the RAID mark is the first thing to be copied to the new drive.

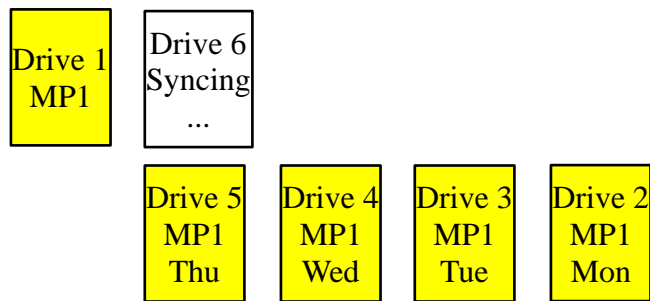| Drive 1 MP1	Drive 3 Syncing ...	Drive 4	Drive 5	Drive 6
	Drive 2 MP1 Mon			

Tuesday, Drive 3 is swapped out.

Drive 1 MP1	Drive 4 Syncing ...	Drive 5	Drive 6
	Drive 3 MP1 Tue	Drive 2 MP1 Mon	
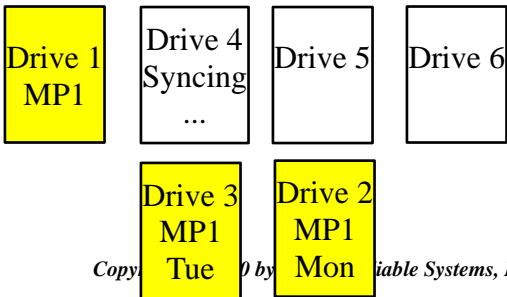
Wednesday, Drive 4 is swapped out.

Drive 1 MP1	Drive 5 Syncing ...	Drive 6

Drive 4 MP1 Wed	Drive 3 MP1 Tue	Drive 2 MP1 Mon

Thursday, Drive 5 is swapped out.

Drive 1 MP1	Drive 6 Syncing ...

Drive 5 MP1 Thu	Drive 4 MP1 Wed	Drive 3 MP1 Tue	Drive 2 MP1 Mon

By Friday, Drive 6 is ready to be swapped out for drive 2 on Monday again.

Drive 1 MP1	Drive 6 MP1 Fri

Drive 5 MP1 Thu	Drive 4 MP1 Wed	Drive 3 MP1 Tue	Drive 2 MP1 Mon
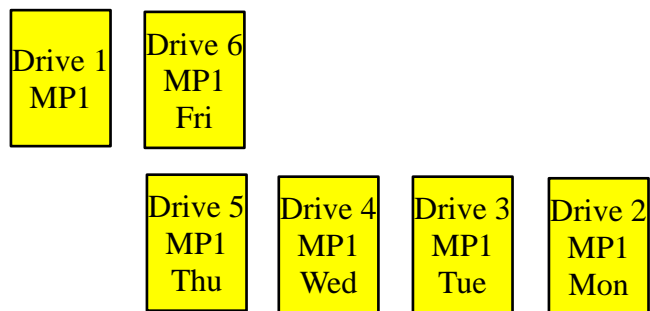
If at any point, another Mirror pool were created, a different RAID group mark would be made on those drives. Call the mark, MP2. If a drive marked MP2 were in ether bay AMT bay with a drive marked MP1, no mirroring (syncing) would occur. For example, if another Mirror was created over the weekend:

Drive 1 MP2	Drive 6 MP2	Drive 5 MP1 Thu	Drive 4 MP1 Wed	Drive 3 MP1 Tue	Drive 2 MP1 Mon
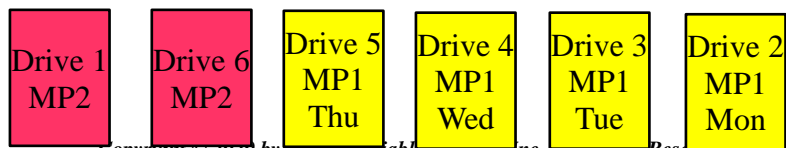
And then the swap occurred on Monday, the AMT would refuse to overwrite Drive 2.

Drive 1 MP2	Drive 2 MP1 Mon	Drive 5 MP1 Thu	Drive 4 MP1 Wed	Drive 3 MP1 Tue
	Drive 6 MP2			
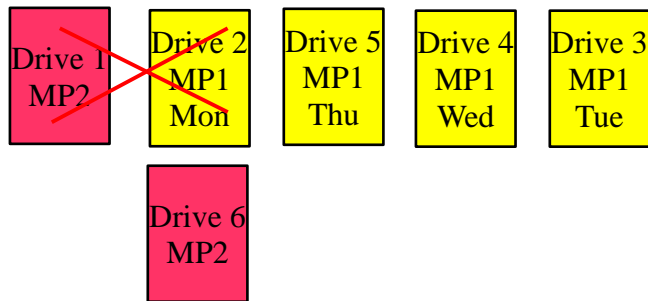
You can also see this in the JM RAID MANAGER program. Below is an example of what the JM RAID Manager screen will look like when there are two drives from different mirror pools.

