



# AMD-RAIDXpert2 User Guide

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## Revision History

Date	Revision	Description
June 2019	3.10	Updated and added new information to Chapters 1, 2, and 4-11. Updated Table 3. Updated the memory requirements. Updated Table 4. Updated chipset names. Updated Table 6. Removed references to licensing type. Updated Section 2.3.2. Updated the release designations. Added Section 11.6. Troubleshooting information for the Web Graphical User Interface (GUI).
February 2019	3.09	Updated Section 12.1.4, Proprietary Rights.
January 2019	3.08	Updated Table 9 and Table 33. Editorial corrections
March 2018	3.07	NVMe RAID validation update Added references to CTS – Cache Tag Size – in Array Creation, Web GUI and rcdm.
July 2017	3.06	Updated the steps to install xampp for RHEL and Ubuntu Operating systems
June 2017	3.05	Fourth Public Release. <ul style="list-style-type: none"> <li>• Updated steps to install Ubuntu OS in RAID mode.</li> <li>• Removed references to RAIDXpert2 Plus.</li> <li>• Removed references to RAID-5 array.</li> <li>• Edited steps to Assign and Unassign spares.</li> <li>• Removed the section related to “Change the Controller Options”</li> </ul>
December 2016	3.02	Third Public Release. <ul style="list-style-type: none"> <li>• Added a new chapter for RAIDXpert2 Configuration Utility (HII).</li> <li>• Added a new chapter for RAID Driver Software Update.</li> <li>• Updated Operating System Requirements.</li> <li>• Updated revisions of Ubuntu Desktop Linux to 16.04 32 bit and 64 bit</li> <li>• Updated revisions of RedHat (RHEL) 7.3 64 bit</li> <li>• Updated steps for BIOS and UEFI boot platforms.</li> <li>• Removed support for Ubuntu 15.04, 15.10.</li> <li>• Removed support for RedHat 7.2 (RHEL)</li> </ul>

Date	Revision	Description
June 2016	3.01	<p>Second Public Release.</p> <p>Removed support for the Microsoft® Windows® 8 operating system.</p> <p>Removed support for Ubuntu 13.10. This included removing extra steps that concerned Ubuntu 13.10.</p> <p>Updated Operating System Requirements</p> <p>Removed references to Windows XP and Windows 8.1.</p> <p>Replaced SUSE (SLED) references with Red Hat (RHEL) 7.2 64 bit</p> <p>Updated revisions of Ubuntu Desktop Linux</p> <ul style="list-style-type: none"><li>• 15.04 32 bit and 64 bit</li><li>• 15.10 32 bit and 64 bit</li></ul> <p>Removed support for SLED</p> <p>Removed support for Ubuntu 12.04.04 and 14.04, 32 bit and 64 bit</p> <p>Changed supported controllers</p> <p>Removed RAID5 from Table 6 and Table 8</p> <p>Updated steps for BIOS and UEFI boot platforms</p>
November 2013	3.00	Initial Public release

# Preface

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This user guide:

- Describes how to configure RAID mode on AMD platforms.
- Provides information about arrays, disks, and RAID levels (RAID types).
- Describes how to improve storage system performance or reliability by understanding array and disk tasks and options.
- Describes how to acquire and load RAIDXpert2 drivers for Windows®, Windows 7 32-bit, Windows 7 64-bit, Windows 10 64-bit and later operating systems and Linux® operating systems.
- Describes the features and procedures for using RAIDXpert2, which is the RAIDXpert2 GUI.

## Intended Audience

This user guide is intended for use by system administrators and technicians who are experienced with the following:

- Direct Attached Storage (DAS), Storage Area Network (SAN), or Network Attached Storage (NAS) operators
- Network administration
- Network installation
- Storage system installation and configuration

## Prerequisites

Prerequisites for installing and configuring this product include familiarity with:

- Servers and computer networks
- RAID and input/output signal technology (such as SCSI, SATA, or NVMe)
- Fibre Channel and Ethernet protocols

## Document Conventions and Symbols

**Table 1. Document Convention**

Convention	Element
Navy blue, underlined text ( <a href="http://www.example.com">http://www.example.com</a> )	Web site addresses
Bold font	Key names Text typed into a GUI element, such as into a box GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes
Italics font	Text emphasis
Monospace font	File and directory names System output Code Text typed at the command line
Monospace, Italic font	Code variables Command line variables
Monospace, bold font	Emphasis of file and directory names, system output, code, and text typed at the command line

## Customer Support

For customer support, contact your system supplier or motherboard vendor.

## Glossary

**Table 2. Glossary of Terms**

Term	Definition
rcadm	A command line interface (CLI) tool for managing RAID controllers on Linux®, on Windows®, and UEFI operating systems. It is used for creating, transforming, and deleting arrays; and adding and removing disks.
Legacy disk	Legacy disks include new or unrecognized disks which may contain data or even an operating system. Legacy disks appear in the BIOS Configuration Utility and in RAIDXpert2 as legacy arrays. When the legacy disk is initialized, configuration data is written to the disk. The legacy array then becomes an online disk usable in arrays. <i><b>CAUTION:</b> A legacy disk can contain valid data. When a legacy disk is initialized, all data on the disk is lost.</i>
Linux®	Free, open-source UNIX-based operating system.

# Chapter 1 Safety Precautions

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## 1.1 General

This section includes general safety precautions and specific RAIDXpert2 cautions. Read and keep this user manual for future reference.

## 1.2 Safety Definitions

**CAUTION:** Indicates that failure to follow directions could result in damage to equipment or data.

**IMPORTANT:** Provides clarifying information or specific instructions.

**Note:** Provides additional information.

**TIP:** Provides helpful hints and shortcuts.

## 1.3 Caution Messages

This section lists the Caution messages that appear in this user guide.

### 1.3.1 Caution Messages About Disks

**CAUTION:** Assigning a dedicated spare does not reserve space on the disk. Therefore, an automatic restore is not guaranteed if a disk fails. If a disk fails, make space on the disk for the fail-over to complete, or assign a different disk with enough space. If a dedicated spare is assigned and a disk fails, the restore process starts automatically, if there is enough space available on the dedicated spare.

**CAUTION:** If a disk is part of an AMD-RAID array, the disk cannot be selected for initialization. To initialize the disk anyway, delete the AMD-RAID array. Data on the disk is deleted during initialization so ensure the correct disks are chosen to initialize.

**CAUTION:** A legacy disk can contain valid data. When a legacy array is deleted, or when its corresponding legacy disk is initialized, the data is lost.

**CAUTION:** When a disk is initialized, all data on the disk is lost.



### 1.3.2 Caution Messages about Arrays

**CAUTION:** *Deleting an array permanently destroys all data that is on the array. This action cannot be undone and it is very unlikely the data can be recovered.*

**CAUTION:** *Do not delete the first array listed in the Arrays section, if it is the AMD-RAID bootable array. Doing this deletes the operating system and AMD-RAID files.*

**CAUTION:** *Do not initialize a disk that is part of an array. Initializing a disk in a non-redundant array deletes the array and its data. The array no longer appears in Array View. This is especially true for a non-redundant bootable array. Initializing a disk in a non-redundant bootable array causes the array to Fail and deletes the operating system, AMD-RAID files, and device drivers.*

**CAUTION:** *Leaving Write Back Cache enabled can increase the likelihood of data being corrupted if the system experiences a power interruption or unexpected shutdown.*

**CAUTION:** *Prior to removing an array, remove its drive letter (Windows) or unmount the array (Linux®).*

**CAUTION:** *All data contained in a AMD-RAID array are lost if the RAIDXpert2 disks of the array are migrated to a non-AMD-RAID system.*

**CAUTION:** *When an array is securely erased, the data on the array is lost. The array remains hidden after the secure erase completes. User must Un-hide the array for data operations.*

**CAUTION:** *In some circumstances, more than eight arrays are possible. They might appear to function properly, but are not supported.*

**CAUTION:** *If the user creates an Array with Skip Initialization, the array will not be redundant.*

**CAUTION:** *Controller support for Socket SP3 compatible processors are as follows:*

*7 NVMe + 4-SoC when x570/590 is set to RAID in the BIOS*

*8-NVMe + 2-SoC + 1-PT when set to RAID in the BIOS*

*10-NVMe when SoC and PT are Disabled in the BIOS*

*10-NVMe + 1-PT when SoC is Disabled in the BIOS*

*9-NVMe + 2-SoC when PT is Disabled in the BIOS*

**CAUTION:** *Hot-Swapping is not recommended for disks that are part of AMD-RAID array.*

**CAUTION:** *Socket SP3 compatible processors support a maximum of 14 SATA ports on the system depending on customer platform design (8 from PT SATA controller, 6 from AMD SATA controller including devices connected to M.2 port).*

**CAUTION:** *Maximum number of disks (both NVMe and SATA) that can be used for Creating/Transforming a Volume, RAID-0 and RAID-10 arrays is eight. For RAID-1 only two disks are supported.*

**CAUTION:** *RAID on AMD SP3 compatible processor platform M.2 port supports both AMD SATA controller and PCIe M.2 NVMe. At any given time, each M.2 port can support either M.2 SATA or M.2 NVMe, but not both.*

**CAUTION:** *Individual disks which are not part of a RAID array will not be listed in Device Manager under the Disk Drive section. Individual Disks can be managed through RAIDXpert2 web utility, HII and the EFI shell.*

## Chapter 2 Getting Started

### 2.1 RAIDXpert2 Technology

RAIDXpert2 consists of (a) storage management and (b) a RAID controller and port virtualization. RAIDXpert2 runs on existing systems by using a motherboard's built-in SATA ports, PCIe M.2 slots and PCIe NVMe Addin cards.

### 2.2 Who Should Use This User Guide

Only trained, experienced, and authorized personnel should install RAIDXpert2 and use its features and capabilities.

All unit operators must be familiar with system hardware, data storage, RAID technology, input/output signal technology (such as NVMe, SCSI, SAS, or SATA), and Direct Attached Storage (DAS), Network Attached Storage (NAS), and/or Storage Area Network (SAN) concepts and technology.

The intended user audience of this user guide is system administrators and experienced users.

### 2.3 System Requirements for Using RAIDXpert2

Make sure the systems that use RAIDXpert2 meet the requirements indicated in Table 3.

**Table 3. System Requirements for RAIDXpert2**

Component	Requirements
Memory (RAM)	Minimum: 2 at 8 GB, for a total of 16 GB for AMD Ryzen® processors and AMD Ryzen® desktop processors. Recommended: 4 at 8 GB for a total of 32 GB for AMD Ryzen® desktop processors.
Storage Devices	1–14 SATA or SSD drives or M.2 SATA drives or NVMe M.2 HHHL. The number of disks depends on the number, type, and capacity of the arrays to be created.

### 2.3.1 Supported Processors and Chipsets

The following processors are supported by the current release of RAIDXpert2:

**Table 4. Supported Processors and Chipsets**

Supported Processors & Chipsets	Description
Supported AMD Processors	3rd Gen AMD Ryzen™ Desktop Processor 2nd Gen AMD Ryzen™ Threadripper™ Processor 2nd Gen AMD Ryzen™ Desktop Processor AMD Ryzen™ Threadripper™ Processor AMD Ryzen™ Desktop Processor AMD Ryzen™ Desktop Processor with Radeon™ Vega Graphics
Supported AMD Chipsets	AMD X470 Chipset AMD X399 Chipset AMD B450 Chipset AMD X370 Chipset AMD B350 Chipset AMD A320 Chipset AMD X570 Chipset

### 2.3.2 Supported Operating Systems

RAIDXpert2 supports the following operating systems:

**RC-9.2.x Release:**

- Microsoft® Windows® 10—64 bit.

**RC-8.1.x Release:**

- Microsoft Windows 7: Professional Edition, Ultimate Edition—32 bit and 64 bit
- Microsoft Windows 10—32 bit and 64 bit
- Red Hat Enterprise Linux® (RHEL) 7.3—64 bit
- Ubuntu Desktop Linux 16.04—32 bit and 64 bit

## 2.4 Features of RAIDXpert2

The features of RAIDXpert2 described in this user manual apply to all license levels and supported operating systems.

Table 5 describes these features. Also see Table 6, on page 23, for a summary of features that are available with the RAIDXpert2 license.

**Table 5. Features of RAIDXpert2**

RAIDXpert2 Feature	Description
Arrays (general information)	RAIDXpert2 allows: <ul style="list-style-type: none"> <li>• An array refers to data storage created by RAIDXpert2 from one or more disks. Although an array can be created from several disks, it is seen by the operating system as a single disk.</li> <li>• Creating arrays of different RAID levels using the same disks.</li> <li>• Creating different RAID level arrays on the same disk, to adapt each array to the I/O that it processes.</li> <li>• Creating an array from a mix of different type disks. For example, a RAID10 array can be created from a group of disks that contain two SATA II HDDs and two SATA SSDs or only on NVMe or group of SATA and NVMe disks.</li> <li>• Migrating an existing array to another RAID level, if the type of array being used is not the optimal type for the application. This function depends on the array capacity, redundancy level, RAIDXpert2 license level and capacity of the drive or free space available.</li> </ul>
Array Hiding	An array can be hidden from the operating system so that neither the software nor users can see or access it.
Array Recovery	If a redundant array is accidentally deleted, it might be recovered by creating a new array with the same properties as the deleted array. (This can occur only if disk Write Access operations are not in-progress.)
Background Array Initialization (BGI)	The background initialization of a redundant array creates the redundant data that allows the array to survive a disk failure. Background initialization allows a redundant array to be used immediately. Data is not lost if a disk goes offline prior to completion of the BGI process.
Cache Support for Arrays	Various array-caching options are supported: No Cache, Read Ahead Cache, Write Back Cache, Read Ahead and Write Back Cache.

**Table 5. Features of RAIDXpert2 (Continued)**

RAIDXpert2 Feature	Description
Cache Support for Disks	<p>Various disk-caching options are supported: No Cache, Read Ahead Cache, Write Back Cache, Read Ahead and Write Back Cache.</p> <p><i>Note: By default, NVMe Physical disk Read Ahead and Write Back cache are always disabled. User cannot enable the setting as it may impact the operational performance of the NVMe disk</i></p>
Secure Erase	<p>All data on an array can be erased and ensured it is unrecoverable, even with advanced data recovery techniques.</p>
Consistency Check	<p>A Consistency Check is a background operation that verifies and corrects the mirror or parity data for fault-tolerant disks. It is recommended that a Consistency Check be run periodically on an array.</p>
Disk Roaming	<p>With disk roaming, SATA cables can be disconnected from their disks and shuffled without confusing RAIDXpert2.</p> <p><i>Note: Disconnect the SATA cables from the disks only when the system is shutdown.</i></p> <p>Disk roaming also allows:</p> <ul style="list-style-type: none"> <li>• Disks to be moved to different slots in the backplane. RAIDXpert2 detects which disks belong to which arrays, regardless of where the disks are moved in the backplane.</li> <li>• Disk(s) to be moved between systems.</li> </ul> <p><i>Note: It might not be possible to move disks between systems if they contain boot arrays.</i></p>
Fault Tolerance	<p>The following fault tolerance features are available with RAIDXpert2, in order to prevent data loss in case of a failed disk.</p> <ul style="list-style-type: none"> <li>• Disk failure detection (automatic).</li> <li>• Array rebuild using hot spares (automatic, if the hot spare is configured for this functionality).</li> <li>• Hot-swap manual replacement of a disk without rebooting the system (available only for systems with a backplane that supports hot-swapping) is not recommend for disks that are part of the Boot Virtual Disk or are connected to the AMD RAID supported chipsets. This applies to all chipsets.</li> </ul> <p>For example if a disk fails in a RAID1, the array remains functional and data is read from the surviving mirrored disk.</p>
Mirror Rebuilding	<p>A broken mirrored array can be rebuilt after a new disk is inserted and the disk is designated as a spare. The system does not have to be rebooted.</p>
Multiple RAID Levels per Disk	<p>Support for multiple array levels per disk allows the administrator to create arrays of different RAID levels using the same disks.</p>

**Table 5. Features of RAIDXpert2 (Continued)**

<b>RAIDXpert2 Feature</b>	<b>Description</b>
Native Command Queuing (NCQ)	Native Command Queuing is a command protocol of disks that are supported by RAIDXpert2. NCQ enables individual disks to internally optimize the order in which Read and Write commands are executed. RAIDXpert2 permits a queue depth of up to 32 read/write commands per disk.
Online Capacity Expansion (OCE)	OCE is a process that allows the user to add storage capacity to an existing array, without taking the system offline. OCE enables the user to increase the total storage capacity of an array by integrating unused storage into the array. Data can be accessed while the disks are added and while data on the array is being redistributed.
Online RAID Level Migration (ORLM)	With online RAID level migration, users can easily move an array from one RAID level to another. While the migration is taking place, data is accessible and protected to the lowest protection of either the source RAID level or the destination RAID level.
RAID Level Support	RAIDXpert2 supports RAID levels 0, 1, 10, Volume, and RAIDABLE.
Self-Monitoring Analysis and Reporting Technology (SMART)	SMART is a hard-disk-drive (HDD) capability which allows reporting of reliability information. If a drive anticipates there is a high likelihood of future failure it triggers a SMART error condition. RAIDXpert2 presents this error condition so the drive can be replaced before the predicted failure occurs.

## 2.5 RAIDXpert2 Feature Set

**Table 6. Supported Feature Set for RAIDXpert2**

<b>Features</b>	<b>Sub-Features</b>
Option ROM (BIOS) Support <sup>1</sup>	Create array
	Delete array
	Boot/INT13 control
UEFI Driver (BIOS) Support	Create array
	Delete array
	Raidxpert2 Configuration utility (HII) <sup>1</sup>
	efi Shell utility

**Table 6. Supported Feature Set for RAIDXpert2 (Continued)**

Features	Sub-Features
RAID Levels Supported <sup>2</sup>	0
	1
	10
	RAIDable
	Volume
Array Creation	No initialization
	Foreground initialization
	Background array scan
	No reboot required
	Multiple RAID levels per disk <sup>6</sup>
Array Deletion	No reboot required
Array Transformation	Online RAID Level Migration (ORLM)
Sparing	Global
	Dedicated
Consistency Check	Background redundancy check
	Scheduled
Online Capacity Expansion (OCE) <sup>3</sup>	
Online RAID Level Migration (ORLM)	
Drive/Disk Roaming <sup>4</sup>	Same-system support
	Between-systems support
RAIDXpert2 Web GUI (Management GUI)	WEB Interface for Array and Disk Management



**Table 6. Supported Feature Set for RAIDXpert2 (Continued)**

Features	Sub-Features
rcadm (management CLI)	
Drive Interfaces Supported <sup>5</sup>	SATA
	SSD
	ATAPI
	M.2 SATA SSD
	M.2 NVMe SSD
	HHHL NVMe SSD
Dissimilar Disk Support Within The Same Array	
Cache Support	No Cache
	Read Ahead Cache
	Write Back Cache
	Read Ahead and Write Back Cache
Restore (Rebuild) Priority	
Touched Region Logging <sup>7</sup>	
System Event Log Integration	
Instant Create Support <sup>8</sup>	
Hot-Swap Support	

**Notes:**

1. At the AMD BIOS Page, arrays can be created or deleted with AMD BIOS Configuration Utility (HII) or Option ROM. Option ROM support is available only with the RC-8.1.x release. Array or physical disk information can be displayed, assign Global or Dedicated spares and Critical or Offline arrays are indicated. INT13 support can be turned off completely at the BIOS Configuration Utility. NVMe is not supported by the Option ROM.
2. See Chapter 3, Understanding Arrays, Disks and RAID Levels, on page 27, for detailed information about understanding arrays, RAID levels, and performance and reliability considerations.
3. The unique ability of RAIDXpert2 to provide online expansion to RAID levels across multiple disks becomes extremely valuable when expanded storage is a requirement.

4. *Disk roaming allows arrays to be moved from port to port, either within the same system or between systems.*
5. *See the system's motherboard specifications for the supported device interface. RC-8.1 and RC-8.2 branches support only SATA. RC-9.1 and above release branches support SATA, M.2 NVMe SSD and HHHL NVMe SSD*
6. *Multiple RAID levels (array types) per disk allows the administrator to create different RAID levels on the same disks. For example: The administrator wants data redundancy for the user data, and creates a RAID1 set using part of the disks' data. At the same time the administrator wants performance for the swap spaces, and creates a RAID0 array using the rest of the disks' capacities (space). This feature is useful in collecting unused capacity from disks with different capacities. This feature increases data integrity for redundant array types, by logging areas of an array that have been written to. In the event of a system crash, the logged area's consistency is checked and/or corrected. Without this feature, data corruption might occur.*
7. *Arrays can be instantly created and used by skipping the background consistency check. For certain types of redundant arrays this is a viable option and has no data integrity drawbacks. A consistency check can always be done at a later time. If an initialization is skipped when creating a RAID1, the array is not redundant until a consistency check is performed.*
8. *It is not recommended to add a Disk to the system and to the array while the system is operating.*

# Chapter 3 Understanding Arrays, Disks and RAID Levels

## 3.1 Understanding Arrays

Arrays are several disks that are grouped together to improve either the performance or reliability of a storage system. Because some RAID levels enhance performance while others improve reliability, it is important to consider the user's needs when planning an array configuration.

*Note: It is highly recommended that this user manual be reviewed in its entirety before configuring arrays. Some of the advanced features of RAIDXpert2 (such as sparing options) must be understood by the user before creating arrays.*

## 3.2 RAID Levels

RAIDXpert2 supports the RAID levels indicated in Table 7.

**Table 7. RAID Levels – General Characteristics**

RAID Level	Main Characteristic	Use/Usefulness
RAID0 (Striping)	<ul style="list-style-type: none"> <li>Provides the highest performance but no data redundancy. Data in the array is striped (distributed) across several disks.</li> <li>Supports 2-8 disks.</li> </ul>	RAID0 arrays are useful for holding information, such as the operating system paging file, where performance is extremely important but redundancy is not.
RAID1 (Mirroring)	<ul style="list-style-type: none"> <li>Mirrors data on a partition of one disk to another.</li> <li>Supports 2 disks.</li> </ul>	Useful when there are only two disks available and data integrity is more important than storage capacity.
RAID10 (Striped RAID1 Sets)	<ul style="list-style-type: none"> <li>Combines mirrors and stripe sets. RAID10 allows multiple disk failures, up to 1 failure in each mirror that has been striped.</li> <li>Supports 4, 6, or 8 disks.</li> </ul>	Offers better performance than a simple mirror because of the extra disks. Requires twice the disk space of RAID1 to offer redundancy.

**Table 7. RAID Levels – General Characteristics (Continued)**

RAID Level	Main Characteristic	Use/Usefulness
Volume (JBOD)	<ul style="list-style-type: none"> <li>RAIDXpert2 treats one or more disks or the unused space on a disk as a single array.</li> <li>Supports 1 to 8 disks</li> </ul>	<p>Provides the ability to link-together storage from one or several disks, regardless of the size of the space on those disks.</p> <p>Useful in scavenging space on disks unused by other disks in the array.</p> <p>Does not provide performance benefits or data redundancy. Disk failure will result in data loss.</p>
RAIDABLE (also known as RAID Ready)	<ul style="list-style-type: none"> <li>Allows a RAIDABLE disk to be transformed later to RAID0 or RAID1.</li> <li>Supports one disk.</li> </ul>	<p>See RAID0 (Striping), on page 27 or RAID1 (Mirroring) on page 27 for post-transformation usefulness.</p>

### 3.3 Array States

Within the management applications, an array is a logical device that can exist in one of four states: Normal, Ready, Critical, or Offline.

- In RAIDXpert2, these states display in the Array List section in a column named State.
- Within the rcadm Command Line interface, these states also display in a column named State.

The array states are defined in Table 8, on page 29.

**Table 8. Array States**

State	Description
Normal	The Normal state is displayed when everything is functioning correctly.
Ready	The Ready state is displayed while an array is being created.
Critical	The Critical state is displayed when the array is no longer redundant (fault tolerant) because of one or more disk failures. Arrays can still be read and written to, but the data is no longer protected should another disk fail.
Offline	The Offline state is displayed when arrays cannot be read or written to because of one or more disk failures.

Whether an array is marked as Critical or Offline depends upon what RAID level it is and how many disks within the array have failed. Note the changes in state in Table 9.

**Table 9. Failure States by RAID Level**

RAID Level	This Failure State	Is Displayed Whenever
RAID1 (Redundant Arrays)	Critical	A single disk fails.
	Offline	Two disks fail.
RAID10 (RAID Levels with Multiple Redundancies)	Critical	A single disk fails in any one of the sets.
	Offline	All the disks in a set fail.
Volume, RAIDABLE and RAID0	Offline	A single disk fails.

More than one array can be created using the same set of disks. If a disk is disconnected that belongs to more than one array, only the arrays that try to access the disk and receive I/O errors report the failure. For example: there are two arrays, both of which are RAID1 sets, and both use disk 4. If a system that is being used by array 1 receives an I/O error when trying to communicate with disk 4, the state of array 1 changes to Critical. However, the state of array 2 using disk 4 does not change to Critical until an I/O error is reported. If systems using array 1 are not communicating with failed disk 4, the state of array 1 still displays as Normal.

If a rescan of all channels is performed after disconnecting a disk, the state of every array using the missing disk changes from Normal to either the Critical or Offline, depending on the RAID level.

