ROG MAXIMUS XI EXTREME

BIOS Manual

Motherboard

E14983
First Edition
November 2018

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Contents

BIOS Setup

1.1 Knowing BIOS

The new ASUS UEFI BIOS is a Unified Extensible Interface that complies with UEFI architecture, offering a user-friendly interface that goes beyond the traditional keyboard-only BIOS controls to enable a more flexible and convenient mouse input. You can easily navigate the new UEFI BIOS with the same smoothness as your operating system. The term “BIOS” in this user manual refers to “UEFI BIOS” unless otherwise specified.

BIOS (Basic Input and Output System) stores system hardware settings such as storage device configuration, overclocking settings, advanced power management, and boot device configuration that are needed for system startup in the motherboard CMOS. In normal circumstances, the default BIOS settings apply to most conditions to ensure optimal performance. **DO NOT change the default BIOS settings** except in the following circumstances:

- An error message appears on the screen during the system bootup and requests you to run the BIOS Setup.
- You have installed a new system component that requires further BIOS settings or update.

Inappropriate BIOS settings may result to instability or boot failure. **We strongly recommend that you change the BIOS settings only with the help of a trained service personnel**.

- When downloading or updating the BIOS file, rename it as **M11E.CAP** for this motherboard.
- BIOS settings and options may vary due to different BIOS release versions. Please refer to the latest BIOS version for settings and options.

1.2 BIOS setup program

Use the BIOS Setup to update the BIOS or configure its parameters. The BIOS screen include navigation keys and brief onscreen help to guide you in using the BIOS Setup program.

Entering BIOS at startup

To enter BIOS Setup at startup, press <Delete> or <F2> during the Power-On Self Test (POST). If you do not press <Delete> or <F2>, POST continues with its routines.

Entering BIOS Setup after POST

To enter BIOS Setup after POST:

- Press <Ctrl>+<Alt>+<Delete> simultaneously.
- Press the reset button on the system chassis.
- Press the power button to turn the system off then back on. Do this option only if you failed to enter BIOS Setup using the first two options.

After doing either of the three options, press <Delete> key to enter BIOS.

- The BIOS setup screens shown in this section are for reference purposes only, and may not exactly match what you see on your screen.
- Ensure that a USB mouse is connected to your motherboard if you want to use the mouse to control the BIOS setup program.
- If the system becomes unstable after changing any BIOS setting, load the default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the **Exit** menu or press hotkey **<F5>**. See section **1.10 Exit menu** for details.
- If the system fails to boot after changing any BIOS setting, try to clear the CMOS and reset the motherboard to the default value. See section **2.3.1 Rear I/O connection** in your user manual for the location of the Clear CMOS button to clear RTC RAM.
- The BIOS setup program does not support Bluetooth devices.

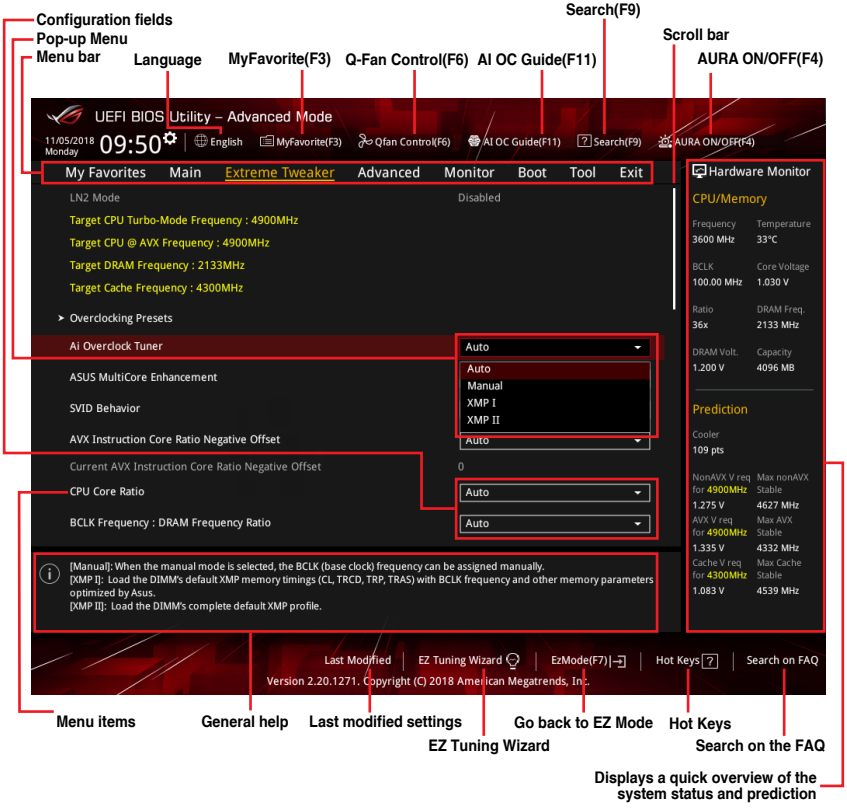
BIOS menu screen

The BIOS Setup program can be used under two modes: **EZ Mode** and **Advanced Mode**. You can change modes from **Setup Mode** in **Boot menu** or by pressing the <F7> hotkey.

1.2.1 Advanced Mode

The Advanced Mode provides advanced options for experienced end-users to configure the BIOS settings. The figure below shows an example of the Advanced Mode. Refer to the following sections for the detailed configurations.

The default screen for entering the BIOS setup program can be changed. Refer to the **Setup Mode** item in section **Boot menu** for details.



Menu bar

The menu bar on top of the screen has the following main items:

My Favorites	For saving the frequently-used system settings and configuration.
Main	For changing the basic system configuration
Extreme Tweaker	For changing the overclocking settings
Advanced	For changing the advanced system settings
Monitor	For displaying the system temperature, power status, and changing the fan settings.
Boot	For changing the system boot configuration
Tool	For configuring options for special functions
Exit	For selecting the exit options and loading default settings

Menu items

The highlighted item on the menu bar displays the specific items for that menu. For example, selecting **Main** shows the Main menu items.

The other items (My Favorites, Extreme Tweaker, Advanced, Monitor, Boot, Tool, and Exit) on the menu bar have their respective menu items.

Submenu items

A greater than sign (>) before each item on any menu screen means that the item has a submenu. To display the submenu, select the item and press <Enter>.

Language

This button above the menu bar contains the languages that you can select for your BIOS. Click this button to select the language that you want to display in your BIOS screen.

My Favorites(F3)

This button above the menu bar shows all BIOS items in a Tree Map setup. Select frequently-used BIOS settings and save it to MyFavorites menu.

Refer to section **1.3 My Favorites** for more information.

Q-Fan Control(F6)

This button above the menu bar displays the current settings of your fans. Use this button to manually tweak the fans to your desired settings.

Refer to section **1.2.3 Q-Fan Control** for more information.

AI OC Guide(F11)

This button above the menu bar allows you to view the descriptions of AI overclocking and enable it.

- Refer to section **1.2.4 AI OC Guide** for more information.
- This function is only enabled when using an unlocked CPU.

Search (F9)

This button allows you to search for BIOS items by entering its name, enter the item name to find the related item listing.

AURA (F4)

This button allows you to turn the RGB LED lighting or functional LED on or off.

[All On]: All LEDs (Aura or Functional) will be enabled.

[Aura Only]: Aura LEDs will be enabled and functional LEDs will be disabled.

[Aura Off]: Aura LEDs will be disabled, however functional LEDs will still be enabled.

[Stealth Mode]: All LEDs (Aura and Functional) will be disabled.

Search on FAQ

Move your mouse over this button to show a QR code, scan this QR code on your mobile device to connect to the BIOS FAQ web page of the ASUS support website. You can also scan the following QR code:

Scroll bar

A scroll bar appears on the right side of a menu screen when there are items that do not fit on the screen. Press the Up/Down arrow keys or <Page Up> / <Page Down> keys to display the other items on the screen.

General help

At the bottom of the menu screen is a brief description of the selected item. Use <F12> key to capture the BIOS screen and save it to the removable storage device.

Configuration fields

These fields show the values for the menu items. If an item is user-configurable, you can change the value of the field opposite the item. You cannot select an item that is not user-configurable.

A configurable field is highlighted when selected. To change the value of a field, select it and press <Enter> to display a list of options.

Hot keys

This button contains the navigation keys for the BIOS setup program. Use the navigation keys to select items in the menu and change the settings.

EZ Tuning Wizard

This button above the menu bar allows you to view and configure the RAID settings of your system.

Refer to section **1.2.5 EZ Tuning Wizard** for more information.

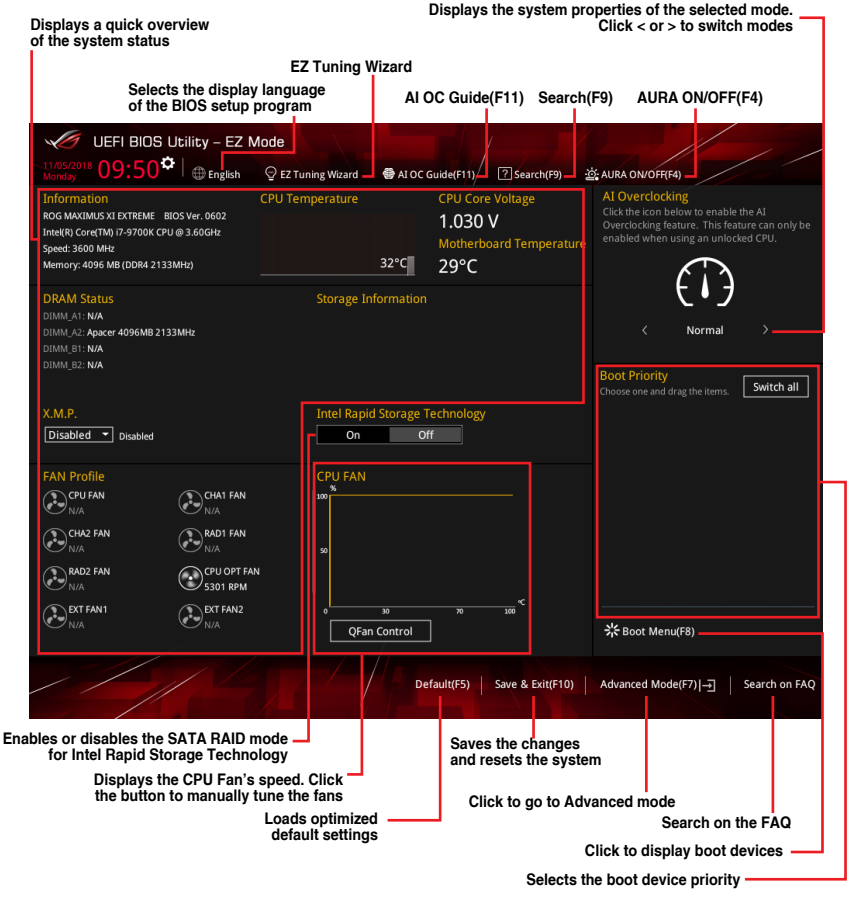
Last Modified button

This button shows the items that you last modified and saved in BIOS Setup.

1.2.2 EZ Mode

The EZ Mode provides you an overview of the basic system information, and allows you to select the display language, system performance, mode and boot device priority. To access the Advanced Mode, select **Advanced Mode** or press the <F7> hotkey for the advanced BIOS settings.

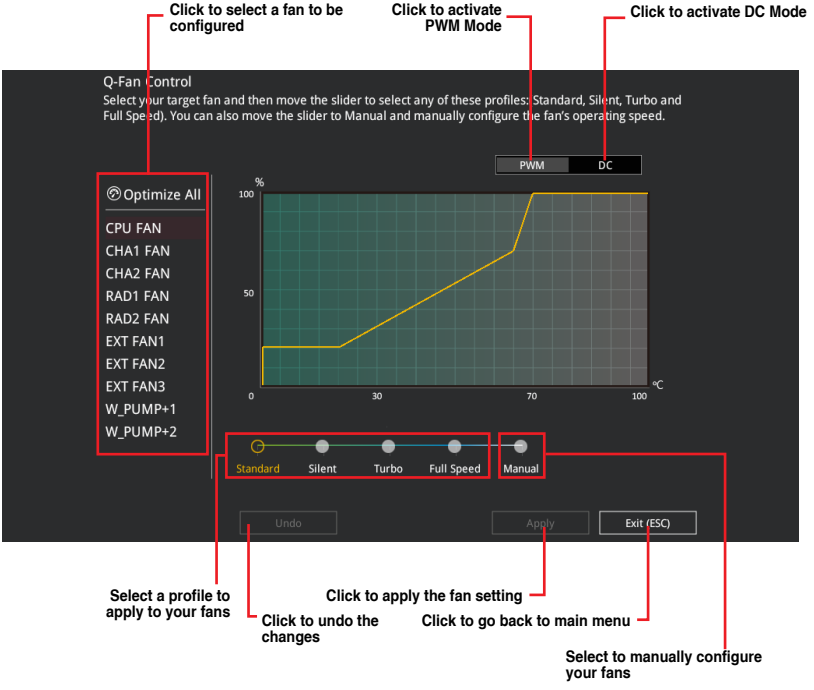
To switch from Advanced Mode to EZ Mode, click **EZ Mode(F7)** or press the <F7> hotkey.



The boot device options vary depending on the devices you installed to the system.

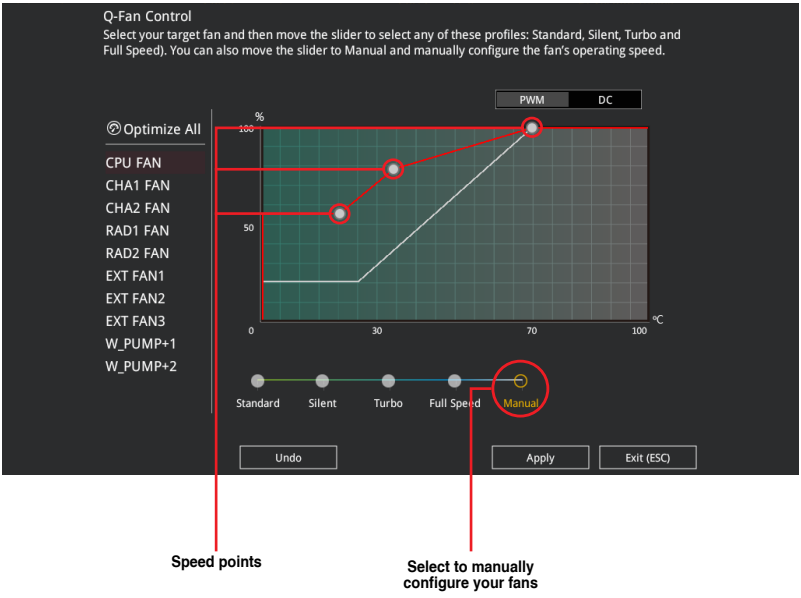
1.2.3 Q-Fan Control

The Q-Fan Control allows you to set a fan profile or manually configure the operating speed of your CPU and chassis fans.



Configuring fans manually

Select **Manual** from the list of profiles to manually configure your fans' operating speed.



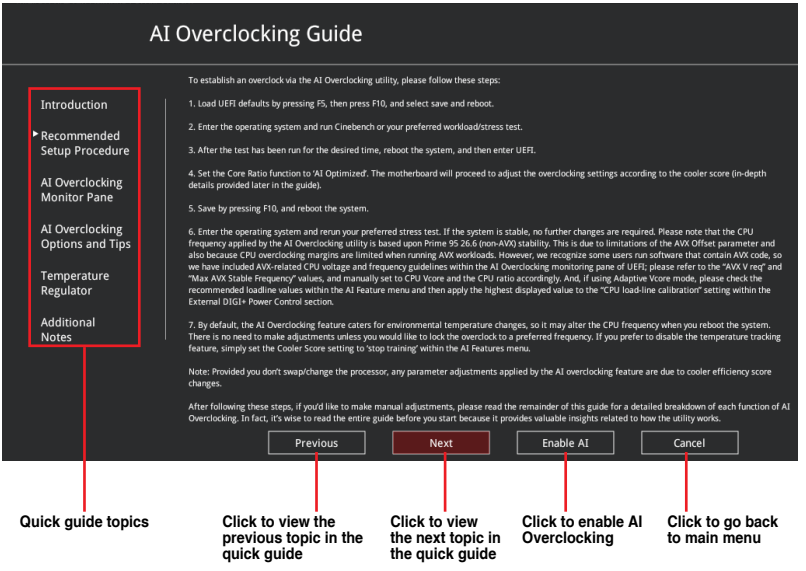
To configure your fans:

1. Select the fan that you want to configure and to view its current status.
2. Click and drag the speed points to adjust the fans' operating speed.
3. Click **Apply** to save the changes then click **Exit (ESC)**.

