RAID Configuration Guide

Motherboard

E16322
Revised Edition V5
January 2020

Offer to Provide Source Code of Certain Software

This product contains copyrighted software that is licensed under the General Public License (“GPL”), under the Lesser General Public License Version (“LGPL”) and/or other Free Open Source Software Licenses. Such software in this product is distributed without any warranty to the extent permitted by the applicable law. Copies of these licenses are included in this product.

Where the applicable license entitles you to the source code of such software and/or other additional data, you may obtain it for a period of three years after our last shipment of the product, either

(1) for free by downloading it from https://www.asus.com/support/

or

(2) for the cost of reproduction and shipment, which is dependent on the preferred carrier and the location where you want to have it shipped to, by sending a request to:

ASUSTeK Computer Inc.

Legal Compliance Dept.

15 Li Te Rd.,

Beitou, Taipei 112

Taiwan

In your request please provide the name, model number and version, as stated in the About Box of the product for which you wish to obtain the corresponding source code and your contact details so that we can coordinate the terms and cost of shipment with you.

The source code will be distributed WITHOUT ANY WARRANTY and licensed under the same license as the corresponding binary/object code.

This offer is valid to anyone in receipt of this information.

ASUSTeK is eager to duly provide complete source code as required under various Free Open Source Software licenses. If however you encounter any problems in obtaining the full corresponding source code we would be much obliged if you give us a notification to the email address **gpl@asus.com**, stating the product and describing the problem (please DO NOT send large attachments such as source code archives, etc. to this email address).

Contents

About this guide

This guide contains information that you need to create RAID configurations. You can create different RAID configurations based on your motherboard chipset and software.

The screenshots in this guide are for reference only. The screenshots may vary with models, but the configurations steps are similar.

How this guide is organized

This guide contains the following parts:

- **Chapter 1: Intel® RAID Configuration**

  This chapter describes the Intel® RAID configurations and lists the setup procedures to create Intel® RAID configurations.

- **Chapter 2: AMD RAID Configuration**

  This chapter describes the AMD RAID configurations and lists the setup procedures to create AMD RAID configurations.

Where to find more information

The ASUS website (www.asus.com) provides updated information on ASUS hardware and software products.

Intel® RAID Configuration 1

1.1 Intel® RAID configurations

If your motherboard supports Intel® Rapid Storage Technology, you can create RAID 0, RAID 1, RAID 5 or RAID 10 configurations.

If you want to install a Windows® operating system to a hard disk drive included in a RAID set, you have to create a RAID driver disk and load the RAID driver during OS installation. Refer to section **1.2 Installing the RAID controller driver during Windows® 10 OS installation** for details.

1.1.1 RAID definitions

RAID 0 (Data striping) optimizes two identical hard disk drives to read and write data in parallel, interleaved stacks. Two hard disks perform the same work as a single drive but at a sustained data transfer rate, double that of a single disk alone, thus improving data access and storage. Use of two new identical hard disk drives is required for this setup.

RAID 1 (Data mirroring) copies and maintains an identical image of data from one drive to a second drive. If one drive fails, the disk array management software directs all applications to the surviving drive as it contains a complete copy of the data in the other drive. This RAID configuration provides data protection and increases fault tolerance to the entire system. Use two new drives or use an existing drive and a new drive for this setup. The new drive must be of the same size or larger than the existing drive.

RAID 5 stripes both data and parity information across three or more hard disk drives. Among the advantages of RAID 5 configuration include better HDD performance, fault tolerance, and higher storage capacity. The RAID 5 configuration is best suited for transaction processing, relational database applications, enterprise resource planning, and other business systems. Use a minimum of three identical hard disk drives for this setup.

RAID 10 is data striping and data mirroring combined without parity (redundancy data) having to be calculated and written. With the RAID 10 configuration you get all the benefits of both RAID 0 and RAID 1 configurations. Use four new hard disk drives or use an existing drive and three new drives for this setup.

1.1.2 Installing storage devices

The motherboard supports SATA hard disk drives and PCIE SSD storage devices. For optimal performance, install identical drives of the same model and capacity when creating a disk array.

Refer to Chapter 2 in your motherboard's user manual for details on installing storage devices to your motherboard.

1.1.3 Intel® Rapid Storage Technology in UEFI BIOS

To enter the Intel® Rapid Storage Technology in UEFI BIOS:

1. Enter the BIOS Setup during POST.

> Refer to Chapter 3 in your motherboard's user manual for details on entering and navigating through the BIOS Setup.

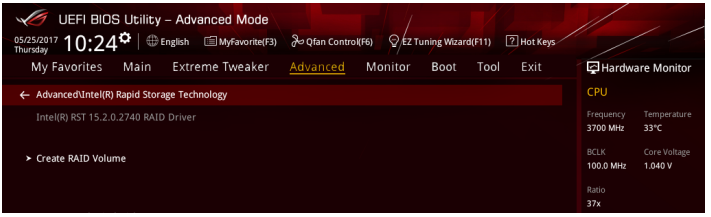
2. Go to **Advanced** > **PCH Storage Configuration**, then set **SATA Mode Selection** to **[Intel RST Premium With Intel Optane System Acceleration (RAID)]**.

> Due to chipset limitation, when SATA ports are set to RAID mode, all SATA ports run at RAID mode together.

3. Configure additional settings for your storage device and RAID configuration:
   - If you are using SATA storage devices, no additional settings are required. Please proceed to next step.
   - If you are using onboard M.2 cards, go to **Advanced** > **PCH Storage Configuration**, then set all the corresponding M.2 PCIE Storage RAID Support to **[Enabled]**.
   - If you are using Hyper M.2 cards or PCIE SSDs, go to **Advanced** > **CPU Storage Configuration**, then set all the corresponding PCIE slots to **[Hyper M.2 X16]** or **[PCIE X4 SSD Card]** accordingly.

> The Hyper M.2 card is purchased separately.

