TUF Z270 MARK 2

BIOS Manual

Motherboard

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Contents

BIOS Setup

1.1   Knowing BIOS

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

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

• An error message appears on the screen during the system bootup and requests you to run the BIOS Setup.

• You have installed a new system component that requires further BIOS settings or update.

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

• When downloading or updating the BIOS file, rename it as **Z270TUF2.CAP** for this motherboard.

• BIOS settings and options may vary due to different BIOS release versions. Please refer to the latest BIOS version for settings and options.

1.2 BIOS setup program

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

Entering BIOS at startup

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

Entering BIOS Setup after POST

To enter BIOS Setup after POST:

- Press <Ctrl>+<Alt>+<Delete> simultaneously.

- Press the reset button on the system chassis.

- Press the power button to turn the system off then back on. Do this option only if you failed to enter BIOS Setup using the first two options.

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

- The BIOS setup screens shown in this section are for reference purposes only, and may not exactly match what you see on your screen.

- Ensure that a USB mouse is connected to your motherboard if you want to use the mouse to control the BIOS setup program.

- If the system becomes unstable after changing any BIOS setting, load the default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the Exit menu or press hotkey <F5>. See section **1.10 Exit menu** for details.

- If the system fails to boot after changing any BIOS setting, try to clear the CMOS and reset the motherboard to the default value. See section **1.1.7 Jumpers** in your user 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.

1.2.1 EZ Mode

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

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 the system properties of the selected mode. Click < or > to switch EZ System Tuning modes

Displays the CPU/motherboard temperature, CPU voltage output, CPU/chassis/power fan speed, and SATA information

Selects the display language of the BIOS setup program

Creates storage RAID and configures system overclocking

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

Search on the FAQ

Click to display boot devices

Selects the boot device priority

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

1.2.2   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.

Configuration fields
Pop-up Menu   **Scroll bar**
Menu bar   **Language**   **MyFavorite(F3)**   **Qfan Control(F6)**   **EZ Tuning Wizard(F11)**   **Hot Keys**

UEFI BIOS Utility – Advanced Mode

05/30/2017 13:18   🌐 English   MyFavorite(F3)   Qfan Control(F6)   EZ Tuning Wizard(F11)   Hot Keys
Tuesday

| My Favorites | Main | Ai Tweaker | Advanced | Monitor | Boot | Tool | Exit |

Hardware Monitor

Target CPU Turbo-Mode Frequency : 4500MHz

Target CPU @ AVX Frequency : 4500MHz

Target DRAM Frequency : 2400MHz

Target Cache Frequency : 4200MHz

Target CPU Graphics Frequency: 1150MHz

Ai Overclock Tuner   Auto

ASUS MultiCore Enhancement   Auto
                                               Manual
AVX Instruction Core Ratio Negative Offset   XMP

CPU Core Ratio   Sync All Cores

  1-Core Ratio Limit   Auto

  2-Core Ratio Limit   Auto

  3-Core Ratio Limit   Auto

  4-Core Ratio Limit   Auto

ⓘ [Manual]: When the manual mode is selected, BCLK(base clock) frequency can be assigned manually.
[XMP]: When XMP(extreme memory profile) mode is selected, BCLK frequency and memory parameters will be optimized automatically.

CPU

Frequency   Temperature
4200 MHz   35°C

BCLK   Core Voltage
100.0 MHz   1.200 V

Ratio
42x

Memory

Frequency   Voltage
2400 MHz   4.080 V

Capacity
16384 MB

Voltage

+12V   +5V
12.288 V   5.040 V

+3.3V
3.360 V

Last Modified   EzMode(F7)   Search on FAQ

Version 2.17.1246. Copyright (C) 2017 American Megatrends, Inc.

Menu items   **General help**   **Last modified settings**   **Go back to EZ Mode**

Search on the FAQ

Displays the CPU temperature,
CPU, and memory voltage output

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

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

Language

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

MyFavorite(F3)

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

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

Qfan Control(F6)

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

Refer to section **1.2.3 QFan Control** for more information.

EZ Tuning Wizard(F11)

This button above the menu bar allows you to view and tweak the overclocking settings of your system. It also allows you to change the motherboard's SATA mode from AHCI to RAID mode.

Refer to section **1.2.4 EZ Tuning Wizard** for more information.

Search on FAQ

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

Hot Keys

This button above the menu bar 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.

1.2.3   QFan Control

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

Click to select a fan to be configured

Click to activate PWM Mode

Click to activate DC Mode

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

| PWM | DC |

⊘ Optimize All

CPU FAN
CHA1 FAN
CHA2 FAN
AIO PUMP

%
100

50

0   30   70   100   ℃

Standard   Silent   Turbo   Full Speed   Manual

Undo   Apply   Exit (ESC)

Select a profile to apply to your fans

Click to undo the changes

Click to apply the fan setting

Click to go back to main menu

Select to manually configure your fans

Configuring fans manually

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

Speed points　　　　　　**Select to manually configure your fans**
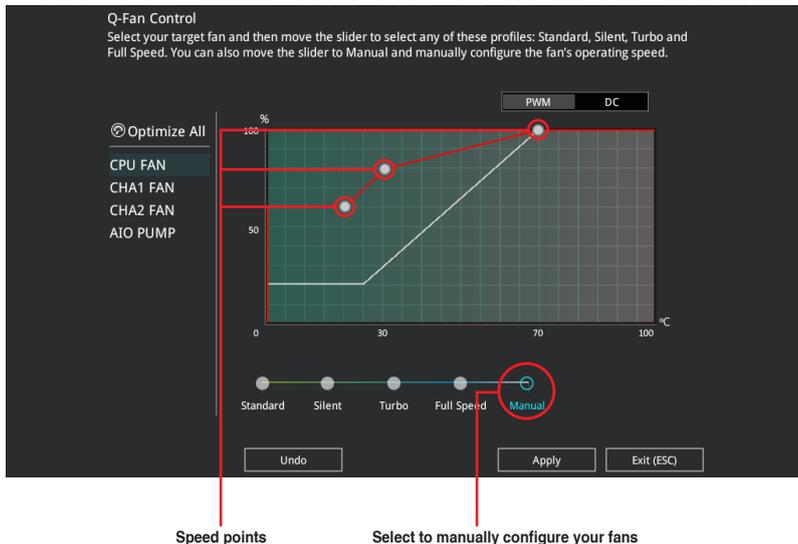
To configure your fans:

1.　Select the fan that you want to configure and to view its current status.

2.　Click and drag the speed points to adjust the fans' operating speed.

3.　Click **Apply** to save the changes then click **Exit (ESC)**.

1.2.4 EZ Tuning Wizard

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

EZ Tuning Wizard

OC   RAID

▶ Current System Configuration
  PC scenario
  Main cooling system
  Estimated tuning results

Current System Configuration

CPU
  Freq: 4200 MHz
  Ratio: 42x
  BCLK: 100.0 MHz
  Temp: 38°C

DRAM
  Freq: 16384 MB (DDR4 2400MHz)

Next   Cancel

OC setup   RAID setup
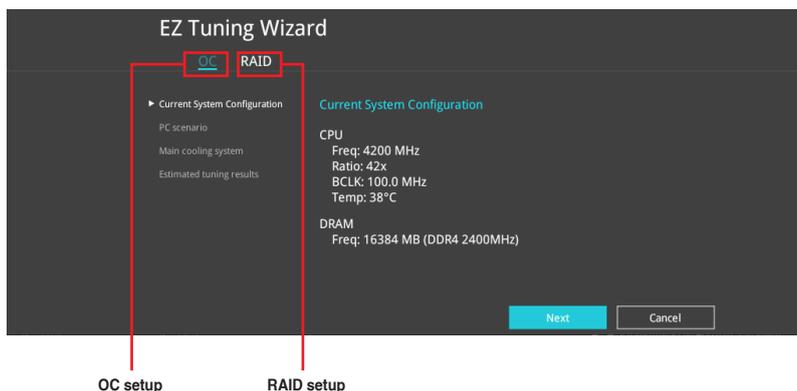
OC Tuning

To start OC Tuning:
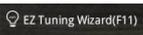
1. Press <F11> on your keyboard or click ⚲ EZ Tuning Wizard(F11) from the BIOS screen to open EZ Tuning Wizard screen.

2. Click **OC** then click **Next**.

3. Select a PC scenario **Daily Computing** or **Gaming/Media Editing**, then click **Next**.

PC scenario
Select your computer usage.

Daily Computing   Gaming/Media Editing

Next   Cancel
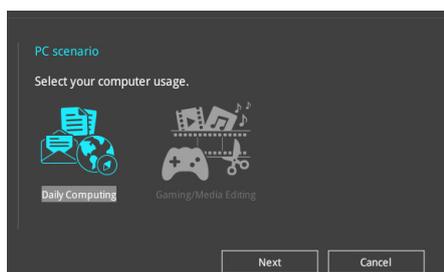
4.	Select a Main Cooling System **BOX cooler**, **Tower cooler**, **Water cooler**, or **I'm not sure**, then click **Next**.
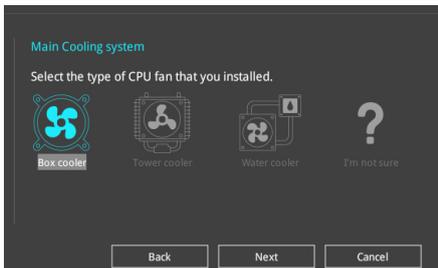
5.	After selecting the Main Cooling System, click **Next** then click **Yes** to start the OC Tuning.

Creating RAID

To create RAID:

1.	Press <F11> on your keyboard or click [EZ Tuning Wizard(F11)] from the BIOS screen to open EZ Tuning Wizard screen.

2.	Click **RAID** then click **Next**.

- Ensure that your HDDs have no existing RAID volumes.

- Ensure to connect your HDDs to Intel® SATA connectors.

