AMD-RAIDXpert2 User Guide

Advanced Micro Devices

Contents

List of Tables

Revision History

Date	Revision	Description

June 2016	3.01	Second Public Release.
		 Removed support for the Microsoft® Windows® 8 operating system.
		 Removed support for Ubuntu 13.10. This included removing extra steps that concerned Ubuntu 13.10.
		 Updated Operating System Requirements
		 Removed references to Windows XP and Windows 8.1.
		 Replaced SUSE (SLED) references with Red Hat (RHEL) 7.2 64 bit
		 Updated revisions of Ubuntu Desktop Linux
		    • 15.04 32 bit and 64 bit
		    • 15.10 32 bit and 64 bit
		 Removed support for SLED
		 Removed support for Ubuntu 12.04.04 and 14.04, 32 bit and 64 bit
		 Changed supported controllers
		 Removed RAID5 from Table 6 and Table 8
		 Updated steps for BIOS and UEFI boot platforms

November 2013	3.00	Initial Public release

Preface

This user guide:

- 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® 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, or SATA)
- Fibre Channel and Ethernet protocols

Document Conventions and Symbols

Table 1. Document Convention

Convention	Element
Navy blue, underlined text (http://www.example.com)	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 initializing, configuration data is written to the disk. The legacy array then becomes an online disk usable in arrays. *CAUTION: A legacy disk can contain valid data. When a legacy disk is initialized, all data on the disk is lost.*
Linux®	Free, open-source UNIX-based operating system.

Chapter 1   Safety Precautions

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 the book.

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, RAIDXpert2 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 RAIDXpert2 array are lost if the RAIDXpert2 disks of the array are migrated to a non-RAIDXpert2 system.*

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

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

CAUTION: *Creating a redundant array with Skip Initialization selected can result in data corruption.*

CAUTION: *Hot-Swapping is not recommend for disks that are part of the Boot Virtual Disk or which are connected to the AMD 300- Series Chip.*

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.

2.2   Who Should Use This Manual

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 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 manual 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: 4 GB. Recommended: 8 GB.
Hard disk	1–12 SATA or SSD drives. The number of disks depends on the number, type, and capacity of the arrays to be created. In some circumstances, more than 12 disks are possible. They may appear to function properly, but are not supported by AMD-RAID

2.3.1   Supported Controllers

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

- AMD Socket AM4-Compatible Processors
- AMD 300-Series Chipsets

2.3.2   Supported Operating Systems

RAIDXpert2 currently supports the following operating systems:

- Microsoft® Windows® 7: Professional Edition, Ultimate Edition; 32 bit and 64 bit
- Microsoft Windows 10: 64 bit
- Red Hat Enterprise Linux® (RHEL) 7.2 64 bit
- Ubuntu Desktop Linux 15.04 32 bit and 64 bit
- Ubuntu Desktop Linux 15.10 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 4 describes these features. Also see Table 5, on page 20, for a summary of features that are available with each license level of RAIDXpert2: RAIDXpert2 Basic and RAIDXpert2 Plus.

Table 4. Features of RAIDXpert2

RAIDXpert2 Feature	Description
Arrays (general information)	RAIDXpert2 allows: • Creating arrays of different RAID levels using the same disks. • Creating different RAID level arrays on the same disk, to adapt each array to the I/O that it processes. • 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. • The ability to create RAID10 or RAIDABLE arrays may not be available on your system. • 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 and RAIDXpert2 license level. • 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.
Array Hiding	An array can be hidden from the operating system so that neither the software nor users can see or access it.

Table 4. Features of RAIDXpert2 (Continued)

RAIDXpert2 Feature	Description
Array Recovery	If an 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, Disk Read Ahead Cache, Write Back Cache, Read + Write Back Cache.
Cache Support for Disks	Various disk-caching options are supported: No Cache, Disk Read Ahead Cache, Disk Write Back Cache, Disk Read Ahead + Write Back Cache.
Secure Erase	All data on an array can be erased and ensured it is unrecoverable, even with advanced data recovery techniques.
Consistency Check	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.
Disk Roaming	With disk roaming, SATA cables can be disconnected from their disks and shuffled without confusing RAIDXpert2. *Note: Disconnect the SATA cables from the disks only when the system is shutdown.* Disk roaming also allows: • 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. • Disk(s) to be moved between systems. *Note: It might not be possible to move disks between systems if they contain boot arrays.*
Fault Tolerance	The following fault tolerance features are available with RAIDXpert2, in order to prevent data loss in case of a failed disk. • Disk failure detection (automatic). • Array rebuild using hot spares (automatic, if the hot spare is configured for this functionality). • Parity generation and checking (RAID5 only). • 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 300-Series Chipset. For example if a disk fails in RAID1, the array remains functional and data is read from the surviving mirrored disk.
Mirror Rebuilding	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.

AMD-RAIDXpert2 User Guide

Table 4. Features of RAIDXpert2 (Continued)

RAIDXpert2 Feature	Description
Multiple RAID Levels per Disk	Support for multiple array levels per disk allows the administrator to create arrays of different RAID levels using the same disks.
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. *Note: This feature is not available with all license levels. See Table 5.*
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. *Note: This feature is not available with all license levels. See Table 5.*
RAID Level Support	RAIDXpert2 supports RAID levels 0, 1, 5, 10, Volume, and RAIDABLE. *Note: RAID5, and RAIDABLE are not supported by all license levels. See Table 5.* *Note: The ability to create RAID10 or RAIDABLE arrays may not be available on your system.*
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

IMPORTANT: *The supported feature set (for RAIDXpert2 Basic or RAIDXpert2 Plus) is determined by the license level that is included in the system BIOS. Refer to the system's motherboard specifications for the supported features.*

Table 5. Feature Set for RAIDXpert2: by RAIDXpert2 License Level

Features	Sub-Features	License Levels	
		RAIDXpert2 Basic	**RAIDXpert2 Plus**
Option ROM (BIOS) Support[1]	Create array	Yes	Yes
	Delete array	Yes	Yes
	Boot/INT13 control	Yes	Yes
RAID Levels Supported[2]	0	Yes	Yes
	1	Yes	Yes
	5	No	Yes
	10	Yes	Yes
	RAIDABLE	Yes	Yes
	Volume	Yes	Yes

Table 5. Feature Set for RAIDXpert2: by RAIDXpert2 License Level (Continued)

Features	Sub-Features	License Levels	
		RAIDXpert2 Basic	RAIDXpert2 Plus
Array Creation	No initialization	Yes	Yes
	Foreground initialization	Yes	Yes
	Background initialization	Yes	Yes
Array Deletion		Yes	Yes
Array Transformation		Yes	Yes
Sparing	Global	Yes	Yes
	Dedicated	Yes	Yes
Consistency Check	Background	Yes	Yes
	Scheduled	Yes	Yes
Online Capacity Expansion (OCE)[3]		No	Yes
Online RAID Level Migration (ORLM)		No	Yes
Drive/Disk Roaming[4]	Same-system support	Yes	Yes
	Between-systems support	Yes	Yes
RAIDXpert2 Web GUI (Management GUI)		Yes	Yes
rcadm (management CLUI)		Yes	Yes
Drive Interfaces Supported[5]	SATA	Yes	Yes
	SSD	Yes	Yes
	ATAPI	Yes	Yes

