

**PRIME /
ProArt /
TUF GAMING
Intel 700
Series**

BIOS Manual

ASUS
Motherboard

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BIOS Setup

1. Knowing BIOS



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

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

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



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



- When downloading or updating the BIOS file for your motherboard, rename it as **XXXX.CAP** or launch the **BIOSRenamer.exe** application to automatically rename the file. The name of the CAP file varies depending on models. Refer to the user manual that came with your motherboard for the name.
- The screenshots in this manual are for reference only, please refer to the latest BIOS version for settings and options.
- BIOS settings and options may vary due to different BIOS release versions or CPU installed. Please refer to the latest BIOS version for settings and options.

2. BIOS setup program

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

Entering BIOS at startup

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

Entering BIOS Setup after POST

To enter BIOS Setup after POST:

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

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



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

BIOS menu screen

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



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

2.1 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.



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

Search AURA ReSize BAR

Information

PRIME Z790-A WIFI BIOS Ver. 0402
13th Gen Intel(R) Core(TM) i5-13600K
Speed: 5100 MHz
Memory: 8192 MB (DDR5 4000MHz)

CPU Temperature: 1.288 V
CPU Core Voltage: 51°C
Motherboard Temperature: 31°C

Status

DRAM Status

DIMM_A1: N/A
DIMM_A2: Micron Technology 8192MB 4800MHz
DIMM_B1: N/A
DIMM_B2: N/A

AEMP

Disabled

FAN Profile

CPU FAN: 2772 RPM
CH1 FAN: N/A
CH2 FAN: N/A
CH3 FAN: N/A
CH4 FAN: N/A

Intel Rapid Storage Technology

On Off

CPU FAN

QFan Control

EZ System Tuning

Click the icon to specify your preferred system settings for a power-saving system environment

Normal

Boot Priority

Choose one and drag the items.

Switch all

Default(F5) | Save & Exit(F10) | Advanced Mode(F7) | Boot Menu(F8)

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

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

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



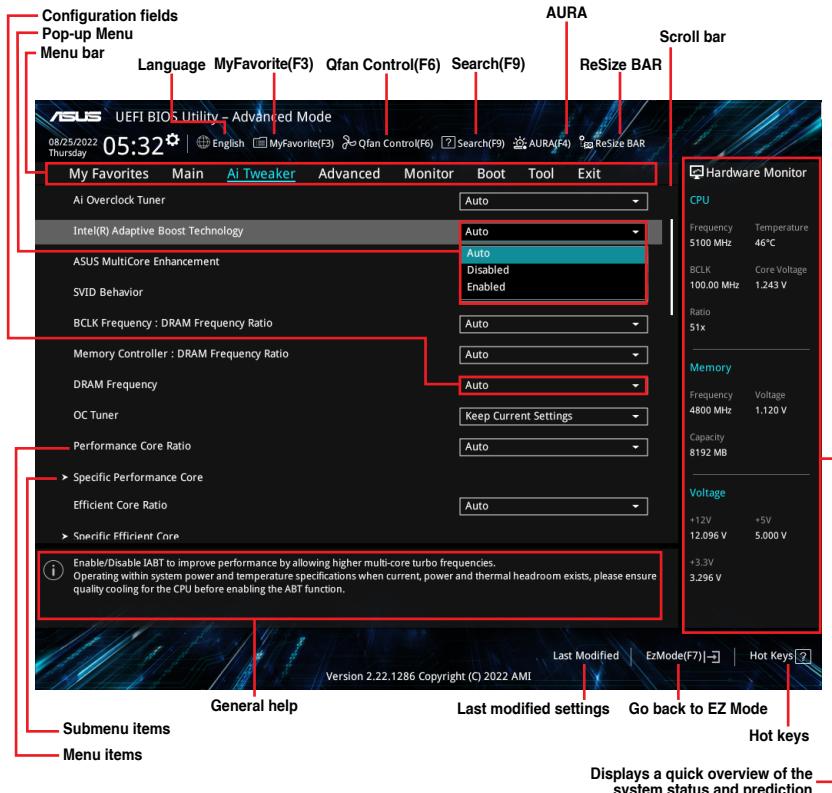
The boot device options vary depending on the devices you installed to the system.

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.



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

Submenu items

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

Language

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

MyFavorite

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



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

Qfan Control

This button above the menu bar displays the current settings of your fans. Use this button to manually tweak the fans to your desired settings. You may also access this item by pressing the <F6> key on the keyboard.



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

AI OC Guide

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



-
- Refer to section **AI OC Guide** for more information.
 - This function is only enabled when using an unlocked CPU.
 - 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. CSM (Compatibility Support Module) will be disabled.
- [Off] ReSize BAR support will be disabled.

MemTest86

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



-
- Please save all changes made before using MemTest86.
 - There will be a few seconds of loading time after clicking the MemTest86 button.
 - This function is only available on selected models.
-

Hot keys

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

Scroll bar

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

General help

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

Configuration fields

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

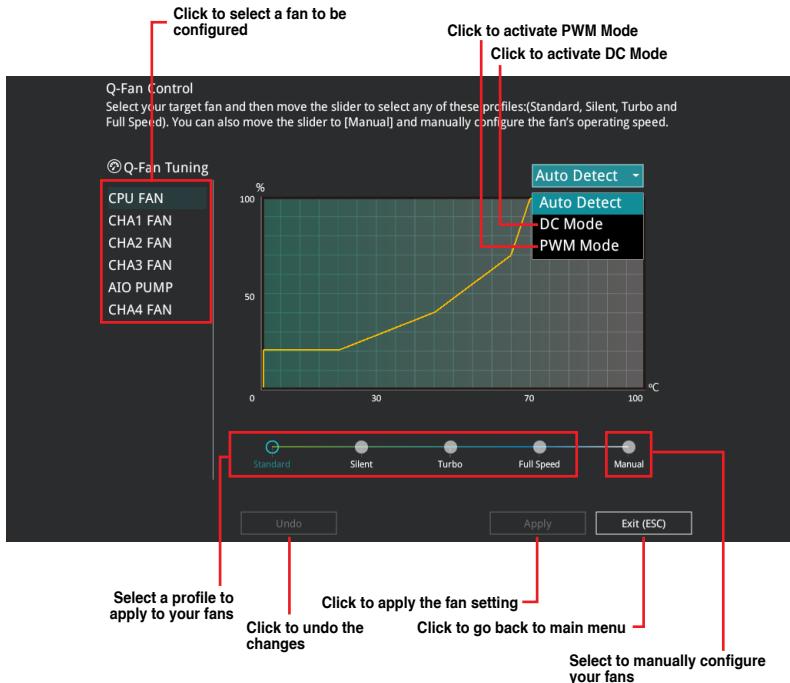
A configurable field is highlighted when selected. To change the value of a field, select it and press <Enter> to display a list of options.

Last Modified button

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

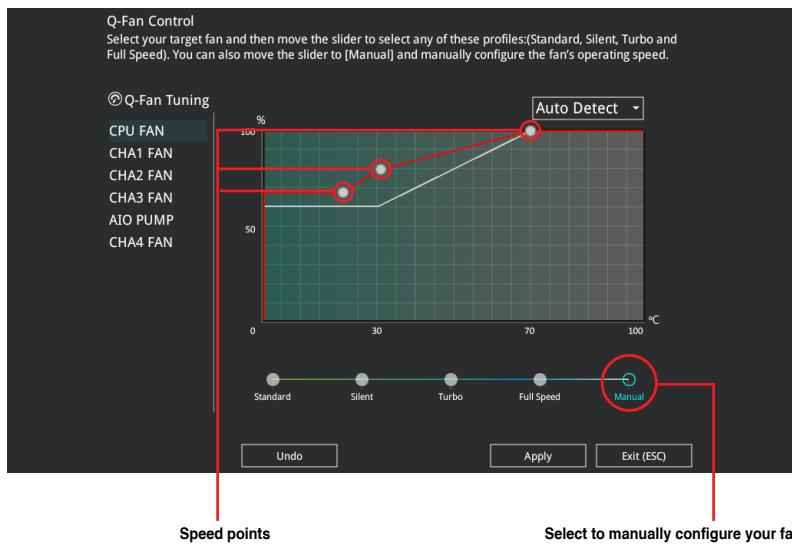
2.3 Qfan Control

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



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



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

AI Overclocking Guide

Introduction

► About the AI Overclocking monitor pane in UEFI

The AI Overclocking feature

The following options are found within Extreme Tweaker> AI Features

On the right-side of the UEF window, a variety of AI Overclocking stats are shown. This portion of the guide explains what each item means.

SP represents an assessment of the current platform.

Cooler Score refers to the efficiency of the cooler. Depending upon configuration of the "Cooler efficiency customize" function, this value changes as data is collected by the motherboard. Contributing factors to the score include CPU Core temperatures, processor leakage, ambient temperatures, and CPU fan speeds. Typically, an air-cooler scores around 130pts, an AIO 150-160, and a custom water-loop around 170+ (ambient temp of 26 Celsius).

V req for target refers to the minimum voltage required for the target CPU frequency during normal (non-AVX) workloads. The value is based on Prime95 small FFT stability and referenced off the worst core.

2core Load Stable refers to the frequency sustainable when 2 cores are under load.

4core Load Stable refers to the frequency sustainable when 4 cores are under load.

8core Load Stable refers to the frequency sustainable when 8 cores are under load. Only applicable if there are more than 10cores.

Allcore Load Stable refers to the frequency sustainable when all cores are under load.

Heavy AVX Stable refers to the frequency sustainable when all cores are under load in heavy AVX workloads such as blender.

[Previous](#) [Next](#) [Enable AI](#) [Cancel](#)

Quick guide topics

Click to view the previous topic in the quick guide

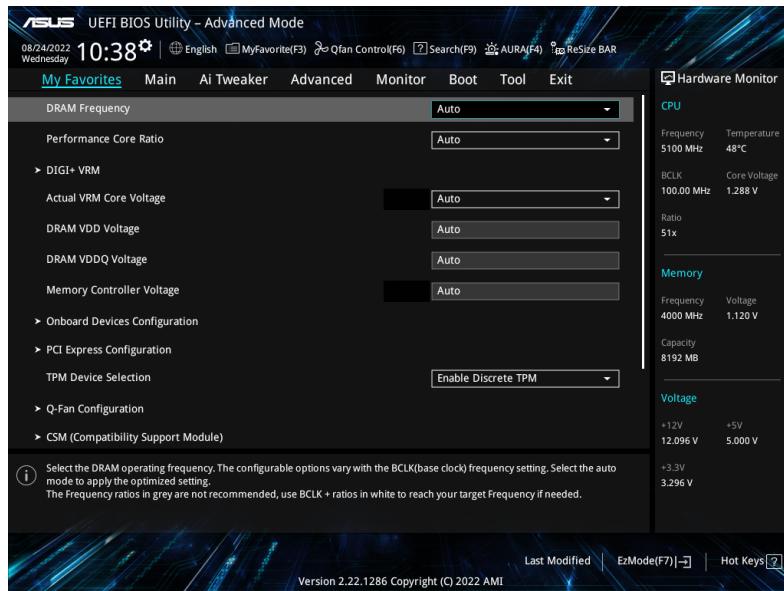
Click to view the next topic in the quick guide

Click to enable AI Overclocking

Click to go back to main menu

3. My Favorites

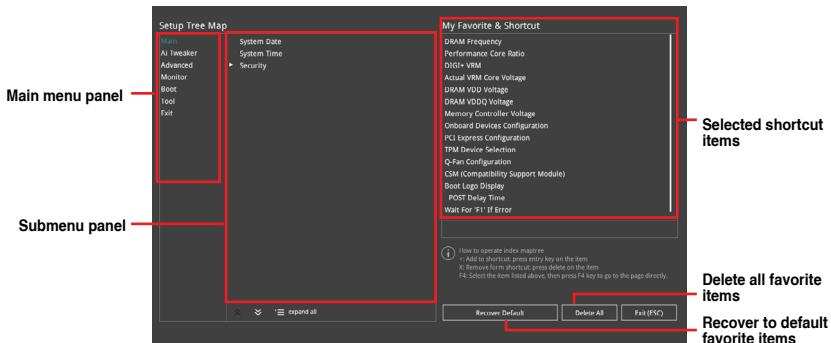
My Favorites is your personal space where you can easily save and access your favorite BIOS items. You can personalize this screen by adding or removing items.