3.	Select the port that you want to set to [RAID] mode, **PCIE** or **SATA**, then click **Next**.
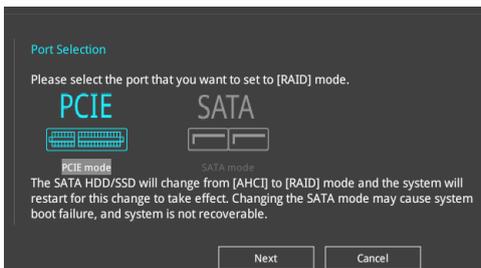
4. Check the available storage disk drives, then click **Next**.
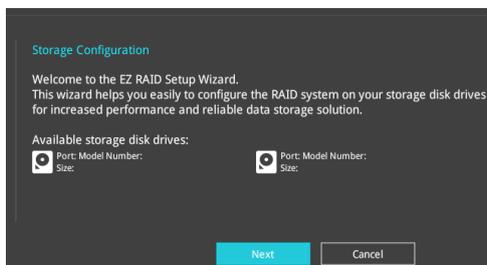
5. Select the type of storage for your RAID, **Easy Backup** or **Super Speed**, then click **Next**.
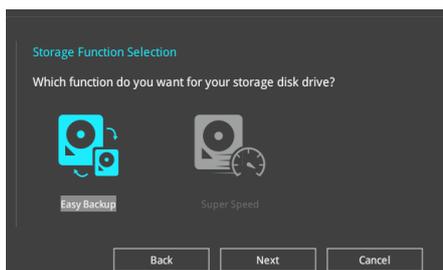
a. For Easy Backup, click **Next** then select from **Easy Backup (RAID 1)** or **Easy Backup (RAID 10)**.
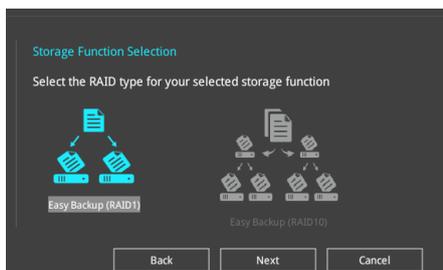
You can only select Easy Backup (RAID 10) if you connect four (4) HDDs.

b.   For Super Speed, click **Next** then select from **Super Speed (RAID 0)** or **Super Speed (RAID 5)**.
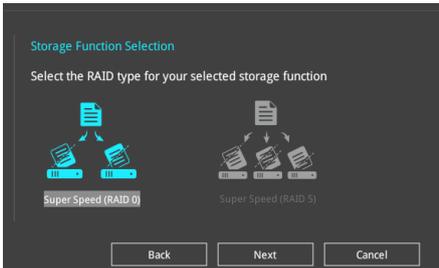
6.   After selecting the type of RAID, click **Next** then click **Yes** to continue the RAID setup.

7.   After the RAID setup is done, click **Yes** to exit the setup then click **OK** to reset your system.

1.3   My Favorites

My Favorites is your personal space where you can easily save and access your favorite BIOS items. My Favorites comes with several performance, power saving, and fast boot related items by default. You can personalize this screen by adding or removing items.
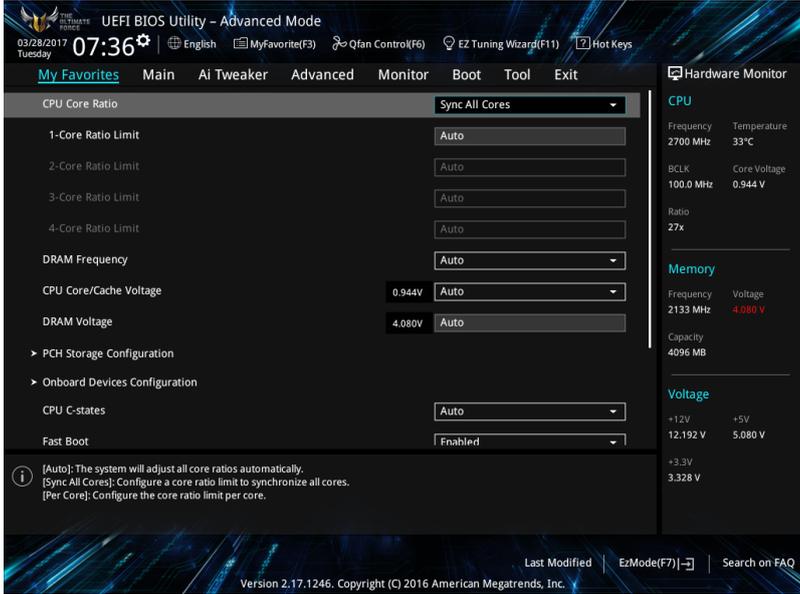
Adding items to My Favorites

To add BIOS items:

1.   Press <F3> on your keyboard or click **MyFavorite(F3)** from the BIOS screen to open Setup Tree Map screen.

2.   On the Setup Tree Map screen, select the BIOS items that you want to save in My Favorites screen.
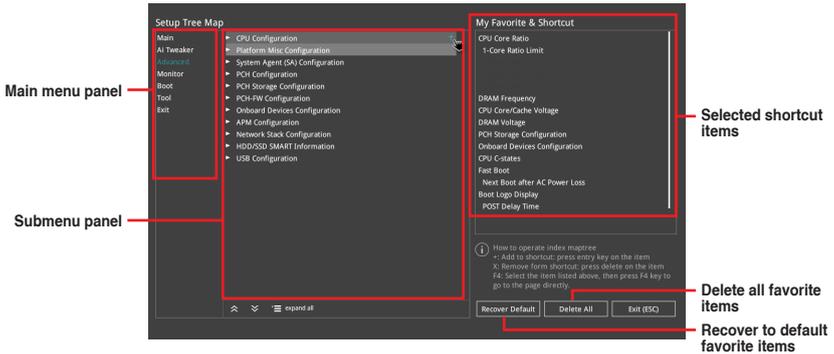
3.   Select an item from main menu panel, then click the submenu that you want to save as favorite from the submenu panel and click ➕ or press <Enter> on your keyboard.

> You cannot add the following items to My Favorite items:
>
> •   Items with submenu options.
>
> •   User-managed items such as language and boot order.
>
> •   Configuration items such as Memory SPD Information, system time and date.

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

5.   Go to My Favorites menu to view the saved BIOS items.

1.4 Main menu

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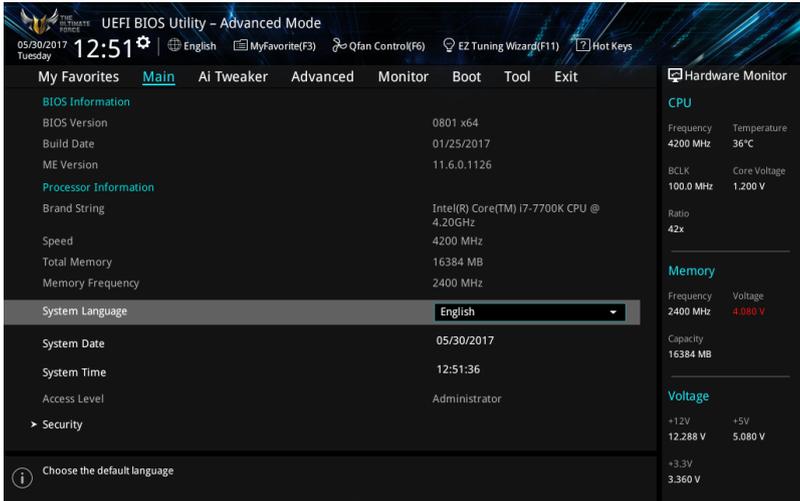
Security

The Security menu items allow you to change the system security settings.
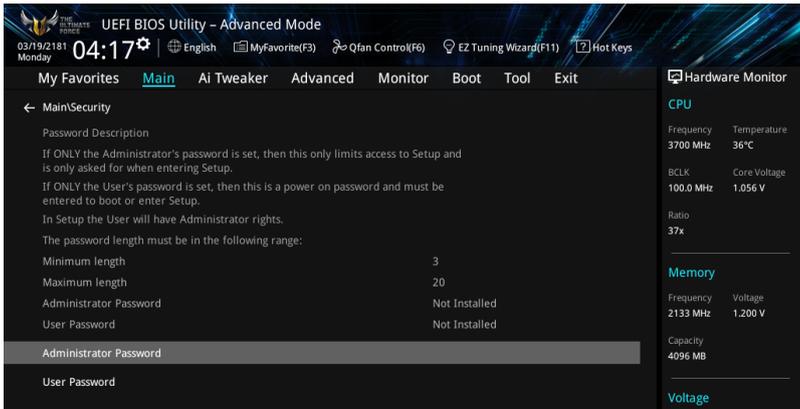
- If you have forgotten your BIOS password, erase the CMOS Real Time Clock (RTC) RAM to clear the BIOS password. See section **1.1.7 Jumpers** in your user manual for information on how to erase the RTC RAM.

- 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]**.

1.5 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.
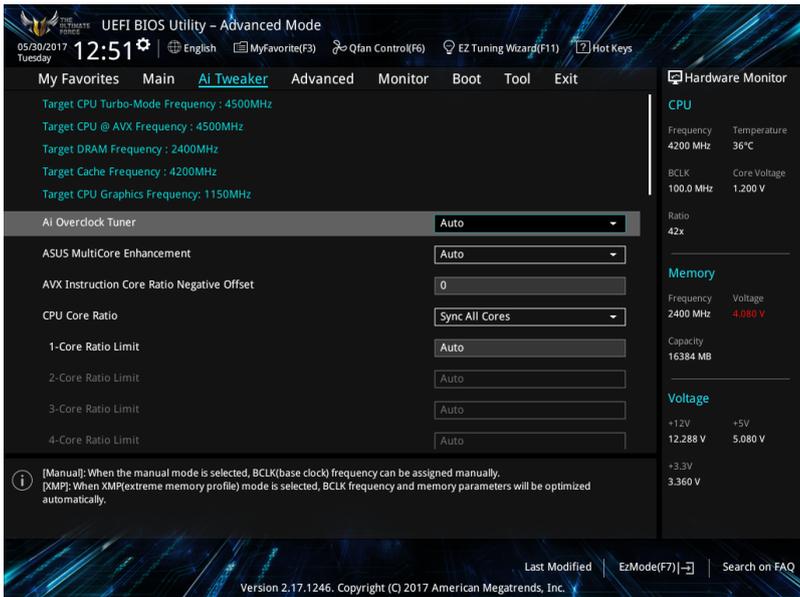
Ai Overclock Tuner

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

[Auto]   Loads the optimal settings for the system.

