AMD-RAID™ Quick Start Guide for Ubuntu Operating Systems

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Revision History

Date	Revision	Description
September 2022	0.60	• Removed duplication with *AMD RAID User Guide*, order# 53987. • Updated Table 1, “System Requirements.” • Corrected title of Chapter 2. • Updated Chapter 3, “Pre-Installation: Enabling RAID.” • Updated Section 4.2, “UEFI Configuration Utility.” • Updated Section 5.2, “Installing AMD-RAID Driver during Ubuntu Desktop OS Installation.” • Updated Section 5.3, “Installing the AMD-RAIDXpert2 Management Application.” • Added Chapter 6, “Updating Ubuntu RAID Drivers.”
September 2021	0.51	• Updated system requirements in Table 1. • In Section 2.1, “Copying AMD-RAID Drivers to a Removable Storage Medium,” added `driver_sdk` requirement for installations. • In Chapter 4, “Creating the Bootable Virtual Disk,” added recommendation not to use SMR hard drives with AMD RAID systems. • Added Section 5.1, “Secure Boot Enablement.” • Updated Section 5.2, “Installing AMD-RAID Driver during Ubuntu Desktop OS Installation”: – General updates for Ubuntu version – Minor clarifications and corrections – New steps for when secure boot is enabled • Updated a directory location in Section 5.3, “Installing the AMD-RAIDXpert2 Management Application.”
September 2020	0.50	Initial preliminary release.

Chapter 1 General Information

1.1 Purpose

This Quick Start Guide is designed to assist with system setup in **RAID Mode** by performing the following general procedures:

- Copy AMD RAID device drivers to removable storage media for 64-bit Ubuntu® 20.04.x.
- Load AMD RAID device drivers on a supported AMD system during Ubuntu installation.
- Install the AMD-RAIDXpert2 (GUI) for RAID array management.

Refer to *AMD RAID User Guide*, order# 53987 for information on configuring RAID mode on AMD platforms, arrays, disks, RAID levels, improving storage system performance, loading RAIDXpert2 drivers, and the RAIDXpert2 GUI.

1.2 System Requirements

Table 1. System Requirements

Component	Requirements
Memory (RAM)	Minimum: 16 GB total for AMD Ryzen® processors and AMD Ryzen® desktop processors. Recommended: 32 GB total for AMD Ryzen® processors and AMD Ryzen® desktop processors.
Hard Disk, SSD	Total 14 devices Support includes ATAPI DVD, SATA drives, SATA SSD drives, M.2 SATA drives, NVMe M.2 devices, NVMe HHHL devices or NVMe U.2 devices. The number of disks depends on the number, type, and capacity of the arrays to be created.
Max number of NVMe devices	10 for sTRX4 Threadripper™ processors
Max Controller Count	11: Two controllers with device ID 0x7917 and NVMe (one controller per NVMe) Maximum for X399 systems with driver 9.3.0: • 8 arrays for deletion • 8 arrays for creation • 11 controllers (9 NVMe + 2 AHCI) • 14 devices (10 NVMe + 4 SATA) • 8 devices per array

Table 1. System Requirements (continued)

Component	Requirements
Supported AMD Processors	3rd Gen AMD Ryzen™ Threadripper™ processors 3rd Gen AMD Ryzen™ Threadripper™ PRO processors
Supported AMD Chipsets	TRX40 WRX80

The maximum number of devices supported is 14, including ATAPI, SATA and NVMe.

Table 2. Information about BIOS Configuration for Platform RAID Support

SoC SATA Mode	Chipset SATA Mode	NVMe RAID Mode	SATA RAID Support	NVMe RAID Support
AHCI / Auto	AHCI / Auto	Disabled	No	No
RAID	RAID	Enabled	Yes	Yes

1.3 Generic System Setup

A generic system setup process is described below:

1. Copy the **AMD-RAID** drivers to a removable storage medium. (Refer to Section 2.1)
2. Power-on the system.
3. Access the platform BIOS window for the system and configure BIOS settings as outlined in Chapter 3 to enable RAID Mode on the system.