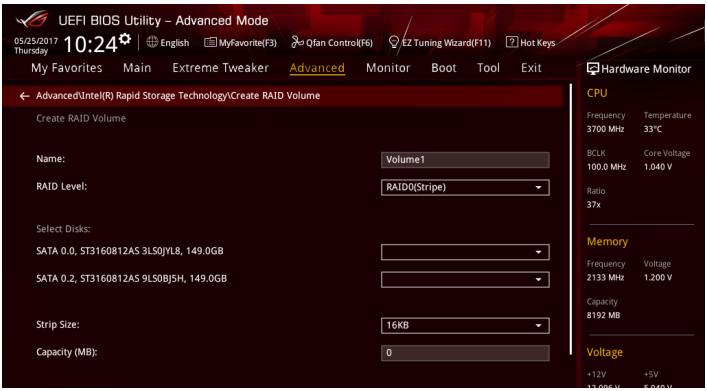
4. Go to **Boot** > **CSM (Compatibility Support Module)**, then set **Launch CSM** to **[Disabled]**.
5. Save your changes and exit the BIOS Setup, then enter the BIOS Setup again.
6. Go to the **Advanced** > **Intel(R) Rapid Storage Technology** to display the Intel® Rapid Storage Technology menu.



Creating a RAID set

To create a RAID set:

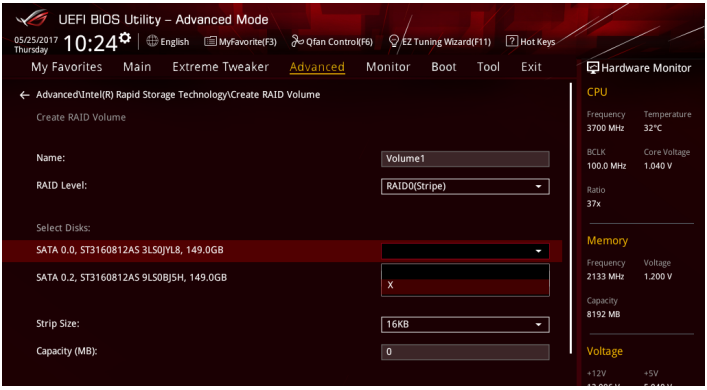
1. From the Intel® Rapid Storage Technology menu, select **Create RAID Volume** and press <Enter>. The following screen appears:



2. When the **Name** item is selected, enter a name for the RAID set and press <Enter>.

3. When the **RAID Level** item is selected, press <Enter> to select the RAID level to create, and then press <Enter>.

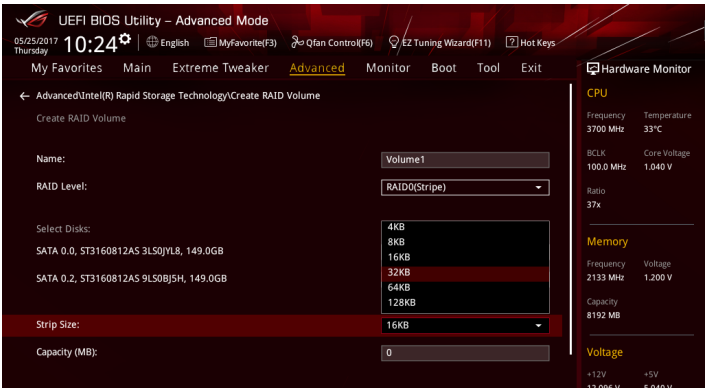
4. Under **Select Disks**, press <Enter> and select **X** for the disks you want to include in the RAID set.



5. When the **Strip Size** item is selected, press <Enter> to select strip size for the RAID array (for RAID 0, 10 and 5 only), and then press <Enter>. The available strip size values range from 4 KB to 128 KB. The following are typical values:

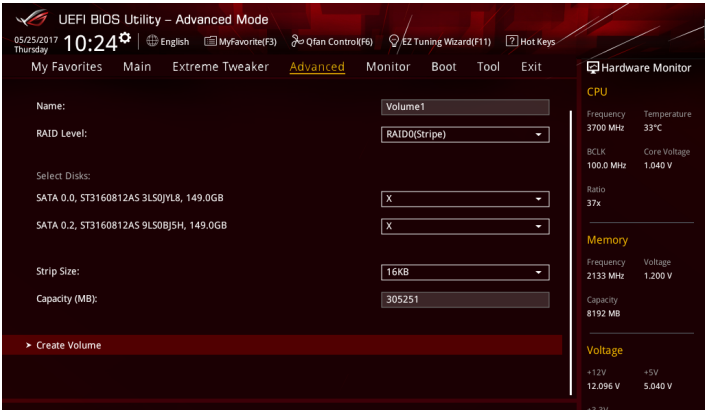
   - RAID 0: 128 KB
   - RAID 10: 64 KB
   - RAID 5: 64 KB

We recommend a lower strip size for server systems, and a higher strip size for multimedia computer systems used mainly for audio and video editing.



6. When the **Capacity (MB)** item is selected, enter the RAID volume capacity that you want and press <Enter>. The default value indicates the maximum allowed capacity.

7. When the **Create Volume** item is selected, press <Enter> to create the RAID volume and return to the Intel® Rapid Storage Technology menu.