1.2.4 AI OC Guide

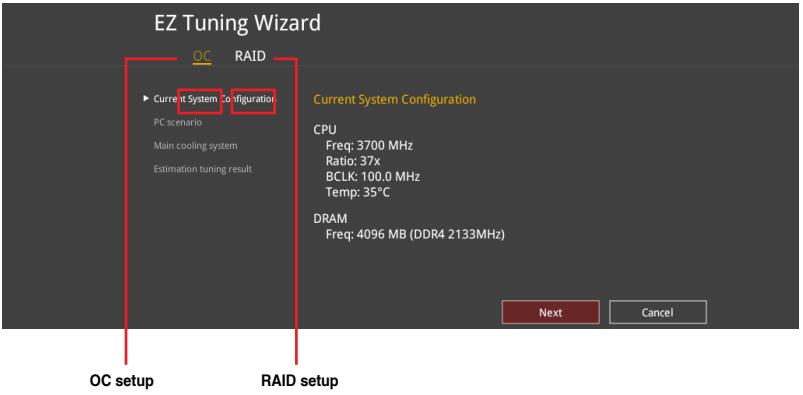
- The screenshot shown in this section is for reference purposes only, and may not exactly match what you see on your screen.
- This function is only enabled when using an unlocked CPU.

The AI OC Guide allows you to enable the AI Overclocking feature, or view a quick guide of the AI Overclocking feature which highlights the recommended setup procedure and descriptions of the AI Overclocking.
Clicking on **Enable AI** will enable AI Overclocking.



1.2.5 EZ Tuning Wizard

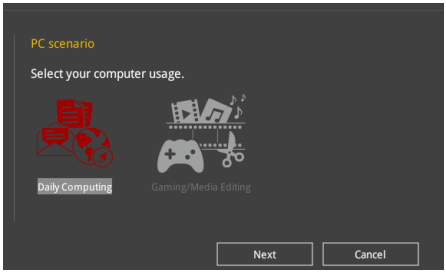
EZ Tuning Wizard allows you to easily overclock your CPU and DRAM, computer usage, and CPU fan to their best settings. You can also set RAID in your system using this feature.



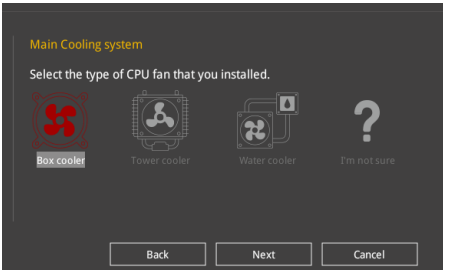
OC Tuning

To start OC Tuning:

1. Click **EZ Tuning Wizard** from the BIOS screen to open EZ Tuning Wizard screen.
2. Click **OC** then click **Next**.
3. Select a PC scenario **Daily Computing** or **Gaming/Media Editing,** then click **Next**.



4. Select a Main Cooling System **BOX cooler, Tower cooler, Water cooler,** or **I'm not sure,** then click **Next**.



5. After selecting the Main Cooling System, click **Next** then click **Yes** to start the OC Tuning.

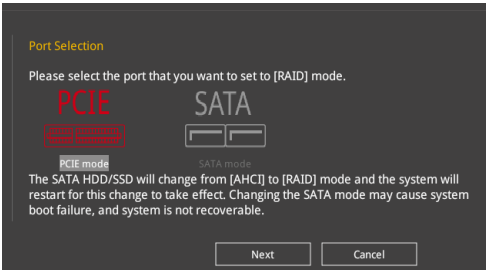
Creating RAID

To create RAID:

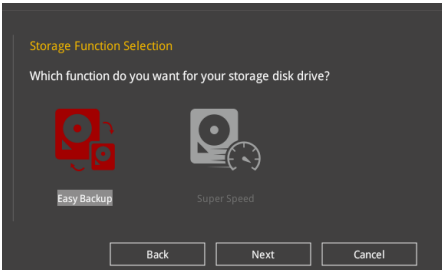
1. Click **EZ Tuning Wizard** from the BIOS screen to open EZ Tuning Wizard screen.
2. Click **RAID** then click **Next**.

- Ensure that your HDDs have no existing RAID volumes.
- Ensure to connect your HDDs to Intel® SATA connectors.

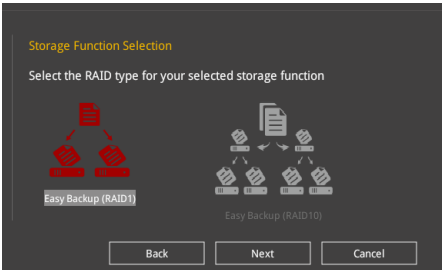
3. Select the port that you want to set to [RAID] mode, **PCIE** or **SATA**, then click **Next**.



4. Select the type of storage for your RAID, **Easy Backup** or **Super Speed**, then click **Next**.

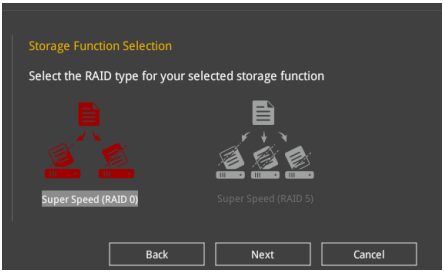


a. For Easy Backup, click **Next** then select from **Easy Backup (RAID1)** or **Easy Backup (RAID10)**.



You can only select Easy Backup (RAID 10) if you connect four (4) HDDs.

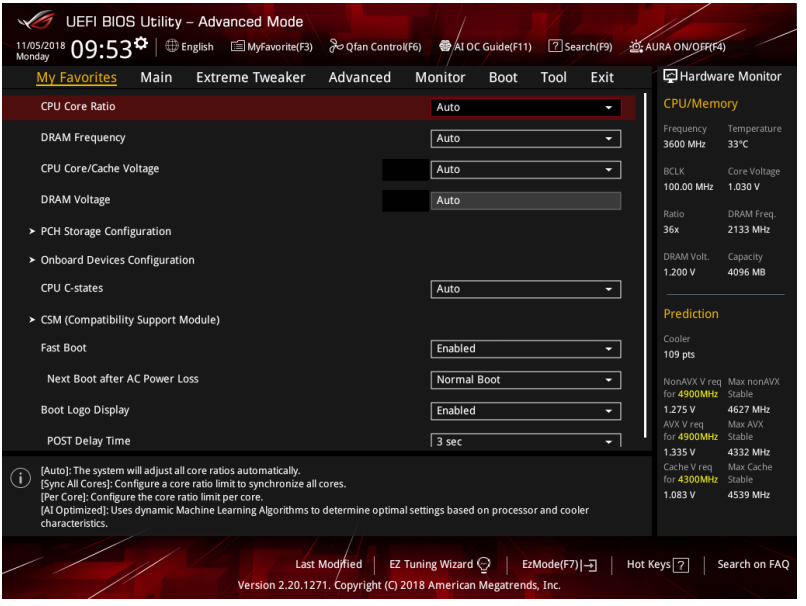
b. For Super Speed, click **Next** then select from **Super Speed (RAID0)** or **Super Speed (RAID5)**.



5. After selecting the type of RAID, click **Next** then click **Yes** to continue the RAID setup.
6. After the RAID setup is done, click **Yes** to exit the setup then click **OK** to reset your system.

1.3 My Favorites

My Favorites is your personal space where you can easily save and access your favorite BIOS items.

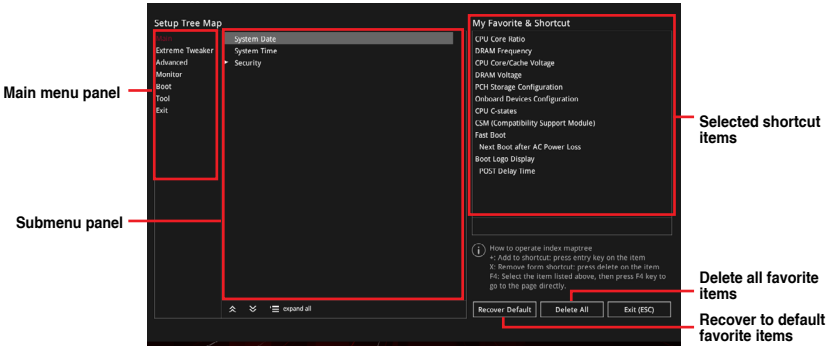


My Favorites comes with several performance, power saving, and fast boot related items by default. You can personalize this screen by adding or removing items.

Adding items to My Favorites

To add frequently-used BIOS items to My Favorites:

1. Press <F3> on your keyboard or click **MyFavorites(F3)** from the BIOS screen to open Setup Tree Map screen.
2. On the Setup Tree Map screen, select the BIOS items that you want to save in My Favorites screen.



3. Select an item from main menu panel, then click the submenu that you want to save as favorite from the submenu panel and click + or press <Enter> on your keyboard.

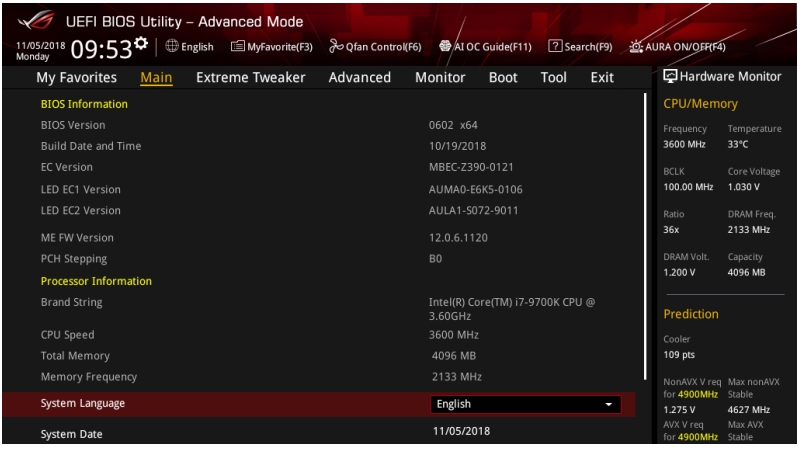
You cannot add the following items to My Favorite items:

- Items with submenu options
- User-managed items such as language and boot order
- Configuration items such as Memory SPD Information, system time and date.

4. Click **Exit (ESC)** or press <Esc> key to close Setup Tree Map screen.
5. Go to My Favorites menu to view the saved BIOS items.

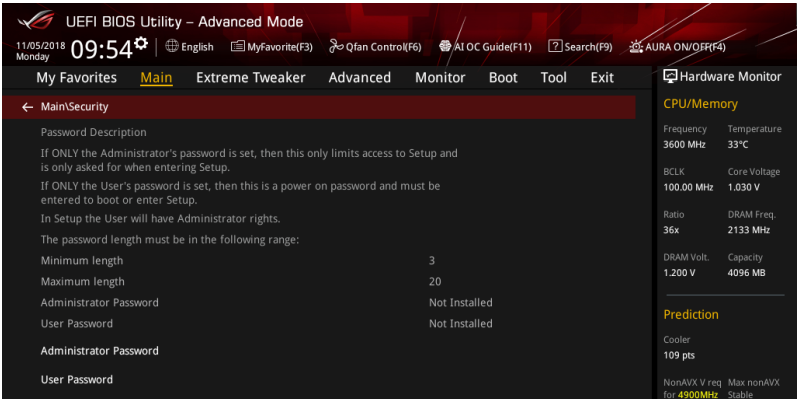
1.4 Main menu

The Main menu screen appears when you enter the Advanced Mode of the BIOS Setup program. The Main menu provides you an overview of the basic system information, and allows you to set the system date, time, language, and security settings.



Security

The Security menu items allow you to change the system security settings.



- If you have forgotten your BIOS password, erase the CMOS Real Time Clock (RTC) RAM to clear the BIOS password. See section **2.3.1 Rear I/O connection** in your user manual for the location of the Clear CMOS button to clear RTC RAM.
- The Administrator or User Password items on top of the screen show the default **[Not Installed]**. After you set a password, these items show **[Installed]**.

Administrator Password

If you have set an administrator password, we recommend that you enter the administrator password for accessing the system. Otherwise, you might be able to see or change only selected fields in the BIOS setup program.

To set an administrator password:

1. Select the **Administrator Password** item and press <Enter>.
2. From the **Create New Password** box, key in a password, then press <Enter>.
3. Re-type to confirm the password then select **OK**.

To change an administrator password:

1. Select the **Administrator Password** item and press <Enter>.
2. From the **Enter Current Password** box, key in the current password, then press <Enter>.
3. From the **Create New Password** box, key in a new password, then press <Enter>.
4. Re-type to confirm the password then select **OK**.

To clear the administrator password, follow the same steps as in changing an administrator password, but leave other fields blank then select **OK** to continue. After you clear the password, the **Administrator Password** item on top of the screen shows **[Not Installed]**.

User Password

If you have set a user password, you must enter the user password for accessing the system. The User Password item on top of the screen shows the default **[Not Installed]**. After you set a password, this item shows **[Installed]**.

To set a user password:

1. Select the **User Password** item and press <Enter>.
2. From the **Create New Password** box, key in a password, then press <Enter>.
3. Re-type to confirm the password then select **OK**.

To change a user password:

1. Select the **User Password** item and press <Enter>.
2. From the **Enter Current Password** box, key in the current password, then press <Enter>.
3. From the **Create New Password** box, key in a new password, then press <Enter>.
4. Re-type to confirm the password then select **OK**.

To clear the user password, follow the same steps as in changing a user password, but leave other fields blank then select **OK** to continue. After you clear the password, the **User Password** item on top of the screen shows **[Not Installed]**.

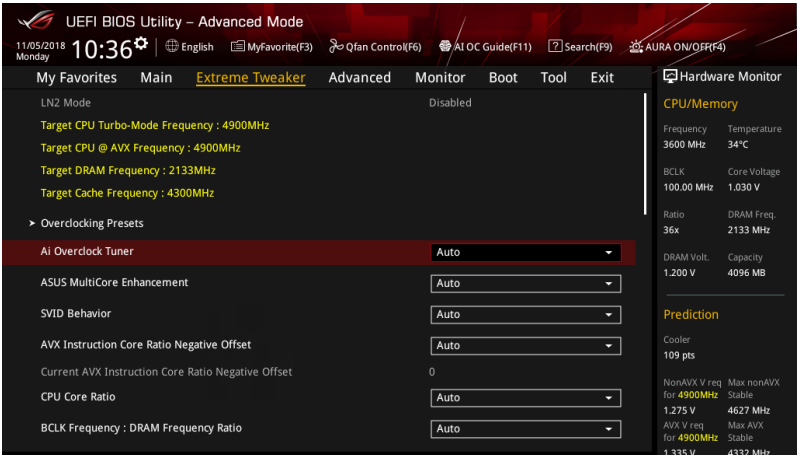
1.5 Extreme Tweaker menu

The Extreme Tweaker menu items allow you to configure overclocking-related items.

Be cautious when changing the settings of the Extreme Tweaker menu items. Incorrect field values can cause the system to malfunction.

The configuration options for this section vary depending on the CPU and DIMM model you installed on the motherboard.

Scroll down to display other BIOS items.



Overclocking Presets

Select this item to load various settings suitably tuned for your needs.

Ai Overclock Tuner

This item allows you to select the CPU overclocking options to achieve the desired CPU internal frequency. Select any of these preset overclocking configuration options:

[Auto] Loads the optimal settings for the system.

[Manual] When the manual mode is selected, the BCLK (base clock) frequency can be assigned manually.

[XMP I] If you install memory modules supporting the eXtreme Memory Profile (XMP) Technology, choose this item to load the DIMM's default XMP memory timings (CL, TRCD, TRP, TRAS) with BCLK frequency and other memory parameters optimized by ASUS.

[XMP II] If you install memory modules supporting the eXtreme Memory Profile (XMP) Technology, choose this item to load the DIMM's default XMP profile.

The **[X.M.P.]** configuration option appears only when you install memory modules supporting the eXtreme Memory Profile(X.M.P.) Technology.

The following item appears only when you set **Ai Overclock Tuner** to **[XMP I]** or **[XMP II]**.

XMP

This item allows you to select your eXtreme Memory Profile (XMP). Each profile has its own DRAM frequency, timing and voltage.

The following item appears only when you set **Ai Overclock Tuner** to **[XMP I]**, **[XMP II]**, or **[Manual]**.

BCLK Frequency

This item allows you to set the BCLK (base clock) frequency to enhance the system performance. Use the <+> or <-> to adjust the value.

