

**PRIME /
ProArt /
TUF GAMING
Intel 800
Series**

BIOS Manual



Motherboard

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BIOS Setup

1. Knowing BIOS

NOTE: 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.

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

IMPORTANT! We Strongly recommend ALWAYS using the ZIP file from the ASUS website to update your BIOS when using ASUS EZ Flash, so that the ME version will be updated as well. If you opt to only use the CAP file, make sure the ME version matches the new BIOS. Keep in mind that once the ME is updated, it cannot be rolled back. For more information please check the product page on the ASUS website.

NOTE:

- 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.

IMPORTANT!

- 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.

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

2.1 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.

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

Displays a quick overview of the system status

Selects the display language of the BIOS setup program

AI OC Search AURA ReSize BAR

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

Information
ProArt Z390-CREATOR WIFI BIOS Ver. 0235
Intel(R) Core(TM) Ultra 5 245K
Speed: 5000 MHz
Memory: 16384 MB (DDR5 4000MHz)

DRAM Status
DIMM_A1: N/A
DIMM_A2: Golden Empire 16384MB 4800MHz
DIMM_B1: N/A
DIMM_B2: N/A

X.M.P.
Disabled Disabled

FAN Profile
CPU_FAN 945 RPM
CHA_FAN1 N/A
CHA_FAN2 N/A
CHA_FAN3 N/A
CHA_FAN4 N/A
CHA_FAN5 N/A
AIO_PUMP 1776 RPM

Storage Information
Intel Rapid Storage Technology
ON OFF

CPU FAN
100%
50%
0%
30 60 90 120 °C
QFan Control

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

Boot Priority
Choose one and drag the items. Switch all

Q-Dashboard(F5) Default(F5) Save & Exit(F10) Advanced Mode(F7)

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

Click to go to Q-Dashboard

Loads optimized default settings

Saves the changes and resets the system

Click to go to Advanced mode
Click to display boot devices

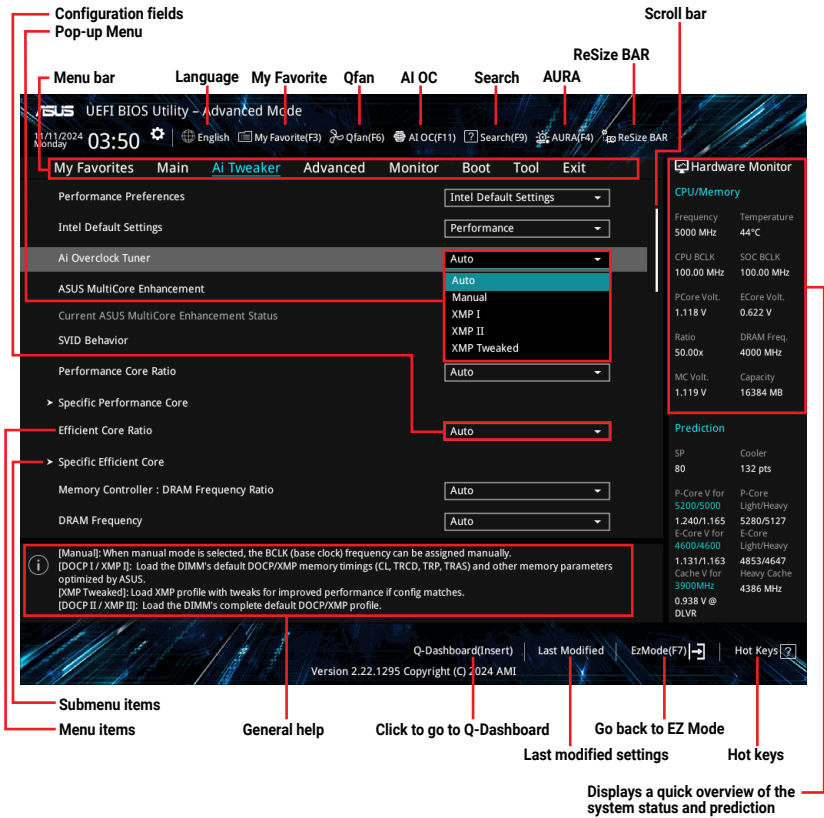
Selects the boot device priority

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

2.2 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.

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



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
Ai 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 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.

My Favorite

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.

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

Qfan

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.

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

AI OC

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.

NOTE:

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

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.

[Off] ReSize BAR support will be disabled.

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.

Q-Dashboard

This button allows you to view all the ports and connectors on your motherboard as well as quick access to the settings of these ports and connectors. You may also access this item by pressing the <Insert> key on the keyboard.

NOTE: Refer to section **Q-Dashboard** for more information.

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.

2.3.1 Configuring fans manually

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

To configure your fans:

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

2.4 AI OC Guide

NOTE:

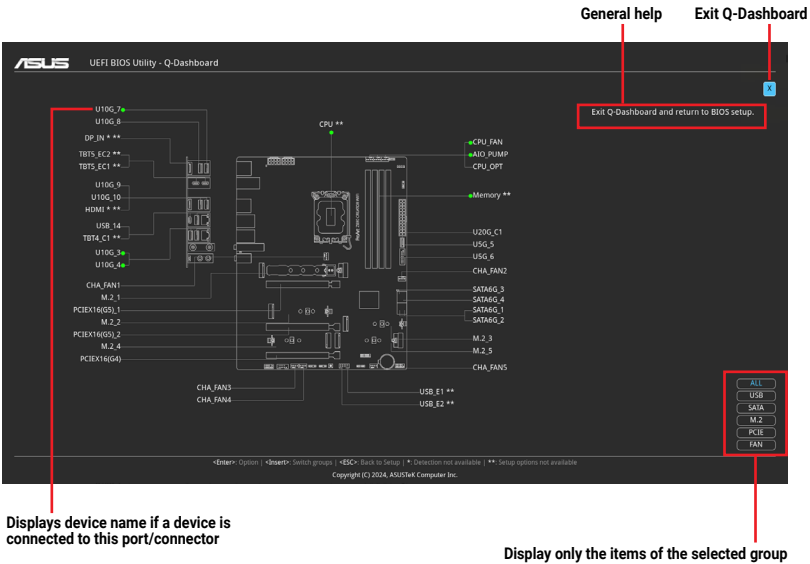
- This function is only enabled when using an unlocked CPU.
 - This function is only available on selected models.
-

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.

2.5 Q-Dashboard

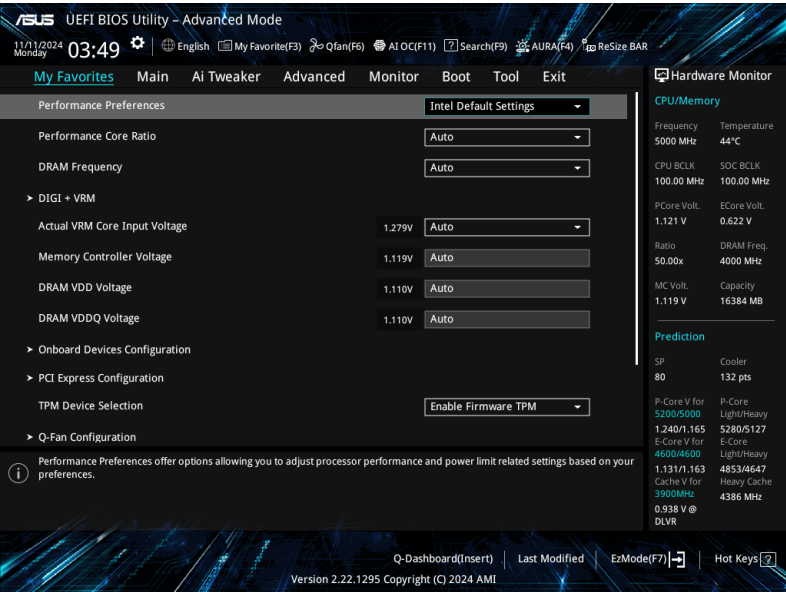
The Q-Dashboard gives you a quick overview of the ports and connectors available on your motherboard. Clicking on a port or connector will redirect you to the BIOS setting of the selected port or connector.



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.

NOTE: The screenshots in this section are for reference only and items listed may differ to your motherboard. Please refer to your motherboard for the actual items.



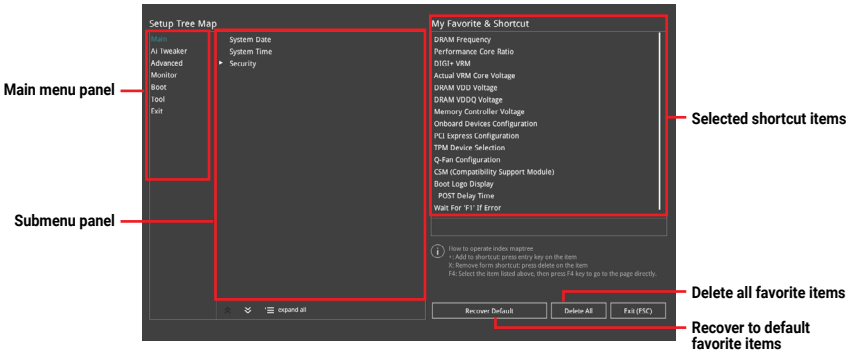
Adding items to My Favorites

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 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.

NOTE: You cannot add the following items to My Favorite items:

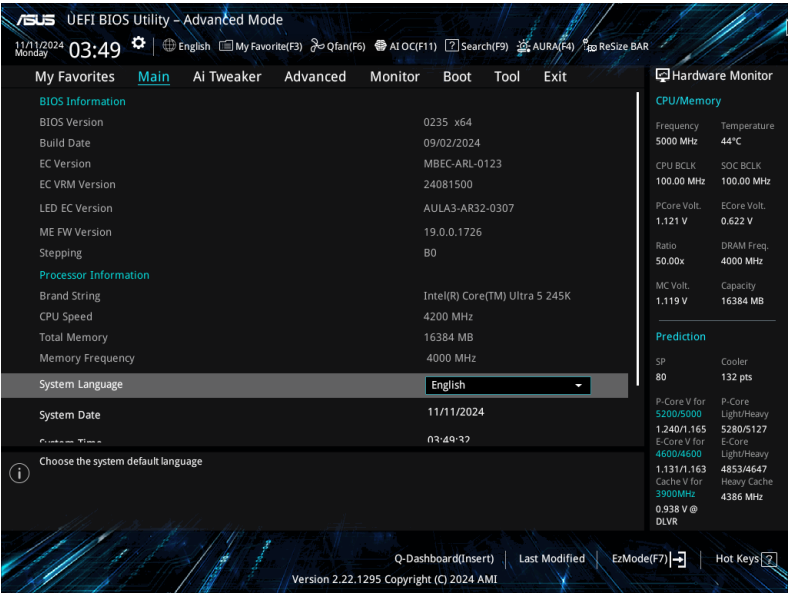
- Items with submenu options.
- User-managed items such as language and boot order.
- Configuration items such as Memory SPD Information, system time and date.



3. Click **Exit (ESC)** or press <Esc> key to close Setup Tree Map screen.
4. 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.



System Language

Allows you to set the system default language.

System Date

Allows you to set the system date. Use <Tab> to switch between Date elements.

System Language

Allows you to set the system time. Use <Tab> to switch between Time elements.

Security

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

NOTE:

- 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.
- 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 already have an administrator password set, 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. In 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. In the **Enter Current Password** box, key in the current password, then press <Enter>.
3. In 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 an administrator password:

1. Select the **Administrator Password** item and press <Enter>.
2. In the **Enter Current Password** box, key in the current password, then press <Enter>.
3. Press <Enter> when prompted to create/confirm the password. 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. In 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. In the **Enter Current Password** box, key in the current password, then press <Enter>.
3. In 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 a user password:

1. Select the **User Password** item and press <Enter>.
2. In the **Enter Current Password** box, key in the current password, then press <Enter>.
3. Press <Enter> when prompted to create/confirm the password. After you clear the password, the **User Password** item on top of the screen shows **[Not Installed]**.

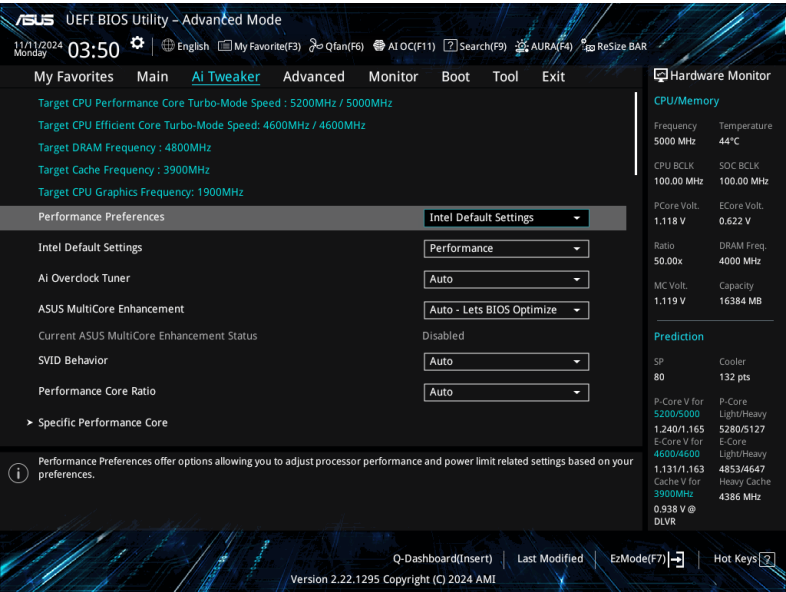
5. Ai Tweaker menu

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

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

NOTE: 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.