Table 5. Feature Set for RAIDXpert2: by RAIDXpert2 License Level (Continued)

Features	Sub-Features	License Levels	
		RAIDXpert2 Basic	**RAIDXpert2 Plus**
Dissimilar Disk Support Within The Same Array		Yes	Yes
Cache Support	No Cache	Yes	Yes
	Read Cache	Yes	Yes
	Write Back Cache	Yes	Yes
	Read with Write Back Cache	Yes	Yes
Create Array and Delete Array Functions Without Rebooting		Yes	Yes
Restore (Rebuild) Priority		Yes	Yes
Multiple RAID Levels per Disk[6]		Yes	Yes
Touched Region Logging[7]		Yes	Yes
E-mail Event Notification		Yes	Yes
System Event Log Integration		Yes	Yes
Instant Create Support[8]		Yes	Yes
Hot-Swap Support[9]		Yes	Yes

Notes:

1. At the AMD BIOS Configuration Utility (also referred to as the Option-ROM) arrays can be created or deleted, and Critical or Offline arrays are indicated. INT13 support can be turned off completely at the BIOS Configuration Utility.

2. See Chapter 3, Arrays, Disks and RAID Levels, on page 24, 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.

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 RAID5 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.

7. 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.

8. 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 using RAID5, the array is not redundant until a consistency check is performed.

9. Disks can be added to the system and to an array while the system is operating, but is not recommend for disks that are part of the Boot Virtual Disk or which are connected to the AMD 300-Series Chipset.

Chapter 3   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 6.

Table 6. RAID Levels – General Characteristics

RAID Level	Main Characteristic	Use/Usefulness
RAID0 (Striping)	• Provides the highest performance but no data redundancy. Data in the array is striped (distributed) across several disks. • Supports 2-8 disks.	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)	• Mirrors data on a partition of one disk to another. • Supports 2 disks.	Useful when there are only two disks available and data integrity is more important than storage capacity.

Table 6. RAID Levels – General Characteristics (Continued)

RAID Level	Main Characteristic	Use/Usefulness
RAID10 (Striped RAID1 Sets)	• Combines mirrors and stripe sets. RAID10 allows multiple disk failures, up to 1 failure in each mirror that has been striped. • Supports 4, 6, or 8 disks.	Offers better performance than a simple mirror because of the extra disks. Requires twice the disk space of RAID1 to offer redundancy.
Volume (JBOD)	• RAIDXpert2 treats one or more disks or the unused space on a disk as a single array. • Supports 1 to 8 disks	Provides the ability to link-together storage from one or several disks, regardless of the size of the space on those disks. Useful in scavenging space on disks unused by other disks in the array. Does not provide performance benefits or data redundancy. Disk failure will result in data loss.
RAIDABLE (also known as RAID Ready)	• Allows a RAIDABLE disk to be transformed later to RAID0 or RAID1. • Supports one disk.	See RAID0 (Striping), on page 24 or RAID1 (Mirroring) on page 24 for post-transformation usefulness.

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 tool, these states also display in a column named State.

The array states are defined in Table 7, on page 26.

Table 7. 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 8.

Table 8. Failure States by RAID Level

RAID Level	This Failure State	Is Displayed Whenever
RAID1 (Redundant Arrays)	Critical	A single disk fails.
	Offline	Two or more disks fail.
RAID10 (RAID Levels with Multiple Redundancies)	Critical	A single disk fails in any one of the sets.
	Offline	All disks in a set fail.
Volume 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 RAID5 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 30 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 9. 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 *(http://www.microsoft.com)* 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 (Supported by RAIDXpert2 Plus)

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 6.6.3, Transform Arrays (Supported by RAIDXpert2 Plus), on page 73.

3.6   Migrating RAID Levels Online: Using ORLM (Supported by RAIDXpert2 Plus)

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.

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 10 on page 29, can be displayed for each array.

Table 10. 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 that the parity (RAID5) or 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 parity on a RAID5 set, or 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 17, on page 64, for additional information.
- Within the rcadm program, these states are also displayed in a column named State. See Table 41, on page 102, and Table 42, on page 103, for additional information.

The disk states are defined in Table 11.

Table 11. Disk States

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

Table 11. 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 recommend for disks that are part of the Boot Virtual Disk or those that are connected to the AMD 300-Series Chipset.

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 RAID5 set with six disks into a new system, do not perform a rescan until all six 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 RAID5 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 12.

Table 12. 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 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. (Be aware that the Transform task is supported only by RAIDXpert2 Plus.)

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.

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 6.6.13, Add or Remove Dedicated Spares, on page 82.

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 6.6.14, Add or Remove Global Spares, on page 83.

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 caching using RAIDXpert2, 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, RAID5, or RAID10.

3.14   RAID Reliability Considerations

RAID reliability is enhanced through data redundancy and backup.

3.14.1   Data Redundancy

RAID1, RAID5, 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.

3.17   RAIDABLE Arrays

RAIDABLE arrays (also known as RAID Ready) are a special type of Volume (JBOD) that allow the user to add more storage space or create a redundant array after a system is installed. RAIDABLE arrays are created using Option ROM, UEFI, or rcadm.

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

Chapter 4   BIOS Configuration Utility

4.1   When to Use the AMD-RAID Controller BIOS Configuration Utility

The AMD-RAID Controller BIOS Configuration Utility is also known as the Option ROM. Use the utility to accomplish the procedures indicated in Table 13.

Table 13. 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 4.4, Initialize Disks, on page 35
Create or delete arrays	Create arrays at different RAID levels (depending on the license level for the system), or delete an array.	Section 4.5, Create Arrays, on page 36 Section 4.6, Delete Arrays, on page 38
Swap arrays	Change the array order, especially for the AMD-RAID bootable array.	Section 4.7, Swap Arrays, on page 38
Manage hot spares	Allows selection of global and dedicated hot spares.	Section 4.8, Manage Spares, on page 39
View disk and array details	View information about each disk or array.	Section 4.9, View Disk Details, on page 40 Section 4.10, View Array Details, on page 40
Rescan all channels	Rescan all channels to detect new or removed disks and arrays.	Section 4.11, Rescan All Channels, on page 41
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 4.12, Change the Controller Options, on page 41
Continue to boot	Exit the BIOS Configuration Utility and continue booting the system.	Section 4.13, Continue Booting from the BIOS Configuration Utility, on page 42

4.2   Access the AMD-RAID Controller BIOS Configuration Utility

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.

4.3   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 14.

Table 14. 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.

4.4   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.

4.4.1   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.

4.5   Create Arrays

Arrays can be created after the disks are initialized. See Section 3.2, RAID Levels, on page 17, for deciding what type of RAID levels to use for the array.

TIP: See also Section 6.6.1, Create and Format Arrays on page 71, and Section 9.4, Create New Arrays: `rcadm --create`, on page 104.

4.5.1   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.

4.5.2   Create an Array

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

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 4.12, Change the Controller Options, on page 41.

4.5.2.1   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 4.5.2, Create an Array, on page 37, 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 5, Software Installation, on page 43.

4.5.2.2   Create a RAIDABLE Array

Note: The ability to create RAIDABLE (also known as RAID Ready) arrays may not be available on your system.

