HighPoint Technologies, Inc.

SSD7103

4x M.2 Port to PCIe 3.0x16 NVMe RAID Controller

User Guide
V1.01

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System Requirements

PC Requirements

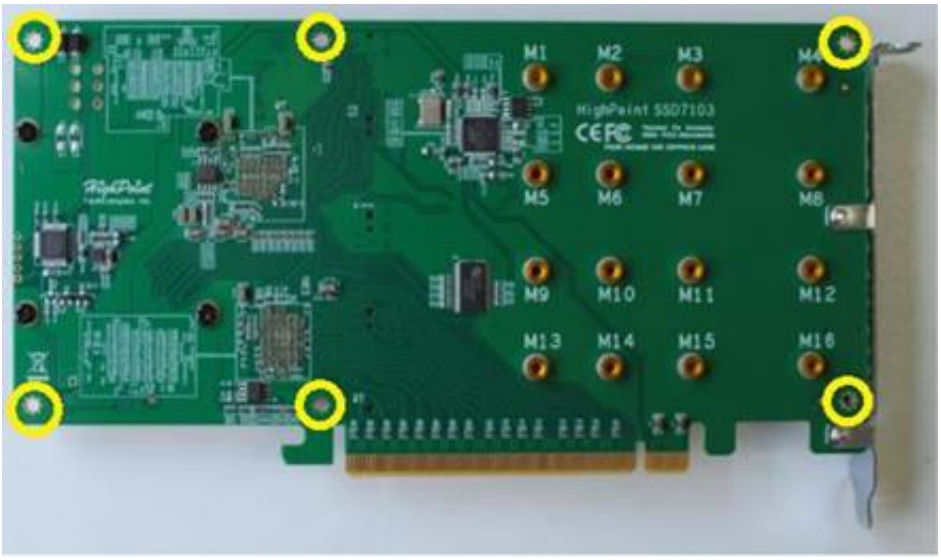
- System with an empty x16 PCIe 3.0 slot
  (Please refer to the SSD7103 compatibility list.)
- Windows 10 and Windows Sever 2016 or later
- Linux Kernel 3.10 later

SSD7103 Hardware

Front View

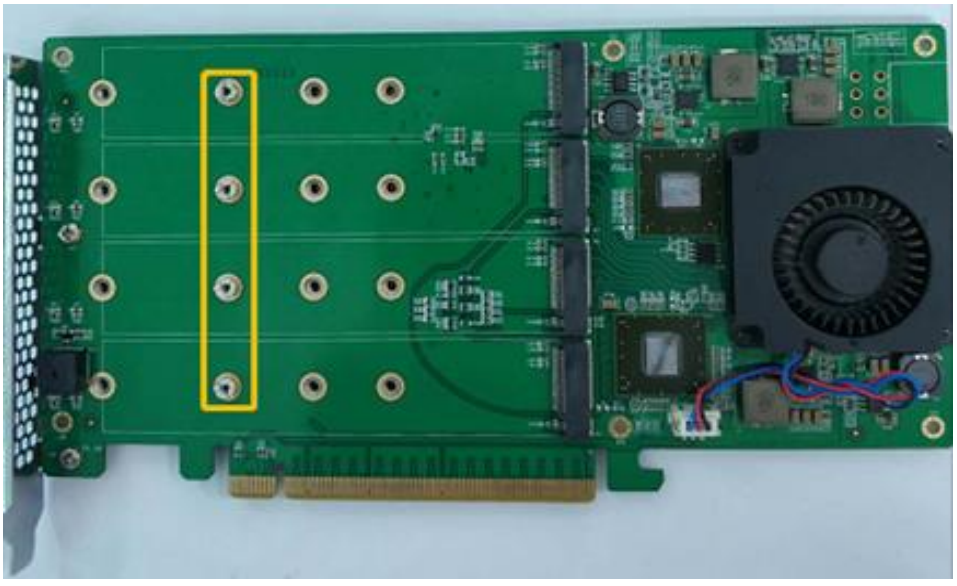
NVMe Drive Installation:

Step 1. On the rear of the SSD7103, remove the six screws that secure the unit's front panel to the PCB.



After removing the screws, carefully remove the front panel from the SSD7103.

Step 2. These 4 screws are used to install the NVMe SSD's.



Step 3. The SSDs should be installed from top to bottom. Remove the top screw.

Step 4. Gently insert the SSD into the slot.

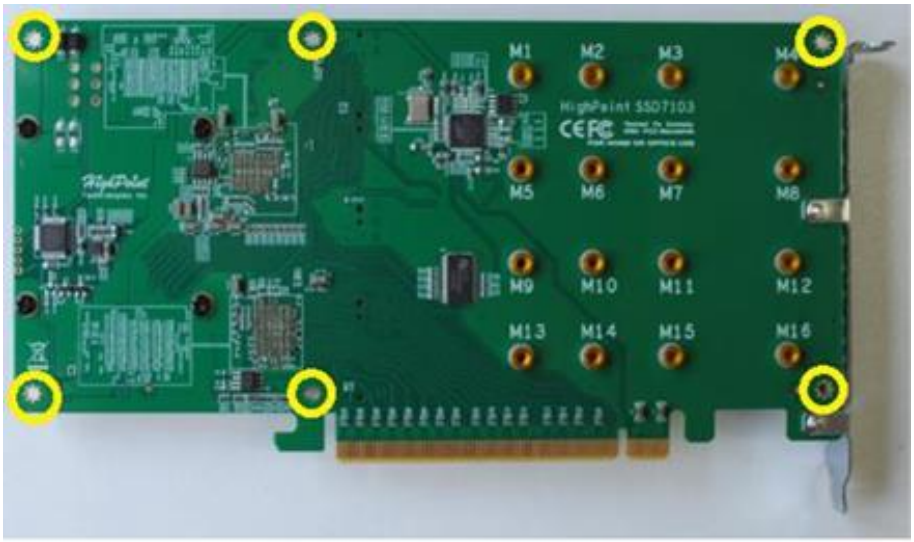
Step 5. Refasten the screw to secure the SSD.

Repeat Steps 3 to 5 to install the remaining SSDs.

Take four Samsung SSD 960 EVO as an example. SSD7103 installs all SSDs and the connected port numbers as shown below.

Step 6. Replace the front panel after installing all SSDs

Step 7. On the rear of the SSD7103, refasten the 6 screws that were removed in step 1.