Performance Preferences

Allows you to adjust processor performance and power limit related settings based on your preferences.

Configuration options: [Intel Default Settings] [ASUS Advanced OC Profile]

Intel Default Settings

Load the Intel Default Settings and operate within Intel's recommended parameters.

Configuration options: [Performance] [Extreme]

Ai Overclock Tuner

[Auto]	Loads the optimal settings for the system.
[Manual]	When the manual mode is selected, the BCLK (base clock) frequency can be assigned manually.
[XMP I]	Load the DIMM's default XMP memory timings (CL, TRCD, TRP, TRAS) with BCLK frequency and other memory parameters optimized by ASUS.
[XMP II]	Load the DIMM's complete default XMP profile.
[XMP Tweaked]	Load XMP profile with tweaks for improved performance if config matches.
[D.O.C.P. I]	Load the DIMM's default D.O.C.P. memory timings (CL, TRCD, TRP, TRAS) with BCLK frequency and other memory parameters optimized by ASUS.
[D.O.C.P. II]	Load the DIMM's complete default D.O.C.P. profile.
[AEMP II]	Load the memory parameters profile optimized by ASUS if no DIMM profiles detected.
[AEMP III]	Load the memory parameters profile optimized by ASUS if no DIMM profiles detected.

NOTE: The configuration options for this item vary depending on the DIMM model you installed on the motherboard.

NOTE: The following items appear only when **Ai Overclock Tuner** is set to **[Manual]**, **[XMP I]**, **[XMP II]**, **[XMP Tweaked]**, **[D.O.C.P. I]**, **[D.O.C.P. II]**, **[AEMP II]**, or **[AEMP III]**.

BCLK Mode

[Auto]	Loads the default setting.
[Synchronous]	The CPU BCLK and SOC BCLK are adjusted together, keeping their clock speeds in sync.
[Asynchronous]	The CPU BCLK and SOC BCLK can be adjusted independently, allowing different clock speeds for each.

CPU BCLK Frequency

Using a higher CPU BCLK frequency will alter the operating frequency of all associated clock domains (CPU and cache). The default BCLK is 100.

NOTE: The following item appears only when **BCLK Mode** is set to **[Auto]** or **[Asynchronous]**.

SOC BCLK Frequency

Using a higher SOC BCLK frequency will alter the operating frequency of all associated clock domains (DRAM, NGU and D2D). The default BCLK is 100.

PCIE CLK Frequency

Using a higher PCIE BCLK frequency will alter the operating frequency of all associated clock domains (CPU PCIE). The default BCLK is 100.

NOTE: The following item appears only when **Ai Overclock Tuner** is set to **[XMP I]**, **[XMP II]**, or **[XMP Tweaked]**.

XMP

Each profile has its own DRAM frequency, timing and voltage.

NOTE: The following item appears only when **Ai Overclock Tuner** is set to **[D.O.C.P. I]** or **[D.O.C.P. II]**.

D.O.C.P.

Each profile has its own DRAM frequency, timing and voltage.

NOTE: The following item appears only when **Ai Overclock Tuner** is set to **[AEMP II]** or **[AEMP III]**.

AEMP

Each profile has its own DRAM frequency, timing and voltage.

ASUS MultiCore Enhancement

[Auto - Lets BIOS Optimize]	ASUS optimized core ratio Turbo and temperature settings at default processor speeds.
[Disabled - Enforce All limits]	Intel default Turbo core ratio settings.
[Enabled - Remove All limits]	Optimized power, temperature and current thresholds for maintaining maximum performance.
[Enabled - Remove All limits (90°C)]	This item allows you to enable ASUS optimized power, current thresholds and limit CPU temperature at 90°C for better performance balance.

SVID Behavior

Programs the CPU's SVID behavior based on CPU's quality. **[Trained]** optimizes SVID behavior to match input parameters such as Target Frequencies.
Configuration options: [Auto] [Best-Case Scenario] [Typical Scenario] [Trained]

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.

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

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

ALL-Core Ratio Limit

Enter **[Auto]** to apply the CPU default Turbo Ratio setting or manually assign a Core ratio limit to synchronize all cores. Use the <+> or <-> to adjust the value.

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

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. Use the <+> or <-> to adjust the value.

NOTE: The following items appear 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. Use the <+> or <-> to adjust the value.

Performance Core0-7 specific Voltage

Configure the P-Core Voltage requested by the cores. Result may be influenced by Actual VRM Core Voltage.

Configuration options: **[Auto]** **[Manual Mode]** **[Offset Mode]** **[Adaptive Mode]**

NOTE: The following item appears only when **Performance Core0-7 specific Voltage** is set to **[Manual Mode]**.

CPU P-Core0-7 Voltage Override

Configure the voltage for the CPU P-Core. The values range from 0.600V to 1.700 V with an interval of 0.001V.

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

NOTE: The following items appear only when **Performance Core0-7 specific Voltage** is set to **[Offset Mode]** or **[Adaptive Mode]**.

Offset Mode Sign

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

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

CPU P-Core0-7 Offset Voltage

Configure the CPU P-Core 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.

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

NOTE: The following items appear only when **Performance Core0-7 specific Voltage** is set to **[Adaptive Mode]**.

Additional Turbo Mode CPU P-Core0-7 Voltage

Configure the amount of voltage fed to the CPU P-Core when running in Turbo mode. Increase the voltage when configuring a high CPU P-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.

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. |

NOTE:

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

NOTE: The following items appear only when **Efficient 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 / Efficient 5-Core Ratio Limit / Efficient 6-Core Ratio Limit / Efficient 7-Core Ratio Limit / Efficient 8-Core Ratio Limit

Ratio Limit for Efficient cores when N Efficient cores are loaded. Use the <+> or <-> to adjust the value.

NOTE: The following items appear only when **Efficient Core Ratio** is set to **[Auto]**, **[Sync All Cores]** or **[By Core Usage]**.

Specific Efficient Core

Efficient Core Group0-7 Specific Ratio Limit

Configure a ratio limit for certain Efficient Cores. Use the <+> or <-> to adjust the value.

Efficient Core Group0-7 specific Voltage

Configure the E-Core Group Voltage requested by the cores. Result may be influenced by Actual VRM Core Voltage.

Configuration options: [Auto] [Manual Mode] [Offset Mode] [Adaptive Mode]

NOTE: The following items appear only when **Efficient Core Group0-7 specific Voltage** is set to **[Manual Mode]**.

CPU E-Core Group0-7 Voltage Override

Configure the voltage for the CPU E-Core Group. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.

NOTE: The following items appear only when **Efficient Core Group0-7 specific Voltage** is set to **[Offset Mode]** or **[Adaptive Mode]**.

Offset Mode Sign

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

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

CPU E-Core Group0 Offset Voltage

Configure the CPU E-Core Group 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.

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

NOTE: The following items appear only when **Efficient Core Group0-7 specific Voltage** is set to **[Adaptive Mode]**.

Additional Turbo Mode CPU E-Core Group0-7 Voltage

Configure the amount of voltage fed to the CPU P-Core when running in Turbo mode. Increase the voltage when configuring a high CPU P-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.

Memory Controller : DRAM Frequency Ratio

Memory Controller Frequency to DRAM Frequency Ratio.

Configuration options: [Auto] [1:2] [1:4]

DRAM Frequency

Select the DRAM operating frequency. The configurable options vary with the BCLK(base clock) frequency setting. Select the auto mode to apply the optimized setting.

NOTE: The configuration options for this item vary depending on the DIMM model you installed on the motherboard.

CAUTION! The frequency ratios in gray are not recommended, use BCLK + ratios in white to reach your target frequency if needed.

DIMM Flex

Enable to configure DRAM Timings and Frequencies based on DRAM Temperature. Disable to disable this feature.

Configuration options: [Disabled] [Enabled]

NOTE: DRAM settings will remain at Level1 at BIOS boot until the handover to OS. Excessive dynamic switching in the DRAM timings and frequency may lead to system instability whilst in OS.

AVX Related Controls

AVX2

Allows you to enable or disable the AVX 2 Instructions.

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

AVX2 Ratio Offset

AVX2 Ratio Offset. Specifies number of bins to decrease AVX ratio vs. 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.

AVX2 Voltage Guardband Scale Factor

AVX2 Voltage Guardband Scale Factor. Controls the voltage guardband applied to AVX workloads. Range 0 - 200 in 1/100 units, where 125 = 1.25 scale factor. A default value of 100 applies the default voltage guardband scale factor of 1.0. A value > 100 will increase the voltage guardband, and < 100 will decrease the voltage guardband.

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.

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

DIMM Fit

DIMM Fit

This feature adjusts parameters based on your hardware margin to maintain memory timing, optimize performance, and improve compatibility.

DIMM Fit Store

You can save the adjusted DIMM Fit parameters to one of three preset locations. Select a valid store to apply its fitted values for boot.

Configuration options: [None] [Store0] [Store1] [Store2]

Delete the current DIMM Fit Store

Delete the current DIMM Fit Store.

Primary Timings

DRAM CAS# Latency

DRAM CAS# Latency (tCL). Only Even numbers are supported on DDR5. Odd Numbers will be rounded up.

DRAM RAS# to CAS# Delay Read

DRAM RAS# to CAS# Delay Read (tRCD).

DRAM RAS# to CAS# Delay Write

DRAM RAS# to CAS# Delay Write (tRCDW).

DRAM RAS# PRE Time

DRAM RAS# PRE Time (tRP).

DRAM RAS# ACT Time

DRAM RAS# ACT Time (tRAS).

DRAM Command Rate

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

Secondary Timings

DRAM RAS# to RAS# Delay L

DRAM RAS# to RAS# Delay (tRRDL).

DRAM RAS# to RAS# Delay S

DRAM RAS# to RAS# Delay (tRRDS).

DRAM REF Cycle Time

DRAM REF Cycle Time (tRFC).

DRAM REF Cycle Time Same Bank

DRAM REF Cycle Time Same Bank (tRFCsb).

DRAM Refresh Interval

DRAM Refresh Interval (tREFI).

DRAM WRITE Recovery Time

DRAM WRITE Recovery Time (tWR).

DRAM READ to PRE Time

DRAM READ to PRE Time (tRTP).

DRAM FOUR ACT WIN Time

DRAM FOUR ACT WIN Time (tFAW).

DRAM WRITE to READ Delay L

DRAM WRITE to READ Delay (tWTR_L).

DRAM WRITE to READ Delay S

DRAM WRITE to READ Delay (tWTR_S).

DRAM Internal Write to Write Command Delay Time

DRAM Internal Write to Write Command Delay Time (tCCD_L_WR).

DRAM CAS Write Latency

DRAM CAS Write Latency (tCWL).

Skew Control

Basic Dimm ODT Control

Sync Basic Dimm ODT mode

Configuration options: [Disabled] [Enabled]

NOTE: The following items appear only when **Sync Basic Dimm ODT mode** is set to **[Enabled]**.

Channel 1 Slot A1 / Channel 1 Slot A2 / Channel 0 Slot B1 / Channel 0 Slot B2

RTT WR

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT NOM RD

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT NOM WR

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT PARK

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT PARK DQS

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

Pull-up Output Driver Impedance

Configuration options: [Auto] [34 ohm] [40 ohm] [48 ohm]

Pull-Down Output Driver Impedance

Configuration options: [Auto] [34 ohm] [40 ohm] [48 ohm]

NOTE: The following items appear only when **Sync Basic Dimm ODT mode** is set to **[Disabled]**.

Mc0 Channel 1 Slot A1 / Mc1 Channel 1 Slot A1 / Mc0 Channel 1 Slot A2 / Mc1 Channel 1 Slot A2 / Mc0 Channel 0 Slot B1 / Mc1 Channel 0 Slot B1 / Mc0 Channel 0 Slot B2 / Mc1 Channel 0 Slot B2

RTT WR

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT NOM RD

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT NOM WR

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT PARK

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

RTT PARK DQS

Configuration options: [Auto] [Disabled] [34 ohm] [40 ohm] [48 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm]

Pull-up Output Driver Impedance

Configuration options: [Auto] [34 ohm] [40 ohm] [48 ohm]

Pull-Down Output Driver Impedance

Configuration options: [Auto] [34 ohm] [40 ohm] [48 ohm]

Advanced Dimm ODT Control

Sync Advanced Dimm ODT mode

Configuration options: [Disabled] [Enabled]

NOTE: The following items appear only when **Sync Advanced Dimm ODT mode** is set to **[Enabled]**.