   This enables the Platform BIOS to be configured in RAID mode by loading the **AMD-RAID UEFI** driver.
4. Initialize the disks, using the RAIDXpert2 Configuration Utility (HII) or UEFI shell. (Refer to *AMD RAID User Guide*, order# 53987.)
5. Create arrays, using the HII Configuration Utility or UEFI shell. (Refer to Chapter 4.)
6. Load the **AMD-RAID** drivers during operating system installation. (Refer to Section 5.1)
7. Complete the rest of the operating system installation.
8. Install the OS RAID Management GUI (AMD RAIDXpert2). (Refer to Section 5.3)

IMPORTANT: *To protect your data, always perform a backup prior to installing any new, major hardware or software. If you are adding NVMe as RAID to your existing RAID arrays, then update all existing RAID controller drivers to the latest version and reboot the system. Later, connect NVMe and install RAID drivers on the NVMe devices or download driver software from the vendor support page.*

Note: *Native AHCI installation does not boot into OS after BIOS setting changed to RAID mode.*

Chapter 2 Copying Drivers

Note: *Before beginning, have the Ubuntu® operating system installation media available and ready to install.*

2.1 Copying AMD-RAID Drivers to a Removable Storage Medium

A removable storage medium is needed to copy **AMD RAID** drivers required for OS installation onto an **AMD-RAID** bootable array.

Copy AMD-RAID drivers to a removable storage medium:

1. Locate and use a system that is running a Windows/Linux operating system with an I/O port for removable storage media (such as a USB flash drive formatted as FAT32).
2. Insert the storage medium into the system.
3. Go to a browser and access the website of your system supplier or motherboard vendor.
4. Download the AMD-RAID drivers from the website to the appropriate removable storage medium.
5. Copy driver files in the `dd-rcraid-Ubuntu [Ubuntu version number].w.x-yz` folder into a folder named `dd`, located on a root path of the USB flash drive. For example:

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

6. Proceed to Ubuntu Install and load the AMD-RAID drivers during an Ubuntu OS installation.

Chapter 3 Pre-Installation: Enabling RAID

Note: *The following steps to configure a system to RAID are specific to **AMD NDA BIOS** based on the **AMI BIOS**. The steps for other BIOS vendors are different.*

Enable RAID for AMD SP3-Series processors before installation:

1. Power-on the system.
2. Press **ESC** to enter the System BIOS setup page.
3. In the BIOS setup:
   a. Select the **Advanced** tab.
   b. Select **AMD CBS**, then press **Enter.**
   c. Select **FCH Common Options**, then press **Enter.**
   d. Select **SATA Configuration Options**, then press **Enter.**
   e. Set **SATA Enable** to **Enabled**, then press **Enter.**
   f. Set **SATA Mode** to **RAID**, then press **Enter.**
4. In the BIOS setup:
   a. Select the **Advanced** tab.
   b. Select **AMD CBS**, then press **Enter.**
   c. Select **Chipset Common Options**, then press **Enter.**
   d. Select **Chipset SATA Configuration Options**, then press **Enter.**
   e. Set **Chipset SATA0 Enable to Enabled**, then press **Enter.**
   f. Set **Chipset SATA1 Enable to Enabled**, then press **Enter.**
   g. Set **Chipset SATA Mode to RAID**, then press **Enter.**
5. In the **BIOS** setup:
   a. Select the **Advanced** tab.
   b. Select **AMD PBS** tab, then press **Enter.**
   c. Set the **NVMe RAID Mode** to **Enabled,** then press **Enter.**
6. Save (**F4**) the settings and restart the system.

Chapter 4 Creating the Bootable Virtual Disk

You can create a bootable virtual disk using the RAIDXpert2 Configuration Utility (HII mode) or by command line (UEFI mode).

Note: *The steps to configure arrays in RAID mode mentioned here are specific to **AMD NDA BIOS** and are based off **AMI BIOS**.*

Note: *AMD recommends not using SMR hard drives with AMD RAID systems because it can cause poor performance or failures. SMR drives are not suitable for workloads that require many random writes (such as boot drive). If used with RAID, the multiple SMR drives and background RAID tasks (such as creates and rebuilds) compound any issues or problems.*

4.1 RAIDXpert2 Configuration Utility (HII Mode) for the AMD Ryzen™ SP3-Series Processor

Use the Configuration Utility (HII) to create a bootable virtual disk:

1. Power-on the system.
   a. Press **ESC** or **DEL** to get into the **Platform BIOS.**
   b. Select the **Advanced** tab.
   c. Select **RAIDXpert2 Configuration Utility**, then press **Enter.**
2. At the RAIDXpert2 Configuration Utility's Main Menu, use the arrow keys to select **Array Management**, then press **Enter**.
3. Use the **arrow keys** to select **Create Array**, then press **Enter.**
4. Select **RAID Level**, then press **Enter**.
   a. From the **Select RAID Level** drop-down menu, use the **arrow keys** to select the desired RAID level, then press **Enter**.
5. Select the disks with which to create the array:
   a. Use the arrow keys to select **Select Physical Disks**, then press **Enter.**
   b. To select individual disks, highlight a disk with the arrow keys, then press the **Space Bar** or **Enter**. Any number of disks may be selected using this method.
   c. To select all disks, use the arrow keys to select **Check All**, then press **Enter.**
   d. Use the arrow keys to select **Apply Changes**, then press **Enter**.
      Note: *"Apply Changes" might be off-screen until you use the arrow keys if the list of options is long.*
6. (Optional) Select an array size:
   a. Use the arrow keys to select **Array Size**, then press **Enter.**

b. The array size defaults to the maximum size allowed by the number of physical disks and RAID level selected. If you want a smaller size array size, enter the desired value.
c. Press **Enter** when the desired size is reached.

7. (Optional) Use the arrow keys to select **Cache Tag Size.**
   – Any Array with only HDD/SSD has the default CTS of 64 k.
   – Any Array with only NVMe has the default CTS of 256 k.
8. (Optional) Use the arrow keys to select **Read Cache Policy**, then press **Enter**.
   a. Select the desired read cache policy, then press **Enter.**
9. (Optional) Use the arrow keys to select **Write Cache Policy**, then press **Enter**.
   a. Select the desired write cache policy, then press **Enter.**
10. Use the arrow keys to select **Create Array**, then press **Enter.**
11. After completion of array creation, press **F4** to save and exit the BIOS.

4.2 UEFI Configuration Utility

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

Use the command line to create a bootable virtual disk:

1. At the system **Power-On Self-Test (POST)** screen, press **F7 / F12 / ESC** (or similar) to access the **UEFI Configuration Utility** (aka UEFI Boot Manager).
2. Boot to the **EFI Internal** shell.
   ***Note:** Obtain the rcadm.efi file from your system supplier or motherboard vendor and copy it onto a UEFI flash drive, in the root directory.*
3. Enter **fsx:** where *x* is the number of the UEFI Flash Drive.
4. Use **rcadm** to create the desired Boot Virtual Disk.
   Examples:
   ***Note**: You may have to press the page up key to see more of the information.*
   a. Query the devices connected in the system: (Output displays the UEFI Version, physical devices, and arrays):
      ```
      rcadm.efi –M -qa
      ```
   b. Create a RAID1 on disks 2, 3 with a max size available and enables Read/Write Cache – default cache setting:
      ```
      rcadm.efi –C –r1 –d 2 3
      ```
   c. Create a RAID0 on disks 1, 2 with a size of 100 Gbs and enables Read Cache:
      ```
      rcadm.efi –C –r0 –d 1 2 –s 100000 –ca r
      ```
   d. Create a RAID10 on disks 1, 2, 3, 4 with a size of 125 Gbs and enables Write Cache:
      ```
      rcadm.efi –C –r10 –d 1 2 3 4 –s 125000 –ca w
      ```

Chapter 5 Installing the AMD-RAID Drivers

5.1 Secure Boot Enablement

Note: *If you do not want to enable Secure Boot, go to Section 5.2 to install AMD RAID drivers.*

Note: *These steps to enable Secure boot are specific to **AMD NDA BIOS** and based on **AMI BIOS**.*

Enable Secure Boot:

1. Power-on the system.
2. Press **ESC**, to enter the platform BIOS.
3. Select the **Security** Tab
4. Select **Secure Boot**, then press **Enter**.
5. Select **Restore Factory Keys**, then press **Enter**.
6. Select **Yes**, then press **Enter**.
7. Select **Secure Boot**, then press **Enter**.
8. Select **Enable**, then press **Enter**.
9. Press **F4** to save and exit the BIOS.

5.2 Installing AMD-RAID Driver during Ubuntu Desktop OS 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 directory named* `dd` *on a USB flash drive formatted as FAT32. (See Section 2.1.)*

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

Note: *Not all windows indicated in this procedure display during installation.*

Note: *AMD recommends a reset/reboot of the system if you are adding or moving a SATA M.2 SSD or NVMe device(s):*

1. *In the OS, issue a reset/reboot.*
2. *Wait for the AMD BIOS screen to display, then press* **ESC** *to enter the BIOS.*
3. *Power off the system.*
4. *Install or remove the necessary device(s).*
5. *Power on the system and allow the OS to boot properly.*

Install the AMD-RAID drivers during the Ubuntu OS installation:

1. Power-on the system.

   Note: *You must have the network connected and configured.*

2. Insert the **Ubuntu Desktop Linux** operating system CD-ROM or DVD into the system's CD or DVD drive.
3. Boot to the Ubuntu Desktop CD-ROM, DVD, or USB Flash drive. This opens the **GNU Grub** window.
   a. Use the arrow keys to select **Ubuntu**.
   b. Press the **e** key to edit the boot string.