And here is an example of drives in the same mirror pool:

Note the difference between the above screens in the Controller 1 section. Drives in the same pool are shown with 'M' (member) designators under the same RAID grouping. Drives from different pools are shown under a different RAID grouping. The BNAS will actually pick up and make available two volumes rather than one as if it were in JBOD mode, which will show under your disk management because the AMT controller is keeping the drives separated.

To clear drives so they can again join a different mirror pool, remove ALL the drives which are in the good pool and install the drives which are in the other pool. Then go back to the settings tab in JM RAID manager and select 'Delete All RAID'. THIS WILL ERASE THE DRIVE! Doing this will remove the RAID mark so that it can take any new RAID mark again.
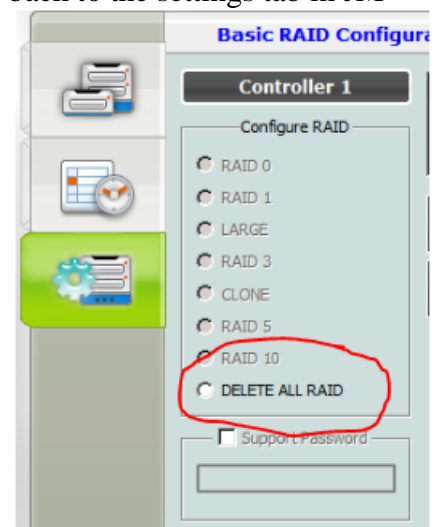
14 Additional features of JM RAID Manager.

JM RAID Manager runs as a service in Windows OS. In addition to configuring and displaying the status of the AMT controller's bay 1 and 2, JM RAID Manager can also:

- Be configured to email notices whenever errors or status changes occur.
- Be used to upgrade the firmware of the AMT controller.
- Maintain and review a log (error log) of AMT related events (errors, failures, disk changes).
- Configure a RAID 0, LARGE or CLONE function for the drives in bays 1 and 2.
- Show more in-depth information about the drives and health.

It is not within the purpose of this manual does to discuss these additional uses. But you should be aware of these additional features. HW RAID Manager is not a High-Rely product, it is provided by the maker of the RAID controller chip used in the AMT controller unit.

15 Repairing a Broken RAID 1 or transferring a Mirror.

The AMT controller stores RAID information on their media, that's why proper set up is important. If all you have from a mirror out of one of the 2 AMT bays is media which was the master or 1 of a fully mirrored set, bringing up a mirror based on that media is simple:

1. Remove both drives from both AMT bays (1&2 BNAS 400/50, 3&4 RAIDFrame BNAS).
2. Install the known master or good mirror media in either of the AMT bays.
3. Wait up to 2 minutes. The volume should appear to the host. Then, simply install the swap media of same or larger size in the remaining AMT bay and it will automatically mirror (unless the target or source drive is damaged).

16 Assigning Drive Letters

Because the AMT in Mirror (RAID 1/10 mode) is one volume for the AMT bays, drive swaps go undetected by the BNAS's operating system. Thus, there are not multiple drive letter issues with media as in a standard High-Rely DAS systems when using Windows operating systems for AMT media. The HRDM2 utility should have little use in this instance. However, in JBOD (PM) mode, the host will see every media swap and use of the High-Rely utility HRDM2 will allow you to set multiple drive (media) to the same letter or designate a particular letter each time the media is inserted without letting Windows allocate the drive letter based on the next available drive letter.

17 Procedure for Swapping Media

17.1 How the Removable HRC Media Operate:

The drive tray used in the BNAS 401 is a standard High-Rely Classic (HRC) media tray. This tray is standard among most of the High-Rely product line and thus can be interchanged between the BNAS and other High-Rely devices like the 1 bay slimline, Tandem AMT, 5 bay, 10 bay and others. The tray houses a single 3.5" SATA Hard drive. USE CARE WHEN HANDLING THIS DEVICE! UNNECESSARY ROUGHNESS OR SHOCK CAN DAMAGE OR SHORTEN THE LIFE!