1.   At the Main Menu, use the **arrow keys** to highlight Create Array, then press **Enter**.
2.   Select the disk with which to create the array, then press Enter to include the selected disk in the array:
3.   In the User Input section, use the **arrow keys** to select **RAIDABLE**, then press **Enter**.
4.   Press the **C** key to confirm array settings, or press the **ESC** key to go back to a previous page.

4.6   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.

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.

4.6.1   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**.

4.7   Swap Arrays

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

4.7.1   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 RAID5—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.

4.7.2   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.

4.8   Manage Spares

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

4.8.1   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.

4.8.2   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.

6. Press **Enter**.

7.   Press the **C key** to continue, or press the **ESC** key to return to the Main Menu.

4.8.3   Unassign 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.

4.9   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**.

4.10   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).

4.11   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.

4.12   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.

4.12.1   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**.

4.12.2   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.

4.12.3   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**.

4.13   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.

4.13.1   Resume the Boot Process

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

2.   Press **Enter**.

Chapter 5   Software Installation

This Installation Guide is designed to assist you with system setup, by performing these general procedures:

5.1   System Setup Process Overview

A generic system setup process follows these steps:

1.   Copy the AMD-RAID drivers to a removable storage medium.

CAUTION: Install the device drivers and applications on a system at the same time that the Windows or Linux operating system is installed.

2.   Power on the system.
3.   Access the platform BIOS setup for the system. For supported AMD chipsets, set the SATA mode as RAID. (This enables the loading of the AMD-RAID Option-ROM).
4.   Initialize the disks using the AMD-RAID Array Configuration Utility.
5.   Create arrays using the AMD-RAID Array Configuration Utility.
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.

5.2   Before You Begin

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

5.3   Copying AMD-RAID Drivers to Removable Storage

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

5.3.1   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.

5.3.2   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 files contained inside the dd-rcraid-Ubuntu [Ubuntu version number].w.x-yz-folder into a dd directory located on a USB flash drive. For an Ubuntu desktop server installation the following files should be located in the dd directory located on the USB flash drive root. For example:

    - dd
      - load_amdraid
      - post_install
      - post_install2
      - pre_install
      - rcraid.ko
      - rcraid_generic.ko
      - readme

5.4   Pre-installation steps

You can choose to boot from the platform BIOS (Basic Input-Output System) or from UEFI. UEFI is a recent industry to standardize boot procedures that, until recently, have been platform-specific.

5.4.1   BIOS Mode

1. Power on the system and press **ESC**..
2. Select **SCU** , and press **Enter**
3. In the BIOS setup:

   a. Select the **AMD-CBS** tab.

   b. Select **AMD FCH Common Options**, then press **Enter**.

   c. Select **SATA Configuration Options**, then press **Enter**.

   d. Set **SATA Mode** to **RAID**, then press **Enter**.

4. 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 Mode** to **RAID**, then press **Enter**.

5. In the BIOS setup:

   a. Select the **Boot** tab.

   b. Set **Boot type to Legacy or Dual Boot Type**, then press **Enter**.

   c. Set **EFI Device First** to **Disabled**, then press **Enter**.

6. Verify that the AMD-RAID bootable array is included in the system's boot priority list.

7. At the system's **Power-On Self-Test (POST)** screen, press **Ctrl + R** to access the AMD-RAID Array Configuration Utility (also called Option-ROM).

8. Scroll to Controller Options and verify that INT13 Boot Support is ON for AMD-RAID.

9. If more than one array exists at the AMD-RAID Array Configuration Utility, verify that the desired bootable array is the first array listed in the Arrays list. Use the Swap Two Arrays task to place the bootable array first.

5.4.2   UEFI Mode

1. Power-on the system then press **ESC**.

2. Select **SCU**, and press **Enter**.

3. In the BIOS setup:

   a. Select the **AMD-CBS** tab.

   b. Select **AMD FCH Common Options**, then press **Enter**.

   c. Select **SATA Configuration Options**, then press **Enter**.

   d. Set **SATA Mode** to **RAID**, then press **Enter**.

4. 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 Mode** to **RAID**, 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 **Enabled**, then press **Enter**.

6. At the system's **Power-On Self-Test** (POST) screen, press **F7 / F12 / ESC** (or similar) to access the UEFI Configuration Utility (also called UEFI Boot Manager).

7. Boot to the EFI Internal shell

8. Enter `fsx:`, where x is the number of the UEFI Flash Drive.

9. Use `rcadm` to create the desired Boot Virtual Disk. Refer to Appendix A, rcadm.efi Information, on page 107 for more information.

5.5   Installing AMD-RAID drivers

Follow the procedures below for your Microsoft Windows or Linux installation.

5.5.1   Installing AMD-RAID Drivers while Installing Microsoft® Windows®

5.5.1.1   Installing AMD-RAID BIOS Drivers during a Microsoft® Windows® 7 or 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.

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 procedure in Section 4.5.2.1, Create an AMD-RAID Bootable Array, on page 37.

3. Insert the Microsoft Windows operating system CD-ROM or DVD into the system's CD or DVD drive.

4. Boot the system and let it 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 first **rcbottom.inf driver** in the list, then click **Next**.

Note: If the installation 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 first rcraid.inf driver in 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.

    i.   Click **Next**, then follow the on-screen instructions to complete the installation.

7.   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 entries are displayed.

8.   Remove the storage medium and Microsoft Windows operating system CD-ROM or DVD from the applicable drive(s) or port.

9.   Proceed to Section 5.6, Installing the AMD RAIDXpert2 Management Suite for Microsoft® Windows®, on page 57.

5.5.1.2   Installing the AMD-RAID UEFI Drivers during a Microsoft® Windows® 7 or 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.

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 4.5.2.1, Create an AMD-RAID Bootable Array, on page 37.

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 first rcbottom.inf driver in 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 first rcraid.inf driver in 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 entries are 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 5.6, Installing the AMD RAIDXpert2 Management Suite for Microsoft® Windows®, on page 57.

5.5.2   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.*

5.5.2.1   Installing the AMD-RAID BIOS Drivers During a Red Hat Enterprise Linux® 7.2 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 5.3.2, Copying AMD-RAID Drivers in a Linux® Environment, on page 44 .

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 4.5, Create Arrays, on page 36.

5. At the Red Hat Enterprise Linux welcome window, do the following:

   a. Press the **Up** arrow, then select **Install Red Hat Enterprise Linux 7.2**.

   b. Press **Tab**.

   c. Type modprobe.blacklist=ahci inst.dd nomodeset at the end of the existing string then press **Enter**. For example, vmlinux 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 7.2, 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 7.2 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 7.2 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.

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

Note: AMD-RAIDXpert2 supports the Ubuntu 15.04 and 15.10 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 5.3.2, Copying AMD-RAID Drivers in a Linux® Environment, on page 44.

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 4.5, Create Arrays, on page 36.

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. Press **F6** - Other Options, then press **ESC**.

