ROG Z690 Series

BIOS Manual

Motherboard

Contents

BIOS Setup

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 for your motherboard, rename it as **XXXXX.CAP** or launch the **BIOSRenamer.exe** application to automatically rename the file. The name of the CAP file varies depending on models. Refer to the user manual that came with your motherboard for the name.

- The screenshots in this manual are for reference only, please refer to the latest BIOS version for settings and options.

- BIOS settings and options may vary due to different BIOS release versions or CPU installed. Please refer to the latest BIOS version for settings and options.

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 **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 your motherboard manual for information on how to erase the 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.

The BIOS settings and options for each motherboard may differ slightly with the options in this manual. Please refer to the BIOS of your motherboard for the settings and options.

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.

Configuration fields
Pop-up Menu
Menu bar
AI OC Guide
AURA
Scroll bar
Language   **MyFavorite**   **Qfan Control**   **Search**   **ReSize BAR**   **MemTest86**

Submenu items
Menu items
General help
Last modified settings
Go back to EZ Mode
Hot keys
Displays a quick overview of the system status and prediction

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

An arrow 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.

MyFavorite

This button above the menu bar shows all BIOS items in a Tree Map setup. Select frequently-used BIOS settings and save it to **My Favorites** menu. You may also access this item by pressing the <F3> key on the keyboard.

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

Qfan Control

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. You may also access this item by pressing the <F6> key on the keyboard.

Refer to section **Qfan Control** for more information.

AI OC Guide

This button above the menu bar allows you to view the descriptions of AI overclocking and enable it. You may also access this item by pressing the <F11> key on the keyboard.

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

Search

This button allows you to search for BIOS items by entering its name, enter the item name to find the related item listing. You may also access this item by pressing the <F9> key on the keyboard.

AURA

This button allows you to turn the RGB LED lighting or functional LED on or off. You may also access this item by pressing the <F4> key on the keyboard.

[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.

ReSize BAR

This button allows you to turn ReSize BAR function on or off.

[On]   Enable ReSize BAR support to fully harness GPU memory. CSM (Compatibility Support Module) will be disabled.

[Off]   ReSize BAR support will be disabled.

MemTest86

This button above the menu bar allows you to activate MemTest86. MemTest86 can be used to scan and detect if there are problems with your memory. For more information on using MemTest86, please refer to www.asus.com/support.

- Please save all changes made before using MemTest86.
- There will be a few seconds of loading time after clicking the MemTest86 button.

Hot keys

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

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.

Last Modified button

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

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(F7)** 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.

Displays a quick overview of the system status

Displays the system properties of the selected mode. Click < or > to switch modes

Selects the display language of the BIOS setup program

ReSize BAR

AI OC Guide   Search   AURA

MemTest86

UEFI BIOS Utility - EZ Mode

01/13/2022 Thursday 17:55 ⚙ | ⊕ English 🎮 AI OC Guide ⌕ Search ☼ AURA ReSize BAR MemTest86

Information
ROG MAXIMUS Z690 HERO   BIOS Ver. 0802
12th Gen Intel(R) Core(TM) i7-12700K
Speed: 4700 MHz
Memory: 8192 MB (DDR5 4000MHz)

CPU Temperature

CPU Core Voltage
1.163 V
Motherboard Temperature
35°C 31°C

AI Overclocking
Click the icon below to enable the AI Overclocking feature. This feature can only be enabled when using an unlocked CPU.

Normal

DRAM Status
DIMM_A1: N/A
DIMM_A2: SK Hynix 8192MB 4800MHz
DIMM_B1: N/A
DIMM_B2: N/A

Storage Information

AEMP
Disabled   Disabled

Intel Rapid Storage Technology
On   Off

Boot Priority
Choose one and drag the items.   Switch all

UEFI: PXE IPv4 Intel(R) Ethernet Controller (3) I225-V

UEFI: PXE IPv6 Intel(R) Ethernet Controller (3) I225-V

FAN Profile
CPU FAN 2099 RPM
CPU OPT FAN N/A
CHA1 FAN N/A
CHA2 FAN N/A
CHA3 FAN N/A
CHA4 FAN N/A
W_PUMP+ N/A
AIO PUMP N/A

CPU FAN

QFan Control

Boot Menu(F8)

Default(F5)   Save & Exit(F10)   Advanced Mode(F7)

Enables or disables the SATA RAID mode for Intel Rapid Storage Technology

Loads optimized default settings

Saves the changes and resets the system

Displays the CPU Fan's speed. Click the button to manually tune the fans

Click to go to Advanced mode

Click to display boot devices

Selects the boot device priority

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

2.3 Qfan Control

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

Click to select a fan to be configured

Click to activate PWM Mode

Click to activate DC Mode

Q-Fan Control
Select your target fan and then move the slider to select any of these profiles:(Standard, Silent, Turbo and Full Speed). You can also move the slider to [Manual] and manually configure the fan's operating speed.

Q-Fan Tuning

CPU FAN
CHA1 FAN
CHA2 FAN
CHA3 FAN
CHA4 FAN
W_PUMP+
AIO PUMP

Auto Detect

Auto Detect
DC Mode
PWM Mode

%
100

50

0   30   70   100   °C

Standard   Silent   Turbo   Full Speed   Manual

Undo   Apply   Exit (ESC)

Select a profile to apply to your fans

Click to apply the fan setting

Click to undo the changes

Click to go back to main menu

Select to manually configure your fans

Configuring fans manually

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

Q-Fan Control
Select your target fan and then move the slider to select any of these profiles:(Standard, Silent, Turbo and Full Speed). You can also move the slider to [Manual] and manually configure the fan's operating speed.

Q-Fan Tuning

Auto Detect

CPU FAN
CHA1 FAN
CHA2 FAN
CHA3 FAN
CHA4 FAN
W_PUMP+
AIO PUMP

Standard   Silent   Turbo   Full Speed   Manual

Undo   Apply   Exit (ESC)
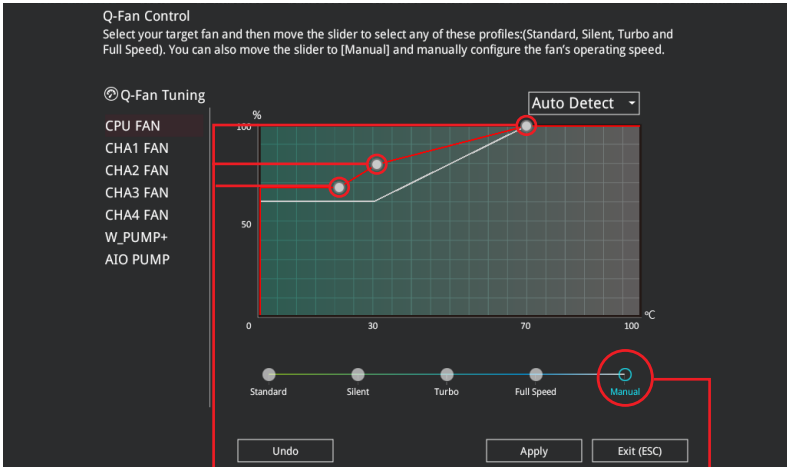
Speed points   **Select to manually configure your fans**

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)**.

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.

Quick guide topics   **Click to view the previous topic in the quick guide**   **Click to view the next topic in the quick guide**   **Click to enable AI Overclocking**   **Click to go back to main menu**

# 3.	My Favorites

My Favorites is your personal space where you can easily save and access your favorite BIOS items. You can personalize this screen by adding or removing items.

Adding items to My Favorites

To add BIOS items:

1.   Press <F3> on your keyboard or click **MyFavorite** 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.
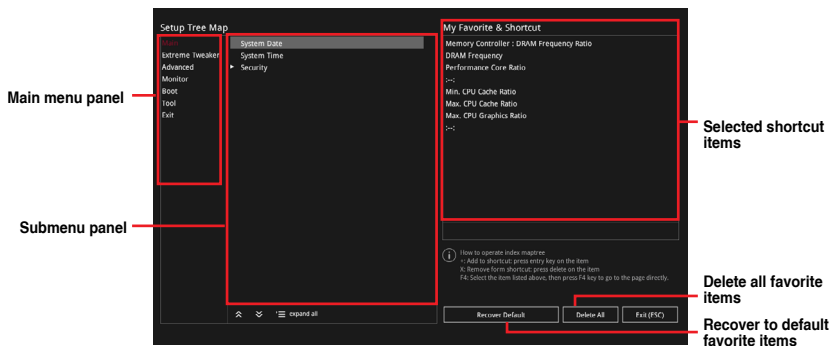
3.   Select an item from main menu panel, then click the submenu that you want to save as favorite from the submenu panel and click ➕ or press <Enter> on your keyboard.

> 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.

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.
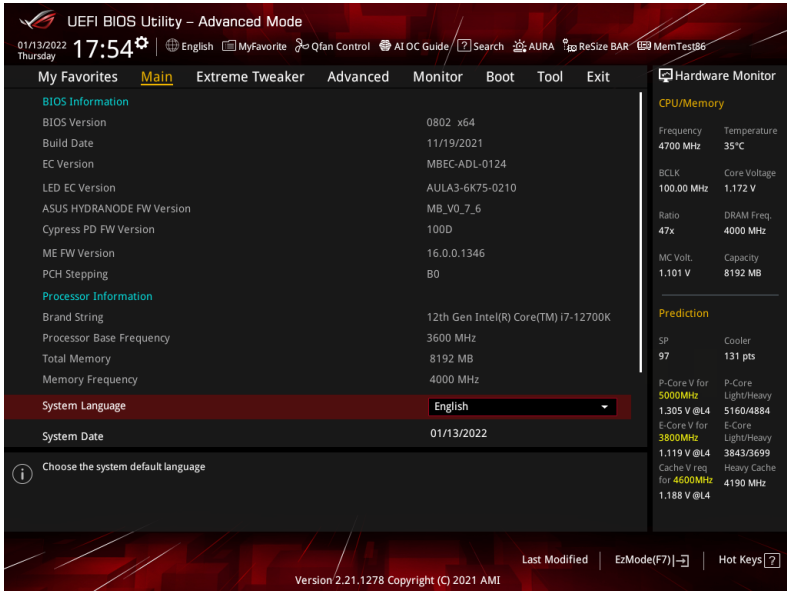
Security

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 the motherboard for information on how to erase the RTC RAM via the Clear CMOS header.

- 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]**.
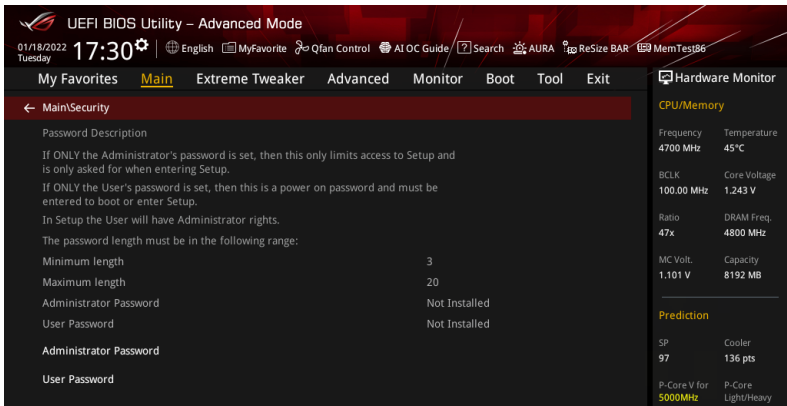
User Password

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]**.

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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.
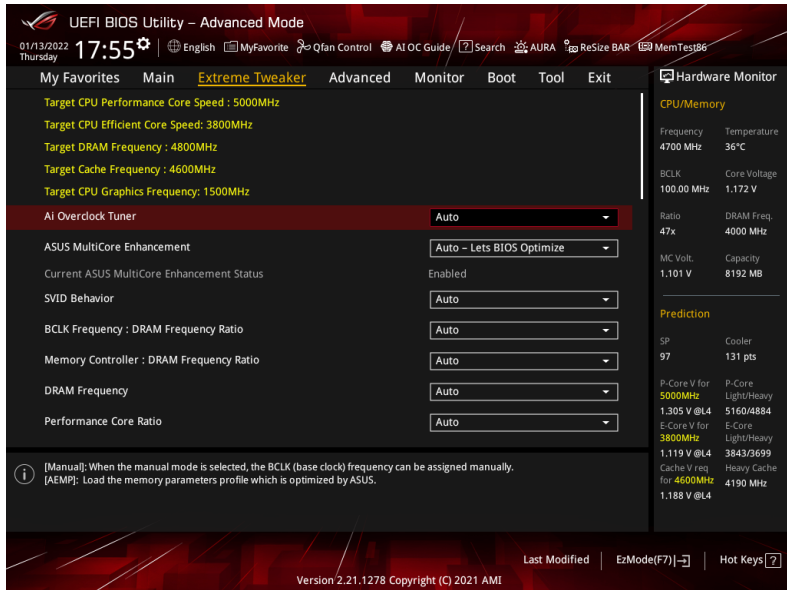
Ai Overclock Tuner

[Auto]	Loads the optimal settings for the system.
[Manual]	Allows you to assign the BCLK (base clock) frequency manually.
[ASUS Enhanced Memory Profile]	Loads the memory parameters profile which is optimized by ASUS.

📝 The following items appear only when **Ai Overclock Tuner** is set to **[ASUS Enhanced Memory Profile]** or **[Manual]**.

BCLK Frequency

Allows you to set the BCLK (base clock) frequency to enhance the system performance. Using a higher BCLK frequency will alter the operating frequency of all associated clock domains (CPU, DRAM, and Cache). Use the <+> or <-> to adjust the value.

PCIE Frequency

Allows you to set the PCIe clock frequency. Use the <+> or <-> to adjust the value. The values range from 80.0 MHz to 200.0 MHz.
Configuration options: [80.0] - [200.0]

> The following item appears only when **Ai Overclock Tuner** is set to **[ASUS Enhanced Memory Profile]**.

AEMP

Allows you to select your ASUS Enhanced Memory Profile (AEMP). Each profile has its own DRAM frequency, timing and voltage.

ASUS MultiCore Enhancement

[Auto - Lets BIOS Optimize]	This item allows you to use ASUS optimized core ratio Turbo settings at default processor speeds.
[Disabled - Enforce All limits]	This item allows you to use Intel default Turbo core ratio settings.
[Enabled - Remove All limits]	This item allows you to use optimized power and current thresholds for maintaining maximum performance.

SVID Behavior

Allows you to program the CPU's SVID behavior based on the CPU's quality. The default option is based on **[Typical Scenario]**, but the more optimistic the mode selected, the lower the temperature of the CPU. **[Intel's Fail Safe]** is the default behavior of the processor oblivious to the actual Motherboard design. **[Trained]** optimizes SVID behavior to match input parameters such as VRM Loadline and Target Frequencies.
Configuration options: [Auto] [Best-Case Scenario] [Typical Scenario] [Worst-Case Scenario] [Intel's Fail Safe] [Trained]

BCLK Frequency : DRAM Frequency Ratio

[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.

Memory Controller : DRAM Frequency Ratio

BCLK Frequency: DRAM Frequency Ratio of 100:133 tends to overclock better and 1:2 Memory Controller: DRAM Frequency Ratio only works with even numbered DRAM Ratios and not odd numbered ratios.
Configuration options: [Auto] [1:1] [1:2] [1:4]

DRAM Frequency

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] [DDR5-800MHz] - [DDR5-13333MHz]

Performance Core Ratio

[Auto]   The system will adjust all Performance core ratios automatically.

[Sync All Cores]   Configure a core ratio limit to synchronize all Performance cores.

[By Core Usage]   Configure the ratio limits for active cores depending on how many
                           Performance cores are being utilized.

[AI Optimized]   Use AI to optimize the Performance core ratios.

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

- The following item appears only when **Performance Core Ratio** is set to **[Auto]**,
  [Sync All Cores], or **[By Core Usage]**.