[Manual]   Automatically optimizes the CPU ratio and BCLK frequency.

[XMP]   If you install memory modules supporting the eXtreme Memory Profile (XMP) Technology, choose this item to set the profiles supported by your memory modules for optimizing the system performance.

> ✎ The **[XMP]** configuration option appears only when you install memory modules supporting the eXtreme Memory Profile(XMP) Technology.

When the Ai Overclock Tuner is set to **[Manual]** or **[XMP]**, the following items appear.

BCLK Frequency

This item allows you to set the BCLK (base clock) frequency to enhance the system performance. Use the <+> or <-> to adjust the value. The values range from 98.0 MHz to 538.25 MHz.

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

BCLK Spread Spectrum

Enable this item to reduce peak value of EMI emissions, or disable for a more accurate Base Clock.

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

ASUS MultiCore Enhancement

[Auto]   This item allows you to maximize the oveclocking performance optimized by ASUS core ratio settings.

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

AVX Instruction Core Ratio Negative Offset

This item allows you to subtract a value from your core ratio at which AVX applications run.

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

CPU Core Ratio

This item allows you to set the CPU core ratio limit per core or synchronize automatically to all cores.

Configuration options: [Auto] [Sync All Cores] [Per Core]

When the CPU Core Ratio is set to **[Sync All Cores]**, the following item appears.

1-Core Ratio Limit

Configure the 1-Core Ratio Limit value that must be higher than or equal to the 2-Core Ratio Limit.

When the CPU Core Ratio is set to **[Per Core]**, the following item appears.

1-Core Ratio Limit

Configure the 1-Core Ratio Limit value that must be higher than or equal to the 2-Core Ratio Limit.

2-Core Ratio Limit

Configure the 2-Core Ratio Limit value that must be higher than or equal to the 3-Core Ratio Limit. The 1-Core Ratio Limit must not be set to **[Auto]**.

3-Core Ratio Limit

Configure the 3-Core Ratio Limit value that must be higher than or equal to the 4-Core Ratio Limit. The 1-Core and 2-Core Ratio Limit must not be set to **[Auto]**.

4-Core Ratio Limit

Configure the 4-Core Ratio Limit value that must be higher than or equal to the 5-Core Ratio Limit. The 1-Core, 2-Core, and 3-Core Ratio Limit must not be set to **[Auto]**.

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.

DRAM Odd Ratio Mode

This item allows you to enable or disable availability of odd DRAM ratios for improved granularity.

Configuration options: [Enabled] [Disabled]

DRAM Frequency

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

Configuration options: [Auto] [DDR4-800MHz] - [DDR4-4266MHz]

OC Tuner

This item allows you to automatically overclock the CPU and DRAM frequencies and voltage for an enhanced system performance.

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

> Ensure to install an efficient CPU fan for the CPU and graphics tuning before selecting the Ratio Tuning or BCLK + Ratio Tuning mode.

EPU Power Saving Mode

The ASUS EPU (Energy Processing Unit) sets the CPU in its minimum power consumption settings. Enabling this item will apply lower CPU Core/Cache Voltage and help save energy consumption. Set this item to **[Disabled]** if you are over clocking the system.

Configuration options: [Disabled] [Enabled]

Load CPU 5G OC Profile

Select this item to easily overclock the Intel 7th generation Core processors (K-series only) to 5GHz.

> Overclockability may vary by processors and does not guarantee stability.

CPU SVID Support

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

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

DRAM Timing Control

The subitems in this menu allow you to set the DRAM timing control features. Use the <+> or <-> keys to adjust the value.

> 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] [1] – [31]

DRAM RAS# to CAS# Delay
Configuration options: [Auto] [1] – [31]

DRAM RAS# ACT Time
Configuration options: [Auto] [1] – [63]

DRAM Command Rate
Configuration options: [Auto] [1N] [2N] [3N] [N:1]

Secondary Timings

DRAM RAS# to RAS# Delay L
Configuration options: [Auto] [1] – [15]

DRAM RAS# to RAS# Delay S
Configuration options: [Auto] [1] – [15]

DRAM REF Cycle Time
Configuration options: [Auto] [1] – [1023]

DRAM Refresh Interval
Configuration options: [Auto] [1] – [65535]

DRAM WRITE Recovery Time
Configuration options: [Auto] [1] – [31]

DRAM READ to PRE Time
Configuration options: [Auto] [1] – [15]

DRAM FOUR ACT WIN Time
Configuration options: [Auto] [1] – [63]

DRAM WRITE to READ Delay
Configuration options: [Auto] [1] – [15]

DRAM WRITE to READ Delay L
Configuration options: [Auto] [1] – [15]

DRAM WRITE to READ Delay S
Configuration options: [Auto] [1] – [15]

DRAM CKE Minimum Pulse Width
Configuration options: [Auto] [0] – [15]

DRAM Write Latency
Configuration options: [Auto] [1] – [31]

Skew Control

ODT RTT WR (CHA)
Configuration options: [Auto] [0 DRAM Clock]
[80 DRAM Clock] [120 DRAM Clock]
[240 DRAM Clock] [255 DRAM Clock]

ODT RTT PARK (CHA)
Configuration options: [Auto] [0 DRAM Clock] [34 DRAM Clock]
[40 DRAM Clock] [48 DRAM Clock]
[60 DRAM Clock] [80 DRAM Clock]
[120 DRAM Clock] [240 DRAM Clock]

ODT RTT NOM (CHA)
Configuration options: [Auto] [0 DRAM Clock] [34 DRAM Clock]
[40 DRAM Clock] [48 DRAM Clock]
[60 DRAM Clock] [80 DRAM Clock]
[120 DRAM Clock] [240 DRAM Clock]

ODT RTT WR (CHB)
Configuration options: [Auto] [0 DRAM Clock]
[80 DRAM Clock] [120 DRAM Clock]
[240 DRAM Clock] [255 DRAM Clock]

ODT RTT PARK (CHB)
Configuration options: [Auto] [0 DRAM Clock] [34 DRAM Clock]
[40 DRAM Clock] [48 DRAM Clock]
[60 DRAM Clock] [80 DRAM Clock]
[120 DRAM Clock] [240 DRAM Clock]

ODT RTT NOM (CHB)
Configuration options: [Auto] [0 DRAM Clock] [34 DRAM Clock]
[40 DRAM Clock] [48 DRAM Clock]
[60 DRAM Clock] [80 DRAM Clock]
[120 DRAM Clock] [240 DRAM Clock]

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

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

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

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

Data Rising Slope
Configuration options: [Auto] [0] - [15]

Data Rising Slope Offset
Configuration options: [Auto] [0] - [1]

Cmd Rising Slope
Configuration options: [Auto] [0] - [15]

Cmd Rising Slope Offset
Configuration options: [Auto] [0] - [1]

Ctl Rising Slope
Configuration options: [Auto] [0] - [15]

Ctl Rising Slope Offset
Configuration options: [Auto] [0] - [1]

Clk Rising Slope
Configuration options: [Auto] [0] - [15]

Clk Rising Slope Offset
Configuration options: [Auto] [0] - [1]

Data Falling Slope
Configuration options: [Auto] [0] - [15]

Data Falling Slope Offset
Configuration options: [Auto] [0] - [1]

Cmd Falling Slope
Configuration options: [Auto] [0] - [15]

Cmd Falling Slope Offset
Configuration options: [Auto] [0] - [1]

Ctl Falling Slope
Configuration options: [Auto] [0] - [15]

Ctl Falling Slope Offset
Configuration options: [Auto] [0] - [1]

Clk Falling Slope
Configuration options: [Auto] [0] - [15]

Clk Falling Slope Offset
Configuration options: [Auto] [0] - [1]

RTL IOL control

> **DRAM RTL INIT value**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHA DIMM0 Rank0)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHA DIMM0 Rank1)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHA DIMM1 Rank0)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHA DIMM1 Rank1)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHB DIMM0 Rank0)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHB DIMM0 Rank1)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHB DIMM1 Rank0)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM RTL (CHB DIMM1 Rank1)**
> Configuration options: [Auto] [0] - [127]
>
> **DRAM IOL (CHA DIMM0 Rank0)**
> Configuration options: [Auto] [0] - [15]
>
> **DRAM IOL (CHA DIMM0 Rank1)**
> Configuration options: [Auto] [0] - [15]
>
> **DRAM IOL (CHA DIMM1 Rank0)**
> Configuration options: [Auto] [0] - [15]
>
> **DRAM IOL (CHA DIMM1 Rank1)**
> Configuration options: [Auto] [0] - [15]
>
> **DRAM IOL (CHB DIMM0 Rank0)**
> Configuration options: [Auto] [0] - [15]
>
> **DRAM IOL (CHB DIMM0 Rank1)**
> Configuration options: [Auto] [0] - [15]
>
> **DRAM IOL (CHB DIMM1 Rank0)**
> Configuration options: [Auto] [0] - [15]
>
> **DRAM IOL (CHB DIMM1 Rank1)**
> Configuration options: [Auto] [0] - [15]
>
> **CHA IO_Latency_offset**
> Configuration options: [Auto] [0] - [127]
>
> **CHB IO_Latency_offset**
> Configuration options: [Auto] [0] - [127]
>
> **CHA RFR delay**
> Configuration options: [Auto] [0] - [127]
>
> **CHB RFR delay**
> Configuration options: [Auto] [0] - [127]

Third Timings

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

tREFIX9

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

OREF_RI

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

Misc.

MRC Fast Boot

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

DRAM CLK Period

Allows you to select the DRAM clock period.
Configuration options: [Auto] [1] - [26]

Memory Scrambler

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

Channel A DIMM Control

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

Channel B DIMM Control

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

MCH Full Check

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

DLLBwEn

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

DRAM SPD Write

Configuration options: [Disabled] [Enabled]

External Digi+ Power Control

CPU Load-line Calibration

Load-line is defined by Intel® specification and affects CPU power voltage. The CPU working voltage decreases proportionally to CPU loading. Higher load-line calibration could get higher voltage and good overclocking performance, but increases the CPU and VRM thermal conditions. Select from levels 1 to 7 to adjust the load-line slope. Configuration options [Auto] [Level 1] - [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.