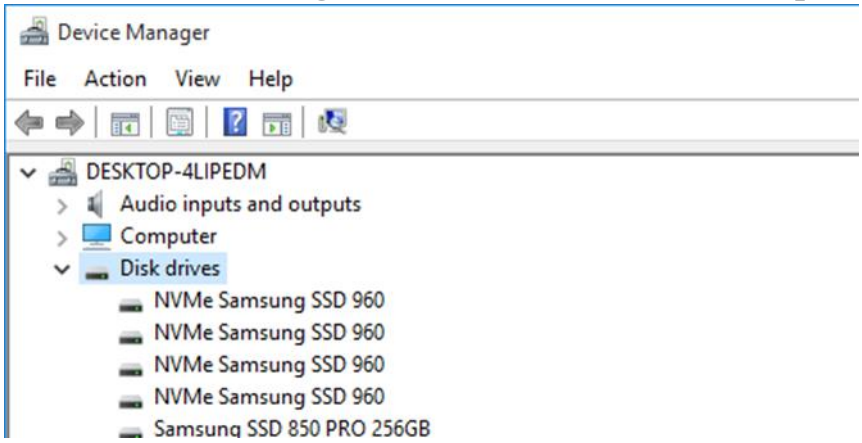
Bootable RAID Installation

1. Bootable RAID Windows Installation, please refer to the manual from the HighPoint Website:
   a. http://www.highpoint-tech.com/PDF/NVMe/SSD7103/SSD7103_Windows_Installation_Guide_v1.00_19_6_11.pdf
2. Bootable RAID Linux Installation, please refer to the manual from the HighPoint Website:
   a. http://www.highpoint-tech.com/PDF/NVMe/SSD7103/SSD7103_Linux_Installation_Guide_v1.00_19_6_18.pdf

Setting up the SSD7103 for a Windows operating system

1. Verifying Installation

After booting Windows, open **Device Manager**, and expand **Disk drives**. The installed NVMe drive should be displayed:
Take four Samsung SSD 960 EVO as an example：



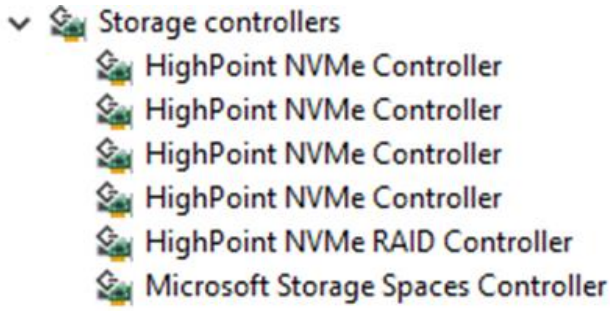
2. Driver Installation

1) Download the Windows driver package from the HighPoint website:
http://highpoint-tech.com/USA_new/series-ssd7103-download.htm

2) Once downloaded, locate the folder you downloaded the driver to. Extract the driver package and double click the **setup.exe** file to start the driver installation.

3) Follow the wizard and reboot system to complete the driver installation.
4) Rebooting. A **HighPoint NVME RAID Controller** and four **HighPoint NVMe Controller** entry should be displayed under Storage Controllers:

   Take four Samsung SSD 960 EVO as an example：



3. Installing the HighPoint RAID Management

The HighPoint RAID Management is used to configure and monitor the SSD7103 driver. Download the HighPoint RAID Management software package from the HighPoint website:

http://highpoint-tech.com/USA_new/series-ssd7103-download.htm

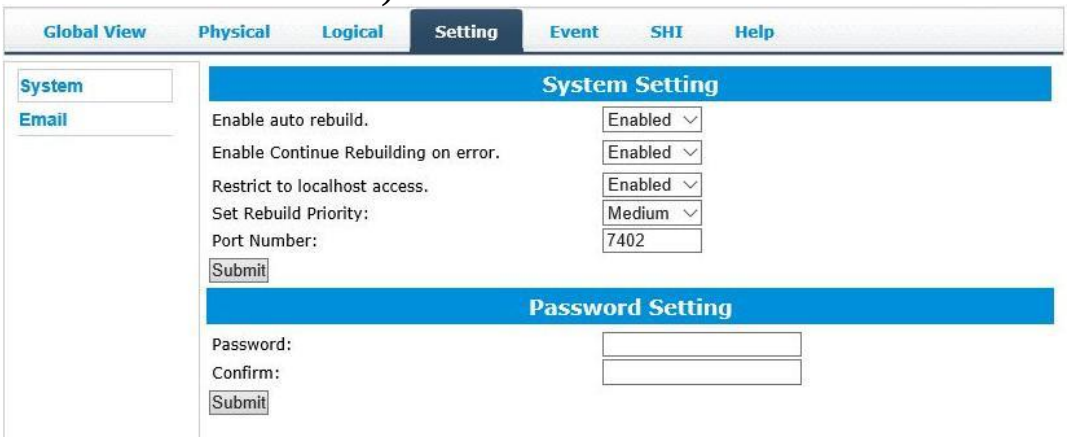
1) Extract the package and double-click the HighPoint RAID Management program to install the software.
2) The HighPoint RAID Management will configure the SSD7103 NVMe drive automatically after installation is completed.
3) Open Windows Disk Management and check to make sure the SSD drive is configured:
4) Create and format the partition using Disk Management and start using the SSD7103 drive.

Using the HighPoint RAID Management

Starting the HighPoint RAID Management

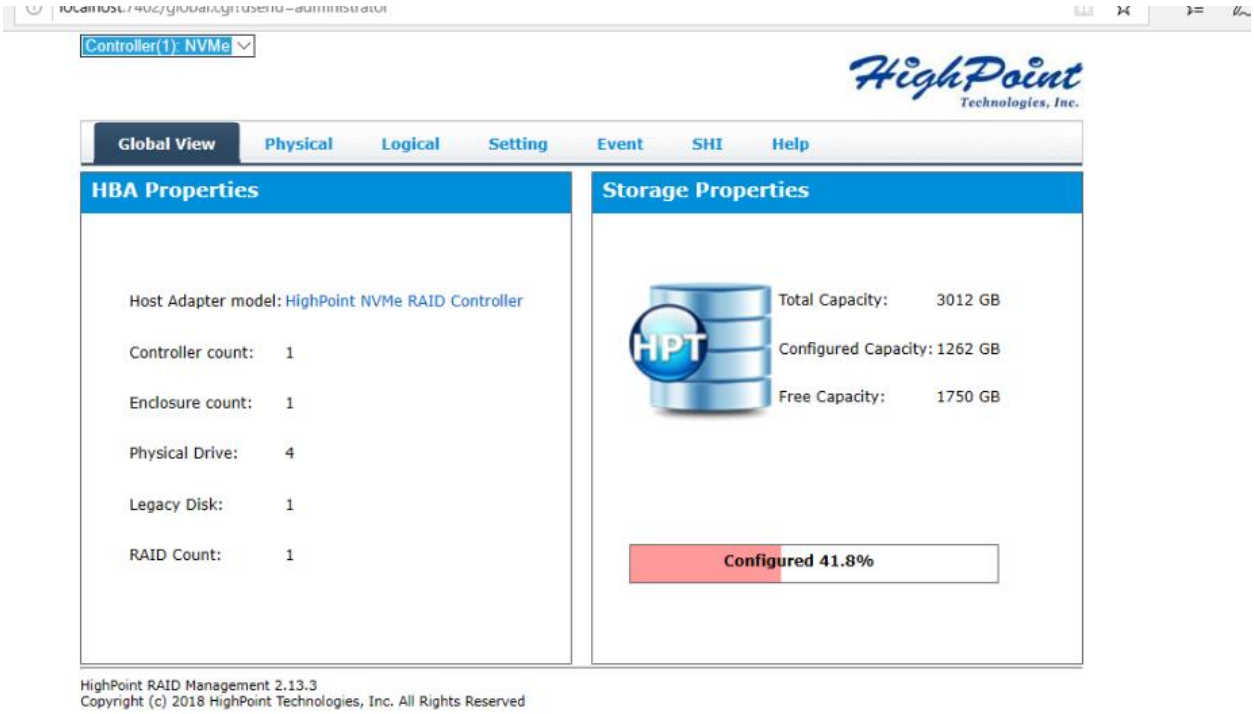
Double click the Desktop ICON to start the Web browser. It will automatically log-in to the HighPoint RAID Management .