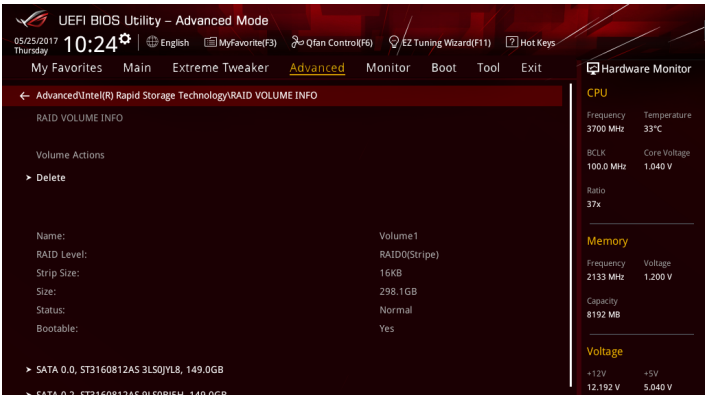


Deleting a RAID set

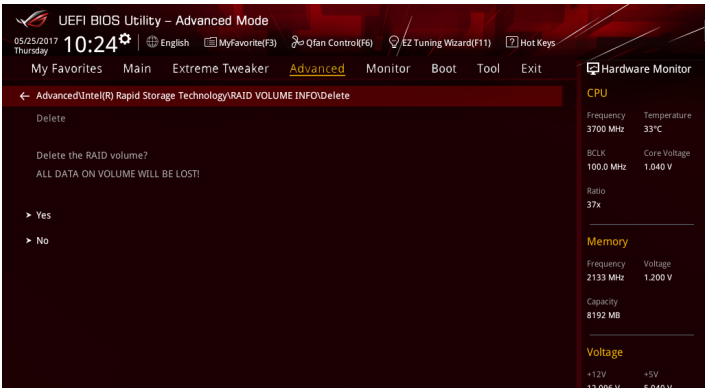
Be cautious when deleting a RAID set. You will lose all data on the hard disk drives when you delete a RAID set.

To delete a RAID set:

1. From the Intel® Rapid Storage Technology menu, select the RAID volume you want to delete and press <Enter>. The following screen appears:



2. When the **Delete** item is selected, press <Enter>, then select **Yes** to delete the RAID volume and return to the Intel® Rapid Storage Technology menu, or select **No** to cancel.



1.1.4 Intel® Virtual Raid on CPU in UEFI BIOS

Some motherboards support Intel® Virtual Raid on CPU with RAID 0, RAID 1, RAID 5, and RAID 10 solution. RAID 0 can be created without a KEY module, while RAID 1, RAID 5, and RAID 10 requires a KEY module.

- The KEY module is purchased separately.
- The Hyper M.2 x16 card is purchased separately.
- Due to CPU behavior, CPU RAID functions with Intel® CPU RSTe only supports Intel® Core™ X-series Processors (6-core or above) and Intel® SSD modules.
- Refer to section **Motherboard layout** in your motherboard's user manual for the location of the VROC_HW_KEY connector.

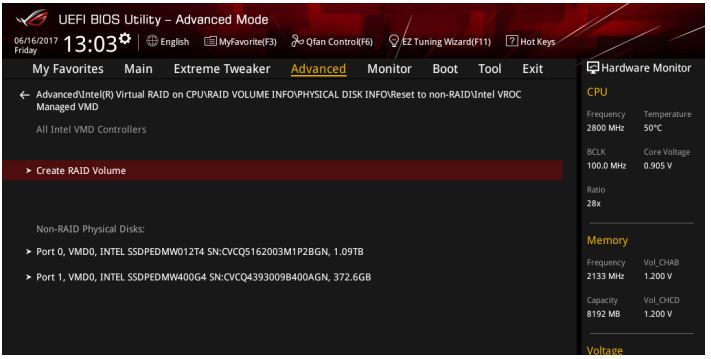
If you plan on using the CPU RAID configuration spanned across different PCIE slots as OS drives, please install the Hyper M.2 x16 cards into supported PCIE slots. Refer to section **Expansion slots** in your motherboard's user manual for more information on the PCIE slots.

To enter the Intel® Virtual Raid on CPU in UEFI BIOS:

1. Enter the BIOS Setup during POST.

Refer to Chapter 3 in your motherboard's user manual for details on entering and navigating through the BIOS Setup.

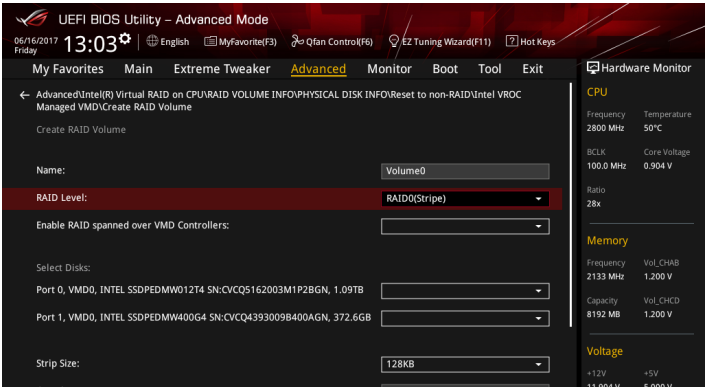
2. Go to **Boot** > **CSM (Compatibility Support Module)**, then set **Launch CSM** to **[Disabled]**.
3. Go to the **Advanced** > **CPU Storage Configuration**, then set the PCIE slot(s) that you have installed the Hyper M.2 x16 card(s) or PCIE X4 SSD card(s) to **[Hyper M.2 X16]** or **[PCIE X4 SSD Card]** accordingly.
4. Save your changes and exit the BIOS Setup, then enter the BIOS Setup again.
5. Go to the **Advanced** > **Intel(R) Virtual Raid on CPU** to display the Intel® Virtual Raid on CPU menu.