Channel 1 Slot A1 / Channel 1 Slot A2 / Channel 0 Slot B1 / Channel 0 Slot B2

GroupA CA ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupA CS ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupA CK ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupB CA ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupB CS ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupB CK ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

NOTE: The following items appear only when **Sync Advanced Dimm ODT mode** is set to **[Disabled]**.

Mc0 Channel 1 Slot A1 / Mc1 Channel 1 Slot A1 / Mc0 Channel 1 Slot A2 / Mc1 Channel 1 Slot A2 / Mc0 Channel 0 Slot B1 / Mc1 Channel 0 Slot B1 / Mc0 Channel 0 Slot B2 / Mc1 Channel 0 Slot B2

GroupA CA ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupA CS ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupA CK ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupB CA ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm] [120 ohm] [240 ohm] [480 ohm]

GroupB CS ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm]
[120 ohm] [240 ohm] [480 ohm]

GroupB CK ODT

Configuration options: [Auto] [Disabled] [40 ohm] [60 ohm] [80 ohm]
[120 ohm] [240 ohm] [480 ohm]

DDRCRCOMPCTL

DqOdtVrefUp

Allows you to set DqOdtVrefUp.

DqOdtVrefDn

Allows you to set DqOdtVrefDn.

CmdSlewRate

Allows you to set CmdSlewRate.

CmdScompPC

Allows you to set CmdScompPC.

CtlSlewRate

Allows you to set CtlSlewRate.

CtlScompPC

Allows you to set CtlScompPC.

DisableCompRotate

Allows you to set DisableCompRotate.

RcompVrefVdd2

Allows you to set RcompVrefVdd2.

CmdDrvVrefDnVdd2

Allows you to set CmdDrvVrefDnVdd2.

CmdDrvVrefUpVdd2

Allows you to set CmdDrvVrefUpVdd2.

CmdDrvVrefUp

Allows you to set CmdDrvVrefUp.

CtlDrvVrefUp

Allows you to set CtlDrvVrefUp.

ClkDrvVrefUp

Allows you to set ClkDrvVrefUp.

DqDrvVrefUp

Allows you to set DqDrvVrefUp.

CmdDrvVrefDn

Allows you to set CmdDrvVrefDn.

CtlDrvVrefDn

Allows you to set CtlDrvVrefDn.

ClkDrvVrefDn

Allows you to set ClkDrvVrefDn.

DqDrvVrefDn

Allows you to set DqDrvVrefDn.

RcompTarget

Rcomp RdODT

Allows you to set Rcomp Read ODT Setting.

Rcomp WrDS

Allows you to set Rcomp WrDS Setting.

Rcomp WrDSCmd

Allows you to set Rcomp WrDSCmd Setting.

Rcomp WrDSCtl

Allows you to set Rcomp WrDSCtl Setting.

Rcomp WrDSClk

Allows you to set Rcomp WrDSClk Setting.

Memory Training Algorithms

Early Command Training

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

SenseAmp Offset Training

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

Early ReadMPR Timing Centering 2D

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

Read MPR Training

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

Receive Enable Training

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

Jedec Write Leveling

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

Early Write Time Centering 2D

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

Early Read Time Centering 2D

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

Unmatched Write Time Centering 1D

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

Write Timing Centering 1D

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

Write Voltage Centering 1D

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

Read Timing Centering 1D

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

Read Voltage Centering 1D

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

DDR5 ODT Timing Config

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

View Pin Calibration

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

Read DQS ODT Training*

Read DQS On-Die Termination Training.

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

Read DQ ODT Training

Read DQ On-Die Termination Training.

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

Read Equalization Training*

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

Read CTLE Training

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

Post Package Repair

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

Write Timing Centering 2D

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

Read Timing Centering 2D

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

Write Voltage Centering 2D

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

Read Voltage Centering 2D

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

RxVref Per-Bit Training

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

Command Voltage Centering

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

Late Command Training

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

Turn Around Timing Training

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

Rank Margin Tool

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

LVR Auto Trim

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

DIMM SPD Alias Test

Test to determine if the SPD has been corrupted to cause memory aliasing.

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

Retrain Margin Check

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

Row Hammering Prevention

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

Dimm ODT Training*

Dimm On-Die Termination Training.

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

DIMM RON Training*
Configuration options: [Auto] [Disabled] [Enabled]

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

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

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

CMD/CTL Drive Strength
Configuration options: [Auto] [Disabled] [Enabled]

CMD/CTL Tx Equalization
Configuration options: [Auto] [Disabled] [Enabled]

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

Write DQ/DQS Retrain
Configuration options: [Auto] [Disabled] [Enabled]

Power Saving Meter Update
Configuration options: [Auto] [Disabled] [Enabled]

Pre Training Comp Calibration
Configuration options: [Auto] [Disabled] [Enabled]

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

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

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

DQ/DQS Swizzle Training
Configuration options: [Auto] [Disabled] [Enabled]

Ref PI Calibration
Configuration options: [Auto] [Disabled] [Enabled]

Rx SAL Calibration
Configuration options: [Auto] [Disabled] [Enabled]

VccClk FF Offset Correction
Configuration options: [Auto] [Disabled] [Enabled]

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

Duty Cycle Correction Downstream Training
Duty Cycle Correction Downstream Training - PI Serializer/LUT
Configuration options: [Auto] [Disabled] [Enabled]

Duty Cycle Correction QCLK Calibration
Configuration options: [Auto] [Disabled] [Enabled]

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

Functional Duty Cycle Correction for DDR5 DQS

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

Functional Duty Cycle Correction for DDR5 CLK

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

Functional Duty Cycle Correction for LP5 WCK

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

Functional Duty Cycle Correction for Data DQ

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

Data PI Linearity Calibration

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

Ddr5 Rx Cross-Talk Cancellation

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

Duty Cycle Correction for LP5 DCA

Duty Cycle Correction for LP5 Duty Cycle Alignment

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

Unmatched Rx Calibration

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

Write Rank-to-Rank Training

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

Read Rank-to-Rank Training

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

Comp Optimization

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

DIMM DFE Training

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

Write Drive Strength

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

Write Equalizationq

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

Margin Check Limit

Checks Margin to Limit to see if next boot memory needs to be retrain.

Configuration options: [Disabled] [L1] [L2] [Both]

NOTE 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. Ex. 200 is 2 x L1 Check.

Third Timings

tRDRD_sg

Allows you to set tRDRD_sg.

tRDRD_dg

Allows you to set tRDRD_dg.

tWRWR_sg

Allows you to set tWRWR_sg.

tWRWR_dg

Allows you to set tWRWR_dg.

tRDWR_sg

Allows you to set tRDWR_sg.

tRDWR_dg

Allows you to set tRDWR_dg.

tWRRD_sg

Allows you to set tWRRD_sg.

tWRRD_dg

Allows you to set tWRRD_dg.

tRDRD_dr

Allows you to set tRDRD_dr.

tRDRD_dd

Allows you to set tRDRD_dd.

tWRWR_dr

Allows you to set tWRWR_dr.

tWRWR_dd

Allows you to set tWRWR_dd.

tRDWR_dr

Allows you to set tRDWR_dr.

tRDWR_dd

Allows you to set tRDWR_dd.

tWRRD_dr

Allows you to set tWRRD_dr.

tWRRD_dd

Allows you to set tWRRD_dd.

tRPRE

Allows you to set tRPRE.

tWPRE

Allows you to set tWPRE.

tWPOST

Allows you to set tWPOST.

tCCD_L_tDLLK

Allows you to set tCCD_L_tDLLK.

Misc. Timings

Refresh Hp Wm

Allows you to set refresh Hp Wm.

Refresh Panic Wm

Allows you to set refresh Panic Wm.

Refresh Abr Release

Allows you to set refresh Abr Release.

Misc.

Fast Boot

Enable/Disable fast path thru the MRC.

Configuration options: [Disabled] [Enabled]

MCH Full Check

Enable this item to enhance the system stability. Disable this item may enhance the DRAM overclocking capability.

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

Mem Over Clock Fail Count

Allows you to set Mem Over Clock Fail Count.

Training Profile

Select DIMM Training Profile.

Configuration options: [Auto] [Standard Profile] [ASUS User Profile]

Mrc Training Loop Count

Exponential number of loops to run the test.

DRAM CLK Period

Select the DRAM clock period.

SOC BCLK OC Workaround

Can try enabling if Memory training fails when overclocking SOC BCLK.

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

Controller 0, Channel 0 Control

Controller 0, Channel 0 Control - Enable or Disable Controller 0, Channel 0.

Configuration options: [Enabled] [Disabled]

Controller 0, Channel 1 Control

Controller 0, Channel 1 Control - Enable or Disable Controller 0, Channel 1.

Configuration options: [Enabled] [Disabled]

Controller 1, Channel 0 Control

Controller 1, Channel 0 Control - Enable or Disable Controller 1, Channel 0.

Configuration options: [Enabled] [Disabled]

Controller 1, Channel 1 Control

Controller 1, Channel 1 Control - Enable or Disable Controller 1, Channel 1.

Configuration options: [Enabled] [Disabled]

Configure Memory Dynamic Frequency Switching

NOTE: This item will be not selectable when DIMM Flex has been enabled. Disable DIMM Flex if you wish to use this.

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

Dynamic Memory Boost

Enable/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]

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

Realtime Memory Frequency

Enable/Disable Realtime Memory Frequency feature, Allows manual switching in runtime between default SPD Profile frequency and XMP profile 1 frequency. Only valid if XMP Profile 1 is selected.

Configuration options: [Disabled] [Enabled]

SAGV

System Agent Geyserville. Disabled or Enabled.

Configuration options: [Disabled] [Enabled]

NOTE The following item appears only when **SAGV** is set to **[Enabled]**.

First Point Gear

Gear ratio for this SAGV point.

Configuration options: [Auto] [Gear2] [Gear4]

Second Point Gear

Gear ratio for this SAGV point.

Configuration options: [Auto] [Gear2] [Gear4]

Third Point Gear

Gear ratio for this SAGV point.

Configuration options: [Auto] [Gear2] [Gear4]

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

DIGI + VRM

VRM Initialization Check

When any error occurs during VRM initialization, the system will hang at POSTcode 77 if this function is enabled.

Configuration options: [Disabled] [Enabled]

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 8 to adjust the load-line slope.

Level 1 = greater Vdroop, Level = 8 minimum Vdroop.

Configuration options: [Auto] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5] [Level 6] [Level 7] [Level 8]

NOTE: Performance is dependent on the CPU model used. Do not remove the VRM heatsink.

Current CPU Load-line Calibration

Synch ACDC Loadline with VRM Loadline

If enabled,VRM Loadline will be adjust automatically to match AC/DC Loadline.

Configuration options: [Disabled] [Enabled]

CPU Current Capability

Sets the shut-off current limit for the 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%] [110%] [120%] [130%] [140%] [200%]

NOTE: Configure higher values when overclocking or when using high current demanding stress tests.

CPU Current Reporting

Configuration options: [Auto] [100%] [75%] [50%] [25%]

CPU VRM Switching Frequency

Sets the VRM switching frequency. VRM switching frequency affects transient response and VRM component temperatures. 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]

CAUTION! Do not remove the VRM heatsink.

NOTE: 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 to reduce peak noise. Disable this setting when overclocking.

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

NOTE: 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. The values range from 300 KHz to 800 KHz with an interval of 100 KHz.

CPU Power Duty Control

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

[T. Probe]	Sets the buck controller to balance VRM FET temperatures
[Extreme]	Select to set the VRM current balance mode.

CAUTION! Do not remove the VRM Heatsink.

CPU Power Phase Control

[Auto]	Automatically selects the power phase control.
[Standard]	The number of active phases is controlled by the CPU.
[Optimized]	Sets the ASUS optimized phase profile.
[Extreme]	Sets full phase mode.

CPU Power Thermal Control

Sets the VRM thermal cut-off trip point. 125 Celsius is default and recommended for all overclocking and normal use.

CAUTION! DO NOT remove the VRM heatsink.

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 8 to adjust the CPU Graphics power voltage from 100% to 0%.

Configuration options: [Auto] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5] [Level 6] [Level 7] [Level 8]

CAUTION! The 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%]

NOTE: 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 speed and the component thermal production. Select the manual mode to configure a higher frequency to get a quicker transient response speed.

Configuration options: [Auto] [Manual]

CAUTION! Do not remove the thermal module when the manual mode is selected. The thermal conditions should be monitored.

NOTE: 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 speed 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.

VCCSA Load-line Calibration

CPU System Agent Load-line Calibration.

Configuration options: [Auto] [Level 1] [Level 2] [Level 3] [Level 4] [Level 5] [Level 6] [Level 7] [Level 8]

VCCSA Current Capability

Configuration options: [Auto] [100%] [140%]

VCCSA VRM Switching Frequency

Configuration options: [Auto] [Manual]

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

Fixed CPU VCCSA Switching Frequency(KHz)

The switching frequency will affect the CPU VCCSA transient response speed and the component thermal production. Configure a higher frequency to get a quicker transient response speed. Use the <+> or <-> to adjust the value. The values range from 500 KHz to 800 KHz with an interval of 100 KHz.

Internal CPU Power Management

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

Maximum CPU Core Temperature

Set the maximum allowable temperature for CPU cores. The CPU will throttle or shutdown when it reaches this temperature to prevent damaging the cores.