CPU Current Capability

This item allows you to set the shut off current limit for external voltage regulator. A higher setting will allow the voltage regulator to supply more current while a lower setting will cause the voltage regulator to shut off the system when the supplied current is higher than the set value.
Configuration options: [Auto] [100%] [110%] [120%] [130%] [140%]

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

CPU VRM Switching Frequency

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

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

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

Fixed CPU VRM Switching Frequency (KHz)
This item allows you to set a higher frequency for a quicker transient response speed. Use the <+> or <-> to adjust the value. The values range from 250 KHz to 500 KHz with an interval of 50 KHz.

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

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

VRM Spread Spectrum

This item allows you to enhance the system stability.
Configuration options: [Auto] [Disabled] [Enabled]

CPU Power Duty Control

DIGI+ VRM Duty Control adjusts the current of every VRM phase and the thermal conditions of every phase component.

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

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

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

CPU Power Phase Control

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

[Auto]   Automatically set the phase control mode.

[Standard]   The phase control will be based on the CPU command.

[Optimized]   Set to the ASUS optimized phase tuning profile.

[Extreme]   Set to the full phase mode.

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

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

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

CPU Graphics Current Capability

This item adjusts the total power range for CPU Graphics overclocking. A higher value setting provides higher power consumption delivery and extends the overclocking frequency range simultaneously.
Configuration options: [Auto] [100%] [110%] [120%] [130%] [140%]

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

CPU Graphics Switching Frequency

The switching frequency will affect the CPU Graphics transient response speed and the component thermal production.
Configuration options: [Auto] [Manual]

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

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

Fixed CPU Graphics Switching Frequency(KHz)
This item allows you to set a higher frequency for a quicker transient response speed. Use the <+> or <-> to adjust the value. The values range from 250 KHz to 500 KHz with an interval of 50 KHz.

CPU Graphics Power Phase Control

This item allows you to set the power phase control of the CPU Graphics.
Configuration options: [Auto] [Standard] [Extreme]

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

Internal CPU Power Management

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

Intel(R) SpeedStep(tm)

Allows the operating system to dynamically adjust the processor voltage and cores frequency to decrease the average power consumption and decrease average heat production.
Configuration options: [Auto] [Disabled] [Enabled]

Turbo Mode

Allows you to enable your processor cores to run faster than the base operating frequency when it is below power, current and specification limit.
Configuration options: [Disabled] [Enabled]

Turbo Mode Parameters

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

Long Duration Package Power Limit

As known as the power limit 1 in Watts. The default value will be the TDP (thermal design power). The turbo ratio can be maintained for a duration to exceed the TDP for the maximum system performance.
Configuration options: [Auto] [1] - [4095]

Package Power Time Window

As known as the power limit 1 in seconds. The value indicates the maintained duration for the turbo ratio to exceed TDP (thermal design power).
Configuration options: [Auto] [1] - [127]

Short Duration Package Power Limit

As known as the power limit 2 in Watts. It is the second power limit to provide a rapid protection when the package power exceed power limit 1. The default setting is 1.25 times the power limit 1. According to Intel, the platform must be capable of supporting the duration for up to 10 msec when the turbo ratio exceeds the power limit 2. The ASUS motherboards can support the duration for a longer time.
Configuration options: [Auto] [1] - [4095]

IA AC Load Line

This item allows you to set the AC Loadline defined in 1/100 mOhms. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.01] - [62.49]

IA DC Load Line

This item allows you to set the DC Loadline defined in 1/100 mOhms. Use the <+> and <-> keys to adjust the value.
Configuration options: [Auto] [0.01] - [62.49]

FCLK Frequency for Early Power On

This item allows you to set the FCLK Frequency for Early Power On.

Configuration options: [Auto] [Normal (800MHz)] [1GHz] [400MHz]

CPU Core/Cache Current Limit Max.

This item allows you to configure a higher current limit to prevent a frequency or power throttling when overclocking. Use the <+> and <-> keys to adjust the value.

Configuration options: [Auto] [0.00] - [255.50]

CPU Graphics Current Limit

This item allows you to set a high current limit to prevent frequency or power throttling during overclocking.

Configuration options: [Auto] [0.00] - [255.50]

Min. CPU Cache Ratio

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

Configuration options: [Auto] [8] - [33]

Max. CPU Cache Ratio

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

Configuration options: [Auto] [8] - [33]

Max. CPU Graphics Ratio

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

Configuration options: [Auto] [1] - [60]

Extreme Over-voltage

Enable this item to allow higher voltages for overclocking, but the CPU lifetime will not be guaranteed.

Configuration options: [Disabled] [Enabled]

This item can only be enabled when the onboard CPU_OV jumper is switched on.

BCLK Aware Adaptive Voltage

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

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

CPU Core/Cache Voltage

This item allows you to configure the mode of voltage fed to the CPU cores.

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

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

CPU Core Voltage Override

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

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

Offset Mode Sign

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

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

CPU Core Voltage Offset

This item allows you to configure the CPU core voltage offset value.
Configuration options: [Auto] [0.005] - [0.635]

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

Offset Mode Sign

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

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

Additional Turbo Mode CPU Core Voltage

This item allows you to configure the CPU core voltage offset value.
Configuration options: [0.250] - [1.520]

Offset Voltage

This item allows you to configure the CPU core voltage offset value.
Configuration options: [Auto] [0.001] - [0.999]

DRAM Voltage

Configuration options: [Auto] [1.0000] - [1.8350]

CPU VCCIO Voltage

Configuration options: [Auto] [0.70000] - [1.58500]

CPU System Agent Voltage

Configuration options: [Auto] [0.70000] - [1.68500]

CPU Graphics Voltage Mode

Configures the mode of voltage fed to the CPU graphics.

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

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

CPU Graphics Voltage Override

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

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

Offset Mode Sign

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

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

CPU Graphics Voltage Offset

This item allows you to configure the CPU graphics voltage offset value.
Configuration options: [Auto] [0.005] - [0.635]

PCH Core Voltage

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

CPU Standby Voltage

Configuration options: [Auto] [0.700] - [2.200]

Internal PLL Voltage

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

DRAM REF Voltage Control

DRAM CTRL REF Voltage on CHA/CHB

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

DRAM DATA REF Voltage on CHA DIMM0 Rank0 BL0-7

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

DRAM DATA REF Voltage on CHA DIMM0 Rank1 BL0-7

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

DRAM DATA REF Voltage on CHA DIMM1 Rank0 BL0-7

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

DRAM DATA REF Voltage on CHA DIMM1 Rank1 BL0-7

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

DRAM DATA REF Voltage on CHB DIMM0 Rank0 BL0-7

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

DRAM DATA REF Voltage on CHB DIMM0 Rank1 BL0-7

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

DRAM DATA REF Voltage on CHB DIMM1 Rank0 BL0-7

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

DRAM DATA REF Voltage on CHB DIMM1 Rank1 BL0-7
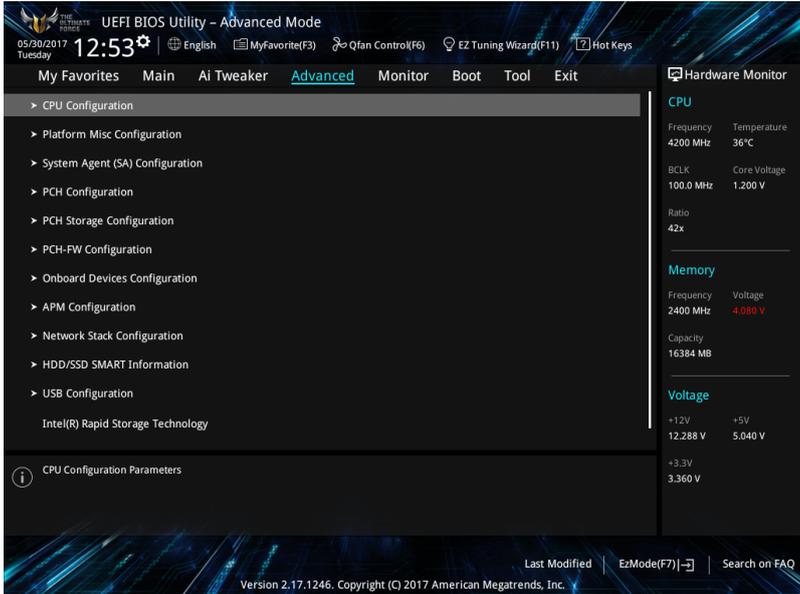
Configures the DRAM Data REF Voltage.
Configuration options: [Auto] [0] - [63]

1.6   Advanced menu

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

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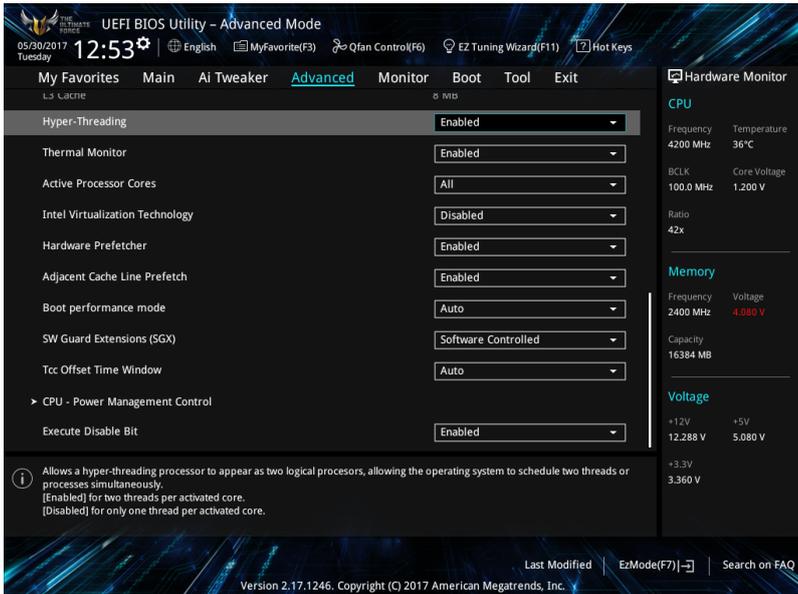
1.6.1   CPU Configuration

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

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

Hyper-Threading
This item allows you to enable or disable the Hyper-Threading for logical processor threads.