Specific Performance Core

Performance Core0-7 Specific Ratio Limit
Configure a ratio limit for certain Performance Cores.

Performance Core0-7 Specific Adaptive Voltage
Allows configuration of the voltage supply to the CPU cores. Setting to **[Auto]** will
scale voltage according to the applied CPU core ratio. Do not confuse this setting with
VCCIN (CPU Input voltage).
Configuration options: [Auto] [Adaptive Mode]

The following item appears only when **Performance Core0-7 Specific Adaptive Voltage**
is set to **[Adaptive Mode]**.

Offset Mode Sign

[+]   Offset the CPU core voltage by a positive value.

[-]   Offset the CPU core voltage by a negative value.

Performance Core0-7 Offset
Configure the CPU core voltage offset value. Use the <+> or <-> to adjust the value.
The values range from 0.001 V to 0.999 V with an interval of 0.001 V.
Configuration options: [Auto] [0.00100] - [0.99900]

You need to save the changes and reset the system for the changes to take effect.

Additional Turbo Mode CPU Core0-7 Voltage
Configure the amount of voltage fed to the CPU cores when running in the turbo
mode. Increase the voltage when configuring a High CPU core frequency. This
voltage will be affected by the offset value. Use the <+> or <-> to adjust the value. The
values range from 0.250 V to 1.920 V with an interval of 0.001 V.
Configuration options: [Auto] [0.25000] - [1.92000]

The following item appears only when **Efficient Core Ratio** is set to **[Sync All Cores]**.

ALL-Core Ratio Limit

Ratio Limit for Efficient Cores when N Efficient cores are loaded. Use the <+> or <-> to
adjust the value.
Configuration options: [Auto] [8] - [50]

1-Core Ratio Limit / 2-Core Ratio Limit / 3-Core Ratio Limit / 4-Core Ratio Limit / 5-Core Ratio Limit / 6-Core Ratio Limit / 7-Core Ratio Limit / 8-Core Ratio Limit

The N-core ratio limit must be higher than or equal to the (N+1)-core ratio limit. (N stands for the number of CPU cores) The core ratio limit cannot be set to **[Auto]** when the core number is lower than N. The biggest core's ratio limit must be lower than or equal to the second biggest core's ratio limit.

Optimized AVX Frequency

Select **[Normal Use]** for typical use cases, or select **[Heavy AVX]** for extreme loads such as Prime 95 AVX.
Configuration options: [Normal Use] [Heavy AVX]

Efficient Core Ratio

[Auto]　　　　　The system will adjust all Efficient core ratios automatically.

[Sync All Cores]　Configure a core ratio limit to synchronize all Efficient cores.

[By Core Usage]　Configure the ratio limits for active cores depending on how many Efficient cores are being utilized.

[AI Optimized]　　Use AI to optimize the Efficient core ratios.

Specific Efficient Core

Efficient Core Group0 Specific Ratio Limit
Configure a ratio limit for certain Efficient Cores. Use the <+> or <-> to adjust the value.
Configuration options: [Auto] [8] - [120]

Efficient Core Group0 Specific Adaptive Voltage
Allows configuration of the voltage supply to the CPU cores. Setting to **[Auto]** will scale voltage according to the applied CPU core ratio. Do not confuse this setting with VCCIN (CPU Input voltage).
Configuration options: [Auto] [Adaptive Mode]

Offset Mode Sign
[+]　　　　　Offset the CPU core voltage by a positive value.

[-]　　　　　Offset the CPU core voltage by a negative value.

Efficient Core Group0 Offset

Configure the CPU core voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001 V to 0.999 V with an interval of 0.001 V.
Configuration options: [Auto] [0.00100] - [0.99900]

You need to save the changes and reset the system for the changes to take effect.

Additional Turbo Mode Efficient Group0 Voltage

Configure the amount of voltage fed to the CPU cores when running in the turbo mode. Increase the voltage when configuring a High CPU core frequency. This voltage will be affected by the offset value. Use the <+> or <-> to adjust the value. The values range from 0.250 V to 1.920 V with an interval of 0.001 V.
Configuration options: [Auto] [0.25000] - [1.92000]

The following item appears only when **Efficient Core Ratio** is set to **[Sync All Cores]**.

ALL-Core Ratio Limit

Ratio Limit for Efficient Cores when N Efficient cores are loaded. Use the <+> or <-> to adjust the value.
Configuration options: [Auto] [8] - [85]

The following items appear only when **CPU Core Ratio** is set to **[By Core Usage]**.

Efficient 1-Core Ratio Limit / Efficient 2-Core Ratio Limit / Efficient 3-Core Ratio Limit / Efficient 4-Core Ratio Limit

Ratio Limit for Efficient cores when N Efficient cores are loaded. Use the <+> or <-> to adjust the value.
Configuration options: [Auto] [27] - [85]

CPU SVID Support

Disable this item to stop the CPU from communicating with the external voltage regulator. We recommend setting this item to **[Disabled]** for overclocking.
Configuration options: [Auto] [Disabled] [Enabled]

AVX Related Controls

AVX2

Allows you to enable or disable the AVX 2 Instructions.
Configuration options: [Auto] [Disabled] [Enabled]

AVX512

Allows you to enable or disable the AVX 512 Instructions.
Configuration options: [Auto] [Disabled] [Enabled]

AVX512 is only available when E-Cores are disabled.

AVX2 Ratio Offset to per-core Ratio Limit

Configuration options: [Auto] [User Specify]

The following item appears only when **AVX2 Ratio Offset to per-core Ratio Limit** is set to **[User Specify]**.

AVX2 Ratio Offset

Specifies number of bins to decrease AVX ratio vs. Per-Core Ratio. AVX is a more stressful workload, it is helpful to lower the AVX ratio to ensure maximum possible ratio for SSE workloads. Uses Mailbox MSR 0x150, cmd 0x1B. Range 0-31. 0=No offset. Use the <+> or <-> to adjust the value.
Configuration options: [0] - [31]

AVX2 Voltage Guardband Scale Factor
Configuration options: [Auto] [User Specify]

The following item appears only when **AVX2 Voltage Guardband Scale Factor** is set to **[User Specify]**.

AVX2 Voltage Guardband Scale Factor

Controls the voltage guardband applied to AVX workloads. Range in 1/100 units, where 125=1.25 scale factor. The resulting final voltage guardband is default guardband * Scale Factor. Therefore lower than 100 values reduce guardband while higher than 100 values increase guardband. Use the <+> or <-> to adjust the value.
Configuration options: [0] - [199]

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. You can also select various Memory Presets to load settings suitably tuned for some memory modules.

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

Memory Presets
The items in this menu allow you to select different memory presets for different memory modules.

Maximus Tweak
Configuration options: [Auto] [Mode1] [Mode2]

Primary Timings

DRAM CAS# Latency
Configuration options: [Auto] [2] - [126]

DRAM RAS# to CAS# Delay
Configuration options: [Auto] [0] - [255]

DRAM RAS# PRE Time
Configuration options: [Auto] [0] - [255]

DRAM RAS# ACT Time
Configuration options: [Auto] [1] - [511]

DRAM Command Rate

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

The following item appears only when **DRAM Command Rate** is set to **[N:1]**.

N to 1 ratio

Number of bubbles between each valid command cycle.
Configurations: [1] - [7]

Secondary Timings

DRAM RAS# to RAS# Delay L
Configuration options: [Auto] [1] - [63]

DRAM RAS# to RAS# Delay S
Configuration options: [Auto] [1] - [127]

DRAM REF Cycle Time
Configuration options: [Auto] [1] - [65535]

DRAM REF Cycle Time 2
Configuration options: [Auto] [1] - [65535]

DRAM REF Cycle Time Same Bank
Configuration options: [Auto] [0] - [2047]

DRAM Refresh Interval
Configuration options: [Auto] [1] - [262143]

DRAM WRITE Recovery Time
Configuration options: [Auto] [1] - [234]

DRAM READ to PRE Time
Configuration options: [Auto] [1] - [255]

DRAM FOUR ACT WIN Time
Configuration options: [Auto] [1] - [511]

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] - [127]

DRAM Write Latency
Configuration options: [Auto] [1] - [255]

Skew Control

DDRCRCOMPCTL0/1/2

Ctl0 dqvrefup
Configuration options: [Auto] [0] - [255]

Ctl0 dqvrefdn
Configuration options: [Auto] [0] - [255]

Ctl0 dqodtvrefup
Configuration options: [Auto] [0] - [255]

Ctl0 dqodtvrefdn
Configuration options: [Auto] [0] - [255]

Ctl1 cmdvrefup
Configuration options: [Auto] [0] - [255]

Ctl1 ctlvrefup
Configuration options: [Auto] [0] - [255]

Ctl1 clkvrefup
Configuration options: [Auto] [0] - [255]

Ctl1 ckecsvrefup
Configuration options: [Auto] [0] - [255]

Ctl2 cmdvrefup
Configuration options: [Auto] [0] - [255]

Ctl2 ctlvrefdn
Configuration options: [Auto] [0] - [255]

Ctl2 clkvrefdn
Configuration options: [Auto] [0] - [255]

Tc Odt Control

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]

MC0 Dimm0 / MC0 Dimm1 / MC1 Dimm0 / MC1 Dimm1

DQ RTT WR

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]

DQ RTT NOM RD

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]

DQ RTT NOM WR

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]

DQ RTT PARK

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]

DQ RTT PARK DQS

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]

GroupA CA ODT

Configuration options: [Auto] [0 DRAM Clock] [40 DRAM Clock] [60 DRAM Clock] [80 DRAM Clock] [120 DRAM Clock] [240 DRAM Clock] [480 DRAM Clock]

GroupA CS ODT

Configuration options: [Auto] [0 DRAM Clock] [40 DRAM Clock] [60 DRAM Clock] [80 DRAM Clock] [120 DRAM Clock] [240 DRAM Clock] [480 DRAM Clock]

GroupA CK ODT

Configuration options: [Auto] [0 DRAM Clock] [40 DRAM Clock] [60 DRAM Clock] [80 DRAM Clock] [120 DRAM Clock] [240 DRAM Clock] [480 DRAM Clock]

GroupB CA ODT

Configuration options: [Auto] [0 DRAM Clock] [40 DRAM Clock] [60 DRAM Clock] [80 DRAM Clock] [120 DRAM Clock] [240 DRAM Clock] [480 DRAM Clock]

GroupB CS ODT

Configuration options: [Auto] [0 DRAM Clock] [40 DRAM Clock] [60 DRAM Clock] [80 DRAM Clock] [120 DRAM Clock] [240 DRAM Clock] [480 DRAM Clock]

GroupB CK ODT

Configuration options: [Auto] [0 DRAM Clock] [40 DRAM Clock] [60 DRAM Clock] [80 DRAM Clock] [120 DRAM Clock] [240 DRAM Clock] [480 DRAM Clock]

Pull-up Output Driver Impedance

Configuration options: [Auto] [34 DRAM Clock] [40 DRAM Clock] [48 DRAM Clock]

Pull-Down Output Driver Impedance

Configuration options: [Auto] [34 DRAM Clock] [40 DRAM Clock] [48 DRAM Clock]

RTL IOL Control

Round Trip Latency Init Value MC0-1 CHA-B

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

Round Trip Latency Max Value MC0-1 CHA-B

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

Round Trip Latency Offset Value Mode Sign MC0-1 CHA-B

Configuration options: [-] [+]

Round Trip Latency Offset Value MC0-1 CHA-B

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

Round Trip Latency MC0-1 CHA-B R0-7

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

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: [Auto] [Enabled] [Disabled]

Early ReadMPR Timing Centering 2D

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

Read MPR Training

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

Receive Enable Training

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

Jedec Write Leveling

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

Early Write Timing Centering 2D

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

Early Read Timing Centering 2D

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

Write Timing Centering 1D

Configuration options: [Disabled] [Enabled]

Write Voltage Centering 1D

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

Read Timing Centering 1D

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

Read Timing Centering with JR

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

Dimm ODT Training*

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

Max RTT_WR

Allows you to cap the maximum RTT_WR in power training.
Configuration options: [ODT OFF] [120 Ohms]

DIMM RON Training*

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

Write Drive Strength/Equalization 2D*

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

Write Slew Rate Training*

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

Read ODT Training*

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

Comp Optimization Traning

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

Read Equalization Training*

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

Read Amplifier Training*

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

Write Timing Centering 2D

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

Read Timing Centering 2D

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

Command Voltage Centering

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

Early Command Voltage Centering

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

Write Voltage Centering 2D

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

Read Voltage Centering 2D

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

Late Command Training
Configuration options: [Disabled] [Enabled] [Auto]

Round Trip Latency
Configuration options: [Auto] [Disabled] [Enabled]

Turn Around Timing Training
Configuration options: [Auto] [Disabled] [Enabled]

CMD CTL CLK Slew Rate
Configuration options: [Auto] [Disabled] [Enabled]

CMD/CTL DS & E 2D
Configuration options: [Auto] [Disabled] [Enabled]

Read Voltage Centering 1D
Configuration options: [Auto] [Disabled] [Enabled]

TxDqTCO Comp Training*
Configuration options: [Auto] [Disabled] [Enabled]

ClkTCO Comp Training*
Configuration options: [Auto] [Disabled] [Enabled]

TxDqsTCO Comp Training*
Configuration options: [Auto] [Disabled] [Enabled]

VccDLL Bypass Training*
Configuration options: [Auto] [Disabled] [Enabled]

CMD/CTL Drive Strength Up/Dn 2D
Configuration options: [Auto] [Disabled] [Enabled]

DIMM CA ODT Training
Configuration options: [Auto] [Disabled] [Enabled]

PanicVttDnLp Training*
Configuration options: [Auto] [Disabled] [Enabled]

Read Vref Decap Traning*
Configuration options: [Auto] [Disabled] [Enabled]

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

Duty Cycle Correction Training
Configuration options: [Auto] [Disabled] [Enabled]

Rank Margin Tool Per Bit
Configuration options: [Auto] [Disabled] [Enabled]

DIMM DFE Training
Configuration options: [Auto] [Disabled] [Enabled]

Tx Dqs Dcc Training
Configuration options: [Auto] [Disabled] [Enabled]

Rank Margin Tool
Configuration options: [Auto] [Disabled] [Enabled]

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

DIMM SPD Alias Test
Configuration options: [Auto] [Disabled] [Enabled]

Receive Enable Centering 1D

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

Retrain Margin Check

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

Write Drive Strength Up/Dn independently

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

Margin Check Limit

Checks Margin to Limit to see if next boot memory needs to be retrained.
Configuration options: [Disabled] [L1] [L2] [Both]

The following item appears only when **Margin Check Limit** is set to **[L2]** or **[Both]**.

Margin Limit Check L2

L2 check threshold is scale of L1 check.
Configuration options: [1] - [300]

Third Timings

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

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

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

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

tRDWR_sg
Configuration options: [Auto] [0] - [255]

tRDWR_dg
Configuration options: [Auto] [0] - [255]

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

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

tWRRD_sg
Configuration options: [Auto] [0] - [511]

tWRRD_dg
Configuration options: [Auto] [0] - [511]

tRDRD_dr
Configuration options: [Auto] [0] - [255]

tRDRD_dd
Configuration options: [Auto] [0] - [255]

tRDWR_dr
Configuration options: [Auto] [0] - [255]

tRDWR_dd
Configuration options: [Auto] [0] - [255]

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

tWRWR_dd
Configuration options: [Auto] [0] - [255]

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

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

tWRPRE
Configuration options: [Auto] [0] - [1023]

tPRPDEN
Configuration options: [Auto] [0] - [31]

tRDPDEN
Configuration options: [Auto] [0] - [255]

tWRPDEN
Configuration options: [Auto] [0] - [1023]

tCPDED
Configuration options: [Auto] [0] - [31]

tREFIX9
Configuration options: [Auto] [0] - [255]

Ref Interval
Configuration options: [Auto] [0] - [8191]

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

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

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

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

Misc.