We recommend you to set the value based on the CPU specification, as high BCLK frequencies may damage the CPU permanently.

ASUS MultiCore Enhancement

[Auto]	This item allows you to use ASUS optimized core ratio Turbo settings at default processor speeds.
[Disabled]	This item allows you to use Intel default Turbo core ratio settings.
[Enabled]	This item allows you to use optimized power and current thresholds for maintaining maximum performance.

SVID Behavior

This item allows you to program the CPU's SVID behavior based on the CPU's quality.
Configuration options: [Auto] [Best-Case Scenario] [Typical Scenario] [Worst-Case Scenario] [Intel's Fail Safe]

AVX Instruction Core Ratio Negative Offset

This item allows you to subtract a value from your core ratio at which AVX applications run.
Configuration options: [Auto] [1] – [31]

CPU Core Ratio

This item allows you to set the CPU core ratios.
Configuration options: [Auto] [Sync All Cores] [Per Core] [AI Optimized]

The **[AI Optimized]** item appears only when you use an unlocked CPU.

The following item appears only when you set **CPU Core Ratio** to **[Sync All Cores]** or **[Per Core]**.

1-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 1-Core Limit value that must be higher than or equal to the 2-Core Ratio Limit.

The following items appear only when you set **CPU Core Ratio** to **[Per Core]**.

2-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 2-core ratio limit that must be higher than or equal to the 3-core ratio limit.

If you assign a value for 2-Core Ratio Limit, do not set the 1-Core Ratio Limit to **[Auto]**.

3-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 3-core ratio limit that must be higher than or equal to the 4-core ratio limit.

If you assign a value for 3-Core Ratio Limit, do not set the 1-Core Ratio Limit and 2-Core Ratio Limit to **[Auto]**.

4-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 4-core ratio limit that must be higher than or equal to the 5-core ratio limit.

If you assign a value for 4-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, and 3-Core Ratio Limit to **[Auto]**.

5-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 5-core ratio limit that must be higher than or equal to the 6-core ratio limit.

If you assign a value for 5-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, 3-Core Ratio Limit, and 4-Core Ratio Limit to **[Auto]**.

6-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 6-core ratio limit that must be lower than or equal to the 5-core ratio limit.

If you assign a value for 6-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, 3-Core Ratio Limit, 4-Core Ratio Limit, and 5-Core Ratio Limit to **[Auto]**.

7-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 7-core ratio limit that must be lower than or equal to the 6-core ratio limit.

If you assign a value for 6-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, 3-Core Ratio Limit, 4-Core Ratio Limit, 5-Core Ratio Limit, and 6-Core Ratio Limit to **[Auto]**.

8-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a 8-core ratio limit that must be lower than or equal to the 7-core ratio limit.

If you assign a value for 6-Core Ratio Limit, do not set the 1-Core Ratio Limit, 2-Core Ratio Limit, 3-Core Ratio Limit, 4-Core Ratio Limit, 5-Core Ratio Limit, 6-Core Ratio Limit, and 7-Core Ratio Limit to **[Auto]**.

BCLK Frequency : DRAM Frequency Ratio [Auto]

[Auto]	The BCLK frequency to DRAM frequency ratio will be set to the optimized setting.
[100:133]	The BCLK frequency to DRAM frequency ratio will be set to 100:133.
[100:100]	The BCLK frequency to DRAM frequency ratio will be set to 100:100.

DRAM Odd Ratio Mode

This item allows you to enable or disable availability of odd DRAM ratios for improved granularity.
Configuration options: [Enabled] [Disabled]

DRAM Frequency

This item allows you to set the memory operating frequency. The configurable options vary with the BCLK (base clock) frequency setting. Select the auto mode to apply the optimized setting.
Configuration options: [Auto] [DDR4-800MHz] - [DDR4-8533MHz]

Xtreme Tweaking

This item may help improve some benchmarks performance.
Configuration options: [Enabled] [Disabled]

CPU SVID Support [Auto]

Disable this item to stop the CPU from communicating with the external voltage regulator.
Configuration options: [Auto] [Disabled] [Enabled]

DRAM Timing Control

The sub-items in this menu allow you to set the DRAM timing control features. Use the <+> and <-> keys to adjust the value. To restore the default setting, type [Auto] using the keyboard and press the <Enter> key.

Changing the values in this menu may cause the system to become unstable! If this happens, revert to the default settings.

Memory Presets

Load settings suitably tuned for different memory modules.

Maximus Tweak

Configuration options: [Auto] [Mode 1] – [Mode 2]

Primary Timings

DRAM CAS# Latency

Configuration options: [Auto] [1] – [31]

DRAM RAS# to CAS# Delay

Configuration options: [Auto] [1] – [31]

DRAM RAS# ACT Time

Configuration options: [Auto] [1] – [63]

DRAM Command Rate

Configuration options: [Auto] [1N] [2N] [3N] [N:1]

Secondary Timings

DRAM RAS# to RAS# Delay L

Configuration options: [Auto] [1] – [15]

DRAM RAS# to RAS# Delay S

Configuration options: [Auto] [1] – [15]

DRAM REF Cycle Time

Configuration options: [Auto] [1] – [1023]

DRAM REF Cycle Time 2

Configuration options: [Auto] [1] – [1023]

DRAM REF Cycle Time 4

Configuration options: [Auto] [1] – [1023]

DRAM Refresh Interval

Configuration options: [Auto] [1] – [65535]

DRAM WRITE Recovery Time

Configuration options: [Auto] [1] – [31]

DRAM READ to PRE Time

Configuration options: [Auto] [1] – [15]

DRAM FOUR ACT WIN Time

Configuration options: [Auto] [1] – [63]

DRAM WRITE to READ Delay

Configuration options: [Auto] [1] – [15]

DRAM WRITE to READ Delay L

Configuration options: [Auto] [1] – [15]

DRAM WRITE to READ Delay S

Configuration options: [Auto] [1] – [15]

DRAM CKE Minimum Pulse Width

Configuration options: [Auto] [0] – [15]

DRAM Write Latency

Configuration options: [Auto] [1] – [31]

Skew Control

ODT RTT WR (CHA)

Configuration options: [Auto] [0 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK] [255 DRAM CLOCK]

ODT RTT PARK (CHA)

Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]

ODT RTT NOM (CHA)

Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]

ODT RTT WR (CHB)

Configuration options: [Auto] [0 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK] [255 DRAM CLOCK]

ODT RTT PARK (CHB)

Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]

ODT RTT NOM (CHB)

Configuration options: [Auto] [0 DRAM CLOCK] [34 DRAM CLOCK] [40 DRAM CLOCK] [48 DRAM CLOCK] [60 DRAM CLOCK] [80 DRAM CLOCK] [120 DRAM CLOCK] [240 DRAM CLOCK]

ODT_READ_DURATION

Configuration options: [Auto] [0] - [7]

ODT_READ_DELAY

Configuration options: [Auto] [0] - [7]

ODT_WRITE_DURATION

Configuration options: [Auto] [0] - [7]

ODT_WRITE_DELAY

Configuration options: [Auto] [0] - [7]

Data Rising Slope

Configuration options: [Auto] [0] - [15]

Data Rising Slope Offset

Configuration options: [Auto] [0] - [1]

Cmd Rising Slope

Configuration options: [Auto] [0] - [15]

Cmd Rising Slope Offset

Configuration options: [Auto] [0] - [1]

Ctl Rising Slope

Configuration options: [Auto] [0] - [15]

Ctl Rising Slope Offset

Configuration options: [Auto] [0] - [1]

Clk Rising Slope

Configuration options: [Auto] [0] - [15]

Clk Rising Slope Offset

Configuration options: [Auto] [0] - [1]

Data Falling Slope

Configuration options: [Auto] [0] - [15]

Data Falling Slope Offset

Configuration options: [Auto] [0] - [1]

Cmd Falling Slope

Configuration options: [Auto] [0] - [15]

Cmd Falling Slope Offset

Configuration options: [Auto] [0] - [1]

Ctl Falling Slope

Configuration options: [Auto] [0] - [15]

Ctl Falling Slope Offset

Configuration options: [Auto] [0] - [1]

Clk Falling Slope

Configuration options: [Auto] [0] - [15]

Clk Falling Slope Offset

Configuration options: [Auto] [0] - [1]

RTL IOL Control

DRAM RTL INIT Value

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM0 Rank0)

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM0 Rank1)

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM1 Rank0)

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHA DIMM1 Rank1)

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM0 Rank0)

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM0 Rank1)

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM1 Rank0)

Configuration options: [Auto] [0] - [127]

DRAM RTL (CHB DIMM1 Rank1)

Configuration options: [Auto] [0] - [127]

DRAM IOL (CHA DIMM0 Rank0)

Configuration options: [Auto] [0] - [15]

DRAM IOL (CHA DIMM0 Rank1)

Configuration options: [Auto] [0] - [15]

DRAM IOL (CHA DIMM1 Rank0)

Configuration options: [Auto] [0] - [15]

DRAM IOL (CHA DIMM1 Rank1)

Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM0 Rank0)

Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM0 Rank1)

Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM1 Rank0)

Configuration options: [Auto] [0] - [15]

DRAM IOL (CHB DIMM1 Rank1)

Configuration options: [Auto] [0] - [15]

IO Latency offset

CHA IO_Latency_offset

Configuration options: [Auto] [0] - [127]

CHB IO_Latency_offset

Configuration options: [Auto] [0] - [127]

IO Latency RFR delay

CHA RFR delay

Configuration options: [Auto] [0] - [127]

CHB RFR delay

Configuration options: [Auto] [0] - [127]

Memory Training Algorithms

The items in this menu allows you to enable or disable different Memory Training Algorithms.

Early Command Training

Configuration options: [Auto] [Enabled] [Disabled]

SenseAmp Offset Training

Configuration options: [Enabled] [Disabled]

Early ReadMPR Timing Centering 2D

Configuration options: [Enabled] [Disabled]

Read MPR Training

Configuration options: [Enabled] [Disabled]

Receive Enable Training

Configuration options: [Enabled] [Disabled]

Jedec Write Leveling

Configuration options: [Enabled] [Disabled]

Early Write Timing Centering 2D

Configuration options: [Auto] [Enabled] [Disabled]

Early Read Timing Centering 2D

Configuration options: [Auto] [Enabled] [Disabled]

Write Timing Centering 1D

Configuration options: [Enabled] [Disabled]

Write Voltage Centering 1D

Configuration options: [Auto] [Enabled] [Disabled]

Read Timing Centering 1D

Configuration options: [Auto] [Enabled] [Disabled]

Dimm ODT Training*

Configuration options: [Auto] [Enabled] [Disabled]

The following item appears only when you set **Dimm ODT Training*** to **[Auto]** or **[Enabled]**.

Max RTT_WR

Configuration options: [ODT Off] [120 Ohms]

DIMM RON Training*

Configuration options: [Auto] [Enabled] [Disabled]

Write Drive Strength/Equalization 2D*

Configuration options: [Enabled] [Disabled]

Write Slew Rate Training*

Configuration options: [Auto] [Enabled] [Disabled]

Read ODT Training*

Configuration options: [Auto] [Enabled] [Disabled]

Read Equalization Training*

Configuration options: [Auto] [Enabled] [Disabled]

Read Amplifier Training*

Configuration options: [Auto] [Enabled] [Disabled]

Write Timing Centering 2D

Configuration options: [Auto] [Enabled] [Disabled]

Read Timing Centering 2D

Configuration options: [Auto] [Enabled] [Disabled]

Command Voltage Centering

Configuration options: [Auto] [Enabled] [Disabled]

Write Voltage Centering 2D

Configuration options: [Auto] [Enabled] [Disabled]

Read Voltage Centering 2D

Configuration options: [Auto] [Enabled] [Disabled]

Late Command Training

Configuration options: [Auto] [Enabled] [Disabled]

Round Trip Latency

Configuration options: [Auto] [Enabled] [Disabled]

Turn Around Timing Training

Configuration options: [Enabled] [Disabled]

Rank Margin Tool

Configuration options: [Enabled] [Disabled]

Memory Test

Configuration options: [Enabled] [Disabled]

DIMM SPD Alias Test

Configuration options: [Auto] [Enabled] [Disabled]

Receive Enable Centering 1D

Configuration options: [Auto] [Enabled] [Disabled]

Retrain Margin Check

Configuration options: [Enabled] [Disabled]

Write Drive Strength Up/Dn independently

Configuration options: [Enabled] [Disabled]

Third Timings

tRDRD_sg

Configuration options: [Auto] [0] - [63]

tRDRD_dg

Configuration options: [Auto] [0] - [63]

tRDWR_sg

Configuration options: [Auto] [0] - [63]

tRDWR_dg

Configuration options: [Auto] [0] - [63]

tWRWR_sg

Configuration options: [Auto] [0] - [63]

tWRWR_dg

Configuration options: [Auto] [0] - [63]

tWRRD_sg

Configuration options: [Auto] [0] - [127]

tWRRD_dg

Configuration options: [Auto] [0] - [63]

tRDRD_dr

Configuration options: [Auto] [0] - [63]

tRDRD_dd

Configuration options: [Auto] [0] - [63]

tRDWR_dr

Configuration options: [Auto] [0] - [63]

tRDWR_dd

Configuration options: [Auto] [0] - [63]

tWRWR_dr

Configuration options: [Auto] [0] - [63]

tWRWR_dd

Configuration options: [Auto] [0] - [63]

tWRRD_dr

Configuration options: [Auto] [0] - [63]

tWRRD_dd

Configuration options: [Auto] [0] - [63]

TWRPRE

Configuration options: [Auto] [0] - [127]

TRDPRE

Configuration options: [Auto] [0] - [15]

tREFIX9

Configuration options: [Auto] [0] - [127]

OREF_RI

Configuration options: [Auto] [0] – [255]

Misc.

MRC Fast Boot

Allows you to enable, disable or automatically set the MRC fast boot.
Configuration options: [Auto] [Enabled] [Disabled]

DRAM CLK Period

Configuration options: [Auto] [1] – [95]

Memory Scrambler

Set this item to enable or disable memory scrambler support.
Configuration options: [Enabled] [Disabled]

Channel A DIMM Control

Allows you to enable or disable the Channel A DIMM slots.
Configuration options: [Enable Both DIMMS] [Disable DIMM0] [Disable DIMM1] [Disable Both DIMMS]

Channel B DIMM Control

Allows you to enable or disable the Channel B DIMM slots.
Configuration options: [Enable Both DIMMS] [Disable DIMM0] [Disable DIMM1] [Disable Both DIMMS]

MCH Full Check

Enable this item to enhance the stability of your system. Disable this item to enhance the DRAM overclocking capability.
Configuration options: [Auto] [Enabled] [Disabled]

Training Profile

Allows you to select the DIMM training profile.
Configuration options: [Auto] [Standard Profile] [User Profile]

DLLBwEn

Configuration options: [Auto] [1] - [7]

DRAM SPD Write

Configuration options: [Enabled] [Disabled]

XTU Setting

Configuration options: [Auto] [1] - [7]

External Digi+ Power Control

CPU Load-line Calibration

Load-line is defined by Intel® specification and affects CPU power voltage. The CPU working voltage decreases proportionally to CPU loading. Higher load-line calibration could get higher voltage and good overclocking performance, but increases the CPU and VRM thermal conditions.
Configuration options [Auto] [Level 1] - [Level 8]

The actual performance boost may vary depending on your CPU specification.

DO NOT remove the thermal module. The thermal conditions should be monitored.

Synch ACDC Loadline with VRM Loadline

Enable this item to allow the VRM Loadline to be adjusted automatically to match the AC/DC Loadline.
Configuration options: [Enabled] [Disabled]

CPU Current Capability

This item allows you to set the shut off current limit for external voltage regulator. A higher setting will allow the voltage regulator to supply more current while a lower setting will cause the voltage regulator to shut off the system when the supplied current is higher than the set value.
Configuration options: [Auto] [100%] - [140%]

Configure higher values when overclocking or under a high loading for extra power support.

CPU VRM Switching Frequency

This item affects the VRM transient response speed and the component thermal production. Select [**Manual**] to configure a higher frequency for a quicker transient response speed.

Configuration options: [Auto] [Manual]

DO NOT remove the thermal module. The thermal conditions should be monitored.

The following item appears only when you set **CPU VRM Switching Frequency** to **[Manual]**.

Fixed CPU VRM Switching Frequency (KHz)

This item allows you to set a higher frequency for a quicker transient response speed. Use the <+> or <-> to adjust the value.

The following item appears only when you set **CPU VRM Switching Frequency** to [**Auto**].

VRM Spread Spectrum

This item allows to enhance the system stability.