CAUTION! Do not set this value too high, as high temperatures may damage the CPU permanently.

Turbo Mode Parameters

Unlimited ICCMAX

Enable/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 configuration of a current limit for frequency/power throttling. Can be set to maximum value (511.75) to prevent throttling when overclocking.

CPU Graphics Current Limit

Set a high current limit to prevent frequency or power throttling during overclocking.

CPU System Agent Current Limit

Set a high current limit to prevent frequency or power throttling during overclocking.

Long Duration Package Power Limit

An Intel parameter known as [power limit 1] and specified in Watts. The default 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. The values range from 1 to 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]

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.

Power Limit 4 Switch

Enabled/Disabled Power Limit 4 Function.

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

NOTE: The following item appears only when **Power Limit 4 Switch** is set to **[Enabled]**.

Power Limit 4

An Intel parameter known as [power limit 4] and specified in Watts. Values range from 1 W to 1023 W.

IA AC Load Line

AC Loadline defined in mOhms. Range is 0-62.49 mOhms.

IA DC Load Line

DC Loadline defined in mOhms. Range is 0-62.49 mOhms.

CPU SVID Support

Disable this item to prevent the CPU from communicating with the external voltage regulator.

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

CCF AutoGV

Enable/disable CCF AutoGV.

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

Power Floor Management

This option is to disable SoC's aggressive throttling to manage floor power (minimum power consumption). Disabling this might effectively raise power floor of the SoC and may lead to stability issues.

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

P-core Power Density Throttle

This option allows user to disable P-core Power Density Throttling for overclocking purpose. Once disabled, BIOS cannot enable it in the same reset cycle. A warm or cold reset is required to enable protection again.

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

IA CEP Enable

Enable/Disable CEP (Current Excursion Protection) Support.

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

SA CEP Enable

Enable/Disable CEP (Current Excursion Protection) Support.

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

GT CEP Enable

Enable/Disable CEP (Current Excursion Protection) Support.

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

Core VR Fast Vmode

Core VR Fast Vmode. Use to control Core Fast Vmode Enable/Disable.

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

GT VR Fast Vmode

GT VR Fast Vmode. Use to control GT Fast Vmode Enable/Disable.

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

SA VR Fast Vmode

SA VR Fast Vmode. Use to control SA Fast Vmode Enable/Disable.

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

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]

Enhanced TVB

This item is only supported on selected SKUs.

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] [Boost Until Target]

NOTE:

+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.

NOTE: The following item appears only when **Overclocking TVB** is set to **[Enabled]**, **[+1Boost Profile]**, **[+2Boost Profile]**, or **[Boost Until Target]**.

OC TVB Configuration Limit

Select one of the two OC TVB Configuration limits, between Per CCP Module or Per P-core Group.

Configuration options: [Auto] [Per CCP Module] [Per P-core Group]

NOTE: The following item appears only when **Overclocking TVB** is set to **[Boost Until Target]**.

Max Boost Target in MHz

Customize the maximum Target Frequency in MHz or leave auto for auto values based on predictions.

NOTE: The following items appear only when **OC TVB Configuration Limit** is set to **[Per CCP Module]**.

P-core 0-7

Configuration options: [Auto] [Enabled]

NOTE: The following items appear only when **P-core 0-7** is set to **[Enabled]**.

Temperature A-B

Package passing this temperature threshold will engage the negative ratio offset specified in **Negative Ratio Offset A-B**. Unit in Degree Celsius.

NOTE: There is a 5°C degree difference between software and TVB firmware interpretation of CPU Temperature.

Negative Ratio Offset A-B

This will be the potential negative offset to respective ratio when package temperature rises above threshold specified in **Temperature A-B**.

E-core Cluster 0

Configuration options: [Auto] [Enabled]

NOTE: The following items appear only when **E-core Cluster 0-3** is set to **[Enabled]**.

Temperature A-B

Package passing this temperature threshold will engage the negative ratio offset specified in **Negative Ratio Offset A-B**. Unit in Degree Celsius.

NOTE: There is a 5°C degree difference between software and TVB firmware interpretation of CPU Temperature.

Negative Ratio Offset A-B

This will be the potential negative offset to respective ratio when package temperature rises above threshold specified in **Temperature A-B**.

NOTE: The following items appear only when **OC TVB Configuration Limit** is set to **[Per P-core Group]**.

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]

NOTE: 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 / 8-Core Active** is set to **[Enabled]**.

Temperature A-B

Package passing this temperature threshold will engage the negative ratio offset specified in **Negative Ratio Offset A-B**. Unit in Degree Celsius.

NOTE: There is a 5°C degree difference between software and TVB firmware interpretation of CPU Temperature.

Negative Ratio Offset A-B

This will be the potential negative offset to respective ratio when package temperature rises above threshold specified in **Temperature A-B**.

Overclocking TVB Global Temperature Offset Sign

This selects if positive or negative offset is desired when anyone of the Overclocking TVB Boost Profiles are selected.

Configuration options: [+] [-]

Overclocking TVB Global Temperature Offset Value

The desired value to offset the temperature thresholds of the Overclocking TVB Boost Profiles by should be entered here.

Max Voltage Limits

Process Vmax Limit

Disabling the Vmax limit Setting will allow user to set any voltage. But disabling the voltage limit checks may cause permanent damage to processor. Disabling limit check will persist until next cold boot. Disabling VMax Limit will clip ratio to 4x unless the processor is under 10 degrees Celsius.

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

P-Core Max Voltage limits

Allows you to set P-Core Max Voltage Limits.

E-Core Max Voltage limits

Allows you to set E-Core Max Voltage Limits.

GT Max Voltage limits

Allows you to set GT Max Voltage Limits.

Ring Max Voltage limits

Allows you to set Ring Max Voltage Limits.

SA Max Voltage limits

Allows you to set SA Max Voltage Limits.

NGU Max Voltage limits

Allows you to set NGU Max Voltage Limits.

VCCIA Boot Voltage

Select VCCIA boot voltage between Nominal and High Voltage. VCCIA boot Voltage - the default voltage is Nominal, to support the high voltage, BIOS can program VCCIA boot voltage higher than 1.65v (max 2.01v).

Configuration options: [Auto] [Nominal] [High Voltage]

VCCSA Boot Voltage

Select VCCSA boot voltage between Nominal and High Voltage (up to 1.2/1.3V).
VCCSA boot Voltage - the default voltage is Nominal, to support the high voltage, BIOS can program the EPOC2 bits to bump up voltage to up to 1.2/1.3V. 0 - Nominal. 1 - High Voltage(up to 1.2/1.3V).

Configuration options: [Auto] [Nominal] [High Voltage]

V/F Point Offset

V/F Point Present Mode

Configuration options: [Auto] [All Core Mode] [Per Core Mode]

NOTE: The following item appears only when **V/F Point Present Mode** is set to **[All Core Mode]**.

V/F Point Voltage Control Mode

Configuration options: [Auto] [Manual Mode]

NOTE: The following items appear only when **V/F Point Voltage Control Mode** is set to **[Manual Mode]**.

Offset Mode Sign 1~15

Configuration options: [+] [-]

V/F Point 1~15 Offset

V/F Point 1~15 Offset in Milli-Volts.

NOTE: The following items appear only when **V/F Point Present Mode** is set to **[Per Core Mode]**.

Performance Core0-7 V/F Point Offset

V/F Point Voltage Control Mode

Configuration options: [Auto] [Manual Mode]

NOTE: The following items appear only when **V/F Point Voltage Control Mode** is set to **[Manual Mode]**.

Offset Mode Sign 1~15

Configuration options: [+] [-]

V/F Point 1~15 Offset

V/F Point 1~15 Offset in Milli-Volts.

Efficient Core V/F Point Offset

V/F Point Present Mode

Configuration options: [Auto] [All Core Mode] [Per Core Mode]

NOTE: The following item appears only when **V/F Point Present Mode** is set to **[All Core Mode]**.

V/F Point Voltage Control Mode

Configuration options: [Auto] [Manual Mode]

NOTE: The following items appear only when **V/F Point Voltage Control Mode** is set to **[Manual Mode]**.

Offset Mode Sign 1~15

Configuration options: [+] [-]

V/F Point 1~15 Offset

V/F Point 1~15 Offset in Milli-Volts.

NOTE: The following items appear only when **V/F Point Present Mode** is set to **[Per Core Mode]**.

Efficient Core Group0~7 V/F Point Offset

V/F Point Voltage Control Mode

Configuration options: [Auto] [Manual Mode]

NOTE: The following items appear only when **Efficient Core Group0~7 V/F Point Offset** is set to **[Manual Mode]**.

Offset Mode Sign 1~15

Configuration options: [+] [-]

V/F Point 1~15 Offset

V/F Point 1~15 Offset in Milli-Volts.

Tweaker's Paradise

Clocking

Initial CPU BCLK Frequency

Allows you to set Initial CPU BCLK Frequency.

Initial SOC BCLK Frequency

Allows you to set Initial SOC BCLK Frequency.

SOC BCLK Spread Spectrum

Enable to reduce EMI, disable to get more accurate Base Clocks.

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

PCIe/DMI Spread Spectrum

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

Realtime Memory Timing

Enable/Disable realtime memory timings. When enabled, the system will allow performing realtime memory timing changes after MRC_DONE.

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

SPD Write Disable

Enable/Disable setting SPD Write Disable. For security recommendations, SPD write disable bit must be set.

Configuration options: [TRUE] [FALSE]

CPU OC Features

UnderVolt Protection

When UnderVolt Protection is enabled, user will not be able to program under voltage in OS runtime. Recommended to keep it enabled by default.

[Auto] Use default settings.

[Enabled] Allow BIOS undervolting, but enable UnderVolt Protection in Runtime.

[Disabled] No UnderVolt Protection in Runtime.

CPU BGREF Mode

Select CPU Bandgap Reference Mode between Normal and Bandgap Bypassed. CPU Bandgap Reference Mode - the default voltage is Normal.

Configuration options: [Auto] [Normal] [Bandgap Bypassed]

PVD Ratio Threshold for SOC

Select PVD Ratio Threshold Value from Range 1 to 63. 0 - Static PVD ratio specified by PvdMode for SOC

PVD Mode Select for SOC

Select PVD Mode Value from Range 1 to 3. 0x0 = div-1 (VCO = Output clock), 0x1 = div-2 (VCO = 2x Output clock), 0x2 = div-4 (VCO = 4x Output clock), 0x3 = div-8 (VCO = 8x Output clock)

PVD Ratio Threshold for CPU

Select PVD Ratio Threshold Value from Range 1 to 63. 0 - Static PVD ratio specified by PvdMode for CPU

PVD Mode Select for CPU

Select PVD Mode Value from Range 1 to 3. 0x0 = div-1 (VCO = Output clock), 0x1 = div-2 (VCO = 2x Output clock), 0x2 = div-4 (VCO = 4x Output clock), 0x3 = div-8 (VCO = 8x Output clock)

FLL OC mode

Select the type of tuning you want for the CPU FLL.

Configuration options: [Auto] [Disabled] [Ratio OC] [Ratio + BCLK OC] [BCLK OC]

Core Minimum Ratio

Request Core Minimum Ratio. Limit Core minimum ratio for extreme overclocking and the ratio is in units of 100Mhz. The request value will be updated to minimum allowed one if it's too small. The request value will be updated to the maximum allowed one if it's too big. 0 indicates no setting.

SA PLL Frequency Override

Configure Sa PLL Frequency.

Configuration options: [Auto] [2400 MHz] [1600 MHz]

BCLK TSC HW Fixup

BCLK TSC HW Fixup disable during TSC copy from PMA to APIC.

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

Core PLL Voltage Offset

PLL Voltage Offset, Range 0-15. Units are in 17.5mV. Default is 0. This control can be used to increase the range of this domain frequency in extreme overclocking conditions.

Ring PLL Voltage Offset

PLL Voltage Offset, Range 0-15. Units are in 17.5mV. Default is 0. This control can be used to increase the range of this domain frequency in extreme overclocking conditions.

SOC System Agent PLL Voltage Offset

PLL Voltage Offset, Range 0-15. Units are in 17.5mV. Default is 0. This control can be used to increase the range of this domain frequency in extreme overclocking conditions.

IA Atom PLL Voltage Offset

PLL Voltage Offset, Range 0-15. Units are in 17.5mV. Default is 0. This control can be used to increase the range of this domain frequency in extreme overclocking conditions.

Memory Controller PLL Voltage Offset

PLL Voltage Offset, Range 0-15. Units are in 17.5mV. Default is 0. This control can be used to increase the range of this domain frequency in extreme overclocking conditions.

CPU System Agent PLL Voltage Offset

PLL Voltage Offset, Range 0-15. Units are in 17.5mV. Default is 0. This control can be used to increase the range of this domain frequency in extreme overclocking conditions.

Core PLL IRefTune Offset

PLL Current Reference Tuning Offset, Range 0-15. Default is 0. The value provided in this field is added to the PLL fuse. The value after adding offset cannot exceed 0xF, it is does, FW clips the value to 0xF before writing back the value to fuse.