See Section 3.9, Rescanning Disks for Changes in State, on page 33 for a discussion of when to rescan disks and the outcomes when doing so.

## 3.4 Creating Arrays: Future Expansion

When creating arrays, consider whether disk capacity needs to expand in the future. If the file system must be expanded, perform the tasks indicated in Table 8.

**Table 10. Array Expansion Considerations**

Operating System	Do This...	And Consider This...
Microsoft® Windows®	Format the arrays with NTFS. Microsoft Corporation provides a utility (Diskpart.exe) that can dynamically extend an NTFS file system onto any unused adjacent space. Note also that using a single partition per array makes expansion much easier.	1. The Diskpart.exe utility version depends on which version of the Windows operating system is running. 2. The Diskpart.exe utility can be found on the CD for some versions of Windows operating systems, or on the Microsoft Corporation website ( <a href="http://www.microsoft.com">http://www.microsoft.com</a> ) for other versions. Use the correct version for the operating system.
Linux®	Use an expandable file system.	Because RAIDXpert2 software is limited to eight arrays, if a large number of logical volumes are needed, use a logical volume manager (LVM).

## 3.5 Expanding Disk Capacity Online: Using OCE

Online Capacity Expansion (OCE) allows:

- Adding disks to an array at any time to increase an array's capacity.
- Accessing the array data while it is being redistributed.

To increase the size and organization of an array, transform the array. For more information about transforming arrays, see Section 9.6.3, Transform Arrays on page 104.

## 3.6 Migrating RAID Levels Online: Using ORLM

Online RAID Level Migration (ORLM) allows an array to move from one RAID level to almost any other RAID level. This task includes migrating the array from a non-redundant RAID level to a redundant RAID level.

Prior to starting a RAID level migration/transformation, make sure that the disks selected for the destination array have sufficient capacity. RAID level migration/transformation can occur only when the destination array has the same or larger capacity as the source array.

While the migration/transformation is taking place, data is accessible and protected to the lowest protection of either the source RAID level or the destination RAID level.

The Transform task can also be used to expand the capacity of an array, by using OCE. It can also be used as part of the system backup and recovery strategy through the use of the RAID1 and RAID10 levels.

To perform this process, see Section 9.6.3, Transform Arrays on page 104.

## 3.7 Array Tasks: Starting and Stopping Tasks

Tasks are started when one of the following actions are performed:

- Create a redundant array.
- Transform an array.
- Restore an array.
- Securely erase an array.
- Check for consistency on redundant arrays.
- Verify that data was not corrupted after a system crash (Check\_Bitmap performed automatically).

Full task control can be used on Create, Consistency Check and Bitmap Check tasks. On a Transform or Restore task for dedicated and global spares, task control can only pause/resume, but it cannot remove the task. To remove these types of tasks, pause and then remove them.

The tasks indicated in Table 11 on page 32, can be displayed for each array.

**Table 11. Types of Tasks per Array**

Task	When Displayed
Transform	While an array is being transformed.
Create	While an array is being created.
Consistency Check	While verifying the mirror disk (RAID1 or RAID10) consistency is correct. (For redundant type arrays only.)
Restore	While an array is being restored.
Secure Erase	While an array secure erase is being performed.
Check_Bitmap	While verifying that the mirror halves on a RAID1 or RAID10 set, are consistent. This action is performed automatically to ensure that data is not corrupted whenever a system crashes.
Not_Active	When no other tasks are being performed.

## 3.8 Understanding Disks

### 3.8.1 Disks States

Within the management applications, a disk can be part of one or more arrays and can exist in one of five states: Online, Offline, New, Legacy, or SMART Error.

- In RAIDXpert2, these states are displayed in the Disk List section in a column named State. See Table 20, on page 95, for additional information.
- Within the rcadm command line interface, these states are also displayed in a column named State. See Table 33, on page 120, and Table 34, on page 121, for additional information.

The disk states are defined in Table 12.

**Table 12. Disk States**

Disk State	When Displayed
Online	Whenever the disk is connected, functioning correctly, and RAIDXpert2 can communicate with it.



**Table 12. Disk States (Continued)**

Disk State	When Displayed
New	Whenever an uninitialized, new disk is connected.
Legacy	Whenever a disk containing non-RAIDXpert2 configuration data is connected.
Offline	Whenever the disk fails and RAIDXpert2 detects an error condition on the disk.
SMART Error	Whenever the disk reports a SMART error(s) to RAIDXpert2.

A disk can be a member of multiple arrays. A disk failure in one array doesn't necessarily mean it has failed in other arrays.

After a rescan is performed the following can occur:

- A disconnected disk no longer appears in the Disk List (although the disk appears as Missing in the Array View for the arrays to which it belonged).
- A disk that experiences a catastrophic failure appears in the Disk List as Offline and is highlighted in red. The disk appears as Failed for the arrays to which it belonged.
- A disk that has a SMART error appears in the Disk List as SMART Error. (A disk with a SMART error can't be used to create an array)
- A disk that experiences a software-related failure appears in the Disk List as Online and is highlighted in red. New arrays can be created with the disk.

Arrays that exist on a failed or disconnected disk might not be designated as Failed or Missing until the system attempts to communicate with the failed or disconnected disk.

### 3.9 Rescanning Disks for Changes in State

The information displayed in the Disk List section is the state of the disks when they were last scanned. If a rescan has not been performed, the information being displayed is the state of the disks at boot time.

Every time a disk is connected or disconnected while online, a message asks if the user wants to perform a rescan (of all SATA channels). If Rescan is selected, the information in both the Array List and the Disk List is updated. This view might show arrays as being in a Critical or Offline state, if all disks have not been installed or removed.

Although it is highly recommended that the system be shut down before adding or removing disks, disks can be added or removed while the system is online (“hot-swapping”), if the system supports the hot-swapping function. This is not recommended for disks that are part of the Boot Virtual Disk or those that are connected to the AMD RAID supported chipsets.

Because of this function, RAIDXpert2 does not automatically perform a rescan when it detects that a disk has been added or removed. For example, to hot-swap a RAID1 set with two disks into a new system, do not perform a rescan until both disks have been connected.

Arrays associated with the disks that are not yet connected change state to either Critical or Offline. In the example above, if the state of the RAID1 set changes to Offline, data is unavailable.

Rescanning can also result in the state of a disk being reported differently in the Array View and the Disk List. A disk within an array can have a state of Failed in the Array View field, while at the same time it can show a state of Online in the Disk List.

## 3.10 Sparing Options: Disks and Arrays

RAIDXpert2 supports multiple sparing options. Spares are restored in the order indicated in Table 13.

**Table 13. Sparing Options**

Option	Description
Dedicated	A spare disk assigned to a specific redundant array.
Global	A spare disk that is shared by multiple arrays.

*Note:* An array is marked Critical or Offline if a disk reports a Failed state to an I/O, or if the Disk, SATA cable, or power cable is disconnected.

*Note:* One or more spares can be assigned to a redundant RAID level.

*Note:* Spare assignments do not apply to non-redundant RAID levels. To protect data, transform the array to a redundant RAID level. Spares can then be assigned.

## 3.11 Dedicated Sparing

A dedicated spare is a disk that is assigned as an alternate disk for a specific array. Should a disk fail in that array, the alternate disk is used to replace the failed disk and the array is rebuilt.

A dedicated spare can be assigned to any redundant array type, and up to four spares can be assigned to an array.

*Note:* Disk capacity of the Dedicated Spare must be greater or equal to the capacity of the smallest disk in the array.

**CAUTION:** Assigning a dedicated spare does not reserve space on the disk. Therefore, an automatic restore is not guaranteed if a disk fails. If a disk fails, make space on the disk for the fail-over to complete, or assign a different disk with enough space. If a

*dedicated spare is assigned and a disk fails, the restore process starts automatically, if there is enough space available on the dedicated spare.*

For additional information, see Section 9.6.13, Add or Remove Dedicated Spares, on page 112.

## 3.12 Global Sparing

A global spare is a disk that is assigned as an alternate disk for multiple arrays, instead of associating it with only one array.

Many arrays can be restored using the global spare disk, as long as it is not already part of the array and it has enough space available. Unlike a dedicated spare, this type of spare can be assigned at any time, even while tasks are running on arrays.

Assigning a disk for use as a global spare does not reserve space on that disk. An automatic restore is not guaranteed if a disk fails.

If there is not enough disk space on the global spare, make room for the fail-over to complete, or assign a different disk with enough capacity as the spare. If there is enough space available on the global spare and a disk failure occurs, the restore process starts automatically.

For additional information, see Section 9.6.14, Add or Remove Global Spares, on page 113.

## 3.13 RAID Performance Considerations

With RAID technology, performance is based on the following considerations:

- The number and organization of disks in an array.
- Caching attributes used for the array.
- Application workload.

### 3.13.1 Number and Organization of Disks

RAID functions increase performance by putting more disks to work and by buffering data for the host.

Many disks can transfer data at greater than 100 MB per second. RAIDXpert2 can aggregate this bandwidth in an almost linear fashion, as more of the same disks are included in an array.

### 3.13.2 Caching Attributes

Arrays can also be configured to provide Read and Write Back cache, Write Back cache, Read Ahead cache and No cache option with RAIDXpert2 configuration utility and WebGUI utility, if desired. Write Back caching has a large effect on most workloads, but should be used with caution.

### **3.13.3 Application Workload**

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

## **3.14 RAID Reliability Considerations**

RAID reliability is enhanced through data redundancy and backup.

### **3.14.1 Data Redundancy**

RAID1 or RAID10 are necessary for redundancy. With redundancy, both capacity and performance are sacrificed for reliability. With RAIDXpert2, extremely high performance is obtained even with redundant-type arrays.

### **3.14.2 Backup**

It is good practice to back up your data periodically in case of a catastrophic failure. Tape backup or other media can be used to secure your data.

## **3.15 Flexibility and Expansion Considerations**

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

## **3.16 Multiple RAID Levels**

With RAIDXpert2, different RAID levels can be created on the same disk, to adapt each array to the I/O that it processes. Also, more than one array can be created per disk.

Depending on the array capacity and redundancy level, an existing array can be transformed to another RAID level, if the level of the array being used is not the optimal RAID level for the application. Also, different arrays with different characteristics can be built for different applications.

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# Chapter 4 Platform BIOS RAID Configuration Prerequisites

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This chapter assists to configure and enable RAID mode in Platform BIOS for the listed AMD products in Table 4 on page 20.

*Note: Prior to starting the below procedure, Platform should be programmed with RAID Supported BIOS. Obtain the BIOS from your system supplier or motherboard vendor.*

## 4.1 Enable RAID for the x570/590 AMD Socket AM4-Compatible Processors

*NOTE: The steps to configure a system to RAID mentioned here are specific to AMD NDA BIOS based off the AMI BIOS.*

*The steps for other BIOS Vendors will be different.*

1. Power-ON the system
2. Press ESC to enter the System BIOS setup page
3. In the BIOS setup:
  - a. Select **CSM Configuration**, then press **Enter**
  - b. Set **CSM Support** to **Enabled**, then press **Enter**
  - c. Set **Boot option filter** to **UEFI** only, then press **Enter**
  - d. Set **Storage** to **UEFI**, then press **Enter**
4. In the BIOS setup:
  - a. Select the **Advanced** tab
  - b. Select **FCH Common Options**, then press **Enter**
  - c. Select **SATA Configuration Options**, then press **Enter**
  - d. Set **SATA Enable** to **Enabled**, then press **Enter**
  - e. Set **SATA Mode** to **RAID**, then press **Enter**
5. In the BIOS setup:
  - a. Select the **Advanced** tab
  - b. Select **X570/590 Chipset Common Options**, then press **Enter**
  - c. Select **X570/590 Chipset SATA Configuration Options**, then press **Enter**
  - d. Set **X570/590 Chipset SATA0 Enable** to **Enabled**, then press **Enter**
  - e. Set **X570/590 Chipset SATA1 Enable** to **Enabled**, then press **Enter**
  - f. Set **X570/590 Chipset SATA Mode** to **RAID**, then press **Enter**

6. In the **BIOS** setup:
  - a. Select the **Advanced** tab
  - b. Set **NVMe RAID Mode** to **Enabled**, then press **Enter**
7. Save (**F4**) the settings and restart the system.

## 4.2 Enable RAID for the 300/400/500 AMD Socket AM4-Compatible Processors

***NOTE:** The steps to configure a system to RAID mentioned here are specific to AMD NDA BIOS based off the AMI BIOS. The steps for other BIOS Vendors will be different.*

1. Power-ON the system
2. Press **ESC** to enter the **System BIOS** setup page
3. In the BIOS setup:
  - a. Select **CSM Configuration**, then press **Enter**
  - b. Set **CSM Support** to **Enabled**, then press **Enter**
  - c. Set **Boot option filter** to **UEFI** only, then press **Enter**
  - d. Set Storage to **UEFI**, then press **Enter**
4. In the BIOS setup:
  - a. Select the **AMD-CBS**
  - b. Select **FCH Common Options**, then press **Enter**
  - c. Select **SATA Configuration Options**, then press **Enter**
  - d. Set **SATA Enable to Enabled**, then press **Enter**
  - e. Set **SATA Mode** to **RAID**, then press **Enter**
5. In the BIOS setup:
  - a. Select the **AMD-CBS**
  - b. Select **300/400/500 Chipset Common Options**, then press **Enter**
  - c. Select **300/400/500 Chipset SATA Configuration Options**, then press **Enter**
  - d. Set **PT SATA Mode** to **RAID**, then press **Enter**
6. In the BIOS setup:
  - a. Select the **AMD-PBS** tab
  - b. Set **NVMe RAID Mode** to **Enabled**, then press **Enter**
7. Save (**F4**) the settings and restart the system.

## 4.3 Enable RAID for the AMD SP3-Series Chipsets

*Note: The steps to configure a system to RAID mentioned here are specific to AMD NDA BIOS based off the AMI BIOS.*

*The steps for other BIOS Vendors will be different.*

1. Power-ON the system.
2. Press **Delete** or **ESC** to enter the **System BIOS** setup page.
3. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select the **AMD PBS** tab, then press **Enter**.
  - c. Set **NVMe RAID Mode** to **Enabled**.
4. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select the **AMD CBS** tab, then press **Enter**.
  - c. Select **FCH Common Options**, then press **Enter**.
  - d. Select **SATA Configuration Options**, then press **Enter**.
  - e. Set **SATA Controller** to **Enabled**.
5. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select the **AMD CBS** tab, then press **Enter**.
  - c. Select **FCH Common Options**, then press **Enter**.
  - d. Select **SATA Configuration Options**, then press **Enter**.
  - e. Set **SATA Mode** to **RAID**.
6. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select **Promontory Common Options**, then press **Enter**.
  - c. Select **PT SATA Configuration Options**, then press **Enter**.
  - d. Set **PT SATA Port Enable** to **Enabled**.
7. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select **Promontory Common Options**, then press **Enter**.
  - c. Select **PT SATA Configuration Options**, then press **Enter**.
  - d. Set **PT SATA Mode** to **RAID**.
8. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select **CSM Configuration**, then press **Enter**.
  - c. Set **CSM Support** to **Enabled**.

9. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select **CSM Configuration**, then press **Enter**.
  - c. Set **Boot Option Filter** to **UEFI Only**.
10. In the BIOS setup:
  - a. Select the **Advanced** tab, then press **Enter**.
  - b. Select **CSM Configuration**, then press **Enter**.
  - c. Set **Storage > UEFI**.
11. Save (**F4**) the setting and restart the system.
12. To proceed with RAID array creation, Refer to Section 5.5.2, Create an Array, on page 44.

## **4.4 Enable RAID for the AMD Socket AM4-Compatible Processors**

***NOTE:** The steps to configure a system to RAID mentioned here are specific to AMD NDA BIOS based off the **Insyde BIOS**.  
The steps for other BIOS Vendors will be different.*

1. Power-ON the system
2. Press **ESC** to enter the **System BIOS** setup page
3. Select **Setup Utility**, then press **Enter**
4. In the BIOS setup:
  - a. Select the **Advanced** tab
  - b. Select **IDE Configuration**, then press **Enter**
  - c. Set **SATA Configure As** to **RAID**, then press **Enter**
  - d. Set Force **RAID Mode** to **Enabled**, then press **Enter**
5. In the BIOS setup:
  - a. Select the **Boot** tab
  - b. Set **Boot Type** to **Dual** or **UEFI Boot Type**, then press **Enter**
  - c. Set **EFI Device First** to **Enable**, then press **Enter**
6. In the BIOS setup:
  - a. Select the **AMD-PBS** tab
  - b. Set **NVMe RAID Mode** to **Enabled**, then press **Enter**
7. In the BIOS setup:
  - a. Select the **AMD-CBS** tab
  - b. Select **SATA Configuration Options**, then press **Enter**
  - c. Set **SATA Controller** to **Enabled**, then press **Enter**
  - d. Set **SATA Mode** to **RAID**, then press **Enter**



8. In the BIOS setup:
  - a. Select the **AMD-CBS** tab
  - b. Select **Promontory Common Options**, then press **Enter**
  - c. Select **PT SATA Configuration Options**, then press **Enter**
  - d. Set **PT SATA Port Enable** to **Enabled**, then press **Enter**
  - e. Set **PT SATA Mode** to **RAID**, then press **Enter**
9. Save (**F10**) the settings, then restart the system.

## Chapter 5 BIOS Configuration Utility (Option ROM)

*Note: OPROM supports only SATA devices with RC-8.x release*

Before you begin, enable platform RAID mode by referring to Chapter 4, Platform BIOS RAID Configuration Prerequisites on page 37.

### 5.1 When to Use the AMD-RAID Controller BIOS Configuration Utility

*Note: For OPROM to get listed, set both AMD and PT SATA Controller to RAID.*

*Note: OPROM will not be visible when Boot mode is set to UEFI only.*

*Note: OPROM supports only SATA devices with RC-8.x release.*

The AMD-RAID Controller BIOS Configuration Utility is also known as the Option ROM. OPROM can be used to accomplish the below RAID functional procedures indicated in Table 14.

**Table 14. When to use the AMD-RAID Controller BIOS Configuration Utility (Option ROM)**

Procedure	Description	Find Information At
Initialize a new disk	To initialize a new disk drive for data storage.	Section 5.4, Initialize Disks, on page 43
Create or delete arrays	Create arrays at different RAID levels (depending on the license level for the system) or delete an array.	Section 5.5, Create Arrays, on page 44.
Swap arrays	Change the array order, especially for the AMD-RAID bootable array.	Section 5.5.5, Swap Arrays, on page 48
Manage hot spares	Allows selection of global and dedicated hot spares.	Section 5.5.6, Manage Spares, on page 48
View disk and array details	View information about each disk or array.	Section 5.5.7, View Disk Details, on page 49 Section 5.5.8, View Array Details, on page 50
Rescan all channels	Rescan all channels to detect new or removed disks and arrays.	Section 5.5.9, Rescan All Channels, on page 50.
Change controller options	Change INT13 boot support, turn off Critical arrays or warning for Offline arrays while booting, or change the number of disks that can be spun-up when the system is powered-on.	Section 5.5.10, Change the Controller Options, on page 50
Continue to boot	Exit the BIOS Configuration Utility and continue booting the system.	Section 5.5.11, Continue Booting from the BIOS Configuration Utility, on page 51

## 5.2 Access the AMD-RAID Controller BIOS Configuration Utility (OPROM)

*Note:* OPRM can be accessed only when Boot mode is set to Dual boot type or Legacy boot type.

When booting the system, press **Ctrl + R** when the BIOS banner displays. There is a maximum of three seconds to use this key combination to enter the BIOS Configuration Utility.

*Note:* If the BIOS Configuration Utility does not display, contact your system or motherboard supplier.

## 5.3 Understanding the Color Code in the BIOS Configuration Utility

Color codes indicate the type or status of information at the BIOS Configuration Utility. See Table 15.

**Table 15. BIOS Configuration Utility Color Codes**

Color	Description
White text	Indicates an available option or informational text.
Black text, yellow highlighting	Indicates an option or device for which action might be taken.
Yellow text	Indicates information about the yellow-highlighted option.
Green text	Indicates an item that has been selected.
Light blue text	Indicates that the item cannot be selected.
Magenta text	Indicates items that are related to spares.
Red text	Indicates a failed virtual or physical disk or a warning. For example, informational text might be red if an option is not available.

## 5.4 Initialize Disks

New disks and legacy disks must be initialized before they can be used to create an AMD-RAID array.

Initialization writes AMD-RAID configuration information (metadata) to a disk.

### 5.4.1 Initialize Disks

**CAUTION:** If a disk is part of an AMD-RAID array, the disk cannot be selected for initialization. To initialize the disk anyway, delete the AMD-RAID array. Data on the disk is deleted during initialization so ensure the correct disks are chosen to initialize.

**CAUTION:** A legacy disk can contain valid data. When a legacy array is deleted, all data on the disk is lost.

1. At the **Main Menu**, use the **arrow keys** to highlight **Initialize Disk(s)**.
2. Press **Enter** to select **Initialize Disk(s)**.
3. Select the disks to initialize:
  - To select all disks, press the **A** key
  - To select individual disks, highlight a disk with the **arrow keys** and press **Insert**. Any number of disks may be selected using this method
4. Press **Enter** to initialize the selected disks or press **ESC** to cancel the initialization. Initialization takes 10 to 15 seconds per disk. During initialization, a status indicator shows which disk is being initialized. When the initialization is complete, the status indicator turns off. A complete rescan of all channels is done automatically during initialization.

## 5.5 Create Arrays

Arrays can be created after the disks are initialized. See Section 3.2, RAID Levels, on page 27, for deciding what type of RAID levels to use for the array.

**TIP:** See also Section 9.6.1, Create and Format Arrays on page 101, and Section 10.4, Create New Arrays: `rcadm --create` on page 122.

### 5.5.1 Before You Begin

- In some circumstances, more than eight arrays are possible. They might appear to function properly, but are not supported by AMD-RAID.
- For redundant arrays, the Create process starts after the operating system and AMD-RAID OS drivers have been installed and the system has booted to the operating system. However, the arrays are immediately available to use for either a bootable array or a data array.
- Array numbers are valid only for a given boot and might be different in the BIOS Configuration Utility and RAIDXpert2. If a permanent label is required, use the Array Naming feature.
- At any point in the procedure, return to a prior window by pressing **ESC**.
- If the system is booted from an AMD-RAID bootable array, the first array in the Arrays section must be the bootable array. The system boots only from the first array in the Arrays section. As necessary, use the Swap Two Arrays feature to swap arrays and place the RAIDXpert2 bootable array in the first position.

### 5.5.2 Create an Array

1. At the **Main Menu**, use the **arrow keys** to highlight **Create Array**.
2. Press **Enter**.

3. Select the disks with which to create the array:
  - To select all disks, press the **A** key
  - To select individual disks, highlight a disk with the **arrow keys** and press **Insert**. Any number of disks may be selected using this method
4. Press **Enter** to include the selected disks in the array.
5. In the User Input section, use the **arrow keys** to select an array type. Only array types that can be created with the selected disks are available.
6. Press **Enter**.
7. Select an array size by doing the following:
  - a. To create an array whose size is less than or equal to 2.199 TB:
    - Press the **Page Up** or the **up arrow** key to increase the array size and the **Page Down** or **down arrow** key to decrease the size.
    - Press **Enter** when the desired size is reached.
  - b. To create an array whose size is greater than 2.199 TB:
    - Press the **Page Up** or the **up arrow** key to increase the array size.
    - Press **Enter** when the desired size of 2.199 TB is reached.

*Note: A message displays stating that a size greater than the maximum is being attempted, and whether the size of the array should be limited.*
    - Press **ESC** to bypass the **Page Up** or the **up arrow** key to continue modifying the size.
    - Press **Enter** when either the desired size or the maximum available size is reached.
8. Select a caching level using the **arrow keys** then press **Enter**.
9. Press the **C** key to confirm the array settings or press **ESC** to go back to a previous page.
10. Repeat step 8 through step 11 to create additional arrays.

*Note: When installing the operating system to an AMD-RAID bootable array, modify the boot priority list in the motherboard BIOS. See the motherboard's user documentation for more information. Ensure that the AMD-RAID bootable array is included in the boot priority list.*
11. Ensure that INT13 support is enabled on the RAID controller, as described in Section 5.5.10, Change the Controller Options, on page 50.

### 5.5.3 Create an AMD-RAID Bootable Array

**CAUTION:** Do not use eSATA drives for bootable arrays as they are removable.

The operating system and RAIDXpert2 files can be installed to a RAIDXpert2 bootable array. Use the procedure in Section 5.5.2, Create an Array, on page 44, to create the bootable array. Ensure it is the first array listed in the Arrays section of the BIOS Configuration Utility.

To install the operating system and RAIDXpert2 files see Chapter 7, Software Installation, 62.