Adding items to My Favorites

To add BIOS items:

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



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



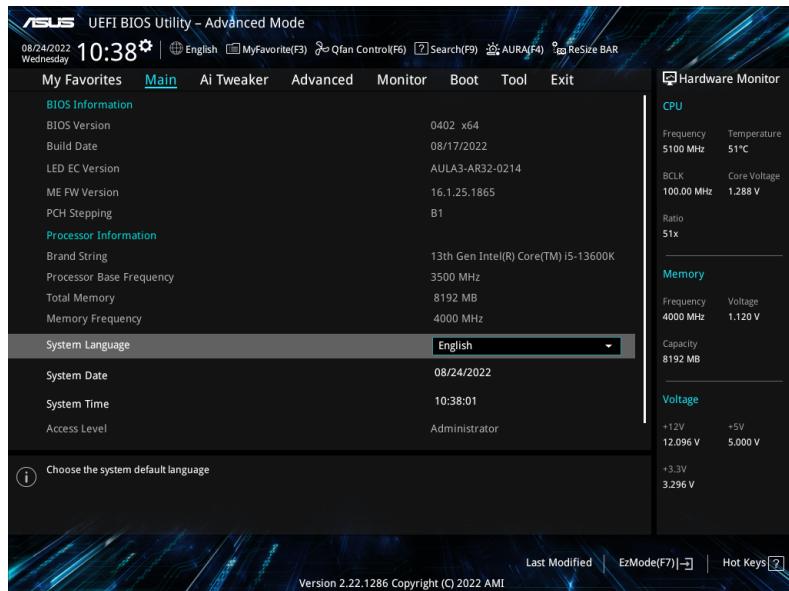
You cannot add the following items to My Favorite items:

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

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

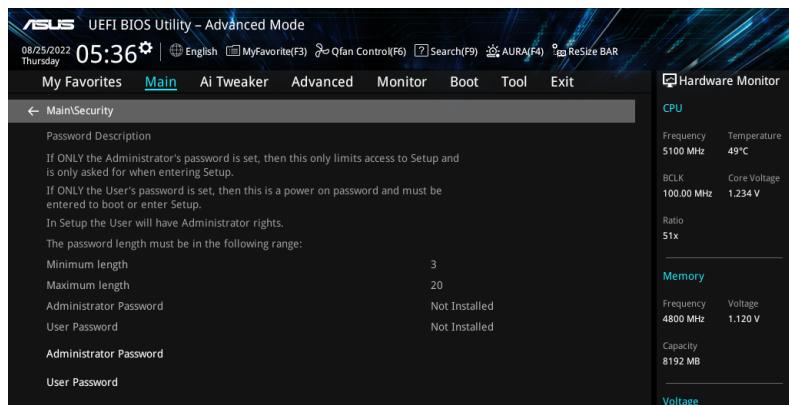
4. Main menu

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



Security

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





- If you have forgotten your BIOS password, erase the CMOS Real Time Clock (RTC) RAM to clear the BIOS password. See the motherboard for information on how to erase the RTC RAM.
- The Administrator or User Password items on top of the screen show the default [**Not Installed**]. After you set a password, these items show [**Installed**].

Administrator Password

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

To set an administrator password:

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

To change an administrator password:

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

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

User Password

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

To set a user password:

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

To change a user password:

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

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

5. Ai Tweaker menu

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



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



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

Scroll down to display other BIOS items.

ASUS UEFI BIOS Utility – Advanced Mode
08/24/2022 10:44 | English | MyFavorite(F3) | QFan Control(F6) | Search(F9) | AURA(F4) | ReSize BAR

My Favorites Main Ai Tweaker Advanced Monitor Boot Tool Exit

Target CPU Performance Core Turbo-Mode Speed : 5100MHz
Target CPU Efficient Core Turbo-Mode Speed: 3900MHz
Target DRAM Frequency : 4800MHz
Target Cache Frequency : 4500MHz
Target CPU Graphics Frequency: 1550MHz

Ai Overclock Tuner Auto
Intel(R) Adaptive Boost Technology Auto
ASUS MultiCore Enhancement Auto – Lets BIOS Optimize
SVID Behavior Auto
BCLK Frequency : DRAM Frequency Ratio Auto
Memory Controller : DRAM Frequency Ratio Auto
DRAM Frequency Auto
OC Tuner Keep Current Settings

Hardware Monitor

CPU

Frequency	Temperature
5100 MHz	53°C
BCLK	Core Voltage
100.00 MHz	1.288 V

Ratio 51x

Memory

Frequency	Voltage
4000 MHz	1.120 V
Capacity	
8192 MB	

Voltage

+12V	+5V
12.096 V	5.000 V
+3.3V	
3.296 V	

(i) [Manual]: When manual mode is selected, the BCLK (base clock) frequency can be assigned manually.
[DOCP I / XMP I]: Load the DIMM's default DOCP/XMP memory timings (CL, TRCD, TRP, TRAS) and other memory parameters optimized by ASUS.
[DOCP II / XMP II]: Load the DIMM's complete default DOCP/XMP profile.
[AEMP]: Load the memory parameters profile optimized by ASUS if no DIMM profiles detected.

Last Modified EzMode(F7) | Hot Keys ? Version 2.22.1286 Copyright (C) 2022 AMI

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.
[AEMP] Loads the memory parameters profile which is optimized by ASUS.
[XMP I] Load the DIMM's default XMP memory timings (CL, TRCD, TRP, TRAS) and other memory parameters optimized by ASUS.
[XMP II] Load the DIMM's complete default XMP profile.



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



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

BCLK Frequency

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



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



The following item appears only when **Ai Overclock Tuner** is set to **[AEMP]**.

AEMP

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



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

XMP

Allows you to select your Extreme Memory Profile. Each profile has its own DRAM frequency, timing and voltage.

Intel(R) Adaptive Boost Technology

Allows you to enable or disable IABT to improve performance by allowing higher multi-core turbo frequencies. Operating within system power and temperature specifications when current, power and thermal headroom exists, please ensure quality cooling for the CPU before enabling the ABT function.

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

ASUS MultiCore Enhancement

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

SVID Behavior

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

Configuration options: [Auto] [Best-Case Scenario] [Typical Scenario] [Worst-Case Scenario] [**[Intel's Fail Safe]**]

BCLK Frequency : DRAM Frequency Ratio

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

Memory Controller : DRAM Frequency Ratio

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

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

DRAM Frequency

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



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



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

OC Tuner

OC Tuner automatically overclocks the CPU or DRAM frequencies and voltage for an enhanced system performance depending on the DRAM type and an accelerated iGPU performance depending on the iGPU loading. Install an efficient CPU fan for OC Tuner I or OC Tuner II mode selection.

Configuration options: [Keep Current Settings] [OC Tuner I] [OC Tuner II]

Performance Core Ratio

- [Auto] The system will adjust all Performance core ratios automatically.
- [Sync All Cores] Configure a core ratio limit to synchronize all Performance cores.
- [By Core Usage] Configure the ratio limits for active cores depending on how many Performance cores are being utilized.
- [AI Optimized] Use AI to optimize the Performance core ratios.



- The [AI Optimized] item appears only when you use an unlocked CPU.
- The following item appears only when **Performance Core Ratio** is set to [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.

Configuration options: [Auto] [8] - [85]



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

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.

Configuration options: [Auto] [36] - [85]



The following item appears only when **Performance Core Ratio** is set to [AI Optimized].

Optimized AVX Frequency

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

Configuration options: [Normal Use] [Heavy AVX]



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

Specific Performance Core

Performance Core0-5 Specific Ratio Limit

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

Configuration options: [Auto] [8] - [85]

Performance Core0-5 specific Voltage

Allows configuration of the voltage supply to the CPU cores. Setting to [Auto] will scale voltage according to the applied CPU core ratio. Do not confuse this setting with VCCIN (CPU Input voltage).

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



The following item appears only when **Performance Core0-5 specific Voltage** is set to [Manual Mode].

CPU Core-0 Voltage Override / CPU Core-1 Voltage Override / CPU Core-2 Voltage Override / CPU Core-3 Voltage Override / CPU Core-4 Voltage Override / CPU Core-5 Voltage Override

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

Configuration options: [Auto] [0.00600] - [1.70000]



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



The following items appear only when **Performance Core0-5 specific Voltage** is set to **[Adaptive Mode]**.

Offset Mode Sign

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

Additional Turbo Mode CPU Core0-5 Voltage

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

Configuration options: [Auto] [0.00100] - [1.92000]

Performance Core0-5 Offset

Configure the CPU core voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001 V to 0.999 V with an interval of 0.001 V.

Configuration options: [Auto] [0.00100] - [0.99900]



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

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.



- 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.

Configuration options: [Auto] [8] - [85]



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.

Configuration options: [Auto] [27] - [85]



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 Group0-1 Specific Ratio Limit

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

Configuration options: [Auto] [8] - [120]

Efficient Core Group0-1 specific Voltage

Allows configuration of the voltage supply to the CPU cores. Setting to **[Auto]** will scale voltage according to the applied CPU core ratio. Do not confuse this setting with VCCIN (CPU Input voltage).

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



The following item appears only when **Efficient Core Group0-1 specific Voltage** is set to **[Manual Mode]**.

CPU Core-0 Voltage Override / CPU Core-1 Voltage Override

Allows configuration of the CPU core voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.

Configuration options: [Auto] [0.00600] - [1.70000]



- You need to save the changes and reset the system for the changes to take effect.
- The following items appear only when **Efficient Core Group0 specific Voltage / Efficient Core Group1 specific Voltage** is set to **[Adaptive Mode]**.

Offset Mode Sign

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

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

Additional Turbo Mode Efficient Group0 Voltage / Additional Turbo Mode

Efficient Group1 Voltage

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

Configuration options: [Auto] [0.00100] - [1.92000]

Efficient Core Group0 Offset / Efficient Core Group1 Offset

Configure the CPU core voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001 V to 0.999 V with an interval of 0.001 V.

Configuration options: [Auto] [0.00100] - [0.99900]



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

AVX Related Controls

AVX2

Allows you to enable or disable the AVX 2 Instructions.

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

AVX2 Ratio Offset to per-core Ratio Limit

Configuration options: [Auto] [User Specify]



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

AVX2 Ratio Offset

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

Configuration options: [0] - [31]

AVX2 Voltage Guardband Scale Factor

Configuration options: [Auto] [User Specify]



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

AVX2 Voltage Guardband Scale Factor

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

Configuration options: [0] - [199]

DRAM Timing Control

The sub-items in this menu allow you to set the DRAM timing control features. Use the <+> and <-> keys to adjust the value. To restore the default setting, type **[Auto]** using the keyboard and press the <Enter> key. You can also select various Memory Presets to load settings suitably tuned for some memory modules.



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

Primary Timings

DRAM CAS# Latency

Configuration options: [Auto] [2] - [126]

DRAM RAS# to CAS# Delay

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

DRAM RAS# PRE Time

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

DRAM RAS# ACT Time

Configuration options: [Auto] [1] - [511]

DRAM Command Rate

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



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

N to 1 ratio

Number of bubbles between each valid command cycle.