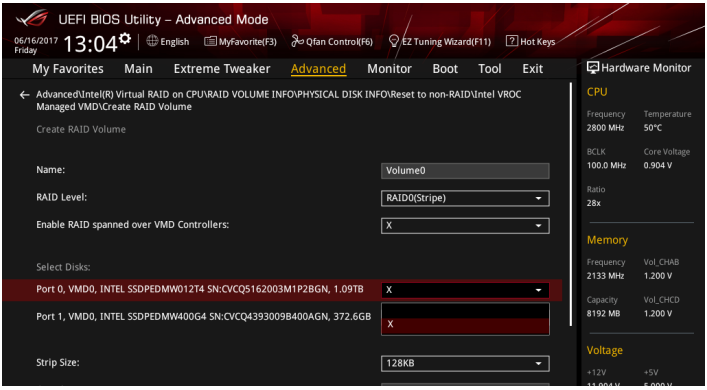
Creating a RAID set

To create a RAID set:

1. From the Intel® Virtual Raid on CPU menu, select **Create RAID Volume** and press <Enter>. The following screen appears:



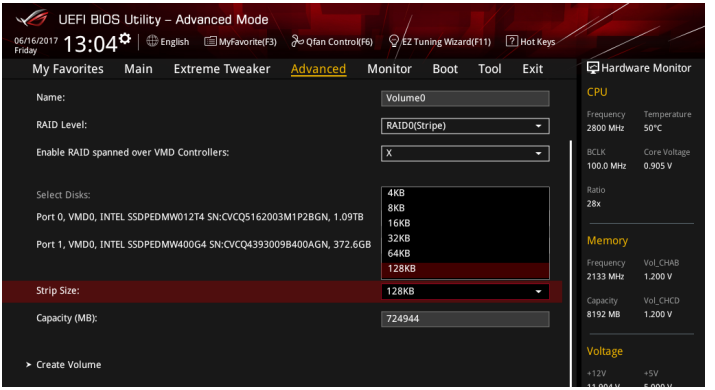
2. When the **Name** item is selected, enter a name for the RAID set and press <Enter>.
3. When the **RAID Level** item is selected, press <Enter> to select the RAID level to create, and then press <Enter>.
4. When the **Enable RAID spanned over VMD Controllers** item is selected, press <Enter> and select **X** to enable this function.
5. Under Select Disks, press <Enter> and select **X** for the disks you want to include in the RAID set.



6. When the **Strip Size** item is selected, press <Enter> to select strip size for the RAID array (for RAID 0, 10 and 5 only), and then press <Enter>. The available strip size values range from 4 KB to 128 KB. The following are typical values:

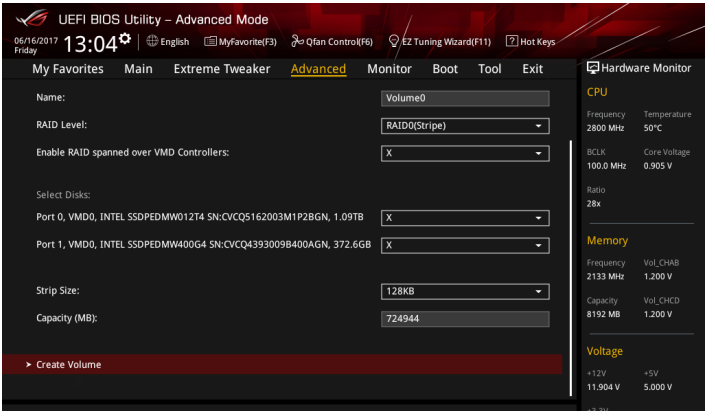
   - RAID 0: 128 KB
   - RAID 10: 64 KB
   - RAID 5: 64 KB

We recommend a lower strip size for server systems, and a higher strip size for multimedia computer systems used mainly for audio and video editing.



7. When the **Capacity (MB)** item is selected, enter the RAID volume capacity that you want and press <Enter>. The default value indicates the maximum allowed capacity.

8. When the **Create Volume** item is selected, press <Enter> to create the RAID volume and return to the Intel® Rapid Storage Technology menu.

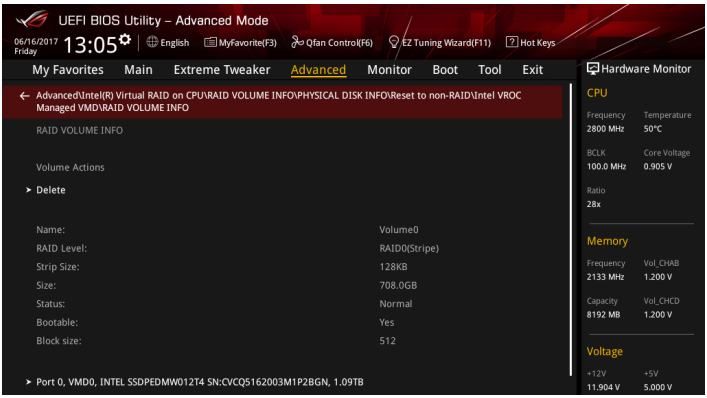


Deleting a RAID set

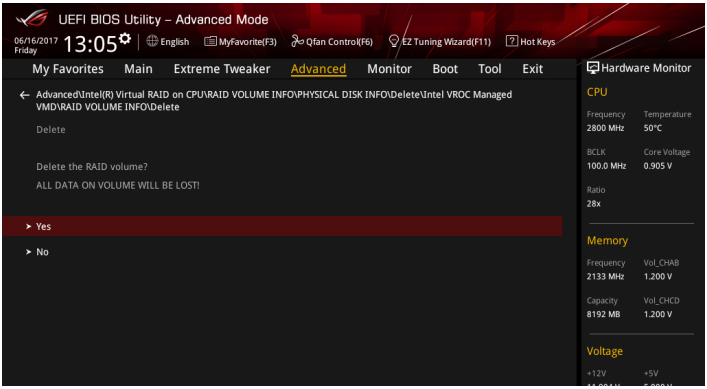
Be cautious when deleting a RAID set. You will lose all data on the hard disk drives when you delete a RAID set.