Configuration options: [Disabled] [Enabled]

Thermal Monitor
This item allows you to enable or disable the Thermal Monitor.

Configuration options: [Disabled] [Enabled]

Active Processor Cores
This item allows you to select the number of CPU cores to activate in each processor package.

Configuration options: [All] [1] [2] [3]

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

Configuration options: [Disabled] [Enabled]

Hardware Prefetcher

This item allows the CPU to prefetch commands and data in the L2 cache, reducing the DRAM loading time and improves the system performance.

Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch

This item allows the mid level cache (L2) to prefetch adjacent cache lines, reducing the DRAM loading time and improves the system performance.

Configuration options: [Disabled] [Enabled]

Boot Performance Mode

This item allows you to select the CPU performance state during system boot before the operating system takes control. The CPU runs at a selected performance ratio based on CPU configuration.

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

SW Guard Extensions (SGX)

This item allows you to enable or disable Software Guard Extensions (SGX).

Configuration options: [Disabled] [Software Controlled]

Tcc Offset Time Window

This item allows you to set the TCC Offset Time Window for Running Average Temperature Limit (RATL) feature. RATL allows setting an average max thermal temperature. Temperatures within the time window can get higher than the temperature threshold but only the average is used to cause frequency clipping.

Configuration options: [Auto] [Disabled] [5 ms] - [448 sec]

CPU - Power Management Control

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

Intel(R) SpeedStep(tm)

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

Turbo Mode

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

CPU C-states

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

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

Enhanced C-states

When enabled, CPU will switch to minimum speed when all cores enter C-state.

Configuration options: [Disabled] [Enabled]

CPU C3 Report

This item allows you to enable or disable the CPU C3 report to the operating system.

Configuration options: [Disabled] [Enabled]

CPU C6 Report

This item allows you to enable or disable the CPU C6 report to the operating system.

Configuration options: [Disabled] [Enabled]

CPU C7 Report

This item allows you to enable or disable the CPU C7 report to the operating system.

Configuration options: [Disabled] [CPU C7] [CPU C7s]

CPU C8 Report

This item allows you to enable or disable the CPU C8 report to the operating system.

Configuration options: [Disabled] [Enabled]

Package C State Limit

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

CFG Lock

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

Intel(R) Speed Shift Technology

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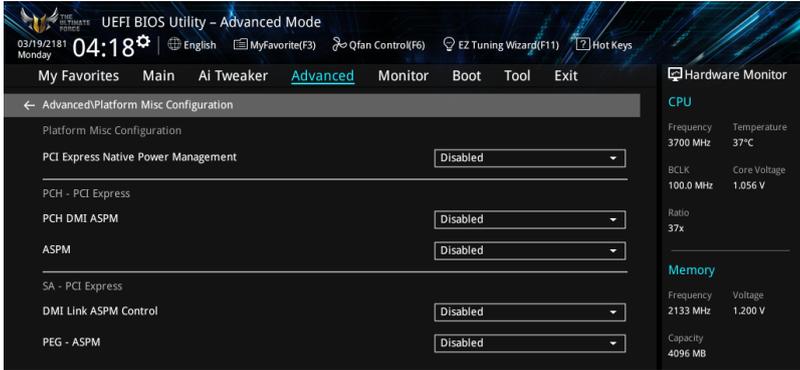Configuration options: [Disabled] [Enabled]

Execute Disable Bit

Execute Disable prevents certain classes of malicious buffer overflow attacks when combined with a supporting OS (SuSE Linux 9.2, RedHat Enterprise 3 Update 3).

Configuration options: [Disabled] [Enabled]

1.6.2 Platform Misc Configuration

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

PCI Express Native Power Management

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

Configuration options: [Disabled] [Enabled]

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

Native ASPM

[Enabled]   OS Controlled ASPM.

[Disabled]   BIOS Controlled ASPM.

PCH - PCI Express

PCH DMI ASPM

This item allows you to control the Active State Power Management on both NB (NorthBridge) and SB (SouthBridge) side of the DMI Link.

Configuration options: [Disabled] [Enabled]

ASPM

This item allows you to select the ASPM state for energy-saving conditions.

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

SA - PCI Express

DMI Link ASPM Control

This item allows you to enable or disable the control of Active State Power Management on SA side of the DMI Link.
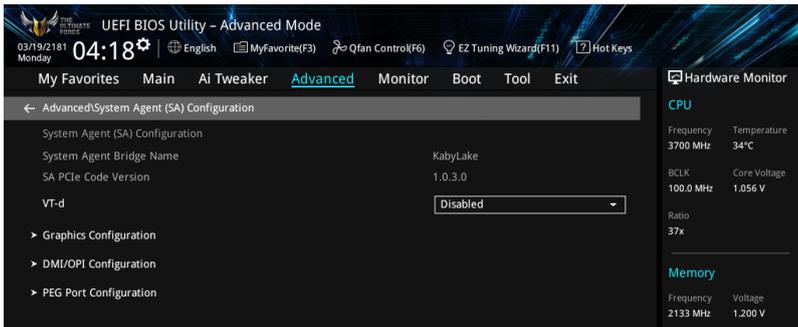
Configuration options: [Disabled] [L1]

PEG - ASPM

This item allows you to select the ASPM state for energy-saving conditions, or use the ASUS optimized energy saving profile.

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

1.6.3 System Agent (SA) Configuration

VT-d

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

Configuration options: [Disabled] [Enabled]

Graphics Configuration

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

Primary Display

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

iGPU Multi-Monitor

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

RC6(Render Standby)

This item allows you to enable check of render standby support.
Configuration options: [Disabled] [Enabled]

DVMT Pre-Allocated

This item allows you to select the DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
Configuration options: [32M] - [1024M]

DMI/OPI Configuration

This item allows you to control various DMI (Direct Media Interface) functions.

DMI Max Link Speed

Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PEG Port Configuration

This item allows you to configure the PEG Port settings.

PCIEX16_1 Link Speed

This item allows you to configure the PCIEX16_1 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PCIEX16_2 Link Speed

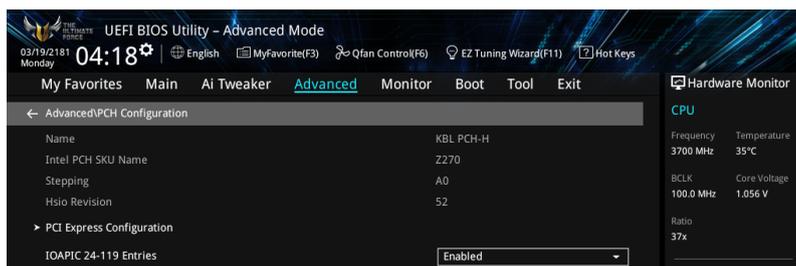This item allows you to configure the PCIEX16_2 slot.
Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

PCIe Spread Spectrum Clocking

This item allows you to enable or disable Spread Spectrum Clocking for compliance testing.
Configuration options: [Auto] [Enabled] [Disabled]

1.6.4   PCH Configuration

PCI Express Configuration

This item allows you to configure the PCI Express slots.

PCIe Speed

|	
[Auto]	The system will automatically select the PCI-E port speed.
[Gen1]	The PCI-E port will run at PCI-E 1.0 speed.
[Gen2]	The PCI-E port will run at PCI-E 2.0 speed.
[Gen3]	The PCI-E port will run at PCI-E 3.0 speed.

IOAPIC 24-119 Entries

This item allows you to enable or disable IOAPIC 24-119 Entries.
Configuration options: [Disabled] [Enabled]

1.6.5 PCH Storage Configuration

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

Scroll down to display the other BIOS items.
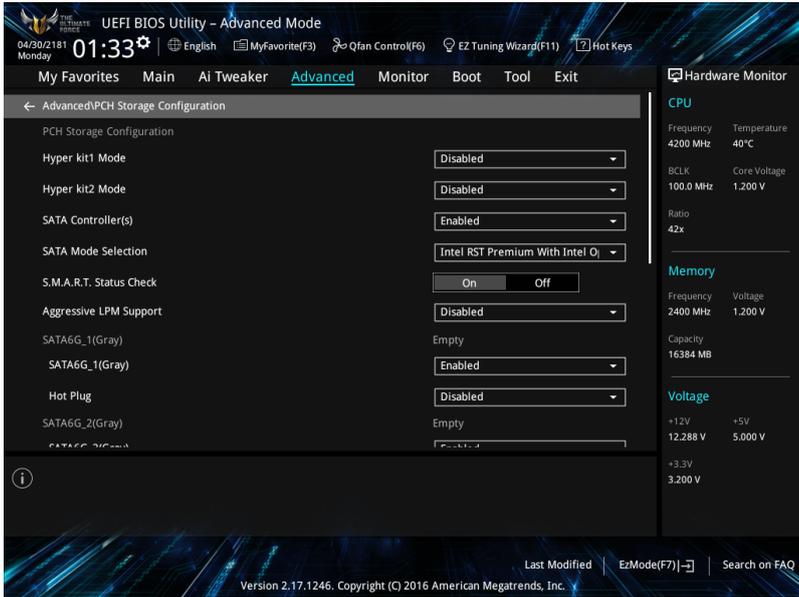
Hyper kit1 Mode

Disable this option for M.2_1 devices. Enable this option for "ASUS Hyper kit" card.

Configuration options: [Disabled] [Enabled]

Hyper kit2 Mode

Disable this option for M.2_2 devices. Enable this option for "ASUS Hyper kit" card.

Configuration options: [Disabled] [Enabled]

SATA Controller(s)

This item allows you to enable or disable the SATA Device.

Configuration options: [Enabled] [Disabled]

SATA Mode Selection

This item allows you to set the SATA configuration.

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

S.M.A.R.T. Status Check

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

Configuration options: [On] [Off]

Aggressive LPM support

This item is designed for LPM (Link Power Management) support with a better energy saving conditions. When disabled, the hot plug function of SATA ports are disabled.