Configurations: [1] - [7]

Secondary Timings

DRAM RAS# to RAS# Delay L

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

DRAM RAS# to RAS# Delay S

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

DRAM REF Cycle Time

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

DRAM REF Cycle Time 2

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

DRAM REF Cycle Time Same Bank

Configuration options: [Auto] [0] - [2047]

DRAM Refresh Interval

Configuration options: [Auto] [1] - [262143]

DRAM WRITE Recovery Time

Configuration options: [Auto] [1] - [234]

DRAM READ to PRE Time

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

DRAM FOUR ACT WIN Time

Configuration options: [Auto] [1] - [511]

DRAM WRITE to READ Delay

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

DRAM WRITE to READ Delay L

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

DRAM WRITE to READ Delay S

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

DRAM CKE Minimum Pulse Width

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

DRAM Write Latency

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

Skew Control

DDRCRCOMPCTL0/1/2

Ctl0 dqvrefup

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

Ctl0 dqvrefdn

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

Ctl0 dqodtvrefup

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

Ctl0 dqodtvrefdn

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

Ctl1 cmdvrefup

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

Ctl1 ctlvrefup

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

Ctl1 clkvrefup

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

Ctl1 ckecsvrefup

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

Ctl2 cmdvrefdn

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

Ctl2 ctlvrefdn

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

Ctl2 clkvrefdn

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

Tc Odt Control

ODT_READ_DURATION

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

ODT_READ_DELAY

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

ODT_WRITE_DURATION

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

ODT_WRITE_DELAY

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

MC0 Dimm0 / MC0 Dimm1 / MC1 Dimm0 / MC1 Dimm1

DQ RTT WR

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

DQ RTT NOM RD

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

DQ RTT NOM WR

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

DQ RTT PARK

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

DQ RTT PARK DQS

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

GroupA CA ODT

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

GroupA CS ODT

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

GroupA CK ODT

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

GroupB CA ODT

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

GroupB CS ODT

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

GroupB CK ODT

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

Pull-up Output Driver Impedance

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

Pull-Down Output Driver Impedance

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

RTL IOL Control

Round Trip Latency Init Value MC0-1 CHA-B

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

Round Trip Latency Max Value MC0-1 CHA-B

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

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

Configuration options: [-] [+]

Round Trip Latency Offset Value MC0-1 CHA-B

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

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

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

Memory Training Algorithms

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

Early Command Training

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

SenseAmp Offset Training

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

Early ReadMPR Timing Centering 2D

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

Read MPR Training

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

Receive Enable Training

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

Jedec Write Leveling

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

Early Write Timing Centering 2D

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

Early Read Timing Centering 2D

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

Write Timing Centering 1D

Configuration options: [Disabled] [Enabled]

Write Voltage Centering 1D

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

Read Timing Centering 1D

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

Read Timing Centering with JR

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

Dimm ODT Training*

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

Max RTT_WR

Allows you to cap the maximum RTT_WR in power training.

Configuration options: [ODT OFF] [120 Ohms]

DIMM RON Training*

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

Write Drive Strength/Equalization 2D*

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

Write Slew Rate Training*

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

Read ODT Training*

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

Comp Optimization Traning

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

Read Equalization Training*

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

Read Amplifier Training*

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

Write Timing Centering 2D

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

Read Timing Centering 2D

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

Command Voltage Centering

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

Early Command Voltage Centering

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

Write Voltage Centering 2D

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

Read Voltage Centering 2D

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

Late Command Training

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

Round Trip Latency

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

Turn Around Timing Training

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

CMD CTL CLK Slew Rate

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

CMD/CTL DS & E 2D

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

Read Voltage Centering 1D

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

TxDqTCO Comp Training*

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

ClkTCO Comp Training*

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

TxDqsTCO Comp Training*

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

VccDLL Bypass Training*

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

CMD/CTL Drive Strength Up/Dn 2D

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

DIMM CA ODT Training

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

PanicVttDnP Training*

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

Read Vref Decap Traning*

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

Vddq Training

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

Duty Cycle Correction Training

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

Rank Margin Tool Per Bit

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

DIMM DFE Training

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

EARLY DIMM DFE Training

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

Tx Dqs Dcc Training

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

DRAM DCA Training

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

Write Driver Strength Training

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

Rank Margin Tool

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

Memory Test

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

DIMM SPD Alias Test

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

Receive Enable Centering 1D

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

Retrain Margin Check

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

Write Drive Strength Up/Dn independently

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

Margin Check Limit

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

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



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

Margin Limit Check L2

L2 check threshold is scale of L1 check.

Configuration options: [1] - [300]

Third Timings

tRDRD_sg_Training

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

tRDRD_sg_Runtime

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

tRDRD_dg_Training

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

tRDRD_dg_Runtime

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

tRDWR_sg

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

tRDWR_dg

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

tWRWR_sg

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

tWRWR_dg

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

tWRRD_sg

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

tWRRD_dg

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

tRDRD_dr

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

tRDRD_dd

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

tRDWR_dr

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

tRDWR_dd

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

tWRWR_dr

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

tWRWR_dd

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

tWRRD_dr

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

tWRRD_dd

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

tRPRE

Configuration options: [Auto] [0] - [4]

tWPRE

Configuration options: [Auto] [0] - [4]

tWRPRE

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

tPRPDEN

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

tRDPDEN

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

tWRPDEN

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

tCPDED

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

tREFIX9

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

Ref Interval

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

tXPDLL

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

tXP

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

tPPD

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

tCCD_L_tDLLK

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

Misc.**MRC Fast Boot**

Allows you to enable or disable the MRC fast boot.

Configuration options: [Disabled] [Enabled]

MCH Full Check

Enable this item to enhance the system stability. Setting this item to **[Disabled]** may enhance the DRAM overclocking capability.

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

Mem Over Clock Fail Count

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

Training Profile

Allows you to select the DIMM training profile.

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

RxDfe

Allows you to set the DFE on SOC Rx.

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

Mrc Training Loop Count

Allows you to set the exponential number of loops to run the test.

Configuration options: [Auto] [0] - [32]

DRAM CLK Period

Allows you to set the DRAM clock period.

Configuration options: [Auto] [0] - [161]

DII_bwsel

Try range of 22+ for OC.

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

Controller 0, Channel 0 Control

Allows you to enable or disable Controller 0, Channel 0.

Configuration options: [Enabled] [Disabled]

Controller 0, Channel 1 Control

Allows you to enable or disable Controller 0, Channel 1.

Configuration options: [Enabled] [Disabled]

Controller 1, Channel 0 Control

Allows you to enable or disable Controller 1, Channel 0.

Configuration options: [Enabled] [Disabled]

Controller 1, Channel 1 Control

Allows you to enable or disable Controller 1, Channel 1.

Configuration options: [Enabled] [Disabled]

MC_Vref0-2

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

Fine Granularity Refresh mode

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

DRAM SPD Configuration

SDRAM Density Per Die

Configuration options: [Auto] [4 Gb] [8 Gb] [12 Gb] [16 Gb] [24 Gb] [32 Gb] [48 Gb] [64 Gb]

SDRAM Banks Per Bank Group

Configuration options: [Auto] [1 bank per bank group] [2 bank per bank group] [4 bank per bank group]

SDRAM Bank Groups

Configuration options: [Auto] [1 bank group] [2 bank groups] [4 bank groups] [8 bank groups]

Configure Memory Dynamic Frequency Switching



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

Dynamic Memory Boost

Allows you to enable or disable Dynamic Memory Boost Feature. Allows automatic switching between default SPD Profile frequency and selected XMP profile frequency. Only valid if an XMP Profile is selected.

Configuration options: [Disabled] [Enabled]



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

Realtime Memory Frequency

Allows you to enable or disable Memory Frequency feature. Allows manual switching between default SPD Profile frequency and selected XMP profile frequency. Only valid if an XMP Profile is selected.

Configuration options: [Disabled] [Enabled]

SA GV

System Agent Geyserville. Can disable, fix to a specific point, or enable frequency switching. If enabled, we recommend you to leave options at parked values for best compatibility. Enabling this feature requires a longer boot time.

Configuration options: [Disabled] [Enabled] [Fixed to 1st Point] [Fixed to 2nd Point] [Fixed to 3rd Point] [Fixed to 4th Point]



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

First Point Frequency

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

Configuration options: [0] - [65535]

First Point Gear

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

Configuration options: [0] - [4]

Second Point Frequency

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

Configuration options: [0] - [65535]

Second Point Gear

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

Configuration options: [0] - [4]

Third Point Frequency

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

Configuration options: [0] - [65535]

Third Point Gear

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

Configuration options: [0] - [4]



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

Digi+ VRM

CPU Input Voltage Load-line Calibration

Configuration options [Auto] [Level 1] [Level 2] [Level 3]

CPU Load-line Calibration

The load-line is defined by the Intel VRM specification and affects the level of voltage supplied to the processor. Higher load-line calibration settings result in reduced VDroop at the expense of voltage overshoot and will increase CPU temperatures due to higher voltage under load. Select from level 1 to 7 to adjust the load-line slope.
Level 1 = greater VDroop, Level 7 = minimum VDroop.

Configuration options [Auto] [Level 1] [Level 2] [Level 3] [Level 4:Recommended for OC] [Level 5] [Level 6] [Level 7]



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



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

Synch ACDC Loadline with VRM Loadline

Enable this item to allow the VRM Loadline to be adjusted automatically to match the AC/DC Loadline.

Configuration options: [Disabled] [Enabled]

CPU Current Capability

Allows you to set the shut-off current limit for external voltage regulator. A higher setting will allow the voltage regulator to supply more current while a lower setting will cause the voltage regulator to shut off the system when the supplied current is higher than the set value.

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



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

CPU VRM Switching Frequency

This item affects the VRM transient response speed and the component thermal production. Select [Manual] to configure a higher frequency for a quicker transient response speed. Setting a higher switching frequency will result in better transient response at the expense of higher VRM temperatures. Active cooling of the VRM heatsink is recommended when running high CPU voltage and high load-line calibration values.

Configuration options: [Auto] [Manual]



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



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

Fixed CPU VRM Switching Frequency(KHz)

Allows you to set a higher frequency for a quicker transient response speed. The values range from 250 KHz to 500 KHz with an interval of 50 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. |



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

CPU Power Phase Control

Allows you to set the power phase control of the CPU.

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



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

CPU VRM Thermal Control

Disable to increase the temperature limit of the CPU VRM.

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



DO NOT remove the VRM heatsink.



The following items appear only when using the onboard graphics.

CPU Graphics Load-line Calibration

The load-line is defined by the Intel VRM specification and affects the CPU Graphics power voltage. The CPU Graphics working voltage will decrease proportionally depending on the CPU Graphics loading. Higher levels of the load-line calibration can get a higher voltage and a better overclocking performance but increase the CPU Graphics and VRM thermal production. Select from level 1 to 8 to adjust the CPU Graphics power voltage from 100% to 0%.

Configuration options [Auto] [Level 1] [Level 2] [Level 3] [Level 4:Recommended for OC] [Level 5] [Level 6] [Level 7]



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

CPU Graphics Current Capability

The CPU Graphics current capability adjusts the total power range for CPU Graphics overclocking. A higher value provides a wider total power range and extends the overclocking frequency range simultaneously.

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



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

CPU Graphics VRM Switching Frequency

The switching frequency will affect the CPU Graphics transient response speed and the component thermal production. Select manual mode to configure a higher frequency to get a quicker transient response speed.

Configuration options: [Auto] [Manual]



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



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

Fixed CPU Graphics Switching Frequency(KHz)

The switching frequency will affect the CPU Graphics transient response speed and the component thermal production. Use the <+> or <-> to adjust the value. The values range from 250 KHz to 500 KHz with an interval of 50 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.

Configuration options: [Auto] [62] - [115]



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

Turbo Mode Parameters

IVR Transmitter VDDQ ICCMAX

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

Unlimited ICCMAX

Allows you to enable or disable Unlimited ICCMAX. Support VR Current Limit (ICCMAX) value set above 511.75A

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

CPU Core/Cache Current Limit Max.

Allows you to configure a current limit for frequency or power throttling when overclocking. Can be set to maximum value (511.75) to prevent throttling when overclocking.

Configuration options: [Auto] [0.00] - [511.75]

CPU Graphics Current Limit

Allows you to configure a high current limit to prevent frequency or power throttling when overclocking.

Configuration options: [Auto] [0.00] - [511.75]

Long Duration Package Power Limit

An Intel parameter known as [power limit 1] and specified in Watts. The 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.

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

Package Power Time Window

An Intel parameter of [power limit 1] and specified in seconds. The applied value indicates how long the Turbo ratio can be active when TDP is exceeded.