8. Press the **down arrow key** to Install Ubuntu.

9. At the end of the Boot Options string, type the following, then press **Enter**: break=mount nomodeset

Note: The string should look like the following: splash -- break=mount 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/sda1 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. When the Welcome screen displays, select the desired language then click **Continue**.
12. Accept the defaults, then click **Continue**.
13. Accept the default settings, then click **Continue**.
14. Select **Erase Disk and install Ubuntu**, then click **Install Now**.
15. From the **Write Changes to Disks?** window, then click **Continue**.
16. Select the desired time zone, then click **Continue**.
17. Select the desired keyboard layout, then click **Continue**.
18. Enter valid entries for the following, then click **Continue**.
    a. Your name
    b. Computer name
    c. User name
    d. Password
    e. Confirm Password
19. When the Installation Complete window displays, do the following:
    a. Insert the USB flash drive.
    b. Press **CTRL + ALT + F1**.
    c. At the Ubuntu dialog box, enter **ubuntu** as the username, then press **Enter**.
    d. When prompted to enter a password, leave it blank, then press **Enter**.
    e. Type the following, pressing **Enter** after each one:
       • sudo mount -t vfat /dev/sdal /mnt
       • sudo cp -ap /mnt/dd /
       • sudo /dd/post_install
20. Wait for the Setup is Complete message, then press CTRL + ALT + F7.
21. 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 5.7, Installing the AMD RAIDXpert2 Management Suite for Linux®, on page 58.

5.5.2.3   Install the AMD-RAID UEFI Drivers during a RHEL 7.2 64 bit Linux® 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 5.3.2, Copying AMD-RAID Drivers in a Linux® Environment, on page 44.

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 4.5.2.1, Create an AMD-RAID Bootable Array, on page 37.

5. At the Red Hat Enterprise Linux Welcome window:
   a. Press the Up arrow.
   b. Select Install Red Hat Enterprise Linux 7.2 64 bit.
   c. Press the E key.
   d. At the end of the existing string, type **modprobe.blacklist=ahci inst.dd nomodeset**
      For example, the string should look like the following: linuxefi /images……..quiet modprobe.blacklist=ahci inst.dd nomodeset
   e. Press CTRL X.

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 the Select Drivers to Install, do the following:
   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, 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. At the Installation Complete window, click **Reboot** in the bottom right corner, then eject and remove the USB flash drive.

15. At the Initial Setup of Red Hat Enterprise Linux Server 7.2, 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, then 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 7.2 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 7.2 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

22. Open a Web Browsr 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.

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

Note: AMD-RAIDXpert2 supports the Ubuntu 15.04 and 15.10 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, see Section 5.3.2, Copying AMD-RAID Drivers in a Linux® Environment, on page 44.

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 4.5.2.1, Create an AMD-RAID Bootable Array, on page 37.
5. Boot to the Ubuntu desktop CD-ROM or DVD. This will bring you to the GNU GRUB Window.
6. Press the **down arrow** key to Install Ubuntu.
    Note: Press the E key to edit the commands before booting.

7. Find the string that starts with linux /casper/vmlinuz.efi file=/cdrom…..splash --
8. Press the **END** key.
9. At the end of the Boot Options string, type: break=mount nomodeset
    Note: The string should look like the following: splash -- break=mount nomodeset.

10. Press **F10** to Boot.
11. 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/sda1 may need to be changed to /dev/sdb1 or /dev/sdc1, depending on the number of devices.

        * cp -ap /tmp/dd /
        * /dd/pre_install
        * umount /tmp
        * exit
    c. Remove the USB flash drive.

12. When the Welcome screen displays, select the desired **Language** and then click **Continue**.

13. Accept the default settings, then click **Continue**.

14. Select **Erase Disk and install Ubuntu**, then click **Continue**.

15. From the Select Drive drop-down menu, select the **AMD-RAID Array**, then **click Install Now**.

16. From the **Write Changes to Disks?** Window, then click **Continue**.

17. Select the desired **Time Zone** and then click **Continue**.

18. Select the desired Keyboard layout and 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

20. When the Installation Complete window displays, do following:

    a. Insert the USB flash drive.

    b. Press **CTRL + ALT + F1**

    c. At the Ubuntu dialog box, enter **ubuntu** as the username, then press **Enter**.

    d. When prompted to enter a password, leave it blank, then press **Enter**.

    e. Type the following commands, 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 and then press **CTRL + ALT + F7**.

22. Click **Restart Now** to finish the installation.

23. When prompted to remove the installation media, remove the CD/DVD and USB flash drive from the system, then press **Enter**.

24. Reconnect the Ethernet cable.

25. Proceed to Section 5.7, Installing the AMD RAIDXpert2 Management Suite for Linux®, on page 58.

5.6   Installing the AMD RAIDXpert2 Management Suite for Microsoft® Windows®

Obtain the latest Catalyst executable file from your system supplier or motherboard vendor. Download the file to the system's desktop and execute it. Follow the on-screen prompts.

See Section 6.1.1.1, Browser Setup, on page 61, for supported browsers and configurations.

5.7   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 15. Linux® Procedure for Installing the Management Suite

Element	Action
RHEL 7.2 64 bit	Manually load the following i686 rpms - libX11, libXau, libXcb, libXext, libXi, libXtst, compat-libstdc++, gtk2, libSM, libpng12, adwaita-gtk2-theme, libcanberra-gtk2 and PackageKit-gtk3-module.
Ubuntu 15.04 and 15.10, 32-bit operating systems only	For Ubuntu 15.04 and 15.10, 32-bit operating systems, enter the following command before executing Setup.sh: `sudo ln -s /lib/i386-linux-gnu/libc.so.6 /lib/libc.so.6`

Ubuntu 15.04 and 15.10, 64-bit operating systems only	For the Ubuntu 15.04 and 15.10, 64-bit operating systems, type the following commands before executing `Setup.sh`, pressing **Enter** after each one:
	`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 libxxf86vml:i386`
	`sudo apt-get install libsm6:i386`
	`sudo apt-get install gtk2-engines-murrine:i386`
	`sudo apt-get install libcanberra-gtk-module:i386`

Setup.sh	Verify that the `Setup.sh` file is executable by right-clicking on the `Setup.sh` file on the system's desktop. From the pop-up menu, select the Properties category. Click the **Permissions** tab.

Table 15. Linux® Procedure for Installing the Management Suite (Continued)

Element	Action
Permissions tab	Ensure that the Execute or Executable checkbox(es) is/are selected. Click **Close**.
Setup.sh icon	Double-click the Setup.sh icon that is on the desktop. At Do you want to run 'Setup.sh' or display its contents?, click **Run**. Wait while Linux runs the Management Suite installer.
Introduction window	Click **Next**.
License Agreement window	Select **I accept the terms of the License Agreement**. Click **Next**.
What would you like to install? window	Click **Next**.
Choose Install Folder window	Accept the default settings. Click **Next**.
Choose Shortcuts window	Click **Next**.
Pre-Installation Summary window	Review the selections. If they are okay, click **Install**. *Note: The Installing the AMD RAIDXpert2 Management Suite window appears, showing the progress of the installation.*
Install Complete window	Click **Done**.

5.8   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 6, AMD RAIDXpert2 Graphical User Interface (GUI), on page 61.

5.8.1   RHEL Linux® – AMD RAIDXpert2 Web GUI Installation

1. Copy xampp-linux-1.8.1.tar.gz to the desktop
2. Open a console window and navigate to /root/Desktop.
3. Start Super User (su) mode and type the following commands, pressing **Enter** after each one:

- tar xvfz xampp-linux-1.8.1.tar.gz –C /opt
- cd /opt/raidxpert2/htdocs
- cp –rv raidxpert2 /opt/lampp/htdocs

4.   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.