Configuration options: [Disabled] [Enabled]

SATA6G_1(Gray) - SATA6G_6(Gray)

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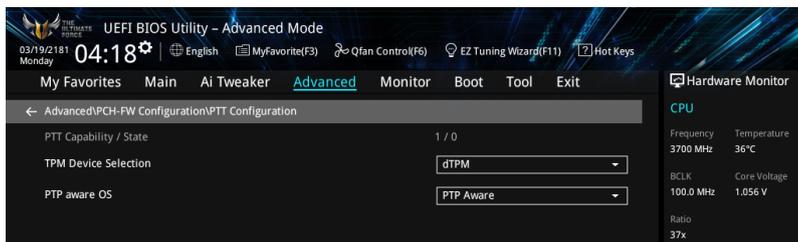Configuration options: [Disabled] [Enabled]

Hot Plug

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

1.6.6 PCH-FW Configuration

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

PTT Configuration

TPM Device Selection

This item allows you to select the TPM device.
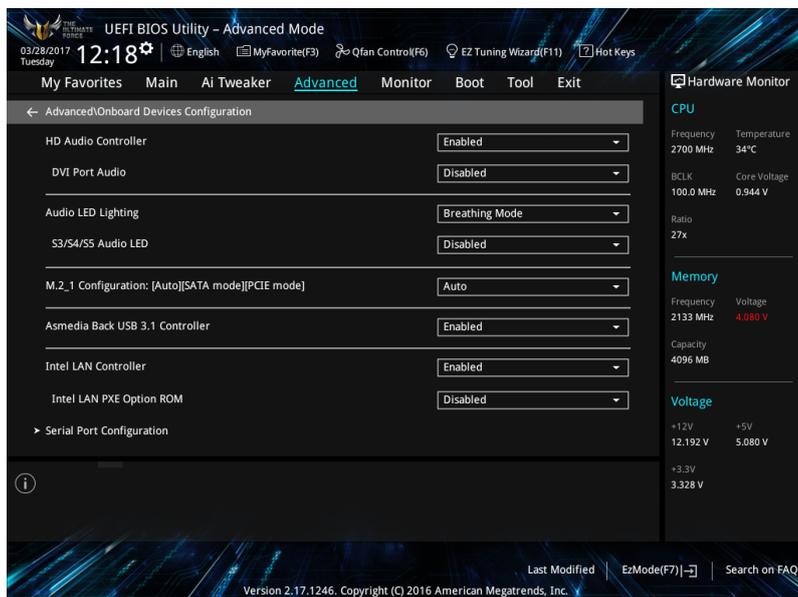Configuration options: [dTPM] [PTT]

PTP aware OS

This item allows you to select whether or not the OS will be PTP aware.
Configuration options: [PTP aware] [Not PTP aware]

1.6.7 Onboard Devices Configuration

Scroll down to view the other BIOS items.

HD Audio Controller

This item allows you to use the Azalia High Definition Audio Controller

Configuration options: [Disabled] [Enabled]

DVI Port Audio

Configuration options: [Disabled] [Enabled]

Audio LED Lighting

Configuration options: [Disabled] [Still Mode] [Breathing Mode]

S3/S4/S5 Audio LED

Configuration options: [Disabled] [Enabled]

M.2_1 Configuration: [Auto][SATA mode][PCIE mode]

[Auto]   Auto-detects the M.2 device mode. If a SATA device is detected, SATA6G_1 will be disabled.

[SATA mode]   Only supports M.2 SATA devices. Please note that SATA6G_1 port cannot be used in this mode.

[PCIE mode]   Only supports M.2 PCIE devices.

ASMedia Back USB 3.1 Controller

This item allows you to enable or disable the ASMedia Back USB 3.1 Controller.

Configuration options: [Disabled] [Enabled]

Intel LAN Controller

This item allows you to enable or disable the Intel LAN controller.

Configuration options: [Disabled] [Enabled]

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

Intel LAN PXE Option ROM

This item allows you to enable or disable the Intel PXE OPROM.

Configuration options: [Disabled] [Enabled]

Serial Port Configuration

This item allows you to set parameters of Serial Port.

This item functions only if there is a serial port (COM1) connector on a motherboard.

Serial Port

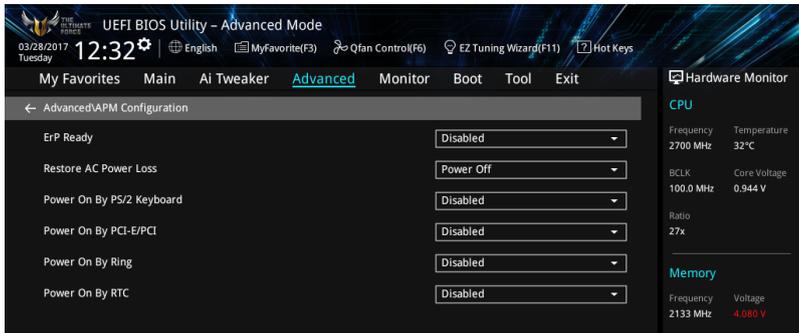This item allows you to enable or disable Serial Port.

Configuration options: [On] [Off]

Change Settings

This item 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]

1.6.8   APM Configuration

ErP Ready

This item allows you to switch off some power at S4/S5 to get the system ready for ErP requirement. When set to **[Enabled]**, all other PME options will be switched off.

Configuration options: [Disabled] [Enabled(S4+S5)] [Enabled(S5)]

Restore AC Power Loss

This item allows you to select AC power state when power is re-applied after a power failure.

Configuration options: [Power On] [Power Off] [Last State]

Power On By PS/2 Keyboard

Configuration options: [Disabled] [Space Bar] [Ctrl-Esc] [Power Key]

Power On By PCI-E/PCI

This item allows you to enable or disable the Wake-on-LAN function of the onboard LAN controller or other installed PCI-E LAN cards.

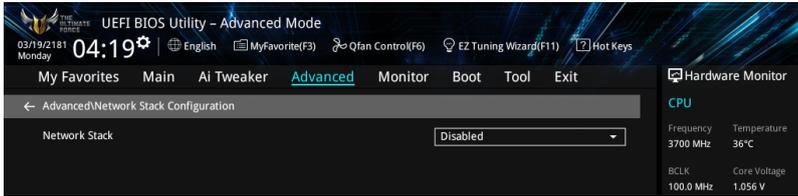Configuration options: [Disabled] [Enabled]

Power On By Ring

Configuration options: [Disabled] [Enabled]

Power On By RTC

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

Configuration options: [Disabled] [Enabled]

1.6.9 Network Stack Configuration

Network Stack

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

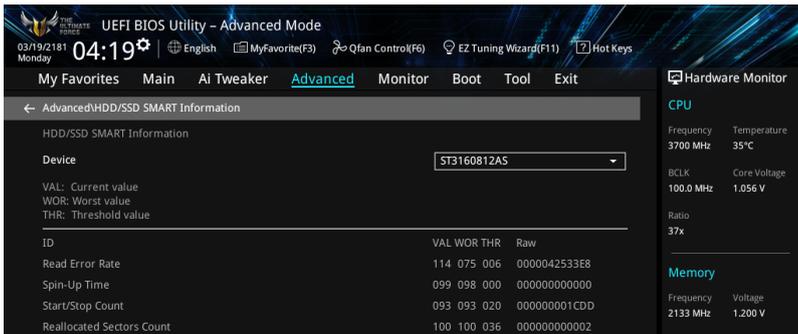> The following item appears only when you set the Network Stack to **[Enabled]**.

Ipv4/Ipv6 PXE Support

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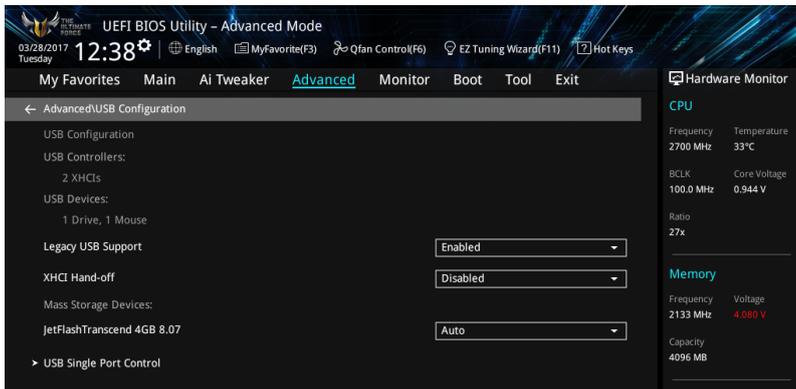Configuration options: [Disabled] [Enabled]

1.6.10 HDD/SSD SMART Information

This menu displays the SMART information of the connected devices.

> NVM Express devices do not support SMART information.

1.6.11 USB Configuration

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

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

Legacy USB Support

[Enabled]   Enables Legacy USB support.

[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

[Enabled]   Enables the support for operating systems without an XHCI hand-off feature.

[Disabled]   Disables the XHCI Hand-off support.

USB Single Port Control

This item allows you to enable or disable the individual USB ports.
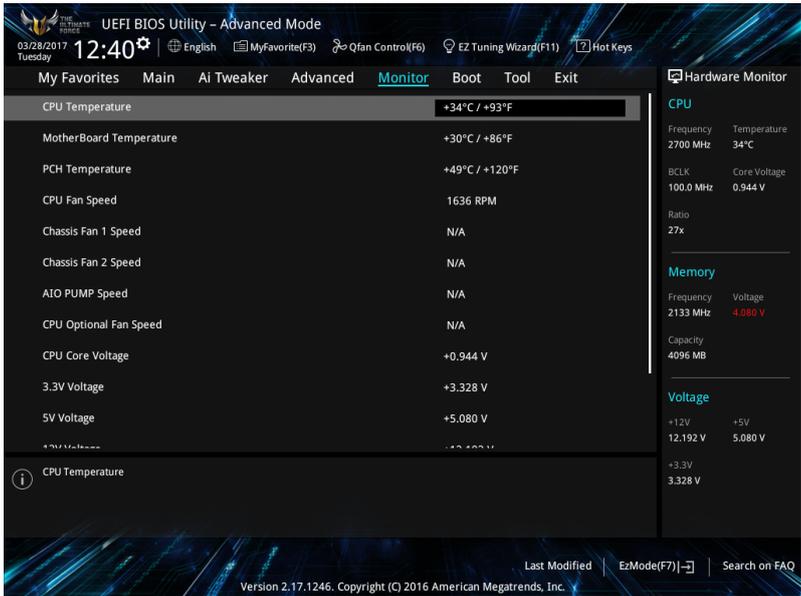
> Refer to section **1.1.2 Motherboard layout** in your user manual for the location of the USB ports.