MRC Fast Boot
Allows you to enable or disable the MRC fast boot.
Configuration options: [Disabled] [Enabled]

MCH Full Check
Enable this item to enhance the system stability. Setting this item to **[Disabled]** may
enhance the DRAM overclocking capability.
Configuration options: [Auto] [Enabled] [Disabled]

Mem Over Clock Fail Count

Configuration options: [Auto] [1] - [255]

Training Profile

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

RxDfe

Allows you to set the DFE on SOC Rx.
Configuration options: [Auto] [Enabled] [Disabled]

Mrc Training Loop Count

Allows you to set the exponential number of loops to run the test.
Configuration options: [Auto] [0] - [32]

DRAM CLK Period

Allows you to set the DRAM clock period.
Configuration options: [Auto] [0] - [161]

Controller 0, Channel 0 Control

Allows you to enable or disable Controller 0, Channel 0.
Configuration options: [Enabled] [Disabled]

Controller 0, Channel 1 Control

Allows you to enable or disable Controller 0, Channel 1.
Configuration options: [Enabled] [Disabled]

Controller 1, Channel 0 Control

Allows you to enable or disable Controller 1, Channel 0.
Configuration options: [Enabled] [Disabled]

Controller 1, Channel 1 Control

Allows you to enable or disable Controller 1, Channel 1.
Configuration options: [Enabled] [Disabled]

MC_Vref0-2

Configuration options: [Auto] [0] - [65533]

Configure Memory Dynamic Frequency Switching

The following item appears only when **Realtime Memory Frequency** is set to **[Disabled]**.

Dynamic Memory Boost

Allows you to enable or disable Dynamic Memory Boost Feature. Allows automatic switching between default SPD Profile frequency and selected XMP profile frequency. Only valid if an XMP Profile is selected.
Configuration options: [Disabled] [Enabled]

The following item appears only when **Dynamic Memory Boost** is set to **[Disabled]**.

Realtime Memory Frequency

Allows you to enable or disable Memory Frequency feature. Allows manual switching between in runtime between default SPD Profile frequency and selected XMP profile frequency. Only valid if an XMP Profile is selected.
Configuration options: [Disabled] [Enabled]

SA GV

System Agent Geyserville. Can disable, fix to a specific point, or enable frequency switching. If enabled, we recommend you to leave options at parked values for best compatibility. Enabling this feature requires a longer boot time.
Configuration options: [Disabled] [Enabled] [Fixed to 1st Point] [Fixed to 2nd Point] [Fixed to 3rd Point] [Fixed to 4th Point]

The following items appear only when **SA GV** is set to **[Enabled]**, **[Fixed to 1st Point]**, **[Fixed to 2nd Point]**, **[Fixed to 3rd Point]**, or **[Fixed to 4th Point]**.

First Point Frequency

Allows you to specify the frequency for the given point. 0-MRC auto, else a specific frequency as an integer: 2000Mhz.
Configuration options: [0] - [65535]

First Point Gear

Allows you to set the gear ratio for this SAGV point. 0-Auto, 1-G1, 2-G2, 4-G4.
Configuration options: [0] - [4]

Second Point Frequency

Allows you to specify the frequency for the given point. 0-MRC auto, else a specific frequency as an integer: 2000Mhz.
Configuration options: [0] - [65535]

Second Point Gear

Allows you to set the gear ratio for this SAGV point. 0-Auto, 1-G1, 2-G2, 4-G4.
Configuration options: [0] - [4]

Third Point Frequency

Allows you to specify the frequency for the given point. 0-MRC auto, else a specific frequency as an integer: 2000Mhz.
Configuration options: [0] - [65535]

Third Point Gear

Allows you to set the gear ratio for this SAGV point. 0-Auto, 1-G1, 2-G2, 4-G4.
Configuration options: [0] - [4]

The Fourth Point Gear will always be the settings you set in the main menu, so configure the Fourth Point Gear there.

Digi+ VRM

Voltage Monitor
Configuration options: [Die Sense] [Socket Sense]

VRM Initialization Check
When any error occurs during VRM initialization, the system will hang at POST code 76/77 if this function is enabled.
Configuration options: [Disabled] [Enabled]

CPU Input Voltage Load-line Calibration
Configuration options [Auto] [Level 1] [Level 2] [Level 3]

CPU Load-line Calibration

The load-line is defined by the Intel VRM specification and affects the level of voltage supplied to the processor. Higher load-line calibration settings result in reduced VDroop at the expense of voltage overshoot and will increase CPU temperatures due to higher voltage under load. Select from level 1 to 7 to adjust the load-line slope. Level 1 = greater VDroop, Level 7 = minimum VDroop.
Configuration options [Auto] [Level 1] [Level 2] [Level 3] [Level 4:Recommended for OC] [Level 5] [Level 6] [Level 7] [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: [Disabled] [Enabled]

CPU Current Capability

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 Current Reporting

Configuration options: [Auto] [50%] [100%] [150%]

CPU Voltage Suspension

Allows you to manipulate voltage output, effective in both over-ride and non over-ride modes.
Configuration options: [Auto] [Enabled] [Disabled]

The following items appear only when **CPU Voltage Suspension** is set to **[Enabled]**.

Voltage Floor Mode

[Static]   Sets a fixed minimum voltage.

[Dynamic]   Sets a customized minimum that actively moves based on CPU temperature.

The following item appears only when **Voltage Floor Mode** is set to **[Static]**.

Voltage Floor

Boosts output to keep voltage above this level, efficacy up to 0.3V. Use the <+> and <-> keys to adjust the value. The values range from 0.000V to 3.000V with an interval of 0.00625V.
Configuration options: [Auto] [0.00000] - [3.00000]

Floor Low VMin

The lowest minimum voltage point that maps to Floor Hot Temp should the processor temperature move to hotter or equal to Floor Hot Temp. Auto is 1.15V. Use the <+> and <-> keys to adjust the value. The values range from 0.000V to 3.000V with an interval of 0.00625V.

Configuration options: [Auto] [0.00000] - [3.00000]

Floor Hot Temp

The hottest temperature point that maps to Floor Low Vmin should the processor temperature move to hotter or equal to Floor Hot Temp. Auto is 95C. Use the <+> and <-> keys to adjust the value. The values range from 0C to 255C with an interval of 1C.

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

Floor High VMin

The highest minimum voltage point that maps to Floor Cold Temp should the processor temperature move to colder or equal to Floor Cold Temp. Auto is 1.30V. Use the <+> and <-> keys to adjust the value. The values range from 0.000V to 3.000V with an interval of 0.00625V.

Configuration options: [Auto] [0.00000] - [3.00000]

Floor Cold Temp

The coldest temperature point that maps to Floor High Vmin should the processor temperature move to colder or equal to Floor Cold Temp. Auto is 55C. Use the <+> and <-> keys to adjust the value. The values range from 0C to 255C with an interval of 1C.

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

Voltage Ceiling Mode

[Static]   Sets a fixed maximum voltage.

[Dynamic]   Sets a customized maximum that actively moves based on CPU temperature.

Voltage Ceiling

Suppresses output to keep voltage below this level, efficacy up to 0.3V. Use the <+> and <-> keys to adjust the value. The values range from 0.000V to 3.000V with an interval of 0.00625V.

Configuration options: [Auto] [0.00000] - [3.00000]

Ceiling Low VMax

The lowest maximum voltage point that maps to Ceiling Hot Temp should the processor temperature move to hotter or equal to Ceiling Hot Temp. Auto is 1.30V. Use the <+> and <-> keys to adjust the value. The values range from 0.000V to 3.000V with an interval of 0.00625V.

Configuration options: [Auto] [0.00000] - [3.00000]

Ceiling Hot Temp

The hottest temperature point that maps to Ceiling Low VMax should the processor temperature move to hotter or equal to Ceiling Hot Temp. Auto is 88C. Use the <+> and <-> keys to adjust the value. The values range from 0C to 255C with an interval of 1C.

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

Ceiling High VMax

The highest maximum voltage point that maps to Ceiling Cold Temp should the processor temperature move to colder or equal to Ceiling Cold Temp. Auto is 1.40V. Use the <+> and <-> keys to adjust the value. The values range from 0.000V to 3.000V with an interval of 0.00625V.

Configuration options: [Auto] [0.00000] - [3.00000]

Ceiling Cold Temp

The coldest temperature point that maps to Ceiling High VMax should the processor temperature move to colder or equal to Ceiling Cold Temp. Auto is 65C. Use the <+> and <-> keys to adjust the value. The values range from 0C to 255C with an interval of 1C.

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

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. Setting a higher switching frequency will result in better transient response at the expense of higher VRM temperatures. Active cooling of the VRM heatsink is recommended when running high CPU voltage and high load-line calibration values.

Configuration options: [Auto] [Manual]

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

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

Fixed CPU VRM Switching Frequency(KHz)

Allows you to set a higher frequency for a quicker transient response speed. Use the <+> or <-> to adjust the value .The values range from 300 KHz to 800 KHz with an interval of 100 KHz.

Configuration options: [300] - [800]

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

VRM Spread Spectrum

Allows you to reduce the magnitude of peak noise from the VRM. Enable this item to reduce peak noise. Disable this settings when overclocking.

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.

[Auto]   Automatically selects the power duty control.

[T. Probe]   Sets the buck controller to balance VRM FET temperatures

[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

Allows you to set the power phase control of the CPU.
Configuration options: [Auto] [Standard] [Optimized] [Extreme]

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

CPU Power Thermal Control

Allows you to set the VRM thermal cut-off trip point. 125 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. The values range from125C to 145C with an interval of 1C.
Configuration options: [125] - [145]

> DO NOT remove the VRM heatsink.

> The following items appear only when using the onboard graphics.

CPU Graphics Load-line Calibration

The load-line is defined by the Intel VRM specification and affects the CPU Graphics power voltage. The CPU Graphics working voltage will decrease proportionally depending on the CPU Graphics loading. Higher levels of the load-line calibration can get a higher voltage and a better overclocking performance but increase the CPU Graphics and VRM thermal production. Select from level 1 to 7 to adjust the CPU Graphics power voltage from 100% to 15%.
Configuration options [Auto] [Level 1] [Level 2] [Level 3] [Level 4:Recommended for OC] [Level 5] [Level 6] [Level 7] [Level 8]

> Boosted performance may vary depending on the CPU Graphics specification. DO NOT remove the thermal module.

CPU Graphics Current Capability

The CPU Graphics current capability adjusts the total power range for CPU Graphics overclocking. A higher value provides a wider total power range and extends the overclocking frequency range simultaneously.
Configuration options: [Auto] [100%] [140%]

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

CPU Graphics VRM Switching Frequency

The switching frequency will affect the CPU Graphics transient response spreed and the component thermal production. Select manual mode to configure a higher frequency to get a quicker transient response speed.
Configuration options: [Auto] [Manual]

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

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

Fixed CPU Graphics Switching Frequency(KHz)

The switching frequency will affect the CPU Graphics transient response spreed and the component thermal production. Use the <+> or <-> to adjust the value. The values range from 500 KHz to 800 KHz with an interval of 100 KHz.

Boot Voltages

CPU Core/Cache Boot Voltage

Allows you to set the CPU voltage at initial boot up. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.
Configuration options: [Auto] [0.60000] - [1.70000]

CPU Input Boot Voltage

Allows you to set the CPU Input Voltage at initial boot up. Use the <+> or <-> to adjust the value. The values range from 1.500V to 2.100V with an interval of 0.010V.
Configuration options: [Auto] [1.50000] - [2.10000]

PLL Termination Boot Voltage

Allows you to set the PLL Termination voltage at initial boot up. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.800V with an interval of 0.010V.
Configuration options: [Auto] [0.80000] - [1.80000]

CPU Standby Boot Voltage

Allows you to set the CPU Standby voltage at initial bootup. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.800V with an interval of 0.010V.
Configuration options: [Auto] [0.80000] - [1.80000]

Memory Controller Boot Voltage

Allows you to set the Memory Controller voltage at initial bootup. Use the <+> or <-> to adjust the value. The values range from 1.000V to 2.000V with an interval of 0.00625V.
Configuration options: [Auto] [1.00000] - [2.00000]

Auto Voltage Caps

CPU Core Auto Voltage Cap

Setting this to a specific value will set a ceiling for CPU Core Auto Voltage. When not in manual mode, it's effectiveness is subject to other factors such as AC/DC Loadline values and CPU's native VID. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.
Configuration options: [Auto] [0.60000] - [1.70000]

CPU Input Auto Voltage Cap

Setting this to a specific value will set a ceiling for CPU Input Auto Voltage. Use the <+> or <-> to adjust the value. The values range from 1.500V to 2.100V with an interval of 0.010V.
Configuration options: [Auto] [1.50000] - [2.10000]

Memory Controller Auto Voltage Cap

Setting this to a specific value will set a ceiling for Memory Controller Auto Voltage. Use the <+> or <-> to adjust the value. The values range from 1.000V to 2.000V with an interval of 0.00625V.
Configuration options: [Auto] [1.00000] - [2.00000]

Internal CPU Power Management

The items in this submenu allow you to set the CPU ratio and features.

TCC Activation Offset

Offset from factory set TCC activation temperature at which the Thermal Control Circuit must be activated. Tcc will be activated at: TCC Activation Temp - Tcc Activation Offset. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [1] - [63]

Package Temperature Threshold

When regulation is set to enable, frequency will adjust to stay below this package temperature threshold. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [30] - [115]

Regulate Frequency by above Threshold

When regulation is set to enable, frequency will adjust to stay below the above threshold. SVID must be enabled for this to work.
Configuration options: [Auto] [Enabled] [Disabled]

Turbo Mode Parameters

IVR Transmitter VDDQ ICCMAX

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

Unlimited ICCMAX

Allows you to enable or disable Unlimited ICCMAX. Support VR Current Limit (ICCMAX) value set above 511.75A.
Configuration options: [Auto] [Disabled] [Enabled]

CPU Core/Cache Current Limit Max.

Allows you to configure a current limit for frequency or power throttling when overclocking. Can be set to maximum value (511.75) to prevent throttling when overclocking. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.00] - [511.75]

CPU Graphics Current Limit

Allows you to configure a high current limit to prevent frequency or power throttling when overclocking. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.00] - [511.75]

Long Duration Package Power Limit

An Intel parameter known as [power limit 1] and specified in Watts. The defualt value is defined by TDP of the processor. Increasing the value will allow the Turbo ratio to be maintained for a longer duration under higher current loads. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [1] - [4095]

Package Power Time Window

An Intel parameter of [power limit 1] and specified in seconds. The applied value indicates how long the Turbo ratio can be active when TDP is exceeded.
Configuration options: [Auto] [1] [2] [3] [4] [5] [6] [7] [8] [10] [12] [14] [16] [20] [24] [28] [32] [40] [48] [56] [64] [80] [96] [112] [128] [160] [192] [224] [256] [320] [384] [448]

Short Duration Package Power Limit

An Intel parameter known as [power limit 2] and specified in Watts. It is the second Intel power limit which provides protection when package power exceeds power limit 1. The default setting is 1.25 times power limit 1. According to Intel, the platform must support this value for up to 10msec when power consumption exceeds power limit 2. ASUS motherboards are engineered to support this duration for a longer time as required to facilitate overclocking.
Configuration options: [Auto] [1] - [4095]

IA AC Load Line

Allows you to set the AC loadline defined in mOhms. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.01] - [62.49]

IA DC Load Line

Allows you to set the DC loadline defined in mOhms. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.01] - [62.49]

IA CEP Enable

Allows you to enable or disable IA CEP (Current Excursion Protection) Support. Uses pCode Mailbox Command 0x37, Sub-command 0x1. Set Databit2 to 1.
Configuration options: [Auto] [Disabled] [Enabled]

GT CEP Enable

Allows you to enable or disable GT CEP (Current Excursion Protection) Support. Uses pCode Mailbox Command 0x37, Sub-command 0x1. Set Databit3 to 1.
Configuration options: [Auto] [Disabled] [Enabled]

SA CEP Enable

Allows you to enable or disable SA CEP (Current Excursion Protection) Support. Uses pCode Mailbox Command 0x37, Sub-command 0x1. Set Databit3 to 1.
Configuration options: [Auto] [Disabled] [Enabled]

IA SoC Iccmax Reactive Protector

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

Inverse Temperature Dependency Throttle

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

IA VR Voltage Limit

Voltage Limit (VMAX). This value represents the Maximum instantaneous voltage allowed at any given time. Range is 0 - 7999mV. Uses BIOS VR mailbox command 0x8. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0] - [7999]

Thermal Velocity Boost

TVB Voltage Optimizations

This service controls thermal based voltage optimizations for processors that implement the Intel Thermal Velocity Boost (TVB) feature. This item is set to **[Enabled]** by default. Uses Overclocking Mailbox command 0x18/0x19.
Configuration options: [Auto] [Disabled] [Enabled]

V-Max Stress

If set to **[Enabled]**, Frequency may be clipped if the max voltage on the silicon is too high. Frequency will not be clipped if disabled.
Configuration options: [Auto] [Disabled] [Enabled]

Overclocking TVB

Enable this to be able to draw temperature/frequency dependencies.
Configuration options: [Auto] [Disabled] [Enabled] [+1Boost Profile] [+2Boost Profile]

> • +1Boost Profile(K CPU):
> This setting will enable additional boost of one bin with the help of Auto Optimized Temperature Control.
> +2Boost Profile(K CPU):
> This setting will enable additional boost of two bins with the help of Auto Optimized Temperature Control.
>
> • The following items appear only when **Overclocking TVB** is set to **[Enabled]**.