### 5.5.3.1 Create RAIDABLE Array

*Note: Refer to Table 7 for RAIDABLE array characteristics.*

1. At the Main Menu, use the **arrow keys** to highlight **Create Array**, then press **Enter**.
2. Select the appropriate disk using **Insert** to create the RAIDABLE array level, then press **Enter**.
3. In the User Input section, use the **arrow keys** to select **RAIDABLE**, then press **Enter**.
4. In the Caching mode section, use the **arrow keys** to select the Cache setting for the array, then press **Enter**.
5. Press the **C** key to confirm creation of array or press the **ESC** key to go back to a previous page.
6. **RAIDABLE** array listed in the **Arrays** section

### 5.5.3.2 Create Volume Array

*Note: Refer to Table 7 for Volume array characteristics.*

1. At the Main Menu, use the **arrow keys** to highlight **Create Array**, then press **Enter**.
2. Select the appropriate number of disks using **Insert** to create the Volume array level, then press **Enter**.
3. In the User Input section, use the **arrow keys** to select **Volume**, then press **Enter**.
4. To set the Desired Array capacity, Use **Page-UP** or **Page-Down key**, then press **Enter**.
5. In the Caching mode section, use the **arrow keys** to select the Cache setting for the array, then press **Enter**.
6. Press the **C** key to confirm creation of array or press the **ESC** key to go back to a previous page.
7. **Volume** array listed in the **Arrays** section

### 5.5.3.3 Create RAID0 Array

*Note: Refer to Table 7 for RAID0 array characteristics.*

1. At the Main Menu, use the **arrow keys** to highlight **Create Array**, then press **Enter**.
2. Select the appropriate number of disks using **Insert** to create the **RAID0** array level, then press **Enter**.
3. In the User Input section, use the **arrow keys** to select **Volume**, then press **Enter**.
4. To set the Desired Array capacity, Use **Page-UP** or **Page-Down key**, then press **Enter**.
5. In the Caching mode section, use the **arrow keys** to select the Cache setting for the array, then press **Enter**.
6. Press the **C** key to confirm creation of array or press the **ESC** key to go back to a previous page.
7. **RAID0** array listed in the **Arrays** section

### 5.5.3.4 Create RAID1 Array

*Note: Refer to Table 7 for RAID1 array characteristics.*

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1. At the Main Menu, use the **arrow keys** to highlight **Create Array**, then press **Enter**.
2. Select the appropriate number of disks using **Insert** to create the **RAID1** array level, then press **Enter**
3. In the User Input section, use the **arrow keys** to select **Volume**, then press **Enter**.
4. To set the Desired Array capacity, Use **Page-UP** or **Page-Down key**, then press **Enter**
5. In the Caching mode section, use the **arrow keys** to select the Cache setting for the array, then press **Enter**
6. Press the **C** key to confirm creation of array or press the **ESC** key to go back to a previous page.
7. **RAID1** array listed in the **Arrays** section

### 5.5.3.5 Create RAID10 Array

*Note: Refer to Table 7 for RAID10 array characteristics.*

1. At the Main Menu, use the **arrow keys** to highlight **Create Array**, then press **Enter**.
2. Select the appropriate number of disks using **Insert** to create the **RAID10** array level, then press **Enter**
3. In the User Input section, use the **arrow keys** to select **Volume**, then press **Enter**.
4. To set the Desired Array capacity, Use **Page-UP** or **Page-Down key**, then press **Enter**
5. In the Caching mode section, use the **arrow keys** to select the Cache setting for the array, then press **Enter**
6. Press the **C** key to confirm creation of array or press the **ESC** key to go back to a previous page.
7. **RAID10** array listed in the **Arrays** section

### 5.5.4 Delete Arrays

*CAUTION: Deleting an array permanently destroys all data that is on the array. This action cannot be undone and it is very unlikely the data can be recovered.*

*CAUTION: Do not delete the first array listed in the Arrays section, if it is the AMD-RAID bootable array. Doing this deletes the operating system and AMD-RAID files.*

#### 5.5.4.1 Delete an Array

1. At the Main Menu, use the **arrow keys** to highlight **Delete Arrays** then press **Enter**.
2. Select the arrays to delete:
  - To select all arrays, press the **A** key.
  - To select individual arrays, highlight an array with the **arrow keys** and press **Insert**. Any number of arrays may be selected using this method.
3. Press **Enter** to delete the selected arrays. A warning message displays.
4. Press the **C** key to confirm the deletion, or press the **ESC** key to exit to the **Main Menu**.

## 5.5.5 Swap Arrays

Use the Swap Two Arrays option to arrange arrays in a different order.

### 5.5.5.1 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(s) in the first array (Array 1) of the Array section, regardless on which array the operating system is installed.
- It is recommended that the user install the operating system on an AMD-RAID bootable array at a redundant RAID level, such as RAID1 or RAID 10 and swap the array into the first position, if it is not already Array 1.
- Swapping arrays can be performed only at the BIOS Configuration Utility.

### 5.5.5.2 Swap Arrays

1. At the **Main Menu**, use the **arrow keys** to highlight **Swap Two Arrays**, then press **Enter**.
2. Select the arrays to swap:
  - a. Highlight an array using the **arrow keys**.
  - b. Press **Insert** to select it.
  - c. Highlight a different array using the **arrow keys**.
  - d. Press **Insert** to select it.
3. Press **Enter** to swap the arrays.

## 5.5.6 Manage Spares

This option allows the user to assign or unassign global or dedicated spares.

### 5.5.6.1 Assign Global Spares

1. At the **Main Menu**, use the **arrow keys** to highlight **Manage Host Spare(s)**, then press **Enter**.
2. Use the **arrow keys** to highlight **Assign Global Hot Spare(s)**, then press **Enter**.
3. Select the disks to assign as global spares:
  - To select all disks, press the **A** key
  - To select individual disks, highlight a disk with the **arrow keys** and press **Insert**. Any number of disks may be selected using this method
4. Press **Enter** to assign the selected disks as global spares.

### 5.5.6.2 Assign Dedicated Spares

1. At the **Main Menu**, use the **arrow keys** to highlight **Manage Host Spare(s)**, then press **Enter**.



2. Use the **arrow keys** to highlight **Assign Dedicated Hot Spare(s)**, then press **Enter**.
3. Use the **arrow keys** to highlight the array. (must be a redundant array)
4. Press **Insert** to select the array, then press **Enter**.
5. Select the disks to assign as dedicated spares.
  - To select all disks, press the **A** key.
  - To select individual disks, use the **arrow keys** to highlight the disk and press **Insert** to select it. Any number of disks may be selected using this method.
  - Press **Enter**.
6. Press the **C** key to continue, or press the **ESC** key to return to the Main Menu.

### 5.5.6.3 Un-Assign Spares

1. At the **Main Menu**, use the **arrow keys** to highlight **Manage Host Spare(s)**, then press **Enter**.
2. Use the **arrow keys** to highlight **Unassign Hot Spare(s)**, then press **Enter**.
3. Select the disks to unassign as spares:
  - To select all disks, press the **A** key.
  - To select individual disks, use the **arrow keys** to highlight the disk and press **Insert** to select it. Any number of disks may be selected using this method.
4. Press **Enter** to unassign the selected disks.
5. Press the **C** key to continue, or press the **ESC** key to return to the Main Menu.

### 5.5.7 View Disk Details

This option allows the user to view details about the disk. Nothing can be changed using this menu option; it is for informational purposes only.

1. At the Main Menu, use the **arrow keys** to highlight **View Disk Details**, then press **Enter**.
2. Use the **arrow keys** to highlight a disk. Information about the disk is displayed in the Information field across the top:
  - Unique Disk ID
  - Drive Type
  - Cache Settings
  - Maximum Free Space
  - Model Number
  - Serial Number
3. Press **ESC** to exit to the **Main Menu**.

### **5.5.8 View Array Details**

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

1. At the **Main Menu**, use the **arrow keys** to highlight **View Array Details**, then press **Enter**.
2. Use the **arrow keys** to choose an array.
3. The full details of the array are displayed in the Information field across the top:
  - Array number
  - RAID level
  - Size
  - State
  - Cache settings

*Note: The disks in the array are selected (green).*

### **5.5.9 Rescan All Channels**

This option allows the user to rescan all channels to detect new or removed disks and arrays. It rereads the configuration information from each disk.

Sometimes when a disk is offline, it can be brought online through a rescan.

1. At the **Main Menu**, use the **arrow keys** to highlight **Rescan All Channels**.
2. Press **Enter**.
3. The activity indicator in the Information field spins while the disks are being polled.

### **5.5.10 Change the Controller Options**

Controller Options allows the user to configure options for the boot sequence.

*Note: By default, all options are On. It is recommended that options remain On.*

#### **5.5.10.1 Booting the System from an Array**

This option allows the user to enable boot support.

It is recommended that this option be disabled only if the system is booted from another device.

1. At the Main Menu, use the **arrow keys** to highlight **Controller Options** then press **Enter**.
2. Use the **arrow keys** to highlight **Toggle INT13 Boot Support**.
3. Press **Enter** to toggle between **On** and **Off**.
4. Press **ESC** to return to the Main Menu.

### 5.5.10.2 Pausing the Boot Sequence for Warning Messages

When the Pause feature is enabled and an array goes critical, offline, or there is another problem with the system, the boot process stops and an error message is displayed on the screen. The user must press **Enter** to continue booting.

If the Pause feature is disabled, error messages are briefly displayed as the system continues to boot.

1. At the **Main Menu**, use the **arrow keys** to highlight **Controller Options**, then press **Enter**.
2. Set pauses to the boot sequence for critical warnings.
  - a. Use the **arrow keys** to highlight **Toggle Pause if Critical**.
  - b. Press **Enter** to toggle between **On** (enables pauses) and **Off** (disables pauses).
3. Set pauses to the boot sequence for offline warnings by doing the following:
  - a. Use the **arrow keys** to highlight **Toggle Pause if Critical**.
  - b. Press **Enter** to toggle between **On** (enables pauses) and **Off** (disables pauses).
4. Press **ESC** to return to the Main Menu.

### 5.5.10.3 Change the Staggered Spinup Count

Depending on a system's power supply load-rating, the end-user might want to limit the number of disks that are spun-up together when a system is powered on.

For example, if a system has six disks and the staggered spinup count is set to 2, RAIDXpert2 sends a command to spin-up disks 1 and 2 together, then disks 3 and 4, and finally disks 5 and 6.

1. At the **Main Menu**, use the **arrow keys** to highlight **Controller Options**, then press **Enter**.
2. Use the **arrow keys** to highlight **Set Staggered Spinup Count**, then press **Enter**. The number within the brackets changes color to indicate it is selected.
3. Use the **arrow keys** to change the number within the brackets. The minimum is **1** and the maximum is **8**.
4. Press **Enter** to save the setting, or press **ESC** to return to the **Main Menu**.

## 5.5.11 Continue Booting from the BIOS Configuration Utility

After settings have been changed, continue booting the system from the point where the user entered the RAIDXpert2 BIOS Configuration Utility.

### 5.5.11.1 Resume the Boot Process

1. At the Main Menu, use the **arrow keys** to highlight **Continue to Boot**.
2. Press **Enter**.

# Chapter 6 RAIDXpert2 Configuration Utility (HII)

Before you begin, enable platform RAID mode by referring to Chapter 4, Platform BIOS RAID Configuration Prerequisites, on page 37.

## 6.1 When to Use the RAIDXpert2 Configuration Utility (HII)

The RAIDXpert2 Configuration Utility is also known as the HII. Use the utility to accomplish the procedures indicated in Table 16.

**Table 16. When to use the AMD-RAID RAIDXpert2 Configuration Utility (HII)**

Procedure	Description	Find Information At
Initialize a new disk	To initialize a new disk drive for data storage.	Section 6.3, Initialize Disks, on page 53
Create Arrays	Create arrays at different RAID levels (depending on the license level for the system)	Section 6.4, Create Arrays, on page 54 Section 6.5, Delete Arrays, on page 58
Delete Arrays	Delete an array	Section 6.5, Delete Arrays, on page 58
Manage hot spares	Allows selection of global and dedicated hot spares.	Section 6.6, Manage Spares, on page 58
View Controller details	View information about each controller.	Section 6.7, View Controller Details, on page 59 Section 6.8, View Disk Details, on page 60
View Disk details	View information about each disk.	Section 6.7, View Controller Details, on page 59
View Array details	View information about each array.	Section 6.8, View Disk Details, on page 60
Rescan all channels	Rescan all channels to detect new or removed disks and arrays.	Section 6.10, Rescan All Channels, on page 61

## 6.2 Access the AMD RAIDXpert2 Configuration Utility (HII)

*Note:* The step(s) mentioned below is specific to AMD NDA BIOS.

AMD SP3-Series Chipsets BIOS is based on **AMI BIOS**:

To enter the **RAIDXpert2 Configuration Utility (HII)** Power on the system, then press **DEL**. In the **Menu Bar**, select **Advanced**, select **RAIDXpert2 Configuration Utility**, then press **Enter**

AMD Socket AM4-Compatible Processor is based on **Insyde BIOS**:

To enter the **RAIDXpert2 Configuration Utility (HII)** Power on the system, then press **ESC**. Select **Device Management**, then press **Enter**.

Select **RAIDXpert2 Configuration Utility**, then press **Enter**.

*Note:* If the BIOS Configuration Utility does not display, contact your system or motherboard supplier.

## 6.3 Initialize Disks

New disks and legacy disks must be initialized before they can be used to create an AMD-RAID array.

Initialization writes AMD-RAID configuration information (metadata) to a disk.

**CAUTION:** If a disk is part of an AMD-RAID array, the disk cannot be selected for initialization. To initialize the disk anyway, delete the AMD-RAID array. Data on the disk is deleted during initialization so ensure the correct disks are chosen to initialize.

**CAUTION:** A legacy disk can contain valid data. When a legacy array is deleted, all data on the disk is lost.

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Physical Disk Management**, then press **Enter**.
2. Use the arrow keys to select **Select Physical Disk Operations**, then press **Enter**.
3. Use the **arrow keys** to highlight **Initialize Disk**, then press **Enter**
4. Select the disk(s) to initialize:
  - To select individual disks, highlight a disk with the arrow keys and press the Space Bar or Enter. Multiple disks may be selected using this method.
  - When the desired number have been selected, use the arrow keys to select OK, then press Enter.
  - Review the warning message, if you want to proceed, use the arrow keys to select YES, then press the Enter key, or press ESC to cancel the initialization.

Initialization takes 10 to 15 seconds per disk. During initialization, a complete rescan of all channels is done automatically.

## 6.4 Create Arrays

Arrays can be created after the disks are initialized. See Section 3.2, RAID Levels, on page 27, for deciding what type of RAID levels to use for the array.

*TIP: See also Section 9.6.1, Create and Format Arrays on page 101, and Section 10.4, Create New Arrays: `rcadm --create`, on page 122.*

### 6.4.1 Before You Begin

- In some circumstances, more than eight arrays are possible. They might appear to function properly, but are not supported by AMD-RAIDXpert2.
- For redundant arrays, the Create process starts after the operating system and AMD-RAID OS drivers have been installed and the system has booted to the operating system. However, the arrays are immediately available to use for either a bootable array or a data array.
- Array numbers are valid only for a given boot, and might be different in the RAIDXpert2 Configuration Utility (HII) and RAIDXpert2 Web GUI. If a permanent label is required, use the RAIDXpert2 Web GUI Array Naming feature.
- At any point in the procedure, return to a prior window by pressing **ESC**.
- If the system is booted from an AMD-RAID bootable array, the first array in the Arrays section must be the bootable array. The system boots only from the first array in the Arrays section.

### 6.4.2 Create an Array

*Note: The step(s) mentioned below are specific to AMD NDA BIOS. AMD SP3-Series Chipsets BIOS is based on AMI BIOS. AMD Socket AM4-Compatible Processor is based on Insyde BIOS.*

Before proceeding with array create and manage, System BIOS configuration should be setup as mentioned in Chapter 4, Platform BIOS RAID Configuration Prerequisites for system RAID mode to be enabled

- The **RAIDXpert2 Configuration Utility** can be used to create a bootable array with levels Volume, Raidable, RAID0, RAID1 and RAID10. Configure array cache and Cache tag size settings by following the steps mentioned in the sections below.

**Table 17. Default Cache Tag Size**

Array Type	Default CTS
HDD Array SSD Array Mix of HDD/SSD Array	64k
All NVMe Array	256k
Mix of NVMe with HDD/SSD Array	256k

*Caution:* Cache Tag Size cannot be changed for an array after creation.

To install the operating system and RAIDXpert2 files see Chapter 7, Software Installation, on page 62.

#### 6.4.2.1 Create an AMD-RAID Bootable Array

*CAUTION:* Do not use eSATA drives for bootable arrays as they are removable.

To install the operating system, AMD RAID Device driver and RAIDXpert2 Web-GUI utility refer to Chapter 7, Software Installation, 62.

#### 6.4.2.2 Create a RAIDABLE Array

*Note:* Refer to Table 7 for RAIDABLE array characteristics.

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**
2. Use the **arrow keys** to select **Create Array**, then press **Enter**.
3. Use the **arrow keys** to select **Select RAID Level**, then press **Enter**.
  - From the **Select RAID Level Drop** down menu, use the **arrow keys** to select **RAIDABLE**, then press **Enter**.
4. Select the disk with which to create the array:
  - Use the arrow keys to select **Select Physical Disks**, then press **Enter**.
  - Select an individual disk, highlight a disk with the **arrow keys** and press the **Space Bar** or **Enter**.
  - Use the **arrow keys** to select **Apply Changes**, then press **Enter**.
5. Please refer to Table 17 on page 55 for Default Cache Tag Size.
6. Using the **arrow keys** to select **Read Cache Policy**, then press **Enter**.
  - Select the desired **Read Cache Policy**, then press **Enter**.
7. Using the **arrow keys** to select **Write Cache Policy**, then press **Enter**.
  - Select the desired **Write Cache Policy**, then press **Enter**.
8. Use the **arrow keys** to select **Create Array**, then press **Enter**.

### 6.4.2.3 Create a VOLUME Array

*Note: Refer to Table 7 for VOLUME array characteristics*

9. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**.
10. Use the **arrow keys** to select **Create Array**, then press **Enter**.
11. Use the **arrow keys** to select **Select RAID Level**, then press **Enter**.
  - From the **Select RAID Level** Drop down menu, use the **arrow keys** to select **VOLUME**, then press **Enter**.
12. Select the disks with which to create the array:
  - Use the arrow keys to Select Physical Disks, then press Enter.
  - Select desired disks, highlight a disk with the **arrow keys** and press the **Space Bar** or **Enter**.
  - Use the **arrow keys** to select **Apply Changes**, then press **Enter**.
13. Please refer to Table 17 on page 55 for Default Cache Tag Size.
14. Using the **arrow keys** to select **Read Cache Policy**, then press **Enter**.
  - Select the desired **Read Cache Policy**, then press **Enter**.
15. Using the **arrow keys** to select **Write Cache Policy**, then press **Enter**.
  - Select the desired **Write Cache Policy**, then press **Enter**.
16. Use the **arrow keys** to select **Create Array**, then press **Enter**.

### 6.4.2.4 Create a RAID0 Array

*Note: Refer to Table 7 for RAID0 array characteristics*

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**.
  2. Use the **arrow keys** to select **Create Array**, then press **Enter**.
  3. Use the **arrow keys** to select **Select RAID Level**, then press **Enter**.
    - From the **Select RAID Level** Drop down menu, use the **arrow keys** to select **RAID0**, then press **Enter**.
  4. Select the disks with which to create the array:
    - Use the arrow keys to Select Physical Disks, then press Enter.
    - Select desired disks, highlight a disk with the **arrow keys** and press the **Space Bar** or **Enter**.
    - Use the **arrow keys** to select **Apply Changes**, then press **Enter**.
  5. Please refer to Table 17 on page 55 for Default Cache Tag Size.
  6. Using the **arrow keys** to select **Read Cache Policy**, then press **Enter**.
    - Select the desired **Read Cache Policy**, then press **Enter**.
  7. Using the **arrow keys** to select **Write Cache Policy**, then press **Enter**.
-



- Select the desired **Write Cache Policy**, then press **Enter**.
8. Use the **arrow keys** to select **Create Array**, then press **Enter**.

#### 6.4.2.5 Create a RAID1 Array

*Note: Refer to Table 7 for RAID1 array characteristics*

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**.
2. Use the **arrow keys** to select **Create Array**, then press **Enter**.
3. Use the **arrow keys** to select **Select RAID Level**, then press **Enter**.
  - From the **Select RAID Level** Drop down menu, use the **arrow keys** to select **RAID1**, then press **Enter**.
4. Select the disks with which to create the array:
  - Use the arrow keys to Select Physical Disks, then press Enter.
  - Select desired disks, highlight a disk with the **arrow keys** and press the **Space Bar** or **Enter**.
  - Use the **arrow keys** to select **Apply Changes**, then press **Enter**.
5. Please refer to Table 17 on page 55 for Default Cache Tag Size.
6. Using the **arrow keys** to select **Read Cache Policy**, then press **Enter**.
  - Select the desired **Read Cache Policy**, then press **Enter**.
7. Using the **arrow keys** to select **Write Cache Policy**, then press **Enter**.
  - Select the desired **Write Cache Policy**, then press **Enter**.
8. Use the **arrow keys** to select **Create Array**, then press **Enter**.

#### 6.4.2.6 Create a RAID10 Array

*Note: Refer to Table 7 for RAID10 array characteristics*

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**.
2. Use the **arrow keys** to select **Create Array**, then press **Enter**.
3. Use the **arrow keys** to select **Select RAID Level**, then press **Enter**.
  - From the **Select RAID Level** Drop down menu, use the **arrow keys** to select **RAID10**, then press **Enter**.
4. Select the disks with which to create the array:
  - Use the arrow keys to Select Physical Disks, then press Enter.
  - Select desired disks, highlight a disk with the **arrow keys** and press the **Space Bar** or **Enter**.
  - Use the **arrow keys** to select **Apply Changes**, then press **Enter**.
5. Please refer to Table 17 on page 55 for Default Cache Tag Size.

6. Using the **arrow keys** to select **Read Cache Policy**, then press **Enter**.
  - Select the desired **Read Cache Policy**, then press **Enter**.
7. Using the **arrow keys** to select **Write Cache Policy**, then press **Enter**.
  - Select the desired **Write Cache Policy**, then press **Enter**.
8. Use the **arrow keys** to select **Create Array**, then press **Enter**.

## 6.5 Delete Arrays

***CAUTION:** Deleting an array permanently destroys all data that is on the array. This action cannot be undone and it is very unlikely the data can be recovered.*

***CAUTION:** Do not delete the first array listed in the Arrays section, if it is the AMD-RAID bootable array. Doing this deletes the operating system and AMD-RAID files.*

### 6.5.1 Delete an Array

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**.
2. Use the **arrow keys** to select **Delete Arrays** then press **Enter**.
3. Select the array(s) to delete:
  - Use the arrow keys to select the desired array or multiple arrays, then press the Space Bar or Enter to change option to Enabled for deletion.
  - If you want to select all of the arrays, use the arrow keys to select Check all, then press Enter.
  - Use the arrow keys to select Delete Array, then press the Space Bar or Enter.
  - To select all the arrays for deletion: use the arrow keys to select Check all, then press the Space Bar or Enter.
  - Review the warning message, if you want to proceed, press the Space Bar or Enter.
  - Use the arrow keys to select, Yes to Delete arrays or press the ESC key to exit.

## 6.6 Manage Spares

This option allows the user to assign or unassign global or dedicated spares.

***Note:** In order to assign a physical disk as a Global Spare, it must not be part of any Array.*

### 6.6.1 Assign Global Spares

1. At the **RaidXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Physical Disk Management**, then press **Enter**.
2. Use the **arrow keys** to select **Select Physical Disk Operations**, then press **Enter**.
3. Use the **arrow keys** to select **Select Physical Disk**, then press **Enter**.
4. Use the **arrow keys** to select **Assign Global Hot Spare**, then press **Enter**.

5. Review the warning message, if you want to proceed, use the **arrow keys** to select **Yes** or press **ESC** or select **No**, to exit.

### 6.6.2 Assign Dedicated Spares

*Note: Dedicated spares can only be assigned to redundant arrays and must be the same size or larger than the other members of the redundant array.*

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**.
2. Use the **arrow keys** to select **Manage Array Properties**, then press **Enter**.
3. Use the arrow keys to select **Select Array**.
  - From the drop down menu, select the desired array (must be a redundant array), then press **Enter**.
4. Use the **arrow keys** to select **Manage Dedicated Hot Spares**, then press **Enter**.
5. Select the disks to assign as dedicated spares.
  - To select the disk, use the **arrow keys** to highlight the disk and press the **Space Bar** or **Enter** to select it.
  - Use the arrow keys to select **Add Hot Spare Physical Disk**, then press **Enter**.
  - At the warning message, press the **space bar** or **Enter** to Confirm.
  - Use the **arrow keys** to select **Yes**, then press **Enter** or press the **ESC** key to exit adding the Dedicated Spare.

### 6.6.3 Unassign Spares

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Physical Disk Management**, then press **Enter**.
2. Use the **arrow keys** to select **Select Physical Disk Operations**, then press **Enter**.
3. Use the **arrow keys** to select **Select Physical Disk**, then press **Enter**.
4. From the drop down menu, use the **arrow keys** to select the **Global / Dedicated Spare**, then press **Enter**.
5. Use the **arrow keys** to select **Unassign Hot Spare**, then press **Enter**.
6. Review the warning message, if you want to proceed, select **Yes**, then press **Enter** or press the **ESC** key to exit.

## 6.7 View Controller Details

This option will display the details about of the controllers. Nothing can be changed using this menu option; it is for informational purposes only.

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Controller Management**, then press **Enter**.
2. Use the **arrow keys** to select **Select View Controller Information**, then press **Enter**.