17.1.1 Procedure for inserting the media.

To insert the media first make sure the lock is in the unlocked position (position C). Proper orientation of the removable drive is with the blue buttons to the left as shown in the sketch above. Notice that the entire large lever, called the "release lever" is in the fully open position. Do not attempt to insert the drive with the release lever closed.
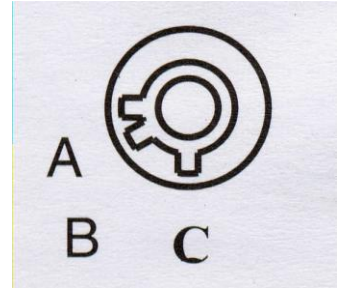
Push the drive all the way in until you feel resistance. At this time move the small lever (the "lock cover" lever) to its midway (position E). Move the larger "release lever" towards the closed position, using the lever action of the mechanism to pull the drive in the last few centimeters. Close the release lever until it snaps. If it will not snap shut check to ensure that you have the smaller lock cover lever in the partially closed position E.

Lock Cover lever position E is used to insure the larger "release lever" will snap shut
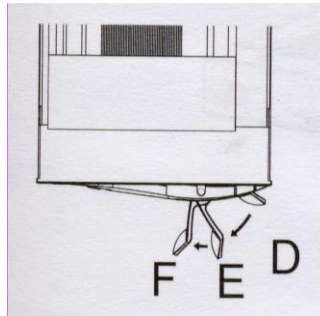
Now insert the key and turn it clockwise to the "A" position to power up the drive as shown in the photo. The B position of the lock is considered "off" and is not used in the High-Rely system.

At this point, you should see the LCD front panel of the drive light up and possibly hear the hard drive spin up. If you do not, the drive is not seated properly. Remove it and try re-seating it. Once you have successfully powered up the drive you should flip the lock cover to the fully closed, or D position to keep it out of the way. Depending on your device, you may need to allow up to 1 minute for the drive to be operational to the host.

17.1.2 Procedure for removing the media.

To remove the media, move the lock cover to position F. Now turn the key lock to position C. **Wait at least 15 seconds to allow the drive to spin down and safely park the heads before proceeding further. Failing to do this could damage or shorten the life of the media!** Now, using the lock cover, pull in an outward arc towards the blue buttons until the larger release lever comes out and stops. At this point, you may pull the media out.

17.2 How the Removable RAIDPac Media Operate:

RAIDPacs are a bit more involved and thus have their own separate manual. Download and read the RAIDPac G2 Manual from our website off the Software/Documentation tab located here: **http://www.high-rely.com/hr_66/products/largest-hard-drive/**

18   Status Indicators and Meanings in Mirror mode (RAID 1).

Below are the FRONT panel status signals for each condition when operating in Mirror mode:

State	Left Status Indicator	Power/Error Indicator	Right Status Indicator
Left Media (bay 1 or 3 (RFBNAS)) Out or Off	Off	On-Blue	On-Green
Right Media (bay 2 or 4 (RFBNAS)) Out or Off	On-Green	On-Blue	Off
Both media out or off	Off	On-Blue	Off
Replacement/new media installed and On in Left bay 1 or 3 (RFBNAS), and rebuilding.	Flashing Red/Green	Flashing Red/Blue	On – Green flickering
Replacement/new media installed and On in Right bay 2 or 4 (RFBNAS) and rebuilding.	On – Green flickering	Flashing Red/Blue	Flashing Red/Green
Disk Damaged	If Disk damaged, status indicator Solid Red, otherwise Green or Red/Green flashing or off.	Red	If Disk damaged, status indicator Solid Red, otherwise Green or Red/green flashing.

Figure 1. Table of FRONT Panel Status indicators and conditions for (RAID 1) Mirror Mode (BNAS 400/50 and RFBNAS).

NOTE: if the Power/Error light remains Red, or the Status light for the drive is RED for more than 1 minute beyond the time the replacement media was inserted, then it is likely that the AMT is unable to use the replacement media for some reason – either a failure or error was detected on the target drive, or the replacement is smaller than the master and therefore can not be used. The disk activity indicators on the LCD display will also show a rotating disk and may flicker the blue latch light bars if copying is occurring (BNAS 400/50). Both indicators should be showing activity (the little disk image will appear to rotate) when mirroring is working. For the RFBNAS, all three of the LED status lights will flicker as activity occurs.

Assuming no problems and resyncing has started, during this period, if the Master media is removed, permanent data loss or corruption can occur! Usually replacing the media immediately will be OK if the host has not been writing during the mirroring process. The Master media is the one media which remained in the AMT bay when the other AMT bay's media was swapped out.