      At the end of the Boot Options Linux string, add the following:

      ```
      break=mount
      ```

      Note: *The string should look like the following, with possible variation due to video card differences.*

      ```
      splash --- break=mount
      ```

   c. Press **F10**.

      Note*: If the BusyBox shell does not appear (the screen is black) reset the system and try with the following settings:*

      Enter: `break=mount nomodeset`

      The string should look like the following:

      ```
      splash --- break=mount nomodeset
      ```

      Press **F10**.

4. Complete the following when the BusyBox shell displays:
   a. Insert the USB flash drive.
   b. Press **Enter** to get a prompt.
   c. To mount the drive containing the RAID drivers:
      Enter: `mount -t vfat /dev/sdb1 /tmp`

      Note: *Instead of `/dev/sdb1`, you may need to enter `/dev/sdc1` or `/dev/sdd1`, depending on the number of devices. You can enter `ls /dev/sd*` to list possible entries.*

   d. Enter: `cp -ap /tmp/dd /`
   e. Enter: `/dd/pre_install` (Wait for the install to complete; this may take some time.)
   f. Enter: `umount /tmp`
   g. Remove the USB flash drive.
   h. Enter: **exit**.

5. Wait for the **Welcome** screen to load.

   Note: *If the Welcome screen is not displayed, but the Ubuntu Desktop is displayed, double-click **Install Ubuntu** for desktop.*

6. On the Welcome screen, select **Install Ubuntu** for desktop.
7. Select the desired **Language** from the **Keyboard** layout window and click **Continue**.

Note: Only if your network does not connect: *On the Wireless window, select the desired options/configuration, then click **Continue**.*

8. Select **Normal Installation** from the Updates and Other Software window and select **Continue**.
9. If you did not remove the external drive (such as a USB), the Installation Type window is displayed. Select **Erase Disk and Install Ubuntu**, and click **Install Now**.
10. On the **Write the changes to disks?** window, click **Continue**.
11. Select the desired **Time Zone** and click **Continue**.
12. Enter valid entries for **Who are you**? with the following, and then click **Continue**:
    - Your name
    - Computer name
    - Username
    - Password
    - Confirm Password
13. When the **Installation Complete** window displays, complete the following:

    CAUTION: *Do NOT click "Restart Now."*

    a. Press **CTRL+ALT+F2**.
    b. From the Ubuntu Login prompt, enter **ubuntu**, then press **Enter.**

       Note: *If asked for a password, press **Enter** without entering a password.*

    c. Insert the USB flash drive used in a previous step.
    d. Press **Enter** to get a prompt.
    e. Mount the drive containing the RAID drivers:
       Enter: `sudo mount -t vfat /dev/sdb1 /mnt`

       Note: *Instead of `/dev/sdb1`, you may need to enter `/dev/sdc1` or `/dev/sdd1`, depending on the number of devices. You can enter `ls /dev/sd*` to list possible entries.*

    f. Enter: `sudo cp -ap /mnt/dd /`
    g. Enter: `sudo /dd/post_install`

       If prompted:
       For input password, enter a password, then press **Enter**. *Remember the password for later*.
       For input password again, re-enter the password to confirm it, then press **Enter**.

14. Wait for the message **Setup is Complete,** press **CTRL+ALT+F1**, select **Restart Now** to finish the installation.
15. Remove the installation media:
    - If prompted, remove the CD/DVD or DVD and USB flash drive.
    - When installation media is removed, press **Enter** or **Reboot** the system.
16. If prompted, finalize the kernel upgrade:
    a. Wait for the system to reboot. After the BIOS screen appears, the “Press any key to enter the MOK management” window is displayed. *Within 5 seconds,* press any key to enter MOK management.
    b. Select **Enroll MOK**, then press **Enter**.
    c. Select **Continue**, then press **Enter**.
    d. At the Enroll the Key(s), select **Yes**, then press **Enter**.
    e. At the password window, enter the password you used for Step 14g, then press **Enter**.
    f. Select **Reboot**, then press **Enter**.