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

- /opt/raidxpert2/bin/rcpopup &

Note: This must be done after each system reboot.

6.   Click the **RAIDXpert2 Desktop Icon**
7.   Enter the following default credentials:
   a.   Username: `admin`
   b.   Password: `admin`
8.   Create a new username and password, and log into the system again with the new credentials.

5.8.2   Ubuntu

1.   Copy xampp-linux-1.8.1.tar.gz to the desktop.
2.   Open a console window.
3.   Navigate to /root/Desktop and type the following commands, pressing **Enter** after each one:

- sudo tar xvfz xampp-linux-1.8.1.tar.gz –C /opt
- cd /opt/raidxpert2/htdocs
- sudo cp –rv raidxpert2 /opt/lampp/htdocs

4.   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.

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

- /opt/raidxpert2/bin/rcpopup &

Note: This must be done after each system reboot

6.   Click the **RAIDXpert2 Desktop Icon**.
7.   Enter the following default credentials:
   a.   Username: **admin**
   b.   Password: **admin**
8.   Create a new username and password, and log into the system again with the new credentials.

Chapter 6   AMD RAIDXpert2 Graphical User Interface (GUI)

6.1   Start RAIDXpert2

RAIDXpert2 can be accessed using a web browser or Windows shortcut.

6.1.1   Web-Browser Access

6.1.1.1   Browser Setup

Note: Microsoft® Edge is not supported.

- 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.
- To navigate beyond the Sign In page (with a valid user account):
  - Set the browser's local-intranet security option to medium or medium-low. For Internet Explorer 8, adding the controller's network IP address as a trusted site can avoid access issues.
  - Verify that the browser is set to allow cookies at least for the IP address of the controller.
- To see the help window in Microsoft Internet Explorer, you must enable pop-up windows.

6.1.1.2   Signing In Using a Web Browser

1. In the web browser's address field, type the IP address of a controller network port and press **Enter**.
2. The AMD RAIDXpert2 Management Tool Login is displayed. If the Login page does not display, verify that you have entered the correct IP address.
3. On the Login page, enter the name and password of a configured user. The default user name and password are admin and admin.

Note: Both usernames and passwords are case-sensitive.

4. Select a language at the drop-down menu.
5. Click Submit. If the system is available, the RAIDXpert2 GUI page is displayed; otherwise, a message indicates that the system is unavailable.

6.1.1.3   Tips for Signing In and Signing Out Using a Web Browser

- Do not include a leading zero in an IP address. For example, enter 10.1.4.33 not 10.1.4.033.
- Multiple users can be signed in to each controller simultaneously.

- For each active RAIDXpert2 session an identifier is stored in the browser. Depending on how your browser treats this session identifier, you might be able to run multiple independent sessions simultaneously. Internet Explorer can run separate RAIDXpert2 sessions if you select File > New Session. If you do not select a new session, all instances of Internet Explorer share the same session.

- End a RAIDXpert2 session by selecting Options > Logout. Do not simply close the browser window.

6.1.2   Desktop Shortcut Access

6.1.2.1   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** page, enter the name and password of a configured user. The default user name and password are admin and admin.

Note: Both usernames and passwords are case-sensitive.

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

6.2   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 6.2.1, Things to Know About Passwords, on page 62.
3. In the Confirm New Password field, re-enter the new password.

Note: Both usernames and passwords are case-sensitive.

4. Click **Submit**.

6.2.1   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 6.2.2, Change a Password at the Options Menu, on page 63.

- If a user forgets the username or password, delete rc_login.txt to restore the default user name and password (admin and admin).

6.2.2   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 6.2.1, Things to Know About Passwords, on page 62.
5.   In the New Password field, re-enter the new password.
6.   Click **Submit**.

6.3   Help and About Windows®

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.

6.4   Reviewing the RAIDXpert2 GUI

6.4.1   The Array View Section of the Array Status Window

6.4.1.1   Elements of the Array View Section

The Array View section presents a graphical view of array properties. Table 16 provides information about the elements of the Array View section.

Table 16. 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.

Table 16. Elements of the Array View Section, Array Status Window (Continued)

Element	Description
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.

6.4.2   The Disk List Section of the Array Status Window

6.4.2.1   Elements of the Disk List Section

The Disk List section provides information about all disks assigned or available to arrays. Table 17 provides information about the elements of the Disk List section.

Table 17. 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 ***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*
Port Type	Type (SATA) and negotiated speed (not the speed of the port type).
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).
Model	Disk manufacturer's model number.
Serial No.	Disk manufacturer's serial number.

Table 17. Elements of the Disk List Section, Array Status Window (Continued)

Element	Description
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 6.5.2, Rescan Disks, on page 69.

6.4.3   The Array List Section of the Array Status Window

6.4.3.1   Elements of the Array List Section

The Array List section provides information about the arrays. Table 18 provides information about the elements of the Array List section.

Table 18. 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.) ***Note:*** *If a dynamic volume is created on an array, RAIDXpert2 cannot retrieve the volume's drive letter.*
Array Name	User-created name for the array.
Type	The RAID level (RAID type) or LEGACY.

Table 18. Elements of the Array List Section, Array Status Window (Continued)

Element	Description
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.
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 Cache, WB = Write Back Cache, RW = Read/Write Cache).

6.4.4   The Event View Section of the Array Status Window

6.4.4.1   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 accesses by selecting View > Log.

The Event View provides information about the events. Table 19, on page 67, provides information about the elements of the Event View section.

Table 19. 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.

6.4.5   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 20 provides page numbers for each command.

Table 20. 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 71	Initialize	page 68
Name	page 73	Rescan	page 69
Transform	page 73	Properties	page 69
Prepare to Remove	page 77	Spare/Identify	page 69
Delete	page 77		
Modify Cache Settings	page 79		
Task	page 80		
Check Consistency	page 80		
Background Array Scan	page 82		
Remove Spares	page 82		
Hide	page 83		
Secure Erase	page 83		

6.5   Working with Disks

6.5.1   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.

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

6.5.1.1   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**.

6.5.2   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.

6.5.3   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.*

6.5.3.1   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.*

6.5.4   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.

6.5.4.1   Assign a Disk as a Dedicated or Global Spare

1.   In the Disk List section, select a disk.

2.   At the Disk menu, select **Spare/Identify**.

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.

6.5.5   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) with a corresponding legacy array. When the legacy disk is initialized in RAIDXpert2 (or in the BIOS Configuration Utility), the legacy array disappears.

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

6.5.5.1   Legacy Disk and New Disk

Table 21 provides information on how disks appear in RAIDXpert2 and in the BIOS Configuration Utility.

Table 21. New and Legacy Disks, as They Appear in the BIOS Configuration Utility and RAIDXpert2

Status of the Disk	In RAIDXpert2	In the BIOS Configuration Utility
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 Empty.

Table 21. New and Legacy Disks, as They Appear in the BIOS Configuration Utility and RAIDXpert2 (Continued)

Status of the Disk	In RAIDXpert2	In the BIOS Configuration Utility
A disk containing non-RAIDXpert2 configuration data. *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.*	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 6, AMD RAIDXpert2 Graphical User Interface (GUI), on page 61, for the disk initialization procedure and the appearance of legacy disks in the BIOS Configuration Utility.

6.6 Working with Arrays

6.6.1 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.