Configuration options: [Auto] [1] [2] [3] [4] [5] [6] [7] [8] [10] [12] [14] [16] [20] [24] [28] [32] [40] [48] [56] [64] [80] [96] [112] [128] [160] [192] [224] [256] [320] [384] [448]

Short Duration Package Power Limit

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

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

Dual Tau Boost

Allows you to enable or disable Dual Tau Boost feature. This is only applicable for Desktop 35W/65W/12W sku. When DPTF is enabled this feature is ignored.

Configuration options: [Disabled] [Enabled]

IA AC Load Line

Allows you to set the AC loadline defined in mOhms. Use the <+> and <-> keys to adjust the value.

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

IA DC Load Line

Allows you to set the DC loadline defined in mOhms. Use the <+> and <-> keys to adjust the value.

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

IA CEP Enable

Allows you to enable or disable IA CEP (Current Excursion Protection) Support. Uses pCode Mailbox Command 0x37, Sub-command 0x1. Set Databit2 to 1.

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

GT CEP Enable

Allows you to enable or disable GT CEP (Current Excursion Protection) Support. Uses pCode Mailbox Command 0x37, Sub-command 0x1. Set Databit3 to 1.

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

SA CEP Enable

Allows you to enable or disable SA CEP (Current Excursion Protection) Support. Uses pCode Mailbox Command 0x37, Sub-command 0x1. Set Databit3 to 1.

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

IA SoC Iccmax Reactive Protector

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

Inverse Temperature Dependency Throttle

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

IA VR Voltage Limit [Auto]

Voltage Limit (VMAX). This value represents the Maximum instantaneous voltage allowed at any given time. Range is 0 - 7999mV. Uses BIOS VR mailbox command 0x8.

Configuration options: [Auto] [0] - [7999]

CPU DLVR Bypass mode support

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]



+1Boost Profile(K CPU):

This setting will enable additional boost of one bin with the help of Auto Optimized Temperature Control.

+2Boost Profile(K CPU):

This setting will enable additional boost of two bins with the help of Auto Optimized Temperature Control.



The following items appear only when **Overclocking TVB** is set to [Enabled].

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

Configuration options: [Auto] [Enabled]



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

Temperature A

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

Configuration options: [Auto] [1] - [115]

Negative Ratio Offset A

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

Configuration options: [Auto] [User Specify]



The following item appears only when **Negative Ratio Offset A** is set to [User Specify].

Ratio Offset

Use the <+> and <-> keys to adjust the value.

Configuration options: [0] - [31]

Temperature B

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

Configuration options: [Auto] [1] - [115]

Negative Ratio Offset B

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

Configuration options: [Auto] [User Specify]



The following item appears only when **Negative Ratio Offset B** is set to **[User Specify]**.

Ratio Offset

Use the <+> and <-> keys to adjust the value.

Configuration options: [0] - [31]

V/F Point Offset

Offset Mode Sign 1-11

Configuration options: [+/-]

V/F Point 1-11 Offset

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

Tweaker's Paradise

Realtime Memory Timing

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

Configuration options: [Disabled] [Enabled]

SPD Write Disable

Allows you to enable or disable setting SPD Write Disable. For security recommendations, SPD write disable bit must be set.

Configuration options: [TRUE] [FALSE]

PVD Ratio Threshold

For the Core Domain PLL, the threshold to switch to lower post divider is 15 by default. You can set a value lower than 15 when pushing high BCLK so that Digitally Controlled Oscillator (DCO) remains at reasonable frequency.

Configuration options: [Auto] [1] - [40]

SA PLL Frequency Override

Allows you to configure Sa PLL Frequency.

Configuration options: [Auto] [3200 MHz] [1600 MHz]

BCLK TSC HW Fixup

Allows you to enable or disable BCLK TSC HW Fixup disable during TSC copy from PMA to APIC.

Configuration options: [Enabled] [Disabled]

Core Ratio Extension Mode

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

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

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

FLL OC mode

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

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.

- [Disabled] No UnderVolt Protection in Runtime.
- [Enabled] Allow BIOS undervolting, but enable UnderVolt Protection in Runtime.

Core PLL Voltage

Allows you to configure the offset for the Core PLL VCC Trim. The values range from 0.900V to 1.845V with an interval of 0.015V.

Configuration options: [Auto] [0.90000] - [1.84500]

GT PLL Voltage

Allows you to configure the offset for the GT PLL VCC Trim. The values range from 0.900V to 1.845V with an interval of 0.015V.

Configuration options: [Auto] [0.90000] - [1.84500]

Ring PLL Voltage

Allows you to configure the offset for the Ring PLL VCC Trim. The values range from 0.900V to 1.845V with an interval of 0.015V.

Configuration options: [Auto] [0.90000] - [1.84500]

System Agent PLL Voltage

Allows you to configure the offset for the System Agent PLL VCC Trim. The values range from 0.900V to 1.845V with an interval of 0.015V.

Configuration options: [Auto] [0.90000] - [1.84500]

Memory Controller PLL Voltage

Allows you to configure the offset for the Memory Controller PLL VCC Trim. The values range from 0.900V to 1.845V with an interval of 0.015V.

Configuration options: [Auto] [0.90000] - [1.84500]

CPU 1.8V Small Rail

Allows you to configure the voltage for the CPU 1.8V Small Rail. The values range from 1.500V to 2.300V with an interval of 0.010V.

Configuration options: [Auto] [1.50000] - [2.30000]

PLL Termination Voltage

Allows you to configure the voltage for the PLL Termination. The values range from 0.800V to 1.800V with an interval of 0.010V.

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

VPPDDR Voltage

Allows you to configure the voltage for the VPPDDR. The values range from 2.500V to 2.800V with an interval of 0.100V.

Configuration options: [Auto] [2.50000V] - [2.80000V]

PCH 1.05V Primary Voltage

Allows you to configure the voltage for the PCH 1.05V. The values range from 0.800V to 1.600V with an interval of 0.010V.

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

PCH Core Voltage

Allows you to configure the voltage for the PCH Core. The values range from 0.700V to 1.000V with an interval of 0.010V.

Configuration options: [Auto] [0.70000] - [1.00000]

Ring Down Bin

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

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



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

Min. CPU Cache Ratio

Allows you to set the minimum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value.

Configuration options: [Auto] [8] - [85]

Max. CPU Cache Ratio

Allows you to set the maximum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value.

Configuration options: [Auto] [8] - [85]

Max. CPU Graphics Ratio

Allows you to configure the CPU graphics ratio. The ratio may vary depending on the system loading. Use the <+> and <-> keys to adjust the value.

Configuration options: [Auto] [1] - [42]

Extreme Over-voltage

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

Configuration options: [Disabled] [Enabled]

Actual VRM Core Voltage

Allows you to configure the VRM output rail for Core Voltage. Manual mode allows users-defined values. Offset mode modifies the values by SVID.

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



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

CPU Core Voltage Override

Allows you to configure the input voltage for the CPU by the external voltage regulator. Use the <+> and <-> keys to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.005V.

Configuration options: [Auto] [0.60000] - [1.70000]



The following items appear only when **Actual VRM Core Voltage** is set to [Offset Mode].

Offset Mode Sign

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

CPU Core Voltage Offset

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

Configuration options: [Auto] [0.00500] - [0.63500]

Global Core SVID Voltage

Allows you to configure the global Core Voltage requested by the cores. Result may be influenced by Actual VRM Core Voltage.

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



The following item appears only when **Global Core SVID Voltage** is set to [Manual Mode].

CPU Core Voltage Override

Allows you to configure the input voltage for the CPU by the external voltage regulator. Use the <+> and <-> keys to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.005V.

Configuration options: [Auto] [0.60000] - [1.70000]



The following items appear only when **Global Core SVID Voltage** is set to [Adaptive Mode].

Offset Mode Sign

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

Additional Turbo Mode CPU Core Voltage

Allows you to configure the amount of voltage fed to the CPU cores when running in Turbo mode. Increase the voltage when configuring a high CPU core frequency. This voltage will be affected by the offset value. Use the <+> or <-> to adjust the value. The values range from 0.250V to 1.920V with an interval of 0.001V.

Configuration options: [Auto] [0.25000] - [1.92000]

Offset Voltage

Allows you to configure the CPU 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.

Configuration options: [Auto] [0.00100] - [0.99900]



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

Cache SVID Voltage

Allows you to configure the Cache Voltage requested by the Ring Domain. Result may be influenced by Actual VRM Core Voltage.

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



The following item appears only when **Cache SVID Voltage** is set to **[Manual Mode]**.

CPU Core Voltage Override

Allows you to configure the voltage for the Cache. Use the <+> and <-> keys to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.001V.

Configuration options: [Auto] [0.60000] - [1.70000]



The following items appear only when **Cache SVID Voltage** is set to **[Adaptive Mode]**.

Offset Mode Sign

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

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

Additional Turbo Mode Cache Voltage

Allows you to configure the amount of voltage fed to the CPU cores when running in Turbo mode. Increase the voltage when configuring a high CPU core frequency. This voltage will be affected by the offset value. Use the <+> or <-> to adjust the value. The values range from 0.250V to 1.920V with an interval of 0.001V.

Configuration options: [Auto] [0.25000] - [1.92000]

Offset Voltage

Allows you to configure the Cache voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.

Configuration options: [Auto] [0.00100] - [0.99900]



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

CPU Graphics Voltage

Allows you to configure the mode of voltage fed to the CPU Graphics. Manual mode allows user-defined values. Offset mode modified values by SVID.

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



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

CPU Graphics Voltage Override

Allows you to configure the voltage for the CPU Graphics. Use the <+> or <-> to adjust the value. The values range from 0.600V to 1.700V with an interval of 0.005V.

Configuration options: [Auto] [0.60000] - [1.70000]



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

Offset Mode Sign

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

CPU Graphics Voltage Offset

Allows you to configure the CPU graphics voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.005V to 0.635V with an interval of 0.005V.

Configuration options: [Auto] [0.00500] - [0.63500]



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

CPU L2 Voltage

Allows you to configure the voltage for the CPU L2. This may help for sustaining high clock speeds.

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



The following item appears only when **CPU L2 Voltage** is set to **[Manual Mode]**.

CPU L2 Voltage Override

Allows you to configure the voltage for the CPU L2. Use the <+> or <-> to adjust the value. The values range from 0.700V to 1.800V with an interval of 0.001V.

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



The following items appear only when **CPU L2 Voltage** is set to **[Adaptive Mode]**.

Offset Mode Sign

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

Additional Turbo Mode CPU L2 Voltage

Allows you to configure the amount of voltage fed to the CPU cores when running in Turbo mode. Increase the voltage when configuring a high CPU core frequency. This voltage will be affected by the offset value. Use the <+> or <-> to adjust the value. The values range from 0.250V to 1.920V with an interval of 0.001V.

Configuration options: [Auto] [0.25000] - [1.92000]

Offset Voltage

Allows you to configure the CPU L2 voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.

Configuration options: [Auto] [0.00100] - [0.99900]



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

CPU System Agent Voltage

Allows you to configure the voltage for the CPU System Agent.

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



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

CPU System Agent Voltage Override

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

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



The following item appears only when **CPU System Agent Voltage** is set to **[Offset Mode]**.

CPU System Agent Voltage Offset

Allows you to configure the CPU System Agent Voltage offset value. Use the <+> or <-> to adjust the value. The values range from 0.001V to 0.999V with an interval of 0.001V.

Configuration options: [Auto] [0.00100] - [0.99900]



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

CPU Input Voltage

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

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

High DRAM Voltage Mode

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

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

DRAM VDD Voltage

Power for the DRAM ICs' VDD portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.

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

DRAM VDDQ Voltage

Power for the DRAM ICs' VDD Data portion. Use the <+> or <-> to adjust the value. The values range from 0.800V to 1.435V with an interval of 0.005V.

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

Advanced Memory Voltages

IVR Transmitter VDDQ Voltage

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

Configuration options: [Auto] [0.70000] - [2.20000]

Memory Controller Voltage

Allows you to set the voltage for the Memory Controller. Use the <+> or <-> to adjust the value. The values range from 1.006V to 2.006V with an interval of 0.010V.