The password can be set after the first log-in. To change the password, select **Setting>Security** from the menu bar (see page 23 for more information).



Verify the Controller Status

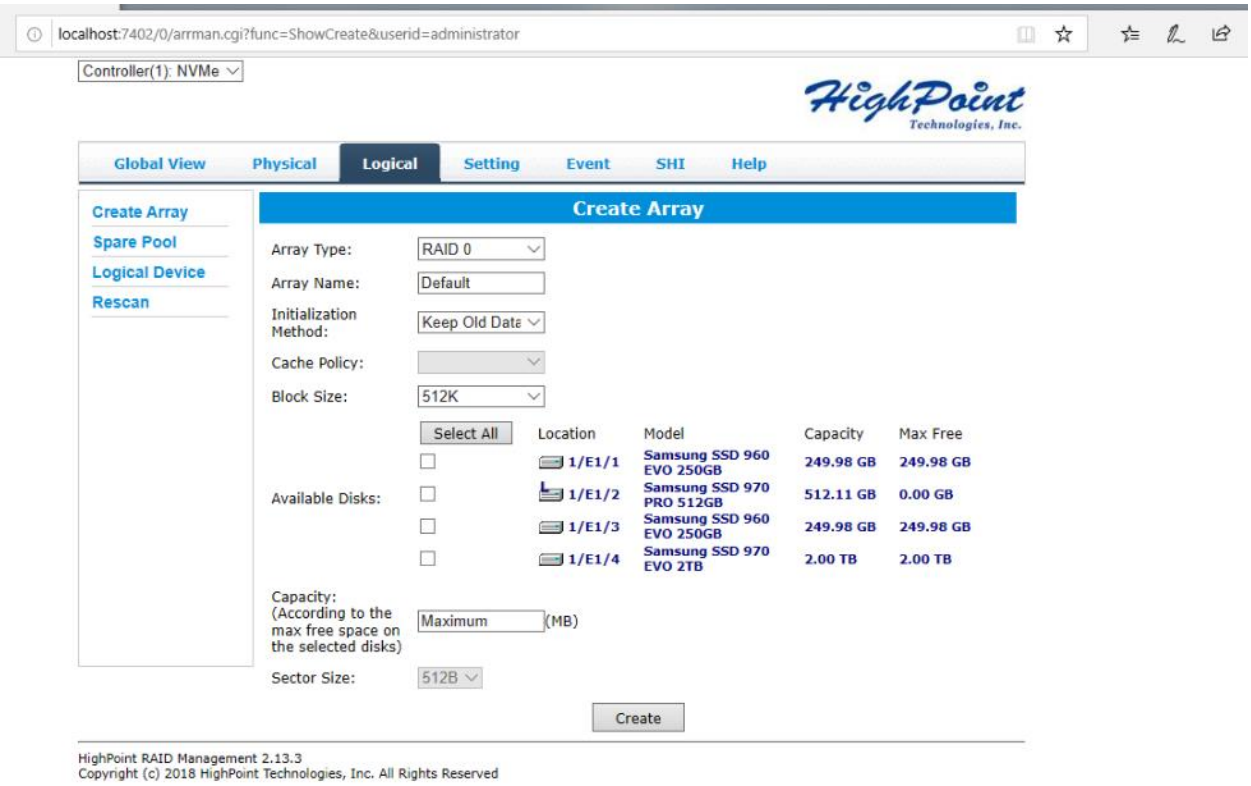
The **Global View** Tab will display the overall status of the controller. The Virtual Disk is listed under **Logical Device Information**. The individual M.2 SSDs are listed under **Physical Device Information.**



Creating an Array

To create an array:

1. Log into HRM
2. Select the proper **controller** from the drop down on the top left
3. Click **Logical**
4. Click **Create Array**



Array Type:
An array is a collection of physical disks that will be seen as one virtual drive by your Operating System (OS).

The SSD7103 is capable of creating the following array types:

- RAID 0 — Striping
- RAID 1 — Mirroring
- RAID 10 — Striping Mirrored array

Each RAID level has its pros and cons based on the application you use it for (Note: Refer to RAID level Quick Reference)

Array Name: the name that will be displayed in Logical Device Information (Default: RAID_<level>_<array number>)

Initialization Method: Initialization of a disk sets all data bits to 0, essentially clearing all the data on the drive. It is important to initialize disks as previous data physically stored on the drive may interfere with new data.

- **Keep Old Data:** This option skips the initialization process and all data on each physical disk of the array will be untouched.
- **Quick Init**: This option grants immediate access to the RAID array by skipping the initialization process, but it will delete all data. Note*:* Skipping initialization is generally not recommended as residual data on disks may interfere with new data in the future.
- **Foreground**: The array initialization process will be set at high priority. During this time array is not accessible, but the initialization process will complete much faster.
- **Background**: The array initialization process will have a lower priority. During this time the array will be accessible, but the initialization process will take much longer to complete.

Note: Initializing takes a significant amount of time (approximately 2 hours per 1 TB when using hard drives).

Background and Foreground Initialization
Foreground initializing the array will completely zero out the data on the disks, meaning the disk will be completely wiped and every bit on the disk will be set to 0. Background initialization means the array will still be created, and you can still write new data onto the array. But when your array requires rebuilding, residual data left behind may interfere with the process.

Cache Policy (Default: Write Back)

Write Back – Any data written to the array will be stored as cache, resulting in better I/O performance at the risk of data failures due to power outages. Data will be stored as cache before it is physically written to the disk; when a power outage occurs, any data in the cache will be lost.

Write Through – Data written to an array is directly written onto the disk, meaning lower write performance for higher data availability. Without cache acting as a buffer, write performance will be noticeably slower but data loss due to power outages or other failures is significantly minimized.

Block Size (default: 512K)
[128K to 512K are the supported block sizes]

Adjusting the block size towards your disk usage can result in some performance gain.

In a typical RAID configuration, data of the virtual drive is striped (or spread across) the physical drives. Having a smaller array block size will increase the likelihood of accessing all physical drives when processing large I/O requests. Multiple physical drives working in parallel increases the throughput, meaning better performance.

For smaller I/O requests (512 bytes to 4 kilobytes), it is better to have each individual disks handle their own I/O request, improving the IOPS (I/O per second), rather than having one tiny I/O request being handled by multiple disks.

Capacity (Default: Maximum)

The total amount of space you want the RAID array to take up. When creating RAID levels, disk capacities are limited by the smallest disk.