Configuration options: [Auto] [Disabled] [Enabled]

CPU Power Duty Control

CPU power duty control adjusts the duty cycle of each VRM phase based upon current and/or temperature.

[T. Probe]	Select to set the VRM thermal balance mode.
[Extreme]	Select to set the VRM current balance mode.

DO NOT remove the thermal module when setting this item to **[Extreme]**. The thermal conditions should be monitored.

CPU Power Phase Control

This item allows you to set the power phase control of the CPU.

Configuration options: [Auto] [Standard] [Optimized] [Extreme] [Power Phase Response]

DO NOT remove the thermal module when setting this item to **[Extreme]**. The thermal conditions should be monitored.

CPU Power Thermal Control

This item allows you to set the VRM thermal cut-off trip point. 115 Celsius is default and recommended for all overclocking and normal use. Can be set to a lower value if a lower thermal cut-off point is preferred. Use the <+> or <-> to adjust the value.

DO NOT remove the VRM heatsink.

CPU VRM Thermal Control

This item allows you to enable or disable the temperature limit of the CPU VRM.
Configuration options: [Auto] [Disabled] [Enabled]

DRAM Current Capability

This item allows you to set the shut off current limit for external DRAM voltage regulator. A higher setting will allow the voltage regulator to supply more current while a lower setting will cause the voltage regulator to shut off the system when the supplied current is higher than the set value.
Configuration options: [100%] [110%] [120%] [130%]

Configure higher values when overclocking or under a high loading for extra power support.

DRAM Switching Frequency

This item affects the VRM transient response speed and the component thermal production. Select **[Manual]** to configure a higher frequency for a quicker transient response speed.
Configuration options: [Auto] [Manual]

The following item appears only when you set **DRAM Switching Frequency** to **[Manual]**.

Fixed DRAM Switching Frequency (KHz)

This item allows you to set a higher frequency for a quicker transient response speed. Use the <+> or <-> to adjust the value.

Boot Voltages

CPU Core/Cache Boot Voltage

Configuration options: [Auto] [0.600] - [1.700]

DMI Boot Voltage

Configuration options: [Auto] [0.3000] - [1.9000]

Core PLL Boot Voltage

Configuration options: [Auto] [0.70000] - [1.60000]

CPU System Agent Boot Voltage

Configuration options: [Auto] [0.7000] - [1.8000]

CPU VCCIO Boot Voltage

Configuration options: [Auto] [0.9000] - [1.8000]

PLL Termination Boot Voltage

Configuration options: [Auto] [0.36000] - [2.27000]

CPU Standby Boot Voltage

Configuration options: [Auto] [0.800] - [1.800]

Internal CPU Power Management

The subitems in this menu allow you to set the CPU ratio and features.

Intel(R) SpeedStep(tm)

Allows the operating system to dynamically adjust the processor voltage and cores frequency to decrease the average power consumption and decrease average heat production.

Configuration options: [Auto] [Enabled] [Disabled]

Turbo Mode

Allows you to enable your processor cores to run faster than the base operating frequency when it is below power, current and specification limit.

Configuration options: [Disabled] [Enabled]

Turbo Mode Parameters

The following items appear only when you set **Turbo Mode** to **[Enabled]**.

Long Duration Package Power Limit

As know as the power limit 1 in Watts. The default value will be the TDP (thermal design power). The turbo ratio can be maintained for a duration to exceed the TDP for the maximum system performance.

Configuration options: [Auto] [1] - [4095]

Package Power Time Window

As know as the power limit 1 in seconds. The value indicates the maintained duration for the turbo ratio to exceed TDP (thermal design power).

Configuration options: [Auto] [1] - [127]

Short Duration Package Power Limit

Also know as the power limit 2 in Watts. It is the second power limit to provide a rapid protection when the package power exceed power limit 1. The default setting is 1.25 times the power limit 1. According to Intel, the platform must be capable of supporting the duration for up to 10 msec when the turbo ratio exceeds the power limit 2. The ASUS motherboards can support the duration for a longer time.

Configuration options: [Auto] [1] - [4095]

IA AC Load Line

This item allows you to set the AC loadline defined in 1/100 mOhms. Use the <+> and <-> keys to adjust the value.

Configuration options: [Auto] [0.01] - [62.49]

IA DC Load Line

This item allows you to set the DC loadline defined in 1/100 mOhms. Use the <+> and <-> keys to adjust the value.

Configuration options: [Auto] [0.01] - [62.49]

TVB Voltage Optimizations

This item controls thermal based voltage optimizations for processors that implement the Intel Thermal Velocity Boost (TVB) feature.

Configuration options: [Auto] [Enabled] [Disabled]

Tweaker's Paradise

Realtime Memory Timing

This item allows you to enable or disable realtime memory timing.
Configuration options: [Enabled] [Disabled]

BCLK Frequency for Early Power On

This item allows you to set the BCLK Frequency for Early Power On.
Configuration options: [Auto] [Normal (800 MHz)] [1GHz] [400 MHz]

Initial BCLK Frequency

This item allows you to start overclocking the system from the initial BCLK (base clock) frequency to the assigned BCLK frequency. Use the <+> or <-> to adjust the value.

BCLK Amplitude

This item allows you to set the magnitude of the base clock driven for the processor.
Configuration options: [Auto] [700mV] [800mV] [900mV] [1000mV]

BCLK Slew Rate

Configuration options: [Auto] [1.5V/ns] [2.5V/ns] [3.5V/ns] [4.5V/ns]

BCLK Spread Spectrum

This item allows you to reduce the EMI. Disable to get more accurate base clocks.
Configuration options: [Auto] [Disabled] [-0.22] [-0.34] [-0.46] [+0.12] [+0.22] [+0.28] [+0.38] [+0.17]

BCLK Frequency Slew Rate

Configuration options: [Auto] [Disabled] [32us/MHz] [64us/MHz] [128us/MHz] [512us/MHz]

DRAM VTT Voltage

Configuration options: [Auto] [0.50000] - [1.30000]

VPPDDR Voltage

Configuration options: [Auto] [2.10000] - [3.13500]

DMI Voltage

Configuration options: [Auto] [0.30000] - [1.90000]

Core PLL Voltage

Configuration options: [Auto] [0.70000] - [1.60000]

Internal PLL Voltage

Configuration options: [Auto] [0.900] - [1.845]

GT PLL Voltage

Configuration options: [Auto] [0.900] - [1.845]

Ring PLL Voltage

Configuration options: [Auto] [0.900] - [1.845]

System Agent PLL Voltage

Configuration options: [Auto] [0.900] - [1.845]

Memory Controller PLL Voltage

Configuration options: [Auto] [0.900] - [1.845]

PLL Bandwidth

Select Level 6 to Level 8 when overclocking High BCLK or High CPU frequency.
Configuration options: [Auto] [Level 0] - [Level 10]

Eventual DRAM Voltage

Configuration options: [Auto] [1.0000] - [2.0000]

Eventual CPU Standby Voltage

Configuration options: [Auto] [0.800] - [1.800]

Eventual PLL Termination Voltage

Configuration options: [Auto] [0.36000] - [2.27000]

Eventual DMI Voltage

Configuration options: [Auto] [0.30000] - [1.90000]

AI Features

The items in this menu allows you to enable or disable different AI Features.

Package Temperature Threshold

Frequency will adjust to stay below this package temperature threshold when **Regulate Frequency by above threshold** is enabled.
Configuration options: [Auto] [30] - [115]

Regulate Frequency by above threshold

Frequency will adjust to stay below the **Package Temperature Threshold** when this item is enabled.
Configuration options: [Auto] [Enabled] [Disabled]

Cooler Efficiency Customize

[Keep Training]	Continuous evaluations will be performed on Cooler efficiency and updated accordingly.
[Stop Training]	Cooler efficiency evaluations will stop and current evaluated efficiency will be used.
[User Specify]	Manually specify the Cooler efficiency and all predictions will be based off this manual setting.

The following item appears only when you set **Cooler Efficiency Customize** to **[User Specify]**.

Cooler Score

Configuration options: [1] - [2000]

Recalibrate Cooler

This item allows you to recalibrate your cooler efficiency.

Cooler Re-evaluation Algorithm

This item allows you to set how inclined the re-evaluation will update.
Configuration options: [Normal] [More inclined to update] [Very inclined to update] [Less inclined to update] [Least inclined to update]

Optimism Scale

This item allows you to set the optimism of the predictions.
Configuration options: [50] - [150]

CPU Core/Cache Current Limit Max.

This item allows you to configure a higher current limit to prevent a frequency or power throttling when overclocking. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.00] - [255.50]

Ring Down Bin

This item allows you to enable or disable the Ring Down Bin feature. When enabled, the CPU will down bin the ring ratio, and the requested maximum ring ratio may not be observed.
Configuration options: [Auto] [Disabled] [Enabled]

Please use caution when disabling this feature. Disabling this feature may result in overvoltaging the CPU.

Min. CPU Cache Ratio

This item allows you to set the minimum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [8] - [83]

Max. CPU Cache Ratio

This item allows you to set the maximum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [8] - [83]

BCLK Aware Adaptive Voltage

When this option is enabled, pcode will be aware of the BCLK frequency when calculating the CPU V/F curves. This is ideal for BCLK OC to avoid high voltage overrides. Uses OC Mailbox command 0x15.
Configuration options: [Disabled] [Enabled]

CPU Core/Cache Voltage

Configures the mode of Voltage fed to the cores of the processor.
Configuration options: [Auto] [Manual Mode] [Offset Mode] [Adaptive Mode]

The following items appear only when you set **CPU Core/Cache Voltage** to **[Manual Mode]**.

CPU Core Voltage Override

Allows you to configure the CPU Core voltage.
Configuration options: [Auto] [0.600] - [1.700]

The following items appear only when you set **CPU Core/Cache Voltage** to **[Offset Mode]**.

Offset Mode Sign

[+] To offset the voltage by a positive value.

[–] To offset the voltage by a negative value.
CPU Core Voltage Offset

CPU Core Voltage Offset

This item allows you to configure the input voltage for the CPU by the external voltage regulator.

Configuration options: [Auto] [-0.635] - [0.635]

The following items appear only when you set **CPU Core/Cache Voltage** to **[Adaptive Mode]**.

Offset Mode Sign

[+] To offset the voltage by a positive value.

[–] To offset the voltage by a negative value.

Additional Turbo Mode CPU Core Voltage

This item allows you to configure the amount of voltage fed to the CPU cores when running in Turbo Mode. Increase the voltage when configuring a high CPU core frequency. This voltage will be affected by the offset value.

Configuration options: [Auto] [0.250] - [1.920]

Offset Voltage

This item allows you to configure the CPU core voltage offset value.

Configuration options: [Auto] [0.001] - [0.999]

DRAM Voltage

Configuration options: [Auto] [1.0000] - [2.0000]

CPU VCCIO Voltage

Configuration options: [Auto] [0.90000] - [1.80000]

CPU System Agent Voltage

Configuration options: [Auto] [0.70000] - [1.80000]

PLL Termination Voltage

Configuration options: [Auto] [0.36000] - [2.27000]

PCH Core Voltage

Configuration options: [Auto] [0.90000] - [1.80000]

CPU Standby Voltage

Configuration options: [Auto] [0.800] - [1.800]

DRAM REF Voltage Control

DRAM CTRL REF Voltage on CHA/CHB

Configures the DRAM reference voltage on the control lines. The reference voltage will be the DRAM voltage times the configured value.
Configuration options: [Auto] [0.39500] - [0.63000]

DRAM DATA REF Voltage on CHA DIMM0 Rank0 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

DRAM DATA REF Voltage on CHA DIMM0 Rank1 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

DRAM DATA REF Voltage on CHA DIMM1 Rank0 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

DRAM DATA REF Voltage on CHA DIMM1 Rank1 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

DRAM DATA REF Voltage on CHB DIMM0 Rank0 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

DRAM DATA REF Voltage on CHB DIMM0 Rank1 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

DRAM DATA REF Voltage on CHB DIMM1 Rank0 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

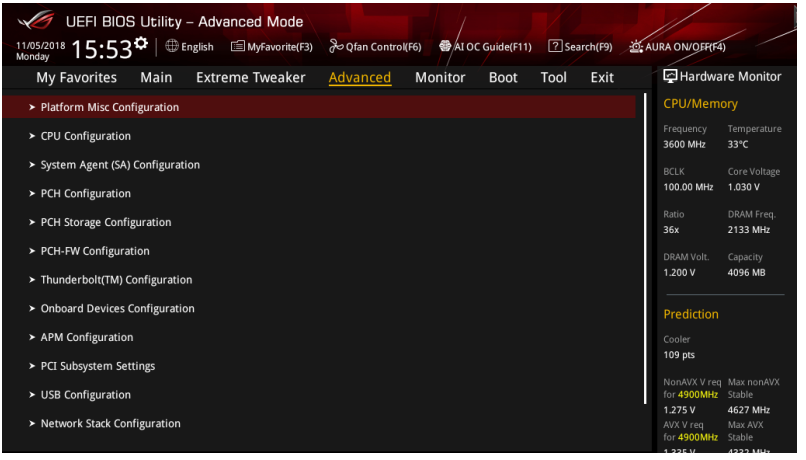
DRAM DATA REF Voltage on CHB DIMM1 Rank1 BL0-7

Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

1.6 Advanced menu

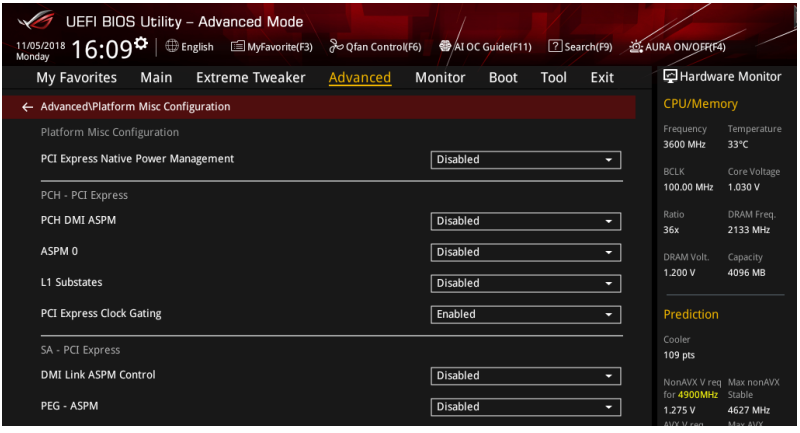
The Advanced menu items allow you to change the settings for the CPU and other system devices.

Be cautious when changing the settings of the Advanced menu items. Incorrect field values can cause the system to malfunction.



1.6.1 Platform Misc Configuration

The items in this menu allow you to configure the platform-related features.



PCI Express Native Power Management

This item allows you to enhance the power saving feature of PCI Express and perform ASPM operations in the operating system.
Configuration options: [Disabled] [Enabled]

The following item appears only when you set **PCI Express Native Power Management** to **[Enabled]**.

Native ASPM

Configuration options: [Auto] [Enabled] [Disabled]

PCH - PCI Express

PCH DMI ASPM

This item allows you to control the Active State Power Management on both NB (NorthBridge) side and SB (SouthBridge) side of the DMI Link.
Configuration options: [Disabled] [L0s] [L1] [L0sL1] [Auto]

ASPM 0

This item allows you to select the ASPM state for energy-saving conditions.
Configuration options: [Disabled] [L0s] [L1] [L0sL1] [Auto]

L1 Substates

This item allows you to select the PCI Express L1 Substates settings.
Configuration options: [Disabled] [L1.1] [L1.1 & L1.2]

PCI Express Clock Gating

This item allows you to enable or disable PCI Express Clock Gating for each port.
Configuration options: [Disabled] [Enabled]

SA - PCI Express

DMI Link ASPM Control

This item allows you to control the Active State Power Management on both CPU and PCH (platform controller hub) Both DMI link ASPM control items of the CPU and PCH sides must be enabled for the ASPM to take effect.
Configuration options: [Disabled] [L0s] [L1] [L0sL1]

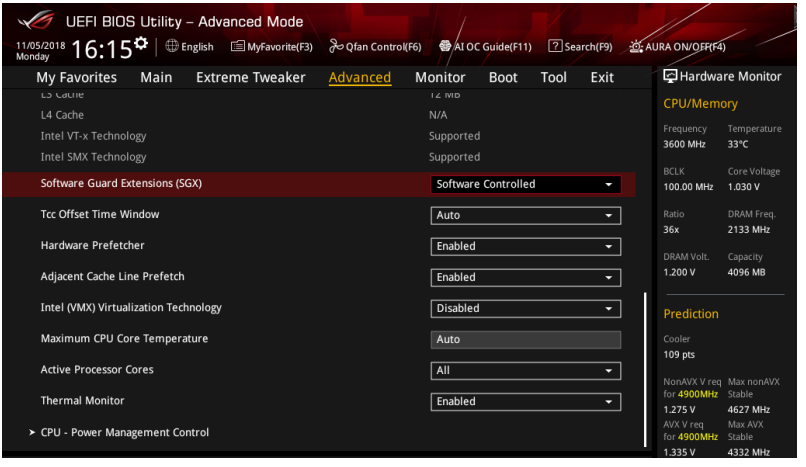
PEG - ASPM

This item allows you to select the ASPM state for energy-saving conditions, or use the ASUS optimized energy saving profile.
Configuration options: [Disabled] [Auto] [ASPM L0s] [ASPM L1] [ASPM L0sL1]

1.6.2 CPU Configuration

The items in this menu show the CPU-related information that the BIOS automatically detects.