Configuration options: [Auto] [1.00600] - [2.00600]

MC Voltage Calculation Voltage Base

Allows you to set the base MC Voltage used for calculations. Use the <+> or <-> to adjust the value. The values range from 0.700V to 2.200V with an interval of 0.005V.

Configuration options: [Auto] [0.70000] - [2.20000]

VDD Calculation Voltage Base

Allows you to set the base VDD Voltage used for calculations. Use the <+> or <-> to adjust the value. The values range from 0.700V to 2.200V with an interval of 0.005V.

Configuration options: [Auto] [0.70000] - [2.20000]

PMIC Voltages

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



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

SPD HUB VLDO (1.8V)

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

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

SPD HUB VDDIO (1.0V)

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

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

DRAM VDD Voltage

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

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

DRAM VDDQ Voltage

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

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

DRAM VPP Voltage

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

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

DRAM VDD Switching Frequency

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

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

DRAM VDDQ Switching Frequency

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

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

DRAM VPP Switching Frequency

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

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

DRAM Current Capability

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

Configuration options: [Auto] [0.12500] - [7.87500]



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

PMIC0-3 SPD HUB VLDO (1.8V)

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

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

PMIC0-3 SPD HUB VDDIO (1.0V)

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

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

PMIC0-3 DRAM VDD Voltage

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

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

PMIC0-3 DRAM VDDQ Voltage

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

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

PMIC0-3 DRAM VPP Voltage

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

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

PMIC0-3 DRAM VDD Switching Frequency

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

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

PMIC0-3 DRAM VDDQ Switching Frequency

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

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

PMIC0-3 DRAM VPP Switching Frequency

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

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

PMIC0-3 DRAM Current Capability

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

Configuration options: [Auto] [0.12500] - [7.87500]

PCH 1.8V Primary Voltage

Allows you to configure the voltage for the PCH 1.8V Primary. Use the <+> or <-> to adjust the value. The values range from 1.800V to 2.100V with an interval of 0.100V.

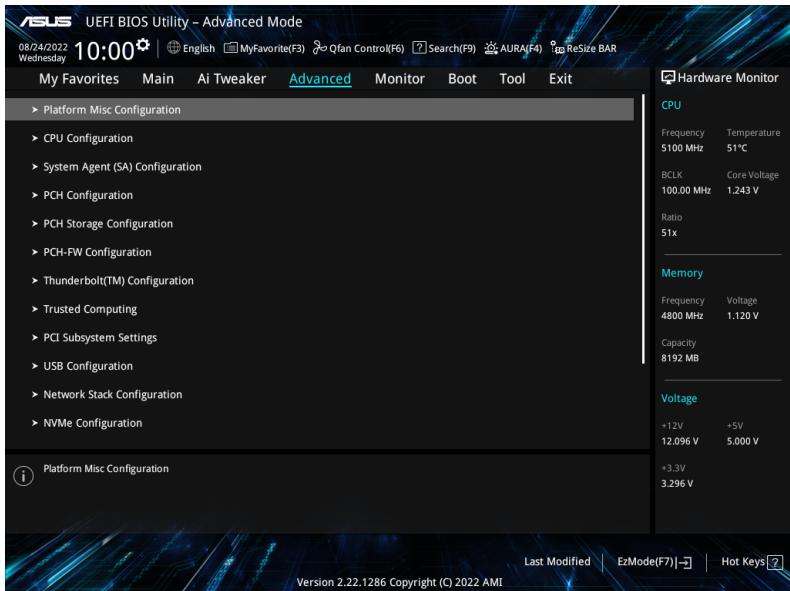
Configuration options: [Auto] [1.80000] - [2.10000]

6. Advanced menu

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

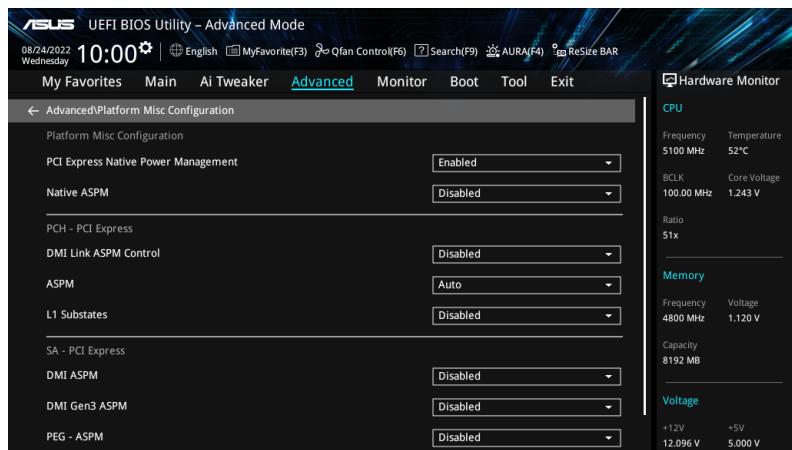


Be cautious when changing the settings of the Advanced menu items. Incorrect field values can cause the system to malfunction.



6.1 Platform Misc Configuration

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



PCI Express Native Power Management

Allows you to enhance the power saving feature of PCI Express and perform ASPM operations in the operating system.

Configuration options: [Disabled] [Enabled]



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

Native ASPM

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

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

PCH - PCI Express

DMI Link ASPM Control

Allows you to control the Active State Power Management of the DMI Link.

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

ASPM

Allows you to select the ASPM state for energy-saving conditions.

Configuration options: [Disabled] [L1.1] [Auto]

L1 Substates

Allows you to select the PCI Express L1 Substates settings.

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

SA - PCI Express

DMI ASPM

Allows you to set the DMI ASPM Support.

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

DMI Gen3 ASPM

Allows you to set the DMI Gen3 ASPM Support.

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

PEG - ASPM

Allows you to control the ASPM support for the PEG 0. This has no effect if PEG is not the currently active device.

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

PCI Express Clock Gating

Allows you to enable or disable PCI Express Clock Gating for each root port.

Configuration options: [Disabled] [Enabled]

6.2 CPU Configuration

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

The screenshot shows the ASUS UEFI BIOS Utility interface. At the top, it displays the date (08/24/2022), time (10:02), and day (Wednesday). It also shows system status icons for English language, MyFavorite (F3), QFan Control (F6), Search (F9), AURA (F4), and ReSize BAR. Below the header, there are tabs: My Favorites, Main, Ai Tweaker, Advanced (which is selected and highlighted in blue), Monitor, Boot, Tool, and Exit. On the left, a sidebar lists navigation links: Advanced > CPU Configuration, Efficient Core Information, and Performance Core Information. The main panel displays detailed CPU configuration information. On the right, there are two monitoring panels: 'Hardware Monitor' showing CPU and Memory details, and 'Voltage' showing power supply voltages. The CPU configuration table includes the following data:

Parameter	Value
CPU Signature	0xB0671
Brand String	13th Gen Intel(R) Core(TM) i5-13600K
Microcode Revision	108
Hyper Threading Technology	Supported
64-bit	Supported
EIST Technology	Supported
CPU C3 state	Not Supported
CPU C6 state	Supported
CPU C7 state	Not Supported
CPU C8 state	Supported
CPU C9 state	Not Supported
CPU C10 state	Supported

The 'Hardware Monitor' panel shows the following data:

Category	Parameter	Value
CPU	Frequency	5100 MHz
	Temperature	53°C
Memory	Core Voltage	1.243 V
	Frequency	100.00 MHz

The 'Memory' panel shows the following data:

Category	Parameter	Value
Memory	Frequency	4800 MHz
	Voltage	1.120 V
Voltage	Capacity	8192 MB
	Voltage	+12V

Efficient Core Information

This submenu displays the Efficient Core Information.

Performance Core Information

This submenu displays the Performance Core Information.

Hardware Prefetcher

Allows you to enable or disable the MLC streamer prefetcher.

Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch

Allows you to prefetch adjacent cache lines, reducing the DRAM loading time and improving the system performance.

Configuration options: [Disabled] [Enabled]

Intel (VMX) Virtualization Technology

When set to [Enabled], VMX can utilize the additional hardware capabilities provided by Vanderpool Technology.

Configuration options: [Disabled] [Enabled]

Per P-Core Control

Configuration options: [Disabled] [Enabled]



The following items appear only when **Per P-Core Control** is set to [Enabled].

P-Core 0-5

Do not disable all P-core options simultaneously or P-core options will reset after reboot.

Configuration options: [Enabled] [Disabled]

Per E-Core Control

Configuration options: [Disabled] [Enabled]



The following items appear only when **Per P-Core Control** is set to [Enabled].

E-Core 0-7

Configuration options: [Enabled] [Disabled]

Active Performance Cores

Allows you to select the number of CPU cores to activate in each processor package.

Configuration options: [All] [1] - [5]

Active Efficient Cores

Allows you to select the number of Efficient cores to activate in each processor package.

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



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

Hyper-Threading

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

[Enabled] For two threads per activated core.

[Disabled] For only one thread per activated core.

Per Core Hyper-Threading

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

Hyper-Threading of Core 0-5

Configuration options: [Disabled] [Enabled]

Total Memory Encryption

Allows you to configure the Total Memory Encryption (TME) to protect DRAM data from physical attacks.

Configuration options: [Disabled] [Enabled]

Legacy Game Compatibility Mode

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

Configuration options: [Disabled] [Enabled]

CPU - Power Management Control

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

Boot performance mode

Allows you to select the performance state that the BIOS will set starting from the reset vector.

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

Intel(R) SpeedStep(tm)

Allows more than two frequency to be supported.

Configuration options: [Disabled] [Enabled]

Intel(R) Speed Shift Technology

Allows you to disable or enable Intel(R) Speed Shift Technology support. When enabled, CPPC v2 interface allows hardware controlled P-states.

Configuration options: [Disabled] [Enabled]

Intel(R) Turbo Boost Max Technology 3.0

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

Configuration options: [Disabled] [Enabled]

Turbo Mode

Allows you to automatically set the CPU cores to run faster than the base operating frequency when it is below the operating power, current and temperature specification limit. (Requires EMTTM enabled too)

Configuration options: [Disabled] [Enabled]

Acoustic Noise Settings

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

Acoustic Noise Settings

Acoustic Noise Mitigation

Enabling this option will help mitigate acoustic noise on certain SKUs when the CPU is in deeper C state.

Configuration options: [Disabled] [Enabled]



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

Pre Wake Time

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

Configuration options: [0] - [255]

Ramp Up Time

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

Configuration options: [0] - [255]

Ramp Down Time

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

Configuration options: [0] - [255]

IA VR Domain

Disable Fast PKG C State Ramp for IA Domain

This option needs to be configured to reduce acoustic noise during deeper C states.

[FALSE] Don't disable Fast ramp during deeper C states.

[TRUE] Disable Fast ramp during deeper C state.

Slow Slew Rate for IA Domain

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

Configuration options: [Fast/2] [Fast/4] [Fast/8]

GT VR Domain

Disable Fast PKG C State Ramp for GT Domain

This option needs to be configured to reduce acoustic noise during deeper C states.

[FALSE] Don't disable Fast ramp during deeper C states.

[TRUE] Disable Fast ramp during deeper C state.

Slow Slew Rate for GT Domain

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

Configuration options: [Fast/2] [Fast/4] [Fast/8]

CPU C-states

Allows you to enable or disable CPU Power Management. Allows CPU to go to C states when it's not 100% utilized.

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



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

Enhanced C-States

Allows you to enable or disable C1E. When enabled, CPU slows down to minimum speed when all cores enter C-State.

Configuration options: [Enabled] [Disabled]

Package C State Limit

Allows you to set the C-state limit for the CPU package. Setting to [CPU Default] will leave it as the Factory default value. Setting to [Auto] will initialize the deepest available Package C State Limit.

Configuration options: [C0/C1] [C2] [C3] [C6] [C7] [C7s] [C8] [C9] [C10] [CPU Default] [Auto]

Thermal Monitor

Allows you to enable or disable the Thermal Monitor.