6.6.1.1 Before You Begin...

Review the issues and recommendations indicated in Table 22.

Table 22. 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 6.6.2, Name Arrays, on page 73.

Table 22. Creating Arrays: Issues and Recommendations (Continued)

Issues	Recommendations
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.

6.6.1.2   Create an Array

6.6.1.2.1 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.*

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

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

$$(\quad) \quad ^\wedge \quad , \quad | \quad = \quad `` \quad " \quad .$$

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.   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: See Section 6.6.12, Scan an Array in the Background, on page 82, for details.

9.   Check Skip Initialize to skip initialization.

CAUTION: Creating a redundant array with Skip Initialization selected can result in data corruption.

10.   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 37, on page 92, for additional information.

11.   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).

12.   Click Create to create the array.

6.6.1.3   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.

6.6.2   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:

$$(\quad) \quad \wedge \quad , \quad | \quad = \quad `` \quad " \quad .$$

4.   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).

6.6.3   Transform Arrays (Supported by RAIDXpert2 Plus)

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).

6.6.3.1   Before You Begin

Review the issues and recommendations indicated in Table 23.

Table 23. 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 23. 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. *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.*
System reboot during a Transform	If the system reboots during a Transform, the Transform continues where it left off.

6.6.3.2   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: If the system is not licensed for RAIDXpert2 Plus, a License Issue message displays when the user clicks 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.

6.6.3.3 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.

6.6.4 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 RAID5), 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.

6.6.4.1 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 6.6.13, Add or Remove Dedicated Spares, on page 82 or Section 6.6.14, Add or Remove Global Spares, on page 83.

6.6.4.2 Restore a Critical Array

1. In the Array View section, select the critical array.
2. At the Disk List section, select a disk.
3. At the Disk menu, select Spare/Identify. 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**.

6.6.5 Prepare to Physically Remove an Array

6.6.5.1 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.

6.6.5.2 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.

6.6.6 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.

6.6.6.1 Before You Begin

Review the issues and recommendations indicated in Table 24.

Table 24. 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.

6.6.6.2   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 4.6, Delete Arrays, on page 38.

6.6.6.3   Recreate a Deleted Array

If an array is deleted, it might be possible to recreate the array. See

Table 37, Recreate a Deleted Array, on page 92.

6.6.7   Change Cache Settings for Arrays

Table 25 provides information about the four array-caching options available.

Table 25. 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.

6.6.7.1   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.

6.6.8   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.

6.6.8.1   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**.

6.6.9   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.

6.6.9.1   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.

6.6.10   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 parity (RAID5) or 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 6.6.11, Schedule a Consistency Check, on page 81.

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 6.6.8, Change the Priority Level of a Task, on page 79).

A Consistency Check task can be scheduled with the Schedule Consistency Check task (see Section 6.6.11, Schedule a Consistency Check, on page 81).

6.6.10.1   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.

6.6.10.2   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.

6.6.10.3   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.

6.6.11   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 26 provides information on the available scheduling options for a Consistency Check.

Table 26. 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.

6.6.11.1   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**.

6.6.11.2   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**.

6.6.12   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).

6.6.12.1   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.   Enabled 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.

6.6.13   Add or Remove Dedicated Spares

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

6.6.13.1   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, select the disk chosen as the dedicated spare.

3.   At the **Disk** menu, select **Spare/Identify**.

4.   Select **Assign as Dedicated Spare**, then click **Confirm**.

6.6.13.2   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 **Spare/Identify**.
3.   Select Remove as Dedicated Spare, then click **Confirm**.

TIP: For additional information see Section 3.10, Sparing Options: Disks and Arrays, on page 31.

6.6.14   Add or Remove Global Spares

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

6.6.14.1   Add a Global Spare

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

6.6.14.2   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 **Spare/Identify**.
3.   Select Remove as Global Spare, then click **Confirm**.

6.6.15   Hide an Array

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

6.6.15.1   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.

6.6.16   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 4 pass with all zeros to ensure that a RAID1, or RAID5 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 6.6.15, Hide an Array, on page 83.

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

6.6.16.1   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**.

6.7   Working with Views

The View menu allows the user to:

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

6.7.1   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.

6.7.2   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.

6.7.3   Refresh the Display

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

6.8   Working with Options

6.8.1   Change Password Settings

A password can be changed at the Options menu. See Section 6.2.2, Change a Password at the Options Menu, on page 63.

6.8.2   Set Event Notifications

With the Notification option, the user can manage event log and email notifications of events.

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 27.

Table 27. 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.

6.8.2.1   Set or Change Event Notifications

1.   At the **Options** menu, select **Notification**. The Notification Setup window opens.
2.   Specify the **Outgoing Mail Server (SMTP)** and **To Email Address**, to which e-mail messages are sent when an event occurs.
3.   If the SMTP server requires a login, check the Server Required Login box and enter a valid Username and Password for the server.
4.   Specify a user address as the sender of the e-mail notifications in From Email Address. (By default, the system on which RAIDXpert2 is installed is used.)
5.   Click **Send Test Message** to verify that the e-mail notification works.
6.   To disable messaging, uncheck the Enable Messaging check box in the Notification Events section.
7.   Choose the types of notification events to use (Email or Event Log) for each event priority (Low, Informational, Warning, Critical, Fatal) by selecting the appropriate options.

Note: Warning, Critical, and Fatal events will always display in the Event Log.

6.8.3   Licensing

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

6.9   Add Space 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 7   Troubleshooting

7.1   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.

7.2   System Startup Problems

- Table 28. The System Does Not Boot
- Table 29. The BIOS Configuration Utility Does Not Display

Table 28. 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 29. 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 30. Username and Password

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

7.3   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 described in Table 31 appear during the boot sequence.

Table 31. POST Screen Warning Messages

Warning Message	Additional Information	Corrective Action
WARNING: *Found arrays that are Critical [or equivalent]*	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 25, 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 7.5.1, Troubleshooting Disks, on page 93.

Table 31. POST Screen Warning Messages (Continued)

Warning Message	Additional Information	Corrective Action
WARNING: _Found arrays that are Offline_ _[or equivalent]_	This warning message appears when at least one array is in an Offline state and **Toggle Pause if Offline** is set to **ON** at the BIOS Configuration Utility. 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. 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.	See Section 7.5.1, Troubleshooting Disks, on page 93. If, after performing a rescan, the state remains Offline, the bootable array has suffered an unrecoverable failure. Create a new bootable array. Reinstall the operating system and drivers.
WARNING: _Found arrays that are Critical and Offline_ [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]	This warning message appears when **Toggle INT13 Boot Support** option has been set to **OFF** at the BIOS Configuration Utility and another boot device is not selected. Bootable devices do not function with the controller when **Toggle INT13 Boot Support** is set to **OFF**. The default setting is **ON**, which allows bootable devices to function with the controller.	Restart the system. Enter the system's BIOS screen. Select **Main Menu > Controller Options > Toggle INT13 Boot Support**. Change **Toggle INT13 Boot Support** from **OFF** to **ON**. Navigate to Main Menu. Select **Continue to Boot.** The system boot process continues to the operating system.