The items in this menu may vary based on the CPU installed.



Software Guard Extensions (SGX)

This item allows you to enable or disable Software Guard Extensions (SGX).
Configuration options: [Disabled] [Software Controlled]

Tcc Offset Time Window

This item allows you to set the TCC Offset Time Window for Running Average Temperature Limit (RATL) feature. RATL allows setting an average max thermal temperature. Temperatures within the time window can get higher than the temperature threshold but only the average is used to cause frequency clipping.
Configuration options: [Auto] [Disabled] [5 ms] - [448 sec]

Hardware Prefetcher

This item allows the CPU to prefetch commands and data in the L2 cache, reduces the DRAM loading time and improves the system performance.
Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch

This item allows you to prefetch adjacent cache lines, reducing the DRAM loading time and improves the system performance.
Configuration options: [Disabled] [Enabled]

Intel (VMX) Virtualization Technology

When set to **[Enabled]**, VMX can utilize the additional hardware capabilities provided by Vanderpool Technology.
Configuration options: [Disabled] [Enabled]

Maximum CPU Core Temperature

This item allows you to set the maximum allowable temperature for CPU cores. The CPU will throttle or shutdown when it reaches this temperature to prevent damaging the cores.
Configuration options: [Auto] [62] - [115]

Active Processor Cores

This item allows you to select the number of CPU cores to activate in each processor package.
Configuration options: [All] [1] - [7]

Thermal Monitor

This item allows you to enable or disable the Thermal Monitor.
Configuration options: [Disabled] [Enabled]

CPU Power Management Configuration

This item allows you to manage and configure the CPU's power.

Boot performance mode

This item allows you to select the CPU performance state during system boot before the operating system takes control. The CPU runs at a selected performance ratio based on CPU configuration.
Configuration options: [Auto] [Max Battery] [Max Non-Turbo Performance] [Turbo Performance]

Intel(R) SpeedStep(tm)

This item allows more than two frequency to be supported.
Configuration options: [Auto] [Enabled] [Disabled]

Intel(R) Speed Shift Technology

This item allows you to disable or enable Intel(R) Speed Shift Technology support. When enabled, CPPC v2 interface allows hardware controlled P-states.
Configuration options: [Auto] [Enabled] [Disabled]

Turbo Mode

This item allows you to automatically set the CPU cores to run faster than the base operating frequency when it is below the operating power, current and temperature specification limit.
Configuration options: [Enabled] [Disabled]

CPU C-states

This item allows you to set the power saving of the CPU states.
Configuration options: [Auto] [Disabled] [Enabled]

The following items appear only when you set **CPU C-states** to **[Enabled]**.

Enhanced C-States

When enabled, CPU will switch to minimum speed when all cores enter C-State.
Configuration options: [Enabled] [Disabled]

CPU C3 Report

This item allows you to disable or enable the CPU C3 report to the operating system.
Configuration options: [Enabled] [Disabled]

CPU C6 Report

This item allows you to disable or enable the CPU C6 report to the operating system.
Configuration options: [Enabled] [Disabled]

CPU C7 Report

This item allows you to disable or enable the CPU C7 report to the operating system.
Configuration options: [CPU C7] [CPU C7s] [Disabled]

CPU C8 Report

This item allows you to disable or enable the CPU C8 report to the operating system.
Configuration options: [Enabled] [Disabled]

CPU C9 Report

This item allows you to disable or enable the CPU C9 report to the operating system.
Configuration options: [Enabled] [Disabled]

CPU C10 Report

This item allows you to disable or enable the CPU C10 report to the operating system.
Configuration options: [Enabled] [Disabled]

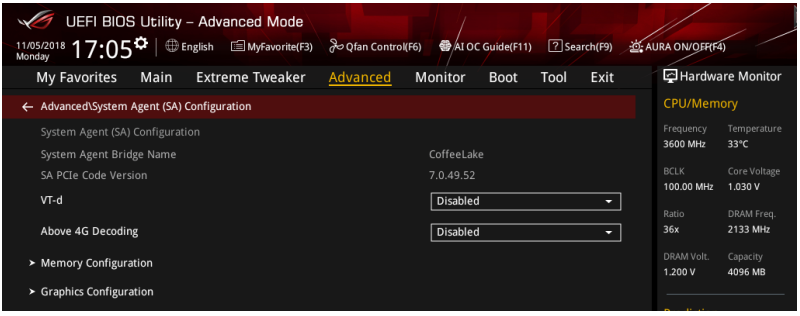
Package C State Limit

This item allows you to set the C-state limit for the CPU package.
Configuration options: [C0/C1] [C2] [C3] [C6] [C7] [C7s] [C8] [C9] [C10] [CPU Default] [Auto]

CFG Lock

This item allows you to disable or enable the CFG Lock.
Configuration options: [Enabled] [Disabled]

1.6.3 System Agent (SA) Configuration



VT-d

Allows you to enable virtualization technology function on memory control hub.
Configuration options: [Enabled] [Disabled]

Above 4G Decoding

This item enables or disables 64-bit capable devices to be decoded in above 4G address space if your system supports 64-bit PCI Decoding.
Configuration options: [Enabled] [Disabled]

Memory Configuration

This item allows you to set memory configuration parameters.

Memory Remap

This item allows you to enable or disable memory remap above 4GB.
Configuration options: [Enabled] [Disabled]

Graphics Configuration

This item allows you to select a primary display from CPU and PCIe graphical devices.

Primary Display

This item allows you to select the primary display from CPU and PCIe devices.
Configuration options: [Auto] [CPU Graphics] [PCIE]

iGPU Multi-Monitor

This item allows you to enable the iGPU Multi-Monitor. The iGPU shared system memory size is fixed 64 MB.
Configuration options: [Disabled] [Enabled]

DMI/OPI Configuration

This item allows you to control various DMI (direct media interface) functions.

DMI Max Link Speed

This item allows you to set DMI speed.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PEG Port Configuration

This item allows you to configure the PEG Port settings.

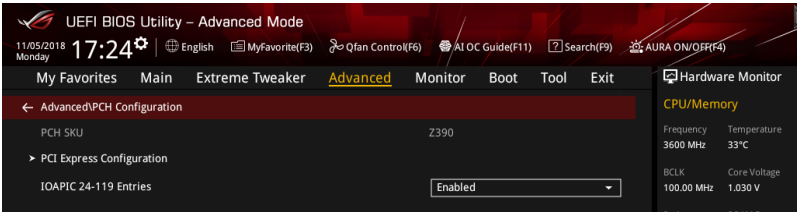
PCIEx16_1 Link Speed

This item allows you to configure the PCIEx16_1 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PCIEx16_2 Link Speed

This item allows you to configure the PCIEx16_2 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

1.6.4 PCH Configuration



PCI Express Configuration

This item allows you to configure the PCI Express slots.

PCIe Speed

This item allows your system to automatically select the PCI Express port speed.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

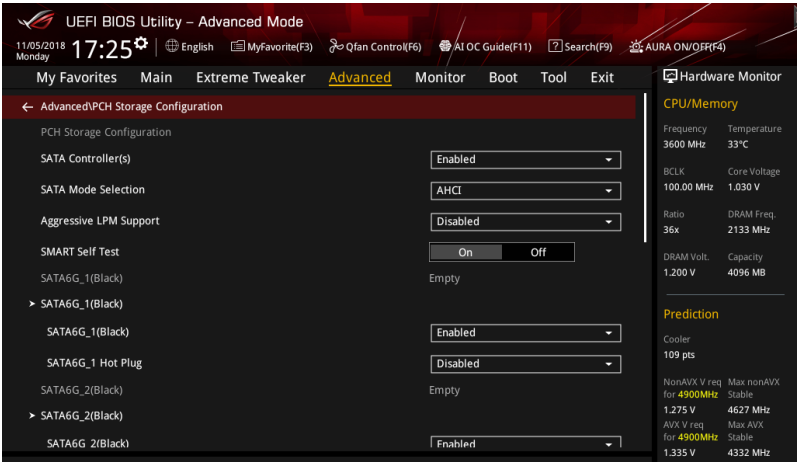
IOAPIC 24-119 Entires

Allows you to enable or disable IOAPIC 24-119 Entires. Disabling this item may cause some devices to fail.
Configuration options: [Enabled] [Disabled]

1.6.5 PCH Storage Configuration

While entering Setup, the BIOS automatically detects the presence of SATA devices. The SATA Port items show **Empty** if no SATA device is installed to the corresponding SATA port.

Scroll down to display the other BIOS items.



SATA Controller(s)

This item allows you to enable or disable the SATA Device.
Configuration options: [Disabled] [Enabled]

The following items appear only when you set **SATA Controller(s)** to **[Enabled]**.

SATA Mode Selection

This item allows you to set the SATA configuration.

[AHCI]	Set to [AHCI] when you want the SATA hard disk drives to use the AHCI (Advanced Host Controller Interface). The AHCI allows the onboard storage driver to enable advanced Serial ATA features that increases storage performance on random workloads by allowing the drive to internally optimize the order of commands.
[Intel RST Premium With Intel Optane System Acceleration (RAID)]	Set to [Intel RST Premium With Intel Optane System Acceleration (RAID)] when you want to create a RAID configuration from the SATA hard disk drives.

Aggressive LPM support

This item is designed for LPM (link power management) support with a better energy saving conditions. When disabled, the hot plug function of SATA ports are disabled.
Configuration options: [Disabled] [Enabled]

SMART Self Test

S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) is a monitoring system that shows a warning message during POST (Power-on Self Test) when an error occurs in the hard disks.
Configuration options: [On] [Off]

SATA6G_1(Black) - SATA6G_6(Black)

SATA6G_1(Black) - SATA6G_6(Black)

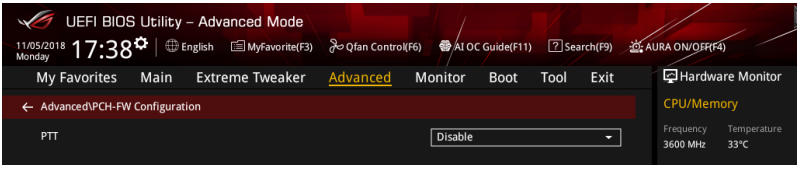
This item allows you to enable or disable the selected SATA port.
Configuration options: [Disabled] [Enabled]

SATA6G_1 - SATA6G_6 Hot Plug

These items appears only when the SATA Mode Selection is set to [**AHCI**] and allows you to enable or disable SATA Hot Plug Support.
Configuration options: [Disabled] [Enabled]

1.6.6 PCH-FW Configuration

This item allows you to configure the firmware TPM.

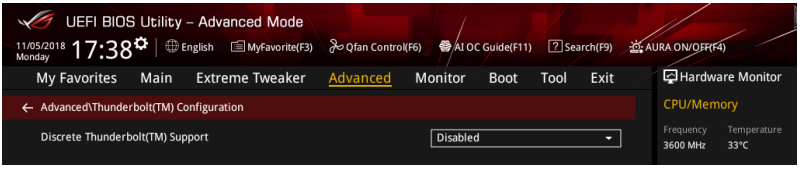


PTT

This item allows you to enable or disable PTT in SkuMgr.
Configuration options: [Disabled] [Enabled]

1.6.7 Thunderbolt(TM) Configuration

The items in this menu allow you to configure Thunderbolt settings.

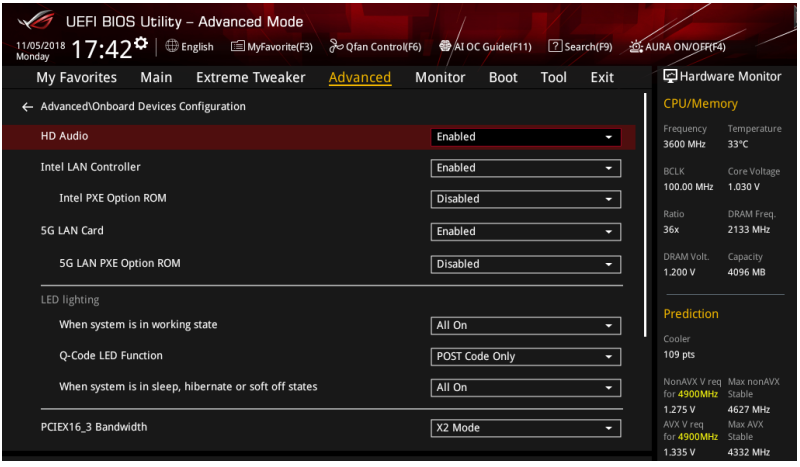


Discrete Thunderbolt(TM) Support

This item allows you to enable or disable Discrete Thunderbolt(TM) Support.
Configuration options: [Disabled] [Enabled]

1.6.8 Onboard Devices Configuration

Scroll down to view the other BIOS items.



HD Audio Controller

This item allows you to use the Azalia High Definition Audio Controller.
Configuration options: [Disabled] [Enabled]

Intel LAN Controller

This item allows you to enable or disable the Intel(R) LAN controller.
Configuration options: [Disabled] [Enabled]

The following item appears only when you set **Intel LAN Controller** to **[Enabled]**.

Intel LAN PXE Option ROM

This item allows you to enable or disable the PXE Option Rom of the Intel LAN controller.
Configuration options: [Disabled] [Enabled]

5G LAN Card

This item allows you to enable or disable the 5G LAN Card.
Configuration options: [Disabled] [Enabled]

The following item appears only when you set **5G LAN Card** to **[Enabled]**.

5G LAN PXE Option ROM

This item allows you to enable or disable the PXE Option Rom of the 5G LAN Card.
Configuration options: [Disabled] [Enabled]

LED lighting

When system is in working state

This item allows you to turn the RGB LED lighting on or off when the system is in the working state.

[All On]:	All LEDs (Aura or Functional) will be enabled.
[Stealth Mode]:	All LEDs (Aura and Functional) will be disabled.
[Aura Only]:	Aura LEDs will be enabled and functional LEDs will be disabled.
[Aura Off]:	Aura LEDs will be disabled, however functional LEDs will still be enabled.

Q-Code LED Function

[Disabled]	Turn off Q-Code LED.
[POST Code Only]	Show POST (Power-On Self-Test) code on Q-Code LED.
[Auto]	Automatically display POST (Power-On Self-Test) code and CPU temperature on Q-Code LED.

When system is in sleep, hibernate or soft off states

This item allows you to turn the RGB LED lighting on or off when the system is in the sleep, hibernate or soft off states.

[All On]:	All LEDs (Aura or Functional) will be enabled.
[Stealth Mode]:	All LEDs (Aura and Functional) will be disabled.
[Aura Only]:	Aura LEDs will be enabled and functional LEDs will be disabled.
[Aura Off]:	Aura LEDs will be disabled, however functional LEDs will still be enabled.

PCIEX16_3 Bandwidth

[X2 Mode]	Run at X2 mode with SATA6G_56 enabled.
[X4 Mode]	Run at X4 mode for higher performance with SATA6G_56 disabled.

CPU PCIE Configuration Mode

This item allows you to configure the CPU PCIE configurations.

[PCIEX16_1 + PCIEX16_2]	Deafult and auto-detects mode.
[DIMM.2_1 + PCIEX16_2]	When DIMM.2_1 is enabled, PCIEx16_1 will run at x8 mode, and PCIEx16_2 will run at x4 mode.
[DIMM.2_1 + DIMM.2_2]	When DIMM.2_1 and DIMM.2_2 are both enabled, PCIEx16_1 will run at x8 mode, and PCIEx16_2 will be disabled.

USB power deliver in Soft Off state (S5)

This item allows you to enable or disable USB power when your PC is in the S5 state. Configuration options: [Disabled] [Enabled]

Front Panel USB Type C Power Mode

[Auto]	The system will automatically detect your USB 3.1 Gen 2 Type-C devices and provide suitable power if needed.
[Enabled]	The USB Type C port will always provide power to your USB 3.1 Gen 2 Type-C devices.