1-Core Active / 2-Core Active / 3-Core Active / 4-Core Active / 5-Core Active / 6-Core Active / 7-Core Active / 8-Core Active

Configuration options: [Auto] [Enabled]

> The following items appear only when **1-Core Active**, **2-Core Active**, **3-Core Active**, **4-Core Active**, **5-Core Active**, **6-Core Active**, **7-Core Active**, or **8-Core Active** is set to **[Enabled]**.

Temperature A

Package passing this temperature threshold will engage the negative ratio offset specified in **Negative Ratio Offset A**. Unit in Degree Celsius. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [1] - [115]

Negative Ratio Offset A

This will be the potential negative offset to respective ratio when package temperature rises above threshold specified in **Temperature A**.
Configuration options: [Auto] [User Specify]

Ratio Offset

Use the <+> and <-> keys to adjust the value.
Configuration options: [0] - [31]

Temperature B

Package passing this temperature threshold will engage the negative ratio offset
specified in **Negative Ratio Offset B**. Unit in Degree Celsius. Use the <+> and <->
keys to adjust the value.
Configuration options: [Auto] [1] - [115]

Negative Ratio Offset B

This will be the potential negative offset to respective ratio when package temperature
rises above threshold specified in **Temperature B**.
Configuration options: [Auto] [User Specify]

Ratio Offset

Use the <+> and <-> keys to adjust the value.
Configuration options: [0] - [31]

V/F Point Offset

Offset Mode Sign 1-11
Configuration options: [+] [-]

V/F Point 1-11 Offset
Configuration options: [Auto] [0.001] - [0.999]

Tweaker's Paradise

Initial BCLK Frequency

Allows you to set a different BCLK value during POST. May be useful for setting
a lower BCLK in scenarios where memory training is not stable at a higher BCLK
(a large frequency gap between BCLK Frequency and Initial frequency is not
recommended). Applies the same value as BCLK Frequency if left at default. Use
the <+> and <-> keys to adjust the value. The values range from 80.000MHz to
1000.000MHz with an interval of 0.050MHz.
Configuration options: [Auto] [80.0000] - [1000.00000]

BCLK Amplitude

Allows you to set the magnitude of the reference BCLK supplied to the processor.
Higher values may improve overclocking stability.
Configuration options: [Auto] [800mV] [900mV]

BCLK Slew Rate

Allows you set the speed at which the base clock rises or falls. Set a high value for
overclocking stability.
Configuration options: [Auto] [Slow] [Fast]

BCLK Spread Spectrum

Allows you to reduce the EMI. Disable to get more accurate base clocks.
Configuration options: [Auto] [Disabled] [Enabled]

Initial PCIE Frequency

Allows setting a different PCIE BCLK value during POST. May be useful for setting a lower PCIE BCLK in scenarios where memory training is not stable at a higher BCLK (a large frequency gap between BCLK Frequency and Initial frequency is not recommended). Applies same value as BCLK Frequency if left at default. Use the <+> and <-> keys to adjust the value. The values range from 80.000MHz to 200.000MHz with an interval of 0.100MHz.
Configuration options: [Auto] [80.0000] - [200.00000]

PCIE/DMI Amplitude

Allows you to set the signal magnitude of the reference PCIE/DMI CLK supplied to the processor. Higher values may improve overclocking stability.
Configuration options: [Auto] [800mV] [900mV]

PCIE/DMI Slew Rate

Allows you set the speed at which the base clock rises or falls. Set a high value for overclocking stability.
Configuration options: [Auto] [Slow] [Fast]

PCIE/DMI Spread Spectrum

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

Cold Boot PCIE Frequency

Allows you to set the PCIE Frequency at cold boot. Use the <+> and <-> keys to adjust the value. The values range from 80.000MHz to 200.000MHz with an interval of 0.100MHz.
Configuration options: [Auto] [80.0000] - [200.00000]

This is only with regards to PCIE clk NOT BCLK.

Realtime Memory Timing

Allows you to enable or disable realtime memory timing. When set to **[Enabled]**, the system will allow performing realtime memory timing changes after MRC_DONE.
Configuration options: [Disabled] [Enabled]

SPD Write Disable

Allows you to enable or disable setting SPD Write Disable. For security recommendations, SPD write disable bit must be set.
Configuration options: [TRUE] [FALSE]

PVD Ratio Threshold

For the Core Domain PLL, the threshold to switch to lower post divider is 15 by default. You can set a value lower than 15 when pushing high BCLK so that Digitally Controlled Oscillator (DCO) remains at reasonable frequency. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [1] - [40]

Banding Ratio

Use the <+> or <-> to adjust the value.
Configuration options: [Auto] [1] - [120]

SA PLL Frequency Override

Allows you to configure Sa PLL Frequency.
Configuration options: [Auto] [3200 MHz] [1600 MHz]

BCLK TSC HW Fixup

Allows you to enable or disable BCLK TSC HW Fixup disable during TSC copy from
PMA to APIC.
Configuration options: [Enabled] [Disabled]

Core Ratio Extension Mode

Allows you to enable or disable Core Ratio Above 85 Extension Mode.

[Disabled]	Max Overclocking Ratio Limit as specified by OCMB 0x1 command is 85.
[Enabled]	Max Overclocking Ratio Limit as specified by OCMB 0x1 command is 120.

FLL OC mode

Configuration options: [Auto] [Disabled] [Normal] [Elevated] [Extreme Elevated]

Core PLL Voltage

Allows you to configure the offset for the Core PLL VCC Trim. Use the <+> and <->
keys to adjust the value. The values range from 0.900V to 1.845V with an interval of
0.015V.
Configuration options: [Auto] [0.90000] - [1.84500]

GT PLL Voltage

Allows you to configure the offset for the GT PLL VCC Trim. Use the <+> and <->
keys to adjust the value. The values range from 0.900V to 1.845V with an interval of
0.015V.
Configuration options: [Auto] [0.90000] - [1.84500]

Ring PLL Voltage

Allows you to configure the offset for the Ring PLL VCC Trim. Use the <+> and <->
keys to adjust the value. The values range from 0.900V to 1.845V with an interval of
0.015V.
Configuration options: [Auto] [0.90000] - [1.84500]

System Agent PLL Voltage

Allows you to configure the offset for the System Agent PLL VCC Trim. Use the <+>
and <-> keys to adjust the value. The values range from 0.900V to 1.845V with an
interval of 0.015V.
Configuration options: [Auto] [0.90000] - [1.84500]

Memory Controller PLL Voltage

Allows you to configure the offset for the Memory Controller PLL VCC Trim. Use the
<+> and <-> keys to adjust the value. The values range from 0.900V to 1.845V with
an interval of 0.015V.
Configuration options: [Auto] [0.90000] - [1.84500]

CPU 1.8V Small Rail

Allows you to configure the voltage for the CPU 1.8V Small Rail. Use the <+> and <->
keys to adjust the value. The values range from 1.500V to 2.300V with an interval of
0.010V.
Configuration options: [Auto] [1.50000] - [2.30000]

PLL Termination Voltage

Allows you to configure the voltage for the PLL Termination. Use the <+> and <-> keys to adjust the value. The values range from 0.800V to 1.800V with an interval of 0.010V.

Configuration options: [Auto] [0.80000] - [1.80000]

CPU Standby Voltage

Allows you to configure the voltage for the CPU Standby. Use the <+> and <-> keys to adjust the value. The values range from 0.800V to 1.800V with an interval of 0.010V.

Configuration options: [Auto] [0.80000] - [1.80000]

PCH 1.05V Voltage

Allows you to configure the voltage for the PCH 1.05V. Use the <+> and <-> keys to adjust the value. The values range from 0.800V to 1.600V with an interval of 0.010V.

Configuration options: [Auto] [0.80000] - [1.60000]

PCH 0.82V Voltage

Allows you to configure the voltage for the PCH 0.82V. Use the <+> and <-> keys to adjust the value. The values range from 0.700V to 1.300V with an interval of 0.010V.

Configuration options: [Auto] [0.70000] - [1.30000]

CPU Input Voltage Reset Voltage

Allows you to configure the voltage for the CPU Input when reset. Use the <+> and <-> keys to adjust the value. The values range from 1.500V to 2.100V with an interval of 0.010V.

Configuration options: [Auto] [1.50000] - [2.10000]

Eventual CPU Input Voltage

Allows you to configure the voltage for the CPU Input. Use the <+> and <-> keys to adjust the value. The values range from 1.500V to 2.100V with an interval of 0.010V.

Configuration options: [Auto] [1.50000] - [2.10000]

Eventual Memory Controller Voltage

Allows you to configure the voltage for the Memory Controller. Use the <+> and <-> keys to adjust the value. The values range from 1.000V to 2.000V with an interval of 0.00625V.

Configuration options: [Auto] [1.00000] - [2.00000]

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 regulation 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. SVID must be enabled for this to work.

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 **Cooler Efficiency Customize** is set to **[User Specify]**.

Cooler Score

The value of the Cooler's pts. [Maximum] 250 pts; [Minimum] 1 pts; [Default] 125 pts. Configuration options: [1] - [250]

Recalibrate Cooler

Allows you to recalibrate your cooler efficiency.

Cooler Re-evaluation Algorithm

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

Allows you to set the optimism of the predictions. The higher the value, the more optimistic the predictions and vice versa.
Configuration options: [50] - [150]

Ring Down Bin

Allows you to enable or disable the Ring Downbin feature. This option is defaulted to **[Enabled]**. Uses OC mailbox command 0x19.

[Auto]	Set to default.
[Disabled]	CPU will not down bin the ring ratio and the requested ring ratio limit will be observed.
[Enabled]	CPU will down bin the ring ratio, which means the requested max ring ratio may not be observed.

Please use caution when disabling this feature as it may result in overvoltaging of the CPU.

Min. CPU Cache Ratio

Allows you to set the minimum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [8] - [44]

Max. CPU Cache Ratio

Allows you to set the maximum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [8] - [44]

Max. CPU Graphics Ratio

Allows you to configure the CPU graphics ratio. The ratio may vary depending on the system loading. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [1] - [29]

Extreme Over-voltage

This item can only be enabled when the onboard CPU_OV jumper is switched on. Setting this item to **[Enabled]** allows you to configure higher voltages for overclocking, but the CPU lifetime will not be guaranteed.
Configuration options: [Disabled] [Enabled]

BCLK Aware Adaptive Voltage

Allows you to enable or disable BCLK Aware Adaptive Voltage. When 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.
Configuration options: [Disabled] [Enabled]

CPU Core/Cache Voltage

Configures the mode of Voltage fed to the CPU cores. Manual mode allows user-defined values. Offset mode modifies values by SVID.
Configuration options: [Auto] [Manual Mode] [Offset Mode] [Adaptive Mode]

> The following item appears only when **CPU Core/Cache Voltage** is set to **[Manual Mode]**.

CPU Core Voltage Override

Allows you to configure the input voltage for the CPU by the external voltage regulator. Use the <+> and <-> keys to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.
Configuration options: [Auto] [0.60000] - [1.70000]

> The following items appears only when **CPU Core/Cache Voltage** is set to **[Offset Mode]**.

Offset Mode Sign

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

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

CPU Core Voltage Offset

Allows you to configure the input voltage for the CPU by the external voltage regulator. Use the <+> or <-> to adjust the value. The values range from 0.005V to 0.635V with an interval of 0.005V.
Configuration options: [Auto] [0.00500] - [0.63500]

> The following items appears only when **CPU Core/Cache Voltage** is set to **[Adaptive Mode]**.

Offset Mode Sign

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

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

Additional Turbo Mode CPU Core Voltage

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. Use the <+> and <-> keys to adjust the value. The values range from 0.250V to 1.920V with an interval of 0.001V.
Configuration options: [Auto] [0.25000] - [1.92000]

Offset Voltage

Allows you to configure the CPU core voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> and <-> keys to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.
Configuration options: [Auto] [0.00100] - [0.09990]

CPU Graphics Voltage

Allows you to configure the mode of voltage fed to the CPU Graphics. Manual mode allows user-defined values. Offset mode modified values by SVID.
Configuration options: [Auto] [Manual Mode] [Offset Mode]

> The following item appears only when **CPU Graphics Voltage** is set to **[Manual Mode]**.

CPU Graphics Voltage Override

Allows you to configure the voltage for the CPU Graphics. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.
Configuration options: [Auto] [0.60000] - [1.70000]

> The following items appear only when **CPU Graphics Voltage** is set to **[Offset Mode]**.

Offset Mode Sign

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

CPU Graphics Voltage Offset

Allows you to configure the CPU graphics voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.005V to 0.635V with an interval of 0.005V.
Configuration options: [Auto] [0.00500] - [0.63500]

> You need to save the changes and reset the system for the changes to take effect.

CPU L2 Voltage

Allows you to configure the voltage for the CPU L2. This may help for sustaining high clock speeds.
Configuration options: [Auto] [Manual Mode] [Adaptive Mode]

CPU L2 Voltage Override

Allows you to configure the voltage for the CPU L2. Use the <+> or <-> to adjust the value. The values range from 0.700V to 1.800V with an interval of 0.001V.
Configuration options: [Auto] [0.70000] - [1.80000]

Additional Turbo Mode CPU L2 Voltage

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. Use the <+> or <-> to adjust the value. The values range from 0.250V to 1.920V with an interval of 0.001V.
Configuration options: [Auto] [0.25000] - [1.92000]

Offset Mode Sign

[+]   To offset the CPU L2 voltage by a positive value.
[–]   To offset the CPU L2 voltage by a negative value.