3. Use the **arrow keys** to select **Select Controller**, then press **Enter**.
4. From the drop-down menu, select the desired controller, then press **Enter**.
5. Information about the controller is displayed below the **Select Controller** header:
  - PCI ID
  - Controller Physical Disk Count
  - Total Physical Disk Count
  - Total Array Count
  - UEFI Driver Version
  - Firmware Properties/Firmware Build Time
6. To view another controller, press **Enter** and from the drop-down menu, select a different controller, then press **Enter**.
7. Press **ESC** to exit to the **Main Menu**.

## **6.8 View Disk Details**

This option allows the user to view details about the physical disk(s). Nothing can be changed using this menu option; it is for informational purposes only.

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to highlight **Physical Disk Management**, then press **Enter**.
2. Use the **arrow keys** to select **View Physical Disk Properties**, then press **Enter**.
3. Use the **arrow keys** to select **Select Physical Disk**, then press **Enter**.
4. From the drop down menu, select the physical disk you want more information about, then press **Enter**.
5. Information about the physical disk is displayed below the **Select Physical Disk** header:
  - Unique Disk ID
  - State
  - Size
  - Smart Status
  - Revision
  - Drive Type
  - Maximum Free Space
  - Used Space
  - Disk Protocol
  - Disk Speed
  - Associated Array, if part of one
  - Serial Number
  - Model Number

6. To view another physical disk, press **Enter** and from the drop down menu, select a different physical disk, then press **Enter**.
7. Press **ESC** to exit to the **Main Menu**.

## 6.9 View Array Details

This option will display the details of an array. Nothing can be changed using this menu option; it is for informational purposes only.

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Array Management**, then press **Enter**.
2. Use the **arrow keys** to select **Select Manage Array Properties**, then press **Enter**.
3. Use the **arrow keys** to select **Select Array**, then press **Enter**.
4. From the drop down menu, select the desired array, then press **Enter**.
5. Use the **arrow keys** to select **View Associated Physical Disks**, then press **Enter**.
6. Press the **Space Bar** to select one of the members of the Array
7. Use the **arrow keys** to select **View Physical Disk Properties**, then press **Enter**.
8. Information about the array is displayed below the **Select Array header**:
  - Array number
  - RAID level
  - State
  - Size
  - Cache Tag Size
  - Cache settings
  - Associated physical disks
9. To view another array, press **ESC** twice and perform steps 2 through 8 again.
10. Press **ESC** to exit to the **Main Menu**.

## 6.10 Rescan All Channels

This option allows the user to rescan all channels to detect new or removed disks and arrays. It rereads the configuration information from each disk.

Sometimes when a disk is offline, it can be brought online through a rescan.

1. At the **RAIDXpert2 Configuration Utility's Main Menu**, use the **arrow keys** to select **Controller Management**, then press **Enter**.
2. Use the arrow keys to select **Rescan Disks**, then press **Enter**.
  - After a rescan completes, all of the physical disks will be displayed.
3. Use the **arrow keys** to select **OK**, then press **Enter**.

## **Chapter 7      Software Installation**

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This chapter is designed to assist you with installation of Operating systems, by performing these general procedures:

### **7.1      System Setup Process Overview**

A generic system setup process follows these steps:

1. Copy the AMD-RAID drivers to a removable storage medium.
2. Power on the system.
3. To enable RAID on Refer to Chapter 4, Platform BIOS RAID Configuration Prerequisites, on page 37. (This enables the loading of the AMD-RAID Option-ROM and or AMD-RAID UEFI driver).
4. Initialize the disks using the AMD-RAID Array Configuration Utility (HII) or AMD-RAID Option-ROM.
5. Create arrays using the AMD-RAID Array Configuration Utility (HII) or AMD-RAID Option-ROM.
6. Install the AMD-RAID drivers on the system.
7. Load the operating system.
8. Install the OS RAID Management Suite (AMD RAIDXpert2) on the system.

*Note: To protect your data, always perform a backup prior to installing any new, major hardware or software.*

### **7.2      Before You Begin**

Have the Windows® or Linux® operating system software available and ready to install.

### **7.3      Copying AMD-RAID Drivers to Removable Storage**

You need to copy the drivers to a removable storage medium before you begin the installation.

#### **7.3.1      Copying AMD-RAID Drivers in a Microsoft® Windows® Environment**

1. Power on the system.
2. Locate and use a system that is running a Windows operating system and has a CD DVD drive or an I/O port for removable storage media (such as a USB flash drive).
3. Go to a browser and access the web site of your system supplier or motherboard vendor.
4. Insert the storage medium into the system:

- Connect a USB flash drive to a USB I/O port or insert a blank CD-DVD disk into the applicable drive.
5. Download the AMD-RAID drivers from the web site to the appropriate removable storage medium.

### 7.3.2 Copying AMD-RAID Drivers in a Linux® Environment

1. Power on the system.
2. Locate and use a system that is running a Windows operating system and has a USB I/O port for the USB flash drive.
3. Use a browser to access the web site of your system supplier or motherboard vendor.
4. Insert a USB flash drive into the USB I/O port of the system.
5. Download the AMD-RAID drivers for the correct distribution version of Linux®. Copy the drivers onto the USB flash drive:
  - For Red Hat Linux: Copy the .iso image file (that matches the applicable distribution of Linux to the USB flash drive . For example:
    - dd-rcraid-RHEL7-3.10.0-327.el7-x86\_64.iso
  - For Ubuntu: Copy the driver files contained inside the dd-rcraid-Ubuntu [Ubuntu version number].w.x-yz-folder into a dd directory located on a root path of the USB flash drive. For example:
    - dd
      - load\_amdraid
      - post\_install
      - post\_install2
      - pre\_install
      - rcraid.ko
      - rcraid\_generic.ko
      - readme

## 7.4 Installing AMD-RAID Drivers

Follow the procedures below for Pre-install of AMD RAID Driver during Installation of your Microsoft Windows or Linux® Operating System.

### 7.4.1 Installing AMD-RAID Drivers while Installing Microsoft® Windows®

#### 7.4.1.1 Installing AMD-RAID OS Drivers during a Microsoft® Windows® 10 Installation

*Note: The windows described in this procedure are typical. Path names and text can vary, depending on user-designated selections and other parameters.*

*Note: NVMe devices are listed in the “Where do you want to install Windows?” do not delete any of the partitions or format the devices. Doing so will delete the AMD-RAID metadata and the desired RAID level will be deleted. After AMD-RAID drivers have been loaded, a valid AMD-RAID Virtual Disk appears.*

1. Power on the system.
2. Create a bootable array, refer to Section 6.4, Create Arrays, on page 54.
3. Insert the Microsoft Windows operating system media/disk into the system’s Optical drive.
4. Boot the system and allow it to access the Microsoft Windows operating system installation media/disk.
5. At the Windows setup window:
  - Select the language, time, and keyboard options
  - Click **Next**.
  - Click **Install Now** or similar.
  - If prompted, select the desired Operating System
  - Click **Next**.
  - Depending on the installation window observed, choose one of the methods below to load **rcbottom.inf**
    - If the window observed is **Select driver to install**
      - Insert the storage medium with the **AMD-RAID** drivers into the USB port or applicable system drive
      - Click **Browse**.
      - Navigate to the directory containing the saved **AMD-RAID** drivers
      - Click **OK**.
      - Select the first **rcbottom.inf** driver in the list
      - Click **Next**.
    - Else follow onscreen prompt until **Where to install Windows?** window observed
      - Select **Load driver**
      - Click **Browse**.
      - Navigate to the directory containing the saved **AMD-RAID** drivers
      - Click **OK**.
      - Select the first **rcbottom.inf** driver in the list
      - Click **Next**.
6. At the Load Driver Window:
  - Click **OK**
  - Click **Browse**.

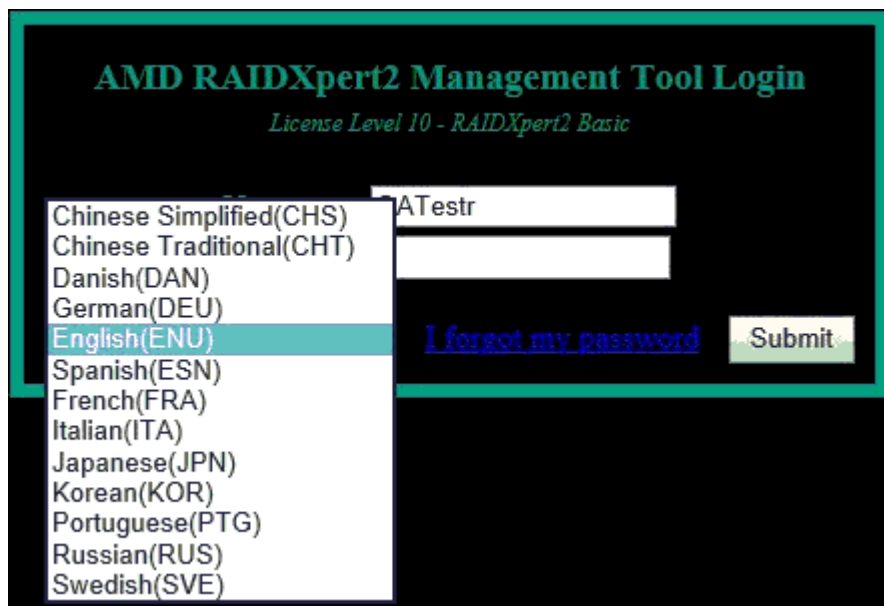


- Navigate to the directory containing the saved **AMD-RAID** drivers
  - Click **OK**.
  - Select the **rccraid.inf** driver from the list
  - Click **Next**.
7. Select (Check Mark) the **I Accept the License Terms**
    - Click **Next**.
    - Select Custom: Install Windows Only (advanced) or similar.
  8. After both the rcbottom and rccraid drivers have been loaded, a valid Virtual disk appears in “Where do you want to install Windows?” window:
    - Click Load Drivers
    - Click **Browse**
    - Navigate to the directory containing the saved **AMD-RAID** drivers
    - Click **OK**
    - Select the **rccfg.inf** driver in the list
    - Click **Next**
  9. At the Where do you want to install Windows
    - Click **Next**
  10. Follow the on-screen instructions to complete the installation of the applicable Windows operating system.
  11. After the OS is installed, open Device Manager and verify the following:
    - Expand Storage Controllers: there are entry(ies) listed as **AMD-RAID Bottom Device**
    - Expand Storage Controllers: there are entry(ies) listed as **AMD-RAID Controller**
    - Expand System Devices: there is an entry listed as **AMD-RAID Config Device**.
  12. Remove the storage medium and Microsoft Windows OS CD-ROM or DVD from the applicable drive(s) or port. Proceed to Section 7.6, Installing the AMD RAIDXpert2 Management Suite for Microsoft® Windows®, on page 79.

## 7.5 Installing the AMD RAIDXpert2 Management Suite for Microsoft® Windows®

### 7.5.1 Windows® – AMD-RAIDXpert2 Management Suite

1. Obtain the latest executable file from your system supplier, motherboard vendor, or from <https://www.amd.com/support>. Download the file to the system’s desktop, execute it and follow the on-screen prompts.
2. Click on the RAIDXpert2 Desktop Icon.
  - Select the applicable **language** from the drop-down menu (default is English).



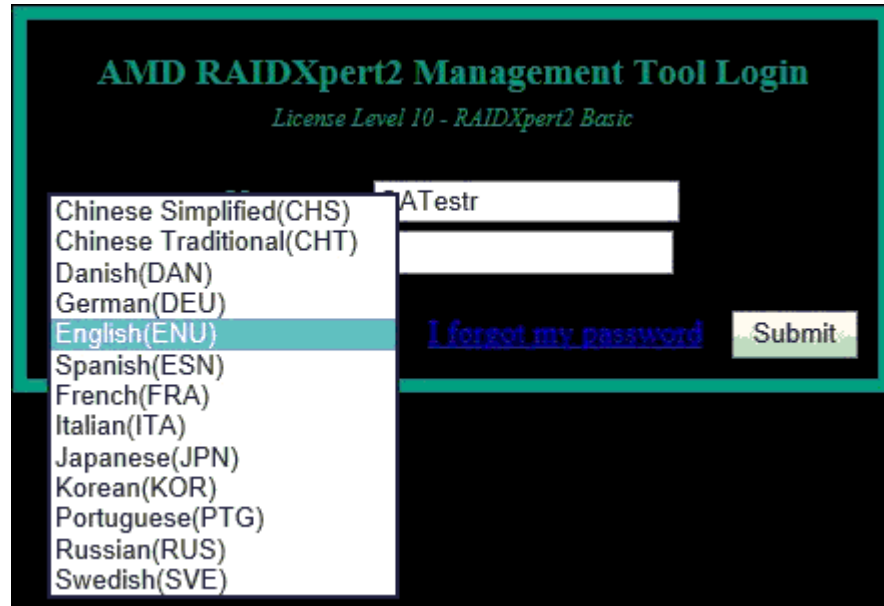
**Figure 1. Management Tool Login**

- Default credentials are:
  - Username – **admin**
  - Password – **admin**
- 3. Change the credentials:
  - Create new username
  - Create new password
- 4. Re-log into the system with the new credentials.

### 7.5.2 Windows® – AMD RAIDXpert2 Management Suite Installation (Manually)

*Note: AMD RAIDXpert2 Management Suite installation default is a Silent installation.*

1. Obtain the AMD RAIDXpert2 Management Suite executable file (Setup.exe) from your system supplier or motherboard vendor. Download Setup.exe to the system's desktop.
2. Install AMD RAIDXpert2 (setup.exe):
  - a. Open a command prompt, must be run as Administrator
  - b. By typing **cd C:\User\User\_Name\Desktop**
  - c. For silent installation: **setup.exe**
  - d. For GUI installation: **setup.exe -i gui**
3. Turn off Windows Firewall (or unblock during step 2).
4. Click on the RAIDXpert2 Desktop Icon
  - a. Select the applicable **language** from the drop-down menu (defaults on English)



**Figure 2. Language Selection**

- Default credentials are:
  - i. Username – **admin**
  - ii. Password – **admin**
- 5. Change the credentials:
  - b. Create new username
  - c. Create new password
- 6. Re-log into the system with the new credentials.

See Section 9.1.1.1, Browser Setup, on page 90, for supported browsers and configurations.

### 7.5.2.1 Installing AMD-RAID BIOS Drivers during a Microsoft® Windows® 7 Installation

*Note: The windows described in this procedure are typical. Path names and text can vary, depending on user-designated selections and other parameters.*

*Note: Windows® 7 is supported only with RE-8.1 release. No NVMe support is available with Windows 7.*

1. Power on the system.

*Note: Do not boot up with a USB flash key in the system when performing an install, as the system will use that as the boot device.*

2. Create a bootable array by following the procedures in Section 6.4.2.1, Create an AMD-RAID Bootable Array, on page 55.

3. Insert the Microsoft Windows operating system CD-ROM or DVD into the system's CD or DVD drive.
4. Boot the system and allow it to access the Microsoft Windows operating system CD-ROM or DVD.
5. At the Windows setup dialog box, do the following:
  - a. Select the language, time, and keyboard options, then click **Next**.
  - b. Click **Install Now**. If prompted, select the desired Operating System, then click **Next**.
  - c. Insert the storage medium with the AMD-RAID drivers into the USB port or applicable system drive, then click **Browse**.
  - d. Navigate to the directory containing the saved AMD-RAID drivers, then click **OK**.
  - e. Select the **rcbottom.inf** driver from the list, then click **Next**.

*Note: If the system has multiple controllers, there will be two or more rcbottom.inf's listed.*

6. At the Load Driver Window, do the following:
  - a. Click **OK, Browse**.
  - b. Navigate to the directory containing the saved AMD-RAID drivers, then click **OK**.
  - c. Select the **rcraid.inf** driver from the list, then click **Next**.
  - d. Select the **I Accept the License Terms** checkbox, then click **Next**.
  - e. Select **Custom: Install Windows Only (advanced)** option.
  - f. Click **Load Drivers, Browse**.
  - g. Navigate to the directory containing the saved AMD-RAID drivers, then click **OK**.
  - h. Select the **rccfg.inf** driver, then click **Next**. A valid drive displays at the Windows installation location screen.
7. Click **Next**, then follow the on-screen instructions to complete the installation.
8. Once the OS installation is complete, open Device Manager and verify the following:
  - In the Expand Storage Controllers list, the **AMD-RAID Bottom Device** and **AMD-RAID Controller** entries are displayed.
  - In the Expand System Devices list, the **AMD-RAID Config Device** entry is displayed.
9. Remove the storage medium and Microsoft Windows OS CD-ROM or DVD from the applicable drive(s) or port.
10. Proceed to Section 7.6, Installing the AMD RAIDXpert2 Management Suite for Microsoft® Windows®, on page 79.

### **7.5.3 Installing AMD-RAID Drivers While Installing Linux® Operating System**

*Note: The Linux® operating system modules must include the gcc+ compiler and the pthreads library so that the rcadm program can be installed properly.*

*Note: Linux Operating System is supported only with RC-8.1 release. No NVMe support available with Linux Operating System.*

### 7.5.3.1 Installing the AMD-RAID BIOS Drivers During a Red Hat Enterprise Linux® 7.3 64 bit (RHEL) Installation

**Note:** Prior to starting this procedure, obtain the AMD-RAID drivers from your system supplier or motherboard vendor. Copy the AMD-RAID drivers to a USB flash drive, following the instructions in Section 7.3.2, Copying AMD-RAID Drivers in a Linux® Environment, on page 63 .

**Note:** When installing Red Hat Linux, use the Linux dd installation mode instead of the Linux expert mode.

**Note:** Not all of the windows indicated in this procedure will appear during the installation.

1. Power on the system.
2. Insert the USB drive that contains the AMD-RAID drivers into the USB port.
3. Insert the Red Hat operating system CD-ROM or DVD into the system's CD or DVD drive.
4. Create a bootable array by following the procedure in Section 6.4, Create Arrays, on page 54.
5. At the Red Hat Enterprise Linux welcome window, do the following:
  - a. Press the **Up** arrow, then select **Install Red Hat Enterprise Linux 7.3**.
  - b. Press **Tab**.
  - c. Type `modprobe.blacklist=ahci inst.dd nomodeset` at the end of the existing string then press **Enter**. For example, `vmlinix initrd.img.....quiet modprobe.blacklist=ahci inst.dd nomodeset`
6. At the **Driver Disk Device Selection**, press **1** (the number of the flash drive), then press **Enter**.
7. At the **Choose Driver Disk ISO** file, press **1** (the number of the `dd-rcraid-RHEL....el7.2x86_64.iso` entry), then press **Enter**.
8. At **Select Drivers to Install**, do the following:
  - a. Press **1** (the number of the `/media/DD/.....x86_64.rpm` entry), then press **Enter**. The `/media/DD/...` is selected and should look like `[X] /media/DD/.....x86_64.rpm`.
  - b. Press the **C** key, then press **Enter**.
9. At the **Driver Disk Device Selection**, press the **C** key, then press **Enter**.
10. At the **Welcome to Red Hat Enterprise Linux Screen**, do the following:
  - a. Choose the desired Language and Country.
  - b. In the bottom right corner, then click **Continue**.
11. At the **Installation Summary Screen**:
  - a. Under **Localization**, configure the following:
    - Date and Time
    - Keyboard
    - Language Support
  - b. Under **Software**, configure the following:

- Installation Source
  - Software Selection
    - Under Base Environments, select Server with GUI.
    - Under Add-Ons for Selected Environments, select **Compatibility Library**.
  - In the upper left corner, click **Done**.
    - c. Under System, configure the following:
  - Installation Destination
    - Under Local Standard Disks, select **AMD-RAID Array**.
    - In the upper left corner, click **Done**.
  - Network and Hostname
    - In the bottom left corner, enter a valid Hostname.
      - Select an Ethernet Port.
      - In the bottom right corner, click **Configure**.
      - Enter valid entries.
      - Click **Save**.
    - In the upper left corner, click **Done**.
12. In the bottom right corner, click **Begin Installation**.
13. At the Configuration window, do the following:
- a. Click **Root Password**:
    - Enter an applicable root password.
    - Re-enter the root password.
    - In the upper right corner, click **Done**.
  - b. Click **User Creation**:
    - Enter a Full Name.
    - Enter a Username.
    - Enter an applicable password.
    - Re-enter the user password.
    - In the upper right corner, click **Done**.
14. When the Installation Complete message displays, do the following:
- a. In the bottom right corner, click **Reboot**.
  - b. Eject and remove the USB flash drive and the installation media.
15. At the Initial Setup of Red Hat Enterprise Linux Server 7.3, do the following:
- a. Press **1**, then press **Enter**.
  - b. Press **2**, then press **Enter**.
  - c. Press **R**, then press **Enter**.
  - d. Press the **C** key, then press **Enter**.
-

16. Login to the system and do the following:
  - a. Select a user.
  - b. Enter a password.
17. At the Welcome window, select the desired language, then click **Next**
18. At the Select Input Sources Window, select the desired Input Source, then click **Next**.
19. If desired, Configure Online Accounts, then click **Next**.
20. Click **Start using Red Hat Enterprise Linux Server**.
21. For RHEL 7.3 64 bit installs, manually load the following el7.i686 rpms.
  - a. Allow the system to boot and login as root when prompted.
  - b. Insert the RHEL 7.3 x 64 installation CD/DVD into the system.
  - c. Install the following rpms:
    - libX11...el7.i686
    - libXau...el7.i686
    - libxcb...el7.i686
    - libXext...el7.i686
    - libXi...el7.i686
    - libXtst...el7.i686
    - gtk2.....el7.i686
    - libstdc++\*.el7.i686
    - libSM-\*.el7.i686
    - libpng12\*.el7.i686
    - adwaita-gtk2-theme-\*.el7.i686
    - libcanberra-gtk2-\*.el7.i686
    - PackageKit-gtk3-module-\*.el7.i686
22. Open a Web Browser, then do the following:
  - a. Go to rpmfind.net
  - b. Search for compat-libstdc++-33
  - c. Download and install the compat-libstdc++-33-3.2.3-71.el7.i686.rpm
  - d. Reboot the system.

### 7.5.3.2 Installing the AMD-RAID BIOS Drivers during a Supported Ubuntu Desktop Installation

*Note:* AMD-RAIDXpert2 supports the Ubuntu 16.04 desktop operating systems.

*Note:* Prior to starting this procedure, obtain the AMD-RAID drivers from your system supplier or motherboard vendor. Copy the AMD-RAID drivers to the dd directory on a USB flash drive, following the instructions in Section 7.3.2, Copying AMD-RAID Drivers in a Linux® Environment, on page 63.

*Note: The Ubuntu driver CD-ROM .iso image contains all Linux variations for a particular release.*

*Note: Some of the windows indicated in this procedure might not appear during the installation.*

1. Power on the system.
2. Remove the Ethernet cable from the system.
3. Insert the Ubuntu desktop operating system CD-ROM or DVD into the system's CD or DVD drive.
4. Create a bootable array by following the procedure in Section 6.4, Create Arrays, on page 54.
5. As soon as the Ubuntu desktop kernel starts loading, press **F6** to go to **Advanced Options**.
6. Select the desired language, then press **Enter**.
7. From the list, select **Try Ubuntu without Installing**
8. Press **F6** - Other Options, then press **ESC**.
9. At the end of the Boot Options string, type the following, then press **Enter**: break=mount modprobe.blacklist=ahci nomodeset

*Note: The string should look like the following: splash --- break=mount modprobe.blacklist=ahci nomodeset*

10. When the BusyBox shell displays, perform the following steps:
    - a. Insert the USB flash drive.
    - b. Type the following, pressing Enter after each one:
      - mount -t vfat /dev/sdal /tmp
      - **Note:** /dev/sdal may need to be changed to /dev/sdb1 or /dev/sdc1, depending on the number of devices there are.
      - cp -ap /tmp/dd /
      - /dd/pre\_install
      - umount /tmp
      - exit
    - c. Remove the USB flash drive.
  11. Wait patiently for the Ubuntu Desktop to appear
  12. Double Click the **Install Ubuntu 16.04.1 LTS Desktop ICON**
  13. When the Welcome screen displays, select the desired language then click **Continue**.
  14. From the **Preparing to Install Ubuntu** window, accept the defaults, then click **Continue**.
  15. From the **Installation Type** window, Select **Erase Disk and install Ubuntu**, then click **Install Now**.
  16. From the **Write Changes to Disks?** window, then click **Continue**.
  17. Select the desired time zone, then click **Continue**.
  18. Select the desired keyboard layout, then click **Continue**.
-



19. Enter valid entries for the following, then click **Continue**.
  - a. Your name
  - b. Computer name
  - c. User name
  - d. Password
  - e. Confirm Password
  - f. Click Continue
20. When the **Installation Complete** window displays, do the following:
  - a. Insert the USB flash drive.
  - b. Press **CTRL + ALT + T**.
  - c. Type the following, pressing **Enter** after each one:
    - `sudo mount -t vfat /dev/sdal /mnt`
    - `sudo cp -ap /mnt/dd /`
    - `sudo /dd/post_install`
21. Wait for the **Setup is Complete** message, then press **CTRL + D**. Click **Restart Now**, to finish the installation.
22. When prompted, remove the CD/DVD and USB flash drive from the system, then press Enter.
23. Reconnect the Ethernet cable.
24. Proceed to Section 7.7, Installing the AMD RAIDXpert2 Management Suite for Linux<sup>®</sup>, on page 79.