Back I/O USB Type C Power Mode

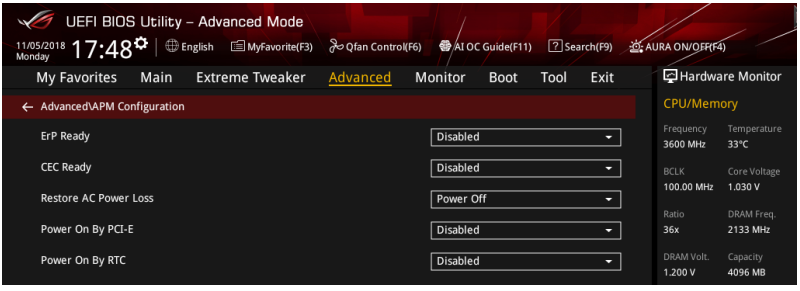
[Auto] The system will automatically detect your USB 3.1 Gen 2 Type-C devices and provide suitable power if needed.

[Enabled] The USB Type C port will always provide power to your USB 3.1 Gen 2 Type-C devices.

Connectivity mode (Wi-Fi & Bluetooth)

This item allows you to enable or disable the Wi-Fi & Bluetooth connectivity module.
Configuration options: [Disabled] [Enabled]

1.6.9 APM Configuration



ErP Ready

This item allows you to switch off some power at S4+S5 or S5 to get the system ready for ErP requirement. When set to **[Enabled]**, all other PME options are switched off.
Configuration options: [Disabled] [Enabled (S4+S5)] [Enabled (S5)]

CEC Ready

Enable this option to allow your system to comply with CEC (California Energy Commission) regulations and save more power under S0 state
Configuration options: [Disabled] [Enabled]

Restore AC Power Loss

This item allows your system to go to ON state, OFF state, or both states after an AC power loss. When setting your system to [Last State], it goes to the previous state before the AC power loss.
Configuration options: [Power Off] [Power On] [Last State]

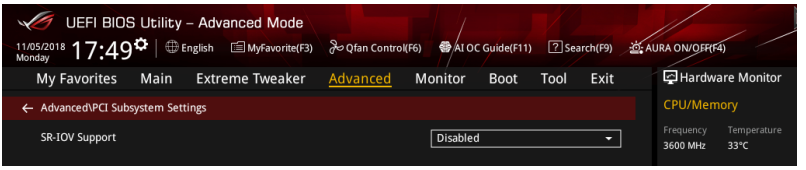
Power On By PCI-E

This item allows you to enable or disable the Wake-on-LAN function of the onboard LAN controller or other installed PCI-E LAN cards.
Configuration options: [Disabled] [Enabled]

Power On By RTC

This item allows you to enable or disable the RTC (Real-Time Clock) to generate a wake event and configure the RTC alarm date. When enabled, you can set the days, hours, minutes, or seconds to schedule an RTC alarm date.
Configuration options: [Disabled] [Enabled]

1.6.10 PCI Subsystem Settings

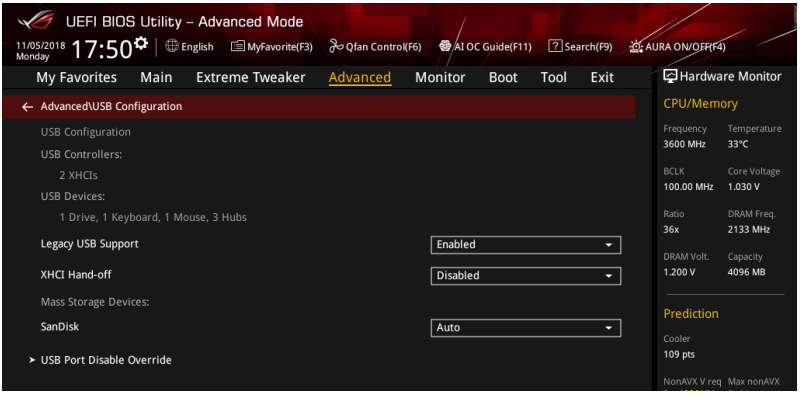


SR-IOV Support

This option enables or disables Single Root IO Virtualization Support if the system has SR-IOV capable PCIe devices.
Configuration options: [Disabled] [Enabled]

1.6.11 USB Configuration

The items in this menu allow you to change the USB-related features.



The **Mass Storage Devices** item shows the auto-detected values. If no USB device is detected, the item shows **None**.

Legacy USB Support

[Enabled] Your system supports the USB devices in legacy operating systems.

[Disabled] Your USB devices can be used for BIOS setup only and cannot be recognized in the boot devices list.

[Auto] Your system automatically detects the presence of USB devices at startup. If any USB devices are detected, the legacy USB support is enabled.

XHCI Hand-off

This item is set to **[Disabled]** by default for the EHCI (enhanced host controller interface) support by XHCI drivers in operating systems.

[Disabled] Support XHCI by XHCI drivers for operating systems with XHCI support.

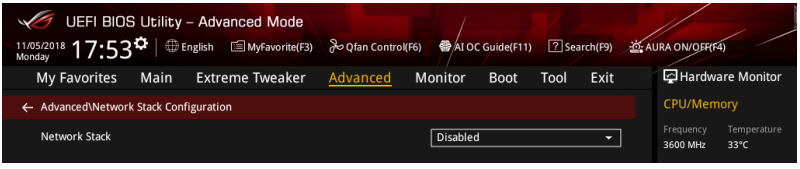
[Enabled] Support XHCI by BIOS for operating systems without XHCI support.

USB Port Disable Override

This item allows you to enable or disable the individual USB ports.

Refer to section **1.1.2 Motherboard layout** in your user manual for the location of the USB ports.

1.6.12 Network Stack Configuration



Network stack

This item allows you to disable or enable the UEFI network stack.
Configuration options: [Disable] [Enable]

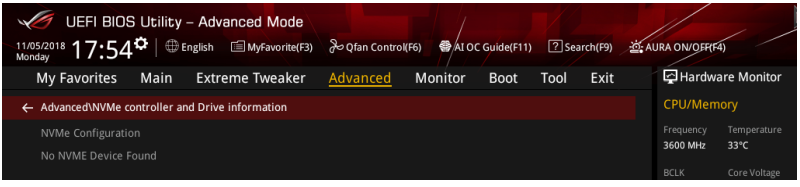
The following item appears only when you set **Network Stack** to **[Enabled]**.

Ipv4/Ipv6 PXE Support

This item allows you to enable or disable the Ipv4/Ipv6 PXE wake event.
Configuration options: [Disabled] [Enabled]

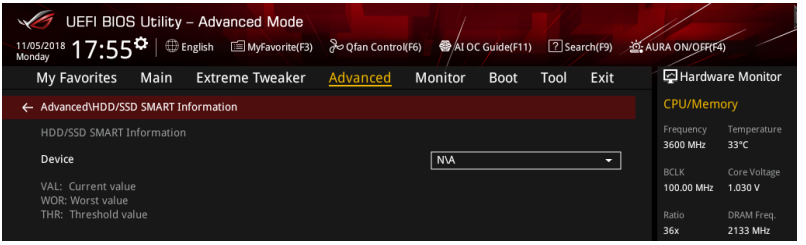
1.6.13 NVMe Configuration

This menu displays the NVMe controller and Drive information of the connected devices.



1.6.14 HDD/SSD SMART Information

This menu displays the SMART information of the connected devices.

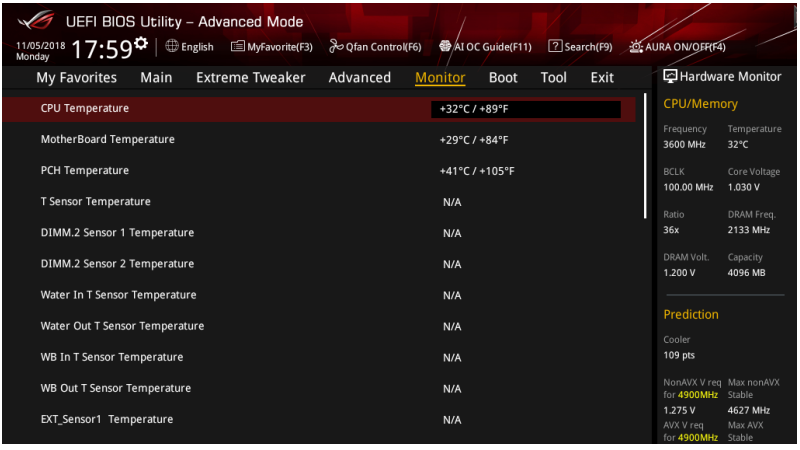


NVM Express devices do not support SMART information.

1.7 Monitor menu

The Monitor menu displays the system temperature/power status, and allows you to change the fan settings.

Scroll down to display the other BIOS items.



CPU Temperature, Motherboard Temperature, PCH temperature, T Sensor Temperature, DIMM.2 Sensor 1-2 Temperature, Water In T Sensor Temperature, Water Out T Sensor Temperature, WB In T Sensor Temperature, WB Out T Sensor Temperature, EXT_Sensor1-3 Temperature [xxx°C/xxx°F]

The onboard hardware monitor automatically detects and displays the component and sensor temperatures. Select **[Ignore]** if you do not wish to display the detected temperatures.

CPU Fan Speed, CPU Optional Fan Speed, Chassis Fan 1-2 Speed, Radiator Fan 1-2 Speed, W_PUMP+ 1-2 Speed, AIO pump Speed, Extension Fan 1-3, Flow Rate, WB Flow Rate [xxxx RPM]

The onboard hardware monitor automatically detects and displays the fan and pump speeds in rotations per minute (RPM). If the fan or pump is not connected to the motherboard, the field shows N/A. Select **[Ignore]** if you do not wish to display the detected speed.

CPU Core Voltage, 3.3V Voltage, 5V Voltage, 12V Voltage [x.xxxx V]

The onboard hardware monitor automatically detects the voltage output through the onboard voltage regulators. Select **[Ignore]** if you do not want to detect this item.

Q-Fan Configuration

Q-Fan Tuning

Click this item to automatically detect the lowest speed and configure the minimum duty cycle for each fan.

CPU Q-Fan Control

This item allows you to set the CPU Q-Fan operating mode.

[Auto]	Detects the type of CPU fan installed and automatically switches the control modes.
[PWM Mode]	Enables the CPU Q-Fan Control feature in PWM mode for 4-pin CPU fan.
[DC Mode]	Enables the CPU Q-Fan Control feature in DC mode for 3-pin CPU fan.
[Disabled]	Disables the Q-Fan Control.

The following items appear only when you set **CPU Q-Fan Control** to **[Auto]**, **[PWM Mode]**, or **[DC Mode]**.

CPU Fan Step Up

This item allows you to set the value of the CPU fan step up.
Configuration options: [0 sec] [2.1 sec] [2.8 sec] [3.6 sec] [4.2 sec] [5.0 sec] [6.3 sec] [8.5 sec] [12 sec] [25 sec]

CPU Fan Step Down

This item allows you to set the value of the CPU fan step down.
Configuration options: [0 sec] [2.1 sec] [2.8 sec] [3.6 sec] [4.2 sec] [5.0 sec] [6.3 sec] [8.5 sec] [12 sec] [25 sec]

CPU Fan Speed Low Limit

This item allows you to set the low limit warning for CPU Fan speed.
Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

CPU Fan Profile

This item allows you to set the appropriate performance level of the CPU fan.

[Standard]	Set to make the CPU fan adjust automatically depending on the CPU temperature.
[Silent]	Set to minimize the fan speed for quiet CPU fan operation.
[Turbo]	Set to achieve maximum CPU fan speed.
[Manual]	Set to assign the detailed fan speed control parameters.

Chassis Fan(s) Configuration

Chassis Fan 1-2 Q-Fan Control

This item allows you to set the chassis fan operating mode.

[Auto]	Detects the type of chassis fan installed and automatically switches the control modes.
[PWM Mode]	Enables the Chassis Fan Q-Fan Control feature in PWM mode for 4-pin chassis fan.
[DC Mode]	Enables the Chassis Fan Q-Fan Control feature in DC mode for 3-pin chassis fan.
[Disabled]	Disables the Q-Fan control.

The following items appear only when you set **Chassis Fan 1-3 Q-Fan Control** to **[Auto]**, **[PWM Mode]**, or **[DC Mode]**.

Chassis Fan 1-2 Q-Fan Source

The assigned fan will be controlled according to the selected temperature source.
Configuration options: [CPU] [MotherBoard] [PCH] [T Sensor] [DIMM.2 Senor 1] [DIMM.2 Sensor 2] [Water In T Sensor] [Water Out T Sensor] [WB In T Sensor] [WB Out T Sensor] [EXT_Sensor1] [EXT_Sensor2] [EXT_Sensor3] [Multiple Sources]

- For EXT_Sensor1-3, connect a Thermistor cable to one of these connectors, then tape the other end on a critical component to control its temperature.
- For Multiple Sources, select up to three temperature sources and the fan will automatically change based on the highest temperature.

Chassis Fan 1-2 Step Up

This item allows you to set the value of the chassis fan step up.
Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

Chassis Fan 1-2 Step Down

This item allows you to set the value of the chassis fan step down.
Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

Chassis Fan 1-2 Fan Speed Low Limit

This item allows you to disable or set the chassis fan warning speed.
Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

Chassis Fan 1-2 Profile

This item allows you to set the appropriate performance level of the chassis fan.

[Standard]	Sets to [Standard] to make the chassis fan automatically adjust depending on the chassis temperature.
[Silent]	Sets to [Silent] to minimize the fan speed for quiet chassis fan operation.
[Turbo]	Sets to [Turbo] to achieve maximum chassis fan speed.
[Manual]	Sets to [Manual] to assign detailed fan speed control parameters.

The following items appear only when you set **Chassis Fan 1-2 Profile** to **[Manual].**

Chassis Fan 1-2 Upper Temperature

Use the <+> or <-> keys to adjust the upper limit of the Chassis Fan 1-2 temperature. The Chassis Fan 1-2 will operate at the maximum duty cycle when the temperature source is higher than the limit.

Chassis Fan 1-2 Max. Duty Cycle (%)

Use the <+> or <-> keys to adjust the maximum Chassis Fan 1-2 duty cycle. When the temperature source reaches the upper limit, the Chassis Fan 1-2 will operate at the maximum duty cycle.

Chassis Fan 1-2 Middle Temperature

Use the <+> or <-> keys to adjust the middle limit of the Chassis Fan 1-2 temperature.

Chassis Fan 1-2 Middle. Duty Cycle (%)

Use the <+> or <-> keys to adjust the Chassis Fan 1-2 middle duty cycle.

Chassis Fan 1-2 Lower Temperature

Use the <+> or <-> keys to adjust the lower limit of the Chassis Fan 1-2 temperature. The Chassis Fan 1-2 will operate at the minimum duty cycle when the temperature source is lower than the limit.

Chassis Fan 1-2 Min. Duty Cycle(%)

Use the <+> or <-> keys to adjust the minimum Chassis Fan 1-2 duty cycle. When the temperature source is under the limit, the Chassis Fan 1-2 will operate at the minimum duty cycle.

RAD1-2 Q-Fan Control

This item allows you to set the Radiator Fan operating mode.

[Auto]	Detects the type of radiator fan installed and automatically switches the control modes.
[PWM Mode]	Enables the Radiator Q-Fan Control feature in PWM mode for 4-pin Radiator Fan.
[DC Mode]	Enables the Radiator Q-Fan Control feature in DC mode for 3-pin Radiator Fan.
[Disabled]	Disables the Q-Radiator Fan Control.

Radiator Fan 1-2 Q-Fan Source

The assigned fan will be controlled according to the selected temperature source. Configuration options: [CPU] [MotherBoard] [PCH] [T Sensor] [DIMM.2 Senor 1] [DIMM.2 Sensor 2] [Water In T Sensor] [Water Out T Sensor] [WB In T Sensor] [WB Out T Sensor] [EXT_Sensor1] [EXT_Sensor2] [EXT_Sensor3] [Multiple Sources]

- For EXT_Sensor1-2, connect a Thermistor cable to one of these connectors, then tape the other end on a critical component to control its temperature.
- For Multiple Sources, select up to three temperature sources and the fan will automatically change based on the highest temperature.

Radiator Fan 1-2 Step Up

This item allows you to set the value of the radiator fan step up.

Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

Radiator Fan 1-2 Step Down

This item allows you to set the value of the radiator fan step down.

Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

Radiator Fan 1-2 Speed Low Limit

This item allows you to disable or set the radiator fan warning speed.

Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

Radiator Fan 1-2 Profile

This item allows you to set the appropriate performance level of the radiator fan.

[Standard]	Sets to [Standard] to make the radiator fan automatically adjust depending on the chassis temperature.
[Silent]	Sets to [Silent] to minimize the fan speed for quiet chassis fan operation.
[Turbo]	Sets to [Turbo] to achieve maximum radiator fan speed.
[Manual]	Sets to [Manual] to assign detailed fan speed control parameters.

The following items appear only when you set **Radiator Fan 1-2 Profile** to **[Manual].**

Radiator Fan 1-2 Temperature

Use the <+> or <-> keys to adjust the upper limit of the radiator fan temperature. The radiator fan will operate at the maximum duty cycle when the temperature source is higher than the limit.

Radiator Fan 1-2 Max. Duty Cycle (%)

Use the <+> or <-> keys to adjust the maximum radiator fan duty cycle. When the temperature source reaches the upper limit, the radiator fan will operate at the maximum duty cycle.

Radiator Fan 1-2 Middle Temperature

Use the <+> or <-> keys to adjust the middle limit of the radiator fan temperature.

Radiator Fan 1-2 Middle. Duty Cycle (%)

Use the <+> or <-> keys to adjust the radiator fan middle duty cycle.

Radiator Fan 1-2 Lower Temperature

Use the <+> or <-> keys to adjust the lower limit of the radiator fan temperature. The radiator fan will operate at the minimum duty cycle when the temperature source is lower than the limit.

Radiator Fan 1-2 Min. Duty Cycle (%)

Use the <+> or <-> keys to adjust the minimum radiator fan duty cycle. When the temperature source is under the limit, the radiator fan will operate at the minimum duty cycle.

Ext. Fan(s) Configuration

An ASUS FAN EXTENSION CARD is required to configure these items

Extension Fan 1-3 Q-Fan Control

[Disabled] Disable the Extension Fan Q-Fan control feature.

[DC mode] Enable the Extension Fan Q-Fan control in DC mode for 3-pin extension fan.

[PWM mode] Enable the Extension Fan Q-Fan control in PWM mode for 4-pin extension fan.

Extension Fan 1-3 Q-Fan Source

The assigned fan will be controlled according to the selected temperature source. Configuration options: [CPU] [MotherBoard] [PCH] [T Sensor] [DIMM.2 Senor 1] [DIMM.2 Sensor 2] [Water In T Sensor] [Water Out T Sensor] [WB In T Sensor] [WB Out T Sensor] [EXT_Sensor1] [EXT_Sensor2] [EXT_Sensor3] [Multiple Sources]

- For EXT_Sensor1-3, connect a Thermistor cable to one of these connectors, then tape the other end on a critical component to control its temperature.
- For Multiple Sources, select up to three temperature sources and the fan will automatically change based on the highest temperature.

Extension Fan 1-3 Fan Speed Low Limit

This item allows you to disable or set the extension fan warning speed. Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

Extension Fan 1-3 Profile

This item allows you to set the appropriate performance level of the extension fan.

[Standard] Set to make the extension fan adjust automatically depending on the CPU temperature.

[Silent] Set to minimize the fan speed for quiet extension fan operation.

[Turbo] Set to achieve maximum extension fan speed.

[Manual] Set to assign the detailed fan speed control parameters.

The following items appear only when you set **Extension Fan Profile 1-3** to **[Manual]**.

Extension Fan 1-3 Upper Temperature

Use the <+> or <-> keys to adjust the upper limit of the extension fan temperature. The extension fan will operate at the maximum duty cycle when the temperature source is higher than the limit.

Extension Fan 1-3 Max. Duty Cycle (%)

Use the <+> or <-> keys to adjust the maximum extension fan duty cycle. When the temperature source reaches the upper limit, the extension fan will operate at the maximum duty cycle.

Extension Fan 1-3 Middle Temperature

Use the <+> or <-> keys to adjust the middle limit of the extension fan temperature.

Extension Fan 1-3 Middle. Duty Cycle (%)

Use the <+> or <-> keys to adjust the extension fan middle duty cycle.

Extension Fan 1-3 Lower Temperature

Use the <+> or <-> keys to adjust the lower limit of the extension fan temperature. The extension fan will operate at the minimum duty cycle when the temperature source is lower than the limit.

Extension Fan 1-3 Min. Duty Cycle(%)

Use the <+> or <-> keys to adjust the minimum extension fan duty cycle. When the temperature source is under the limit, the extension fan will operate at the minimum duty cycle.

Extension Fan 1-3 Allow Fan Stop

This item allows your fans to run at 0% duty cycle when the temperature of the source drops below the lower temperature.
Configuration options: [Disabled] [Enabled]

WATER_PUMP+ 1-2 Control

[Disabled]	Disable the water WATER_PUMP+ control feature.
[Auto]	Detects the type of water WATER_PUMP+ installed and automatically switches the control modes.
[DC mode]	Enable the water WATER_PUMP+ control in DC mode for 3-pin chassis fan.
[PWM mode]	Enable the water WATER_PUMP+ control in PWM mode for 4-pin chassis fan.

The following items appear only when you set **WATER_PUMP+ 1-2 Control** to **[Auto]**, **[DC mode]**, or **[PWM mode].**

WATER_PUMP+ 1-2 Q-Fan Source

The assigned fan will be controlled according to the selected temperature source.
Configuration options: [CPU] [MotherBoard] [PCH] [T Sensor] [DIMM.2 Senor 1] [DIMM.2 Sensor 2] [Water In T Sensor] [Water Out T Sensor] [WB In T Sensor] [WB Out T Sensor] [EXT_Sensor1] [EXT_Sensor2] [EXT_Sensor3] [Multiple Sources]

- For EXT_Sensor1-3, connect a Thermistor cable to one of these connectors, then tape the other end on a critical component to control its temperature.
- For Multiple Sources, select up to three temperature sources and the fan will automatically change based on the highest temperature.

WATER_PUMP+ 1-2 Upper Temperature

Use the <+> or <-> keys to adjust the upper limit of the water WATER_PUMP+ temperature.

WATER_PUMP+ 1-2 Max. Duty Cycle (%)

Use the <+> or <-> keys to adjust the maximum water WATER_PUMP+ duty cycle. When the CPU temperature reaches the upper limit, the water WATER_PUMP+ will operate at the maximum duty cycle.

WATER_PUMP+ 1-2 Middle Temperature

Use the <+> or <-> keys to adjust the middle limit of the water WATER_ PUMP+ temperature.

WATER_PUMP+ 1-2 Middle. Duty Cycle (%)

Use the <+> or <-> keys to adjust the maximum water WATER_PUMP+ duty cycle. When the CPU temperature reaches the upper limit, the water WATER_PUMP+ will operate at the maximum duty cycle.

WATER_PUMP+ 1-2 Lower Temperature

Use the <+> or <-> keys to adjust the lower limit of the water WATER_ PUMP+ temperature. The water WATER_PUMP+ will operate at the minimum duty cycle when the temperature is lower than the limit.

WATER_PUMP+ 1-2 Min. Duty Cycle(%)

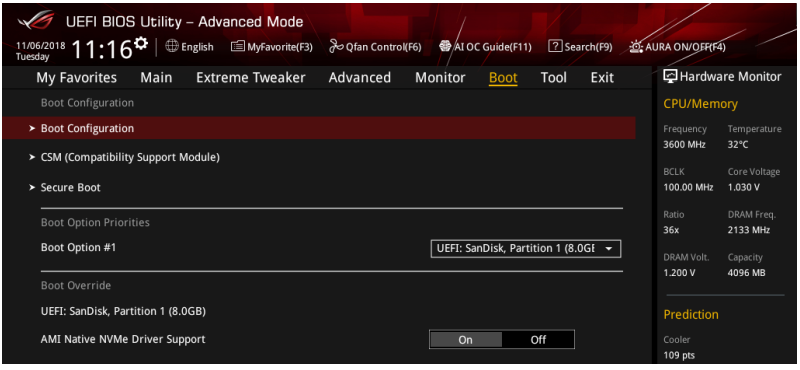
Use the <+> or <-> keys to adjust the minimum water WATER_PUMP+ duty cycle. When the CPU temperature is under the limit, the water WATER_PUMP+ will operate at the minimum duty cycle.

CPU Temperature LED Switch

This item allows you to turn the CPU Temperature LED on or off.
Configuration options: [On] [Off]

1.8 Boot menu

The Boot menu items allow you to change the system boot options.



Boot Configuration

Fast Boot

[Disabled] Allows your system to go back to its normal boot speed.

[Enabled] Allows your system to accelerate the boot speed.

The following item appears only when you set **Fast Boot** to **[Enabled]**.

Next Boot after AC Power Loss

[Normal Boot] Returns to normal boot on the next boot after an AC power loss.

[Fast Boot] Accelerates the boot speed on the next boot after an AC power loss.

Boot Logo Display

[Enabled] Display the boot logo during POST.

[Disabled] Hide the logo during POST.

The following item appears only when you set **Boot Logo Display** to **[Enabled]**.

Post Delay Time

This item allows you to select a desired additional POST waiting time to easily enter the BIOS Setup. You can only execute the POST delay time during normal boot.

Configuration options: [0 sec] - [10 sec]

This feature only works when set under normal boot.

The following item appears only when you set **Boot Logo Display** to **[Disabled]**.

Post Report

This item allows you to select a desired POST report waiting time.
Configuration options: [1 sec] - [10 sec] [Until Press ESC]

Boot up NumLock State

This item allows you to enable or disable power-on state of the NumLock.
Configuration options: [On] [Off]

Wait For 'F1' If Error

This item allows your system to wait for the <F1> key to be pressed when error occurs.
Configuration options: [Disabled] [Enabled]

Option ROM Messages

[Force BIOS]	The Option ROM Messages will be shown during the POST.
[Keep Current]	Only the ASUS logo will be shown during the POST.

Interrupt 19 Capture

[Enabled]	Execute the trap right away.
[Disabled]	Execute the trap during legacy boot.

Setup Mode

[Advanced Mode]	This item allows you to go to Advanced Mode of the BIOS after POST.
[EZ Mode]	This item allows you to go to EZ Mode of the BIOS after POST.

CSM (Compatibility Support Module)

This item allows you to configure the CSM (Compatibility Support Module) items to fully support the various VGA, bootable devices and add-on devices for better compatibility.

Launch CSM

[Enabled]	For better compatibility, enable the CSM to fully support the non-UEFI driver add-on devices or the Windows® UEFI mode.
[Disabled]	Disable the CSM to fully support the non-UEFI driver add-on devices or the Windows® UEFI mode.

The following items appear only when you set **Launch CSM** to **[Enabled]**.

Boot Device Control

This item allows you to select the type of devices that you want to boot.
Configuration options: [UEFI and Legacy OPROM] [Legacy OPROM only] [UEFI only]

Boot from Network Devices

This item allows you to select the type of network devices that you want to launch.
Configuration options: [Ignore] [Legacy only] [UEFI only]

Boot from Storage Devices

This item allows you to select the type of storage devices that you want to launch.

Configuration options: [Ignore] [Legacy only] [UEFI only]

Boot from PCI-E/PCI Expansion Devices

This item allows you to select the type of PCI-E/PCI expansion devices that you want to launch.

Configuration options: [Ignore] [Legacy only] [UEFI only]

Secure Boot

This item allows you to configure the Windows® Secure Boot settings and manage its keys to protect the system from unauthorized access and malwares during POST.

OS Type

[Windows UEFI Mode]	This item allows you to select your installed operating system. Execute the Microsoft® Secure Boot check. Only select this option when booting on Windows® UEFI mode or other Microsoft® Secure Boot compliant OS.
[Other OS]	Get the optimized function when booting on Windows® non-UEFI mode. Microsoft® Secure Boot only supports Windows® UEFI mode.

Key Management

Install Default Secure Boot keys

This item allows you to immediately load the default Security Boot keys, Platform key (PK), Key-exchange Key (KEK), Signature database (db), and Revoked Signatures (dbx). When the default Secure boot keys are loaded, the PK state will change from Unloaded mode to loaded mode.

Clear Secure Boot keys

This item appears only when you load the default Secure Boot keys. This item allows you to clear all default Secure Boot keys.

Save all Secure Boot variables

This item allows you to save all secure boot keys to a USB storage device.

PK Management

The Platform Key (PK) locks and secures the firmware from any permissible changes. The system verifies the PK before your system enters the OS.

Save To File

This item allows you to save the PK to a USB storage device.

Set New key

This item allows you to load the downloaded PK from a USB storage device.

Delete key

This item allows you to delete the PK from your system. Once the PK is deleted, all the system's Secure Boot keys will not be active.
Configuration options: [Yes] [No]

The PK file must be formatted as a UEFI variable structure with time-based authenticated variable.

KEK Management

The KEK (Key-exchange Key or Key Enrollment Key) manages the Signature database (db) and Revoked Signature database (dbx).

Key-exchange Key (KEK) refers to Microsoft® Secure Boot Key-Enrollment Key (KEK).

Save to file

This item allows you to save the KEK to a USB storage device.

Set New key

This item allows you to load the downloaded KEK from a USB storage device.

Append Key

This item allows you to load the additional KEK from a storage device for an additional db and dbx loaded management.

Delete key

This item allows you to delete the KEK from your system.
Configuration options: [Yes] [No]

The KEK file must be formatted as a UEFI variable structure with time-based authenticated variable.

DB Management

The db (Authorized Signature database) lists the signers or images of UEFI applications, operating system loaders, and UEFI drivers that you can load on the single computer.

Save to file

This item allows you to save the db to a USB storage device.

Set New key

This item allows you to load the downloaded db from a USB storage device.

Append Key

This item allows you to load the additional db from a storage device for an additional db and dbx loaded management.

Delete key

This item allows you to delete the db file from your system.
Configuration options: [Yes] [No]

The db file must be formatted as a UEFI variable structure with time-based authenticated variable.

DBX Management

The dbx (Revoked Signature database) lists the forbidden images of db items that are no longer trusted and cannot be loaded.

Save to file

This item allows you to save the dbx to a USB storage device.

Set New key

This item allows you to load the downloaded dbx from a USB storage device.

Append Key

This item allows you to load the additional dbx from a storage device for an additional db and dbx loaded management.

Delete key

This item allows you to delete the dbx file from your system.
Configuration options: [Yes] [No]

The dbx file must be formatted as a UEFI variable structure with time-based authenticated variable.

Boot Option Priorities

These items specify the boot device priority sequence from the available devices. The number of device items that appears on the screen depends on the number of devices installed in the system.

- To access Windows® OS in Safe Mode, press <F8 > after POST (Windows® 8 not supported).
- To select the boot device during system startup, press <F8> when ASUS Logo appears.

Boot Override

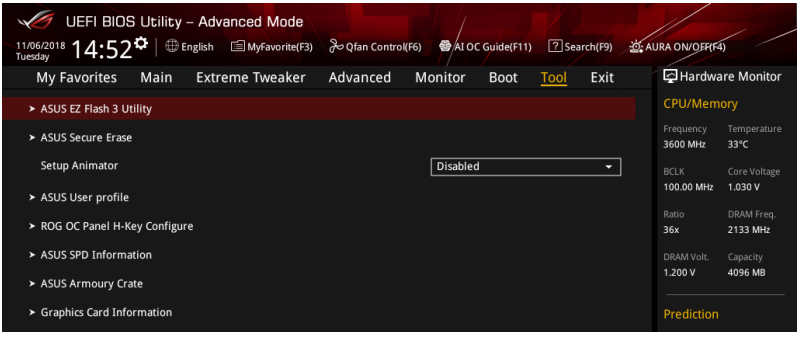
These item displays the available devices. The number of device items that appear on the screen depends on the number of devices installed in the system. Click an item to start booting from the selected device.

AMI Native NVMe Driver Support

This item allows you to enable or disable all NVMe device native OpROM.
Configuration options: [On] [Off]

1.9 Tool menu

The Tool menu items allow you to configure options for special functions. Select an item then press <Enter> to display the submenu.



Setup Animator

This item allows you to enable or disable the Setup animator.
Configuration options: [Disabled] [Enabled]

1.9.1 ASUS EZ Flash 3 Utility

This item allows you to run ASUS EZ Flash 3. When you press <Enter>, a confirmation message appears. Use the left/right arrow key to select between [Yes] or [No], then press <Enter> to confirm your choice.

For more details, refer to section **1.11.2 ASUS EZ Flash 3**.