Additional Turbo Mode CPU L2 Voltage

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. Use the <+> or <-> to adjust the value. The values range from 0.250V to 1.920V with an interval of 0.001V.
Configuration options: [Auto] [0.25000] - [1.92000]

Offset Voltage

Allows you to configure the CPU L2 voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.
Configuration options: [Auto] [0.00100] - [0.99900]

CPU System Agent Voltage

Allows you to configure the voltage for the CPU System Agent.
Configuration options: [Auto] [Manual Mode] [Offset Mode]

CPU System Agent Voltage Override

Allows you to configure the input voltage for the CPU by the external voltage regulator. Use the <+> and <-> keys to adjust the value. The values range from 0.700V to 1.800V with an interval of 0.001V.
Configuration options: [Auto] [0.70000] - [1.80000]

CPU System Agent Voltage Offset

Allows you to configure the CPU System Agent Voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.
Configuration options: [Auto] [0.00100] - [0.99900]

CPU Input Voltage

Allows you to configure the voltage for the CPU Input. Use the <+> or <-> to adjust the value. The values range from 1.500V to 2.100V with an interval of 0.010V.
Configuration options: [Auto] [1.50000] - [2.10000]

High DRAM Voltage Mode

If this item is set to **[Disabled]**, the upper range for DRAM Voltage will be 1.435V. If this item is set to **[Enabled]**, the upper range will be 2.070V. If enabled on non-supported DRAM, the voltage will be lower than requested.
Configuration options: [Auto] [Disabled] [Enabled]

DRAM VDD Voltage

Power for the DRAM ICs' VDD portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.
Configuration options: [Auto] [0.80000] - [1.43500]

DRAM VDDQ Voltage

Power for the DRAM ICs' VDD Data portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.
Configuration options: [Auto] [0.80000] - [1.43500]

Advanced Memory Voltages

IVR Transmitter VDDQ Voltage

Allows you to set the voltage for the internal transmitter voltage for the Memory Controller. Use the <+> or <-> to adjust the value. The values range from 0.700V to 2.200V with an interval of 0.005V.
Configuration options: [Auto] [0.70000] - [2.20000]

Memory Controller Voltage

Allows you to set the voltage for the Memory Controller. Use the <+> or <-> to adjust the value. The values range from 1.000V to 2.000V with an interval of 0.00625V.
Configuration options: [Auto] [1.00000] - [2.00000]

PMIC Voltages

Configuration options: [Auto] [Sync All PMICs] [By per PMIC]

SPD HUB VLDO (1.8V)

Allows you to set the main power for the SPD Hub Logic. Default set to 1.8V. Use the <+> or <-> to adjust the value. The values range from 1.700V to 2.000V with an interval of 0.100V.

Configuration options: [Auto] [1.70000] - [2.00000]

SPD HUB VDDIO (1.0V)

Allows you to set the main power for the SPD Hub side-band interface. Default set to 1.0V. Use the <+> or <-> to adjust the value. The values range from 0.900V to 1.200V with an interval of 0.100V.

Configuration options: [Auto] [0.90000] - [1.20000]

Memory VDD Voltage

Allows you to set the power for the DRAM IC's VDD portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.

Configuration options: [Auto] [0.80000] - [1.43500]

Memory VDDQ Voltage

Allows you to set the power for the DRAM IC's Data portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.

Configuration options: [Auto] [0.80000] - [1.43500]

Memory VPP Voltage

Allows you to set the power for the DRAM Activating Power Supply. Use the <+> or <-> to adjust the value. The values range from 1.500V to 2.135V with an interval of 0.005V.

Configuration options: [Auto] [1.50000] - [2.13500]

Memory VDD Switching Frequency

Allows you to set the switching frequency of memory VDD regulator in MHz. Use the <+> or <-> to adjust the value. The values range from 0.750MHz to 1.500MHz with an interval of 0.250MHz.

Configuration options: [Auto] [0.75000] - [1.50000]

Memory VDDQ Switching Frequency

Allows you to set the switching frequency of memory VDDQ regulator in MHz. Use the <+> or <-> to adjust the value. The values range from 0.750MHz to 1.500MHz with an interval of 0.250MHz.

Configuration options: [Auto] [0.75000] - [1.50000]

Memory VPP Switching Frequency

Allows you to set the switching frequency of memory VPP regulator in MHz. Use the <+> or <-> to adjust the value. The values range from 0.750MHz to 1.500MHz with an interval of 0.250MHz.

Configuration options: [Auto] [0.75000] - [1.50000]

Memory Current Capability

Allows you to set the current capability for the switching regulators in Amps. Use the <+> or <-> to adjust the value. The values range from 0.125A to 6.000A with an interval of 0.125A.

Configuration options: [Auto] [0.12500] - [6.00000]

PMIC0-3 SPD HUB VLDO (1.8V)

Allows you to set the main power for the SPD Hub Logic. Default set to 1.8V. Use the <+> or <-> to adjust the value. The values range from 1.700V to 2.000V with an interval of 0.100V.
Configuration options: [Auto] [1.70000] - [2.00000]

PMIC0-3 SPD HUB VDDIO (1.0V)

Allows you to set the main power for the SPD Hub side-band interface. Default set to 1.0V. Use the <+> or <-> to adjust the value. The values range from 0.900V to 1.200V with an interval of 0.100V.
Configuration options: [Auto] [0.90000] - [1.20000]

PMIC0-3 Memory VDD Voltage

Allows you to set the power for the DRAM IC's VDD portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.
Configuration options: [Auto] [0.80000] - [1.43500]

PMIC0-3 Memory VDDQ Voltage

Allows you to set the power for the DRAM IC's Data portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.
Configuration options: [Auto] [0.80000] - [1.43500]

PMIC0-3 Memory VPP Voltage

Allows you to set the power for the DRAM Activating Power Supply. Use the <+> or <-> to adjust the value. The values range from 1.500V to 2.135V with an interval of 0.005V.
Configuration options: [Auto] [1.50000] - [2.13500]

PMIC0-3 Memory VDD Switching Frequency

Allows you to set the switching frequency of memory VDD regulator in MHz. Use the <+> or <-> to adjust the value. The values range from 0.750MHz to 1.500MHz with an interval of 0.250MHz.
Configuration options: [Auto] [0.75000] - [1.50000]

PMIC0-3 Memory VDDQ Switching Frequency

Allows you to set the switching frequency of memory VDDQ regulator in MHz. Use the <+> or <-> to adjust the value. The values range from 0.750MHz to 1.500MHz with an interval of 0.250MHz.
Configuration options: [Auto] [0.75000] - [1.50000]

PMIC0-3 Memory VPP Switching Frequency

Allows you to set the switching frequency of memory VPP regulator in MHz. Use the <+> or <-> to adjust the value. The values range from 0.750MHz to 1.500MHz with an interval of 0.250MHz.
Configuration options: [Auto] [0.75000] - [1.50000]

PMIC0-3 Memory Current Capability

Allows you to set the current capability for the switching regulators in Amps. Use the <+> or <-> to adjust the value. The values range from 0.125A to 7.875A with an interval of 0.125A.
Configuration options: [Auto] [0.12500] - [7.87500]

6.   Advanced menu

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

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

6.1   Platform Misc Configuration

The items in this menu allow you to configure the platform-related features. Scroll down to display other BIOS items.
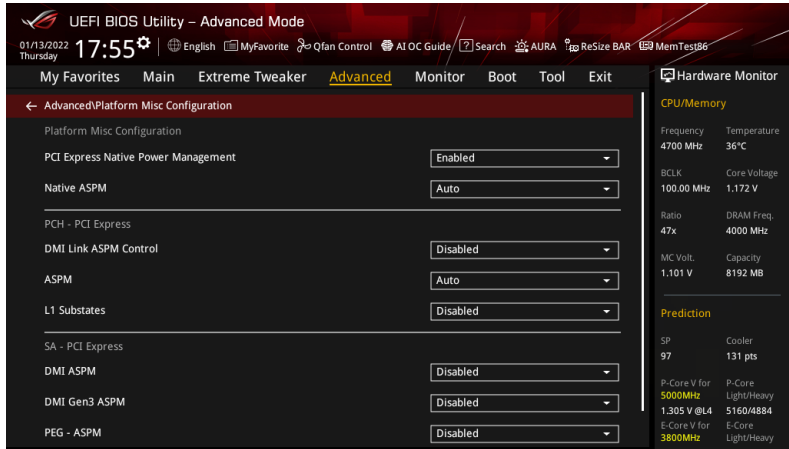
PCI Express Native Power Management

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 **PCI Express Native Power Management** is set to **[Enabled]**.

Native ASPM

Set this item to **[Enabled]** for OS Controlled ASPM, or set this item to **[Disabled]** for BIOS controlled ASPM.
Configuration options: [Auto] [Enabled] [Disabled]

PCH - PCI Express

DMI Link ASPM Control

Allows you to control the Active State Power Management of the DMI Link.
Configuration options: [Disabled] [L1] [Auto]

ASPM

Allows you to select the ASPM state for energy-saving conditions.
Configuration options: [Disabled] [L1] [Auto]

L1 Substates

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

SA - PCI Express

DMI ASPM

Allows you to set the DMI ASPM Support.
Configuration options: [Disabled] [Auto] [ASPM L1]

DMI Gen3 ASPM

Allows you to set the DMI Gen3 ASPM Support.
Configuration options: [Disabled] [Auto] [ASPM L1]

PEG - ASPM

Allows you to control the ASPM support for the PEG 0. This has no effect if PEG is not the currently active device.
Configuration options: [Disabled] [L0s] [L1] [L0sL1]

PCI Express Clock Gating

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

6.2   CPU Configuration

The items in this menu show the CPU-related information that the BIOS automatically detects. Scroll down to display other BIOS items.

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

Efficient Core Information

This submenu displays the Efficient Core Information.

Performance Core Information

This submenu displays the Performance Core Information.

Hardware Prefetcher

Allows you to enable or disable the MLC streamer prefetcher.
Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch

Allows you to prefetch adjacent cache lines, reducing the DRAM loading time and improving 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]

Per P-Core Control

Configuration options: [Disabled] [Enabled]

Per E-Core Control

Configuration options: [Disabled] [Enabled]

Active Performance Cores

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

Active Efficient Cores

Allows you to select the number of Efficient cores to activate in each processor package.
Configuration options: [All] [0] - [3]

> Number of Cores and Efficient Cores are looked at together. When both are {0,0}, Pcode will enable all cores.

Active Processor Cores

Allows you to select the number of CPU cores to activate in each processor package.
Configuration options: [All] [1] - [5]

Hyper-Threading

Allows a hyper-threading processor to appear as two logical processors, allowing the operating system to schedule two threads or processes simultaneously.

[Enabled]   For two threads per activated core.

[Disabled]   For only one thread per activated core.

Per Core Hyper-Threading

The items in this submenu allow you to enable or disable Hyper-Threading for each core.

Hyper-Threading of Core 0-7
Configuration options: [Disabled] [Enabled]

Total Memory Encryption

Allows you to configure the Total Memory Encryption (TME) to protect DRAM data from physical attacks.
Configuration options: [Disabled] [Enabled]

Legacy Game Compatibility Mode

When enabled, pressing the scroll lock key will toggle the Efficient-cores between being parked when Scroll Lock LED is on and un-parked when LED is off.
Configuration options: [Disabled] [Enabled]

CPU - Power Management Control

The items in this submenu allow you to manage and configure the CPU's power.

Boot performance mode

Allows you to select the performance state that the BIOS will set starting from the reset vector.
 Configuration options: [Max Battery] [Max Non-Turbo Performance]
[Turbo Performance] [Auto]

Intel(R) SpeedStep(tm)

Allows more than two frequency to be supported.
Configuration options: [Disabled] [Enabled]

Intel(R) Speed Shift Technology

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

Intel(R) Turbo Boost Max Technology 3.0

Allows you to disable or enable Intel(R) Turbo Boost Max Technology 3.0 support. Disabling will report the maximum ratio of the slowest core in _CPC object.
Configuration options: [Disabled] [Enabled]

Turbo Mode

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. (Requires EMTTM enabled too)
Configuration options: [Disabled] [Enabled]

Acoustic Noise Settings

The items in this submenu allow you to configure Acoustic Noise Settings for IA, GT, and SA domains.

Acoustic Noise Settings

Acoustic Noise Mitigation

Enabling this option will help mitigate acoustic noise on certain SKUs when the CPU is in deeper C state.
Configuration options: [Disabled] [Enabled]

The following items appear only when **Acoustic Noise Mitigation** is set to **[Enabled]**.

Pre Wake Time

Allows you to set the maximum Pre Wake randomization time in micro ticks. This is for acoustic noise mitigation Dynamic Periodicity Alteration (DPA) tuning. Use the <+> or <-> to adjust the value.
Configuration options: [0] - [255]

Ramp Up Time

Allows you to set the maximum Ramp Up randomization time in micro ticks. This is for acoustic noise mitigation Dynamic Periodicity Alteration (DPA) tuning. Use the <+> or <-> to adjust the value.
Configuration options: [0] - [255]

Ramp Down Time

Allows you to set the maximum Ramp Down randomization time in micro ticks. This is for acoustic noise mitigation Dynamic Periodicity Alteration (DPA) tuning. Use the <+> or <-> to adjust the value.
Configuration options: [0] - [255]

IA VR Domain

Disable Fast PKG C State Ramp for IA Domain

This option needs to be configured to reduce acoustic noise during deeper C states.
[FALSE]   Don't disable Fast ramp during deeper C states.
[TRUE] Disable Fast ramp during deeper C state.

Slow Slew Rate for IA Domain

Set VR IA Slow Slew Rate for Deep Package C State ramp time; Slow slew rate equals to Fast divided by number, the number is 2, 4, 8 to slow down the slew rate to help minimize acoustic noise.
Configuration options: [Fast/2] [Fast/4] [Fast/8]

GT VR Domain

Disable Fast PKG C State Ramp for GT Domain

This option needs to be configured to reduce acoustic noise during deeper C states.
[FALSE]   Don't disable Fast ramp during deeper C states.
[TRUE] Disable Fast ramp during deeper C state.

Slow Slew Rate for GT Domain

Set VR GT Slow Slew Rate for Deep Package C State ramp time; Slow slew rate equals to Fast divided by number, the number is 2, 4, 8 to slow down the slew rate to help minimize acoustic noise.
Configuration options: [Fast/2] [Fast/4] [Fast/8]

CPU C-states

Allows you to enable or disable CPU Power Management. Allows CPU to go to C states when it's not 100% utilized.
Configuration options: [Auto] [Disabled] [Enabled]

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

Enhanced C-States

Allows you to enable or disable C1E. When enabled, CPU will switch to minimum speed when all cores enter C-State.
Configuration options: [Enabled] [Disabled]

Package C State Limit

Allows you to set the C-state limit for the CPU package. Setting to **[Cpu Default]** will leave it as the Factory default value. Setting to **[Auto]** will initialize the deepest available Package C State Limit.
Configuration options: [C0/C1] [C2] [C3] [C6] [C7] [C7s] [C8] [C9] [C10] [Cpu Default] [Auto]

Thermal Monitor

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

Dual Tau Boost

Allows you to enable Dual Tau Boost feature. This is only applicable for CMLS 35W/65W/125W sku. When DPTF is enabled this feature is ignored.
Configuration options: [Disabled] [Enabled]

6.3   System Agent (SA) Configuration

The items in this menu allow you to change the System Agent (SA) parameters.
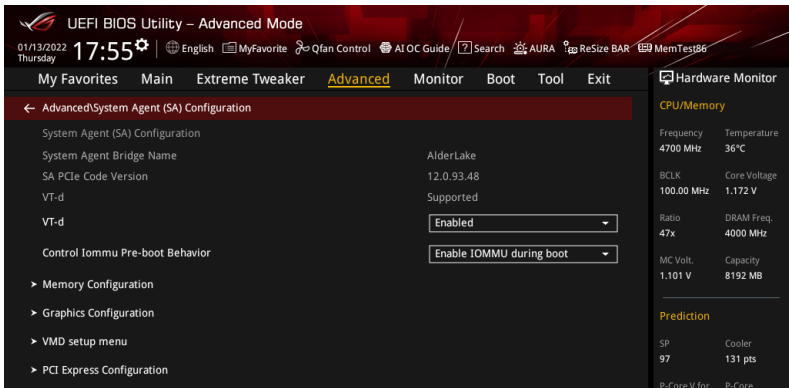
VT-d

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

The following item appears only when **VT-d** is set to **[Enabled]**.

Control Iommu Pre-boot Behavior

Allows you to enable IOMMU in Pre-boot environment (if DMAR table is installed in DXE and if VTD_INFO_PPI is installed in PEI).
Configuration options: [Disable IOMMU] [Enable IOMMU during boot]

Memory Configuration

The items in this submenu allow you to set memory configuration parameters.