7.4   Array-Related Errors

- Table 32. Cannot Create an Array, 90

-

-

- Table 36. Cannot Create a Global Spare, on page 92
-
- Table 37. Recreate a Deleted Array, on page 92

Table 32. Cannot Create an Array

Possible Causes	Additional Information	Corrective Actions
The disk is not displayed.	The controller cannot communicate with the disks.	See Section 7.5.1, Troubleshooting Disks, on page 93.
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 24, 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. *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.*

Table 33. 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 7.5.1, Troubleshooting Disks, on page 93.

Table 34. 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. • If the array is non-redundant, the failure of a single disk causes the array to fail. • If the array is redundant, the failure of two or more disks causes the array to fail. The array cannot be restored (rebuilt).	See Section 7.5.1, Troubleshooting Disks, on page 93.

Table 35. 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.	• Create an array with a different RAID level and assign a dedicated spare. • Create a global spare.
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 36. 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. *CAUTION: 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 7.5.1, Troubleshooting Disks, on page 93.

Table 37. 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.	1. At the Array pop-up menu, select **Create**. 2. Create a new array using the same settings as the deleted array. • The same disks. • The same RAID type (RAID level). • The same capacity. • The same cache options. 3. Check Leave Existing Data Intact. 4. Click **Create**. 5. Ensure the settings are the same as the deleted array: • The same drive letter. • The same RAID type (RAID level). • The same disks. • The same capacity. • The same cache option 6. Check the data files of the array for corrupted or missing files, incorrect file extensions, and so on.

7.5   Disk Related Errors

- Table 38. Disk Errors
  - Section 7.5.1, Troubleshooting Disks, on page 93.

Table 38. Disk Errors

Possible Causes	Additional Information	Corrective Actions
A disk has been removed from an array		See Section 7.5.1, Troubleshooting Disks, on page 93.
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. *CAUTION: When a disk is initialized, all data on the disk is lost.*	• Ensure the disk is not already a member of an array. • Ensure the disk is still assigned as a global or dedicated spare. • Ensure the disk is reporting a Ready state.

7.5.1   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.

Chapter 8   Software License: EULA

8.1   Software License: End-User License Agreement (EULA)

BY INSTALLING, DOWNLOADING AND/OR USING THE SOFTWARE THAT ACCOMPANIES THIS END USER LICENSE AGREEMENT ("AGREEMENT") AND ANY ASSOCIATED DOCUMENTATION OR UPDATES THERETO ("SOFTWARE"), YOU AGREE THAT, WHETHER AS AN INDIVIDUAL OR AUTHORIZED REPRESENTATIVE OF AN ENTITY, YOU HAVE READ THIS AGREEMENT, UNDERSTAND IT AND AGREE TO BE BOUND BY IT. IF YOU DO NOT AGREE TO IT, YOU ARE NOT AUTHORIZED TO INSTALL, DOWNLOAD OR OTHERWISE USE THE SOFTWARE AND ARE ASKED TO PLEASE RETURN THE SOFTWARE TO THE PARTY FROM WHOM YOU RECEIVED IT. THE RIGHT TO USE THE SOFTWARE IS GRANTED ONLY UPON THE CONDITION THAT YOU AGREE TO THE TERMS AND CONDITIONS OF THIS AGREEMENT.

FURTHER, YOU UNDERSTAND THAT THIS SOFTWARE MAY ONLY BE OBTAINED FROM Advanced Micro Devices, Inc. ("AMD") OR AN AUTHORIZED DISTRIBUTOR OF AMD. IF YOU OBTAINED THIS SOFTWARE FROM ANY OTHER SOURCE, THAT SOURCE PROVIDED IT TO YOU ILLEGALLY, AND YOU HAVE NO RIGHT TO INSTALL, DOWNLOAD OR OTHERWISE USE THE SOFTWARE; SUCH USE IS A VIOLATION OF INTELLECTUAL PROPERTY RIGHTS.

8.1.1   Limited License to Authorized Distributors

If you are an OEM, distributor, reseller, integrator or other entity in the business of providing technology products and/or services, and if you have been expressly authorized to distribute copies of the Software to End User(s), you are an "Authorized Distributor." Subject to the terms and conditions of this Agreement, you are granted a limited, non-exclusive, non-transferable, non-sub licensable license to distribute and/or install the Software in its unaltered, object code form solely (i) to, and on behalf of, a purchasing End User for the End User's internal business purposes; and (ii) only for use with one (1) AMD product, purchased through authorized AMD sales channels. Except as specifically stated in this Section 1, Authorized Distributors are expressly prohibited from: copying and/or distributing the Software in whole or in part; using the Software to provide consulting or other services to third parties; and distributing the Software in any form or format. Authorized Distributors are subject to all other terms and conditions of this Agreement. Authorized Distributors must ensure that its End Users see and agree to this Agreement.

8.1.2   Limited License to End Users

If you have licensed the Software for your own personal use or your company's internal use, you are an "End User." You are hereby granted, subject to the terms and conditions of this Agreement, a limited, non-exclusive, non-transferable, non-sublicensable license to use this Software in its

unaltered, object code form solely (i) for internal business purposes; and (ii) only with respect to one (1) AMD product that was purchased through authorized AMD sales channels. Further, you must obtain this Software only from authorized AMD sales channels. Obtaining it from any other source is a violation of the intellectual property rights of AMD and its licensors.

8.1.3   Restrictions

Except as expressly authorized in Sections 1 and 2 above, Authorized Distributors and End Users (collectively "You") shall not (nor cause or permit any other person to): (i) reverse engineer, translate, disassemble, derive source code from, decompile, rent, lease, manufacture, adapt, create derivative works from, or otherwise modify or distribute the Software or any part thereof; (ii) copy, in whole or in part, the Software with the exception that only End Users may make one copy of the Software for their backup or archival purposes; (iii) publicly display the Software or use the Software to provide consulting or other services to third parties; or (iv) delete any copyright, trademark, patent or other notices of proprietary rights as they appear anywhere in or on the Software.

8.1.4   Proprietary Rights

The Software is primarily the intellectual property of Dot Hill Systems Corp. ("Dot Hill") and its licensors ("Licensors"). In no event shall You obtain title to the Software or any component thereof. As between Dot Hill and You, Dot Hill has all rights, title, interest, ownership and proprietary rights in and to the Software. Dot Hill's rights include, but are not limited to, all copies of the Software and any patent rights, copyrights, trademark rights, trade secret rights, and any other intellectual property right recognized in any country or jurisdiction in the world. The Software is protected both by United States law and international treaty provisions.   All rights not expressly granted in this Agreement are reserved by Dot Hill and Licensors, respectively.

8.1.5   Term and Termination

This Agreement shall continue in effect until terminated. Dot Hill or AMD may terminate this Agreement immediately if You fail to comply with any provision of this Agreement. Upon termination, You shall discontinue use of the Software, and either destroy, erase, or return all copies of the Software in Your possession or control.

8.1.6   No Warranty

THE SOFTWARE IS PROVIDED "AS IS" WITHOUT ANY WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. DOT HILL AND AMD DISCLAIM, ON THEIR OWN BEHALF AND ON BEHALF OF LICENSORS, ANY EXPRESS OR IMPLIED WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE SOFTWARE OR THAT THE OPERATION OF THE SOFTWARE WILL BE UNINTERRUPTED OR ERROR-FREE OR WILL OPERATE IN COMBINATION WITH OTHER SOFTWARE OR HARDWARE. Dot Hill and its Licensors will not provide support for the Software and, to the extent you believe that are entitled to support, you are advised to contact the party from whom you

received the Software. Notwithstanding the foregoing, Updates to the Software (which may or may not be distributed) shall be governed by this Agreement, and such Updates will be considered Software for purposes of this Agreement.