To delete a RAID set:

1. From the Intel® Virtual Raid on CPU menu, select the RAID volume you want to delete and press <Enter>. The following screen appears:



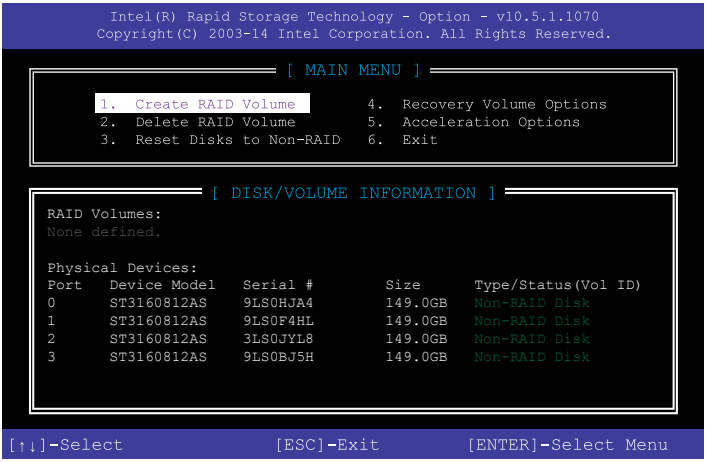
2. When the **Delete** item is selected, press <Enter>, then select **Yes** to delete the RAID volume and return to the Intel® Virtual Raid on CPU menu, or select **No** to cancel.



1.1.5 Intel® Rapid Storage Technology Option ROM utility

To enter the Intel® Rapid Storage Technology Option ROM utility:

1. Turn on the system.
2. During POST, press <Ctrl> + <I> to display the utility main menu.



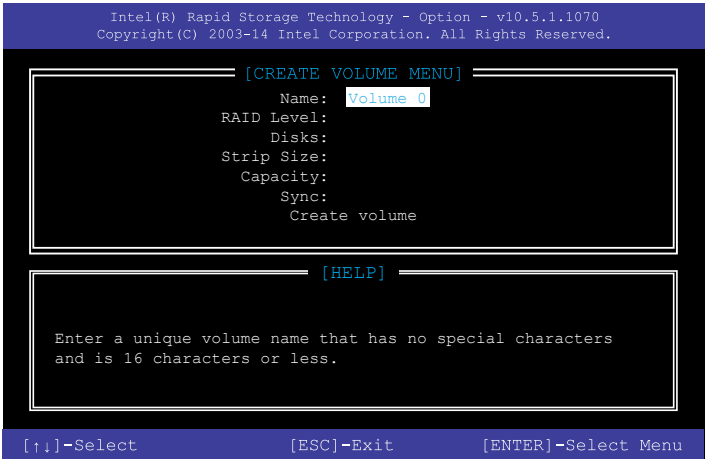
The navigation keys at the bottom of the screen allow you to move through the menus and select the menu options.

The RAID BIOS setup screens shown in this section are for reference only and may not exactly match the items on your screen.

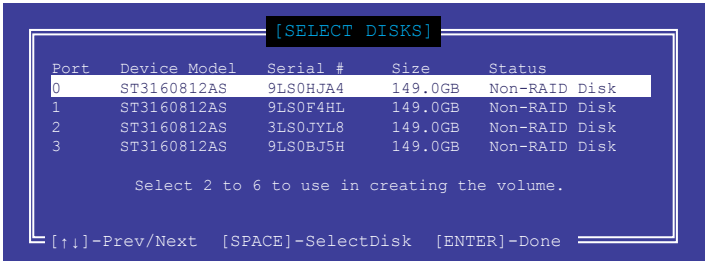
Creating a RAID set

To create a RAID set:

1. From the utility main menu, select **1. Create RAID Volume** and press <Enter>. The following screen appears:



2. Enter a name for the RAID set and press <Enter>.
3. When the RAID Level item is selected, press the up/down arrow key to select a RAID level to create, and then press <Enter>.
4. When the Disks item is selected, press <Enter> to select the hard disk drives you want to include in the RAID set. The SELECT DISKS screen appears:



5. Use the up/down arrow key to select a drive, and then press <Space> to select. A small triangle marks the selected drive. Press <Enter> after completing your selection.

6. Use the up/down arrow key to select the strip size for the RAID array (for RAID 0, 10 and 5 only), and then press <Enter>. The available strip size values range from 4 KB to 128 KB. The following are typical values:

   - RAID 0: 128 KB
   - RAID 10: 64 KB
   - RAID 5: 64 KB

We recommend a lower strip size for server systems, and a higher strip size for multimedia computer systems used mainly for audio and video editing.

7. When the **Capacity** item is selected, enter the RAID volume capacity that you want and press <Enter>. The default value indicates the maximum allowed capacity.

8. When the **Create Volume** item is selected, press <Enter>. The following warning message appears:

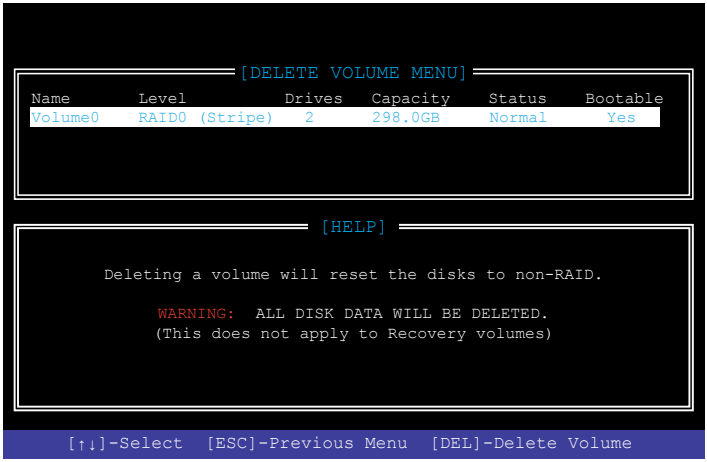
9. Press <Y> to create the RAID volume and return to the main menu, or <N> to go back to the CREATE VOLUME menu.

Deleting a RAID set

Be cautious when deleting a RAID set. You will lose all data on the hard disk drives when you delete a RAID set.