### 7.5.3.3 Install the AMD-RAID UEFI Drivers during a RHEL 7.3 64-bit Linux<sup>®</sup> Installation

**Note:** The Linux operating system modules must include the gcc+ compiler and the pthreads library, so that the rcadm program can be installed properly.

**Note:** Prior to starting this procedure, obtain the AMD-RAID drivers from your system supplier or motherboard vendor. Copy the AMD-RAID drivers to a USB flash drive. See Section 7.3.2, Copying AMD-RAID Drivers in a Linux<sup>®</sup> Environment, on page 63.

**Note:** When installing Red Hat Linux, use the Linux dd installation mode instead of the Linux expert mode.

**Note:** Not all of the windows indicated in this procedure will appear during the installation.

1. Power on the system.
2. Insert the USB drive containing the AMD-RAID drivers.
3. Insert the Red Hat operating system CD-ROM or DVD into the system's CD or DVD drive.
4. Create a bootable array by following the procedures in Section 6.4.2.1, Create an AMD-RAID Bootable Array, on page 55.

5. At the Red Hat Enterprise Linux Welcome window:
  - a. Press the Up arrow.
  - b. Select Install Red Hat Enterprise Linux 7.3 64 bit.
  - c. Press the E key.
  - d. Press the down arrow to the linuxefi /images entry
  - e. Press the **END** key.
  - f. Add “modprobe.blacklist=ahci inst.dd nomodeset” to the end of the string  
Example – linuxefi /images.....quiet modprobe.blacklist=ahci inst.dd nomodeset
6. Wait for the **Driver Disk Device Selection** to appear
  - a. Insert the USB drive (which contains the AMD-RAID drivers) into the USB port.
  - b. Press the **r** key
  - c. Press **Enter**
7. At the **Driver Disk Device Selection**,
  - a. Press **1** – the number of the flash drive
  - b. Press **Enter**.
8. At the **Choose Driver Disk ISO** file
  - a. Press **1** – the number of the dd-rraid-RHEL....el7 x86\_64.iso entry
  - b. Press **Enter**.
9. At the **Select Drivers to Install**
  - a. Press **1** – the number of the /media/DD/.....x86\_64.rpm entry
  - b. Press **Enter**.  
The **/media/DD/...** is now selected and should look like **[X] /media/DD/.....x86\_64.rpm**
  - c. Press the **C** key
  - d. Press **Enter**.
10. At the **Driver Disk Device Selection**
  - a. Press the **C** key
  - b. Press **Enter**.
11. At the **Welcome to Red Hat Enterprise Linux** Screen, do the following:
  - a. Choose the desired **language** and **country**.
  - b. In the bottom right corner, then click **Continue**.
12. At the **Installation Summary** Screen:
  - a. Under **Localization**, configure the following:
    - **Date and Time**
    - **Keyboard**
    - **Language Support**
  - b. Under **Software**, configure the following:
    - **Installation Source**

- **Software Selection**
    - Under Base Environments, select Server with GUI.
    - Under Add-Ons for Selected Environments, select Compatibility Library.
    - In the upper left corner, click Done.
  - c. Under **System**, configure the following:
    - **Installation Destination**
      - Under Local Standard Disks, select AMD-RAID Array.
      - In the upper left corner, click Done.
    - Configure Kdump
    - **Network and Hostname**
      - In the bottom left corner, enter a valid **Hostname**
        - Select an **Ethernet Port**
        - In the bottom right corner, click **Configure**.
        - Enter valid entries.
        - Click **Save**.
        - In the upper left corner, click **Done**.
13. In the bottom right corner, click **Begin Installation**.
14. At the **Configuration** window, do the following:
- a. Click **Root Password**
    - Enter an applicable root password
    - Re-enter the root password.
    - In the upper right corner, click **Done**.
  - b. Click **User Creation**
    - Enter a **Full Name**
    - Enter a **Username**
    - Enter an applicable password.
    - Re-enter the user password.
    - In the upper right corner, click **Done**.
15. At the **Installation Complete** window, click **Reboot** in the bottom right corner, then eject and remove the USB flash drive.
16. At the **Initial Setup** Window
- Click License Information
  - Review and Select (Check Mark) I accept the License Agreement
  - If desired, Configure Subscription Management Registration
  - If not already configured, configure **Configure Network & Hostname**
  - In the upper left corner, Click **Done**

- In the bottom right corner, Click **Finish Configuration**
17. If a pop-up appears stating that the system has to reboot
    - Click **OK**
  18. Login to the system
    - Select a user.
    - Enter a password.
  19. At the **Welcome** window,
    - Select the desired **Language**
    - Click **Next**
  20. At the **Typing – Select your Keyboard Layout or Input Sources** Window
    - Select the desired **Input Source**
    - Click **Next**
  21. If desired, Configure Online Accounts, then click **Next**.
  22. Click **Start using Red Hat Enterprise Linux Server**.
  23. For RHEL 7.3 64 bit installs, manually load the following el7.686 rpms:
    - a. Allow the system to boot and login as root when prompted.
    - b. Insert the RHEL 7.3 64-bit installation CD/DVD into the system.
    - c. Install the following rpms:
      - libX11...el7.i686
      - libXau...el7.i686
      - libxcb...el7.i686
      - libXext...el7.i686
      - libXi...el7.i686
      - libXtst...el7.i686
      - gtk2.....el7.i686
      - libstdc++\*.el7.i686
      - libSM-\*.el7.i686
      - libpng12\*.el7.i686
      - adwaita-gtk2-theme-\*.el7.i686
      - libcanberra-gtk2-\*.el7.i686
      - PackageKit-gtk3-module-\*.el7.i686
  24. Open a Web Browser and do the following:
    - a. Go to **rpmfind.net**
    - b. Search for **compat-libstdc++-33**
    - c. Download and install the **compat-libstdc++-33-3.2.3-71.el7.i686.rpm**
    - d. Reboot the system.

### 7.5.3.4 Installing the AMD-RAID UEFI Drivers during a Supported Ubuntu Desktop Installation

**Note:** AMD-RAIDXpert2 supports the Ubuntu 16.04 desktop operating system.

**Note:** Prior to starting this procedure, obtain the AMD-RAID drivers from your system supplier or motherboard vendor. Copy the AMD-RAID drivers to the `dd` directory on a USB flash drive, see Section 7.3.2, Copying AMD-RAID Drivers in a Linux® Environment, on page 63.

**Note:** The Ubuntu driver CD-ROM .iso image contains all Linux variations for a particular release.

**Note:** Not all of the windows indicated in this procedure will appear during the installation.

1. Power on the system.
2. Remove the Ethernet cable from the system.
3. Insert the Ubuntu desktop operating system CD-ROM or DVD into the system's CD or DVD drive.
4. Create a bootable array by following the procedure in Section 6.4.2.1, Create an AMD-RAID Bootable Array, on page 55.
5. Boot to the Ubuntu desktop CD-ROM or DVD. This will bring you to the GNU GRUB Window.
6. Select **Try Ubuntu without installing**
7. Press the **E** key to edit the commands before booting
8. Find the string that starts with `linux /casper/vmlinuz.efi file=/cdrom.....splash --`
  - Press the **END** key
  - At the end of the Boot Options string add the following: `break=mount modprobe.blacklist=ahci nomodeset`

**Note:** The string should look like: `splash --- break=mount modprobe.blacklist=ahci nomodeset`
  - Press F10, to boot.
9. When the BusyBox shell appears perform the following:

**Note:** If the BusyBox shell doesn't appear, reboot and try again.

  - Install the USB flash drive
  - Type: `mount -t vfat /dev/sda1 /tmp`

**Note:** /dev/sda1 may need to be changed to /dev/sdb1 or /dev/sdc1...depending on the number of devices.
  - Type: `cp -ap /tmp/dd /`
  - Type: `/dd/pre_install`
  - Type: `umount /tmp`
  - Type: **exit**
  - Remove the USB flash drive
10. Wait patiently for the Ubuntu Desktop to appear.

11. Double click the **Install Ubuntu 16.04.1 LTS** desktop ICON
12. From the **Welcome** window
  - Select the desired Language
  - Click Continue
13. From the **Preparing to Install Ubuntu** window
  - Accept the defaults
  - Click Continue
14. From the **Installation Type** window
  - Select Erase Disk and Install Ubuntu
  - Click Install Now
15. From the **Write Changes to Disks?** Window
  - Click Continue
16. Select the desired Time Zone
  - Click Continue
17. Select the desired Keyboard layout
  - Click Continue
18. Enter valid entries for the following:
  - Your name
  - Computer name
  - User name
  - Password
  - Confirm Password
  - Click Continue
19. When the “**Installation Complete**” window appears, do the following:
  - Install the USB flash drive
  - Press CTRL+ALT+T
  - Enter: `sudo mount -t vfat /dev/sda1 /mnt`
  - Enter: `sudo cp -ap /mnt/dd /`
  - Enter: `sudo /dd/post_install`
20. Wait for the **Setup is Complete**
  - Press CTRL+ALT+D
  - Click **Restart Now**, to finish the installation.
21. The installation will prompt the user to remove the installation media, remove the CD/DVD and USB flash drive from the system.
  - When installation media has been removed
  - Press **Enter**
  - Reconnect the Ethernet Cable

22. Proceed to Section 7.7, Installing the AMD RAIDXpert2 Management Suite for Linux®, on page 79.

## 7.6 Installing the AMD RAIDXpert2 Management Suite for Microsoft® Windows®

Obtain the latest executable file from your system supplier, motherboard vendor, or from <https://www.amd.com/support>. Download the file to the system's desktop and execute it. Follow the on-screen prompts.

See Section 9.1.1.1, Browser Setup, on page 90, for supported browsers and configurations.

## 7.7 Installing the AMD RAIDXpert2 Management Suite for Linux®

Obtain the AMD RAIDXpert2 Management Suite executable file (Setup.sh) from your system supplier or motherboard vendor. Download the Setup.sh file to the system's desktop.

**Table 18. Linux® Procedure for Installing the Management Suite**

Element	Action
RHEL 7.3 64 bit	Manually load the following i686 rpms: <ul style="list-style-type: none"> <li>• libX11</li> <li>• libXau</li> <li>• libXcb</li> <li>• libXext</li> <li>• libXi</li> <li>• libXtst</li> <li>• compat-libstdc++</li> <li>• gtk2</li> <li>• libSM</li> <li>• libpng12</li> <li>• adwaita-gtk2-theme</li> <li>• libcanberra-gtk2</li> <li>• PackageKit-gtk3-module.</li> </ul>
Ubuntu 16.04, 32-bit operating systems only	For Ubuntu 16.04, 32-bit operating system, enter the following command before executing Setup.sh: <pre>sudo ln -s /lib/i386-linux-gnu/libc.so.6 /lib/libc.so.6</pre>

Table 18. Linux® Procedure for Installing the Management Suite (Continued)

Element	Action
Ubuntu 16.04, 64-bit operating system only	<p>For the Ubuntu 16.04, 64-bit operating system, type the following commands before executing <code>Setup.sh</code>, pressing <b>Enter</b> after each one:</p> <pre> sudo ln -s /lib/x86_64-linux-gnu/libc.so.6 /lib/libc.so.6 sudo apt-get install lib32z1 sudo apt-get install lib32ncurses5 sudo apt-get install libxext6:i386 sudo apt-get install libxtst6:i386 sudo apt-get install libxi6:i386 sudo apt-get install libstdc++6:i386 sudo apt-get install libgtk2.0-0:i386 sudo apt-get install libxxf86vm1:i386 sudo apt-get install libsm6:i386 sudo apt-get install gtk2-engines-murrine:i386 sudo apt-get install libcanberra-gtk-module:i386 </pre>
Setup.sh	<p>Verify that the <code>Setup.sh</code> file is executable by right-clicking on the <code>Setup.sh</code> file on the system's desktop.</p> <p>From the pop-up menu, select the Properties category.</p> <p>Click the <b>Permissions</b> tab.</p>
Permissions tab	<p>Ensure that the Execute or Executable checkbox(es) is/are selected.</p> <p>Click <b>Close</b>.</p>
Setup.sh icon	<p>Double-click the <code>Setup.sh</code> icon that is on the desktop.</p> <p>At Do you want to run '<code>Setup.sh</code>' or display its contents?, click <b>Run</b>.</p> <p>Wait while Linux runs the Management Suite installer.</p>
Introduction window	<p>Click <b>Next</b>.</p>
License Agreement window	<p>Select <b>I accept the terms of the License Agreement</b>.</p> <p>Click <b>Next</b>.</p>
What would you like to install? window	<p>Click <b>Next</b>.</p>
Choose Install Folder window	<p>Accept the default settings.</p> <p>Click <b>Next</b>.</p>



**Table 18. Linux® Procedure for Installing the Management Suite (Continued)**

Element	Action
Choose Shortcuts window	Click <b>Next</b> .
Pre-Installation Summary window	Review the selections. If they are okay, click <b>Install</b> . <i>Note: The Installing the AMD RAIDXpert2 Management Suite window appears, showing the progress of the installation.</i>
Install Complete window	Click <b>Done</b> .

## 7.8 Installing the AMD RAIDXpert2 Graphical User Interface (GUI)

This section provides instructions for installing the AMD RAIDXpert2 GUI for Linux. For information on using the GUI, see Chapter 9, AMD RAIDXpert2 Graphical User Interface (GUI), on page 90.

### 7.8.1 RHEL Linux® – AMD RAIDXpert2 Web GUI Installation

- Copy `xampp-linux-x64-7.1.6-0-installer.run` to the system's desktop
  - Open a terminal / console window and `cd` to `/root/Desktop`. (or similar)
  - Enter into Super User mode: `su`
  - Enter: `./xampp-linux-x64-7.1.6-0-installer.run --mode unattended --disable-components xampp_developer_files`
- Enter:
  - `cd /opt/raidxpert2/htdocs`
  - Enter: `cp -rv raidxpert2 /opt/lampp/htdocs`
- To start **lampp**, type the following, then press **Enter**:
  - `/opt/lampp/lampp startapache`

*Note: This must be done after each system reboot.*

*Note: rc\_cgi and lampp must be running for the Web GUI to function correctly.*
- To start **rcpopup**, type the following, then press **Enter**:
  - `/opt/raidxpert2/bin/rcpopup &`

*Note: This must be done after each system reboot.*
- Click the **RAIDXpert2 Desktop Icon**

6. Enter the following default credentials:
  - a. Username: admin
  - b. Password: admin
7. Create a new username and password, and log into the system again with the new credentials.

### **7.8.2 Ubuntu – AMD RAIDXpert2 Web GUI Installation**

1. Copy xampp-linux-x64-7.1.6-0-installer.run to the system's Desktop.
  - Open a terminal / console window and cd to /root/Desktop. (or similar)
  - Enter: `sudo ./xampp-linux-x64-7.1.6-0-installer.run --mode unattended --disable-components xampp_developer_files`

2. Enter:

- `cd /opt/raidxpert2/htdocs`
- `sudo cp -rv raidxpert2 /opt/lampp/htdocs`

3. To start lampp, type the following, then press **Enter**:

- `sudo /opt/lampp/lampp startapache`

*Note: This must be done after each system reboot.*

*Note: rc\_cgi and lampp must be running for the Web GUI to function correctly.*

4. To start rcpopup, type the following, then press **Enter**:

- `/opt/raidxpert2/bin/rcpopup &`

*Note: This must be done after each system reboot*

5. Click the **RAIDXpert2 Desktop Icon**.

6. Enter the following default credentials:

- a. Username: **admin**
- b. Password: **admin**

7. Create a new username and password, and log into the system again with the new credentials.

---

## Chapter 8 RAID Software Update

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### 8.1 Purpose

This Chapter is designed to assist the user update their System to the latest released software.

This chapter describes the steps needed to update the AMD-RAID drivers installed on the following Operating Systems:

- Microsoft® Windows® 7 32 bit and 64 bit
- Microsoft Windows 10 32 bit and 64 bit
- Red Hat Enterprise Linux® (RHEL) 7.3 64 bit
- Ubuntu Desktop Linux 16.04.1 32 bit and 64 bit

### 8.2 System Overview Process

A generic System update process is described below.

1. Backup the user data before doing any upgrade.
2. Power-on the System.
3. Log into the System.
4. Copy the AMD RAIDXpert2 Installer to the Systems Desktop.
  - Windows – Latest package from AMD (<https://www.amd.com/support>) – See 2.1 on page 19.
  - Windows – manual install, use Setup.exe – See Section 2.2 on page 19.
  - Linux – Setup.sh
5. Run the AMD RAIDXpert2 Installer to update the AMD RAIDXpert2 Management Suite.
6. Update the AMD-RAID OS drivers.
7. Restart the System.

**IMPORTANT:** *To protect your data; always perform a backup prior to installing any new, major hardware or software. If you are adding NVMe as RAID to your existing AMD-RAID arrays, update all the existing AMD-RAID controller drivers to the latest version and restart the system. Then connect the NVMe devices and install the AMD-RAID driver onto NVMe devices.*

### 8.3 Updating the AMD RAIDXpert2 Management Suite.

#### 8.3.1 Update the AMD RAIDXpert2 Management Application (Web GUI)—AMD RAID Installer

1. Backup the user data before doing any upgrade.

2. Power-on the System.
3. Obtain the latest AMD RAID Installer executable file from your system supplier or motherboard vendor. Download the file to the Systems Desktop and execute it. Follow the on-screen prompts.

### **8.3.1.1 Update the AMD RAIDXpert2 Management Application (Web GUI)—Manually**

1. Backup the user data before doing any upgrade.
2. Open a browser and access the Web Site of your system supplier or motherboard vendor.
3. Download the AMD RAIDXpert2 Installer (**setup.exe**) from the web site and copy it to the Systems Desktop.
4. Open a Command Prompt terminal  
Enter: `cd \Users\user_name\Desktop`  
Enter: `setup.exe -i silent`

*Note: The user must clear the Browser History of the Internet Browser being used by AMD RAIDXpert2 Management Suite (Web GUI)*

### **8.3.2 Copy the AMD RAIDXpert2 Installer to the Systems Desktop: Red Hat Linux®**

1. Power-on the System.
2. Go to a browser and access the Web Site of your system supplier or motherboard vendor.
3. Download the AMD RAIDXpert2 Installer (**setup.sh**) and copy it to the Systems / directory.
4. Open a console / terminal window and enter the following :  
`./setup.sh -i silent cd /opt/raidxpert2/htdocs cp -rv raidxpert2 /opt/lampp/htdocs`

*Note: Enter – \cp -rv raidxpert2 /opt/lampp/htdocs to avoid answering y to all entries.*

### **8.3.3 Copy the AMD RAIDXpert2 Installer to the Systems Desktop: Ubuntu Linux®**

1. Power-on the System.
2. Go to a browser and access the Web Site of your system supplier or motherboard vendor.
3. Download the AMD RAIDXpert2 Installer (**setup.sh**) and copy it to the Systems / directory.
  - For Ubuntu 32-bit OS, enter the following commands before executing Setup.sh:  
`sudo ln -s /lib/i386-linux-gnu/ libc.so.6 /lib/libc.so.6`
  - For Ubuntu 64-bit OS, enter the following commands before executing Setup.sh:  
`sudo ln -s /lib/x86_64-linux-gnu/ libc.so.6 /lib/libc.so.6`
4. Open a console / terminal window and enter the following

```
5. sudo ./setup.sh -i silent cd /opt/raidxpert2/htdocs sudo cp -rv
   raidxpert2 /opt/lampp/htdocs
```

*Note:* Enter – `\cp -rv raidxpert2 /opt/lampp/htdocs` to avoid answering y to all entries.

## 8.4 Updating the AMD-RAID OS Drivers – SOC and AMD 300-Series Chipset

### 8.4.1 Windows® Drivers

#### 8.4.1.1 Windows®—AMD RAID Installer

1. Backup the user data before doing any upgrade.
2. If not already done, perform the steps in Section 7.4.1.1 on page 63.

#### 8.4.1.2 Windows® 10—Manually

1. Backup the user data before doing any upgrade.
2. Open a browser and access the Web Site of your system supplier or motherboard vendor.
3. Download the AMD-RAID Drivers from the Web Site and copy it to the Systems C: drive.
4. **Open Computer Management -> Device Manager.**
5. **Expand Storage Controllers.**
6. **Select the first AMD-RAID Bottom Device**
  - Right Click and select Update Driver Software
  - Click Browse my computer for driver software.
  - Click **Browse**, set the path to the Systems C drive.
  - Click **OK**.
  - Click **Next**

*Note:* If a Window Security Window pops up, select *Install this driver software anyways*.

- Click **Close**
  - At System Settings Change pop up prompting the user to restart the system, Click **No**.
7. **Select the first AMD-RAID Controller**
    - Right Click and select Update Driver Software
    - Click Browse my computer for driver software.
    - Click **Browse**, set the path to the Systems C drive.
    - Click **OK**
    - Click **Next**

*Note:* If a Window Security Window pops up, select *Install this driver software anyways*.

- Click **Close**.
    - At System Settings Change pop up prompting the user to restart the system, Click **No**
8. Expand **System Devices**.
  9. Select **AMD-RAID Config Device**
    - Right Click and select Update Driver Software
    - Click Browse my computer for driver software.
    - Click **Browse**, set the path to the Systems C drive.
    - Click **OK**
    - Click **Next**

*Note:* If a Window Security Window pops up, select Install this driver software anyways.

    - Click **Close**
  10. Restart the System.

## 8.4.2 Linux<sup>®</sup> Drivers

### 8.4.2.1 RHEL

1. Insert a USB flash drive containing the AMD-RAID driver disk iso image.
2. Copy the dd-rcraid-RHEL7...86\_64.iso file to the Systems Desktop
3. Right Click on the dd-rcraid-RHEL7...8x\_64.iso and select Extract Here
4. In a terminal / console window and enter the following:
  - `cd /root/Desktop/dd-rcraid-RHEL7...x86_64/rpms/x86_64`
  - `rpm -i --force kmod-rcraid-6.0.0-3.10...rpm`

*Note:* If command doesn't work, enter `chmod 777 kmod-rcraid.....rpm`

5. Wait for command to complete.
6. Reboot the System.

*Note:* remember to remove the USB Flash drive

### 8.4.2.2 Ubuntu

**Warning:** If the systems kernel has been updated, perform Section 3.2.2 before the system is rebooted. Failing to do so may result in the system failing to boot.

1. Open a terminal / console window.
  - a. Enter `uname -r`
  - b. Document the kernel version. (i.e., `4.2.0-16-generic`)
2. Open the Ubuntu Software Center
  - a. In the upper right corner, search for “**kernel header v.w.x yz**”  
Where v.w.x yz is the documented kernel version

- b. Select all that relate to the Systems kernel version
  - c. Click **Install**  
Example: 4.2.0-16-generic
  - d. In the upper right corner, search for “**build-essential**”
  - e. Select “**build-essential**”
  - f. Click **Install**
3. Change directory to the RAIDXpert2 driver\_sdk directory and enter the following:
    - `cd /opt/raidxpert2/driver_sdk`
    - `sudo ./install`

*Note: If command doesn't work, sudo chmod 777 install.sh*
  4. Wait for command to complete.
  5. Reboot the System.

### 8.4.3 Adding NVMe to Existing AMD-RAID System

#### 8.4.3.1 Update Windows® 10 Drivers for SoC and AMD 300/400/500-Series Chipsets

1. Backup the user data before doing any upgrade
2. If not already done, perform the steps in Section 8.3.1.1 on page 84
3. If not already done, perform steps in Section 8.4.1.1 on page 85

#### 8.4.3.2 Update Platform BIOS

1. Flash the BIOS with a version that supports **AMD-RAID NVMe RAID**
2. Enable RAID on the SOC, Chipset and NVMe
3. Save the BIOS settings
4. Power off the system
5. Install the NVMe devices
6. Power on the system

#### 8.4.3.3 Install the AMD-RAID Driver for NVMe

1. Open **Device Manager**.
2. Expand **Storage Controllers**.
  - a. Select the desired Standard NVM Express Controller
  - b. Right Click and select Update Driver Software...
  - c. Click Browse my computer for driver software.
  - d. Click Let me pick from a list of available drivers on my computer
  - e. Click Have Disk
  - f. Click **Browse**, set the path to the Systems **C:** drive.

- g. From the list, select the rcbottom.inf entry
- h. Click Open
- i. Click OK
- j. Click **Next**

**Note:** If a Window Security Window pops up, select **Install this driver software anyways**.

- k. Click Close
- l. At System Settings Change pop up prompting the user to restart the system, Click No.
- m. Perform Step 2 for each additional NVMe device you want to run RAID.
- n. Expand Other Devices
- o. Select the desired Unknown Device

**Note:** If you are unsure which entry to use, select **an Unknown Device, Right Click** and select **Properties**. Click the **Details Tab** and the Device instance path should display **rcbottom**.

- p. Right Click and select Update Driver Software...
- q. Click Browse my computer for driver software.
- r. Click Next
- s. Click Have Disk
- t. Click Browse, set the path to the Systems C: drive.
- u. From the list, select the rcraid.inf entry
- v. Click Open
- w. Click OK
- x. Click **Next**

**Note:** If a Window Security Window pops up, select **Install this driver software anyways**.

- y. Click Close
  - z. At **System Settings Change** pop up prompting the user to restart the system, Click **No**
3. Perform Step 4 for each addition NVMe you want to run RAID.
4. Expand **Other Devices**
- a. Select AMD-RAID Configuration SCSI Processor Device
  - b. Right Click and select Update Driver Software...
  - c. Click Browse my computer for driver software.
  - d. Click Let me pick from a list of available drivers on my computer
  - e. Click Next
  - f. Click Have Disk
  - g. Click Browse, set the path to the Systems C: drive.
  - h. From the list, select the rccfg.inf entry
  - i. Click Open
  - j. Click OK
  - k. Click **Next**
-



*Note:* If a Window Security Window pops up, select *Install this driver software anyways*.