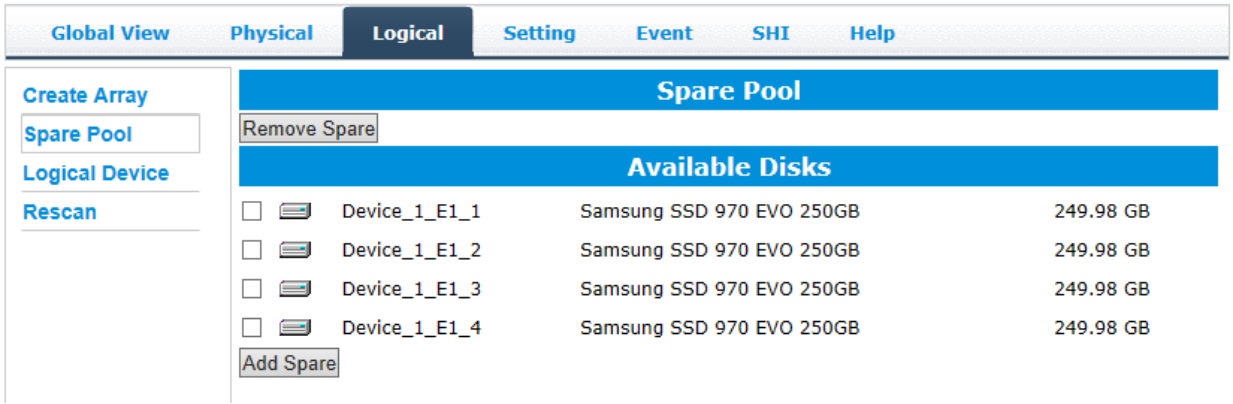
An example of how disk capacities are limited by smallest disk.

- You have 2 drives connected to the enclosure.
- The first drive is 6 TB, the second is 4 TB
- After creating a RAID level 1 using both drives and maximum capacity, the first drive will have 2 TB, the second 0 TB of free capacity
- The free capacity on the second drive can be used to create a separate array with other drives.

You may also choose how much space each array will utilize. You can use the remaining space to create another array (up to 4 arrays are supported).

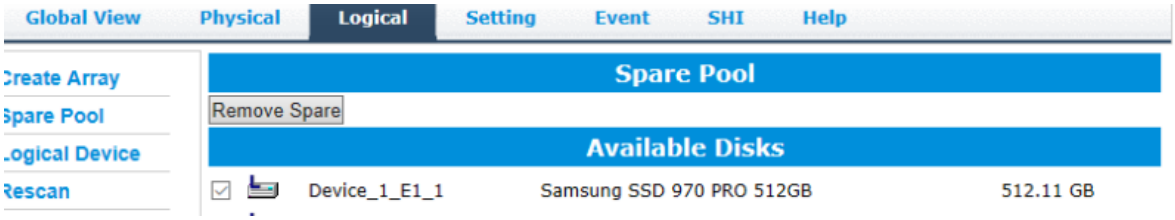
Adding Spare Disks

Spare disks are physical disks that will immediately replace critical disks in an array.

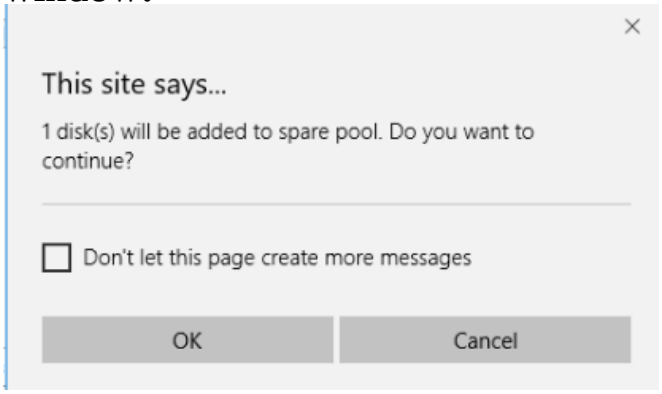


To add spare disks:

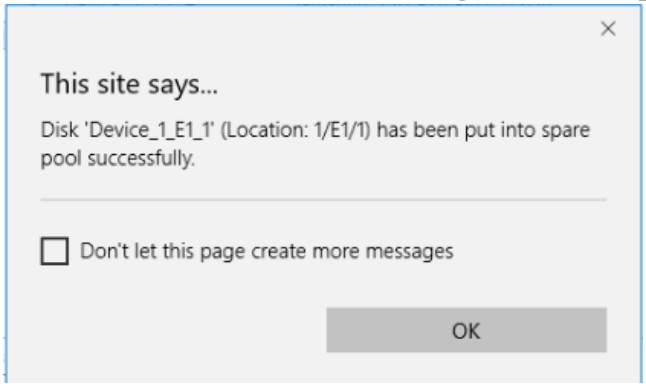
1. Log into the HRM
2. Click **Logical**
3. Click **Spare Pool:**



4. Check the box for the disk you want as a spare under **Available Disks**
5. Click **Add Spare,** and confirm by selecting **OK** from the pop-up window**:**



6. The disk has now been assigned as a spare. Click **OK** to confirm:



Disks added to the spare pool will be displayed under **Spare Pool** and can be removed by checking the box before the target drive, then

clicking the **Remove Spare** button.

Physical drives marked as a spare will automatically be added to an array whenever there is a disk failure. This feature minimizes the chances of a data loss by reducing the time an array is in the critical status.

Obtaining Logical Device Information

The Logical device tab is the default page after clicking the Logical tab of the HRM. This page contains information about your RAID arrays and the individual disks your system detects.

Logical Device Information

Arrays you create and the properties associated with them will appear here.

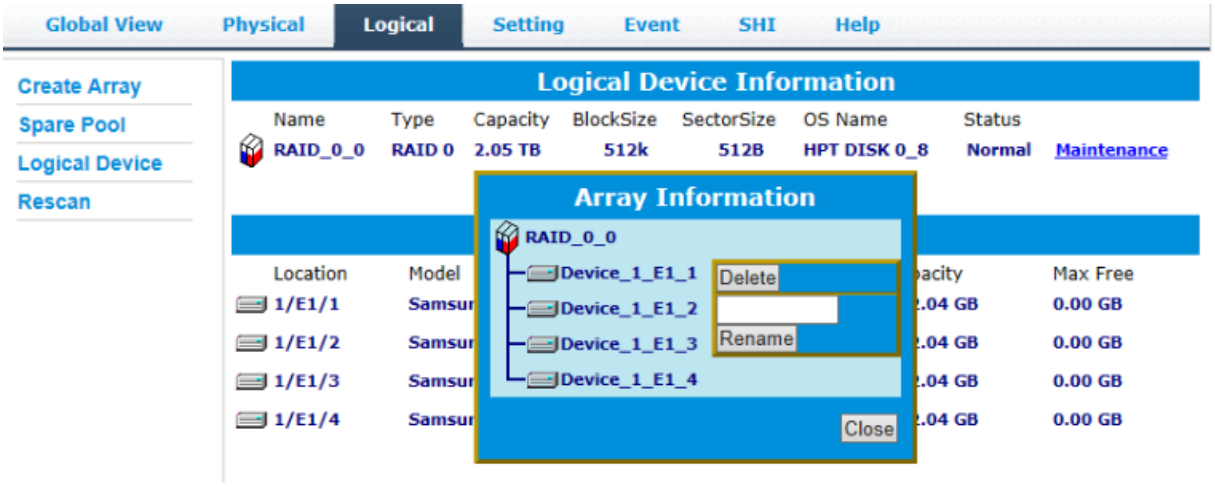
Maintenance

Once an array has been created, the Maintenance menu provides options to maintain or edit it. To access the Maintenance menu, click the **Maintenance** button towards the right-hand side of the array name.