Memory Remap

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

Graphics Configuration

The items in this submenu allow you to select a primary display from CPU Graphics, PEG Graphics devices, or PCIe Graphics devices.

Primary Display

Allows you to select the primary display from CPU Graphics / PEG Graphics / PCIe Graphics device.
Configuration options: [Auto] [CPU Graphics] [PEG Slot] [PCIE]

iGPU Multi-Monitor

Set this item to **[Enabled]** to empower both integrated and discrete graphics for multi-monitor output. iGPU shared system memory size will be fixed at 64M.
Configuration options: [Disabled] [Enabled]

DVMT Pre-Allocated

Allows you to select the DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
Configuration options: [32M] [64M] [96M] [128M] [160M] [192M] [224M] [256M] [288M] [320M] [352M] [384M] [416M] [448M] [480M] [512M]

RC6(Render Standby)

Allows you to enable render standby support.
Configuration options: [Disabled] [Enabled]

VMD setup menu

The items in this submenu allow you to set the VMD configuration settings.

Enable VMD controller

Allows you to enable or disable the VMD controller.
Configuration options: [Disabled] [Enabled]

Setting the **Enable VMD controller** to **[Disabled]** may result in data loss.

The following items appear only when **Enable VMD controller** is set to **[Enabled]**.

Map PCIE Storage under VMD

Allows you to map or unmap PCIE Storage to VMD.
Configuration options: [Disabled] [Enabled]

Ensure to set **Map SATA Controller under VMD** to **[Disabled]** if you set **Map PCIE Storage under VMD** to **[Enabled]**.

Map SATA Controller under VMD

Allows you to map or unmap this Root Port to VMD.
Configuration options: [Disabled] [Enabled]

Ensure to set **Map PCIE Storage under VMD** to **[Disabled]** if you set **Map SATA Controller under VMD** to **[Enabled]**.

PCI Express Configuration

The items in this submenu allow you to configure the PCIe Speeds for the different onboard slots.

> The items in this submenu may vary according to your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.

M.2_1 Link Speed

Allows you to configure the M.2_1 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3] [Gen4]

PCIEX16_1 Link Speed

Allows you to configure the PCIEX16_1 slot.
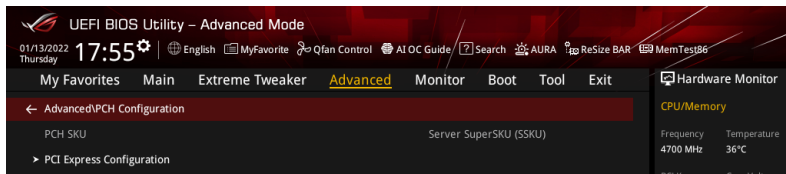Configuration options: [Auto] [Gen1] [Gen2] [Gen3] [Gen4] [Gen5]

PCIEX16_2 Link Speed

Allows you to configure the PCIEX16_2 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3] [Gen4] [Gen5]

6.4 PCH Configuration

The items in this menu allow you to change the PCIe configurations for slots supported by the PCH.

PCI Express Configuration

The items in this submenu allow you to configure the PCIe Speeds for the different onboard slots supported by the PCH.

> The items in this submenu may vary according to your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.

M.2_2 Link Speed

Allows you to configure the M.2_2 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

M.2_3 Link Speed

Allows you to configure the M.2_3 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3] [Gen4]

PCIEX16(G4) Link Speed

Allows you to configure the PCIEX16_2 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3] [Gen4]

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.

> The settings and options of this menu may vary depending on your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.
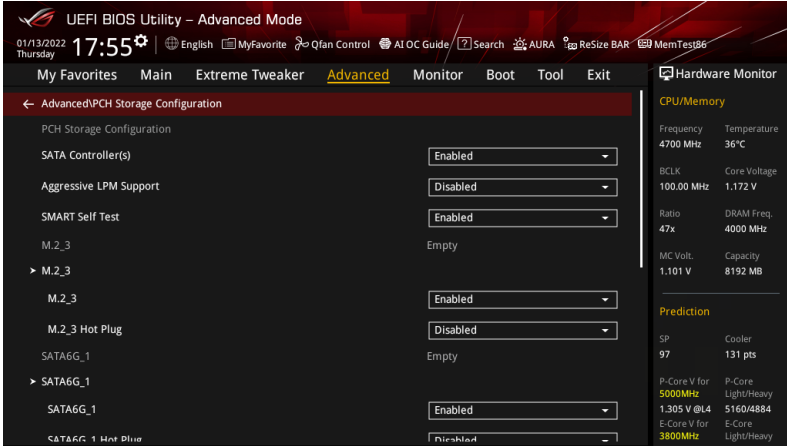
SATA Controller(s)

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

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

Aggressive LPM support

Allows PCH to aggressively enter link power state.
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: [Disabled] [Enabled]

M.2_3

Allows you to enable or disable the selected port.
Configuration options: [Disabled] [Enabled]

M.2_3 Hot Plug

Designates this port as Hot Pluggable.
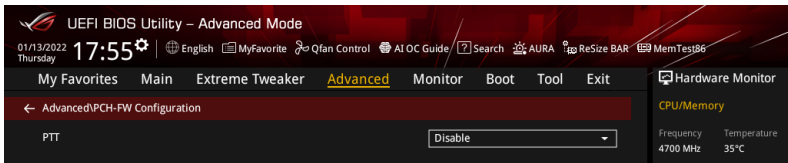Configuration options: [Disabled] [Enabled]

SATA6G_1 - SATA6G_4

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

SATA6G_1 - SATA6G_4 Hot Plug

Designates this port as Hot Pluggable.
Configuration options: [Disabled] [Enabled]

6.6 PCH-FW Configuration

This item allows you to configure the firmware TPM.

PTT

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

6.7 Thunderbolt(TM) Configuration

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

> The availability of this menu, as well as the settings and options may vary depending on your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.
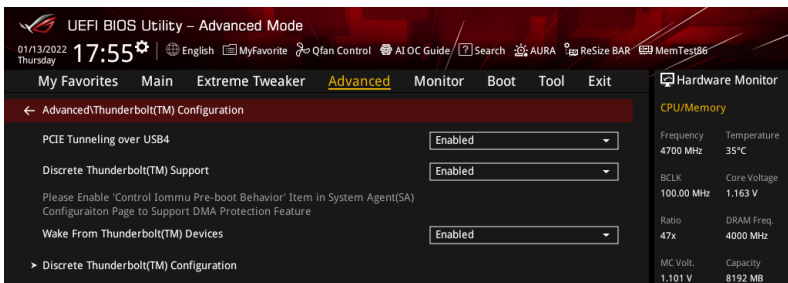
PCIE Tunneling over USB4

Allows you to enable or disable PCIE Tunneling over USB4.
Configuration options: [Disabled] [Enabled]

Discrete Thunderbolt(TM) Support

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

> • Please set **Control Iommu Pre-boot Behavior** in the **System Agent(SA) Configuration** page to **[Enabled]** to support DMA Protection Feature.
>
> • The following items appear only when **Discrete Thunderbolt(TM) Support** is set to **[Enabled]**.

Wake From Thunderbolt(TM) Devices

Allows you to enable or disable system wake from Thunderbolt(TM) devices.
Configuration options: [Disabled] [Enabled]

Discrete Thunderbolt(TM) Configuration

The items in this submenu allow you to configure Discrete Thunderbolt(TM) related configurations.

DTBT Go2Sx Command

Allows you to enable the command to put DTBT into Sx state while system is going into Sx.
Configuration options: [Disabled] [Enabled]

Windows 10 Thunderbolt Support

Allows you to specify Windows 10 Thunderbolt support level.

[Enable + RTD3]   OS Native support plus RTD3.
[Disabled]   No OS native support.

DTBT Controller 0 Configuration

DTBT Contorller 0

Configuration options: [Disabled] [Enabled]

TBT Host Router

Allows you to enable host router based on ports available.
Configuration options: [One Port] [Two Port]

Extra Bus Reserved

Allows you to select the TBT Root Port Type.
[56]   One port Host.
[106]   Two port Host.

Reserved Memory

Allows you to set the Reserved Memory for this Root Bridge. Use the <+> and <-> keys to adjust the value.
Configuration options: [1] - [4096]

Memory alignment

Allows you to set the memory alignment bits. Use the <+> and <-> keys to adjust the value.
Configuration options: [0] - [31]

Reserved PMemory

Allows you to set the Reserved Prefetchable Memory for this Root Bridge. Use the <+> and <-> keys to adjust the value.
Configuration options: [1] - [4096]

PMemory alignment

Allows you to set the PMemory alignment bits. Use the <+> and <-> keys to adjust the value.
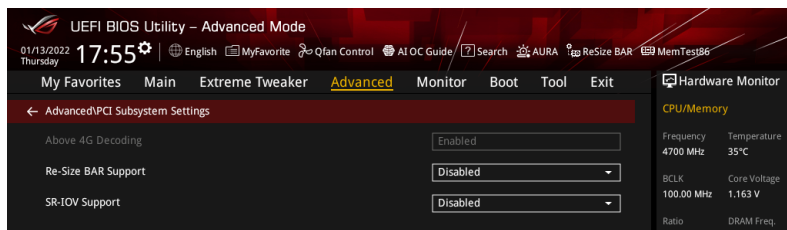Configuration options: [0] - [31]

Reserved I/O

Use the <+> and <-> keys to adjust the value. The values range from 0 to 60.

6.8 PCI Subsystem Settings

The items in this menu allow you to configure PCI, PCI-X, and PCI Express settings.

Above 4G Decoding

Allows you to enable or disable 64bit capable Devices to be Decoded in Above 4G Address Space (Only if System supports 64 bit PCI Decoding).
Configuration options: [Disabled] [Enabled]

> • Only enabled under 64bit operating system.
>
> • The following item appears only when **Above 4G Decoding** is set to **[Enabled]**.

Re-Size BAR Support

If the system has Resizable BAR capable PCIe Devices, this option enables or disables Resizable BAR Support (Only if System supports 64 bit PCI Decoding).
Configuration options: [Disabled] [Enabled]

> To enable Re-Size BAR Support for harnessing full GPU memory, please go to the **Boot** section and set **CSM(Compatibility Support Module)** to **[Disabled]**.
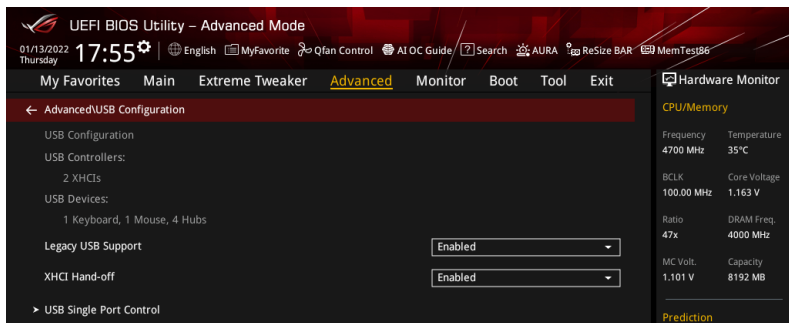
SR-IOV Support

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

6.9 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 is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.

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

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

Mass Storage Devices:

Allows you to select the mass storage device emulation type for devices connected. **[Auto]** enumerates devices according to their media format. Optical drives are emulated as **[CD-ROM]**, drives with no media will be emulated according to a drive type.
Configuration options: [Auto] [Floppy] [Forced FDD] [Hard Disk] [CD-ROM]
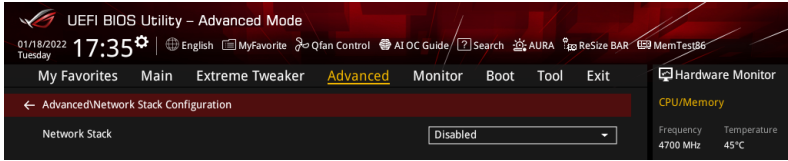
USB Single Port Control

Allows you to enable or disable the individual USB ports.

> Refer to section **Motherboard layout** and **Rear I/O connection** in your motherboard's user manual for the location of the USB ports.

6.10   Network Stack Configuration

The items in this menu allow you to change the Network Stack Configuration.

Network stack

Allows you to disable or enable the UEFI network stack.
Configuration options: [Disabled] [Enabled]

> The following items appear only when **Network Stack** is set to **[Enabled]**.

Ipv4/Ipv6 PXE Support

Allows you to enable or disable the Ipv4/Ipv6 PXE boot support.
Configuration options: [Disabled] [Enabled]

6.11   NVMe Configuration

This menu displays the NVMe controller and Drive information of the connected devices. You may press <Enter> on a connected NVMe device which appears in this menu to view more information on the NVMe device.
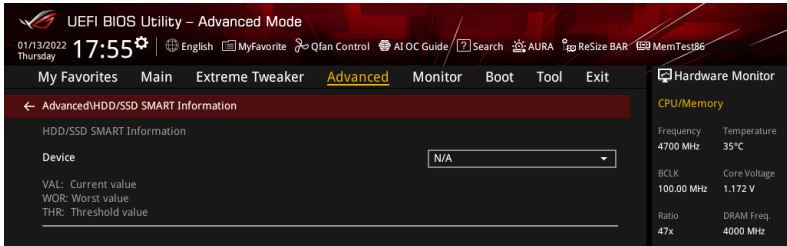
> The options displayed in this menu may vary depending on the devices connected to your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.
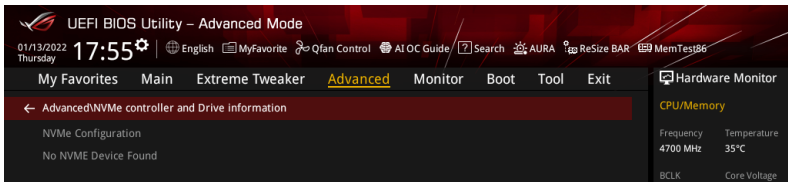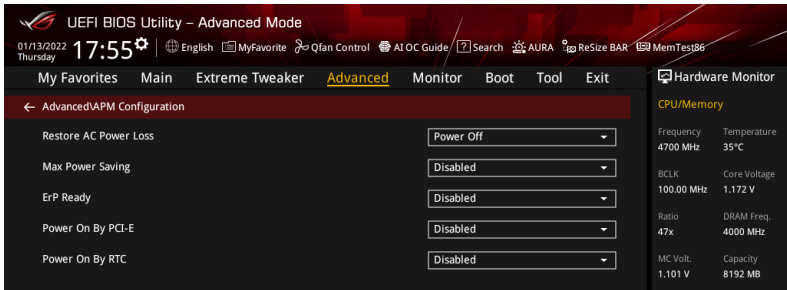
6.12   HDD/SSD SMART Information

The items in this menu allow you to view the SMART information for connected storage devices.

NVM Express devices do not support SMART information.

6.13   APM Configuration

The items in this menu allow you to change the advanced power management settings.

Restore AC Power Loss

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]

Max Power Saving

Configuration options: [Disabled] [Enabled]

ErP Ready

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. RGB LEDs and RGB/Addressable RGB Headers will also be disabled.
Configuration options: [Disabled] [Enabled (S4+S5)] [Enabled (S5)]

Power On By PCI-E

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

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]

6.14   Onboard Devices Configuration

The items in this menu allow you to change the onboard devices settings. Scroll down to view the other BIOS items.