Depending on the size of your media, this copying (mirroring) can take between 1 and ½ hours to 12 hours or more (about 1 hour per 200 to 300 GB). Such will also depend on if your BNAS is creating extra activity on the AMT while it is mirroring. This is because the AMT controller will grant priority to the BNAS's disk requests, delaying it's own internal copying. The AMT Status indicator next to the

media being copied to will flash Green and Red during this whole time. Once the light has ceased flashing red and remains on the Green color, the media are synchronized and either media maybe removed provided the windows "safely remove" (or equivalent) procedure (BNAS is done writing) is followed. If the blue indicators on the media itself or the disk graphic indicate activity or the green Drive Status indicator is flickering green, it may not be safe to remove the media as the BNAS is performing operations, cease the BNAS's operations before performing the removal.

19 Status indicators and meanings in JBOD (PM) mode.

Because this mode performs no RAID functions, its use is much simpler:

State	Left Status Indicator	Power/Error Indicator	Right Status Indicator
Left Media (bay 1 or 3 (RFBNAS)) Out or Off	Off	Blue	On-Green
Right Media (bay 2 or 4 (RFBNAS)) Out or Off	On-Green	Blue	Off
Disk Damaged	If Disk damaged, Status indicator Red, otherwise Green	Red	If Disk damaged, Status indicator Red, otherwise Green

Figure 4. Table of front Status indicators and conditions for BNAS unit in JBOD (PM) Mode.

Simply insert and remove drives (media) as needed from either or both bays. Be sure to follow all other precautions and procedures regarding the mechanical insertion and removal, and the operating system's requirements for safely removing a volume.

20 BNAS's AMT bays Additional Notes

20.1 Synced operation

When the media are in sync, each write operation to the mirror is duplicated simultaneously to each media in the mirror. Thus, once in sync, the media stay in sync until they are physically separated or there is an error.

20.2 Degradation

When the AMT is re-syncing, this is also referred to as "running degraded". Performance will be less for host accesses during this time because of the background activity of the AMT re-syncing (mirroring) the drives.

20.3 Default settings.

The AMT controller inside the BNAS does have dipswitch configurations. However, those are omitted as they are not physically accessible without dismantling the BNAS.

20.4 Selecting Different RAID types

Although not included in our technical support service, the BNAS's AMT supports other RAID configurations as well which can be plainly seen in the JM RAID Manager software. Note: Supported modes are in black.

RAID Type Setting	Description
PM	The media are presented to the host as individual volumes.
RAID 0	The media are striped (RAID 0) meaning the capacities of the smallest media in the set of two are multiplied by 2 and presented to the host as one volume. Data is split between both drives resulting in higher access and throughput speed.
RAID 1/10	This is the factory default setting and is supported by High-Rely's Technical support department. The media are mirrored (RAID 1) and presented to the host as a single volume. One media can fail and be replaced without disturbing the availability of the volume to the host.
LARGE	The drives are "spanned" or joined meaning that both media appear as a single volume to the host and each medias entire capacity is added together (sizes can vary with no waste). The media will become a set and data loss will occur if they are separated or fail under this configuration.
RAID 3	Not Applicable for two bays.
CLONE	Not Applicable for two bays.

RAID 5	Not Applicable for two bays.

20.5 Removing the Media When the Mirror Status LED is Blinking

We recommend not removing the external media until the Status indicator is lit steady, otherwise the data on that media won't be guaranteed to match the master media. However, if you have installed the wrong media and understand that the data is only "partially mirrored" there is nothing to prevent you from powering down the media and removing it. You may want to label the partially mirrored drive as corrupt, partial, or empty in that case to avoid confusion with fully synchronized archive drives.

21 Emergency Restore to Factory Configuration Procedure.

In the event the boot and OS partition are lost, another partition has been created and is stored on your boot drive which can be restored easily by imaging it back to the root of the drive. A small USB thumb drive was supplied with your unit which will boot and copy that image back to the appropriate location on the drive restoring the system software to its original condition when shipped from the factory. Doing so will erase all data and changes which were made to the system boot drive after shipping. It is highly recommended that you do not alter or destroy this partition. The following should be performed by a knowledgeable IT technician.

To restore the partition, turn off the system power. Install the special USB thumb drive that was supplied with the system into a USB slot on the back of the motherboard. Turn the power on, press the "DEL" key until you enter the BIOS setup. Set the BIOS to boot from the USB device as a hard drive. Save the configuration and reboot. The USB drive should boot up to the UBUNTU operating system and immediately begin running a script to restore the partition. Follow the direction displayed on the screen.

Booting the USB drive may take several minutes, please be patient. Follow the directions on the screen after that. Restoration should take less than an hour one the process has been started. When complete. Reboot the system.

22 Contact Information

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