Configuration options: [Disabled] [Enabled]

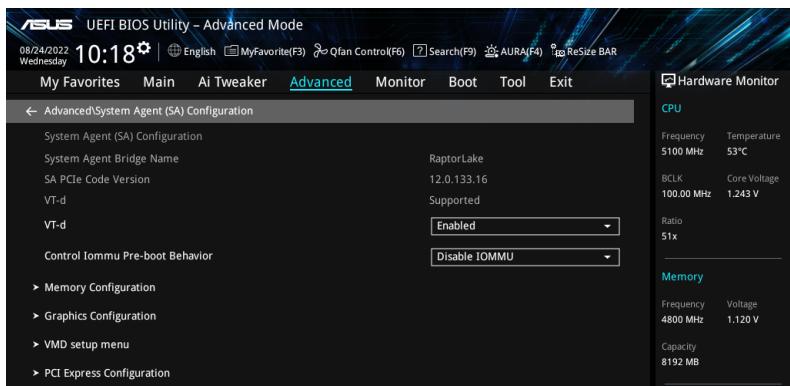
Dual Tau Boost

Allows you to enable Dual Tau Boost feature. This is only applicable for 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

Allows you to enable virtualization technology function on memory control hub.

Configuration options: [Enabled] [Disabled]



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

Control Iommu Pre-boot Behavior

Allows you to enable IOMMU in Pre-boot environment (if DMAR table is installed in DXE and if VTD_INFO_PPI is installed in PEI).

Configuration options: [Disable IOMMU] [Enable IOMMU during boot]

Memory Configuration

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

Memory Remap

Allows you to enable or disable memory remap above 4GB.

Configuration options: [Enabled] [Disabled]

Graphics Configuration

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

Primary Display

Allows you to select the primary display from CPU Graphics / PEG Graphics / PCIe Graphics device.

Configuration options: [Auto] [CPU Graphics] [PEG Slot] [PCIE]

iGPU Multi-Monitor

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

Configuration options: [Disabled] [Enabled]

DVMT Pre-Allocated

Allows you to select the DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.

Configuration options: [32M] [64M] [96M] [128M] [160M] [192M] [224M] [256M] [288M] [320M] [352M] [384M] [416M] [448M] [480M] [512M]

RC6(Render Standby)

Allows you to enable render standby support.

Configuration options: [Disabled] [Enabled]

VMD setup menu

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

Enable VMD controller

Allows you to enable or disable the VMD controller.

Configuration options: [Disabled] [Enabled]



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



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

Map PCIE Storage under VMD

Allows you to map or unmap PCIE Storage to VMD.

Configuration options: [Disabled] [Enabled]



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

Map SATA Controller under VMD

Allows you to map or unmap this Root Port to VMD.

Configuration options: [Disabled] [Enabled]



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

PCI Express Configuration

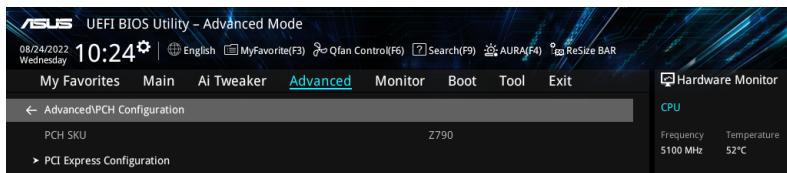
The items in this submenu allow you to configure the PCIe Speeds for the different onboard slots.



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

6.4 PCH Configuration

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



PCI Express Configuration

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



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

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.



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.

UEFI BIOS Utility – Advanced Mode
08/24/2022 Wednesday 10:25 ⓘ | English ⓘ MyFavorit(F3) ⓘ QFan Control(F6) ⓘ Search(F9) ⓘ AURA(F4) ⓘ ReSize BAR

Main Ai Tweaker Advanced Monitor Boot Tool Exit

Advanced>PCH Storage Configuration

SATA Controller(s) Enabled

Aggressive LPM Support Disabled

SMART Self Test Enabled

M.2_4 Empty

> M.2_4

M.2_4 Enabled

SATA6G_1(Gray) Empty

> SATA6G_1(Gray)

SATA6G_1(Gray) Enabled

SATA6G_1 Hot Plug Disabled

SATA6G_2(Gray) Empty

Hardware Monitor

CPU

Frequency	Temperature
5100 MHz	52°C
BCLK	Core Voltage
100.00 MHz	1.243 V
Ratio	
51x	

Memory

Frequency	Voltage
4800 MHz	1.120 V
Capacity	
8192 MB	

Voltage

+12V	+5V
12.096 V	5.000 V

SATA Controller(s)

Allows you to enable or disable the SATA Device.

Configuration options: [Disabled] [Enabled]



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

Aggressive LPM support

Allows PCH to aggressively enter link power state.

Configuration options: [Disabled] [Enabled]

SMART Self Test

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

Configuration options: [Disabled] [Enabled]



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

Allows you to enable or disable the selected SATA port.

Configuration options: [Disabled] [Enabled]

SATA6G

Allows you to enable or disable the selected SATA port.

Configuration options: [Disabled] [Enabled]

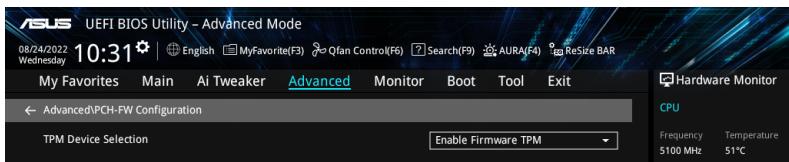
SATA6G Hot Plug

Designates this port as Hot Pluggable.

Configuration options: [Disabled] [Enabled]

6.6 PCH-FW Configuration

This item allows you to configure the firmware TPM.



TPM Device Selection

Allows you to select the TPM device between Firmware TPM or Discrete TPM.

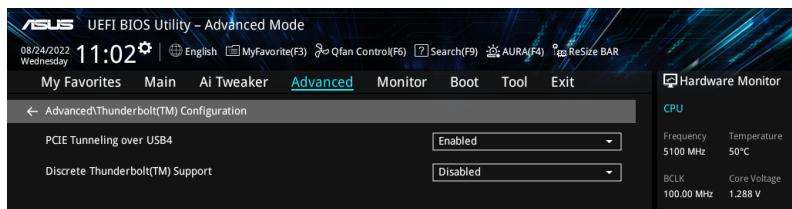
- [Enable Discrete TPM] Enable Discrete TPM and disable platform Firmware TPM. If you plug in a discrete TPM card on your motherboard, please select this option.
- [Enable Firmware TPM] Enable platform Firmware TPM and disable Discrete TPM.

6.7 Thunderbolt(TM) Configuration

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



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



PCIE Tunneling over USB4

Allows you to enable or disable PCIE Tunneling over USB4.

Configuration options: [Disabled] [Enabled]

Discrete Thunderbolt(TM) Support

Allows you to enable or disable Discrete Thunderbolt(TM) Support.

Configuration options: [Disabled] [Enabled]



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

Wake From Thunderbolt(TM) Devices

Allows you to enable or disable system wake from Thunderbolt(TM) devices.

Configuration options: [Disabled] [Enabled]

Discrete Thunderbolt(TM) Configuration

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

DTBT Go2Sx Command

Allows you to enable the command to put DTBT into Sx state while system is going into Sx.

Configuration options: [Disabled] [Enabled]

Windows 10 Thunderbolt Support

Allows you to specify Windows 10 Thunderbolt support level.

[Enable + RTD3] OS Native support plus RTD3.

[Disabled] No OS native support.

DTBT Controller 0 Configuration

DTBT Controller 0

Configuration options: [Disabled] [Enabled]

TBT Host Router

Allows you to enable host router based on ports available.

Configuration options: [One Port] [Two Port]

Extra Bus Reserved

Allows you to select the TBT Root Port Type.

[56] One port Host.

[106] Two port Host.

Reserved Memory

Allows you to set the Reserved Memory for this Root Bridge. Use the <+> and <-> keys to adjust the value.

Configuration options: [1] - [4096]

Memory alignment

Allows you to set the memory alignment bits. Use the <+> and <-> keys to adjust the value.

Configuration options: [0] - [31]

Reserved PMemory

Allows you to set the Reserved Prefetchable Memory for this Root Bridge. Use the <+> and <-> keys to adjust the value.

Configuration options: [1] - [4096]

PMemory alignment

Allows you to set the PMemory alignment bits. Use the <+> and <-> keys to adjust the value.

Configuration options: [0] - [31]

Reserved I/O

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

6.8 Trusted Computing

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



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

The screenshot shows the 'Advanced' tab selected in the BIOS interface. Under the 'Trusted Computing' section, the 'Security Device Support' option is set to 'Enable'. Other visible options include 'SHA256 PCR Bank' (Enabled), 'Pending operation' (None), 'Platform Hierarchy' (Enabled), 'Storage Hierarchy' (Enabled), 'Endorsement Hierarchy' (Enabled), and 'Physical Presence Spec Version' (1.3). On the right side, there is a 'Hardware Monitor' panel displaying CPU and Memory information.

Security Device Support

Allows you to enable or disable the 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]



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]



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]



Some HCK tests might not support 1.3.

TPM 2.0 UEFI Spec Version

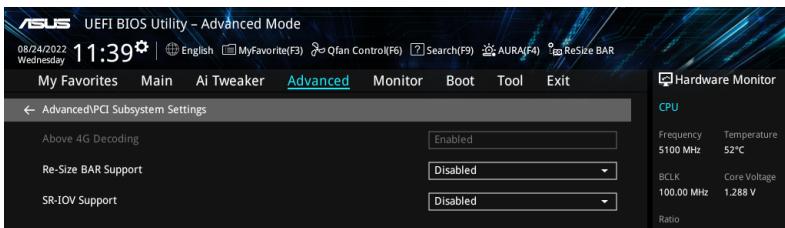
Allows you to select the TCG2 spec version support.

[TCG_1_2] Windows 8 / Windows 10 compatible mode.

[TCG_2] Supports the new TCG2 protocol and event for Windows 10 or later.

6.9 PCI Subsystem Settings

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



Above 4G Decoding

Allows you to enable or disable 64bit capable Devices to be Decoded in Above 4G Address Space (Only if System supports 64 bit PCI Decoding).

Configuration options: [Disabled] [Enabled]



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

Re-Size BAR Support

If the system has Resizable BAR capable PCIe Devices, this option enables or disables Resizable BAR Support (Only if System supports 64 bit PCI Decoding).

Configuration options: [Disabled] [Enabled]



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

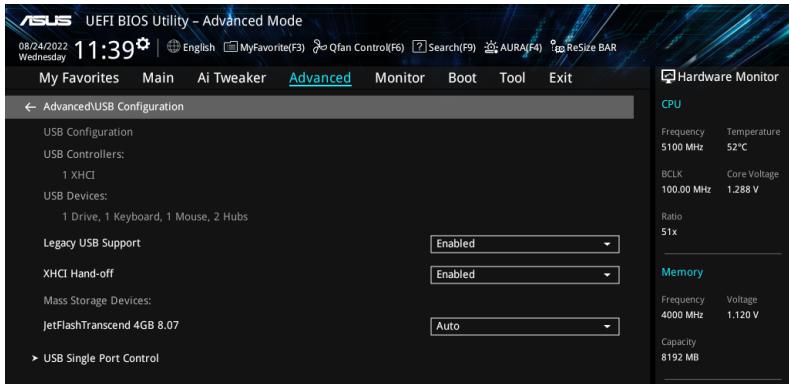
SR-IOV Support

This option enables or disables Single Root IO Virtualization Support if the system has SR-IOV capable PCIe devices.

Configuration options: [Disabled] [Enabled]

6.10 USB Configuration

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



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

Legacy USB Support

- [Enabled] Your system supports the USB devices in legacy operating systems.
- [Disabled] Your USB devices can be used for BIOS setup only and cannot be recognized in the boot devices list.
- [Auto] Your system automatically detects the presence of USB devices at startup. If any USB devices are detected, the legacy USB support is enabled.

XHCI Hand-off

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

- [Disabled] Support XHCI by XHCI drivers for operating systems with XHCI support.
- [Enabled] Support XHCI by BIOS for operating systems without XHCI support.