Array Information

Clicking on the maintenance button will show you the Array information box. Different array statuses (Normal, critical, disabled) will have different maintenance options.

Array Information &Maintenance Options: Normal Status



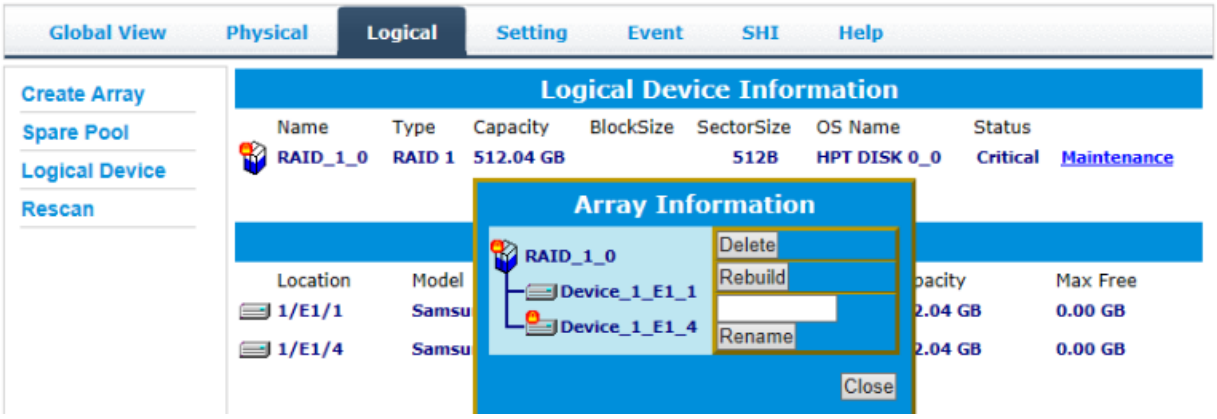
Arrays with the **Normal** status are healthy and functioning properly. Arrays with the **Normal** status will have the following options:

Delete – deletes the selected RAID array

Verify – verifies the integrity of the RAID array

Rename – renames the RAID array.

Array Information & Maintenance Options: Critical Status



Arrays in the **Critical** status can be accessed and utilized, but are no longer fault tolerant. A Critical array should be rebuilt as soon as possible to restore redundancy.
A critical status array has all the normal status options except the following:

- The Array can no longer be renamed
- **Add Disk** replaces the **Verify Disk** option

Once the array status changes to critical, the faulty disk will be taken offline and you can either:

- Reinsert the same disk
- Insert new disk

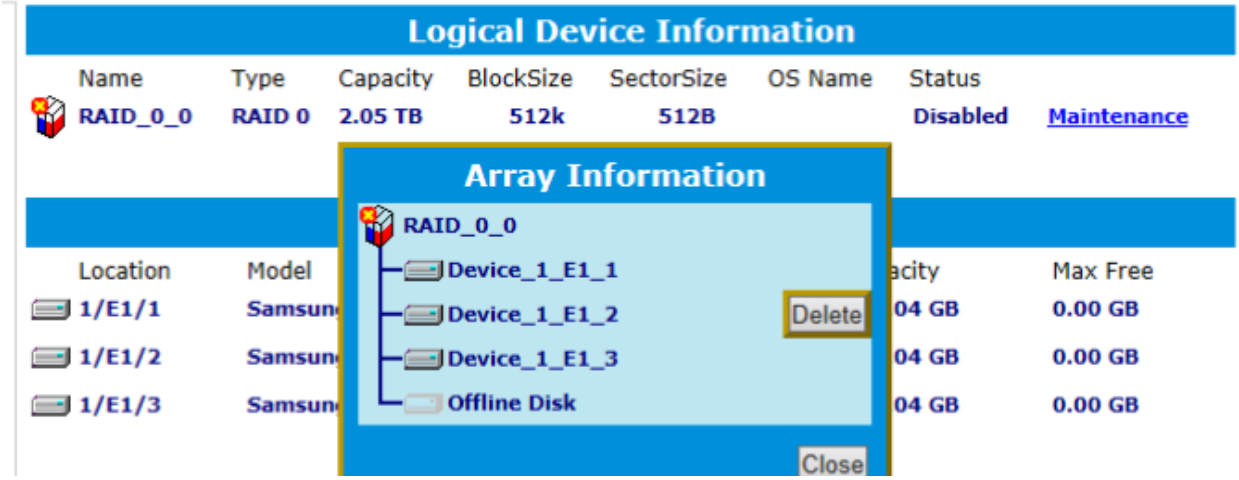
Reinserting the same disk should trigger the rebuilding status, since data on the disk would be recognized.

If you insert a new disk, clicking **Add Disk** will give you the option to

select that disk and add it to the array.

If a spare disk is available, an array that has entered the critical state will begin rebuilding using the next available spare disk.

Array Information & Maintenance Options: Disabled Status



An array with the **Disabled** status means that the RAID level does not have enough disks to function.

- Your data will be inaccessible
- Rebuilding will not trigger, since the RAID array does not have enough parity data to rebuild.

Your options in Maintenance are:

- Delete

Delete – will delete the array

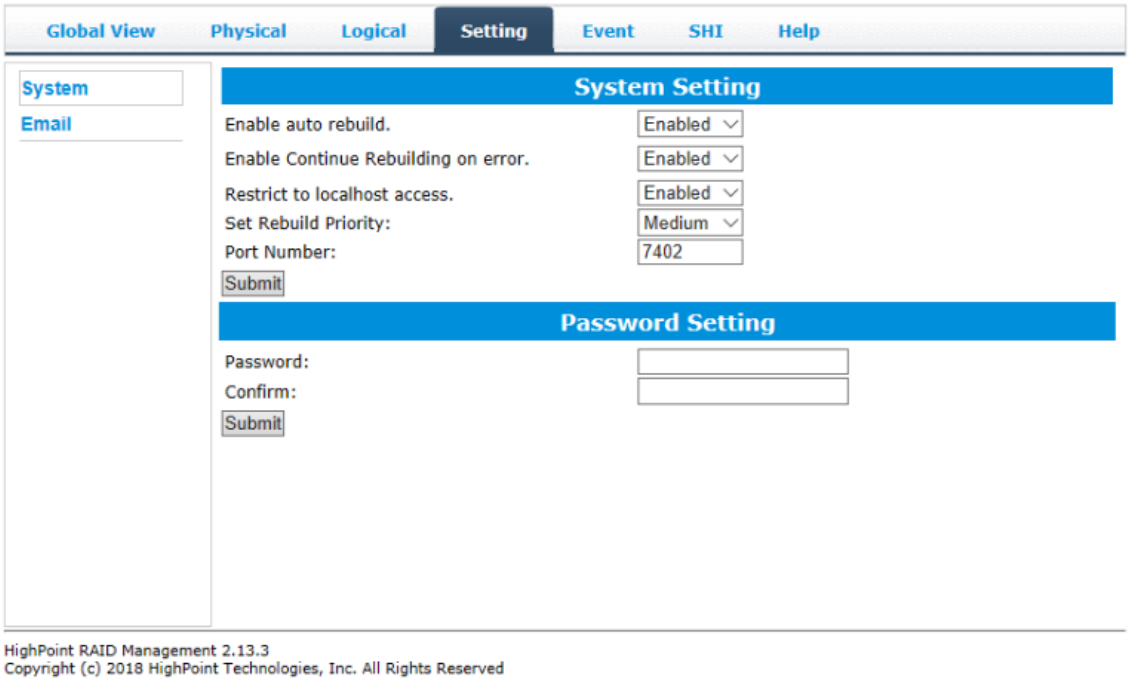
Physical Device Information

- **Location** — which controller and port the drive is located in
- **Model** — model number of the drive connected
- **Capacity** — total capacity of the drive
- **Max Free** — total capacity that is not configured
- **Revision** — revised version of drive
- **Status** — Current state of drive
- **PCIe Width** — PCIe width occupied by drivers
- **PCIe Speed** — Rate of current bandwidth

Rescan

Clicking rescan will force the drivers to report the array status. For any disk(s) you hot plug into the device; do not click rescan until all physical drives are detected and appear under Logical Device Information.

System Setting



Using this tab, you can change the following:

- Enable auto-rebuilding
- Enable rebuilding on error
- Restrict to localhost
- Set rebuild priority
- Change port number
- Change HRM password

System Setting

Enable auto rebuild (default: Enabled)
When a physical drive fails, the controller will take the drive offline. Once you re-insert or replace the disk, the controller will not automatically rebuild the array unless this option is enabled.

Enable continue rebuilding on error (default: Enabled)
When enabled, the rebuilding process will ignore bad disk sectors and continue rebuilding until completion. When the rebuild is finished, the data may be accessible but may also be inconsistent, due to any bad sectors that were ignored during the procedure. If this option is enabled, HighPoint recommends checking the event log periodically for bad sectors warnings.

Restrict to localhost access (default: Enabled)
Remote access to the controller will be restricted when enabled; other users in your network will be unable to remotely log in to the HRM.

Rebuild Priority (default: Medium)
You can specify the amount of system resources you want to dedicate to rebuilding the array. There are 5 levels of priority [Lowest, Low, Medium, High, Highest]

Port Number (default: 7402)
The default port that the HighPoint HRM listens on is 7402. You may change it to any open port.

Password Settings

Changing your HRM password

Under Password Setting, type your new password, confirm it, then click **Submit**.

Recovering your HRM password

If you forget your password, you can delete the file hptuser.dat. Then you need to restart the computer and open the WEBGUI to set a new password

For **Windows** Users:

1. Open file explorer
2. Navigate to **C:/Windows/**
3. Delete **hptuser**.**dat**
4. Reboot

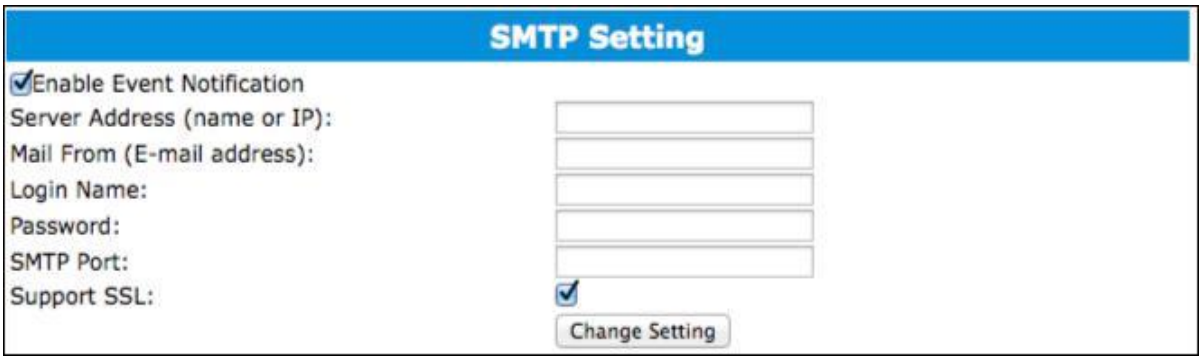
Email Setting

The following topics are covered under email:

SMTP Setting
Adding Recipients

You can instruct the controller to send an email out to the recipients of your choosing when certain events trigger (for more information, see Event Tab).

SMTP settings



To set up email alerts:

1. Check the Enable Event Notification box.
2. Enter the ISP server address name or SMTP name
3. Type in the email address of the **sender** (email account that is going to **send** the alert)
4. Type in the account name and password of the sender
5. Type in the SMTP port (default: **25**)
6. Check support SSL box if SSL is supported by your ISP (port value will change to **465**).

Note: After you click **Change Setting,** the password box will become blank.

How to Add Recipients

You can add multiple email addresses as receivers of a notice.

1. Type the email of the recipient in the **E-mail** text box
2. Type the name of the recipient in the **Name** text box
3. Check which type(s) of events will trigger an email using the respective **Event Level** check boxes.
4. (**Optional**) Click **test** to confirm the settings are correct by sending out a test email
5. Click **add** to add the recipient to recipient list
6. The added recipient will display in under **Recipients**

The email will include the output recorded in the event log.

Example email message:

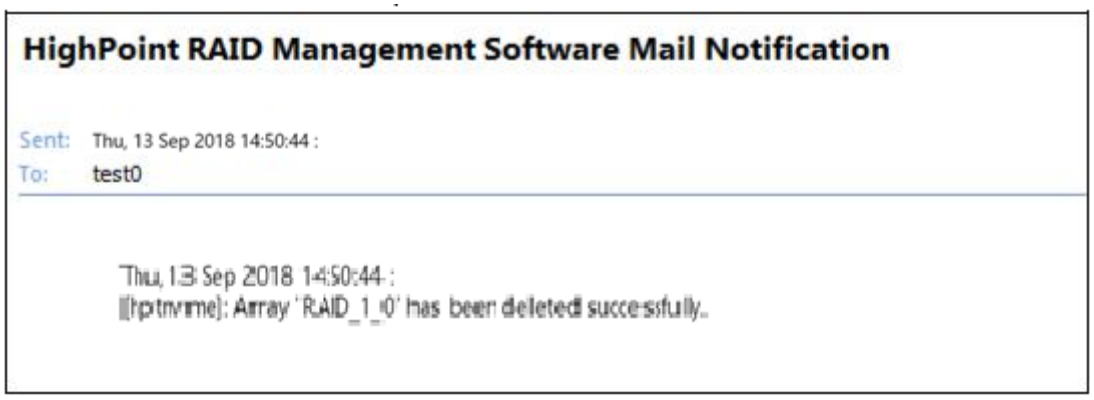


Figure 1. Example event log email

Event Tab

In the event tab, you can see log entries associated with the HighPoint device. The event log provides useful information when troubleshooting your set up.