IA Atom PLL IRefTune Offset

PLL Current Reference Tuning Offset, Range 0-15. Default is 0. The value provided in this field is added to the PLL fuse. The value after adding offset cannot exceed 0xF, it is does, FW clips the value to 0xF before writing back the value to fuse.

External Voltages

NGU SVID Voltage

Configure the NGU Voltage requested by the cores. This adds a Voltage work point to System Agent Voltage Rail for the Processor to evaluate based on NGU Frequency. Configuration options: [Auto] [Manual Mode] [Offset Mode] [Adaptive Mode]

NOTE: The following items appears only when **NGU SVID Voltage** is set to **[Manual Mode]**.

CPU NGU Voltage Override

Configure the voltage for the CPU NGU. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.

NOTE: The following items appear only when **NGU SVID Voltage** is set to **[Offset Mode]** or **[Adaptive Mode]**.

Offset Mode Sign

- [+]: Offset the CPU NGU voltage by a positive value.
- [-]: Offset the CPU NGU voltage by a negative value.

Offset Voltage

Configure the CPU NGU voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.

NOTE: The following item appears only when **NGU SVID Voltage** is set to **[Adaptive Mode]**.

Additional Turbo Mode CPU NGU Voltage

Configure the amount of voltage fed to the CPU NGU when running in Turbo mode. Increase the voltage when configuring a high CPU NGU 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.

VCCIO 1.25v Voltage

Configure the voltage for the VCCIO. Use the <+> or <-> to adjust the value. The values range from 0.700V to 1.700V with an interval of 0.010V.

SOC 1.8v Voltage

Configure the voltage for the SOC 1.8v. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.400V with an interval of 0.010V.

CPU 1.8v Voltage

Configure the voltage for the CPU 1.8v. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.200V with an interval of 0.010V.

DDR 1.8v Voltage

Configure the voltage for the DDR 1.8v. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.400V with an interval of 0.010V.

Quiet 1.8v Voltage

Configure the voltage for the Quiet 1.8v. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.400V with an interval of 0.010V.

CPU Core Boot Voltage

The CPU voltage at initial boot up.

CPU System agent Boot Voltage

The CPU System agent voltage at initial boot up.

VNNAON Boot Voltage

The VNNAON voltage at initial boot up.

SOC 1.8v Boot Voltage

The SOC 1.8v voltage at initial boot up. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.400V with an interval of 0.010V.

CPU 1.8v Boot Voltage

The CPU 1.8v voltage at initial boot up. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.200V with an interval of 0.010V.

CPU Core Reset Voltage

Configure the voltage for the CPU Core when reset.

CPU System agent Reset Voltage

Configure the voltage for the CPU System agent when reset.

VNNAON Reset Voltage

Configure the voltage for the VNNAON when reset.

SOC 1.8v Reset Voltage

Configure the voltage for the SOC 1.8v when reset. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.400V with an interval of 0.010V.

CPU 1.8v Reset Voltage

Configure the voltage for the CPU 1.8v when reset. Use the <+> or <-> to adjust the value. The values range from 1.400V to 2.200V with an interval of 0.010V.

AI Features

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

Processor Utilization

This item allows you to view the Processor Utilization information.

Package Temperature Threshold

When regulation is set to enable, frequency will adjust to stay below this package temperature threshold.

Regulate Frequency by above Threshold

When enabled, frequency will adjust to stay below the above threshold. 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.

NOTE: 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.

Recalibrate Cooler

This will recalibrate your Cooler efficiency from scratch.

Cooler Re-evaluation Algorithm

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.

Ring Down Bin

Enable/Disable Ring Downbin feature. Default for Overclocking is [Disabled] to allow for a predictable ring ratio. 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.

Max. CPU Graphics Ratio

Configures the CPU graphics ratio. The ratio may vary depending on the system loading.

Min. CPU Cache Ratio

Configures the minimum possible CPU cache ratio.

Max. CPU Cache Ratio

Configures the maximum possible CPU cache ratio.

NGU Ratio

Set NGU Ratio. This adds a ratio work point to System Agent Voltage Frequency Curve for the Processor to map NGU SVID Voltage to. This is the maximum ratio the inter-connect within the SOC-Memory Controller runs at. Default is 26x.

CPU D2D Ratio

Set CPU D2D Ratio. D2D is an acronym for Die to Die and this is the ratio of the BUS connecting the different tiles. Default is 21x.

Extreme Over-voltage

[Enabled]: Set to this option to select a high overclocking voltage, but which may affect the CPU lifespan.

[Disabled]: Set to this option for CPU overvoltage protection.

NOTE: This item can only be enabled when the onboard CPU_OV jumper is switched on. [Enabled] allows higher voltages for overclocking, but the CPU lifetime will not be guaranteed.

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. Uses OC Mailbox command 0x15.

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

Actual VRM Core Input Voltage

Configure the VRM output rail for Core Voltage. Manual mode allows user-defined values. Offset mode modifies values by SVID.

Configuration options: [Auto] [Manual Mode] [Offset Mode]

NOTE: The following item appears only when **Actual VRM Core Input Voltage** is set to [Manual Mode].

CPU Core Voltage Override

Configure the voltage for the CPU Core. Use the <+> or <-> to adjust the value. The values range from 0.900V to 1.720V with an interval of 0.005V.

NOTE: The following items appear only when **Actual VRM Core Input 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.

Offset Voltage

Configure the CPU core voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> or <-> to adjust the value. The values range from 0.005V to 0.635V with an interval of 0.005V.

CPU DLVR Mode

Select Core(s) and RING DLVR Mode. Regulation Mode is the default recommended Mode and uses the Processor's Internal Regulator to feed the cores. Power Gate Mode bypasses this and feeds the cores directly from the VCore Rail Source.

Configuration options: [Auto] [Regulation Mode] [Power Gate Mode]

Performance Core DLVR Voltage

Configure the P-Core Voltage requested by the cores. Result may be influenced by Actual VRM Core Voltage.

Configuration options: [Auto] [Manual Mode] [Offset Mode] [Adaptive Mode]

NOTE: The following item appears only when **Performance Core DLVR Voltage** is set to **[Manual Mode]**.

CPU P-Core Voltage Override

Configure the voltage for the CPU P-Core. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.

NOTE: The following items appear only when **Performance Core DLVR Voltage** is set to **[Adaptive Mode]**.

Additional Turbo Mode Voltage

Configure the amount of voltage fed to the CPU P-Core when running in Turbo mode. Increase the voltage when configuring a high CPU P-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.

NOTE: The following items appear only when **Performance Core DLVR Voltage** is set to **[Offset Mode]**, or **[Adaptive Mode]**.

Offset Mode Sign

[+] To offset the CPU P-Core voltage by a positive value.

[-] To offset the CPU P-Core voltage by a negative value.

Offset Voltage

Configure the CPU P-Core voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.

Efficient Core DLVR Voltage

Configure the E-Core Voltage requested by the cores. Result may be influenced by Actual VRM Core Voltage.

Configuration options: [Auto] [Manual Mode] [Offset Mode] [Adaptive Mode]

NOTE: The following item appears only when **Efficient Core DLVR Voltage** is set to **[Manual Mode]**.

CPU E-Core Voltage Override

Configure the voltage for the CPU E-Core. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.

NOTE: The following item appears only when **Efficient Core DLVR Voltage** is set to **[Adaptive Mode]**.

Additional Turbo Mode Voltage

Configure the amount of voltage fed to the CPU E-Core when running in Turbo mode. Increase the voltage when configuring a high CPU P-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.

NOTE: The following items appear only when **Efficient Core DLVR Voltage** is set to **[Offset Mode]**, or **[Adaptive Mode]**.

Offset Mode Sign

[+] To offset the CPU E-Core voltage by a positive value.

[-] To offset the CPU E-Core voltage by a negative value.

Offset Voltage

Configure the CPU E-Core voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.

Ring DLVR Voltage

Configure the Ring Voltage requested by the cores.

Configuration options: [Auto] [Manual Mode] [Offset Mode] [Adaptive Mode]

NOTE: The following item appears only when **Ring DLVR Voltage** is set to **[Manual Mode]**.

CPU Ring Voltage Override

Configure the voltage for the CPU Ring. The values range from 0.600V to 1.700V with an interval of 0.001V.

NOTE: The following item appears only when **Ring DLVR Voltage** is set to **[Adaptive Mode]**.

Additional Turbo Mode Voltage

Configure the amount of voltage fed to the CPU Ring when running in Turbo mode. Increase the voltage when configuring a high CPU Ring 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.

NOTE: The following items appear only when **Ring DLVR Voltage** is set to **[Offset Mode]**, or **[Adaptive Mode]**.

Offset Mode Sign

- [+]: To offset the CPU Ring voltage by a positive value.
- [-]: To offset the CPU Ring voltage by a negative value.

Offset Voltage

Configure the CPU Ring voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.

CPU Graphics Voltage

Configure the VRM output rail for CPU Graphics Voltage. Manual mode allows user-defined values. Offset mode modifies values by SVID.
Configuration options: [Auto] [Manual Mode] [Offset Mode]

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

CPU Graphics Voltage Override

Configure the voltage for the CPU Graphics. Use the <+> or <-> to adjust the value. The values range from 0.700V to 1.700V with an interval of 0.005V.

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

Offset Mode Sign

- [+]: Offset the CPU Graphics voltage by a positive value.
- [-]: Offset the CPU Graphics voltage by a negative value.

Offset Voltage

Configure the CPU Graphics voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> or <-> to adjust the value. The values range from 0.005V to 0.635V with an interval of 0.005V.

CPU System agent Voltage

Configure the VRM output rail for CPU System agent Voltage. Manual mode allows user-defined values. Offset mode modifies values by SVID.
Configuration options: [Auto] [Manual Mode] [Offset Mode]

NOTE: The following item appears only when **CPU System agent Voltage** is set to **[Manual Mode]**.

CPU System agent Voltage Override

Configure the voltage for the CPU System agent. Use the <+> or <-> to adjust the value. The values range from 0.700V to 1.700V with an interval of 0.005V.

NOTE: The following items appear only when **CPU System agent Voltage** is set to **[Offset Mode]**.

Offset Mode Sign

- [+]: Offset the CPU System agent voltage by a positive value.
[-]: Offset the CPU System agent voltage by a negative value.

Offset Voltage

Configure the CPU System agent voltage offset value. Save changes and reset the system for the change to take effect. Use the <+> or <-> to adjust the value. The values range from 0.005V to 0.635V with an interval of 0.005V.

VNNAON 0.77v Voltage

Configure the VRM output rail for VNNAON Voltage. Manual mode allows user-defined values. This rail may help CPU D2D Ratio overclock.

Configuration options: [Auto] [Manual Mode]

NOTE: The following item appears only when **VNNAON 0.77v Voltage** is set to **[Manual Mode]**.

VNNAON Voltage Override

Configure the voltage for the VNNAON. Use the <+> or <-> to adjust the value. The values range from 0.770V to 1.400V with an interval of 0.010V.

Memory Controller Voltage

Configure the voltage for the MC Voltage. Use the <+> or <-> to adjust the value. The values range from 0.900V to 1.800V with an interval of 0.010V.

High DRAM Voltage Mode

If Disabled, the upper range for DRAM Voltage will be 1.435V. If 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.

DRAM VDDQ Voltage

Power for the DRAM ICs' VDD Data portion.

Advanced Memory Voltages

VccDdqControl Bypass

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

Vddq Voltage Override

Vddq Voltage default is 1.1v.

VcclogControl Bypass

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

Vcclog Voltage Override

Vcclog Voltage default is 0.85v.

VccClk Voltage Override

VccClk Voltage default is 0.85v.

MC Voltage Calculation Voltage Base

The Base MC Voltage used for Calculations.

VDD Calculation Voltage Base

The Base VDD Voltage used for Calculations.

PMIC Voltages

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

NOTE: The following items appear only when **PMIC Voltages** is set to **[Sync All PMICs]**.

SPD HUB VLDO (1.8V)

Main power for the SPD Hub Logic. Default is 1.8V.

SPD HUB VDDIO (1.0V)

Power for the SPD Hub side-band interface. Default is 1.0V.

DRAM VDD Voltage

Power for the DRAM ICs' VDD portion.

DRAM VDDQ Voltage

Power for the DRAM ICs' VDD Data portion.

DRAM VPP Voltage

DRAM Activating Power Supply.

DRAM VDD Switching Frequency

Switching Frequency of DRAM VDD Regulator in MHz.

DRAM VDDQ Switching Frequency

Switching Frequency of DRAM VDDQ Regulator in MHz.

DRAM VPP Switching Frequency

Switching Frequency of DRAM VPP Regulator in MHz.

DRAM Current Capability

Current Capability for the Switching Regulators in Amps.

NOTE: The following items appear only when **PMIC Voltages** is set to **[By per PMIC]**.

PMIC0-1 SPD HUB VLDO (1.8V)

Main power for the SPD Hub Logic. Default is 1.8V.

PMIC0-1 SPD HUB VDDIO (1.0V)

Power for the SPD Hub side-band interface. Default is 1.0V.