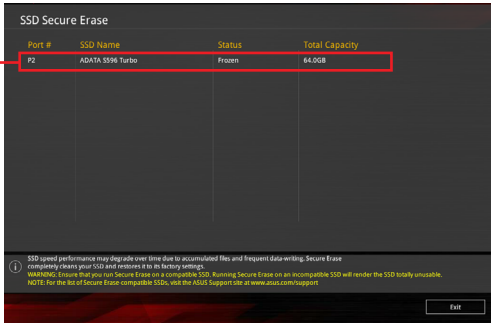
1.9.2 Secure Erase

SSD speeds may lower over time as with any storage medium due to data processing. Secure Erase completely and safely cleans your SSD, restoring it to factory performance levels.

To launch Secure Erase, click **Tool > Secure Erase** on the Advanced mode menu.

- The time to erase the contents of your SSD may take a while depending on its size. Do not turn off the system during the process.
- Secure Erase is only supported on Intel SATA port. For more information about Intel SATA ports, refer to section **1.1.2 Motherboard layout** in your user manual.

Displays the available SSDs

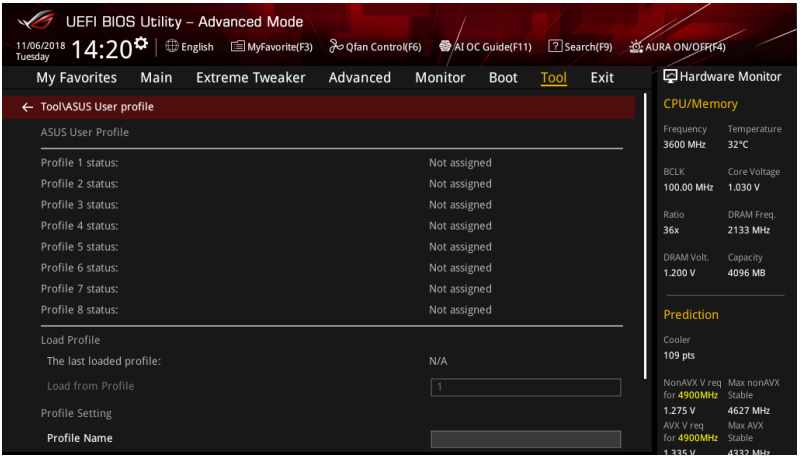


Status definition:

- **Frozen.** The frozen state is the result of a BIOS protective measure. The BIOS guards drives that do not have password protection by freezing them prior to booting. If the drive is frozen, a power off or hard reset of your PC must be performed to proceed with the Secure Erase.
- **Locked.** SSDs might be locked if the Secure Erase process is either incomplete or was stopped. This may be due to a third party software that uses a different password defined by ASUS. You have to unlock the SSD in the software before proceeding with Secure Erase.

1.9.3 ASUS User Profile

This item allows you to store or load multiple BIOS settings.



Load from Profile

This item allows you to load the previous BIOS settings saved in the BIOS Flash. Key in the profile number that saved your BIOS settings, press <Enter>, and then select **Yes**.

- DO NOT shut down or reset the system while updating the BIOS to prevent the system boot failure!
- We recommend that you update the BIOS file only coming from the same memory/ CPU configuration and BIOS version.

Profile Name

This item allows you to key in a profile name.

Save to Profile

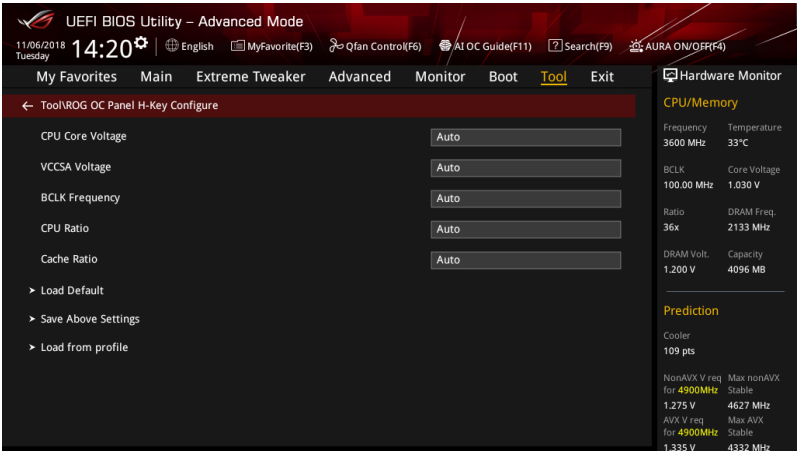
This item allows you to save the current BIOS settings to the BIOS Flash, and create a profile. Key in a profile number from one to eight, press <Enter>, and then select **Yes**.

Load/Save Profile from/to USB Drive

This item allows you to load or save profile from your USB drive, load and save profile to your USB drive.

1.9.4 ROG OC Panel H-Key Configure

The ROG OC Panel H-Key Configure allows you to input and save values on the CPU core voltage, VCCSA voltage, BCLK Frequency, CPU ratio, and Cache ratio in the UEFI BIOS. The saved values can be synchronized to a compatible OC Panel device and these values can be tweaked or configured using the OC Panel without going to the BIOS menu.



CPU Core Voltage

This item allows you to configure the amount of voltage fed to the Cores of the processor. Increase when increasing Core Frequency. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.600] - [2.155]

VCCSA Voltage

This item allows you to configure the VCCSA voltage. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.700] - [1.800]

BCLK Frequency

This item allows you to configure the BCLK frequency. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [40.0] - [650.0]

CPU Ratio

This item allows you to adjust the CPU ratio. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [8] - [83]

Cache Ratio

This item allows you to adjust the Cache ratio. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [8] - [83]

Load Default

This item allows you to load the default values of the CPU Core Voltage, VCCSA Voltage, BCLK Frequency, CPU ratio, and Cache ratio.

Save Above Settings

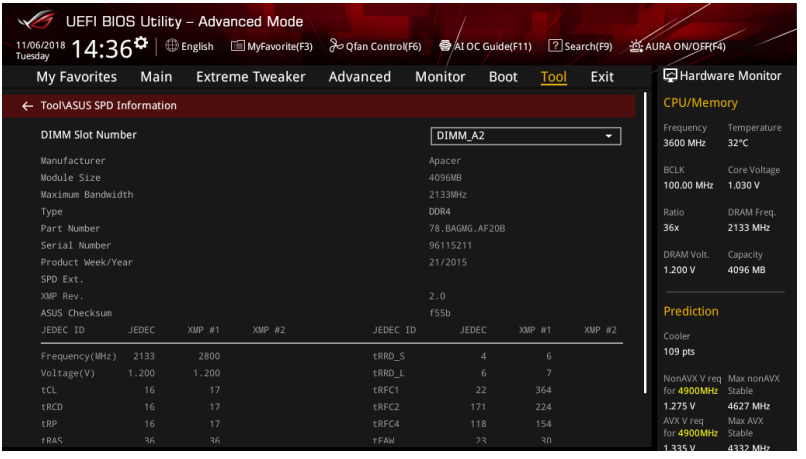
This item allows you to save the new values of the CPU Core Voltage, VCCSA Voltage, BCLK Frequency, CPU ratio, and Cache ratio.

Load from profile

This item allows you to load the previous values of the CPU Core Voltage, VCCSA Voltage, BCLK Frequency, CPU ratio, and Cache ratio.

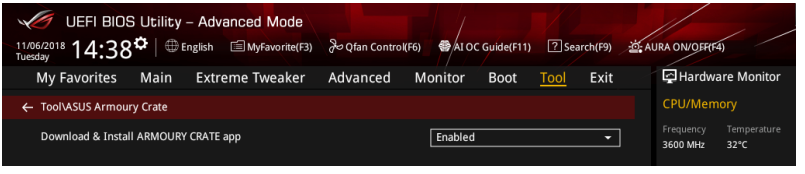
1.9.5 ASUS SPD Information

This item allows you to view the DRAM SPD information.



1.9.6 ASUS Armoury Crate

This item allows you to enable or disable downloading and installing of the Armoury Crate app in the Windows® OS. The Armoury Crate app can help you manage and download the latest ROG drivers and utilities for your motherboard.



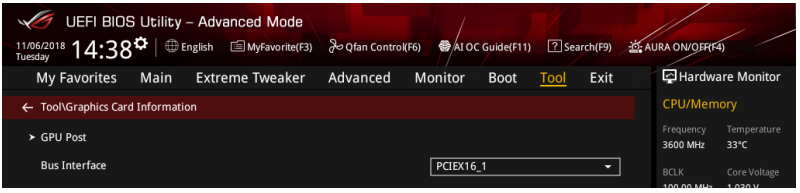
Download & Install ARMOURY CRATE app

Configuration options: [Disabled] [Enabled]

1.9.7 Graphics Card Information

This item displays the information and recommended configuration for the PCIE slots that the graphics card is installed in your system.

The items in this menu may vary depending on the graphics card installed in your system.



GPU Post

This item displays the information and recommended configuration for the PCIE slots that the graphics card is installed in your system.

This feature is only supported on selected ASUS graphics cards.

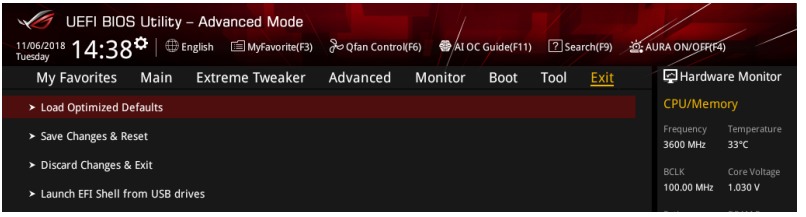
Bus Interface

This item allows you to select the bus interface.

Only the information of the selected ASUS graphics cards will be shown.

1.10 Exit menu

The Exit menu items allow you to load the optimal default values for the BIOS items, and save or discard your changes to the BIOS items. You can access the EZ Mode from the Exit menu.



Load Optimized Defaults

This option allows you to load the default values for each of the parameters on the Setup menus. When you select this option or if you press <F5>, a confirmation window appears. Select **OK** to load the default values.

Save Changes & Reset

Once you are finished making your selections, choose this option from the Exit menu to ensure the values you selected are saved. When you select this option or if you press <F10>, a confirmation window appears. Select **OK** to save changes and exit.

Discard Changes & Exit

This option allows you to exit the Setup program without saving your changes. When you select this option or if you press <Esc>, a confirmation window appears. Select **Yes** to discard changes and exit.

Launch EFI Shell from USB drives

This option allows you to attempt to launch the EFI Shell application (shellx64.efi) from one of the available filesystem devices.

1.11 Updating BIOS

The ASUS website publishes the latest BIOS versions to provide enhancements on system stability, compatibility,and performance. However, BIOS updating is potentially risky. If there is no problem using the current version of BIOS, DO NOT manually update the BIOS. Inappropriate BIOS updating may result to system's failure to boot. Carefully follow the instructions in this chapter to update your BIOS when necessary.

Visit http://www.asus.com to download the latest BIOS file for this motherboard.

The following utilities allow you to manage and update the motherboard BIOS setup program.

1. EZ Update: Updates the BIOS in Windows® environment.
2. ASUS EZ Flash 3: Updates the BIOS using a USB flash drive.
3. ASUS CrashFree BIOS 3: Restores the BIOS using the motherboard support DVD or a USB flash drive when the BIOS file fails or gets corrupted.

1.11.1 EZ Update

The EZ Update is a utility that allows you to update the motherboard BIOS in Windows® environment.

- EZ Update requires an Internet connection either through a network or an ISP (Internet Service Provider).
- This utility is available in the support DVD that comes with the motherboard package.

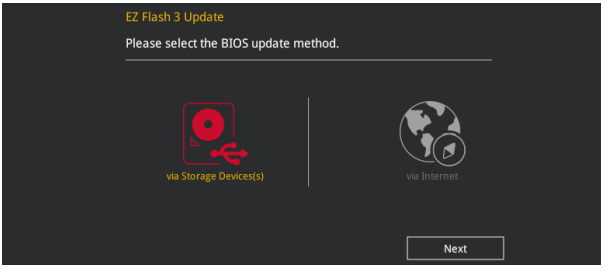
1.11.2 ASUS EZ Flash 3

ASUS EZ Flash 3 allows you to download and update to the latest BIOS through the Internet without having to use a bootable floppy disk or an OS-based utility.

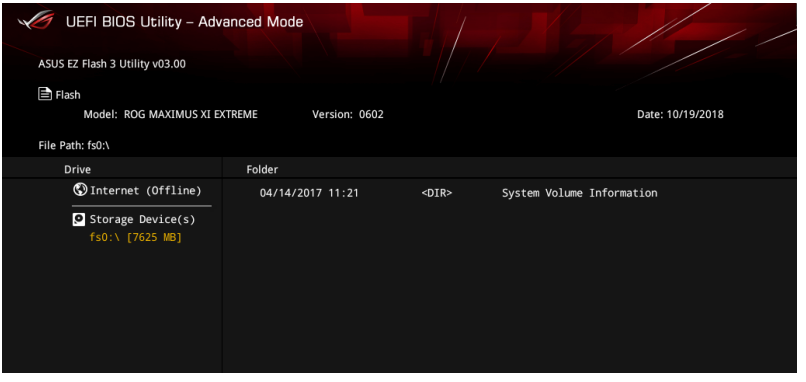
Updating through the Internet varies per region and Internet conditions. Check your local Internet connection before updating through the Internet.

To update the BIOS by USB:

1. Enter the Advanced Mode of the BIOS setup program. Go to the Tool menu to select **ASUS EZ Flash Utility** and press <Enter>.
2. Insert the USB flash disk that contains the latest BIOS file to the USB port.
3. Select **via Storage Device(s).**



4. Press <Tab> to switch to the Drive field.
5. Press the Up/Down arrow keys to find the USB flash disk that contains the latest BIOS, and then press <Enter>.
6. Press <Tab> to switch to the Folder Info field.
7. Press the Up/Down arrow keys to find the BIOS file, and then press <Enter> to perform the BIOS update process. Reboot the system when the update process is done.

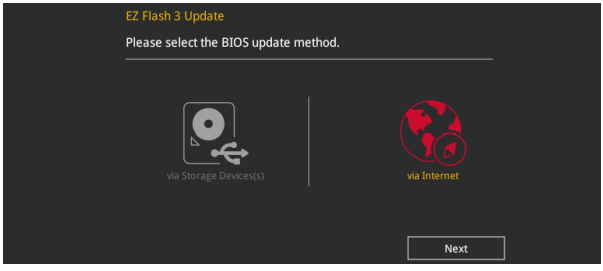


- This function can support devices such as a USB flash disk with FAT 32/16 format and single partition only.
- DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure!

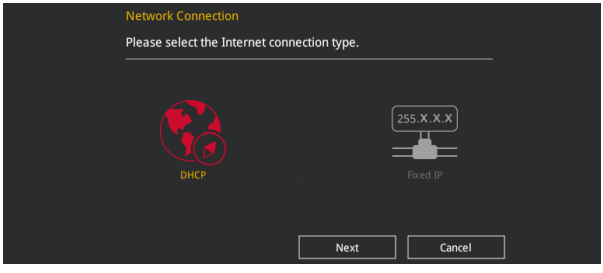
Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the Load Optimized Defaults item under the Exit menu. See section **3.10 Exit Menu** for details.

To update the BIOS by Internet:

1. Enter the Advanced Mode of the BIOS setup program. Go to the Tool menu to select **ASUS EZ Flash Utility** and press <Enter>.
2. Select **via Internet.**



3. Press the Left/Right arrow keys to select an Internet connection method, and then press <Enter>.



4. Follow the onscreen instructions to complete the update.
5. Reboot the system when the update process is done.

Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the Load Optimized Defaults item under the Exit menu. See section **3.10 Exit Menu** for details.

1.11.3 ASUS CrashFree BIOS 3

The ASUS CrashFree BIOS 3 utility is an auto recovery tool that allows you to restore the BIOS file when it fails or gets corrupted during the updating process. You can restore a corrupted BIOS file using the motherboard support DVD or a USB flash drive that contains the BIOS file.

The BIOS file in the motherboard support DVD may be older than the BIOS file published on the ASUS official website. If you want to use the newer BIOS file, download the file at https://www.asus.com/support/ and save it to a USB flash drive.

Recovering the BIOS

To recover the BIOS:

1. Turn on the system.
2. Insert the motherboard support DVD to the optical drive, or the USB flash drive containing the BIOS file to the USB port.
3. The utility automatically checks the devices for the BIOS file. When found, the utility reads the BIOS file and enters ASUS EZ Flash 3 automatically.
4. The system requires you to enter BIOS Setup to recover the BIOS setting. To ensure system compatibility and stability, we recommend that you press <F5> to load default BIOS values.

DO NOT shut down or reset the system while updating the BIOS! Doing so can cause system boot failure!