- l. Click Close
  - m. At System Settings Change pop up, Click No
5. **Restart** the System

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# Chapter 9 AMD RAIDXpert2 Graphical User Interface (GUI)

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## 9.1 Start RAIDXpert2

The RAIDXpert2 graphical user interface (GUI) is a browser-based tool that reads from and writes to an internal Apache-based web server (Apache Software Foundation) that contains the RAID arrays and disc information.

For successful communication between the RAIDXpert2 GUI and the Apache2.4 web server, the Apache2.4 web server service and the RAIDXpert2 **rc\_cgi** service (where **cgi** = common gateway interface) must be running.

The **rc\_cgi** service opens a localhost port as a LISTENING port that allows browser access to the web server. If the Apache2.4 service has failed or is not running, the error message cannot reach this page or similar appears.

If the RAIDXper2-CGI (**rc\_cgi**) service fails or is not running, **License Level 0 – No RAID** is displayed (indicating that RAIDXpert2 is not supported) and the **Submit** button is grayed out. You cannot login.

Access RAIDXpert2 using a web browser or a Windows shortcut.

### 9.1.1 Web-Browser Access

#### 9.1.1.1 Browser Setup

- Use Chrome version 20, Firefox version 14, Internet Explorer 8, or Safari 6, or a greater version of each.
- To optimize the display, use a color monitor and set its color quality to the highest setting.

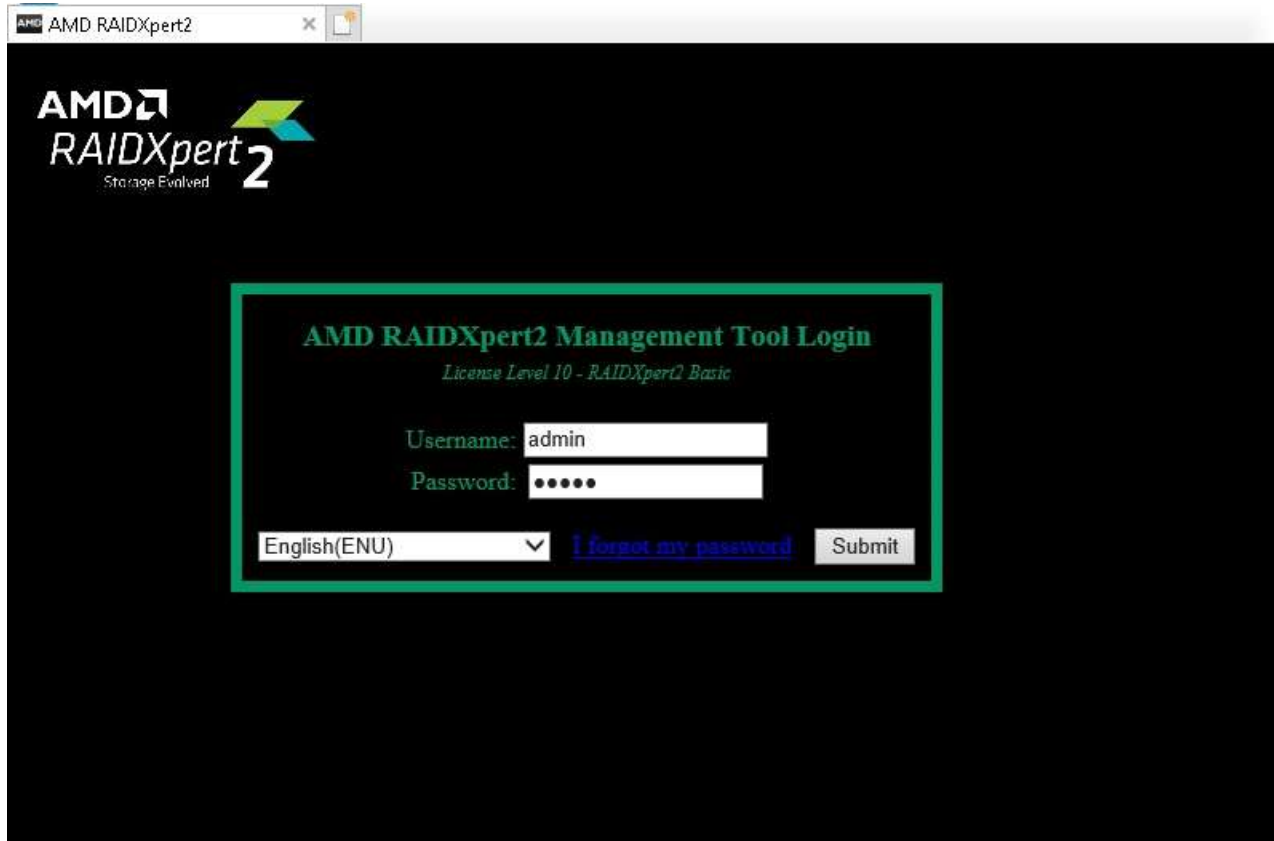
### 9.1.2 Desktop Shortcut Access

#### 9.1.2.1 Signing In Using the RAIDXpert2 Desktop Shortcut

1. Launch the AMD RAIDXpert2 Management Tool using by double-clicking the RAIDXpert2 **desktop shortcut**.
2. The **AMD RAIDXpert2 Management Tool Login** is displayed. If the Login page does not display, verify that you have used the correct shortcut.
3. Select a language at the drop-down menu.

4. On the **Login** (see Figure 3. AMD RAIDXpert2 Login Page on page 91), enter the username and password of a configured user. The default username and password are **admin** and **admin**.

*Note: Both usernames and passwords are case-sensitive.*



**Figure 3. AMD RAIDXpert2 Login Page**

5. Click **Submit**. If the system is available, the RAIDXpert2 GUI page is displayed; otherwise, a message indicates that the system is unavailable.

## 9.2 Password Protection

When the system displays a window that prompts you to choose a username and password, use the procedure below.

1. In the **Username** field, enter the new username.
2. In the **Password** field, enter the new password. Follow the guidelines in Section 9.2.1, Things to Know About Passwords on page 92.
3. In the **Confirm New Password** field, re-enter the new password.

*Note: Both usernames and passwords are case-sensitive.*

4. Click **Submit**.

### **9.2.1 Things to Know About Passwords**

- RAIDXpert2 cannot be opened without a password. Create a password that is easily remembered.
- The password must be 4 - 20 characters long.
- The password is case-sensitive.
- The application does not track previous passwords unless enabled through your web browser.
- To change an existing password, see Section 9.2.2, Change a Password at the Options Menu, on page 92.
- If a user forgets the username or password, delete rc\_login.txt to restore the default user name and password (admin and admin).

### **9.2.2 Change a Password at the Options Menu**

*Note: Both usernames and passwords are case-sensitive.*

1. At the **Options** menu, select **Password**.
2. The **Choose a new Username and Password** window displays.
3. In the **Old Password** field, enter the default password you used to login.
4. In the **New Password** field, enter the new password. Follow the guidelines in Section 9.2.1, Things to Know About Passwords, on page 92.
5. In the **New Password** field, re-enter the new password.
6. Click **Submit**.

## **9.3 Help and About Windows<sup>®</sup>**

To view the software version and build number for the GUI, select **About** at the **Help** menu. The AMD RAIDXpert2 Driver Version and GUI Version displays.

For customer support, select **Help > User Guide**. A pdf version of this document will display. A pdf reader program will be necessary to view it.

For further customer support, contact your system supplier or motherboard vendor.

## 9.4 Reviewing the RAIDXpert2 GUI

### 9.4.1 The Array View Section of the Array Status Window

#### 9.4.1.1 Elements of the Array View Section

The **Array View** section presents a graphical view of array properties. Table 19 provides information about the elements of the **Array View** section (see Figure 4 on page 94).

**Table 19. Elements of the Array View Section, Array Status Window**

Element	Description
Controller Name	The RAIDXpert2 controller for the arrays displayed below it.
Array	The number assigned to an array.
Array name	The name assigned to an array.
RAID Level	The RAID level of the array.
Disk Number	The number assigned to disks in an array.
Disk Manufacturer	The manufacturer of disks in an array.
Disk Model Number	The model number of the disks in an array.

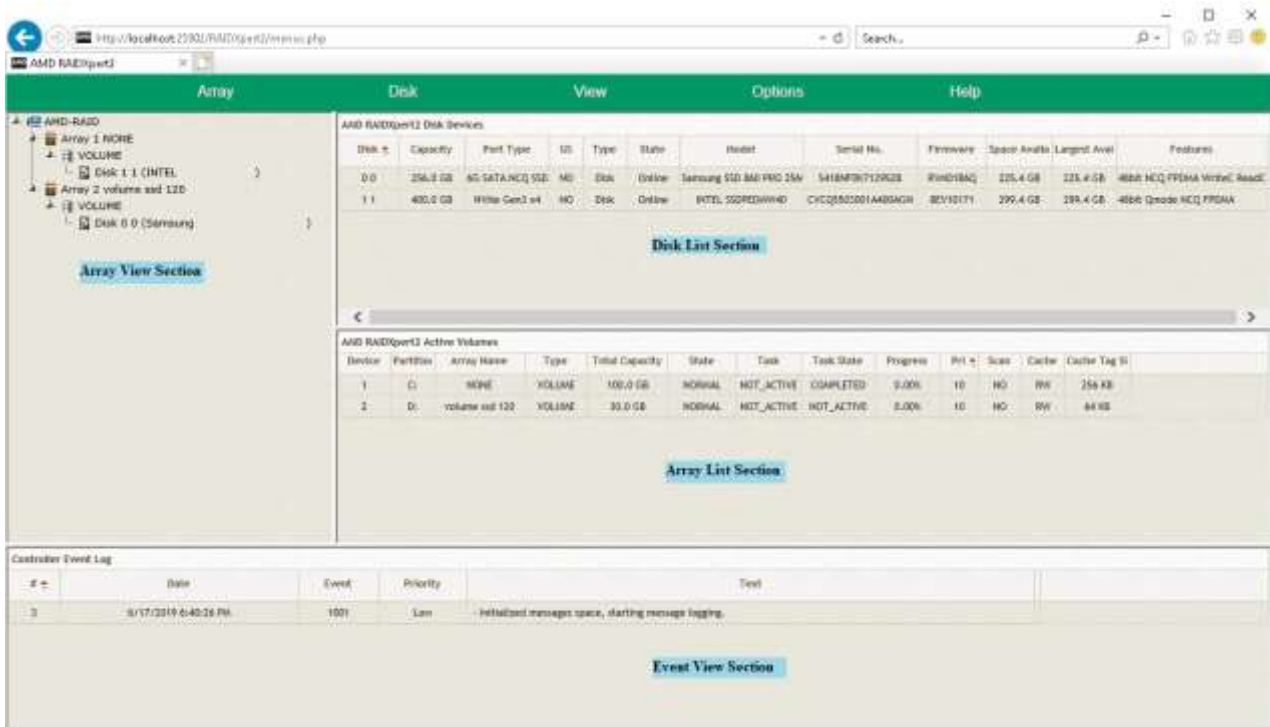


Figure 4. Array Status Window

## 9.4.2 The Disk List Section of the Array Status Window

### 9.4.2.1 Elements of the Disk List Section

The Disk List section provides information about all disks assigned or available to arrays. Table 20 provides information about the elements of the Disk List section.

**Table 20. Elements of the Disk List Section, Array Status Window**

Element	Description
Disk	Disk number.
Capacity	Disk capacity: 1 MB = 1,000,000 bytes 1 GB = 1,000,000,000 bytes <i>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, RAIDXpert2 reports the same units</i>
Port Type	Negotiated Speed (not the speed of the port type and SATA NCQ or NVMe)
GS	Indicates if the disk is assigned as a global spare.
State	State of the disk (Online, Offline, SMART Error).
Type	Disk type (Disk, Legacy, New).
State	State of the disk (Online, Offline, SMART Error)
Model	Disk manufacturer's model number.
Serial No.	Disk manufacturer's serial number.
Firmware	Disk manufacturer's firmware version.
Space Available	Total amount of space unused on the disk.
Largest Available	Largest contiguous unused space on the disk.
Features	Information about port communication and physical disk cache settings.

If a disk is missing from the Disk List, the most likely cause is:

- A loose cable. Make sure that all disk cables are connected, then perform a rescan.
- A disk that is not fully seated in its bay or slot. Make sure that the disk is inserted completely in its bay or slot, then perform a rescan.

For more information, see Section 9.5.2, Rescan Disks, on page 99.

## 9.4.3 The Array List Section of the Array Status Window

### 9.4.3.1 Elements of the Array List Section

The Array List section provides information about the arrays. Table 21 provides information about the elements of the Array List section.

**Table 21. Elements of the Array List Section, Array Status Window**

Element	Description
Device	The array number.
Partition	Drive letter that was assigned to this array during the partition process. (A blank space appears if the array has not been partitioned.) <i>Note: If a dynamic volume is created on an array, RAIDXpert2 cannot retrieve the volume's drive letter.</i>
Array Name	User-created name for the array.
Type	The RAID level (RAID type) or LEGACY.
Total Capacity	Total 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, RAIDXpert2 reports the same units.
State	State of the array (NORMAL, CRITICAL, OFFLINE).
Task	Task type, if in progress (TRANSFORM, CHECK, CHECK_BITMAP, CREATE, RESTORE, ZERO, SECURE_ERASE).
Task State	The state of the task (STARTED, PAUSED, COMPLETED); the progress of the task is given in the Array View section.



**Table 21. Elements of the Array List Section, Array Status Window (Continued)**

Element	Description
Pri	Task priority if a task is in progress.
Scan	Background Array Scan enabled? (Yes/No).
Cache	Current cache setting (NC = No Cache, R = Read Ahead Cache, W = Write Back Cache, RW = Read/Write Cache).
Cache Tag size	Any Array with only HDD/SSD will have default CTS of 64k Any Array with NVMe/HDD/SSD will have default CTS of 256k

## 9.4.4 The Event View Section of the Array Status Window

### 9.4.4.1 Elements of the Event View Section

The Event View section is an optional-view section. It can be displayed or hidden by selecting View > Event View.

The information in the Event View is linked to the View Log. The View Log displays user-initiated tasks or actions, and system-generated notifications and events. The View Log can be accessed by selecting View > Log.

The Event View provides information about the events. Table 22, on page 97, provides information about the elements of the Event View section.

**Table 22. Elements of the Event View Section, Array Status Window**

Element	Description
#	The number of the event.
Date	The date and time at which the event occurred.
Event	The RAIDXpert2 Asynchronous Event Notification (AEN) number of the event.
Priority	The notification priority of the event: Low, Informational, Warning, Critical, or Fatal.
Text	A brief description of the event.

### 9.4.5 Array and Disk Commands

The Array and Disk menus of the Array Status window contain lists of commands. The commands allow the system user to initiate or modify array- and disk-related tasks.

Not all commands are available for an array or for the system. Availability depends on:

- The tasks that can be performed with the system’s license level.
- The RAID level of an array. For example, a Consistency Check can be performed only on arrays at a redundant RAID level.
- The remaining capacity of the disk drives. For example, if a system has three disk drives and large arrays have used all of the capacity on two of the disks, only non-redundant Volume arrays can be created on the remaining disk. Certain commands are not available with a non-redundant array.

Table 23 provides page numbers for each command.

**Table 23. Commands at the Array and Disk Menus**

Array Commands	See Detailed Information on this Page	Disk Commands	See Detailed Information on this Page
Create	page 101	Initialize	page 99
Name	page 103	Rescan	page 99
Transform	page 104	Properties	page 99
Prepare to Remove	page 107	Options	page 100
Delete	page 108		
Modify Cache Settings	page 109		
Task	page 110		
Check Consistency	page 110		
Background Array Scan	page 112		
Remove Spares	page 112		
Hide	page 113		
Secure Erase	page 113		

## 9.5 Working with Disks

### 9.5.1 Initialize Disks

When a disk is initialized, RAIDXpert2 configuration information (metadata) is written to the disks. If a disk is new and has not been used before, or if it is a legacy disk, it must be initialized before it can be used in a RAIDXpert2 array. After a disk is initialized, it appears as Disk in the Disk List.

If all of the discs contain metadata, the **Initialized** button is deactivated (greyed out).

*Note: All new disks and legacy disks will have an associated array. You must delete the array in order to initialize the disk.*

#### 9.5.1.1 To Initialize Disks

1. At the **Disk** menu, select **Initialize**. The Initialize Disk window displays.
2. Select the disk(s) to be initialized, by selecting the box next to the disk(s).
3. Click **Initialize Selected**.

### 9.5.2 Rescan Disks

#### The Rescan Command Performs the Following Actions:

- Rescans the SATA channels that search for new, legacy, or removed disks.
- Rereads the configuration information from each disk.

When a disk is offline, it might be brought online by using a rescan. A rescan also stops and then automatically resumes all tasks.

To rescan disks, select **Rescan** at the **Disk** menu.

### 9.5.3 Change Cache Properties for Disks

The Read Ahead and Write Back Cache properties can be changed if the disks support this option. The default settings are:

- Read Ahead: enabled.
- Write Back Cache: enabled.

*CAUTION: Leaving Write Back Cache enabled can increase the likelihood of data being corrupted if the system experiences a power interruption or unexpected shutdown.*

*Note: A disk's cache setting cannot be changed if a task is active for the array. The cache settings are enabled when the task is finished.*

*Note: As default setting NVMe Physical disk Read ahead and Write Back cache is always disabled. User cannot enable the setting as it may impact the operational performance of the NVMe disk.*

### **9.5.3.1 Change Disk Caching Properties**

1. At the Disk menu, select **Properties**.
2. The Properties window opens.
3. Select the disks you want to change the properties of.
4. Click **Enable** or **Disable** for the desired settings.

*Note: Each time Enable or Disable is clicked, the disk selection clears. To change multiple settings on one disk, select the disk before clicking each setting.*

### **9.5.4 Assign Spares**

Spare disks allow an array to be rebuilt when a disk fails. Global spares can be used in any array, while dedicated spares are assigned to a specific array.

#### **9.5.4.1 Assign a Disk as a Dedicated or Global Spare**

1. In the Disk List section, select a disk.
2. At the Disk menu, select **Options**.
3. Options for Disk Device displays in the Disk List panel.
4. Perform one of the following actions:
  - To use the disk as a dedicated spare, select Assign as Dedicated Spare.

*Note: The capacity of a dedicated spare must be equal to or larger than the capacity of the smallest disk in the array.*

- To use the disk as a global spare, select Assign as Global Spare.
5. Click **Confirm**.

### **9.5.5 Legacy Disks**

A legacy disk is a disk that contains valid data from a non-RAID controller.

A legacy disk appears in RAIDXpert2 (and in the BIOS Configuration Utility / RAIDXpert2 Configuration Utility (HII)) with a corresponding legacy array. When the legacy disk is initialized in RAIDXpert2 (or in the BIOS Configuration Utility / RAIDXpert2 Configuration Utility (HII)), the legacy array disappears.

**CAUTION:** A legacy disk can contain valid data. When a legacy array is deleted the data is lost.

### 9.5.5.1 Legacy Disk and New Disk

Table 24 provides information on how disks appear in RAIDXpert2 web utility and in the BIOS Configuration Utility.

**Table 24. New and Legacy Disks, as They Appear in the BIOS Configuration Utility / RAIDXpert2 Configuration Utility (HII) and RAIDXpert2**

Status of the Disk	RAIDXpert2 Web Utility	In the BIOS Configuration Utility/RAIDXpert2 Configuration Utility (HII)
New, un-initialized disk.	The disk appears as a new disk with a legacy array. When the new disk is initialized, its state changes to Online (or similar).	The disk appears as a new disk (the disk can appear with a legacy array). When the new disk is initialized, RAIDXpert2 configuration data is written to the disk. The disk state changes to Online.
A disk containing non-RAIDXpert2 configuration data. <i><b>CAUTION:</b> A legacy disk can contain valid data. When a legacy array is deleted, or when its corresponding legacy disk is initialized, the data is lost.</i>	The disk appears as a legacy disk with a legacy array. When the legacy array is deleted, the legacy array disappears and the legacy disk type changes to Disk. The disk can now be used in RAIDXpert2 arrays.	The disk appears as a legacy disk with a legacy array. When the legacy array is deleted the state of the legacy disk changes to Empty. The disk can now be used in RAIDXpert2 arrays.

See Chapter 9, AMD RAIDXpert2 Graphical User Interface (GUI), on page 90, for the disk initialization procedure and the appearance of legacy disks in the BIOS Configuration Utility.

## 9.6 Working with Arrays

### 9.6.1 Create and Format Arrays

RAIDXpert2 allows the partitioning and creation of as many as eight arrays across the system's disks. Portions of disks can be used to create arrays, at the same time that other arrays use different portions of the same disks.

#### 9.6.1.1 Before You Begin...

Review the issues and recommendations indicated in Table 25.

**Table 25. Creating Arrays: Issues and Recommendations**

Issues	Recommendations
Access to arrays	The creation of arrays, even redundant arrays, allows users immediate access to the arrays (unless the Zero Create option is used during the Create process).
Array numbers	Array numbers are valid only for a given boot, and can be different in the BIOS Configuration Utility and RAIDXpert2. If a permanent label is required, use the Array Naming feature described in Section 9.6.2, Name Arrays, on page 103.
Array size	The array size of the new array is limited to 2.199 TB on some versions of Windows and Linux. Refer to the 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 AMD-RAID.
System reboot	When the system reboots, the creation process continues where it left off.

**9.6.1.2 Create an Array**

**9.6.1.2.1 Select an Array and Cache**

1. At the Array menu, select **Create**.
2. Select the disk(s) to include in the array by checking the box next to the desired disk(s) in the **Select Active Disks:** field.

*Note: Click **All** to select all disks, or click **Unused** to select disks that are not currently used in an array. Maximum of 8 NVMe/HDD/SSD disks can be part of array. if more than 8 disks, the Create button will be grayed out or unselectable.*

3. Enter a name for the array in the **Array Name:** field.

*Note: The following characters are not allowed in an array name*

( ) ^ , | = “ ” .

4. Select an array type at the **Array Type:** drop-down menu.
5. At the **Organized As:** drop-down menu select an option.

*Note: The Organized As: drop-down menu only displays options for advanced management of a RAID10 configuration if you selected RAID10.*

6. Enter the capacity in the **Capacity:** field. The maximum available capacity changes with:

- The disks that are selected.
  - The RAID level of the array.
7. Select a cache option at the Cache Options: drop-down menu. (The default is Read and Write Back Cache.)
  8. Cache Tag Size will default to a setting based off of the disks that are selected. All HDD/SSD, default will be 64k. All NVMe or a mix of NVMe/HDD/SSD will default to 256k. The user should not change from the default settings.
  9. Check **Background Array Scan** to enable background array scanning. (A background array scan checks the sectors of the disks in an array for potential problems. A background array scan runs continuously, until the user stops it by accessing Array > Background Array Scan > Stop).

*Note:* Please refer to Table 17 on page 55 for Default Cache Tag Size.

*Note:* See Section 9.6.12, Scan an Array in the Background, on page 112, for details.

10. Check **Skip Initialize** to skip initialization.  
*CAUTION:* Creating a redundant array with Skip Initialization selected can result in data corruption.
11. Check **Leave Existing Data Intact** if an array is lost or deleted, and the user immediately creates a replacement array of the same characteristics. This leaves the data on the disks of the lost or deleted array untouched when the replacement array is created. See Table 44, on page 138, for additional information.
12. Check **Zero Create** to write zeros on the created array. If Zero Create is used, the array is not immediately available (the array is hidden from the operating system during the Create process).
13. Click **Create** to create the array.

### 9.6.1.3 Partition and Format an Array

Each operating system has different names and paths for partitioning and formatting arrays and as such are outside the scope of this document. For more information, see your operating system's user documentation.

## 9.6.2 Name Arrays

Naming an array can be useful when creating backups. It makes an array easy to identify in a list of arrays.

1. In the **Array View** section, select the array to name.
2. At the **Array** menu, select **Name**. The **Array Name** window displays.
3. Type the desired name in the blank field.

*Note: The following characters are not allowed in an array name:*

( ) ^ , | = “ ” .

- Click **OK**. The array name appears in the Array List and in the BIOS Configuration Utility (only 17 characters of the name are displayed in the BIOS Configuration Utility).

### 9.6.3 Transform Arrays

With the Transform task, an array can be:

- Transformed from one RAID level to almost any other RAID level. This function is also referred to as Online RAID Level Migration (ORLM).
- Expanded dynamically, even under I/O load, by adding disks to the array to increase the capacity of the array. This function is also referred to as Online Capacity Expansion (OCE).

#### 9.6.3.1 Before You Begin

Review the issues and recommendations indicated in Table 26.

**Table 26. Transforming Arrays: Issues and Recommendations**

Issues	Recommendations
Array size	An array cannot be transformed to a smaller-sized array. The transformed array must be the same size as or larger than the original array.
Array size limits	The array size of the transformed array is limited to 2.199 TB on some versions of the Windows and Linux operating systems. Refer to the operating system documentation for details on maximum array sizes.
Disk failure during a Transform	If a disk fails while the Transform task is in progress, no data is lost as long as the source and destination RAID levels are redundant. If a spare has been assigned to the destination array, a fail-over task starts as soon as the Transform completes (if the spare is available after the Transform).
Multiple arrays	If there are multiple arrays, 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.