Mass Storage Devices:

Allows you to select the mass storage device emulation type for devices connected. [Auto] enumerates devices according to their media format. Optical drives are emulated as [CD-ROM], drives with no media will be emulated according to a drive type.

Configuration options: [Auto] [Floppy] [Forced FDD] [Hard Disk] [CD-ROM]

USB Single Port Control

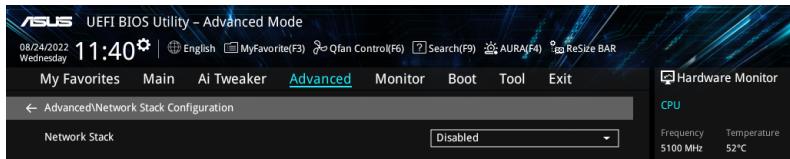
Allows you to enable or disable the individual USB ports.



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

6.11 Network Stack Configuration

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



Network stack

Allows you to disable or enable the UEFI network stack.

Configuration options: [Disabled] [Enabled]



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

Ipv4/Ipv6 PXE Support

Allows you to enable or disable the Ipv4/Ipv6 PXE boot support.

Configuration options: [Disabled] [Enabled]

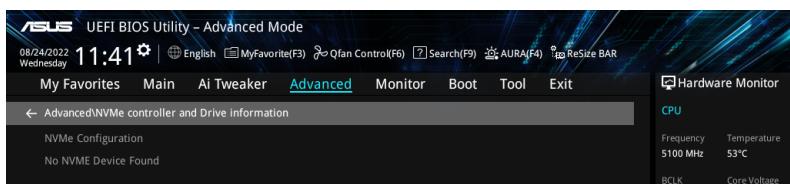
6.12 NVMe Configuration

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

You may press <Enter> on a connected NVMe device which appears in this menu to view more information on the NVMe device.



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



6.13 HDD/SSD SMART Information

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



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.

ASUS UEFI BIOS Utility – Advanced Mode
08/24/2022 Wednesday 11:41 ⓘ | English MyFavorite(F3) QFan Control(F6) Search(F9) AURA(F4) ReSize BAR

Main Ai Tweaker Advanced Monitor Boot Tool Exit

Advanced\HDD/SSD SMART Information

Device N/A

VAL: Current value
WOR: Worst value
THR: Threshold value

CPU

Frequency	Temperature
5100 MHz	52°C

BLK Core Voltage

100.00 MHz	1.288 V
------------	---------

Ratio

51x

Memory



NVM Express devices do not support SMART information.

6.14 APM Configuration

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

ASUS UEFI BIOS Utility – Advanced Mode
08/24/2022 Wednesday 11:42 ⓘ | English MyFavorite(F3) QFan Control(F6) Search(F9) AURA(F4) ReSize BAR

Main Ai Tweaker Advanced Monitor Boot Tool Exit

Advanced\APM Configuration

Restore AC Power Loss Power Off

Max Power Saving Disabled

ErP Ready Disabled

Power On By PCI-E Disabled

Power On By RTC Disabled

CPU

Frequency	Temperature
5100 MHz	52°C

BLK Core Voltage

100.00 MHz	1.288 V
------------	---------

Ratio

51x

Memory

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]

6.15 Onboard Devices Configuration

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



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

The screenshot shows the ASUS UEFI BIOS Utility interface in Advanced Mode. The top bar includes the date (08/25/2022), time (05:40), language (English), and various quick access icons. The main menu bar has tabs: My Favorites, Main, Ai Tweaker, Advanced (which is selected), Monitor, Boot, Tool, and Exit. The left sidebar shows a tree view with 'Advanced\Onboard Devices Configuration' expanded, and 'Serial Port Configuration' collapsed. The main panel displays several configuration options with dropdown menus:

- PCIe Bandwidth Bifurcation Configuration: Auto
- HD Audio: Enabled
- Intel LAN: Enabled
- USB power delivery in Soft Off state (S5): Enabled
- Connectivity mode (Wi-Fi & Bluetooth): Enabled
- LED lighting:
 - When system is in working state: All On
 - When system is in sleep, hibernate or soft off states: All On
- GNA Device: Disabled

On the right side, there is a 'Hardware Monitor' section with three panels: CPU, Memory, and Voltage. The CPU panel shows:

Frequency	Voltage
5100 MHz	54°C
BCLK	Core Voltage
100.00 MHz	1.243 V
Ratio	
51x	

The Memory panel shows:

Frequency	Voltage
4800 MHz	1.120 V
Capacity	
8192 MB	

The Voltage panel shows:

Voltage	
+12V	+5V
12.096 V	5.000 V

PCIe Bandwidth Bifurcation Configuration

[Auto] Run full PCIe X16 mode.

[X8/X8] Split up PCIEX16_1 that runs X16 into X8/X8.

HD Audio

Controls the detection of the HD-Audio device.

- [Disabled] HDA will be unconditionally disabled.
- [Enabled] HDA will be unconditionally enabled.

Intel LAN

Allows you to enable or disable Intel LAN.

Configuration options: [Disabled] [Enabled]

USB power delivery in Soft Off state (S5)

Allows you to enable or disable USB power when your PC is in the S5 state.

Configuration options: [Disabled] [Enabled]

Connectivity mode (Wi-Fi & Bluetooth)

Allows you to enable or disable Wi-Fi and Bluetooth connectivity module.

Configuration options: [Disabled] [Enabled]

LED lighting

When system is in working state

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

- [All On] RGB LEDs and Functional will be behave normally.
- [Stealth Mode] All LEDs will be disabled.
- [Aura Only] RGB LEDs will light up, while all functional LEDs will be disabled.
- [Aura Off] Functional LEDs behave normally, while RGB LEDs will be disabled.



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

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 be behave normally.
- [Stealth Mode] All LEDs will be disabled.
- [Aura Only] RGB LEDs will light up, while all functional LEDs will be disabled.
- [Aura Off] Functional LEDs behave normally, while RGB LEDs will be disabled.



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

GNA Device

Allows you to enable or disable SA GNA Device.

Configuration options: [Enabled] [Disabled]

Serial Port Configuration

This submenu allows you to set parameters for Serial Port.



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

Serial Port

Allows you to enable or disable the Serial port.

Configuration options: [Enabled] [Disabled]



The following item appears only when **Serial Port** is set to **[Enabled]**.

Change settings

Allows you to 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]

Intel Arc Graphics

Allows you to optimize Intel Arc Graphics performance.

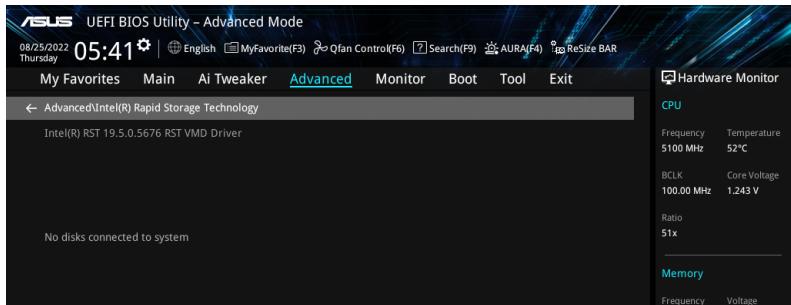
Configuration options: [Enabled] [Disabled]

6.16 Intel(R) Rapid Storage Technology

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



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



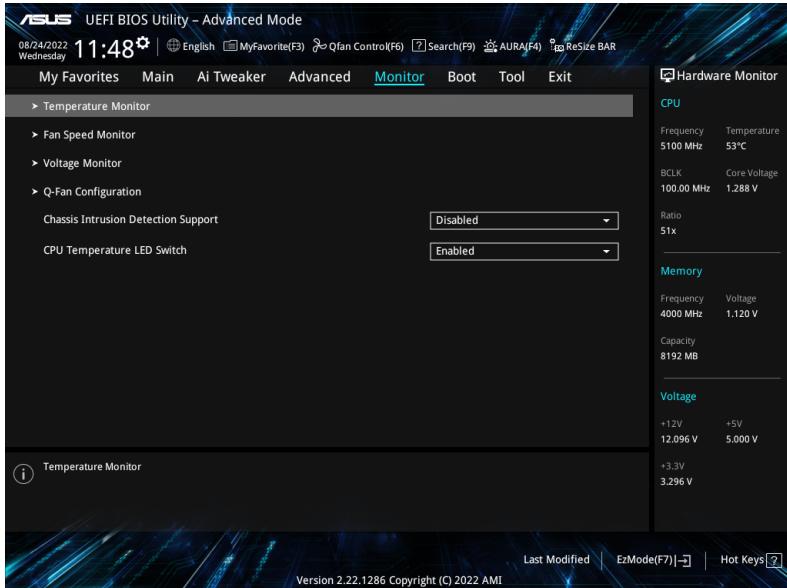
7. Monitor menu

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

Scroll down to display the other BIOS items.



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



Temperature Monitor

CPU Temperature, CPU Package Temperature, MotherBoard Temperature, VRM Temperature, Chipset Temperature, T_Sensor Temperature, 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 and Current Monitor

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

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

Q-Fan Configuration

Q-Fan Tuning

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



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

CPU Q-Fan Control

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

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

CPU Fan Profile

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

Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]



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

CPU Fan Step Up

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



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

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 fan will operate at the duty cycle of P4. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P4. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 fan will operate at the duty cycle of P3-P4. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P3-P4. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 fan will operate at the duty cycle of P2-P3. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P2-P3. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 P1-P2 and the temperature source. Use the <+> or <-> keys to adjust the temperature.

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 P1-P2 and the temperature source. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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]



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] [MotherBoard] [VRM Thermistor] [Chipset] [T_Sensor] [Multiple Sources]



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

Chassis Fan 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]



The following items appear only when **Chassis Fan 1-5 Profile** is set to [Manual].

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 fan will operate at the duty cycle of P4. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P4. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 fan will operate at the duty cycle of P3-P4. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P3-P4. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 fan will operate at the duty cycle of P2-P3. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P2-P3. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 P1-P2 and the temperature source. Use the <+> or <-> keys to adjust the temperature.

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 P1-P2 and the temperature source. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

Allow Fan Stop

This function allows the fan to run at 0% duty cycle when the temperature of the source is dropped below the lower temperature.

Configuration options: [Disabled] [Enabled]

AIO Pump Q-Fan Control

Allows you to set the AIO Pump operating mode.

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

AIO Pump Profile

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

Configuration options: [Standard] [Silent] [Turbo] [Full Speed] [Manual]



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

AIO Pump Q-Fan Source

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

Configuration options: [CPU] [MotherBoard] [VRM] [Chipset] [T_Sensor] [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]



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

AIO Pump 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 fan will operate at the duty cycle of P4. Use the <+> or <-> keys to adjust the temperature.

AIO Pump 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 fan will operate at the duty cycle of P4. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

AIO Pump 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 fan will operate at the duty cycle of P3-P4. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P3-P4. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 fan will operate at the duty cycle of P2-P3. Use the <+> or <-> keys to adjust the temperature.

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 fan will operate at the duty cycle of P2-P3. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

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 P1-P2 and the temperature source. Use the <+> or <-> keys to adjust the temperature.

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 P1-P2 and the temperature source. Use the <+> or <-> keys to adjust the fan/pump duty cycle.

Chassis Intrusion Detection Support

Set this item to [Enabled] to enable the chassis intrusion detection function.