In the event tab, there are four options available:
Download – Save the log file on your computer
Clear – Clears all log entries
Prev – View previous log page
Next – View next log page

SHI (Storage Health Inspector)

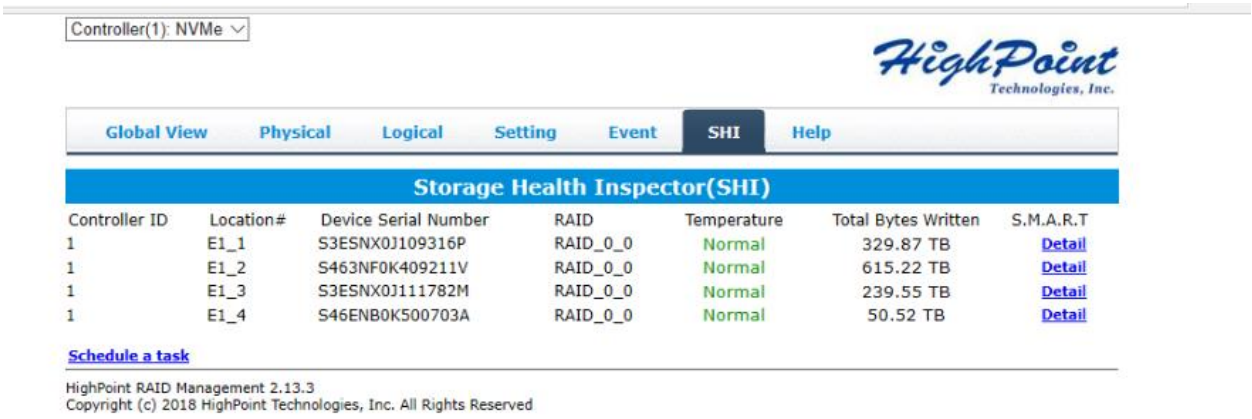
- S.M.A.R.T Attributes
- Schedule a task(Task list and Health Inspector Scheduler)

SHI outputs information collected using SMART (Self-Monitoring Analysis and Reporting Technology) Hard Drive Technology. The data provided on this tab helps you to anticipate any disk failures based on a variety of monitored hard disk properties.

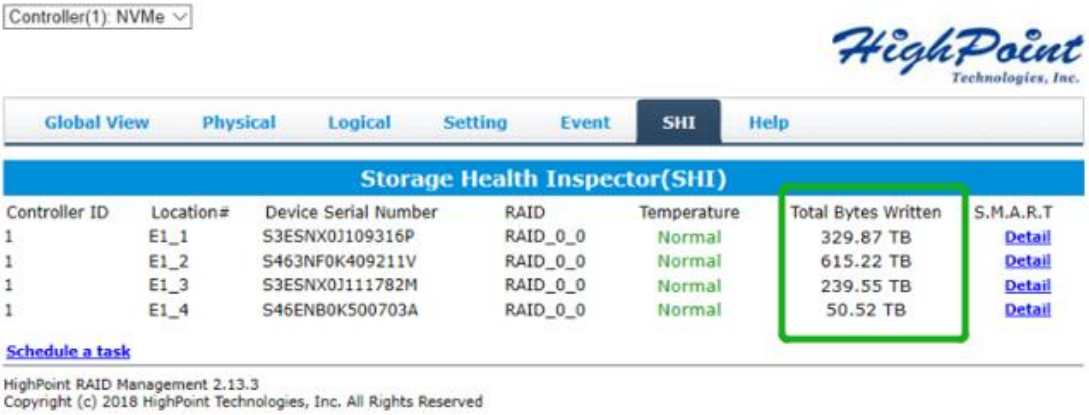
How to Enable SMART Monitoring

To access SMART attributes of an individual disk:

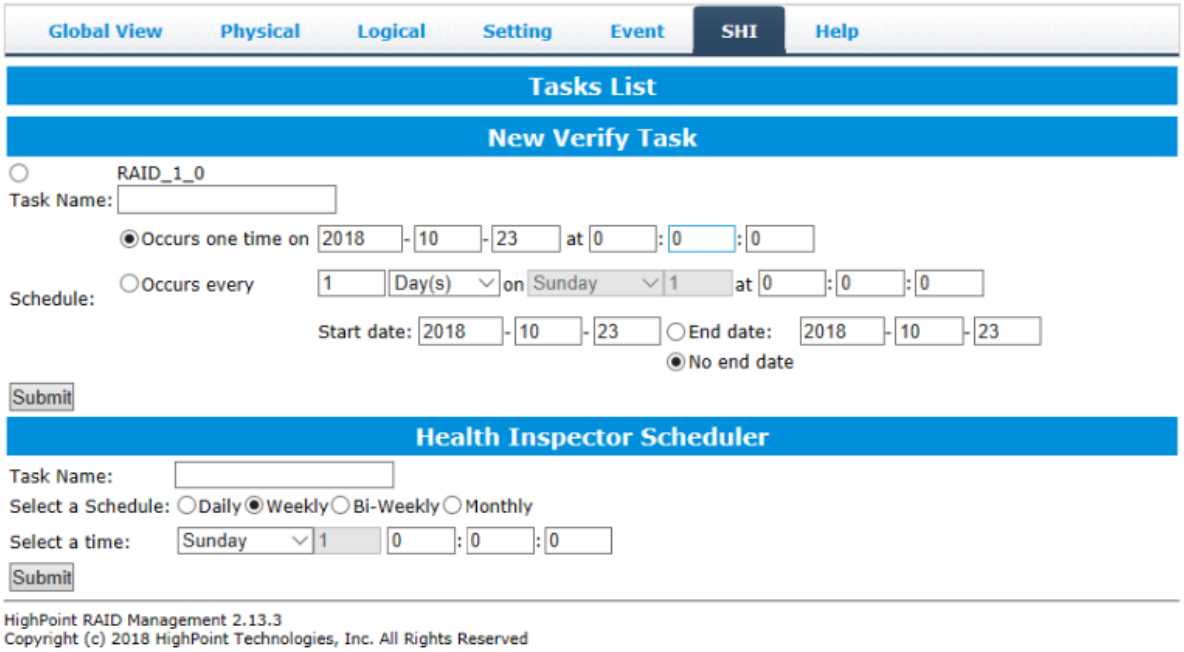
1. Log in to the HRM
2. Select the proper controller using the drop down menu on the top left
3. Click the **SHI** tab
4. Click **Detail** on the desired disk



The TBW (Total Bytes Written) information can be used to monitor the lifespan of the NVMe drives.



How to Use the Health Inspector Scheduler



The **Health Inspector Scheduler** (**HIS**) enables you to schedule disk/array checkups to ensure disks/array are functioning optimally.

How to Create a New Verify Task

All Redundant RAIDs will appear under New Verify Task

1. Log into the HRM
2. Select the proper controller from the top left drop down
3. Click **SHI**
4. Click **Schedule**
5. Select the array you want to schedule the verify task
6. Type the name in **Task Name** entry box
7. Choose whether you want to schedule
8. One time verify task on specific date (YYYY-MM-DD) at (HH:MM:SS, 24-hr clock)
9. Or a specific schedule you can adjust based on Daily, Weekly, or Monthly options
10. Click **Submit**
11. Your entry will appear under **Tasks List**

Note: New Verify Task box only appears if you have normal status arrays. If you have a critical array, New Rebuild Task will replace New Verify Task.