**Table 26. Transforming Arrays: Issues and Recommendations (Continued)**

Issues	Recommendations
Task control commands	When using task control commands, a Transform task can only be paused or resumed but not removed. To end a Transform task, pause and delete it. <i>Note: If a task is paused and then deleted, the array is deleted. Deleting a task is the same as deleting an array. Data loss occurs when a task is deleted. Please ensure that data is backed up prior to deleting a task involving a Transform or a Restore.</i>
System reboot during a Transform	If the system reboots during a Transform, the Transform continues where it left off.

### 9.6.3.2 Transform an Array

1. In the Array View section, select the array to transform.
2. At the Array menu, select Transform.  
*Note: If the system window is not wide enough, only the Destination View is displayed.*
3. Select all the desired disks for the array (including disks that might be already in the array) by selecting the box next to the drive in the Disk List section.  
*Note: Click **Same** to select all disks currently used in the array, **All** to select all disks, or **Unused** to select disks that are not currently used in an array.*
4. Select the RAID level to be transformed at the Array Type: drop-down menu.
5. At the Organized As: drop-down menu select an option.  
*Note: The Organized As: drop-down menu only displays options for advanced management of a RAID10 configuration if you selected RAID10.*
6. Expand the array by entering the size of the new array in the Capacity: field. The maximum available capacity changes with:
  - The disks that are selected.
  - The RAID level of the array.*Note: If a Transform is not possible, the Commit option is not enabled. A typical reason preventing a Transform is insufficient available space on the disks.*
7. Click **Commit**.  
*Note: Unless the transformation is instantaneous, the Array Status window updates to show the source and destination arrays, along with the progress of the transformation.*

### **9.6.3.3 Access Additional Space**

After an array has been transformed to a larger size, use the operating system tools to access the additional space.

There are several possible methods for expanding the existing file system on an array that has been transformed to a larger size:

- Microsoft provides a command prompt utility called Diskpart.exe that can expand any NTFS file system without requiring a reboot. The Diskpart.exe utility version to use depends on the version of Windows being run. The Diskpart.exe utility can be found on the CD that comes with some versions of Windows, or at the Microsoft website (<http://www.microsoft.com>) for others. Use the correct version for the operating system.
- For arrays formatted with FAT32, use a third-party application, such as PartitionMagic from PowerQuest Corporation.

### **9.6.4 Restore (Rebuild) Arrays**

With the Restore task, a redundant-type array whose state has changed to Critical can be restored (rebuilt) in one of two ways:

- By assigning a dedicated spare to the array.
- By creating a global spare or by using an existing global spare. (An existing global spare automatically starts restoring a redundant-type array after the array's state changes to Critical.)

An array in an Offline state cannot be restored. This means that non-redundant arrays (Volume, RAID0) cannot be restored: when a single disk in a non-redundant array fails, the array state changes to Offline.

*Note: If a Critical redundant array that is being restored loses a second disk (RAID1), or loses a second disk in the same mirror set (RAID10), the Restore task fails. The array must be re-created from backup storage data.*

#### **9.6.4.1 Before You Begin**

- Make sure that the disk chosen as the dedicated spare or global spare has sufficient available capacity to restore the array. The capacity of the spare disk must be equal to or larger than the capacity of the smallest disk in the critical array.
- Know how to create a global or dedicated spare. See Section 9.6.13, Add or Remove Dedicated Spares, on page 112 or Section 9.6.14, Add or Remove Global Spares, on page 113.

#### **9.6.4.2 Restore a Critical Array**

1. In the Array View section, select the critical array.

2. At the **Disk List** section, **double click on** a disk.
3. At the **Disk** menu, select **Options**. Options for **Disk Device** displays in the **Disk List** panel. Perform one of the following actions:
  - To use the disk as a dedicated spare, select **Assign as Dedicated Spare**.
  - To use the disk as a global spare, select **Assign as Global Spare**.
4. Click **Confirm**.

## 9.6.5 Prepare to Physically Remove an Array

### 9.6.5.1 Physically Remove an Array

***CAUTION:** Prior to removing an array, remove its drive letter (Windows) or unmount the array (Linux).*

1. In the **Array View** section, select the array to remove.
2. At the **Array** menu, select **Prepare to Remove**.
3. At the **Prepare to Remove** window, click **Yes**. The array and all associated disks disappear from the **Array Status** window.
4. Remove the first disk from the system.
5. When the **Drive Removed** window displays, click **Cancel**.
6. Remove the remaining disks in the array.
7. When all disks in the array are removed from the system, select **Rescan** at the **Disk** menu.

### 9.6.5.2 Array Migration

The disks in an array, after being removed from one system with a RAIDXpert2 controller, can be migrated to another system with a RAIDXpert2 controller. The disks and array(s) appear in the second system, in Disk Management, the BIOS Configuration Utility, and RAIDXpert2, as normal RAIDXpert2 disks and array(s).

If the disks from a RAIDXpert2 system are migrated to a non-RAIDXpert2 Windows-based system, the disks appear in Disk Management of the second system as healthy, unknown partitions. To use the disks, use Disk Management to delete the RAIDXpert2-created partitions and to create Windows partitions on the disks.

***CAUTION:** All data contained in a RAIDXpert2 array are lost if the RAIDXpert2 disks of the array are migrated to a non-RAIDXpert2 system.*

## 9.6.6 Delete Arrays

**CAUTION:** *Deleting an array permanently destroys all data that is on the array. This action cannot be undone and it is very unlikely the data can be recovered.*

### 9.6.6.1 Before You Begin

Review the issues and recommendations indicated in Table 27.

**Table 27. Deleting Arrays: Issues and Recommendations**

Issue	Recommendation
Drive letters or partitions	Remove drive letters or partitions from the array using procedures in your operating system. Each operating system has different names and paths for removing drive letters or partitions and as such are outside the scope of this document. For more information, see your operating system’s user documentation.
Operating system impact on arrays	If the array is not being used by the operating system, the array can be deleted at any time, even while tasks are running on the array. If the array is being used by the operating system, the array cannot be deleted. Therefore, a RAIDXpert2 bootable array cannot be deleted in RAIDXpert2. A RAIDXpert2 bootable array can only be deleted in the BIOS Configuration Utility.

### 9.6.6.2 Delete an Array

1. In the Array Status window, select the array to delete.
2. At the Array menu, select Delete. A windows opens, warning about deleting the array.
3. Click **OK**. The array disappears from the Array View section.

*Note:* Also see Section 10.5, *Delete Arrays: rcadm --delete*, on page 123.

### 9.6.6.3 Recreate a Deleted Array

If an array is deleted, it might be possible to recreate the array. See Table 44. *Recreate a Deleted Array*, on page 138.

## 9.6.7 Change Cache Settings for Arrays

Table 28 provides information about the four array-caching options available.

**Table 28. Cache Array Options**

Option	Description
No Cache	I/O requests are translated and passed to the disks without keeping a cached copy of the data available for future requests
Read Cache	Data reads are cached, if appropriate. This option performs sequential Read Ahead, when necessary
Write Back Cache	Data writes are cached. This setting is intended for advanced users who understand the implications of Write Back caching
Read + Write Back Cache (default setting)	Both Read and Write Back Cache options can be selected

*Note: Cache options cannot be changed while a task is active on the array. They can be changed at any other time, including while I/O is running.*

### 9.6.7.1 Change Cache Settings

1. In the **Array View** section, select the array on which to change caching options.
2. At the Array menu, select **Modify Cache Settings**.
3. Choose **No Cache, Read Cache, Write Back Cache, or Read + Write Back Cache**. The new cache setting displays in the Array List Cache information.

## 9.6.8 Change the Priority Level of a Task

The task priority command allows the user to speed up or slow down tasks being performed on arrays.

To decrease the amount of time it takes for a task to complete, set the task priority higher (10 is the highest).

*Note: A task priority can only be changed after a task is running on the array.*

### 9.6.8.1 Change a Task Priority

1. In the **Array View** section, select the array on which tasks are being performed.
2. At the **Array** menu, select **Task** and select **Priority**.

3. At the **Task Priority** window, change the task priority by moving the slide one way or the other.
4. Click **OK**.

### **9.6.9 Interrupt, Cancel, or Resume a Task**

The task control commands allow the user to pause, resume, or cancel (remove) tasks being performed on arrays.

Full task control can be used on Create, Consistency Check, and Check Bitmap tasks. On Restores with dedicated or global spares the task can be removed, but the array returns to the Critical state.

*Note: Task control can be used only when a task is running on an array.*

#### **9.6.9.1 Interrupt, Cancel, or Resume a Task**

1. In the **Array View** section, select the array on which a task is being performed.
2. At the **Array** menu, select **Task** then click:
  - Pause to interrupt the task.
  - Remove to cancel the task.
  - Resume to interrupt the task.

### **9.6.10 Check for Consistency**

For redundant-type arrays only, the Consistency Check task is available at the Array menu. When this task is selected it starts the process of verifying that the mirror drive consistency for fault-tolerant disks is correct. If inconsistent areas are found, they are corrected during this process.

Having consistent arrays is very important. If an array is inconsistent and a drive fails, data is lost. RAIDXpert2 is designed to maintain consistent arrays, but it is good practice to run frequent consistency checks. See Section 9.6.11, Schedule a Consistency Check, on page 111.

When a redundant array is created using the Create command, and the Skip Initialize option is not checked (the default setting), a Consistency Check is performed automatically. Although a Consistency Check that runs during a Create task can be removed (by highlighting the array and selecting **Task > Remove**), the array that is created is not redundant. Unless a Consistency Check runs from end-to-end, an array is not protected.

After a Consistency Check has been started, adjust the priority of the Consistency Check task relative to user I/O activity. Use the Task Priority option (see Section 9.6.8, Change the Priority Level of a Task, on page 109).

A Consistency Check task can be scheduled with the Schedule Consistency Check task (see Section 9.6.11, Schedule a Consistency Check, on page 111).

### 9.6.10.1 Before you Begin

- The Consistency Check command can be started at any time on a redundant-type array, as long as another task is not running on the array.
- The Consistency Check command can be started while under I/O load.
- If the array state is Critical, the Consistency Check fails.
- To estimate the remaining time for a Consistency Check, look at the percentage of the task that is completed (in hours: minutes: seconds). These details are displayed next to the array in the Array View section of the Array Status window.

### 9.6.10.2 Manually start a Consistency Check

1. In the **Array View** section, select the array on which to run the Consistency Check.
2. At the **Array** menu, select **Check Consistency**.
3. Click **Start**.

### 9.6.10.3 Manually stop a Consistency Check

1. In the **Array View** section, select the array on which to stop the Consistency Check.
2. At the **Array** menu, select **Check Consistency**.
3. Click **Stop**.

## 9.6.11 Schedule a Consistency Check

A Consistency Check task can be scheduled for later in the day or week. A Consistency Check task can be scheduled to run each week or each month.

*Note: Schedule only one Consistency Check event on an array. This means that if a monthly check has been scheduled and a weekly check is desired, delete the monthly event and schedule the new event.*

Table 29 provides information on the available scheduling options for a Consistency Check.

**Table 29. Consistency Check Options**

Option	Description
One Time Only	Schedule the Consistency Check for the current day (“Today”) or up to seven days in the future.
Weekly	Events can be scheduled weekly. After it is selected, a Consistency Check runs on the specified array at the same time each week.
Monthly	Events can be scheduled to run once per month to run on the specified array at a specified time.

### **9.6.11.1 Schedule a Consistency Check for Later**

1. In the **Array View** section, select the array on which to run the Consistency Check.
2. At the **Array** menu, select **Check Consistency**.
3. Select **Schedule**.
4. At the **Check Consistency** window, select the **Frequency**, **Day**, and **Time**, then click **Confirm**.

### **9.6.11.2 Delete a Scheduled Consistency Check**

1. In the **Array View** section, select the array to on which to delete the Consistency Check.
2. At the **Array** menu, select **Check Consistency**.
3. Select **Schedule**.
4. At the **Consistency Check** window, click **Remove**.

## **9.6.12 Scan an Array in the Background**

A Background Array Scan task performs a continuous background read operation of an array, accessing at least one copy of every block of the array from beginning to end.

A Background Array Scan is manually started by the user and runs continuously until the user stops it.

Although a Background Array Scan can run while an array is engaged in other tasks, it is recommended that the Background Array Scan run while the array is idle (that is, when there is no I/O to or from the array).

### **9.6.12.1 Enable or Disable a Background Array Scan**

1. In the **Array View** section, select the array to on which to run the Background Array Scan.
2. At the **Array** menu, select **Background Array Scan**.
3. **Enable** or **disable** the **Background Array Scan**.
  - To enable a Background Array Scan, select **Start**.
  - To disable a Background Array Scan, select **Stop**.

*Note: A Background Array Scan can also be enabled for an array when it is created.*

## **9.6.13 Add or Remove Dedicated Spares**

If a dedicated spare is added, make sure there is adequate space on the dedicated spare.

### **9.6.13.1 Add a Dedicated Spare**

1. In the **Array View** section, select the array on which to assign a dedicated spare.
2. In the **Disk List** section, double click on the disk chosen as the dedicated spare.



3. At the **Disk** menu, select **Options**.
4. Select **Assign as Dedicated Spare**, then click **Confirm**.

### 9.6.13.2 Remove a Dedicated Spare Assignment

1. In the **Array View** section, select the array from which to remove a dedicated spare.
2. At the **Disk** menu, select **Options**.
3. Select **Remove as Dedicated Spare**, then click **Confirm**.

*TIP: For additional information see Section 3.10, Sparing Options: Disks and Arrays, on page 34.*

### 9.6.14 Add or Remove Global Spares

If a global spare is being added, make sure there is adequate space on the global spare.

#### 9.6.14.1 Add a Global Spare

1. In the **Disk List** section, select the disk chosen as the global spare.
2. At the **Disk** menu, select **Options**.
3. Select **Assign as Global Spare**, then click **Confirm**.

#### 9.6.14.2 Remove a Global Spare

1. In the **Disk List** section, select the disk to be removed as the global spare.
2. At the **Disk** menu, select **Options**.
3. Select **Remove as Global Spare**, then click **Confirm**.

### 9.6.15 Hide an Array

Hide allows the user to hide the array from the operating system.

#### 9.6.15.1 Hide an Array

1. In the **Array View** section, select the array to hide.
2. At the **Array** menu, select **Hide**. The array will disappear from the Array View.

*Note: If the array is currently hidden, select Array > Un-hide to display it.*

### 9.6.16 Secure Erase

Secure Erase is used for erasing all data on an array and ensuring that it will be unrecoverable, even with advanced data recovery techniques.

#### **Data is Securely Erased By:**

- Hiding the array from the OS
- Writing over each region of the disk with 3 patterns (0xAA, 0x55, and random)

- Using a 4th pass with all zeros to ensure that a RAID1 will be consistent

After the secure erase is complete, a user can choose to manually delete the array or reuse it. If the user chooses to reuse it, it must be unhidden using the procedure in Section 9.6.15, Hide an Array, on page 113.

**CAUTION:** *When an array is securely erased, the data on the array is lost.*

### **9.6.16.1 Securely Erasing an Array**

1. In the Array View section, select the array to erase.
2. At the Array menu, select **Secure Erase**, then click **OK**.

## **9.7 Working with Views**

The View menu allows the user to:

- Display the event view.
- Display the event log.
- Refresh the display.

### **9.7.1 Display or Hide Controller Event Log Panel**

To display or hide the Controller Event Log, select **Event View** at the View menu. When the Controller Event Log panel displays, a checkmark appears next to the **Event View** option at the View menu.

### **9.7.2 Log Window**

The [system name]: View Log window displays all of the messages generated by RAIDXpert2. All messages are logged, not just the ones enabled at **Options > Notification**.

All messages received from the RAIDXpert2 driver are sent to a message log file. If desired, change the name of this file in the Notification window.

By default, notification events in Windows-based systems are saved to:

%Program Files%\RAIDXpert2\rc\_service.log.

Notification events in Linux-based systems are saved to `/var/log/rc_service.log`.

At the View menu, select Log to view the RAIDXpert2 messages.

### **9.7.3 Refresh the Display**

To refresh the display, select Refresh at the View menu.

## 9.8 Working with Options

### 9.8.1 Change Password Settings

A password can be changed at the Options menu. See Section 9.2.2, Change a Password at the Options Menu, on page 92.

### 9.8.2 Set Event Notifications

With the Notification option, the user can set the level of event notifications.

The Event View section of the Array Status window displays the priority listing. The event log priority levels, in ascending order, are indicated in Table 30.

**Table 30. Event Log Priority Levels**

Event Priority	Description
Low	Displays messages for normal system operations. (This event is not displayed unless requested by the user.)
Informational	Displays information that might be useful to know.
Warning	The system user should to be informed about this event, but probably does not need to take action.
Critical	The system user must be informed about this event and should take action.
Fatal	The RAIDXpert2 driver is fatally damaged and the RAID subsystem has shut down.

### 9.8.3 Licensing

To display Licensing information, including available licensing levels, select **License** at the **Options** menu.

## 9.9 Add Spares Using a RAIDABLE Array

*Note: RAIDABLE array is formerly known as RAID Ready array.*

1. Install a new disk. After a rescan, a pop-up window opens.

*Note: To create a redundant RAID1 array, the new disk must be the same size or greater than the RAIDABLE disk.*

2. In the Select a Disk section, select the new disk.

3. In the Choose a Task section, select the desired option.

*Note: Selecting any option first initializes the disk before the selected task is started.*

- a. **Backup Array:** This option creates a backup of the RAIDABLE array on the new disk.
  - b. **Transform Array:** This option allows the user to either add space to the RAIDABLE array or create a redundant array.
  - c. **Initialize Disk for AMD-RAID:** This option allows the disk to be used when creating arrays.
  - d. **Make disk a Global Spare:** This option assigns the new disk as a global spare.
4. In the Select a Source/Destination section:
- a. Select the Source **RAIDABLE Array** from the drop-down menu.
  - b. Select the **Destination Array Type** from the drop-down menu.

*Note: The **Destination Array Type** option is only available when either the **Backup Array** task or **Transform Array** task is selected. Only valid array types for the number of disks inserted will be displayed. For example, if one new disk is inserted, only RAID0 or RAID1 will display in the drop-down menu.*

5. Click **Confirm**.

If either the Backup Array task or Transform Array task is selected, a Task Progress dialog box opens. To hide the dialog box while the task is executing, click Close.

# Chapter 10 `rcadm` Command Line Interface Tool

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## 10.1 What is `rcadm`?

The `rcadm` program is a command line interface (CLI) tool for managing RAIDXpert2 in the Windows, Linux, or EFI operating system. See Section 10.8, on page 124, for `rcadm.efi` Information.

The `rcadm` program initiates RAIDXpert2 operations, such as:

- Manage RAIDXpert2, arrays and disks (see Section 10.2, Manage Arrays and Disks: `rcadm --manage`, on page 118).
- Create new arrays (see Section 10.4, Create New Arrays: `rcadm --create`, on page 122).
- Delete arrays (see Section 10.5, Delete Arrays: `rcadm --delete`, on page 123).
- Transform arrays (see Section 10.6, Transform Arrays: `rcadm --transform`, on page 124).
- Follow or monitor arrays and disks (see Section 10.7, Follow or Monitor Arrays and Disks: `rcadm --follow`, on page 124).
- Information on drive and array states.

The `rcadm` program has five primary modes, with most primary modes having additional optional arguments. The five modes of operation are indicated in Table 39.

**Table 31. Modes for the `rcadm` Program**

Mode	Usage
Manage	Uses the <code>rcadm --manage</code> command to manage and query RAIDXpert2, arrays, and disks.
Create	Uses the <code>rcadm --create</code> command to create a new array.
Delete	Uses the <code>rcadm --delete</code> command to delete arrays.
Transform	Uses the <code>rcadm --transform</code> command to transform an array.
Follow	Uses the <code>rcadm --follow</code> command to follow or monitor arrays and disks.

Follow these instructions to issue the command on the operating system. Also, see Section 10.3, View Help from the Command Line, on page 122.

### 10.1.1 To Use `rcadm` with a Linux® Operating System

By default, `rcadm` is installed in `/usr/bin`.

### 10.1.2 To Use `rcadm` with a Windows® Operating System

- Change directories to `C:\Program Files (x86)\RAIDXpert2`.
- Run the `rcadm.exe` command from there.
- or
- Add `C:\Program Files (x86)\RAIDXpert2` to the system or user path environment variables.

## 10.2 Manage Arrays and Disks: `rcadm --manage`

The `rcadm --manage` or `rcadm -M` command allows the user to view information about RAIDXpert2 and manage the arrays and disks.

For example, the user can:

- Set cache attributes for arrays.
- Set priority levels for tasks on an array.
- Hide and unhide arrays.
- List arrays.
- Initialize disks.
- Query information about disks.
- Add and remove spares from an array.
- Set cache attributes for disks.

### 10.2.1 Understand Query Output

When the `rcadm --manage --query-all` or `rcadm -M -qa` command is used, information about the disks and arrays for the system is displayed.

To see information about a specific controller, disk, or array use the `rcadm --manage --query` command, in conjunction with the appropriate options.

## 10.2.2 rcadm Controller List Elements

**Table 32. rcadm Controller List Elements**

<b>Element</b>	<b>Description</b>
Number	Controller number assigned by RAIDXpert2
Type	Model number of the controller
Serial Number	Serial number of the controller
Port Count	The number of ports supported by RAIDXpert2
PCIe® Vendor ID	The PCIe vendor identification number
PCIe Device ID	The PCIe device identification number
PCIe SubVendor ID	The PCIe sub-vendor identification number
PCIe SubDevice ID	The PCIe sub-device identification number
SAS Address (WWID)	The SAS Address (world-wide identification number)
BIOS Version	The version of the AMD-RAID Configuration BIOS

### 10.2.3 rcadm Disk List Elements

**Table 33. rcadm Disk List Elements**

Element	Description
Disk	Disk number assigned by RAIDXpert2, corresponding to the SATA channel ID.
State	State of the disk (Online, Failed, Unknown)
Disk Type	Disk type (Disk, Legacy, New, ATAPI)
Port Type	Port type (SATA, SATA II, SATA III, SSD, NVMe)
Port Speed	The negotiated speed of the port <i>Note: For NVMe the port type is always N/A.</i>
Size	Total size of the disk: <ul style="list-style-type: none"> <li>• 1 MB = 1,000,000 bytes</li> <li>• 1 GB = 1,000,000,000 bytes</li> </ul> <i>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, RAIDXpert2 reports the same units.</i>
Free Space	Total amount of space unused on the disk
Largest Free Space	Largest contiguous unused space on the disk
GS	Indicates if the disk is assigned as a global spare
Ca	Current disk cache setting (NC = No Cache, R = Read Cache, W = Write Back Cache, RW = Read + Write Back Cache). <i>Note: For NVMe the CA is always NC.</i>
Ctrl Chan	Disk controller and channel number.
Vendor	Disk vendor
Model Number	Disk model number
Firmware Version	Disk firmware version
Serial Number	Disk serial number



## 10.2.4 rcadm Array List Elements

**Table 34. rcadm Array List Elements**

Element	Description
A	Array number assigned by RAIDXpert2
Type	RAID type.
O.S. Name	Name assigned by the operating system to the array. The name shows as “Hidden” if the array is hidden from the operating system. The name shows “??” if the array is Offline.
Sys or System Device	Indicates whether or not the array is being used as a system disk under Windows
State	State of the array (Normal, Critical, Offline)
Size or Capacity	Total size of the disk: <ul style="list-style-type: none"> <li>• 1 MB = 1,000,000 bytes</li> <li>• 1 GB = 1,000,000,000 bytes</li> </ul> <p><i>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, RAIDXpert2 reports the same units.</i></p>
Hide	Whether the array is hidden from the operating system
Id	Globally unique identifier for the array assigned by RAIDXpert2
Task	Task type (Transform, Check, Check_Bitmap, Not_Active, Create, Restore) <i>Note: See Section 3.7, Array Tasks: Starting and Stopping Tasks, on page 31 for detailed definitions.</i>
Task State	The state of the task (Started, Paused, Completed)
%	The progress of a current array task, such as a Create or Transform, shown as percent complete
CA	Current array cache setting (NC=No Cache, R=Read Cache, W=Write Back Cache, RW=Read + Write Back Cache).

Table 34. rcadm Array List Elements (Continued)

Element	Description
CTS	Cache tag size specifies the amount of data per disk in a stripe. Supported sizes are 64kB, 128kB or 256kB Any Array with only HDD/SSD will have default CTS of 64k Any Array with NVMe/HDD/SSD will have default CTS of 256k
Scan	Background scan enabled (Yes/No)
Name	User-supplied name for the array
Dedicated Spare	Indicates the number of dedicated spares assigned to the array ( <code>--verbose</code> mode only)
Disk	Listing of disks that are part of the array
Used	Capacity used of a specific disk
Offset	Location on the disk where the array begins

## 10.3 View Help from the Command Line

### 10.3.1 To view a List of the Major Modes of Operation

Type: `rcadm --help` or `rcadm -?`

#### 10.3.1.1 To View Help for a Specific Mode and its Options

Type: `rcadm <mode> --help` or `rcadm < mode> -?`

For example, typing `rcadm --manage --help` or `rcadm -M -?` displays help and examples regarding that specific mode and its options.