To delete a RAID set:

1. From the utility main menu, select **2. Delete RAID Volume** and press <Enter>. The following screen appears:



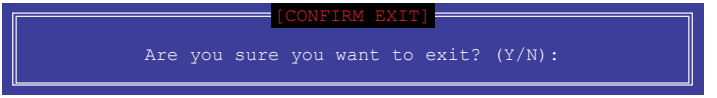
2. Use the up/down arrow key to select the RAID set you want to delete, and then press <Delete>. The following warning message appears:

3. Press <Y> to delete the RAID set and return to the utility main menu, or press <N> to return to the DELETE VOLUME menu.

Exiting the Intel® Rapid Storage Technology Option ROM utility

To exit the utility:

1. From the utility main menu, select **6. Exit**, then press <Enter>. The following warning message appears:



2. Press <Y> to exit or press <N> to return to the utility main menu.

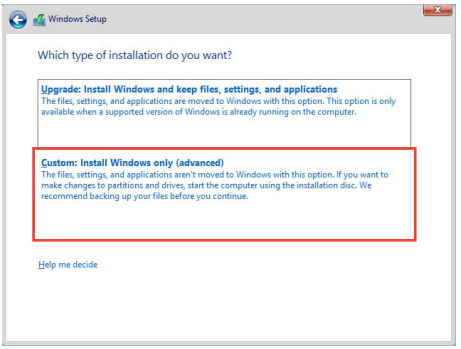
1.2 Installing the RAID controller driver during Windows® 10 OS installation

After creating the RAID sets, you are now ready to install an operating system to the independent drives or bootable array. This part provides the instructions on how to install the RAID controller drivers during OS installation.

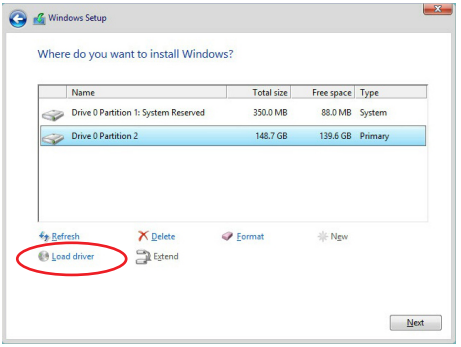
If you plan on using the CPU RAID configuration spanned across different PCIE slots as OS drives, please install the Hyper M.2 x16 cards to the supported PCIE slots. Refer to section **Motherboard layout** in your motherboard's user manual for more information on the PCIE slots.

To install the RAID controller driver when installing Windows® 10 OS:

1. Boot the computer using the Windows® 10 OS installation disc. Follow the screen instructions to start installing Windows® 10.
2. When prompted to choose a type of installation, click **Custom: Install Windows only (advanced)**.



3. Click **Load Driver**.

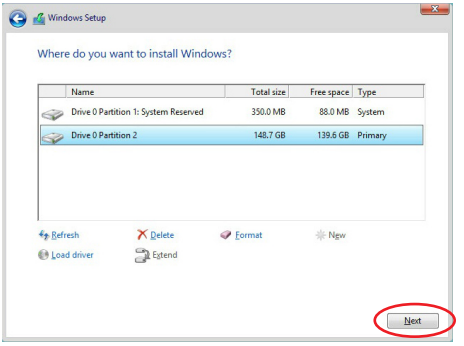


4. A message appears, reminding you to insert the installation media containing the driver of the RAID controller driver. Click **Browse** to continue.

- If you have only one optical drive installed in your system, eject the Windows OS installation disc and replace it with the motherboard Support DVD.
- If you do not have an optical drive, you can use another computer with an optical drive to copy the RAID driver from the support DVD to a USB flash drive.

5. Locate the driver in the corresponding folder of the Support DVD or the USB flash drive with RAID driver, then click **OK** to continue.
6. Select the RAID controller driver you need from the list and click **Next**.
7. When the system finishes loading the RAID driver, select the drive to install Windows and click **Next**.

If you have ejected the Windows OS installation disc in a previous step, ensure to replace the motherboard Support DVD with the Windows OS installation disc.



8. Setup then proceeds with the OS installation. Follow screen instructions to complete.

AMD RAID Configuration

2

2.1 RAID configurations

If your motherboard supports RaidXpert2 Configuration Utility, you can create Volume, RAIDABLE, RAID 0, RAID 1, or RAID 10 (depends on system licensing) configurations.

If you want to install a Windows® operating system to a hard disk drive included in a RAID set, you have to create a RAID driver disk and load the RAID driver during OS installation. Refer to section **2.2 Installing the RAID controller driver during Windows® 10 OS installation** for details.

2.1.1 RAID definitions

Volume provides the ability to link-together storage from one or several disks, regardless of the size of the space on those disks. This configuration is useful in scavenging space on disks unused by other disks in the array. This configuration does not provide performance benefits or data redundancy, disk failure will result in data loss.

RAIDABLE arrays (also known as RAID Ready) are a special type of Volume (JBOD) that allows 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.

The ability to create RAIDABLE arrays may vary per system.

RAID 0 (Data striping) optimizes two identical hard disk drives to read and write data in parallel, interleaved stacks. Two hard disks perform the same work as a single drive but at a sustained data transfer rate, double that of a single disk alone, thus improving data access and storage. Use of two new identical hard disk drives is required for this setup.

RAID 1 (Data mirroring) copies and maintains an identical image of data from one drive to a second drive. If one drive fails, the disk array management software directs all applications to the surviving drive as it contains a complete copy of the data in the other drive. This RAID configuration provides data protection and increases fault tolerance to the entire system. Use two new drives or use an existing drive and a new drive for this setup. The new drive must be of the same size or larger than the existing drive.

RAID 10 is data striping and data mirroring combined without parity (redundancy data) having to be calculated and written. With the RAID 10 configuration you get all the benefits of both RAID 0 and RAID 1 configurations. Use four new hard disk drives or use an existing drive and three new drives for this setup.

2.1.2 Installing storage devices

The motherboard supports SATA hard disk drives and PCIE SSD storage devices. For optimal performance, install identical drives of the same model and capacity when creating a disk array.