5.3 Installing the AMD-RAIDXpert2 Management Application

Install the AMD RAIDXpert2 Management application:

1. Contact your system supplier or motherboard vendor to obtain the new AMD-RAID Linux Management Application.
2. Copy the AMD-RAID `9.3.x-00yyy_linux_raidxpert2.tgz` package to a USB flash drive, formatted as FAT32.
3. Insert USB flash drive with AMD-RAID `9.3.x-00yyy_linux_raidxpert2.tgz`.
4. Click **Files**:
   a. Select the USB that was inserted in the previous step.
   b. Locate and select the AMD-RAID `9.3.x-00yyy_linux_raidxpert2.tgz` package and drag it to the **Desktop** directory icon.
5. Install the AMD RAIDXpert2 Management Application:
   a. Right-click on the desktop background to open the **Terminal** or click the **Terminal** icon.
   b. Enter: `sudo tar xzvf 9.3.x-00yyy_linux_raidxpert2.tgz -C /opt`

Note: Ubuntu 22.04.01 only: Connect and configure the network. In the terminal window: Enter: `sudo apt install libfuse2`

6. To open the AMD RAIDXpert2 Management Application:
   a. Enter: `cd /opt/raidxpert2/bin`
   b. Enter: `sudo bash` (and provide user password)
   c. Enter: `./RAIDXpert2 &`

Chapter 6 Updating Ubuntu RAID Drivers

6.1 System Update Overview

The following process summarizes the system update process:

1. Backup the user data before doing any upgrade.

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

2. Log into the system.
3. Copy the AMD RAIDXpert2 Installer to the Systems Desktop.
4. Run the AMD RAIDXpert2 Installer to update the AMD RAIDXpert2 Management Suite.
5. Update the AMD-RAID OS drivers.
6. Restart the System.

6.2 Updating the AMD-RAIDXpert2 Management Application

Update the AMD RAIDXpert2 Management application:

1. Contact your system supplier or motherboard vendor to obtain the new AMD-RAID Linux Management Application.
2. Copy the AMD-RAID `9.3.x-00yyy_linux_raidxpert2.tgz` package to a USB flash drive, formatted as FAT32.
3. Insert USB flash drive with AMD-RAID `9.3.0-00xxx_linux_raidxpert2.tgz`.
4. Click **Files**.
   - Select the USB that was inserted in the previous step.
   - Locate and select the AMD-RAID `9.3.x-00yyy_linux_raidxpert2.tgz` package and drag it to the **Desktop** directory icon (`/home` section).
5. Install the AMD RAIDXpert2 Management Application:
   - Right-click on the desktop background to open the **Terminal** or click the **Terminal** icon.
   - Enter: `sudo tar xzvf 9.3.x-00yyy_linux_raidxpert2.tgz -C /opt`
6. To open the AMD-RAID RAIDXpert2 Management Application:
   - Enter: `cd/opt/raidxpert2/bin`
   - Enter: `sudo bash` (and provide user password)
   - Enter: `./RAIDXpert2 &`

6.3 Update Drivers or Resync with an Updated Ubuntu Kernel

***Note**: If not already done, complete Section 6.2 to get the latest AMD-RAID driver_sdk.*

1. Click the Terminal icon.
   - Network must be enabled and configured.
   - Enter: `sudo apt-get install -y build-essential dkms`

     ***Warning**: If the systems kernel version is updated, perform step 2 before the system is rebooted. Failing to do so may result in the system failing to boot.*

2. Change directory to the RAIDXpert2 driver_sdk directory and enter the following:
   a. Enter: `cd /opt/raidxpert2/driver_sdk`
   a. Enter: `sudo ./install force`

      If prompted:
      For input password, enter a password, then press **Enter**. *Remember the password for later*.
      For input password again, re-enter the password to confirm it, then press **Enter**.
3. Wait for the command to complete and reboot the system.
4. If prompted, finalize the kernel upgrade:
   a. Wait for the system to reboot. After the BIOS screen appears, the "Press any key to enter the MOK management" window is displayed. *Within 5 seconds*, press any key to enter MOK management.
   b. Select **Enroll MOK**, then press **Enter**.
   c. Select **Continue**, then press **Enter**.
   d. At the Enroll the Key(s), select **Yes**, then press **Enter**.
   e. At the password window, enter the password you used for Step 2b, then press **Enter**.
   f. Select **Reboot**, then press **Enter**.