> The settings and options of this menu may vary depending on your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.
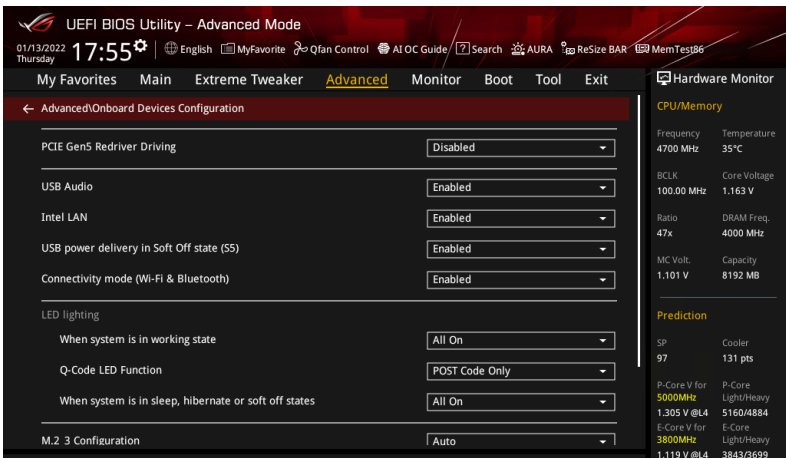
PCIe Gen5 Redriver Driving

[Disabled]   This item allows you to set to default redriving settings.

[Enabled]   This item allows you to maximize the PCIE Gen5 M.2 Device performance from the Add-on Card installed on the PCIEx16_2 optimized by ASUS redriver settings.

> Add-On Card support list: ROG Hyper M.2 Card.

USB Audio

Controls the detection of the USB-Audio device.

[Disabled]   USB-Audio will be unconditionally disabled.

[Enabled]   USB-Audio will be unconditionally enabled.

Intel LAN

Allows you to enable or disable Intel LAN.
Configuration options: [Disabled] [Enabled]

USB power delivery in Soft Off state (S5)

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

Connectivity mode (Wi-Fi & Bluetooth)

Allows you to enable or disable Wi-Fi and Bluetooth connectivity module.
Configuration options: [Disabled] [Enabled]

LED lighting

When system is in working state

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

[All On]   RGB LEDs and Functional LEDs will behave normally.

[Stealth Mode]   All LEDs will be disabled.

[Aura Only]   RGB LEDs will light up, while all functional LEDs will be disabled.

[Aura Off]   Functional LEDs behave normally, while RGB LEDs will be disabled.

The RGB Header(s) and Addressable Header(s) will only work under the S0 (working) state.

Q-Code LED Function

[Disabled]   Disable the 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

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]   RGB LEDs and Functional LEDs will behave normally.

[Stealth Mode]   All LEDs will be disabled.

[Aura Only]   RGB LEDs will light up, while all functional LEDs will be disabled.

[Aura Off]   Functional LEDs behave normally, while RGB LEDs will be disabled.

The RGB Header(s) and Addressable Header(s) will only work under the S0 (working) state.

M.2_3 Configuration

Allows you to set the M.2_3 configuration.

[Auto]   Auto-detects the M.2_3 device mode.
[SATA mode]   Only supports M.2_3 SATA devices.
[PCIE mode]   Only supports M.2_3 PCIE devices.

PCIEX16(G4) Configuration

Allows you to set the PCIEX16(G4) mode.

[PCIEX4 Add-on Card]	Supports PCIe x4 mode.
[Dual M.2 SSD]	Supports PCIe x4/x4 mode for 2 SSDs on the ROG Hyper M.2 Card.
[Optane Memory on ROG Hyper M.2_1]	Supports PCIe x2/x2 mode for Optane Memory at M.2_1 and x4 mode for SSD at M.2_2.
[Optane Memory on ROG Hyper M.2_2]	Supports PCIe x4 mode for SSD at M.2_1 and x2/x2 mode for Optane Memory at M.2_2.
[Dual Optane Memory]	Supports x2/x2/x2/x2 mode for installing Optane Memory at both M.2_1 and M.2_2 on the ROG Hyper M.2 Card.

GNE Device

Allows you to enable or disable SA GNA Device.
Configuration options: [Enabled] [Disabled]

ASM1061 Configuration

ASMedia Storage Controller

Allows you to enable or disable the ASMedia storage controller.
Configuration options: [Disabled] [Enabled]

The following items appear only when **ASMedia Storage Controller** is set to **[Enabled]**.

Windows Hot-plug Notification

Allows you to enable or disable the hot-plug notification in Windows operating systems.
Configuration options: [Disabled] [Enabled]

ASPM Support

Allows you to enable or disable the controller ASPM (Active State Power Management) for energy saving support.
Configuration options: [Disabled] [Enabled]

6.15   Intel(R) Rapid Storage Technology

The items in this menu allow you manage RAID volumes on the Intel(R) RAID Controller.

> • The settings and options of this menu may vary depending on the storage devices connected. Please refer to the BIOS of your motherboard for the actual settings and options.
>
> • Ensure to set the **VMD configuration settings** before using **Intel(R) Rapid Storage Technology** to create a RAID set.
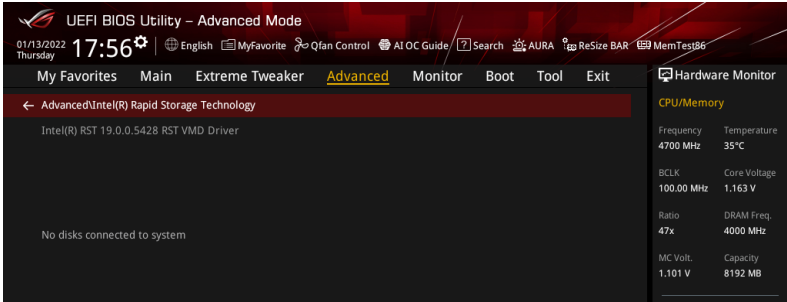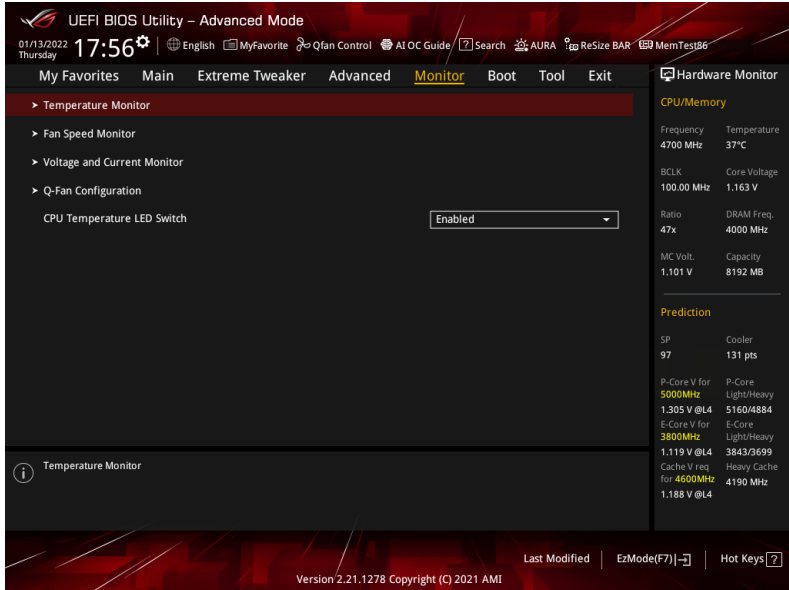
7.   Monitor menu

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.

The settings and options of this menu may vary depending on your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.

Temperature Monitor

CPU Temperature, CPU Package Temperature, MotherBoard Temperature, VRM Temperature, Chipset Temperature, T_Sensor Temperature, Water In T Sensor Temperature, Water Out T Sensor Temperature, DIMM A1-2 Temperature, DIMM B1-2 Temperature [xxx°C/xxx°F]

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

Fan Speed Monitor

CPU Fan Speed, CPU Optional Fan Speed, Chassis Fan 1-4 Speed, Water Pump+ Speed, AIO PUMP Speed [xxxx RPM]

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

Flow Rate

The onboard hardware monitor automatically detects the flow rate. Select **[Ignore]** if you do not want to detect this item.

Voltage and Current Monitor

CPU Core Voltage, 12V Voltage, 5V Voltage, 3.3V Voltage, Memory Controller Voltage [x.xxx 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.

CPU Core Current [xx A]

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

Q-Fan Configuration

AI Cooling

ASUS AI Cooling will automatically manage and control all motherboard fans, ensuring the most efficient settings are set depending on the current system load and temperature. When you enable this function, AI Cooling function will try to lower fan speed to decrease fan noise without compromising current performance. You can keep track of fan performance via the ASUS Fan Xpert software with a blue dot in the Fan curve chart.
Configuration options: [Enabled] [Disabled]

Q-Fan Tuning

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

> The process may take 2 to 5 minutes. DO NOT shut down or reset your system during the tuning process.

HYDRANODE Fan Association

The ASUS HYDRANODE function can be used to build up a communication platform between the motherboard and other devices. For fan control, you can enjoy this function when you use fans which support ASUS HYDRANODE, and will provide you with more advanced fan control options. This function will be in effect when you use compatible fans.

[Enabled]   ASUS HYDRANODE fan function can be used.

[Disabled]   Fans will not support the ASUS HYDRANODE fan function.

HYDRANODE Fan Reset

Click this item to reassociate all ASUS HYDRANODE fans when reconnecting or replacing the fans.

CPU Q-Fan Control

Allows you to set the CPU Q-Fan operating mode.

[Auto Detect]   Detects the type of installed fan/pump and automatically switches the control modes.

[DC Mode]   Enables the Q-Fan Control feature in DC mode for 3-pin fan/pump.

[PWM Mode]   Enables the Q-Fan Control feature in PWM mode for 4-pin fan/pump.

CPU Fan Profile

Allows you to set the appropriate performance level of the assigned fan/pump. When selecting **[Manual]**, we suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty.
Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]

The following items appear only when **CPU Fan Profile** is set to **[Standard]**, **[Silent]**, **[Turbo]**, or **[Manual].**

CPU Fan Step Up

Step up allows you to adjust how quickly the fan rotation speed changes, with level 0 being an instantaneous change in speed. The higher the level, the slower the change in speed, and may also result in less noise, but this will also cause slower heat dissipation.
Configuration options: [Level 0] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5]

CPU Fan Step Down

Step down allows you to adjust how quickly the fan rotation speed changes, with level 0 being an instantaneous change in speed. The higher the level, the slower the change in speed, and may also result in less noise, but this will also cause slower heat dissipation.
Configuration options: [Level 0] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5]

CPU Fan Speed Lower Limit

Allows you to set the lower speed limit for assigned fan/pump. A warning message will appear when the limit is reached; the warning message will not appear if **[Ignore]** is selected.
Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

The following items appear only when **CPU Fan Profile** is set to **[Manual].**

CPU Fan Upper Temperature

Configure the fan/pump upper temperature to make assigned fan/pump operate at the max. duty cycle when the source temperature reaches the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the upper temperature.

The fan/pump upper temperature cannot be lower than the fan/pump lower temperature.

CPU Fan Max. Duty Cycle (%)

Set the maximum fan/pump duty cycle of the assigned fan/pump for when the source temp. reaches the upper limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump maximum duty cycle.

CPU Fan Middle Temperature

Configure the fan/pump middle temperature to make assigned fan/pump operate at the mid. duty cycle when the source temperature is higher than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the middle temperature.

CPU Fan Middle. Duty Cycle (%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. exceeds the middle temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump middle duty cycle.

CPU Fan Lower Temperature

Configure the fan/pump lower temperature to make assigned fan/pump operate at the min. duty cycle when the source temperature is lower than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the lower temperature.

CPU Fan Min. Duty Cycle(%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. is lower than the lower temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump minimum duty cycle.

Chassis Fan(s) Configuration

Chassis Fan 1-4 Q-Fan Control

Allows you to set the Chassis Fan 1-4 operating mode.

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

Chassis Fan 1-4 Profile

Allows you to set the appropriate performance level of the assigned fan/pump. When selecting **[Manual]**, we suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty.
Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]

The following items appear only when **CPU Fan 1-4 Profile** is set to **[Standard]**, **[Silent]**, **[Turbo]**, or **[Manual].**

Chassis Fan 1-4 Q-Fan Source

The assigned fan/pump will be controlled according to the selected temperature source. Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [T_Sensor] [Water In T Sensor] [Water Out T Sensor] [Multiple Sources]

For Multiple Sources, select up to three temperature sources and the fan will automatically change based on the highest temperature.

Chassis Fan 1-4 Step Up

Step up allows you to adjust how quickly the fan rotation speed changes, with level 0 being an instantaneous change in speed. The higher the level, the slower the change in speed, and may also result in less noise, but this will also cause slower heat dissipation. Configuration options: [Level 0] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5]

Chassis Fan 1-4 Step Down

Step down allows you to adjust how quickly the fan rotation speed changes, with level 0 being an instantaneous change in speed. The higher the level, the slower the change in speed, and may also result in less noise, but this will also cause slower heat dissipation. Configuration options: [Level 0] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5]

Chassis Fan 1-4 Speed Low Limit

Allows you to set the lower speed limit for assigned fan/pump. A warning message will appear when the limit is reached; the warning message will not appear if **[Ignore]** is selected.
Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

The following items appear only when **Chassis Fan 1-4 Profile** is set to **[Manual].**

Chassis Fan 1-4 Upper Temperature

Configure the fan/pump upper temperature to make assigned fan/pump operate at the max. duty cycle when the source temperature reaches the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the upper temperature.

The fan/pump upper temperature cannot be lower than the fan/pump lower temperature.

Chassis Fan 1-4 Max. Duty Cycle (%)

Set the maximum fan/pump duty cycle of the assigned fan/pump for when the source temp. reaches the upper limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump maximum duty cycle.

Chassis Fan 1-4 Middle Temperature

Configure the fan/pump middle temperature to make assigned fan/pump operate at the mid. duty cycle when the source temperature is higher than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the middle temperature.

Chassis Fan 1-4 Middle. Duty Cycle (%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. exceeds the middle temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump middle duty cycle.

Chassis Fan 1-4 Lower Temperature

Configure the fan/pump lower temperature to make assigned fan/pump operate at the min. duty cycle when the source temperature is lower than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the lower temperature.

Chassis Fan 1-4 Min. Duty Cycle(%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. is lower than the lower temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump minimum duty cycle.

Allow Fan Stop

This function allows the fan to run at 0% duty cycle when the temperature of the source is dropped below the lower temperature.
Configuration options: [Disabled] [Enabled]

Water Pump+ Q-Fan Control

Allows you to set the Water Pump+ operating mode.

[Auto Detect]   Detects the type of installed fan/pump and automatically switches the control modes.

[DC Mode]   Enables the Q-Fan Control feature in DC mode for 3-pin fan/pump.

[PWM Mode]   Enables the Q-Fan Control feature in PWM mode for 4-pin fan/pump.

Water Pump+ Profile

Allows you to set the appropriate performance level of the assigned fan/pump. When selecting **[Manual]**, we suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty.
Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]

The following items appear only when **Water Pump+ Profile** is set to **[Standard]**, **[Silent]**, **[Turbo]**, or **[Manual].**

Water Pump+ Q-Fan Source

The assigned fan/pump will be controlled according to the selected temperature source.
Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [T_Sensor] [Water In T Sensor] [Water Out T Sensor] [Multiple Sources]

Water Pump+ Step Up

Allows you to set the value of the fan/pump 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]

Water Pump+ Step Down

Allows you to set the value of the fan/pump 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]

Water Pump+ Speed Lower Limit

Allows you to set the lower speed limit for assigned fan/pump. A warning message will appear when the limit is reached; the warning message will not appear if **[Ignore]** is selected.
Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

The following items appear only when **Water Pump+ Profile** is set to **[Manual].**

Water Pump+ Upper Temperature

Configure the fan/pump upper temperature to make assigned fan/pump operate at the max. duty cycle when the source temperature reaches the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the upper temperature.

The fan/pump upper temperature cannot be lower than the fan/pump lower temperature.

Water Pump+ Max. Duty Cycle (%)

Set the maximum fan/pump duty cycle of the assigned fan/pump for when the source temp. reaches the upper limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump maximum duty cycle.

Water Pump+ Middle Temperature

Configure the fan/pump middle temperature to make assigned fan/pump operate at the mid. duty cycle when the source temperature is higher than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the middle temperature.

Water Pump+ Middle. Duty Cycle (%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. exceeds the middle temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump middle duty cycle.