Configuration options: [Enabled] [Disabled]

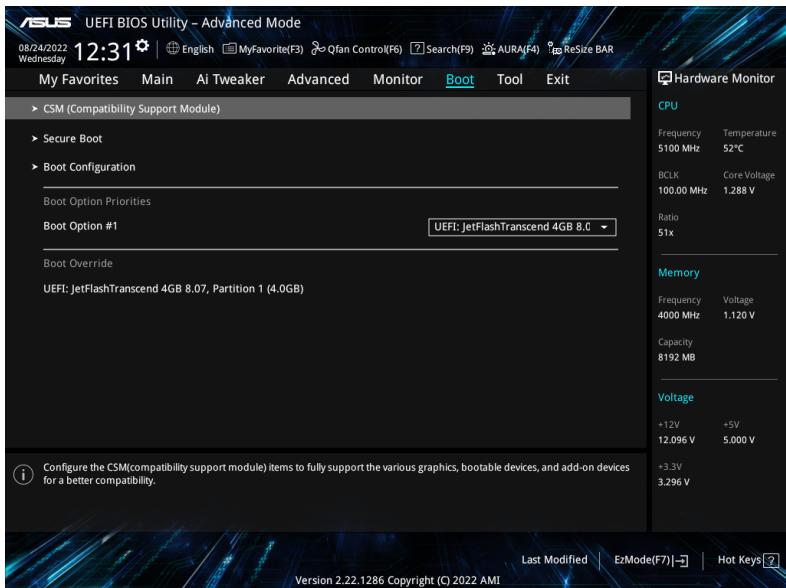
CPU Temperature LED Switch

Set this item to [Enabled] and the CPU_LED will light up to indicate high CPU temperature.

Configuration options: [Enabled] [Disabled]

8. Boot menu

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



CSM (Compatibility Support Module)

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



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

Launch CSM

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



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

Boot Device Control

Allows you to select the type of devices that you want to boot.

Configuration options: [UEFI and Legacy OPROM] [Legacy OPROM only] [UEFI only]

Boot from Network Devices

Allows you to select the type of network devices that you want to launch.

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

Boot from Storage Devices

Allows you to select the type of storage devices that you want to launch.

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

Boot from PCI-E/PCI Expansion Devices

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

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

Secure Boot

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

OS Type

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

[Other OS] Get the optimized function when booting on Windows® non-UEFI mode. Microsoft® Secure Boot only supports Windows® UEFI mode.



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

Secure Boot Mode

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

Configuration options: [Standard] [Custom]



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

Key Management

Install Default Secure Boot keys

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

Clear Secure Boot keys

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

Save all Secure Boot variables

Allows you to save all secure boot keys to a USB storage device.

PK Management

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

Save To File

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

Set New key

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

Delete key

Allows you to delete the PK from your system. Once the PK is deleted, all the system's Secure Boot keys will not be active.

Configuration options: [Yes] [No]



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

KEK Management

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



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

Save to file

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

Set New key

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

Append Key

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

Delete key

Allows you to delete the KEK from your system.

Configuration options: [Yes] [No]



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

DB Management

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

Save to file

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

Set New key

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

Append Key

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

Delete key

Allows you to delete the db file from your system.

Configuration options: [Yes] [No]



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

DBX Management

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

Save to file

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

Set New key

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

Append Key

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

Delete key

Allows you to delete the dbx file from your system.

Configuration options: [Yes] [No]



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

Boot Configuration

Fast Boot

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

Configuration options: [Disabled] [Enabled]



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

Next Boot after AC Power Loss

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

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

Boot Logo Display

[Auto] Automatically adjust the boot logo size for Windows requirements.

[Full Screen] Maximize the boot logo size.

[Disabled] Hide the logo during POST.



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

Post Delay Time

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

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



This feature only works when set under normal boot.



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]

Option ROM Messages

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

Interrupt 19 Capture

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

AMI Native NVMe Driver Support

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

Setup Mode

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

Boot Sector (MBR/GPT) Recovery Policy

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



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.



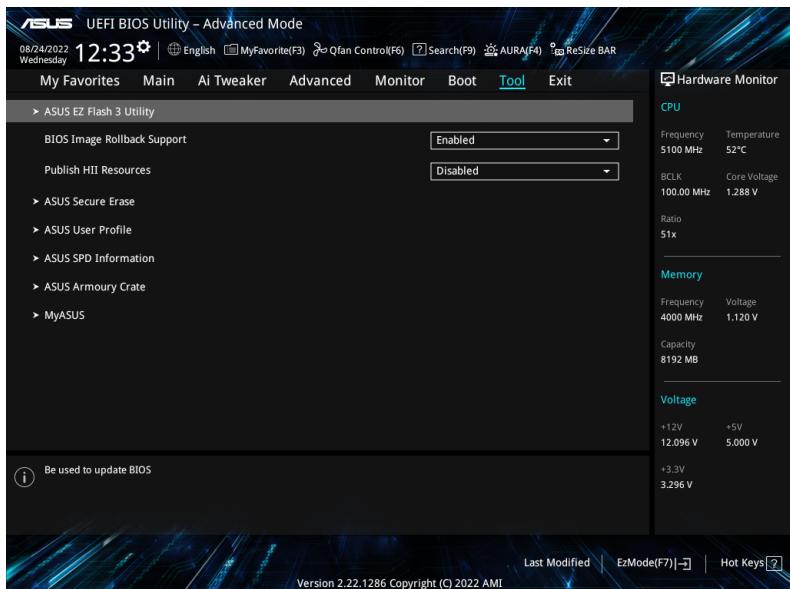
- To access Windows® OS in Safe Mode, press <F8> after POST (Windows® 8 not supported).
- To select the boot device during system startup, press <F8> when ASUS Logo appears.

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]



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]

9.1 ASUS EZ Flash 3 Utility

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



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

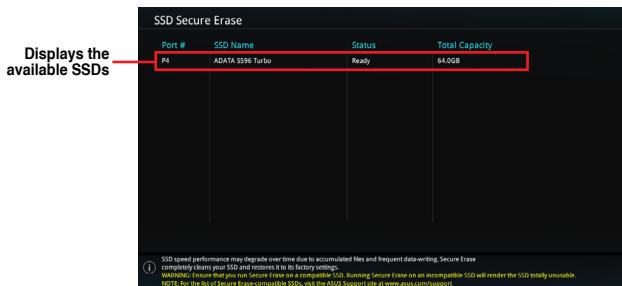
9.2 ASUS Secure Erase

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

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



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

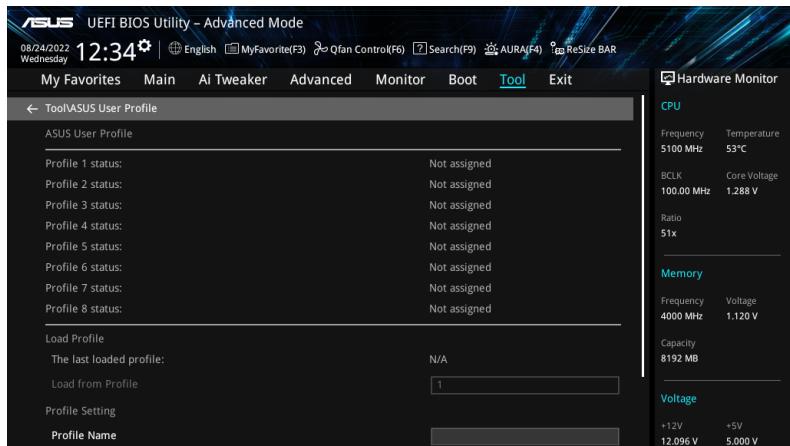


Status definition:

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

9.3 ASUS User Profile

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



Load from Profile

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



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

Profile Name

Allows you to key in a profile name.

Save to Profile

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

Load/Save Profile from/to USB Drive

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

9.4 ASUS SPD Information

This item allows you to view the DRAM SPD information.

The screenshot shows the 'ASUS UEFI BIOS Utility - Advanced Mode' interface. The top bar includes the date (08/24/2022), time (12:34), language (English), and various system status icons. The main menu bar has tabs: My Favorites, Main, Ai Tweaker, Advanced, Monitor, Boot, Tool, and Exit. The 'Tool' tab is selected. A sub-menu for 'ASUS SPD Information' is open, showing details for a DIMM slot (Slot A2). The SPD data table includes fields like Vendor (Micron Technology), Manufacturer (Micron & SpecTek), Module Size (8192MB), Maximum Bandwidth (4800MHz), Type (DDR5), Part Number (MT4C10163S1UC48BAW), Serial Number (30106f7d), Product Week/Year (28/2021), and SPD Ext. (ASUS Checksum e28c, Secure Mode True). The JEDEC ID table lists parameters such as Frequency (MHz), VDD(V), tCL, VDDQ(V), tRCD, VPP(V), tRP, tRFC1, and #DAC. On the right side, there are two sections: 'Hardware Monitor' (CPU and Memory) and 'Voltage' (showing +12V at 12.096 V and +5V at 5.000 V).

9.5 MemTest86

This item allows you to obtain a memory diagnosis.



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.

The screenshot shows the 'ASUS UEFI BIOS Utility - Advanced Mode' interface. The top bar includes the date (12/10/2022), time (15:14), language (English), and various system status icons. The main menu bar has tabs: My Favorites, Main, Ai Tweaker, Advanced, Monitor, Boot, Tool, and Exit. The 'Tool' tab is selected. A sub-menu for 'MemTest86' is open, showing the option 'Activate MemTest86'. On the right side, there is a 'Hardware Monitor' section for CPU/Memory, showing Frequency (4700 MHz) and Temperature (43°C).

Activate MemTest86

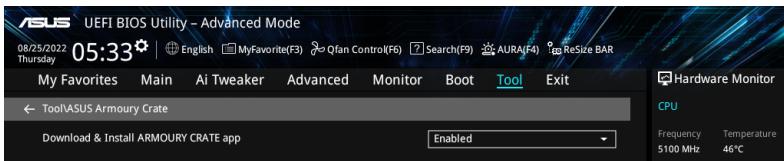
Press <Enter> to open MemTest86 to perform and check testing results.



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

9.6 ASUS Armoury Crate

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

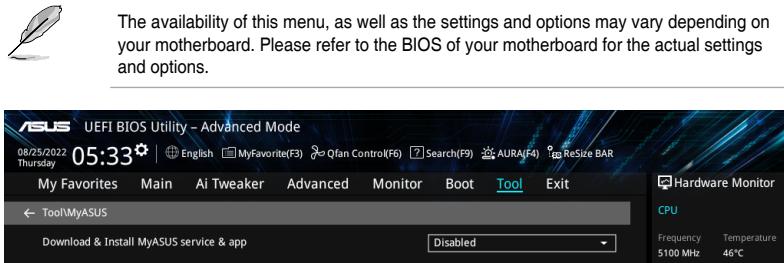


Download & Install ARMOURY CRATE app

Configuration options: [Disabled] [Enabled]

9.7 MyASUS

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

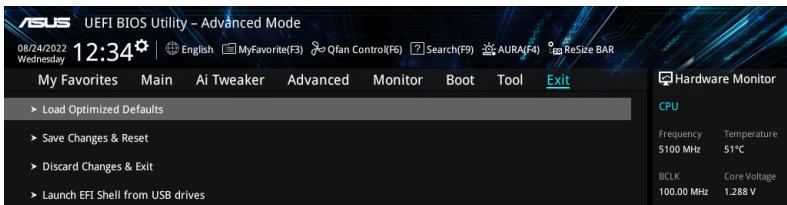


Download & Install MyASUS service & app

Configuration options: [Disabled] [Enabled]

10. Exit menu

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



Load Optimized Defaults

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

Save Changes & Reset

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

Discard Changes & Exit

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

Launch EFI Shell from USB drives

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

11. Updating BIOS

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



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

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

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

11.1 ASUS EZ Flash 3

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

To update the BIOS:

1. Insert the USB flash drive that contains the latest BIOS file to a USB port.
2. Enter the Advanced Mode of the BIOS setup program. Go to the **Tool** menu to select **ASUS EZ Flash 3 Utility** and press <Enter>.
3. Press Left arrow key to switch to the Drive field.
4. Press the Up/Down arrow keys to find the USB flash drive that contains the latest BIOS, and then press <Enter>.
5. Press Right arrow key to switch to the Folder Info field.
6. Press the Up/Down arrow keys to find the BIOS file, and then press <Enter> to perform the BIOS update process. Reboot the system when the update process is done.



11.2 ASUS CrashFree BIOS 3

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



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 3 automatically.
4. The system requires you to enter BIOS Setup to recover the BIOS setting. To ensure system compatibility and stability, we recommend that you press <F5> to load default BIOS values.



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