Refer to Chapter 2 in your motherboard's user manual for details on installing storage devices to your motherboard.

2.1.3 RaidXpert2 Configuration Utility in UEFI BIOS

To enter the RaidXpert2 Configuration Utility in UEFI BIOS:

1. Enter the BIOS Setup during POST.

Refer to Chapter 3 in your motherboard's user manual for details on entering and navigating through the BIOS Setup.

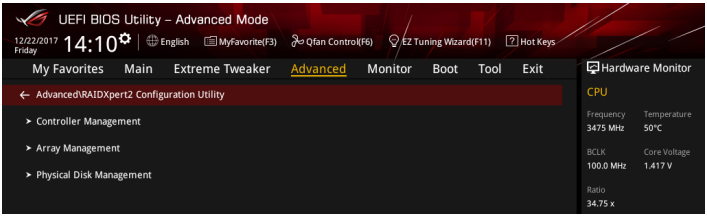
2. Go to **Advanced** > **SATA Configuration**, then set **SATA Mode** to **[RAID]**.

Due to chipset limitation, when SATA ports are set to RAID mode, all SATA ports run at RAID mode together.

3. Configure additional settings for your storage device and RAID configuration:
   - If you are using SATA storage devices, no additional settings are required. Please proceed to next step.
   - If you are setting up an NVMe RAID set, go to **Advanced** > **SATA Configuration** (or **Advanced** > **AMD PBS**), then set **NVMe RAID mode** to **[Enabled]**.
   - If you are using Hyper M.2 x16 card(s), go to **Advanced** > **Onboard Devices Configuration**, then set the corresponding PCIE slot(s) to **[PCIe RAID Mode]**.

The Hyper M.2 x16 card is purchased separately.

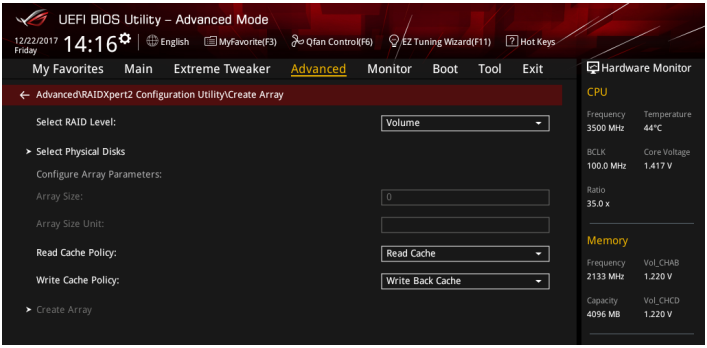
4. Go to **Boot** > **CSM (Compatibility Support Module)**, then set **Launch CSM** to **[Disabled]**.
5. Save your changes and exit the BIOS Setup, then enter the BIOS Setup again.
6. Go to **Advanced** > **RaidXpert2 Configuration Utility** to display the RaidXpert2 Configuration Utility menu.



Creating a RAID set

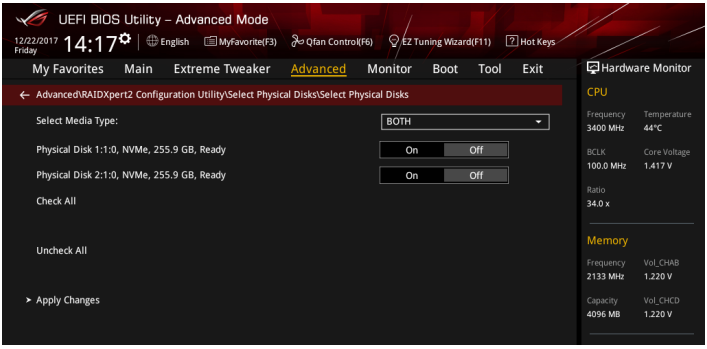
To create a RAID set:

1. From the RaidXpert2 Configuration Utility menu, go to **Array Management** > **Create Array** to enter the Create Array menu. The following screen appears:



2. When the **Select RAID Level** item is selected, press <Enter> to select the RAID level to create, and then press <Enter>.

3. When the **Select Physical Disks** item is selected, press <Enter> to enter the Select Physical Disks menu. The following screen appears:



4. Toggle the physical disks that you want to include in the RAID set to **On**, then select **Apply Changes** and press <Enter> to complete selection.

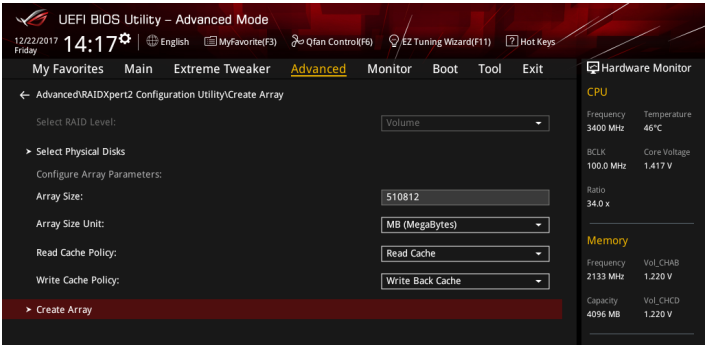
5. When the **Array Size:** item is selected, enter the RAID volume capacity that you want and press <Enter>. The default value indicates the maximum allowed capacity.

6. When the **Array Size Unit:** item is selected, press <Enter> to select the size unit for the RAID array, and then press <Enter>.

7. When the **Read Cache Policy:** item is selected, press <Enter> to select the read policy for the RAID array, and then press <Enter>.

8. When the **Write Cache Policy:** item is selected, press <Enter> to select the write policy for the RAID array, and then press <Enter>.

9. When the **Create Array** item is selected, press <Enter> to create the RAID volume and return to the Array Management menu.