Water Pump+ Lower Temperature

Configure the fan/pump lower temperature to make assigned fan/pump operate at the min. duty cycle when the source temperature is lower than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the lower temperature.

Water Pump+ Min. Duty Cycle(%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. is lower than the lower temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump minimum duty cycle.

AIO Pump Q-Fan Control

Allows you to set the AIO Pump operating mode.

[Auto Detect]   Detects the type of installed fan/pump and automatically switches the control modes.

[DC Mode]   Enables the Q-Fan Control feature in DC mode for 3-pin fan/pump.

[PWM Mode]   Enables the Q-Fan Control feature in PWM mode for 4-pin fan/pump.

AIO Pump Profile

Allows you to set the appropriate performance level of the assigned fan/pump. When selecting **[Manual]**, we suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75°C. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty.
Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]

The following items appear only when **AIO Pump Profile** is set to **[Standard]**, **[Silent]**, **[Turbo]**, or **[Manual].**

AIO Pump Q-Fan Source

The assigned fan/pump will be controlled according to the selected temperature source.
Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [T_Sensor] [Water In T Sensor] [Water Out T Sensor] [Multiple Sources]

AIO Pump Step Up

Step up allows you to adjust how quickly the fan rotation speed changes, with level 0 being an instantaneous change in speed. The higher the level, the slower the change in speed, and may also result in less noise, but this will also cause slower heat dissipation.
Configuration options: [Level 0] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5]

AIO Pump Step Down

Step down allows you to adjust how quickly the fan rotation speed changes, with level 0 being an instantaneous change in speed. The higher the level, the slower the change in speed, and may also result in less noise, but this will also cause slower heat dissipation.
Configuration options: [Level 0] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5]

AIO Pump Speed Lower Limit

Allows you to set the lower speed limit for assigned fan/pump. A warning message will appear when the limit is reached; the warning message will not appear if **[Ignore]** is selected.
Configuration options: [Ignore] [200 RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

AIO Pump Upper Temperature

Configure the fan/pump upper temperature to make assigned fan/pump operate at the max. duty cycle when the source temperature reaches the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the upper temperature.

AIO Pump Max. Duty Cycle (%)

Set the maximum fan/pump duty cycle of the assigned fan/pump for when the source temp. reaches the upper limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump maximum duty cycle.

AIO Pump Middle Temperature

Configure the fan/pump middle temperature to make assigned fan/pump operate at the mid. duty cycle when the source temperature is higher than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the middle temperature.

AIO Pump Middle. Duty Cycle (%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. exceeds the middle temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump middle duty cycle.

AIO Pump Lower Temperature

Configure the fan/pump lower temperature to make assigned fan/pump operate at the min. duty cycle when the source temperature is lower than the limit. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the lower temperature.

AIO Pump Min. Duty Cycle(%)

Set the middle fan/pump duty cycle of the assigned fan/pump for when the source temp. is lower than the lower temperature. We suggest raising your fan/pump duty to 100% if your CPU temperature exceeds 75℃. Please be noted CPU performance will throttle due to overheating with inefficient fan/pump duty. Use the <+> or <-> keys to adjust the fan/pump minimum duty cycle.
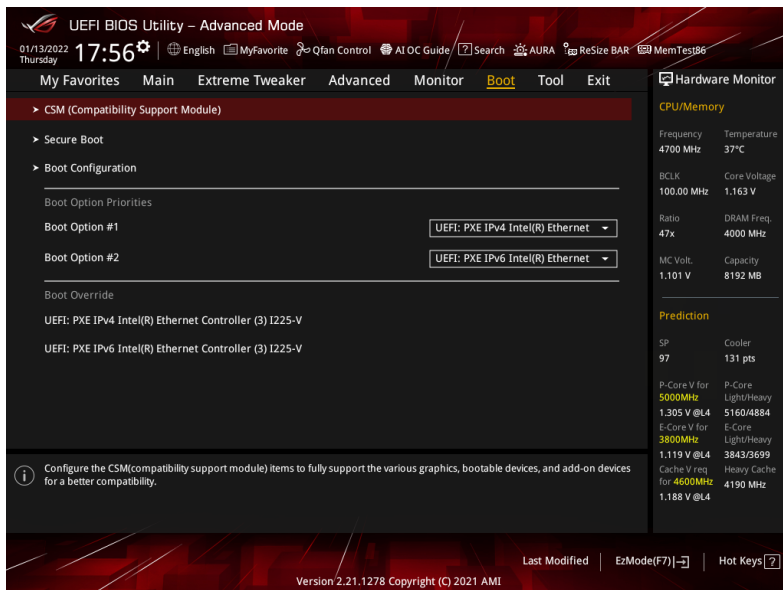
CPU Temperature LED Switch

The CPU_LED will light up to indicate high CPU temperature.
Configuration options: [Disabled] [Enabled]

8.   Boot menu

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

CSM (Compatibility Support Module)

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** will be set to **[Disabled]** and cannot be configured when using the integrated graphics.

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 **Launch CSM** is set to **[Enabled]**.

Boot Device Control

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

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

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

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

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.

> The Microsoft secure boot can only function properly on Windows UEFI mode.

Secure Boot Mode

This option allows you to select the Secure Boot mode from between Standard or Custom. In Custom mode, Secure Boot Policy variables can be configured by a physically present user without full authentication.
Configuration options: [Standard] [Custom]

> The following item appears only when **Secure Boot Mode** is set to **[Custom]**.

Key Management

Install Default Secure Boot keys

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. Allows you to clear all default Secure Boot keys.

Save all Secure Boot variables

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

Allows you to save the PK to a USB storage device.

Set New key

Allows you to load the downloaded PK from a USB storage device.

Delete key

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

Allows you to save the KEK to a USB storage device.

Set New key

Allows you to load the downloaded KEK from a USB storage device.

Append Key

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

Delete key

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

Allows you to save the db to a USB storage device.

Set New key

Allows you to load the downloaded db from a USB storage device.

Append Key

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

Delete key

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**
>
> Allows you to save the dbx to a USB storage device.
>
> **Set New key**
>
> Allows you to load the downloaded dbx from a USB storage device.
>
> **Append Key**
>
> Allows you to load the additional dbx from a storage device for an additional db and dbx loaded management.
>
> **Delete key**
>
> 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 Configuration

Fast Boot

Allows you to enable or disable boot with initialization of a minimal set of devices required to launch active boot option. Has no effect for BBS boot options.
Configuration options: [Disabled] [Enabled]

> The following item appears only when **Fast Boot** is set 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

[Auto]	Automatically adjust the boot logo size for Windows requirements.
[Full Screen]	Maximize the boot logo size.
[Disabled]	Hide the logo during POST.

> The following item appears only when **Boot Logo Display** is set to **[Auto]** or **[Full Screen]**.

Post Delay Time

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.

Post Report

Allows you to select a desired POST report waiting time or until ESC is pressed.
Configuration options: [1 sec] - [10 sec] [Until Press ESC]

Boot up NumLock State

Allows you to select the keyboard NumLock state.
Configuration options: [On] [Off]

Wait For 'F1' If Error

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

Enable this item to allow the option ROMs to trap the interrupt 19.
Configuration options: [Enabled] [Disabled]

AMI Native NVMe Driver Support

Allows you to enable or disable AMI Native NVMe driver.
Configuration options: [Disabled] [Enabled]

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.

Boot Sector (MBR/GPT) Recovery Policy

Allows you to set the Boot Sector Policy.

[Auto Recovery]   Follow UEFI Rule.

[Local User Control] You can enter setup page and select Boot Sector (MBR/GPT) Recovery Policy to recovery MBR/GPT on the next boot time.

Next Boot Recovery Action

Choose the (MBR/GPT) recovery action on the next boot.
Configuration options: [Skip] [Recovery]

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.

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.
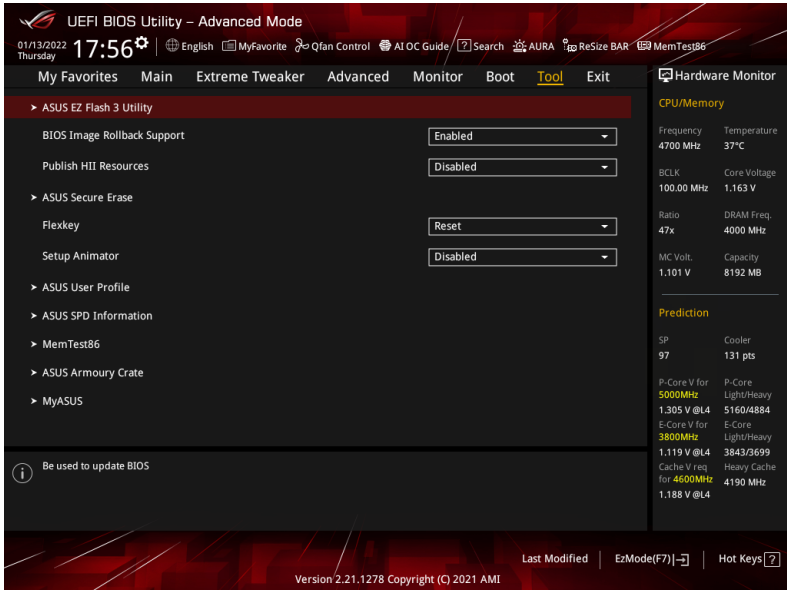
BIOS Image Rollback Support

[Enabled]	Support roll back your BIOS to a previous version, but this setting violates the NIST SP 800-147 requirement.
[Disabled]	Only support updating your BIOS to a newer version, and this setting meets the NIST SP 800-147 requirement.

Publish HII Resources

Configuration options: [Disabled] [Enabled]

Flexkey

[Reset]	Reboots the system.
[Aura On/Off]	Enable or Disable Aura LEDs. This setting does not sync with the BIOS/ software option.
[DirectKey]	Boot directly into the BIOS.
[Safe Boot]	Force the system to reboot into the BIOS safe mode.

Setup Animator

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

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 **ASUS EZ Flash 3**.

9.2 ASUS 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 > ASUS 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 **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.

9.3   ASUS User Profile

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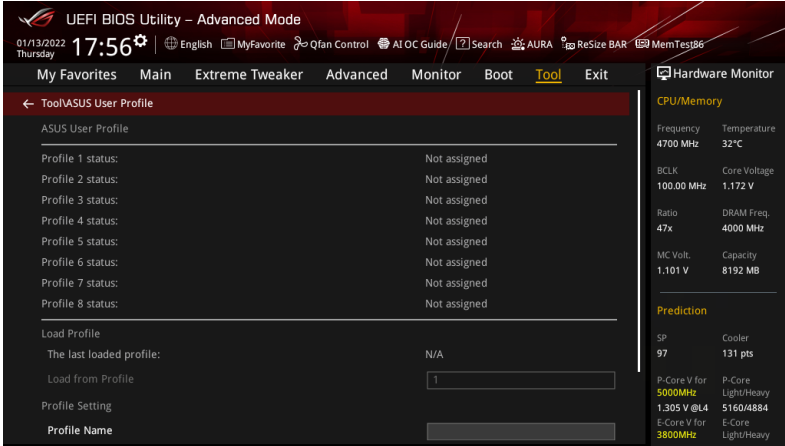
Load from Profile

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

Allows you to key in a profile name.

Save to Profile

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

Allows you to load or save profile from your USB drive, load and save profile to your USB drive.

9.4 ASUS SPD Information

This item allows you to view the DRAM SPD information.

9.5 MemTest86

This item allows you to obtain a memory diagnosis.


Activate MemTest86

Press <Enter> to open MemTest86 to perform and check testing results.

- Please save all changes made before using MemTest86.
- There will be a few seconds of loading time after pressing <Enter> on this option.

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.
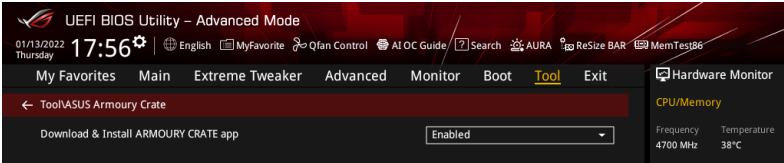
### Download & Install ARMOURY CRATE app

Configuration options: [Disabled] [Enabled]

9.7   MyASUS

This item allows you to enable or disable downloading and installing of the MyASUS app in the Windows® OS.

> The availability of this menu, as well as the settings and options may vary depending on your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.
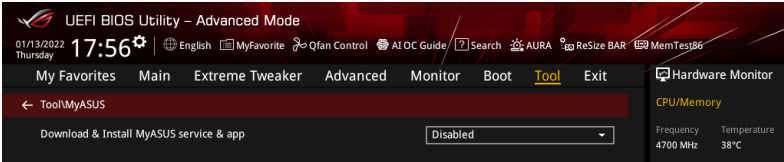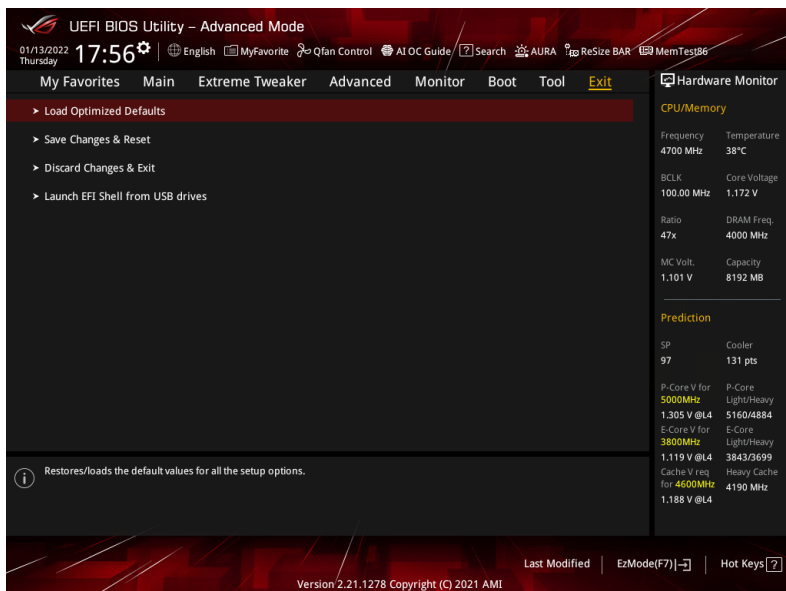

Download & Install MyASUS service & app

Configuration options: [Disabled] [Enabled]

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.

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.   ASUS EZ Flash 3: Updates the BIOS using a USB flash drive.

2.   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.

11.1   ASUS EZ Flash 3

ASUS EZ Flash 3 allows you to download and update to the latest BIOS using a USB drive.

To update the BIOS:

1.   Insert the USB flash drive that contains the latest BIOS file to a USB port.

2.   Enter the Advanced Mode of the BIOS setup program. Go to the **Tool** menu to select **ASUS EZ Flash 3 Utility** and press <Enter>.

3.   Press Left arrow key to switch to the Drive field.

4.   Press the Up/Down arrow keys to find the USB flash drive that contains the latest BIOS, and then press <Enter>.

5.   Press Right arrow key to switch to the Folder Info field.

6.   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.
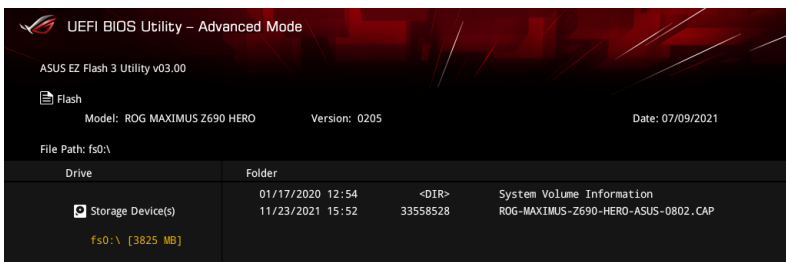
11.2 ASUS CrashFree BIOS 3

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!