1.7   Monitor menu

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

Scroll down to display the other BIOS items.

CPU Temperature / MotherBoard Temperature / PCH Temperature [xxx°C/xxx°F]

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

CPU Fan Speed, Chassis Fan 1/2 Speed, AIO PUMP Speed, CPU Optional Fan Speed [xxxx RPM]

The onboard hardware monitor automatically detects and displays the CPU, chassis, and power fan speed 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.

CPU Core Voltage, 3.3V Voltage, 5V Voltage, 12V 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

Select this item and press <Enter> to automatically detect the lowest speed and configure the minimum duty cycle for each fan.

CPU Q-Fan Control

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

[Disabled]   Disables the Q-Fan control.

[Auto]   Detects the type of CPU fan installed and automatically switches the control modes.

[DC Mode]   Enables the CPU Q-Fan control in DC mode for 3-pin CPU fan.

[PWM Mode]   Enables the CPU Q-Fan control in PWM mode for 4-pin CPU fan.

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

CPU Fan Step Up
This item allows you to set the value of CPU Fan Step Up.

Configuration options: [0 sec] [2.1 sec] [2.8 sec] [3.6 sec] [4.2 sec] [5.0 sec] [6.3 sec] [8.5 sec] [12 sec] [25 sec]

CPU Fan Step Down
This item allows you to set the value of the CPU Fan Step Down.

Configuration options: [0 sec] [2.1 sec] [2.8 sec] [3.6 sec] [4.2 sec] [5.0 sec] [6.3 sec] [8.5 sec] [12 sec] [25 sec]

CPU Fan Speed Low Limit
This item allows you to set the low limit warning for the CPU fan speed.

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

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

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

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

[Turbo]   Set to achieve maximum CPU fan speed.

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

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

CPU Upper Temperature
Use the <+> and <-> keys to adjust the upper limit of the CPU temperature. The CPU fan will operate at the maximum duty cycle when the CPU temperature is higher than the limit.

CPU Fan Max. Duty Cycle (%)
Use the <+> and <-> keys to adjust the maximum CPU fan duty cycle. When the CPU temperature reaches the upper limit, the CPU fan will operate at the maximum duty cycle.

CPU Middle Temperature
Use the <+> and <-> keys to adjust the CPU middle temperature.

CPU Fan Middle Duty Cycle (%)
Use the <+> or <-> keys to adjust the CPU fan middle duty cycle.

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

CPU Fan Min. Duty Cycle (%)
Use the <+> and <-> keys to adjust the minimum CPU fan duty cycle. When the CPU temperature is lower than the lower limit, the CPU fan will operate at the minimum duty cycle.

Chassis Fan(s) Configuration

Chassis Fan 1/2 Q-Fan Control

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

[Disabled]   Disables the chassis Q-Fan control.

[Auto]   Detects the type of chassis fan installed and automatically switches the control modes.

[DC Mode]   Enables the chassis Q-Fan control in DC mode for 3-pin chassis fan.

[PWM Mode]   Enables the chassis Q-Fan control in PWM mode for 4-pin chassis fan.

Chassis Fan 1/2 Q-Fan Source
The assigned fan will be controlled according to the selected temperature source.

Configuration options: [CPU] [MotherBoard] [PCH]

For T_Sensor1, plug a thermistor cable to each T_Sensor header and stick it to the desired component as the temperature source.

Chassis Fan 1/2 Step Up
This item allows you to set the value of the chassis fan step up.

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

Chassis Fan 1/2 Step Down
This item allows you to set the value of the chassis fan step down.

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

Chassis Fan 1/2 Speed Low Limit
This item allows you to disable or set the chassis fan warning speed.

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

Chassis Fan 1/2 Profile
This item allows you to set the appropriate performance level of the chassis fan.

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

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

[Turbo]   Set to achieve maximum chassis fan speed.

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

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

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

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

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

Chassis Fan 1/2 Middle Duty Cycle (%)
Use the <+> or <-> keys to adjust the Chassis Fan 1/2 middle duty cycle.

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

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

AIO PUMP Control

[Disabled]   Disables the AIO PUMP control feature.

[Auto]   Detects the type of AIO pump installed and automatically switches the control modes.

[DC mode]   Enables the AIO PUMP control in DC mode for 3-pin chassis fan.

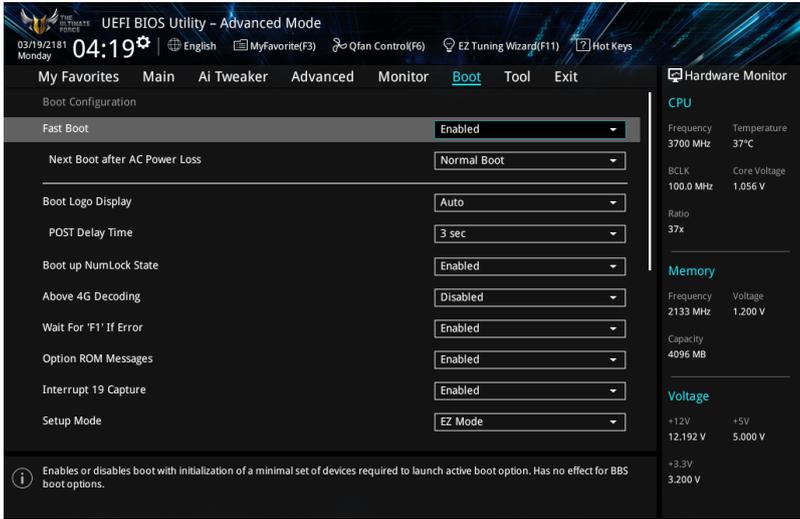[PWM mode]   Enables the AIO PUMP control in PWM mode for 4-pin chassis fan.

Chassis Intrusion Detection Support

Enable this item for chassis intrusion detection function.

Configuration options: [On] [Off]

1.8 Boot menu

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

Fast Boot

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

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

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

Next Boot after AC Power Loss

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

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

Boot Logo Display

[Auto]   Sets the boot logo to display during POST.

[Full Screen]   Sets the boot logo display in full screen during POST.

[Disabled]   Disables the boot logo display during POST.

The following item appears only when you set the Boot Logo Display to **[Auto]** and **[Full Screen]**.

Post Delay Time

This item allows you to select a desired additional POST waiting time to easily enter the BIOS Setup. You can only execute the POST delay time during normal boot. The values range from 0 to 10 seconds.

This feature only works when set under normal boot.

The following items appear only when you set the Boot Logo Display to **[Disabled]**.

Post Report

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

Bootup NumLock State

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

Above 4G Decoding

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

Wait For 'F1' If Error

Enable this item for the system to pause until the <F1> key is pressed when any error occurs.
Configuration options: [Disabled] [Enabled]

Option ROM Messages

[Enabled]   The Option ROM Messages will be shown during the POST.

[Disabled]   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]

Setup Mode

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

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

CSM (Compatibility Support Module)

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

Launch CSM

[Auto]   The system will automatically detect the states of bootable devices and the add-on devices for CSM support.

[Enabled]   For a 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 Windows secure update and secure boot.

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

Boot Devices Control
This item allows you to select the type of devices that you want to boot.

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

Boot from Network Devices
This item allows you to select the type of network devices that you want to launch.

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

Boot from Storage Devices
This item allows you to select the type of storage devices that you want to launch.

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

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

Configuration options: [Legacy only] [UEFI driver first]

Secure Boot

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

OS Type

[Windows UEFI Mode]   This item allows you to 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 functions when booting on Windows non-UEFI mode and Microsoft secure boot non-compliant OS.

The Microsoft secure boot only supports Windows UEFI mode.

Key Management

Clear Secure Boot keys
This item allows you to delete all the previously applied secure boot keys. All the secure boot keys states will change from loaded to unloaded. Save changes and reset the system for the change to take effect.

Save Secure Boot Keys
This item allows you to save all the 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.

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

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

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

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 appears on the screen depends on the number of devices installed in the system. Select an item to start booting from the selected device.

1.9   Tool menu

The Tool menu items allow you to configure options for special functions. Select an item then press <Enter> to display the submenu.
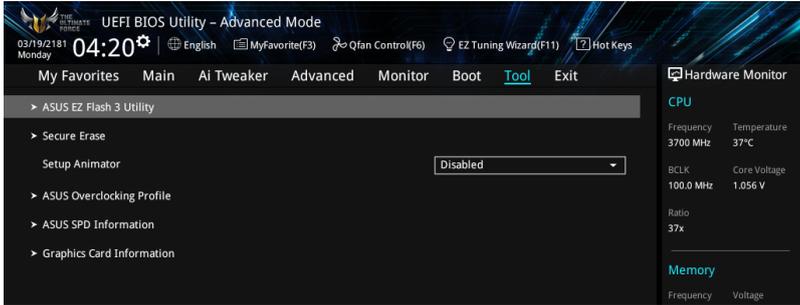
1.9.1   ASUS EZ Flash 3 Utility

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

1.9.2   Secure Erase

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

Secure Erase is only available in AHCI mode. Ensure to set the SATA mode to AHCI. Select **Advanced** > **PCH Storage Configuration** > **SATA Mode Selection** > **AHCI**.

To launch Secure Erase, select **Tool** > **Secure Erase** on the Advanced Mode menu.

Check the ASUS support site for a full list of SSDs tested with Secure Erase. The drive may become unstable if you run Secure Erase on an incompatible SSD.

•   The time to erase the contents of your SSD may take a while depending on its size. Do not turn off the system during the process.

•   Secure Erase is only supported on Intel SATA port. For more information about Intel SATA ports, refer to section **1.1.2 Motherboard layout** in your user manual.