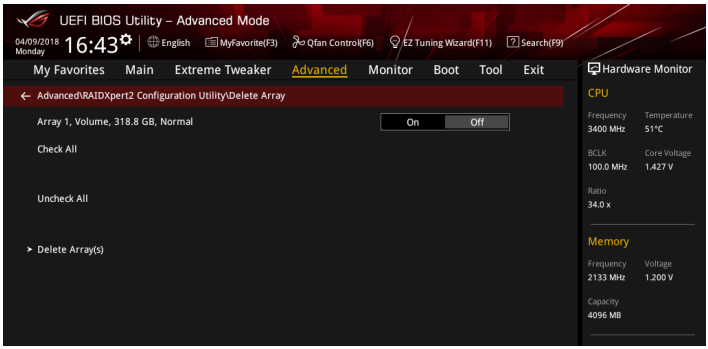


Deleting a RAID set

Be cautious when deleting a RAID set. You will lose all data on the hard disk drives when you delete a RAID set.

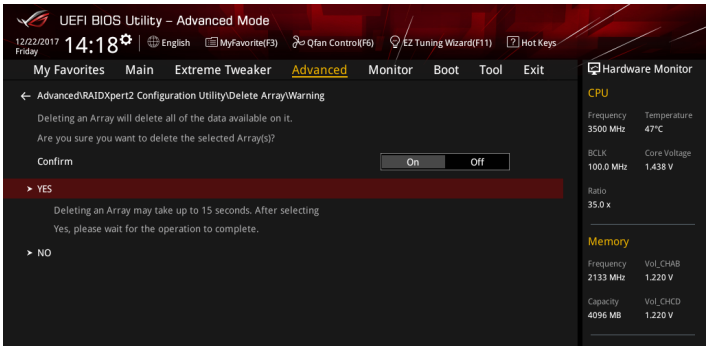
To delete a RAID set:

1. From the RaidXpert2 Configuration Utility menu, go to **Array Management** > **Delete Array** to enter the Delete Array menu. The following screen appears:



2. Toggle the array(s) that you want to delete to **On**.

3. When the **Delete Array(s)** item is selected, press <Enter>, toggle the **Confirm** item to **On**, then select **YES** to delete the RAID volume, or select **NO** to cancel.



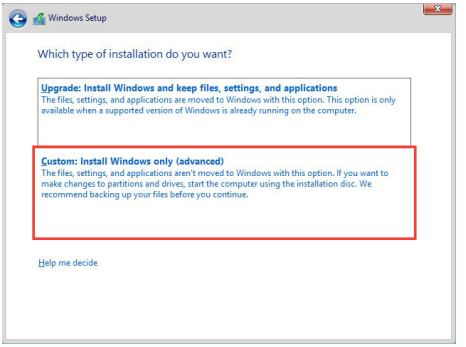
2.2 Installing the RAID controller driver during Windows® 10 OS installation

After creating the RAID sets, you are now ready to install an operating system to the independent drives or bootable array. This part provides the instructions on how to install the RAID controller drivers during OS installation.

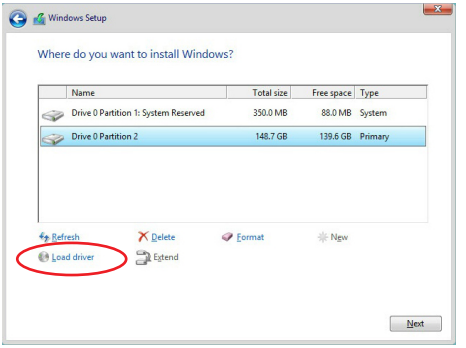
To install the RAID controller driver when installing Windows® 10 OS:

1. Boot the computer using the Windows® 10 OS installation disc. Follow the screen instructions to start installing Windows® 10.

2. When prompted to choose a type of installation, click **Custom: Install Windows only (advanced)**.



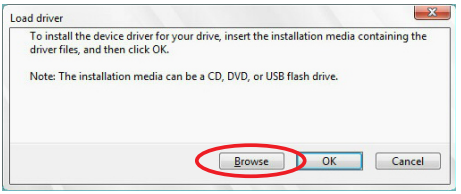
3. Click **Load Driver**.



DO NOT delete any of the partitions or format the NVMe devices. Doing so will delete the AMD-RAID metadata and the desired RAID level will be deleted.

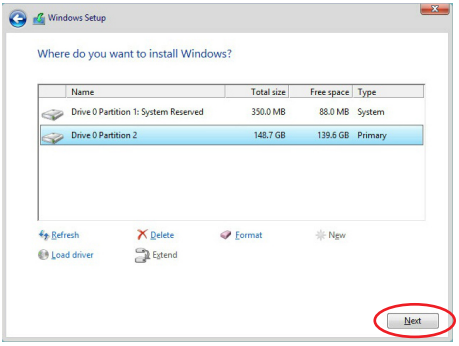
4. A message appears, reminding you to insert the installation media containing the driver of the RAID controller driver. Click **Browse** to continue.

- If you have only one optical drive installed in your system, eject the Windows OS installation disc and replace it with the motherboard Support DVD.
- If you do not have an optical drive, you can use another computer with an optical drive to copy the RAID driver from the support DVD to a USB flash drive.



5. Locate the driver in the corresponding folder of the Support DVD or the USB flash drive with RAID driver, then click **OK** to continue.
6. Select the RAID controller driver (rcbottom.inf) from the list and click **Next**. The available drives will temporary disappear.
7. Repeat steps 3 to 5 and select the RAID controller driver (rcraid.inf) from the list and click **Next**. The available drives will reappear.
8. Repeat steps 3 to 5 and select the RAID controller driver (rccfg.inf) from the list and click **Next**. The AMD-RAID Virtual Disk will appear.
9. Select the drive to install Windows and click **Next**.

If you have ejected the Windows OS installation disc in a previous step, ensure to replace the motherboard Support DVD with the Windows OS installation disc.



10. Setup then proceeds with the OS installation. Follow screen instructions to complete.