PMIC0-1 DRAM VDD Voltage

Power for the DRAM ICs' VDD portion.

PMIC0-1 DRAM VDDQ Voltage

Power for the DRAM ICs' VDD Data portion.

PMIC0-1 DRAM VPP Voltage

DRAM Activating Power Supply.

PMIC0-1 DRAM VDD Switching Frequency

Switching Frequency of DRAM VDD Regulator in MHz.

PMIC0-1 DRAM VDDQ Switching Frequency

Switching Frequency of DRAM VDDQ Regulator in MHz.

PMIC0-1 DRAM VPP Switching Frequency

Switching Frequency of DRAM VPP Regulator in MHz.

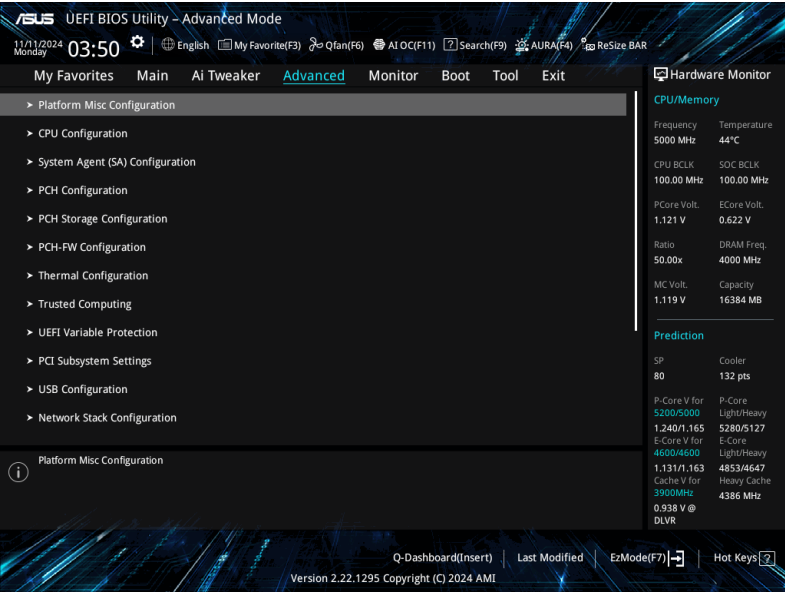
PMIC0-1 DRAM Current Capability

Current Capability for the Switching Regulators in Amps.

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.

CAUTION! 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.

PCI Express Native Power Management

For enhanced PCI Express power saving. Select [Enabled] to perform Active State Power Management (ASPM) operations in OS.

Configuration options: [Disabled] [Enabled]

NOTE: 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

Set the ASPM Level.

Configuration options: [Disabled] [L0s] [L1] [L0sL1] [Auto]

L1 Substates

PCI Express L1 Substates settings.

Configuration options: [Disabled] [L1.1] [L1.1 & L1.2]

SA - PCI Express

DMI ASPM

DMI ASPM Support.

Configuration options: [Disabled] [Auto] [ASPM L1]

ASPM

Set the ASPM Level.

Configuration options: [Disabled] [L0s] [L1] [L0sL1] [Auto]

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.

CAUTION! 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.

Intel (VMX) Virtualization Technology

When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.

Configuration options: [Disabled] [Enabled]

Per Core Control

Configuration options: [Disabled] [Enabled]

NOTE: The following item appears only when **Per Core Control** is set to **[Enabled]**.

Processor Disable

Core 0-23 Control (E-core)

Configuration options: [Disabled] [Enabled]

NOTE: The following items appear only when **Per Core Control** is set to **[Disabled]**.

Active Performance Cores

Number of cores to enable in each processor package.

Configuration options: [All] [1] [2] [3] [4] [5] [6] [7]

Active Efficient Cores

Number of Efficient cores to enable in each processor package.

Configuration options: [All] [0] [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31]

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

Active SOC-North Efficient-cores

Number of SOC-North Efficient-cores to enable in SOC North.

Configuration options: [All] [0] [1]

Total Memory Encryption

Configure Total Memory Encryption (TME) to protect DRAM data from physical attacks.

When this option is configured as **[Enabled]**, **VT-d** option must be **[Enabled]**.

This option will be grayed out when **VT-d** option is configured as **[Disabled]**.

CPU - Power Management Control

Boot performance mode

Select the performance state that the BIOS will set starting from reset vector.

Configuration options: [Max Battery] [Max Non-Turbo Performance] [Turbo Performance]

Intel(R) SpeedStep(tm)

Supports more than two frequency ranges.

Configuration options: [Disabled] [Enabled]

Intel(R) Speed Shift Technology

Enables/disables the Intel(R) Speed Shift Technology support. When enabled, CPPC v2 interface allows hardware controlled P-states.

Configuration options: [Disabled] [Enabled]

Turbo Mode

Enable/Disable processor Turbo Mode (requires EMTTM enabled too).

Configuration options: [Disabled] [Enabled]

CPU C-states

Enable/Disable CPU Power Management. Allows CPU to go to C states when it's not 100% utilized.

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

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

Enhanced C-states

Enables/disables C1E. When enabled, CPU slows down to minimum speed when all cores enter the C-state.

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

Package C State Limit

Maximum Package C State Limit Setting. **[Cpu Default]** Leaves to Factory default value. **[Auto]** Initializes to deepest available Package C State Limit.

Configuration options: [C0/C1] [C2] [C3] [C6] [C7] [C7S] [C8] [C9] [C10] [Cpu Default] [Auto]

Thermal Monitor

Configuration options: [Disabled] [Enabled]

Dual Tau Boost

Enable Dual Tau Boost feature. This is only applicable for Desktop 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

Check to enable VT-d function on MCH.

Configuration options: [Enabled] [Disabled]

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

Control Iommu Pre-boot Behavior

Enable IOMMU in Pre-boot environment (If DMAR table is installed in DXE and If VTD_INFO_PPI is installed in PEI).

Configuration options: [Enabled] [Disabled]

Memory Configuration

Memory Remap

Enable/Disable Memory Remap above 4GB.

Configuration options: [Enabled] [Disabled]

Graphics Configuration

Internal Graphics

Keep IGFX enabled based on the setup options.

Configuration options: [Enabled] [Disabled]

DVMT Pre-Allocated

Select DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.

Configuration options: [32M] [64M] [96M] [128M]

RC6(Render Standby)

Check to enable render standby support.

Configuration options: [Enabled] [Disabled]

VMD Setup menu

Enable VMD controller

Enable/Disable VMD controller.

Configuration options: [Enabled] [Disabled]

Map PCIE Storage under VMD

Map/Unmap PCIE Storage to VMD.

Configuration options: [Enabled] [Disabled]

Map SATA Controller under VMD

Map/Unmap this Root Port to VMD.

Configuration options: [Enabled] [Disabled]

PCI Express Configuration

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

NOTE: 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.

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.

NOTE: 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.

6.5 PCH Storage Configuration

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

NOTE: 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]

NOTE: 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]

NOTE: The SATA items may vary according to your motherboard's ports/slots. Please refer to the BIOS of your motherboard for the actual settings and options.

M.2

Enable or disable the selected SATA port.

Configuration options: [Disabled] [Enabled]

M.2 Hot Plug

Designates this port as Hot Pluggable.

Configuration options: [Disabled] [Enabled]

SATA6G

Enable or Disable SATA Port.

Configuration options: [Disabled] [Enabled]

SATA6G Hot Plug

Designates this port as Hot Pluggable.

Configuration options: [Disabled] [Enabled]

6.6 PCH-FW Configuration

This item allows you to configure the Management Engine Technology parameters.

TPM Device Selection

Selects TPM device: Firmware TPM or Discrete TPM.

[Enable Discrete TPM] Enable Discrete TPM, disable platform Firmware TPM.

[Enable Firmware TPM] Enable platform Firmware TPM, disable Discrete TPM. If you plug in Discrete TPM card on your Mother Board, please select this option to Discrete TPM.

6.7 Thermal Configuration

The items in this menu allow you to configure Thermal Parameters.

Intel(R) Innovation Platform Framework Configuration

This submenu allows you to configure Intel(R) Innovation Platform Framework Configuration options.

Intel(R) Innovation Platform Framework

Allows you to enable or disable Intel Innovation Platform Thermal Framework.

Configuration options: [Disabled] [Enabled]

6.8 Trusted Computing

The items in this menu allow you to configure the Trusted Computing settings.

NOTE: 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.

Security Device Support

Enables or Disables BIOS support for security device. O.S. will not show Security Device.

TCG EFI protocol and INT1A interface will not be available.

Configuration options: [Disable] [Enable]

NOTE: The following items appear only when **Security Device Support** is set to [Enable].

SHA256 PCR Bank

Allows you to enable or disable the SHA256 PCR Bank.

Configuration options: [Disabled] [Enabled]

Pending operation

Allows you to schedule an Operation for the Security Device.

Configuration options: [None] [TPM Clear]

NOTE: Your computer will reboot during restart in order to change the State of the Security Device.

Platform Hierarchy

Allows you to enable or disable the Platform Hierarchy.

Configuration options: [Disabled] [Enabled]

Storage Hierarchy

Allows you to enable or disable the Storage Hierarchy.

Configuration options: [Disabled] [Enabled]

Endorsement Hierarchy

Allows you to enable or disable the Endorsement Hierarchy.

Configuration options: [Disabled] [Enabled]

Physical Presence Spec Version

Allows you to select to Tell O.S. to support PPI Version 1.2 or 1.3.

Configuration options: [1.2] [1.3]

NOTE: Some HCK tests might not support 1.3.

6.9 UEFI Variables Protection

The items in this menu allow you to configure the NVRAM Runtime Variable Protection settings.

Password protection of Runtime Variables

Allows you to control the NVRAM Runtime Variable Protection through System Admin Password.

Configuration options: [Disable] [Enable]

6.10 PCI Subsystem Settings

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

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]

NOTE: To enable Re-Size BAR Support for harnessing full GPU memory, please go to the **Boot** section.

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]

6.11 USB Configuration

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

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.

USB Single Port Control

Allows you to enable or disable the individual USB ports.

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

6.12 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]

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

Ipv4 PXE Support

Allows you to enable or disable the Ipv4 PXE boot support.

Configuration options: [Disabled] [Enabled]

Ipv6 PXE Support

Allows you to enable or disable the Ipv6 PXE boot support.

Configuration options: [Disabled] [Enabled]

6.13 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.

NOTE: 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.

6.14 HDD/SSD SMART Information

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

NOTE:

- 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.
 - NVMe Express devices do not support SMART information.
-

6.15 APM Configuration

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

Restore AC Power Loss

Allows you to set the AC power state to enter when power is re-applied after a power failure.

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]

6.16 Thunderbolt(TM) Configuration

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

NOTE: 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.

PCI-E Tunneling over USB4

Allows you to enable or disable PCI-E Tunneling over USB4.

Configuration options: [Disabled] [Enabled]

USB4 CM Mode

[Software CM] The system boots with SW CM in both BIOS and OS phase.

[CM Debug] The system with boot without any CM in BIOS phase, then boot to OS with the CM based on OS' preference by every boot.

Integrated Thunderbolt(TM) Enable

Enable or Disable Integrated Thunderbolt(TM).

Configuration options: [Disabled] [Enabled]

NOTE: The following item appears only when **Integrated Thunderbolt(TM) Enable** is set to **[Enabled]**.

Integrated Thunderbolt(TM) Configuration

Os Native Resource Balance

Configuration options: [Disabled] [Enabled]

Connect Topology Timeout value for ITBT

Connect Topology Timeout value for Integrated Thunderbolt(TM) Controller.

Force Poweron Timeout value for ITBT

Force Poweron Timeout value for Integrated Thunderbolt(TM).

ITBT RTD3

Configuration options: [Disabled] [Enabled]

NOTE: ITBT RTD3 Disabled is not supported when SW CM is applied for OS3.

ITBT RTD3 EXIT DELAY

ITBT RTD3 EXIT DELAY (milli seconds)

PCIE ITBT RTD3 POLLING LINK ACTIVE TIMEOUT

Adjust link active polling time during D3C exit and delay in PS0 before return to OS (milli seconds).

ITBT Root Port 0 Configuration

ITBT Root Port 0

Configuration options: [Disabled] [Enabled]

Extra Bus Reserved

Extra Bus Reserved 42. Extra Bus Reserved is required for each layer = (Extra Bus Reserved on the previous layer - 2 - the number of non-hot-plug ports in the current layer) / the number of hot-plug ports in the current layer.

Reserved Memory

Reserved Memory for this Root Bridge (1-4096) MB.

Memory Alignment

Memory Alignment (0-31 bits).

Reserved PMemory

Reserved Prefetchable Memory for this Root Bridge (1-32768) MB.

PMemory Alignment

PMemory Alignment (0-31 bits).

Thunderbolt 5 Enable

Configuration options: [Disabled] [Enabled]

NOTE: The following items appear only when **Thunderbolt 5 Enable** is set to **[Enabled]**.

USB4 Host Router Class Code

Option for class code to be applied to Host Router for loading different driver.

[Auto] Determined by OSPM USB support.