Troubleshooting

This section provides guidelines to some problems you may encounter:

- Handling Critical Arrays
- Handling Disabled Arrays
- PC hangs when card is installed.

Handling Critical Arrays

When your disk status turns critical, your array as a whole is still accessible, but one or more disks is faulty (depending on your RAID level), and the array is in danger of failing.

Common scenarios for critical status	**Bad sector is detected on a disk that is part of an array** **Unrecoverable data during rebuilding** **Defective port or cable interrupts rebuilding process**

To recover from this situation,

1. Backup your existing data.
2. Identify which disk is faulty.
   You can refer to the LED lights on the enclosure
   Refer to the HRM Logical tab and Event tab.
3. Re-insert the faulty disk or replace with a new disk.
   The array will rebuild automatically if your auto-rebuild setting is enabled and you reseated the faulty disk.

Note: Click **Rescan** if the array still does not rebuild automatically.

4. If the new disk is added and it does not automatically start rebuilding, you can manually add the disk in maintenance.
   Log into the HRM
   Click **Logical** Tab

Click **Maintenance**>**Add Disk**> select the appropriate disk

5. Rebuild should now start.
   If rebuild does not start, click ‘Rescan’ on the left hand panel.

Note: Rebuilding an array takes on average 2 hours per 1 Terabyte of disk capacity. The process will scan through the entire disk, even if you have very little *used* disk space.

Rebuilding Stops Due to Bad Sectors

If rebuilding fails to complete due to bad disk sector errors (check in the Event Log), there is an option to continue rebuilding on error in the HighPoint HRM.

1. Log into the HRM
2. Click **Setting** tab
3. Under **System Setting**, change **Enable Continue Rebuilding on Error** to **Enabled**

This option will enable rebuilding to ignore bad sectors and attempt to make your data accessible. It is important to backup immediately after backup is complete and replace or repair the disks with bad sectors.

Critical array becomes disabled when you removed faulty disk

If this is the case, you may have removed the wrong disk. When you remove the wrong disk from a critical array, the array status may become disabled. Data is inaccessible for disabled arrays. Follow these steps to restore the array to the previous state.

1. Shut down your PC

2. Place all disks back to original configuration
3. Boot up PC

Your array should be back to Critical status. Identify the correct disk and rebuild from there.

Handling Disabled Arrays

If two or more disks in your array go offline due to an error or physical disconnection your array will become **disabled**.

Disabled arrays are difficult to recover, so it is important to fix any critical status as soon as possible

Online Array Roaming

One of the features of all HighPoint RAID controllers is online array roaming. Information about the RAID configuration is stored on the physical drives. So if a card fails or you wish to switch cards, the RAID configuration data can still be read by another HighPoint card.

Help

Online Help
Register Product

Online Help redirects you to additional documentation concerning the HighPoint HRM.

Register Product takes you to the HighPoint Online Web Support Portal. On this page you can create a new customer profile where you can register your product, or post an online support ticket.

Table 1.HRM Icon Guide

	Critical – missing disk A disk is missing from the array bringing it to ‘critical’ status. The array is still accessible but another disk failure could result in data loss.
	Verifying The array is currently running a disk integrity check.
	Rebuilding The array is currently rebuilding meaning you replaced a failed disk or added a new disk to a ‘critical’ state array.
	Critical – rebuild required The array has all disks, but one disk requires rebuilding.
	Disabled The icon represents a disabled array, meaning more than one disk failed and the array is no longer accessible
	Initializing The array is initializing. The two types of initialization are Foreground and Background. (See Initialization)
	Uninitialized The array initialization process has been interrupted, and the process is incomplete.
	Not Initialized Disk is not initialized yet, and needs to be initialized before use
	OCE/ORLM Array is performing a OCE/ORLM operation
	OCE/ORLM has stopped The array expansion process has been stopped.
	Legacy An existing file system has been detected on the disk. These disks are classified as legacy drives.

	Spare The device is a spare drive, it will automatically replace any failed drive part of an array.
	Normal The array status is normal
	Initializing The array is initializing, either foreground or background initialization
	Initialization Stopped The initialization has been stopped. Current status is uninitialized.
	Critical – Inconsistency Data in the array is inconsistent and needs to be rebuilt.
	Critical – missing disk A disk has been removed or experienced failure, and user needs to reinsert disk or add a new disk.
	Rebuilding The array is currently rebuilding.
	Verifying The array is performing a data consistency check. Array status will show ‘verifying’.
	Disabled The array does not have enough disks to maintain the RAID level. A disabled array is not accessible.
	OCE/ORLM Array is expanding its capacity or migrating to a different raid

	level. Status will display ‘Expanding/Migrating’
	OCE/ORLM stopped The ‘Expansion/Migrating’ process has been stopped. The status will display ‘Need Expanding/Migrating’
	Critical – OCE/ORLM A disk member is lost during the OCE/ORLM process.
	Critical – OCE/ORLM - rebuild The expanding/migrating array requires a rebuild.

Table 2. RAID Level Reference Guide

Type	Description	Min. disks	Usable space	Advantage	Disadvantage	Application
JBOD	Just a bunch of disk	1	100%	Each drive can be accessed as a single volume	No fault tolerance - failure of one drive results in complete data loss	Backup
RAID 0	Disk Striping	2	100%	Offers the highest performance	No fault tolerance - failure of one drive results in complete data loss	Temporary file, performance driven application.
RAID 1	Disk Mirroring	2	50%	Provides convenient low-cost data redundancy for smaller systems and servers	Useable storage space is 50% of total available capacity. Can handle 1 disk failure.	Operating system, backup, and transaction database.
RAID 10	Disk Mirroring followed by stripe	4	50%	High read performance and medium write performance with data protection for up to 2-drive failures	Useable storage capacity equals total capacity of all drives in the array minus two	Fast database and application servers which need performance and data protection
RAID 5	Disk Striping with Rotating parity	3	67-87%	High read performance, and medium write performance with data protection with a single drive failure	Not recommended for database applications that require frequent/heavy write sessions. Can handle 1 disk failure.	Data archives, and ideal for application that require data protection
RAID 50	Disk Mirroring followed by RAID5	6	67-75%	High read performance, and medium write performance with data protection in case of up to two drives failure	Not recommended for applications that require frequent/heavy write sessions.	Data archives and ideal for application that requires data protection
RAID 6	Disk Striping with dual rotating parity	4	50-75%	High read performance, and medium write performance with data protection in case of up to two drives failure	Not recommended for applications that require frequent/heavy write sessions.	Data archives and ideal for application that requires data protection

HighPoint Recommended List of Hard Drives

HighPoint maintains a list of tested hard drives and SSD suitable for RAID applications. Since not every drive in the market can be tested, this list is meant to be a general guideline for selecting hard drives and SSD operating in a RAID environment. Regular, desktop grade drives are highly not recommended for RAID use.

http://highpoint-tech.com/PDF/Compatibility_List/SSD7103_Compatibility_List_062619.pdf

Contacting Technical Support

For any help and support, submit a support ticket online at http://www.highpoint-tech.com/websupport/ .

Please also check our Support page for articles that may answer your questions.

http://highpoint-tech.com/USA_new/support.htm