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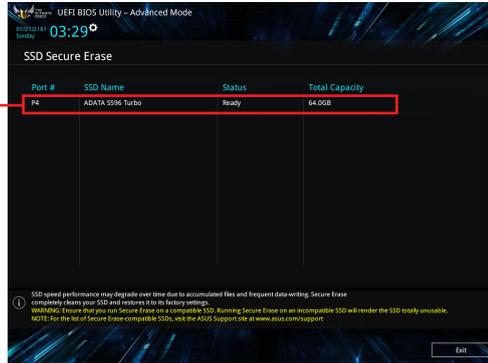
> **Status definition:**
>
> • **Frozen.** The frozen state is the result of a BIOS protective measure. The BIOS guards drives that do not have password protection by freezing them prior to booting. If the drive is frozen, a power off or hard reset of your PC must be performed to proceed with the Secure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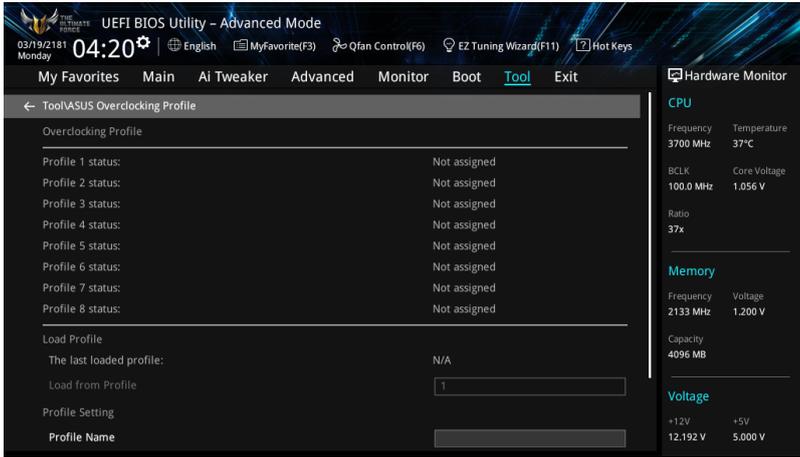

1.9.3   Setup Animator

This item allows you to enable or disable the Setup Animator.

Configuration options: [Enabled] [Disabled]

1.9.4   ASUS Overclocking Profile

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

Profile Name

This item allows you to key in a profile name.
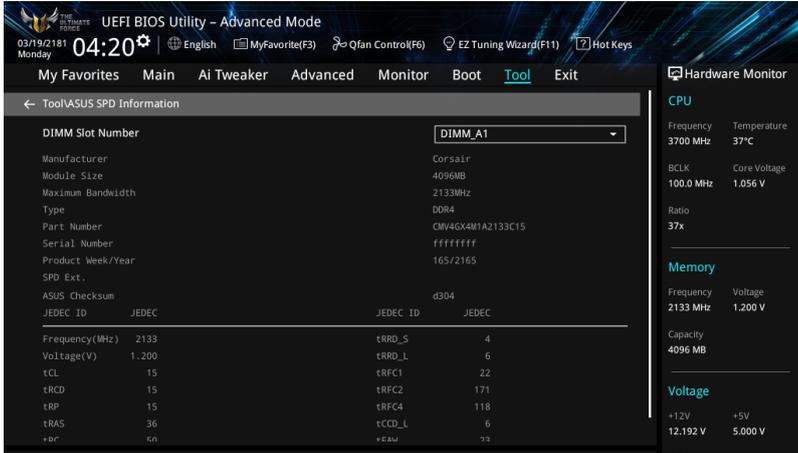
Save to Profile

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

Load/Save Profile from/to USB Drive

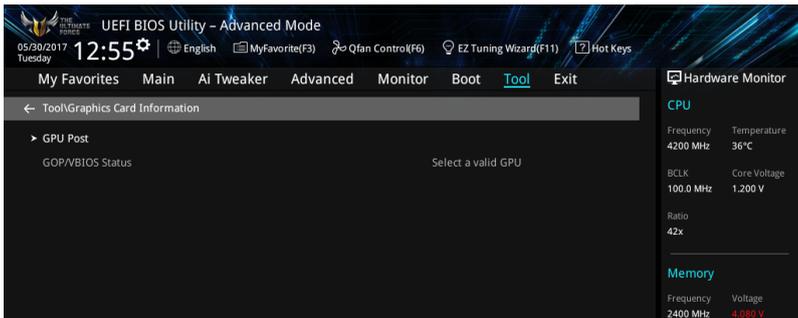This item allows you to load/save profile from/to your USB drive.

1.9.5   ASUS SPD Information

This item allows you to view the DRAM SPD information.

1.9.6   Graphics Card Information

This item displays the information about the graphics card installed in your system.

GPU Post

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

1.10   Exit menu

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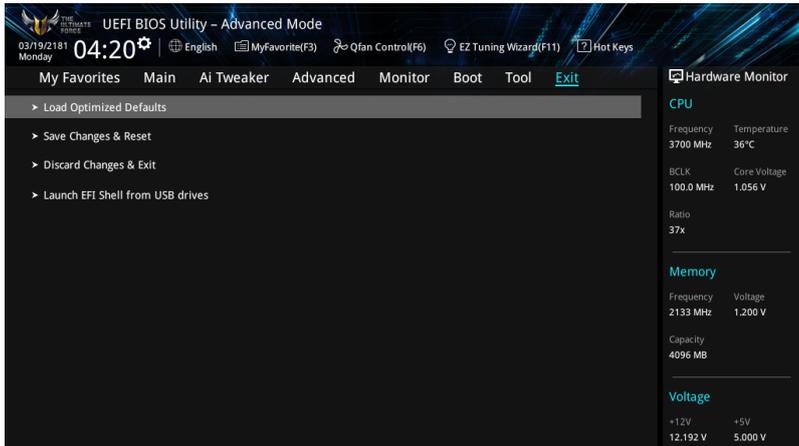
Load Optimized Defaults

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

Save Changes & Reset

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

Discard Changes & Exit

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

Launch EFI Shell from USB drives

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

1.11 Updating BIOS

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

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

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

1. EZ Update: Updates the BIOS in Windows® environment.

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

3. ASUS CrashFree BIOS 3: Restores the BIOS using the motherboard support DVD or a USB flash drive when the BIOS file fails or gets corrupted.

1.11.1 EZ Update

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

- EZ Update requires an Internet connection either through a network or an ISP (Internet Service Provider).

- This utility is available in the support DVD that comes with the motherboard package.

1.11.2 ASUS EZ Flash 3

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

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

To update the BIOS by USB:

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

2. Insert the USB flash disk that contains the latest BIOS file to the USB port.

3. Select **via Storage Device(s)**.
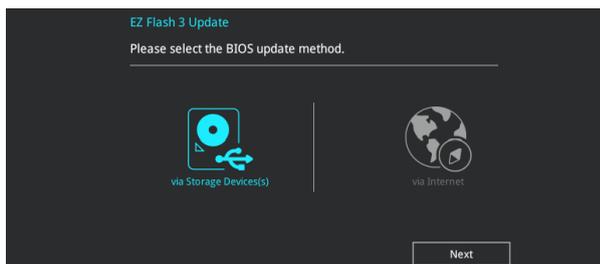
4. Press the Up/Down arrow keys to find the USB flash disk that contains the latest BIOS, and then press <Enter>.

5. Press the Up/Down arrow keys to find the BIOS file, and then press <Enter> to perform the BIOS update process. Reboot the system when the update process is done.
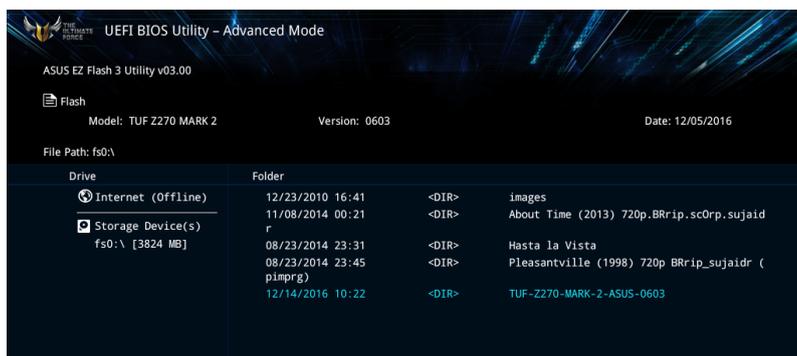
- This function can support devices such as a USB flash disk with FAT 32/16 format and single partition only.

- DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure!
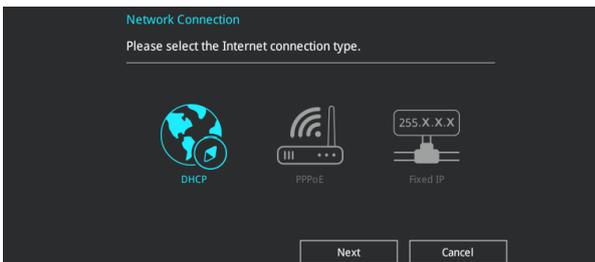
Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the Exit menu. See section **1.10 Exit menu** for details.

To update the BIOS by Internet:

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

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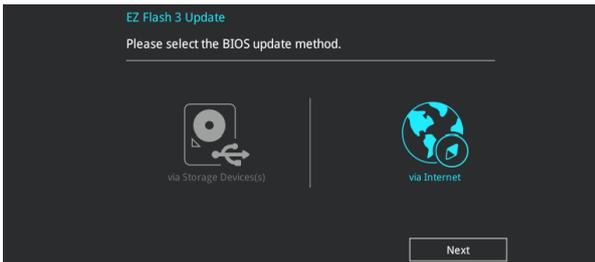
3. Press the Left/Right arrow keys to select an Internet connection method, and then press <Enter>.

4. Follow the onscreen instructions to complete the update.

5. Reboot the system when the update process is done.

Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the Exit menu. See section **1.10 Exit menu** for details.

1.11.3   ASUS CrashFree BIOS 3

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

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

Recovering the BIOS

To recover the BIOS:

1.   Turn on the system.

2.   Insert the motherboard support DVD to the optical drive, or the USB flash drive containing the BIOS file to the USB port.

3.   The utility automatically checks the devices for the BIOS file. When found, the utility reads the BIOS file and enters ASUS EZ Flash 3 automatically.

4.   The system requires you to enter BIOS Setup to recover the BIOS setting. To ensure system compatibility and stability, we recommend that you press <F5> to load default BIOS values.

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