[Intel USB4 Ver2] Intel USB4 Ver2 driver.

[USB4 Standard] OS inbox driver.

Thunderbolt 5 Configuration

GPIO Force Pwr

Set GPIO3 to 1/0.

Configuration options: [Disabled] [Enabled]

GPIO filter

GPIO filter is needed to avoid electrical noise on PCH GPIOs during hotplug of 12V USB devices.

Configuration options: [Disabled] [Enabled]

TBT Controller Configuration

TBT Host Router

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

Extra Bus Reserved

Extra Bus Reserved 56-One port Host, 106-Two port Host.

Reserved Memory

Allows you to set the Reserved Memory for this Root Bridge (1-4096) MB.

Memory alignment

Memory Alignment (0-31 bits)

Reserved PMemory

Reserved Prefetchable Memory for this Root Bridge (1-32768) MB.

PMemory alignment

PMemory Alignment (0-31 bits).

Reserved I/O

Allows you to set Reserved I/O.

6.17 Onboard Devices Configuration

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

NOTE: 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.

CPU TypeC Mode

[Alternate Mode] USB/DP alternate mode

[USB4 Mode] USB4 Mode

PCIe Bandwidth Bifurcation Configuration

[Auto] Run full PCIe X16 mode by default. If PCIe devices are detected in PCIEX16(G5)_2, PCIEX16(G5)_1 will run at X8.

[PCIEX16 Mode] PCIEX16(G5)_1 runs full PCIe X16 mode.

[PCIEX8X4X4 Mode] Split up PCIEX16(G5)_1 that runs at X16 into X8/X4/X4.

[GPU with M.2 storage] PCIEX16(G5)_1 slot will support a graphics card running at x8 and a NVMe M.2 SSD running at x4.

HD Audio

Controls the detection of the HD-Audio device.

[Disabled] HDA will be unconditionally disabled.

[Enabled] HDA will be unconditionally enabled.

Intel LAN Controller

Allows you to enable or disable Intel LAN.

Configuration options: [Disabled] [Enabled]

10G LAN Card

Enable/Disable 10G LAN Card.

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]

Wi-Fi Controller

Allows you to enable or disable Wi-Fi Controller.

Configuration options: [Disabled] [Enabled]

Bluetooth Controller

Allows you to enable or disable Bluetooth Controller.

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 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.

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

Windows Dynamic Lighting

Windows Dynamic Lighting allows users to control RGB devices through Windows Settings.

Configuration options: [Disabled] [Enabled]

NOTE:

- Compatible is limited to Windows 11 OS builds 22H2.23H2 and later, so ensure to verify your system's compatibility before activating it.
 - The aura effect may be limited due to technical constraints when Windows Dynamic Lighting is enabled.
-

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 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.

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

Serial Port Configuration

Set Parameters of Serial Port.

NOTE: This item function only if there is a serial port(COM) connector on a motherboard.

Serial Port

Enable or Disable Serial Port (COM).

Configuration options: [Disabled] [Enabled]

Change Settings

Select an optimal setting for Super IO device.

Configuration options: [IO=3F8h; IRQ=4] [IO=2F8h; IRQ=3] [IO=3E8h; IRQ=4] [IO=2E8h; IRQ=3]

M.2_5 Configuration

[Auto]: Auto-detects the M.2_5 device mode.

[SATA mode]: Only supports M.2_5 SATA devices.

[PCIe mode]: Only supports M.2_5 PCIe devices.

6.18 Intel(R) Rapid Storage Technology

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

NOTE:

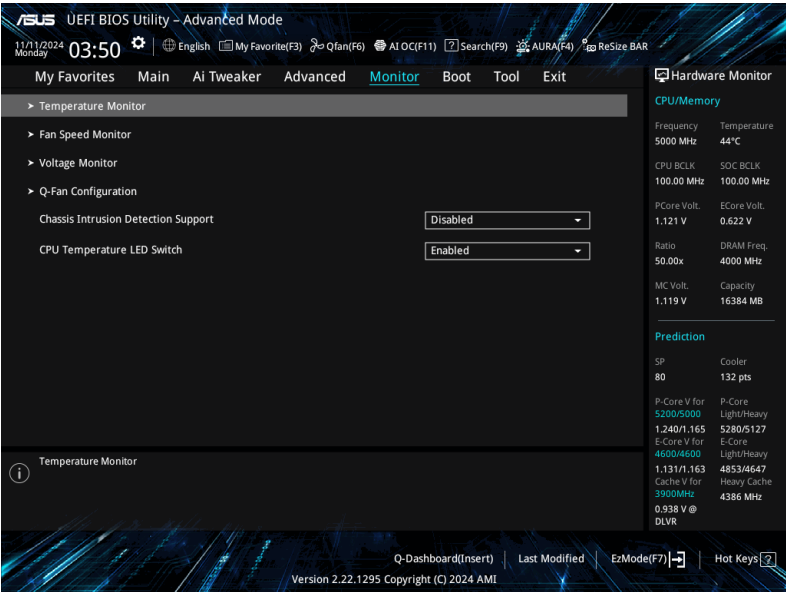
- The settings and options of this menu may vary depending on the storage devices connected. Please refer to the BIOS of your motherboard for the actual settings and options.
 - Ensure to set the **VMD Setup** menu before using **Intel(R) Rapid Storage Technology** to create a RAID set.
-

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.

NOTE: 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/Out T Sensor Temperature, DIMM A Temperature, DIMM B 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 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.

Voltage Monitor

VRM Core Input 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.

Q-Fan Configuration

Q-Fan Tuning

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

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

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]

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

Chassis Fan Q-Fan Source

The assigned fan/pump will be controlled according to the selected temperature source.

Configuration options: [CPU] [CPU Package]

CPU Fan Step Up

Step up allows you to adjust how quickly the fan rotation speed increases, 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 decreases, 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 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]**

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

CPU Fan Point8 Temperature

When the temperature source is lower than the temperature of P8, the duty cycle will be determined according to the P7-P8 and the temperature source. When the temperature source is higher than the temperature of P8, the fan will operate at the duty cycle of P8.

CPU Fan Point8 Duty Cycle (%)

When the temperature source is lower than the temperature of P8, the duty cycle will be determined according to the P7-P8 and the temperature source. When the temperature source is higher than the temperature of P8, the fan will operate at the duty cycle of P8.

CPU Fan Point7 Temperature

When the temperature source is lower than the temperature of P7, the duty cycle will be determined according to the P6-P7 and the temperature source. When the temperature source is higher than the temperature of P7, the duty cycle will be determined according to the P7-P8 and the temperature source.

CPU Fan Point7 Duty Cycle (%)

When the temperature source is lower than the temperature of P7, the duty cycle will be determined according to the P6-P7 and the temperature source. When the temperature source is higher than the temperature of P7, the duty cycle will be determined according to the P7-P8 and the temperature source.

CPU Fan Point6 Temperature

When the temperature source is lower than the temperature of P6, the duty cycle will be determined according to the P5-P6 and the temperature source. When the temperature source is higher than the temperature of P6, the duty cycle will be determined according to the P6-P7 and the temperature source.

CPU Fan Point6 Duty Cycle (%)

When the temperature source is lower than the temperature of P6, the duty cycle will be determined according to the P5-P6 and the temperature source. When the temperature source is higher than the temperature of P6, the duty cycle will be determined according to the P6-P7 and the temperature source.

CPU Fan Point5 Temperature

When the temperature source is lower than the temperature of P5, the duty cycle will be determined according to the P4-P5 and the temperature source. When the temperature source is higher than the temperature of P5, the duty cycle will be determined according to the P5-P6 and the temperature source.

CPU Fan Point5 Duty Cycle (%)

When the temperature source is lower than the temperature of P5, the duty cycle will be determined according to the P4-P5 and the temperature source. When the temperature source is higher than the temperature of P5, the duty cycle will be determined according to the P5-P6 and the temperature source.

CPU Fan Point4 Temperature

When the temperature source is lower than the temperature of P4, the duty cycle will be determined according to the P3-P4 and the temperature source. When the temperature source is higher than the temperature of P4, the duty cycle will be determined according to the P4-P5 and the temperature source.

CPU Fan Point4 Duty Cycle (%)

When the temperature source is lower than the temperature of P4, the duty cycle will be determined according to the P3-P4 and the temperature source. When the temperature source is higher than the temperature of P4, the duty cycle will be determined according to the P4-P5 and the temperature source.

CPU Fan Point3 Temperature

When the temperature source is lower than the temperature of P3, the duty cycle will be determined according to the P2-P3 and the temperature source. When the temperature source is higher than the temperature of P3, the duty cycle will be determined according to the P3-P4 and the temperature source.

CPU Fan Point3 Duty Cycle (%)

When the temperature source is lower than the temperature of P3, the duty cycle will be determined according to the P2-P3 and the temperature source. When the temperature source is higher than the temperature of P3, the duty cycle will be determined according to the P3-P4 and the temperature source.

CPU Fan Point2 Temperature

When the temperature source is lower than the temperature of P2, the duty cycle will be determined according to the P1-P2 and the temperature source. When the temperature source is higher than the temperature of P2, the duty cycle will be determined according to the P2-P3 and the temperature source.

CPU Fan Point2 Duty Cycle (%)

When the temperature source is lower than the temperature of P2, the duty cycle will be determined according to the P1-P2 and the temperature source. When the temperature source is higher than the temperature of P2, the duty cycle will be determined according to the P2-P3 and the temperature source.

CPU Fan Point1 Temperature

When the temperature source is lower than the temperature of P1, the fan will operate at the duty cycle of P1. When the temperature source is higher than the temperature of P1, the duty cycle will be determined according to the P1-P2 and the temperature source.

CPU Fan Point1 Duty Cycle (%)

When the temperature source is lower than the temperature of P1, the fan will operate at the duty cycle of P1. When the temperature source is higher than the temperature of P1, the duty cycle will be determined according to the P1-P2 and the temperature source.

Chassis Fan(s) Configuration

Chassis Fan Q-Fan Control

Allows you to set the Chassis 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. |

Chassis 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]

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

Chassis Fan Q-Fan Source

The assigned fan/pump will be controlled according to the selected temperature source.

Configuration options: [CPU] [CPU Package] [MotherBoard] [Chipset] [VRM] [T_Sensor] [Multiple Sources]

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

Chassis Fan Step Up

Step up allows you to adjust how quickly the fan rotation speed increases, 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 Step Down

Step down allows you to adjust how quickly the fan rotation speed decreases, 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 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]

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

Chassis Fan Point8 Temperature

When the temperature source is lower than the temperature of P8, the duty cycle will be determined according to the P7-P8 and the temperature source. When the temperature source is higher than the temperature of P8, the fan will operate at the duty cycle of P8.

Chassis Fan Point8 Duty Cycle (%)

When the temperature source is lower than the temperature of P8, the duty cycle will be determined according to the P7-P8 and the temperature source. When the temperature source is higher than the temperature of P8, the fan will operate at the duty cycle of P8.

Chassis Fan Point7 Temperature

When the temperature source is lower than the temperature of P7, the duty cycle will be determined according to the P6-P7 and the temperature source. When the temperature source is higher than the temperature of P7, the duty cycle will be determined according to the P7-P8 and the temperature source.

Chassis Fan Point7 Duty Cycle (%)

When the temperature source is lower than the temperature of P7, the duty cycle will be determined according to the P6-P7 and the temperature source. When the temperature source is higher than the temperature of P7, the duty cycle will be determined according to the P7-P8 and the temperature source.

Chassis Fan Point6 Temperature

When the temperature source is lower than the temperature of P6, the duty cycle will be determined according to the P5-P6 and the temperature source. When the temperature source is higher than the temperature of P6, the duty cycle will be determined according to the P6-P7 and the temperature source.

Chassis Fan Point6 Duty Cycle (%)

When the temperature source is lower than the temperature of P6, the duty cycle will be determined according to the P5-P6 and the temperature source. When the temperature source is higher than the temperature of P6, the duty cycle will be determined according to the P6-P7 and the temperature source.

Chassis Fan Point5 Temperature

When the temperature source is lower than the temperature of P5, the duty cycle will be determined according to the P4-P5 and the temperature source. When the temperature source is higher than the temperature of P5, the duty cycle will be determined according to the P5-P6 and the temperature source.

Chassis Fan Point5 Duty Cycle (%)

When the temperature source is lower than the temperature of P5, the duty cycle will be determined according to the P4-P5 and the temperature source. When the temperature source is higher than the temperature of P5, the duty cycle will be determined according to the P5-P6 and the temperature source.

Chassis Fan Point4 Temperature

When the temperature source is lower than the temperature of P4, the duty cycle will be determined according to the P3-P4 and the temperature source. When the temperature source is higher than the temperature of P4, the duty cycle will be determined according to the P4-P5 and the temperature source.

Chassis Fan Point4 Duty Cycle (%)

When the temperature source is lower than the temperature of P4, the duty cycle will be determined according to the P3-P4 and the temperature source. When the temperature source is higher than the temperature of P4, the duty cycle will be determined according to the P4-P5 and the temperature source.