#### 10.3.1.2 To view the rcadm Man Page on a Linux® System

Type: `man rcadm`

## 10.4 Create New Arrays: `rcadm --create`

The `rcadm --create` or `rcadm -C` command allows new arrays to be created. As many as eight arrays can be partitioned and created 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.

### 10.4.1 Before You Begin...

Creation of arrays, even redundant arrays, allows users immediate access to the arrays. If the system reboots, the creation process continues where it left off.

*CAUTION: In some circumstances, more than eight arrays are possible. They might appear to function properly, but are not supported.*

*Note: The array size of the new array is limited to 2.199 TB with some operating systems. Refer to the operating system documentation for details on maximum array sizes.*

*Note: The ability to create RAID10 or RAIDABLE arrays may not be available on your system.*

### 10.4.2 Example

To create a 1 GB RAID1 array using disk members 1, 2, and 3, type: `rcadm -C -r1 -d 1 2 -s 1000`

To see more examples, type: `rcadm -C -?`

## 10.5 Delete Arrays: `rcadm --delete`

The `rcadm --delete` or `rcadm -D` command allows the user to delete one or more arrays.

*CAUTION: Deleting an array permanently destroys all data that is on the array. This action cannot be undone and it is very unlikely the data can be recovered.*

### 10.5.1 Before You Begin...

- If the operating system is using an array it cannot be deleted.
- If an array is accidentally deleted, and the user wants to try and recover the data, create an array using the same disks, same size, and same cache, and use the `--leave-existing-data` option. This option writes new configuration information to the array while trying to use the exact same disk space as before.

### 10.5.2 Example

To delete array 1, type: `rcadm -D -a 1`

To see more examples, type `rcadm -D -?`

## 10.6 Transform Arrays: `rcadm --transform`

The `rcadm --transform` or `rcadm -T` command allows the user to transform (migrate) an array from one RAID level to almost any other RAID level, and to expand the array dynamically, even under I/O load.

### 10.6.1 Before You Begin...

- An array cannot be transformed to a smaller-sized array. New arrays must be either the same capacity or larger.
- When using the task control option, a Transform can only be paused or resumed but not removed.
- If a spare has been assigned to the destination array, a fail-over task starts as soon as the Transform completes, provided the spare is available after the Transform.
- If there are multiple arrays on a single controller, it might not be possible to transform some of the arrays to a larger size. If the size of an array might be expanded in the future, it is best to configure the available space as a single array.
- The array size of the transformed array is limited to 2.199 TB on some operating systems.

## 10.7 Follow or Monitor Arrays and Disks: `rcadm --follow`

The `rcadm --follow` or `rcadm -F` command allows the user to follow or monitor arrays and disks. It polls the RAID subsystem for any status changes and logs them in the Windows System Event Log.

### 10.7.1 Before You Begin...

It is recommended that the user not run more than one instance of `rcadm --follow` at the same time. If the user runs more than one instance of the command, each instance captures some of the events, but no single instance captures all events.

## 10.8 `rcadm.efi` Information

### 10.8.1 `rcadm -?`

`-?, --help`

Displays all primary `rcadm` commands, or if used after an option, displays help for that specific option.

`-log, --log-file`

Print output to a log file as well as standard output. Requires a log file name argument. Overwrites existing file. Only one occurrence of this option on the command line is allowed.

Example: `rcadm -M -qa -v -log status.txt`

`-C, --create`

Command for creating arrays. Array types include linear (JBOD), volume (JBOD), RAID0, RAID1, RAID10, RAID10n, and RAIDABLE. Some of the major functions include assigning spare disks; setting array size; and setting cache attributes.

`-D, --delete`

Command for deleting arrays. This mode does not have any optional arguments.

`-M, --manage`

Commands for managing and querying controllers, arrays, and disks. Some of the major functions include querying for information, adding and removing dedicated and global spare disks, setting cache attributes for arrays and disks, performing consistency checks on redundant array types, initializing disks, prioritizing tasks for arrays, scanning arrays and disks for changes in status, and hiding or unhiding arrays.

## 10.8.2 `rcadm -M`

### MANAGE

`-a, --array`

Used with certain options to specify arrays.

`-as, --add-spare`

Adds a dedicated spare disk to an array. No space is reserved on the disk selected.

`-rs, --remove-spare`

Removes a dedicated spare disk from an array.

`-ras, --remove-all-spares`

Removes any spares from an array.

`-ags, --add-global-spare`

Adds a disk as a global spare. No space is reserved on the disk selected.

`-rgs, --remove-global-spare`

Removes a global spare disk.

`-ca, --cache-array`

Sets the cache attributes for an array. Cache attributes include read cache (r), read and write-back cache (rw), write-back cache (w), and no cache (nc).

`-cd, --cache-disk`

Sets the cache attributes for a disk. Cache attributes include read cache (r), read and writeback cache (rw), write-back cache (w), and no cache (nc).

`-d, --disk`

A required qualifier used with certain options to specify disks.

`-h, --hide`

Hides an array from the operating system.

`-uh, --unhide`

Unhides an array, making it visible to the operating system.

`-id, --initialize-disk`

Initializes a disk. If the disk is new and has not been used, you must initialize it before you can create arrays.

`-n, --name`

Identifies an array with a user-supplied name. The name can be up to 30 characters, but only 17 of those characters display in the BIOS.

`-p, --priority`

Sets an array's task priority from 1-10, with 10 being the highest priority.

`-q, --query`

Lists information about specific controllers, arrays, and disks.

`-qa, --query-all`

Lists information about controllers, arrays, and disks.

`-v, --verbose`

Modifier of the `--query` and `--query-all` option. Specifies more detail for arrays and disks.

`-rsc, --rescan`

Rescans the serial ATA (SATA) channels for new or removed disks.

`-sa, --scan-array <on|off>`

Specifies if background array scan scanning is on or off.

`-sp, --smart-poll`

Turns SMART polling on or off for the specified drive(s).

`-t, --task`

Used to pause, resume, and remove tasks.

`-ul, --unlink`

Unlinks two arrays linked through a create copy operation.

## SYNTAX and EXAMPLES

### ADD SPARE

```
--add-spare --array <list> --disk <list>
-as -a <list> -d <list>
```

```
Examples: rcadm --manage --add-spare --array * --disk 1
rcadm -M -as -a 1 2 -d 5 6
```

### REMOVE SPARE

```
--remove-spare --array <list> --disk <list>
-rs -a <list> -d <list>
```

```
Examples: rcadm --manage --remove-spare --array 5 --disk *
rcadm -M -rs -a * -d 5
```

### REMOVE ALL SPARES

```
--remove-all-spares --array <list>
-ras -a <list>
```

```
Examples: rcadm --manage --remove-all-spares --array 5
rcadm -M -ras -a *
```

### ADD GLOBAL SPARE

```
--add-global-spare --disk <list>
-ags -d <list>
```

```
Examples: rcadm --manage --add-global-spare --disk 1 2 3
rcadm -M -ags -d *
```

### REMOVE GLOBAL SPARE

```
--remove-global-spare --disk <list>
-rgs -d <list>
```

```
Examples: rcadm --manage --remove-global-spare --disk *
```

```
rcadm -M -rgs -d 5
```

### CACHE SETTINGS FOR ARRAYS

```
--cache-array <cache_attribute> --array <list>  
-ca <cache_attribute> -a <list>
```

Cache attributes: <r> for read cache

<rw> for read and write-back cache

<w> for write-back cache

<nc> for no cache

Examples: `rcadm --manage --cache-array rw --array *`

```
rcadm -M -ca nc -a 1
```

### DISK SETTINGS (Advanced)

Disk cache:

```
--cache-disk <cache_attribute> --disk <list>  
-cd <cache_attribute> -d <list>
```

Cache attributes: <r> for read cache

<rw> for read and write-back cache

<w> for write-back cache

<nc> for no cache

Examples: `rcadm --manage --cache-disk r --disk 1 2 3`

```
rcadm -M -cd w -d *
```

### HIDE ARRAY

```
--hide --array <list>  
-h -a <list>
```

Examples: `rcadm --manage --hide --array 5 6`

```
rcadm -M -h -a 4
```

### UNHIDE ARRAY

```
--unhide --array <list>  
-uh -a <list>
```

Examples: `rcadm --manage --unhide --array *`

```
rcadm -M -uh -a 5
```

### INITIALIZE DISK

```
--initialize-disk --disk <list>
```



-id -d <list>

Examples: rcadm --manage --initialize-disk --disk \*  
rcadm -M -id -d 1 2 3

## NAME ARRAY

--name "name" --array <list>  
-n "name" -a <list>

Examples: rcadm --manage --name "System Disk" --array 5  
rcadm -M -n "Backup Disk" -a 4

## QUERY

--query [--array <list>] [--disk <list>]  
[--verbose]  
-q [-a <list>] [-ct <list>] [-d <list>] [-v]

Examples: rcadm --manage --query --array 1 --disk --verbose  
rcadm -M -q -a 1 2 3 -d -v

## QUERY ALL

--query-all  
-qa

Example: rcadm --manage --query-all

## RESCAN DISKS

--rescan  
-rsc

Example: rcadm --manage --rescan

## SCAN ARRAY

--scan-array <on|off> --array <array\_number>  
-sa <on|off> -a <array\_number>

Example: rcadm -M --array 1 --scan-array on

rcadm -M -a 1 -sa off

## SMART POLL

--smart-poll <on|off> --disk <list>  
-sp <on|off> -d <list>

Example: rcadm --manage --smart-poll on --disk

rcadm -M -sp off -d 1 2 3

## TASK CONTROL

--task <task\_operation> --array <array\_number>  
-t <task\_operation> -a <array\_number>

### Task Operation

<pause> to temporarily pause a task  
 <resume> to continue running a task  
 <remove> to permanently remove a task

Examples: `rcadm --manage --task pause --array 5`  
`rcadm -M -t remove -a 4`

### TASK PRIORITY

`--priority <1..10> --array <list>`  
`-p <1..10> -a <list>`

Examples: `rcadm --manage --priority 5 --array 6`  
`rcadm -M -p 1 -a`

### UNLINK ARRAY

`--unlink --array <array_number>`  
`-ul -a <array_number>`

Examples: `rcadm --manage --unlink --array 2`  
`rcadm -M -ul -a 5`

## 10.8.3 rcdm -C

### CREATE

#### Long form:

```
rcadm --create <raid_type> --disk <list> [--size <size_mb>]
      [--sub-member <num>] [--spare-disk <list>]
      [--no-sync] [--d-spare] [--cache <r,rw,w,nc>]
      [--max-size] [--name "name"] [--priority <1..10>]
      [--zero][--scan-array]
```

#### Short form:

```
rcadm -C <raid_type> -d <list> [-s <size_mb>] [-sub <num>]
      [-sp <list>] [-ns] [-ds] [-ca <r, rw, w, nc>] [-ms]
      [-n "name"] [-p <1..10>] [-z] [-sa] }
```

#### RAID Types:

`--volume, -v` Single disk or concatenation of disks (JBOD)  
`--raidable, -ra` Single disk, RAIDABLE  
`--raid0, -r0` Stripe of two or more disks

`--raid1, -r1` Mirror of two disks  
`--raid10, -r10` Stripe set of mirror sets

## OPTIONS

`-sp, --spare-disk`

Specifies the dedicated spare disk or disks to assign, with a maximum of four. No space is reserved on the selected disks.

`-s, --size`

Specifies the size of the array in MBs. If you do not use this option, the largest possible size is used by default.

`-ns, --no-sync`

Disables background synchronization of redundant types when creating the array.

`-ca, --cache`

Specifies a cache setting for the array(s): read cache <r>, read and write-back cache <rw>, write-back cache <w>, or no cache <nc>. The default is read and write-back cache <rw>.

`-cts, --cachetagsize`

Specifies the Cache Tag Size. This is the amount of data per disk in a stripe. Supported sizes are 64, 128, or 256; sizes in kB.

Please refer to Table 17, Default Cache Tag Size, on page 55.

`-ms, --max-size`

Prints the maximum possible size for an array without actually creating an array.

`-n, --name`

Identifies an array with a user-supplied name. The name can be up to 30 characters, but only 17 of those characters display in the BIOS.

`-p, --priority`

Sets the background initialization task priority from 1 to 10, with 10 being the highest priority. For redundant array types only.

`-led, --leave-existing-data`

Leaves the existing data on the disks untouched after the array is created. This option can be used to try to recover user data when an array has been accidentally deleted or the configuration information is lost but the data is still intact. Unless you immediately recreate the array after deleting it and no other tasks have been performed, the likelihood of recovering data with this method is very low.

`-d, --disk`

A required qualifier used with the `--create` option to specify the disk or disks to be included in the array.

`-sa, --scan-array`

Specifies that a background array scan should be continuously run whenever the array is idle (Default is off).

`-z, --zero`

Zero the array in the foreground. This method is faster than doing a background consistency verifies if the array is a redundant type. For non-redundant types, the zero option can be used to verify all blocks in the array can be accessed.

## EXAMPLES

Example: Create a RAID1 set of the maximum possible size using all disks.

```
rcadm -C -raid1 --disk *
```

Example: Create a RAID1 set of the maximum possible size, with a spare disk and without a background initialization task.

```
rcadm -C --raid1 --spare-disk 3 --disk 1 2 --no-sync
```

## 10.8.4 **rcadm -D**

### DELETE

Long form:

```
--delete --array <list> [--no-ask]
```

Short form:

```
-D -a <list> [-na] [-cg <group number>]
```

### OPTIONS

`-na, --no-ask`

If the no ask option is specified the array is deleted without confirmation.

### EXAMPLES

Example: Delete arrays 1 and 2.

```
rcadm -D --array 1 2
```

Example: Delete all arrays.

```
rcadm -D --array
```

# Chapter 11 Troubleshooting

## 11.1 Troubleshooting

The chapter discusses four major categories of troubleshooting:

- Problems with system startup.
- Warning messages that might appear at the Power-On Self-Test (POST) screen.
- Problems with arrays.
- Problems with disks.

## 11.2 System Startup Problems

Table 35 and Table 36 correlate possible startup issues and corrective actions for system boot.

**Table 35. The System Does Not Boot**

Possible Causes	Corrective Actions
Controller mode is set incorrectly during system startup	In the system's BIOS screen, ensure SATA settings are in RAID mode.
The system's boot mode or boot sequence retry mode is set incorrectly	In the system's BIOS screen, ensure that the bootable array is the first array listed. If not, use the Swap Two Arrays option to reposition the arrays.
A bootable array is in an Offline state	Restart the system. Enter the system's BIOS screen. Check the state of the bootable array. Check for missing or offline disks.

**Table 36. The BIOS Configuration Utility Does Not Display**

Possible Causes	Corrective Actions
The controller mode is set incorrectly in the system BIOS	In the system's BIOS screen, ensure the SATA settings are correct.

**Table 37. Username and Password**

<b>Problem</b>	<b>Corrective Actions</b>
A user forgets the username or password.	Reset the username and password by deleting <code>rc_login.txt</code> . This restores the default user name and password ( <code>admin</code> and <code>admin</code> ).

## 11.3 Warning Messages: POST Screen

The POST screen is one of the first screens to appear during the system’s boot sequence. If the system’s arrays were in Normal or Ready state prior to a system boot, the boot sequence continues normally to the operating system.

But, if an array is in Critical or Offline state, or if specific options at Controller Options were changed previously at the BIOS Configuration Utility, the warning messages displayed by OProm are described in Table 38 appear during the boot sequence.

**Table 38. POST Screen Warning Messages**

<b>Warning Message</b>	<b>Additional Information</b>	<b>Corrective Action</b>
<b>WARNING: Found arrays that are Critical [or equivalent]</b>	This warning message appears when at least one array is in a Critical state and Toggle Pause if Critical is set to ON at the BIOS Configuration Utility. The Critical state of an array depends on the RAID level of the array and the number of disks that have failed. See Section 3.3, Array States, on page 28, for information on criticality. If an array is Critical (even a bootable array), the system can continue through the boot process to the operating system.	See Section 11.5.1, Troubleshooting Disks, on page 139.

**Table 38. POST Screen Warning Messages (Continued)**

Warning Message	Additional Information	Corrective Action
<b>WARNING: Found arrays that are Offline</b> [or equivalent]	<p>This warning message appears when at least one array is in an Offline state and <b>Toggle Pause if Offline</b> is set to <b>ON</b> at the BIOS Configuration Utility.</p> <p>If two or more disks in a redundant array have failed, or if a single or multiple disks in a non-redundant array have failed, data has been lost.</p> <p>In RAID10 array, if a single disk fails in each mirrored set, the redundant array goes to a Critical state but data is not lost. If two disks fail in one of the mirrored sets, the redundant array goes to an Offline state and data is lost.</p>	<p>See Section 11.5.1, Troubleshooting Disks, on page 139.</p> <p>If, after performing a rescan, the state remains Offline, the bootable array has suffered an unrecoverable failure.</p> <p>Create a new bootable array.</p> <p>Reinstall the operating system and drivers.</p>
<b>WARNING: Found arrays that are Critical and Offline</b> [or equivalent]	A bootable array that is in an Offline state prevents the operating system from booting.	
BIOS NOT INSTALLED - User Disabled INT13 BIOS Load [or equivalent]	<p>This warning message appears when <b>Toggle INT13 Boot Support</b> option has been set to <b>OFF</b> at the BIOS Configuration Utility and another boot device is not selected.</p> <p>Bootable devices do not function with the controller when <b>Toggle INT13 Boot Support</b> is set to <b>OFF</b>. The default setting is <b>ON</b>, which allows bootable devices to function with the controller.</p>	<p>Restart the system.</p> <p>Enter the system's BIOS screen.</p> <p>Select <b>Main Menu &gt; Controller Options &gt; Toggle INT13 Boot Support</b>.</p> <p>Change <b>Toggle INT13 Boot Support</b> from <b>OFF</b> to <b>ON</b>.</p> <p>Navigate to Main Menu.</p> <p>Select <b>Continue to Boot</b>.</p> <p>The system boot process continues to the operating system.</p>

## 11.4 Array-Related Errors

- Table 39. Cannot Create an Array, on page 136
- Table 41. An Array is in an Offline State, on page 137
- Table 40. An Array is in a Critical State, on page 137
- Table 42. Cannot Assign a Dedicated Spare to an Array, on page 137
- Table 43. Cannot Create a Global Spare, on page 138
- Table 44. Recreate a Deleted Array, on page 138

**Table 39. Cannot Create an Array**

Possible Causes	Additional Information	Corrective Actions
The disk is not displayed.	The controller cannot communicate with the disks.	See Section 11.5.1, Troubleshooting Disks, on page 139.
Insufficient free space available on the selected disks		Select a different combination of disks.
Incorrect number of disks selected for the desired RAID level	See 3.2, RAID Levels, on page 27, for a description of RAID levels and the allowable number of disks used with each RAID level.	Select the correct number of disks.
The desired disk is unavailable.	The disk is a dedicated spare for a different array. The disk is full. The disk's available capacity is insufficient.	Select a different disk.
The disk has SMART errors.	An array can be created with a disk that has SMART errors, but only if the array is created in the BIOS Configuration Utility. RAIDXpert2 cannot be used to create an array with a disk that has SMART errors.	Use the BIOS Configuration Utility to create the array.
The system already has a maximum of eight arrays		Delete unused arrays. <b>CAUTION:</b> <i>Deleting an array permanently destroys all data that is on the array. This action cannot be undone and it is very unlikely the data can be recovered.</i>



**Table 40. An Array is in a Critical State**

Possible Causes	Additional Information	Corrective Actions
One or more disks in the array have failed or been removed.	Due to the failed disk or disks, the array is no longer maintaining redundant (mirrored or parity) data. The failure of an additional disk results in an Offline state and lost data.	See Section 11.5.1, Troubleshooting Disks, on page 139.

**Table 41. An Array is in an Offline State**

Possible Causes	Additional Information	Corrective Actions
The array has lost the maximum allowable disks per RAID level.	One or more disks have failed. <ul style="list-style-type: none"> <li>If the array is non-redundant, the failure of a single disk causes the array to fail.</li> <li>If the array is redundant, the failure of two or more disks causes the array to fail.</li> </ul> The array cannot be restored (rebuilt).	See Section 11.5.1, Troubleshooting Disks, on page 139.

**Table 42. Cannot Assign a Dedicated Spare to an Array**

Possible Causes	Additional Information	Corrective Actions
The RAID level does not allow dedicated spares.	Dedicated spares cannot be created for Volume or RAID0 arrays.	<ul style="list-style-type: none"> <li>Create an array with a different RAID level and assign a dedicated spare.</li> <li>Create a global spare.</li> </ul>
The designated disk does not have sufficient capacity to be a dedicated spare	The capacity of the disk selected to be a dedicated spare must be equal to or larger than the capacity of the smallest disk in the array.	Select a different disk.

**Table 43. Cannot Create a Global Spare**

Possible Causes	Additional Information	Corrective Actions
The disk is already part of an array	A global spare cannot be selected if it is already part of an existing array.	Select a different disk.
There are no empty disks available or the disks have not been initialized	A disk with a legacy state can be initialized, if desired, but it is no longer legacy (initialization adds RAIDXpert2 configuration information to the disk).	Install additional disks. Initialize the disks. <b>CAUTION:</b> When a disk is initialized, all data on the disk is lost.
The disk assigned as the global spare has failed or is missing.		See Section 11.5.1, Troubleshooting Disks, on page 139.

**Table 44. Recreate a Deleted Array**

Possible Causes	Additional Information	Corrective Actions
An array(s) was accidentally deleted, or the wrong array was deleted	This procedure might recreate a deleted array and with its data intact. However, this is not guaranteed to occur. If I/O was running to the deleted array(s) just prior to it being deleted, there might be some data loss in the recreated array(s). If multiple arrays were deleted, all of the deleted arrays must be recreated in order to recover the desired array.	<ol style="list-style-type: none"> <li>At the Array pop-up menu, select <b>Create</b>.</li> <li>Create a new array using the same settings as the deleted array. <ul style="list-style-type: none"> <li>The same disks.</li> <li>The same RAID type (RAID level).</li> <li>The same capacity.</li> <li>The same cache options.</li> </ul> </li> <li>Check Leave Existing Data Intact.</li> <li>Click <b>Create</b>.</li> <li>Ensure the settings are the same as the deleted array: <ul style="list-style-type: none"> <li>The same drive letter.</li> <li>The same RAID type (RAID level).</li> <li>The same disks.</li> <li>The same capacity.</li> <li>The same cache option</li> </ul> </li> <li>Check the data files of the array for corrupted or missing files, incorrect file extensions, and so on.</li> </ol>

## 11.5 Disk Related Errors

- Table 45. Disk Errors
- Section 11.5.1, Troubleshooting Disks, on page 139.

**Table 45. Disk Errors**

Possible Causes	Additional Information	Corrective Actions
A disk has been removed from an array		See Section 11.5.1, Troubleshooting Disks, on page 139.
A disk is not visible in the BIOS Configuration Utility or is offline		
A disk is highlighted red at the BIOS Configuration Utility	The disk has failed. Depending on the RAID level of the array, data might be lost.	
RAIDXpert2 cannot communicate with the spare	The dedicated spare is not visible in the BIOS Configuration Utility or is offline.	
The disk cannot be initialized	Only disks that are Ready can be initialized. <i><b>CAUTION:</b> When a disk is initialized, all data on the disk is lost.</i>	<ul style="list-style-type: none"> <li>• Ensure the disk is not already a member of an array.</li> <li>• Ensure the disk is still assigned as a global or dedicated spare.</li> <li>• Ensure the disk is reporting a Ready state.</li> </ul>

### 11.5.1 Troubleshooting Disks

Perform the following actions when there may be a problem with a disk.

- Ensure there is no damage to the system's backplane.
- Ensure all cables are installed correctly.
- Ensure the disk is seated correctly in the backplane or bay and the latch is secured.
- Reinsert the disk.
- Replace the disk.
- After reconnecting, reseating, reinserting, or replacing a disk:
  - Perform a rescan.
  - Initialize the disk.

***CAUTION:** When a disk is initialized, all data on the disk is lost.*

If problems with a disk have caused an array to go Critical, it may be necessary to also assign a dedicated or global spare for the array.

If problems with a disk have caused an array to go Offline, data may have been lost. Recover lost data from a backup storage source.

## 11.6 Troubleshooting the Web GUI

- Table 46. RAIDXpert2 Web Graphical User Interface (GUI) Troubleshooting

**Table 46. RAIDXpert2 Web Graphical User Interface (GUI) Troubleshooting**

<b>Problem</b>	<b>Possible Cause</b>	<b>Corrective Actions</b>
License Level 0 when logging in.	The RAIDXpert2-CGI (rc_cgi) service stopped working or not running.	Restart the rc_cgi service.
Cannot reach this page or similar.	The Apache service has stopped working or not running.	Restart the Apache service.
Web GUI blank, no array or disc information.	Array name contains a forbidden character.	<p>Open a Command Prompt in Windows.</p> <p>Type <code>cd C:\Program Files (x86)RAIDXpert2</code></p> <p>Enter the following command:  <code>rcadm.exe -M -n "NewName" -a #</code></p> <p>Where # is the Array that has the forbidden character in its name.</p> <p>Press <b>Enter</b>.</p>

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## Chapter 12 Software License: EULA

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