The Software is not absolutely fault-tolerant and is not designed, manufactured or intended for use or resale as on-line control equipment in hazardous environments requiring fail-safe performance in which the failure of the Software could lead directly to death, personal injury or severe physical or environmental damage, such as the operation of nuclear facilities, aircraft navigation, air traffic control, direct life support machines, or weapons systems ("High Risk Activities"). Express or implied warranties for High Risk Activities are specifically disclaimed.

8.1.7   Limitation of Liability

IN NO EVENT SHALL DOT HILL, AMD OR LICENSORS BE LIABLE TO ANY PARTY FOR ANY LOST REVENUE, LOST PROFIT OR DATA, OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL OR PUNITIVE DAMAGES, HOWEVER CAUSED, AND REGARDLESS OF THE THEORY OF LIABILITY, ARISING OUT OF THE USE OF OR INABILITY TO USE THE SOFTWARE EVEN IF THEY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL DOT HILL'S, AMD's or LICENSORS' LIABILITY, TO YOU, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, EXCEED THE AMOUNT OF ANY FEE PAID BY YOU FOR THE SOFTWARE. THE FOREGOING LIMITATIONS SHALL APPLY EVEN IF THE REMEDY FAILS OF ITS ESSENTIAL PURPOSE. Some jurisdictions do not allow for the exclusion of implied warranties as described in Section 6, or the limitation of liabilities as described in this Section 7, so the above exclusions or limitations may not apply to You. In that event, to the extent permissible, any exclusion of warranties or limitation of liability will be limited in duration or type to the greatest extent allowed by law.

8.1.8   Export Controls

You agree to comply fully with all relevant export laws, regulations, treaties, and orders ("Export Laws") to assure that neither the Software nor any components thereof are (i) exported, directly or indirectly, in violation of Export Laws; or (ii) are intended to be used or are used for any purposes prohibited by the Export Laws.

8.1.9   General

This Agreement and any disputes arising from or relating to it shall be governed by and construed in accordance with the laws of the State of Colorado without reference to conflict of laws principles and excluding the U.N. Convention on Contracts for the International Sale of Goods. Any legal action or proceeding shall be instituted in a state or federal court in Denver, Colorado, U.S.A. and You agree to be subject to the jurisdiction of these courts. Taxes and charges imposed by any government with respect to the Software shall be paid by the End User. The waiver by either party of a breach of this Agreement or a failure to exercise any right hereunder shall not operate or be construed as a waiver of any subsequent breach or as a waiver of any other right. If any provision of this Agreement is held to be unenforceable or overbroad for any reason, it will be

modified rather than voided, if possible, in order to achieve the intent of the parties to the extent necessary to make the provision enforceable under applicable law, and enforced as amended. In any event, all other provisions of this Agreement will be deemed valid and enforceable to the full extent. This Agreement constitutes the complete agreement between the parties and supersedes all prior or contemporaneous agreements or representations, written or oral, concerning the subject matter of this Agreement including any purchase order or ordering document. This Agreement may not be modified or amended except in writing and signed by both parties.

Chapter 9   `rcadm` Command Line Interface Tool

9.1   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 Appendix A, on page 107, for rcadm.efi Information.

The rcadm program initiates RAIDXpert2 operations, such as:

- Manage RAIDXpert2, arrays and disks (see Section 9.2, Manage Arrays and Disks: `rcadm --manage`, on page 100).
- Create new arrays (see Section 9.4, Create New Arrays: `rcadm --create`, on page 104).
- Delete arrays (see Section 9.5, Delete Arrays: `rcadm --delete`, on page 105).
- Transform arrays (see Section 9.6, Transform Arrays: `rcadm --transform` (supported by RAIDXpert2 Plus), on page 106).
- Follow or monitor arrays and disks (see Section 9.7, Follow or Monitor Arrays and Disks: `rcadm --follow`, on page 106).
- 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 39. Modes for the `rcadm` Program

Mode	Usage
Manage	Uses the `rcadm --manage` command to manage and query RAIDXpert2, arrays, and disks.
Create	Uses the `rcadm --create` command to create a new array.
Delete	Uses the `rcadm --delete` command to delete arrays.
Transform	Uses the `rcadm --transform` command to transform an array. (supported by RAIDXpert2 Plus)
Follow	Uses the `rcadm --follow` command to follow or monitor arrays and disks.

Follow these instructions to issue the command on the operating system. Also, see Section 9.3, View Help from the Command Line, on page 104.

9.1.1   To Use rcadm with a Linux® Operating System

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

9.1.2   To Use rcadm with a Windows® Operating System

- Change directories to %Program Files%\RAIDXpert2.
- Run the `rcadm.exe` command from there.

or

- Add `%Program Files%\RAIDXpert2` to the system or user path environment variables.

9.2   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.

9.2.1   Understand Query Output

When the `rcadm --manage --query-all` 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.

9.2.2   rcadm Controller List Elements

Table 40. `rcadm` Controller List Elements

Element	Description
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

9.2.3   `rcadm` Disk List Elements

Table 41. 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, Neaw, ATAPI)
Port Type	Port type (SATA, SATA II, eSATA, SSD)
Port Speed	The negotiated speed of the port
Size	Total size of the disk: • 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.*
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).
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

9.2.4   rcadm Array List Elements

Table 42. 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: • 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.*
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) *Note: See Section 3.7, Array Tasks: Starting and Stopping Tasks, on page 28 for detailed definitions.*
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 42. rcadm Array List Elements (Continued)

Element	Description
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 (`--verbose` 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

9.3   View Help from the Command Line

9.3.1   To view a List of the Major Modes of Operation

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

9.3.1.1   To View Help for a Specific Mode and its Options

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

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

9.3.1.2   To view the rcadm Man Page on a Linux® System

Type: `man rcadm`

9.4   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.

9.4.1   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.

9.4.2   Example

To create a 1 GB RAID5 array using disk members 1, 2, and 3, type: `rcadm -C -r5 -d 1 2 3 -s 1000`

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

9.5   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.

9.5.1   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.

9.5.2   Example

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

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

9.6   Transform Arrays: `rcadm --transform` (supported by RAIDXpert2 Plus)

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.

9.6.1   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.

9.7   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 changes in status and sends an e-mail notification and/or executes a specified program. The output of this command is logged to the System Event Log on Windows.

9.7.1   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.

Appendix A   rcadm.efi Information

A.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, RAID1n, RAID10, RAID10n, RAID5, RAID50, RAID6, RAID60, and RAIDABLE. Some of the major functions include assigning spare disks; setting array size; setting the number of disks in each sub member of a RAID10n or RAID50 array; 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.

A.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
```

A.3   rcadm -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
`--raid5, -r5` Stripe set with parity, three to sixteen disks

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>.

`-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 RAID5 set of the maximum possible size using all disks.

```
rcadm -C --raid5 --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
```

Example: Print the maximum size a RAID5 array could be using all disks without actually creating the array.

```
rcadm -C --raid5 --disk * --max-size
```

A.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
```