Chassis Fan Point3 Temperature

When the temperature source is lower than the temperature of P3, the duty cycle will be determined according to the P2-P3 and the temperature source. When the temperature source is higher than the temperature of P3, the duty cycle will be determined according to the P3-P4 and the temperature source.

Chassis Fan Point3 Duty Cycle (%)

When the temperature source is lower than the temperature of P3, the duty cycle will be determined according to the P2-P3 and the temperature source. When the temperature source is higher than the temperature of P3, the duty cycle will be determined according to the P3-P4 and the temperature source.

Chassis Fan Point2 Temperature

When the temperature source is lower than the temperature of P2, the duty cycle will be determined according to the P1-P2 and the temperature source. When the temperature source is higher than the temperature of P2, the duty cycle will be determined according to the P2-P3 and the temperature source.

Chassis Fan Point2 Duty Cycle (%)

When the temperature source is lower than the temperature of P2, the duty cycle will be determined according to the P1-P2 and the temperature source. When the temperature source is higher than the temperature of P2, the duty cycle will be determined according to the P2-P3 and the temperature source.

Chassis Fan Point1 Temperature

When the temperature source is lower than the temperature of P1, the fan will operate at the duty cycle of P1. When the temperature source is higher than the temperature of P1, the duty cycle will be determined according to the P1-P2 and the temperature source.

Chassis Fan Point1 Duty Cycle (%)

When the temperature source is lower than the temperature of P1, the fan will operate at the duty cycle of P1. When the temperature source is higher than the temperature of P1, the duty cycle will be determined according to the P1-P2 and the temperature source.

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]

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]

NOTE: 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] [CPU Package] [MotherBoard] [Chipset] [VRM] [T_Sensor] [Multiple Sources]

AIO Pump Step Up

Step up allows you to adjust how quickly the fan rotation speed increases, 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 decreases, 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 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]

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

AIO Pump Point8 Temperature

When the temperature source is lower than the temperature of P8, the duty cycle will be determined according to the P7-P8 and the temperature source. When the temperature source is higher than the temperature of P8, the fan will operate at the duty cycle of P8.

AIO Pump Point8 Duty Cycle (%)

When the temperature source is lower than the temperature of P8, the duty cycle will be determined according to the P7-P8 and the temperature source. When the temperature source is higher than the temperature of P8, the fan will operate at the duty cycle of P8.

AIO Pump Point3 Duty Cycle (%)

When the temperature source is lower than the temperature of P3, the duty cycle will be determined according to the P2-P3 and the temperature source. When the temperature source is higher than the temperature of P3, the duty cycle will be determined according to the P3-P4 and the temperature source.

AIO Pump Point2 Temperature

When the temperature source is lower than the temperature of P2, the duty cycle will be determined according to the P1-P2 and the temperature source. When the temperature source is higher than the temperature of P2, the duty cycle will be determined according to the P2-P3 and the temperature source.

AIO Pump Point2 Duty Cycle (%)

When the temperature source is lower than the temperature of P2, the duty cycle will be determined according to the P1-P2 and the temperature source. When the temperature source is higher than the temperature of P2, the duty cycle will be determined according to the P2-P3 and the temperature source.

AIO Pump Point1 Temperature

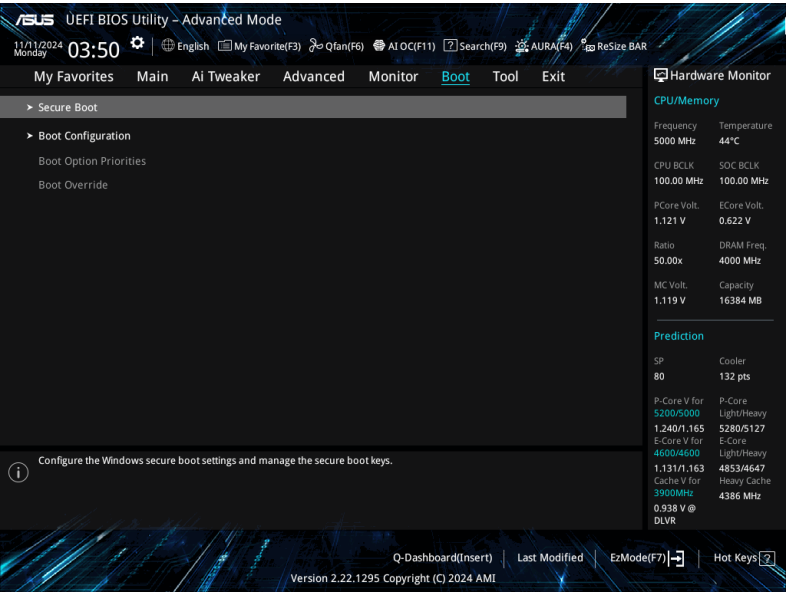
When the temperature source is lower than the temperature of P1, the fan will operate at the duty cycle of P1. When the temperature source is higher than the temperature of P1, the duty cycle will be determined according to the P1-P2 and the temperature source.

AIO Pump Point1 Duty Cycle (%)

When the temperature source is lower than the temperature of P1, the fan will operate at the duty cycle of P1. When the temperature source is higher than the temperature of P1, the duty cycle will be determined according to the P1-P2 and the temperature source.

8. Boot menu

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



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.

NOTE: 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]

NOTE: 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]

IMPORTANT! 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).

NOTE: 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]

IMPORTANT! 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]

IMPORTANT! 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]

IMPORTANT! 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]

NOTE: 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.

NOTE: 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]

IMPORTANT! This feature only works when set under normal boot.

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

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]

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

Determines 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.

NOTE: The following item appears only when **Boot Sector (MBR/GPT) Recovery Policy** is set to **[Local User Control]**.

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.

IMPORTANT!

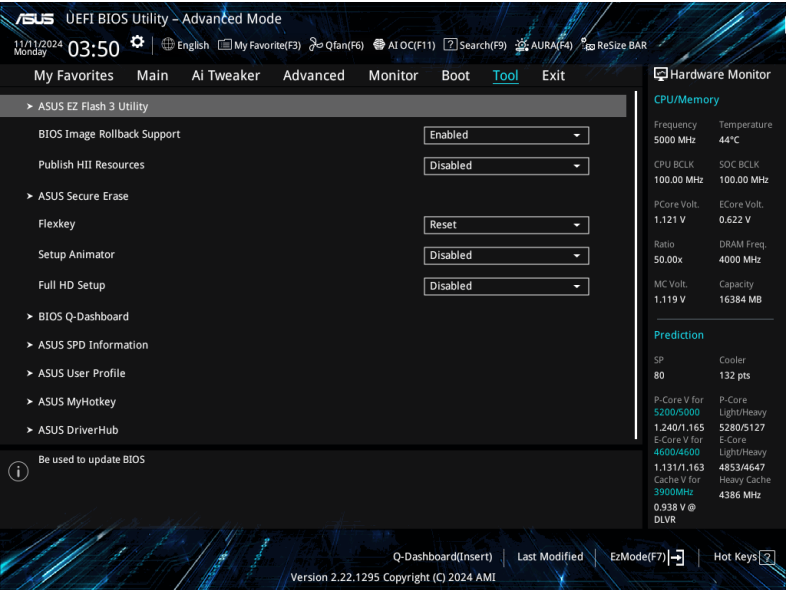
- To access Windows® OS in Safe Mode, press <F8 > after POST (Windows® 8 not supported).
 - To select the boot device during system startup, press <F8> when ASUS Logo appears.
-

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]

NOTE: The availability of the following items may vary according to your motherboard. Please refer to the BIOS of your motherboard for the actual settings and options.

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.

Setup Animator

Allows you to enable or disable the Setup animator.

Configuration options: [Disabled] [Enabled]

Full HD Setup

Enable this feature to have a 1920x1080 resolution for BIOS Setup. Please note the feature is supported when your monitor and graphics card are both 1080p or above. This feature may be limited by the compatibility of your GPU and monitor pairing. When the BIOS detects a Clear CMOS action, the BIOS will forcibly set the Full HD Setup to [Disabled] during this boot process.

Configuration options: [Disabled] [Enabled]

9.1 ASUS EZ Flash Utility

This item allows you to run ASUS EZ Flash. 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.

NOTE: For more details, refer to section **ASUS EZ Flash**.

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.

NOTE:

- 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.
 - **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 BIOS Q-Dashboard

This item allows you to access the BIOS Q-Dashboard feature. This feature provides you with a perspective of the motherboard with vital components and connectors labeled for quick access.

NOTE: For more details, refer to section **Q-Dashboard**.

9.4 ASUS SPD Information

This item allows you to view the DRAM SPD information.

9.5 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**.

NOTE:

- 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.

9.6 ASUS MyHotkey

This menu allow you to configure Hotkeys.

NOTE: 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.

Hotkey F3

Press <F3> to enter UEFI-USB or UEFI-HDD or UEFI-CDROM/DVDROM or UEFI-PXE or ASUS AZ Flash 3 in POST.

Configuration options: [Disabled] [Boot from UEFI USB] [Boot from UEFI HDD] [Boot from UEFI CDROM/DVDROM] [Boot from UEFI PXE] [Toggle ASUS EZ Flash]

NOTE: Please make sure Network is enabled before AsusMyHotkey is set to Boot From UEFI PXE. (Advanced -> Network Stack Configuration -> Network Stack)

Hotkey F4

Press F4 to enter UEFI-USB or UEFI-HDD or UEFI-CDROM/DVDROM or UEFI-PXE or ASUS EZ Flash in POST.

Configuration options: [Disabled] [Boot from UEFI USB] [Boot from UEFI HDD] [Boot from UEFI CDROM/DVDROM] [Boot from UEFI PXE] [Toggle ASUS EZ Flash]

NOTE: Please make sure Network is enabled before AsusMyHotkey is set to Boot From UEFI PXE.
(Advanced -> Network Stack Configuration -> Network Stack)

9.7 ASUS DriverHub

This menu allow you to download and install the ASUS DriverHub app.

NOTE: 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.

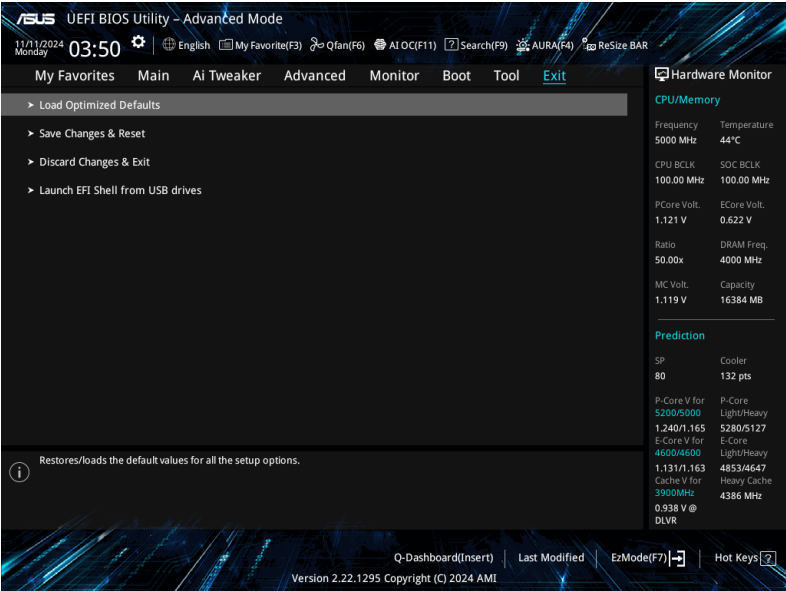
Download & Install ASUS DriverHub app

Allows you to enable DriverHub download process. DriverHub app can help you manage and download the latest drivers and utility updates for your motherboard.

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 in system's failure to boot. Carefully follow the instructions in this chapter to update your BIOS when necessary.

IMPORTANT!

- Visit <http://www.asus.com> to download the latest BIOS file for this motherboard.
- We strongly recommend ALWAYS using the ZIP file from the ASUS website to update your BIOS with EZ Flash to ensure the ME version is updated as well. If you are only using the CAP file, make sure the ME version matches the new BIOS. Please note that once the ME is updated, it cannot be rolled back. For more information, please visit the product page on the ASUS website.

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

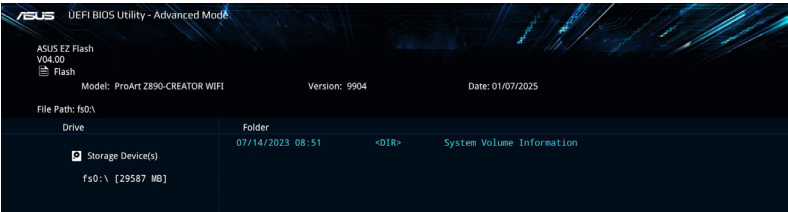
1. ASUS EZ Flash: Updates the BIOS using a USB flash drive.
2. ASUS CrashFree BIOS 3: Restores the BIOS using a USB flash drive when the BIOS file fails or gets corrupted.

11.1 ASUS EZ Flash

ASUS EZ Flash 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 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 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 a USB flash drive that contains the BIOS file.

IMPORTANT! Make sure to download the latest BIOS 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 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 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.

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